19. The time period of an oscillating mass spring system is 10 seconds. If mass attached to spring is doubled then time period becomes.

(A) 10 S (B) 20 S (C) 5 S (D) $10\sqrt{2}$ S

20. Total Energy of Mass Spring System at Displacement $x = \frac{x_o}{2}$

(A) $\frac{1}{2}kx_o^2$ (B) $\frac{1}{2}k(x_o^2 - x_o^2)$ (C) kx_o^2 (D) $\frac{1}{4}kx_o^2$

Topic IV: Simple Pendulum:

21. Time period of simple pendulum only depends on: (2 times)

(A) Mass of the bob (B) length of the pendulum
(C) amplitude of vibration (D) size of the bob

22. The frequency of second pendulum is: (4 Times)

(A) 1 Hz (B) 2 Hz (C) 0.5 Hz (D) 5 Hz

23. Which expression is correct for the time period of a simple pendulum:

(A) $T \propto \ell$ (B) $T \propto m$ (C) $T \propto \sqrt{\ell}$ (D) $T \propto \sqrt{m}$

24. If the period of a simple pendulum is double, its amplitude will become:

(A) Unaffected (B) Double (C) Half (D) 1.41 as large

25. If mass of pendulum becomes double, then its time period will be: (5 Times)

(A) Double (B) Half (C) Four time (D) Remain same

26. If the time period of simple pendulum is 2 seconds its frequency will be: (3 times)

(A) 1.0 Hz (B) 0.5 Hz (C) 1.5 Hz (D) 2 Hz

27. In case of oscillating pendulum its acceleration "a" is:

(A) $a \propto \theta$ (B) $a \propto$ time period
(C) $a \propto \theta$ Length of pendulum (D) $a \propto \theta$ mass of bob

28. The length of second's pendulum is:

(A) 100 cm (B) 90cm (C) 99.2 cm (D) 98 cm

29. The force responsible for the vibratory motion of simple pendulum is: (2 times)

(A) mg Cosθ (B) mg Secθ (C) mg Sinθ (D) Mg Tanθ

30. The correct relation between frequency and time period is:

(A) $\frac{f}{T}$=1 (B) $\frac{T}{f} = 1$ (C) f x T = 2 (D) f x T = 1

31. The frequency of Simple Pendulum is given by:

(A) $\frac{1}{2\pi}\sqrt{\frac{g}{l}}$ (B) $2\pi\sqrt{\frac{g}{l}}$ (C) $\frac{1}{2\pi}\sqrt{\frac{l}{g}}$ (D) $2\pi\sqrt{\frac{l}{g}}$

32. If amplitude of a simple pendulum is increased by 4 times then time period will be: (2 times)

(a) Four times (b) Half (c) Same (d) two times

33. At which place the motion f a simple pendulum will be slowest:

(A) Karachi (B) K – 2 (C) Murree (D) Lahore

34. By increasing the mass of a simple pendulum its period.

(A) Increases (B) Decreases (C) Remains same (D) Become zero

Topic V: Energy Conservation in Simple Harmonic Motion:

35. The maximum K.E of a mass attached to the end of an elastic spring is:

(A) $\frac{1}{2}kx^2$ (B) $\frac{1}{2}k\dot{x}_0^2$ (C) $\frac{1}{4}kx_0^2$ (D) kx_0^2

36. The P.E stored by a mass spring system at an extension of 2cm is 10J. The P.E stored by the same system at an extension of 4cm will be:

(A) 10 J (B) 20 J (C) 30 J (D) 40 J

37. The velocity of a particle having SHM is V at mean position. If its amplitude is doubled then velocity at mean position will be:

(A) v/2 (B) V (C) 2V (D) 4 V

38. A spring of spring constant $10\frac{N}{m}$ after loading the amplitude is 2m. Then the maximum P.E. is:

(A) 10 J (B) 20 J (C) 30 J (D) 40 J

39. Total energy of a particle executing S.H.M is:

(A) $\frac{1}{2}kx^2$ (B) $\frac{1}{2}k(x^2-x^2)$ (C) $\frac{1}{2}kx_o^2$ (D) $\frac{1}{2}k(x^2-x_o^2)$

Topic VII: Resonance:

40. The distance between node and antinodes:

(A) 4λ (B) 2λ (C) $\frac{\lambda}{2}$ (D) $\frac{\lambda}{4}$

41. The time period of a wave is 0.2 s. Its frequency will be: (2 Times)

(A) 2 Hz (B) 3 Hz (C) 4 Hz (D) 5 Hz

42. If 30 waves per second pass through a medium at a speed of $30ms^{-1}$ the wavelength is: (2 times)

(A) 30 m (B) 15 m (C) 1 m (D) 280 m

43. The waves produced in microwave oven have a wavelength of:

(A) 12cm (B) 12 m (C) 18 m (D) 18 cm

44. Tuning of radio is example of:

(A) Mechanical resonance (B) Electrical resonance
(C) Physical resonance (D) Biological resonance

45. The frequency of waves produced in microwave oven is: (3 Times)

(a) 2250 MHz (b) 2450 MHz (c) 2650 MHz (d) 2850 MHz

46. On loading the prong of a tuning fork with wax, the frequency of sound:

(a) Increases (b) decreases
(c) remains same (d) first increases then decreases

47. Shock absorber in automobiles is a practical form of:

(A) SHM (B) Damped oscillations (C) Forced oscillations (D) None of these

Topic VIII: Damped Oscillations:

48. A phenomenon by which energy is dissipated from the oscillating system is called.

(A) Forced oscillation (B) Free Oscillations
(C) Simple harmoinic oscillations (D) Damping

2018

49. The potential energy of a spring mass vibrating system at its man position is:

(a) Maximum (b) Minimum (c) Equal to K.E (d) Zero

50. By increasing mass of the object four times attached to a spring. Time period will become:

(A) same (B) twice (C) thrice (D) four times

51. A hose pipe ejects water at speed of 0.3 ms^{-1} through a hle of area $10cm^2$, flow rate will be:

(A) $3m^3S^{-1}$ (B) $3 \times 10^{-4} m^3S^{-1}$ (C) $30 m^3S^{-1}$ (D) $0.03 m^3S^{-1}$

52. When three-fourth of the cycle of a vibrating body completed then the phase of vibration is:

(A) $\frac{\pi}{4}$ radian (B) $\frac{\pi}{2}$ radian (C) $\frac{3\pi}{2}$ radian (D) π radian

53. When the amplitude of oscillation is doubled then its energy becomes:

(A) double (B) four times (C) one half (D) six times

54. Maximum velocity in SHM is:

(A) $x_o\omega^2$ (B) $x_o\omega$ (C) $x\omega$ (D) $x_o^2\omega$

2019

55. If the length of simple pendulum is doubled then its time period becomes:

(A) half (B) 2 times (C) $\sqrt{2}$ times (D) 4 times

56. Potential energy of oscillating mass spring system at any instant is: (2 Times)

(A) mgh (B) KX^2 (C) $\frac{1}{2}KX_0^2$ (D) $\frac{1}{2}KX^2$

57. Distance covered by a body in one vibration us 20 cm. The amplitude of the vibration will be.

(A) 10 cm (B) 5 cm (C) 15 cm (D) 20 cm

58. A simple pendulum is completing 20 vibration in 5 seconds, its frequency is: (2 Times)

(A) 4 Hz (B) 20 Hz (C) 200 Hz (D) 40 Hz

59. Acceleration in S.H.M is proportional to the:

(A) Velocity (B) Displacement (C) Time period (D) Water

60. The total energy of mass-spring system is independent of.

(A) mass of the body (B) amplitude

(C) spring constant (D) nature of material of spring

61. When the bob of simple pendulum is at extreme position then its K.E is:

(A) maximum (B) minimum (C) zero (D) small

62. $\sqrt{\frac{l}{g}}$ *and* $\sqrt{\frac{m}{k}}$ *has same.*

(A) Numerical value (B) Units (C) Damping (D) Time period

63. If the initial Phase is $\frac{\pi}{2}$ then displacement of SHM is:

(A) $x = x^2_o \sin wt$ (B) $x = \sin wt$ (C) $x = x_o \cos wt$ (D) Zero

64. When a Transverse Wave travelling in rare medium, incident on denser medium after reflection phase changes by:

(A) 360° (B) 180° (C) 90° (D) 0°

65. The distance covered by a body in one complete vibration is 20cm, what is the amplitude of the vibration.

(A) 10 cm (B) 80 cm (C) 5 cm (D) 20 cm

66. In order to double period of a simple pendulum the length of the pendulum should be increased by:

(A) Four times (B) Three times (C) Two times (D) Eight times

2021

67. Acceleration of a pendulum of length $l = 1$ m and displacement of 5 cm having S.H.M is :

(A) $0.29 m/s^2$ (B) $0.19 m/s^2$ (C) $0.69 m/s^2$ (D) $0.49 m/s^2$

68. At resonance, the transfer of energy is:

(A) Zero (B) Minimum (C) Maximum (D) Negative

69. If length of the simple pendulum is double then its period increases:

(A) 1.44 times (B) 2 times (C) 2.4 times (D) 3 times

70. The frequency of the first pendulum is:

(A) 2.0 Hz (B) 1.5 Hz (C) 1.0 Hz (D) 0.5 Hz

71. Energy of particle executing SHM of amplitude X_0 is proportional to:

(A) X_o^2 (B) X_o^{-2} (C) X_0 (D) $X_o^{-2}/2$

72. If the length of a simple pendulum is doubled, its period:

(A) Will not change (B) Will also be doubled

(C) Will be halved (D) Will increase by 1.4 times

73. If pendulum vibrate with frequency 0.5 Hz, then its length will be:

(A) 10 cm (B) 50 cm (C) 80 cm (D) 99 cm

ANSWERS OF THE MULTIPLE CHICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	B	A	D	B	B	B	A	B	D	B	D	B	B	A
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
C	D	B	D	A	B	C	C	A	D	B	A	C	C	D
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
A	C	B	C	B	D	C	B	C	D	D	C	A	B	B.
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
B	B	D	D	B	B	C	B	B	C	D	B	A	B	A
61	62	63	64	65	66	67	68	69	70	71	72	73		
C	B	C	B	C	A	D	C	A	C	A	D	D		

SHORT QUESTIONS OF CHAPTER-7 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Simple Harmonic Motion:

1. Define vibratory motion.

Ans: The to and fro motion of a body about a fixed point is called the vibratory or oscillatory motion.

2. Name two characteristics of S.H.M. **(12 times)**

Ans: The characteristics of SHM are:

i. Acceleration of the body is directly proportional to the displacement and is always directed towards mean position. $a \propto -x$

ii. Total energy of the particle executing SHM remains conserved.

$$E_{total} = K.E. + P.E. = constant$$

3. What is the total distance travelled by an object moving with SHM in a time equal to its period, if its amplitude is A? **(5 Times)**

Ans: The total distance travelled by an object moving with SHM in its time period is $4A$, where A is amplitude of vibration.

4. Does the acceleration of a simple harmonic oscillator remain constant during the motion? Is the acceleration ever zero? Explain briefly. **(16 Times)**

Ans: No, it does not remain constant. The acceleration of a body executing SHM is,

$$a = -\omega^2 x$$

Where x is the displacement from the mean position and a is acceleration which varies directly with x. As x changes during a SHM, its acceleration does not remain constant. The acceleration becomes zero at mean position and becomes maximum at extreme position.

5. State Hook's law. Write it in mathematical form. **(3 times)**

Ans: It states that within elastic limit the applied force is directly proportional to the displacement. Mathematically,

$$\vec{F} = k\ \vec{x}$$

6. What is the difference between displacement and amplitude?

Ans: During simple harmonic motion the value of distance from the mean position is called displacement.

The displacement is maximum at extreme position and the maximum value of displacement is known as amplitude.

Displacement varies with time while amplitude remains same.

7. Under what conditions does the addition of two simple harmonic motions produce a resultant which is also simple harmonic. **(4 Times)**

Ans: The addition of two simple harmonic motions of the same frequency having constant phase difference but of different amplitudes taking place in the same direction produces a resultant which is also a SHM, the amplitude of which is equal to the algebraic sum of the amplitudes of the two component SHMs.

8. Why the motion of projection of a point revolving in a circle with variable angular velocity is not Simple Harmonic Motion?

Ans: Simple Harmonic Motion is a periodic motion which repeats itself after equal interval of time and also $a \propto -x$. Thus, if point is revolving in a circle with variable angular velocity then the motion of projection is not Simple Harmonic Motion.

9. What is slinky spring?

Ans: A large and loose spring coil is called slinky spring. It can be used to demonstrate the effect of the motion of the source in generating waves in a medium.

10. Define frequency and give its unit.

Ans: Number of vibrations per second is called frequency. Its S.I unit is Hz.

11. Define angular frequency. Give its formula and unit.

Ans: Number of cycles per second is called angular frequency. It is denoted by ω.

Formula $\omega = \frac{2\pi}{T} = 2\pi f$

S.I unit: Hertz

12. Define periodic motion. Give example.

Ans: Periodic motion is the one that repeats itself after equal intervals of time. Vibratory motion of mass-spring system and simple pendulum is periodic.

13. Explain restoring force and what is its direction?

Ans: Restoring force opposes the change in shape of a body and is equal and opposite to applied force.

$F_r = -Kx$

It is directed towards mean position.

Topic III: Phase:

14. What do you mean by phase? **(6 Times)**

Ans: The angle θ which specifies the displacement as well as the direction of motion of the point executing SHM is known as phase. $\theta = \omega t$

15. What is meant by phase angle? Does it define angle between max displacement and the driving force? **(7 Times)**

Ans: The angle θ which specifies the displacement as well as the direction of motion of the point executing SHM is known as phase angle.

It does not define angle between maximum displacement and driving force. It is the angle that the rotating radius makes with the reference direction.

16. In relation to SHM, explain the equation: **(3 Times)**

i) $y = A\sin(\omega t + \varphi)$ **ii)** $a = -\omega^2 x$

Ans: i. $y = A\sin(\omega t + \varphi)$

Here

y is the instantaneous displacement

A is the amplitude

ωt is the phase angle subtended in time t

φ is the initial angle

ii. $a = -\omega^2 x$

Here

a is the acceleration

ω is the angular frequency

x is the instantaneous displacement

Negative sign shows that acceleration and displacement are in opposite directions.

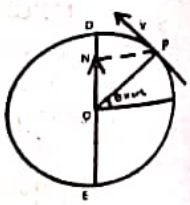
17. In the relation to S.H.M explain the equation y = A sin (ωt + φ). **(2 Times)**

Ans: This equation represents the displacement of simple harmonic oscillator as a function of time, and also tells that displacement follows a sine curve i.e. varies harmonically. 'y' is instantaneous displacement, 'A' is the amplitude, 'φ' is initial phase angle, '(ωt + φ)' is the phase angle made with reference direction and 'ωt' is the angle subtended in time 't' with angular frequency 'ω' starting from initial phase 'φ'.

18. Define phase angle with diagram.

Ans: The angle which gives the displacement as well as direction of motion of point executing SHM is called Phase Angle. Thus, it determines the state of motion of vibrating point.

In the figure θ = ωt is phase angle.



19. What is meant by phase angle and initial phase? **(2 Times)**

Ans: The angle which gives the displacement as well as direction of motion of point executing SHM is called Phase Angle. Thus, it determines the state of motion of vibrating point.

If a body does not start its motion from mean position then the phase angle at the starting position is called initial phase.

Topic IV: Horizontal Mass Spring System:

20. Define restoring force and simple harmonic motion.

Ans: **Restoring force:** The force that brings back the oscillatory object towards its mean position is called the restoring force. $F = -kx$

Simple harmonic motion: The vibratory motion in which the acceleration of the body is proportional to displacement and is directed towards its mean position is called simple harmonic motion. $a \propto -x$

21. If a mass spring system is hung vertically and set into oscillations, why does the motion eventually stop? **(21 Times)**

Ans: If the mass spring system is hung vertically and set into oscillation, the motion eventually stops due to friction and air resistance and some other damping forces.

22. Does frequency depend on amplitude for harmonic oscillator? **(14 Times)**

Ans: Since

$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

And

$$f = \frac{1}{2\pi}\sqrt{\frac{g}{\ell}}$$

So the frequency of the oscillator is independent of the amplitude of oscillation.

23. The equation for SHM of an object is given by x = 0.25 cos(π/8)t What will be the displacement after 2 Seconds?

Ans: Given that $x = 0.25 \cos\left(\frac{\pi}{8}\right)t$

Putting t = 2s

$$x = 0.25 \cos\left(\frac{\pi}{8}\right)2$$

$$x = 0.25 \cos\left(\frac{\pi}{4}\right)$$

$$x = 0.25\ (0.707)$$

$$x = 0.18\ m$$

24. What will be the potential energy of a mass attached to a spring at amplitude of 5 cm, if its spring constant is 10 Nm^{-1}?

Ans: $x_o = 5\ cm = 0.05\ m$

$K = 10\ Nm^{-1}$

For a mass spring system

$$P.E = \tfrac{1}{2}\, k\, x_o^2$$

$$P.E = \tfrac{1}{2}\,(10)\,(0.05)^2$$

$$P.E = 0.0125\ J$$

25. The amplitude of simple pendulum should be small, why?

Ans: If amplitude of simple pendulum is large then force of air friction changes its time period. Therefore amplitude should be kept small.

26. Define Simple Harmonic oscillator and driven harmonic oscillator.

Ans: The oscillator motion taking place under the action of restoring force is known as simple harmonic motion . A body such as simple pendulum, executing SHM is called **simple harmonic oscillator.**

A physical system undergoing forced vibrations is known as **driven harmonic oscillator.**

27. Does the frequency of simple pendulum depend on amplitude or length of simple pendulum? Explain.

Ans: Frequency of simple pendulum is given as

$$f = \frac{1}{2\pi}\sqrt{g/l}$$

This relation shows that frequency of simple pendulum does not depend on amplitude. It depends on length of simple pendulum.

28. What are the factors on which frequency of a spring-mass system depends?

Ans: Frequency of a mass – spring system is given by

$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

It depends upon spring constant and mass attached.

29. Derive the relation $\omega = \sqrt{\frac{k}{m}}$.

Ans: For a mass-spring system which can move freely on a frictionless horizontal surface, acceleration produced in the mass due to restoring force can be calculated using 2nd law of motion.

$F = ma$

Then $-Kx = ma$

$$\alpha = -\frac{k}{m}x \quad \rightarrow \quad \text{(i)}$$

By definition of simple harmonic motion.

$\alpha = -\omega^2 x \rightarrow$ (ii)

Comparing eq. (i) and (ii).

$$-\omega^2 x = \frac{k}{m}x$$

$$\omega^2 = \frac{k}{m}$$

$$\omega = \sqrt{\frac{k}{m}}$$

30. Show that for a body attached with a spring $\vec{a} = \frac{-k}{m}\vec{x}$.

Ans: Let us consider a mass attached with a spring which can move freely on a frictionless horizontal surface. The acceleration $\vec{a}$ produced in the mass due to restoring force can be calculated using 2nd law of motion.

$\vec{F} = m\vec{a}$

But from Hooke's law $\vec{F} = -k\vec{x}$

Then, $-k\vec{x} = m\vec{a}$

Or $\vec{a} = -\frac{k}{m}\vec{x}$

31. If mass of a spring-mass vibrating system is increased by four times. What is the effect on its frequency?

Ans: Frequency of mass-spring system is given as

$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

Let $m' = 4m$ then

$$f' = \frac{1}{2\pi}\sqrt{\frac{k}{m'}}$$

$$= \frac{1}{2\pi}\sqrt{\frac{k}{4m}}$$

$$= \frac{1}{2}\frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

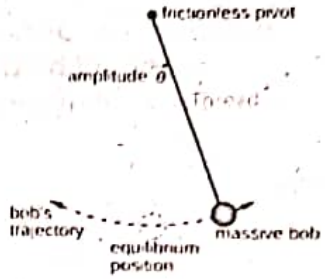
$$f' = \frac{1}{2} f$$

Hence, frequency will be halved.

Topic V: Simple Pendulum:

32. What is simple pendulum?

Ans: A simple pendulum consists of a mass m hanging from a string of length L and fixed at a pivot point P. When displaced to an initial angle and released, the pendulum will swing back and forth with periodic motion.



33. Can we realize an ideal simple pendulum? **(10 Times)**

Ans: No, we can't realize an ideal simple pendulum. Because an ideal simple pendulum should consist of a heavy but small metallic bob suspended from a frictionless rigid support by means of long, weightless and inextensible string. And these conditions are impossible to attain.

34. Calculate the length of the simple pendulum which completes one vibration in one second.

OR What should be the length of simple pendulum whose period is one second? **(4 Times)**

Ans: It is given that

$$g = 9.8\ ms^{-2}$$
$$T = 1\ s$$
$$l = ?$$

Since

$$T = 2\pi\sqrt{\frac{l}{g}}$$
$$T^2 = 4\pi^2\frac{l}{g}$$
$$l = \frac{T^2 g}{4\pi^2}$$
$$l = \frac{(1)^2(9.8)}{4(3.14)^2} = 0.248\ m = 24.8\ cm$$

35. Why the amplitude of lead bob is greater than pith ball as the bobs having equal size and length set into vibration? **(2 Times)**

Ans: It is because the mass of lead bob is much greater than the very light pith ball, so lead bob can travel to greater extent in air against the resistive and retarding forces. Lead bob has greater inertia.

36. What happens to the period of a simple pendulum if its length is doubled? What happens if the suspended mass is doubled? **(15 Times)**

Ans: The time period of a simple pendulum is,

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

If length 'ℓ' is doubled, equ. becomes

$$T' = 2\pi\sqrt{\frac{2\ell}{g}} = \sqrt{2} \times 2\pi\sqrt{\frac{\ell}{g}} = \sqrt{2}\,T = 1.41T$$

So when length is doubled, T increases 1.41 times.

Whereas if mass is doubled, T remains same because T of simple pendulum is independent of mass as it is clear in above relation.

37. What happens to the period of the simple pendulum if the length is halved and mass of bob is doubled?

Ans: Time period of simple pendulum is given as

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

If length 'ℓ' is halved, equ. becomes

$$T' = 2\pi\sqrt{\frac{\ell}{2g}} = \frac{1}{\sqrt{2}}\,(2\pi\sqrt{\frac{\ell}{g}}) = \frac{1}{\sqrt{2}}T = \frac{1}{1.41}T$$

So when length is halved, T decreases 1.41 times.
Whereas if mass is doubled, T remains same because T of simple pendulum is independent of mass as it is clear in above relation.

38. What should be the natural period of Simple Pendulum whose length is 90 cm?

Ans: Time period of simple pendulum is given as

$$T = 2\pi\sqrt{l/g}$$

If $l = 90cm = 0.9m$

Then $T = 2(3.14)\sqrt{\frac{0.9}{9.8}}$

$T = 1.90\ s$

Which is required natural time period.

Topic VI: Energy Conservation in Simple Harmonic Motion:

39. Show that in SHM the acceleration is zero when velocity is greatest and the velocity is zero when acceleration is maximum. (5 Times)

Ans: The acceleration of SHM is

$$a = -\omega^2 x$$

And velocity of SHM is

$$v = \omega\sqrt{x_0^2 - x^2}$$

At mean position $x = 0$, so

$$a = 0 \quad ; \quad v = \omega x_0\ (maximum\ value)$$

At extreme position $x = x_0$, so

$$a = -\omega^2 x \quad ; \quad v = 0\ (velocity\ becomes\ zero)$$

40. Explain relation between total energy, potential energy and kinetic energy for a body in simple harmonic motion. (2 Times)

Ans: When the K.E of the mass is maximum, the P.E of the spring is zero. Conversely, when the P.E of the spring is maximum, the K.E of the mass is zero. The interchange occurs continuously from one form to the other but the total energy remains conserved.

41. A mass-spring system is vibrating with amplitude 10 cm. Find its K.E. and P.E at equilibrium position, when spring constant is 20 Nm^{-1}.

Ans: Gives that $x_o = 10cm = 0.1m$

K = 20 Nm^{-1}

At equilibrium position x = 0

K.E =?

P.E=?

We know that at equilibrium position

P.E = 0

And $K.E = \frac{1}{2}kx_o^2$

$$= \frac{1}{2}(20)(0.1)^2$$

$$= 0.1\ J$$

Topic VII: Free and Forced Oscillations:

42. Describe free vibrations.

Ans: A body is said to be executing free vibrations when it oscillates without the interference of an external force.

43. What do you understand by forced vibrations? Explain with examples.

Ans: If an oscillating system is subjected to an external periodic force, then forced vibrations will take place.

I. The vibrations of a factory floor caused by the running of heavy machinary is an example of forced vibrations.

II. The mass of a vibrating pendulum is struck repeatedly, the forced vibrations are produced.

44. Define free and forced oscillations.
OR Explain free and forced oscillations. (10 Times)
OR Differentiate between free and force oscillations.

Ans: **Free oscillations:** A body is said to be executing free vibrations when it oscillates without the interference of an external force.

Forced oscillations: If an oscillating system is subjected to an external periodic force, then forced vibrations will take place.

I. The vibrations of a factory floor caused by the running of heavy machinary is an example of forced vibrations.

II. The mass of a vibrating pendulum is struck repeatedly, the forced vibrations are produced.

45. Define driven harmonic oscillator and damped oscillations.

Ans: **Damped oscillations:** The oscillations in which the amplitude decreases steadily with time are called damped oscillations.

Driven harmonic oscillator: The physical system undergoing forced vibrations is known as driven harmonic oscillator.

46. What is driven harmonic oscillator? Give example. (4 Times)

Ans: A physical system under going forced vibrations is called driven harmonic oscillator.

An example of forced vibrations is loud music produced by sounding wooden boards of strings instruments.

47. What is the difference between free and driven harmonic oscillators?

Ans: A body is said to be executing free vibrations when it oscillates without the interference of an external force. For example, a simple pendulum vibrates freely with its natural frequency.

A physical system under going forced vibrations is known as driven harmonic oscillator. For Example, the vibrations of a factory floor caused by the running of heavy machinery.

Topic VIII: Resonance:

48. Define resonance. Write its one example. (3 times)

Ans: When the frequency of the applied force is equal to the natural frequency of simple harmonic oscillator, the periodic amplitude of the motion may become extraordinary large. This phenomenon is called resonance.

I. A swing is a good example of mechanical resonance.
II. Tuning a radio is the example of electrical resonance.

49. Briefly give two phenomena in which resonance plays an important role.

Ans: **i)** Tuning a radio, we turn the knob to make the natural frequency of the electric circuit of receiver equal to the transmission frequency of the radio station. When the two frequencies match, energy absorption is maximum and this is the only station we hear.

ii) Food can be easily cooked in a microwave oven. The waves produced in this type of oven have a frequency of 2450 MHz. At this frequency the waves are absorbed due to resonance by water and fat molecules in the food.

50. Why soldiers are advised to break their steps when marching on a bridge? (2 Times)

Ans: The column of soldiers, while marching on a bridge of long span is advised to break their steps. Because their rhythmic march might set up oscillation of dangerously large amplitude in the bridge structure.

51. How cooking of food is possible in micro-wave oven? (8 Times)
OR How does resonance plays an important role in working of microwave oven?
OR Discuss the heating of food in microwave oven by resonance.
OR Why waves of 2450 MHz frequency are necessary for heating and cooking of food in microwave oven.

Ans: Food can be easily cooked in a microwave oven. The waves produced in this type of oven have a frequency of 2450 MHz. At this frequency the waves are absorbed due to resonance by water and fat molecules in the food.

52. Write and explain electrical application of resonance. (2 times)

OR How a particular station is tuned in radio?

Ans: Tuning of a radio is the best example of electrical resonance. When we turn the knob of a radio, to tune a station, we are changing the natural frequency of electrical circuit of receiver, to make it equal to the transmission frequency of the radio station. When the two frequencies match, energy absorption is maximum and this is the only station we hear.

53. Describe some common phenomena in which resonance plays an important role. (10 Times)

Ans: Following are some common phenomena in which resonance plays an important role.

i) Tuning of a radio

It is a good example of electrical resonance. For tuning, we turn the knob of a radio which changes the natural frequency of electrical circuit of receiver until it becomes equal to the frequency of the transmitter. So resonance is produced and energy absorption is maximum. Hence a station is tuned and we can hear the transmission of desired station.

ii) Microwave oven

The waves produced in this type of oven have a wavelength of 12cm at a frequency of 2450 MHz at this frequency the waves are absorbed due to resonance by water and fat molecules in the food resulting in efficient and evenly heating and cooking of food.

54. How the phenomenon of resonance is produced?

OR Describe the condition under which a vibrating body resonates with another body.

Ans: When the frequency of the applied force is equal to the natural frequency of simple harmonic oscillator, the periodic amplitude of the motion may become extraordinary large. This phenomenon is called resonance.

I. A swing is a good example of mechanical resonance.
II. Tuning a radio is the example of electrical resonance.

55. Explain relation between total energy, potential energy and kinetic energy for a body oscillating with SHM.

OR State the total energy of the vibrating mass and spring is constant.

Ans: For a body executing SHM, total energy is the sum of K.E and P.E which remains conserved during the motion in the absence of frictional forces, the K.E and P.E are interchanged continuously from one form to another. At mean position, the energy is totally kinetic i.e. K.E is maximum but P.E. = 0. At extreme positions, the K.E is completely changed into P.E. In between, it is partly K.E and partially P.E.

56. Write one advantage and one disadvantage of resonance. (2 Times)

Ans: **Advantage:** A swing is a god example of mechanical resonance. If a series of regular pushes are given to the swing, its motion can be built up enormously.
Disadvantage: The rhythmic march of column of soldiers on a bridge of long span might set up oscillations of dangerously large amplitude in the bridge structure. Bridge can be collapsed due to violent resonance oscillations. They are advised to break their steps.

57. How does resonance play role in heating and cooking food?

Ans: The waves produced in microwave oven are absorbed due to resonance by water and fat molecules in the food, heating them up and so cooking the food. Microwaves have a wavelength of 12 cm at a frequency of 2450 MHz.

Topic IX: Damped Oscillations:

58. What are damped oscillations? Give some of its applications. (3 times)

Ans: The oscillations in which the amplitude decreases steadily with time are called damped oscillations.

For example

i. The shock absorber of a car

ii. Motion of any microscopic system

59. **Differentiate between damped oscillation and undamped oscillations. (2 times)**

Ans: **Damped oscillations:** The oscillations in which the amplitude decreases steadily with time are called damped oscillations.
For example, shock absorber of a car and motion of any microscopic system.
Undamped oscillations: The oscillations in which the amplitude remains same with time are called undamped oscillations. For example, oscillations in an ideal simple pendulum.

60. **If a heavy and light masses of same size are set into vibration, which of them will stop first?**

Ans: Light mass will stop first.
The damping effect for the light mass due to air resistance is much greater than the heavy mass. Therefore, it will stop first.

61. **What is sharpness of resonance?**

Ans: The amplitude as well as its sharpness, both depend upon the damping. Smaller the damping, greater will be the amplitude and more sharp will be the resonance.

62. **What is damping and give its one application.**

Ans: Damping is the process whereby energy is dissipated from the oscillating system. The amplitude of oscillation decreases steadly with time.
Application:
Shark absorber of a car provide a damping force to prevent excessive oscillations.

63. **Differentiate between Resonance and Damping.**

Ans: Resonance occurs when the frequency of the applied force is equal to the natural frequency of oscillator, the amplitude of the motion may become extraordinary large.
At resonance, the transfer of energy is maximum. Damping is the process whereby energy is dissipated from the oscillating system.
Damping is a process in which amplitude of oscillation of the oscillator decreases steadily with the time.

2021

64. **If equation for simple harmonic motion is $x = 10 \sin(\pi/6)t$. Then calculate the instantaneous displacement after 3 Seconds?**

Ans: Given that

$$x = 10 \sin\left(\frac{\pi}{6}\right)t$$

Putting t = 3 s

$$x = 10 \sin\left(\frac{\pi}{6}\right)3$$

$$x = 10 \sin\left(\frac{\pi}{2}\right)$$

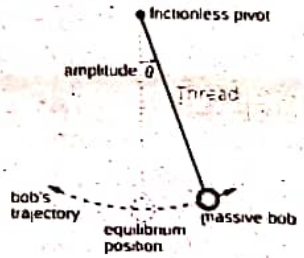
$$x = 10\,(1)$$

$$x = 10\ m$$

65. **What is simple pendulum? Write down its formula for time period.**

Ans:

A simple pendulum consists of a mass m hanging from a string of length L and fixed at a pivot point P. When displaced to an initial angle and released, the pendulum will swing back and forth with periodic motion.



The formula for time period of a simple pendulum is;

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

66. A block weighing 4.0 kg extends a spring by 0.16 m from its unstretched position. The block is removed and a 0.50 kg body is hung from the same spring. If the spring is now stretched and then released, what is the period of vibration?

Ans:

$$\text{mass of first block} = m_1 = 4\ kg$$
$$\text{elongation} = x = 0.16\ m$$
$$\text{mass of second block} = m_2 = 0.5\ kg$$
$$\text{Time Period} = T = ?$$

By Hook's law

$$F = kx \text{ or } k = \frac{F}{x} = \frac{m_1 g}{x} = \frac{4 \times 9.8}{0.16} = 245\ Nm^{-1}$$

As

$$T = 2\pi\sqrt{\frac{m_2}{k}} = 2 \times 3.14 \times \sqrt{\frac{0.5}{245}} = 0.28\ s$$

67. Define simple pendulum and find the frequency of second pendulum.

Ans: A simple pendulum consists of a mass m hanging from a string of length L and fixed at a pivot point P. When displaced to an initial angle and released, the pendulum will swing back and forth with periodic motion. As the time period of second pendulum is 2 second. Then its frequency is calculated by:

$$f = \frac{1}{T} = \frac{1}{2} = 0.5\ Hz$$

LONG QUESTIONS OF CHAPTER-7 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Simple Harmonic Motion:

1. Define simple harmonic motion. Discuss motion of projection of particle moving along the circle. Show that this motion is simple harmonic. **(2 Times)**
2. Define simple harmonic motion. Prove that projection of particle moving in a circle, on vertical diameter is a SHM. **(2 Times)**
3. A particle moving along a circle then its projection on the diameter of the circle executing. SHm. Derive the relation for velocity and acceleration of SHM. **(2 Times)**

Topic III: Horizontal Mass Spring System:

4. Define Simple Harmonic Motion. Show that the body of Mass "m" attached to the spring performs Simple Harmonic Motion. **(2 Times)**
5. Discuss the motion of horizontal mass spring system and also derive formula for time period, displacement and velocity.

Topic IV: Simple Pendulum:

6. What is simple pendulum? Derive an expression for its time period and frequency of pendulum. **(2 Times)**
7. What is Simple Pendulum? Show that its motion is S.H.M. Derive an expression for its time period. **(5 Times)**
8. Define simple pendulum. Prove that the oscillation of simple pendulum is simple harmonic otion. Derive formula for its time period. **(3 Times)**
9. Define simple pendulum. Derive the expression for its time period.

Topic V: Energy Conservation in Simple Harmonic Motion:

10. Define simple harmonic motion. Prove that energy is conserved for a body executing simple harmonic motion.
11. Define SHM. Prove that total energy remains conserved in mass-spring system, oscillating with SHM. **(3 Times)**
12. Show that the total energy of the vibrating mass and spring is constant. **(3 Times)**

NUMERICAL PROBLEMS OF CHAPTER-7 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Simple Harmonic Motion:

1. **Find amplitude, frequency and time period by considering the wave equation** $x = 0.25 \cos(\pi/8)t$

Sol: Given that $x = 0.25 \cos\left(\frac{\pi}{8}\right)t$

As we know that $x = x_o \cos \omega t$

Comparing these two equations, we get

$$x_o = 0.25m$$

$$\omega = \frac{\pi}{8}$$

$$2\pi f = \frac{\pi}{8} \qquad (\because \omega = 2\pi f)$$

$$f = \frac{1}{2\times 8}$$

$$f = \frac{1}{16}\ Hz$$

Since $T = \frac{1}{f}$

$$T = \frac{1}{1/16}$$

$$T = 16\ s$$

Topic IV: Horizontal Mass Spring System:

2. **A block of mass $4.0\ kg$ is dropped from a height of $0.80\ m$ onto a spring constant $k = 1960\ N/m$. Find the maximum distance through which the spring will be compressed.** **(14 Times)**

Sol: Given that

$$mass\ of\ the\ block = m = 4\ kg$$
$$height = h = 0.8\ m$$
$$acceleration\ due\ to\ gravity = g = 9.8\ ms^{-2}$$
$$spring\ constant = k = 1960\ N/m$$
$$maximum\ distance = x_0 = ?$$

Now

$$P.E. = \frac{1}{2}kx_0^2$$

$$mgh = \frac{1}{2}kx_0^2$$

$$x_0^2 = \frac{2mgh}{k}$$

$$x_0^2 = \frac{2(4)(9.8)(0.8)}{1960}$$

$$x_0^2 = 0.032$$

$$\boxed{x_0 = 0.18\ m}$$

3. **A 100 g body hung on a spring elongates the spring by 4.0 cm. When a certain object is hung on the spring and set vibrating, its period is 0.568 s. What is the mass of the object pulling the spring?** **(3 Times)**

Sol:

$$m = 100g = \frac{100}{1000} = 0.1kg$$

$$x = 4.0cm = \frac{4}{100} = 0.04m$$

$$T = 0.568s$$

$$m' = ?$$

$$F = kx \ , \ also \ F = w = mg$$

$$Thus \quad kx = mg$$

$$or \quad k = \frac{mg}{x}$$

$$k = \frac{0.1 \times 9.8}{0.04}$$

$$k = 24.5 \, N/m$$

$$Now \quad T = 2\pi\sqrt{\frac{m'}{k}}$$

$$T^2 = 4\pi^2\left(\frac{m'}{k}\right)$$

$$m' = \frac{KT^2}{4\pi^2}$$

$$m' = \frac{24.5 \times (0.568)^2}{4 \times (3.14)^2}$$

$$m' = 0.200kg$$

$$m' = 200gm$$

4. An 8.0 Kg body excustes SHM with amplitude 30 cm. The restoring force is 60 N when the displacement is 30 cm. Find period and the speed when displacement is 12 cm.

Sol:

$$m = 8.0kg$$

$$x_0 = 30cm = 0.30m$$

$$F = 60N$$

$$x = 30cm = 0.30m$$

$$T = ?$$

$$V = ?$$

As $x = 12cm = 0.12m$

$$F = kx_0$$

$$k = \frac{F}{x_0}$$

$$k = \frac{60}{0.30}$$

$$k = 200Nm^{-1}$$

Since $T = 2\pi\sqrt{\frac{m}{k}}$

$$T = 2 \times 3.14\sqrt{\frac{8}{200}}$$

$$T = 6.28 \times \sqrt{0.04}$$

$$T = 6.28 \times 0.2$$

$$T = 1.256s$$

$$T = 1.3s$$

(iii) As $v = \omega\sqrt{x_0^2 - x^2}$

$$v = \sqrt{\frac{k}{m}}\sqrt{x_0^2 - x^2}$$

$$v = \sqrt{\frac{200}{8}}\sqrt{(0.3)^2 - (0.12)^2}$$

$$v = 5\sqrt{0.09 - 0.0144} = 5\sqrt{0.0756} = 1.37\ m/s$$

$$v = 1.4\ m/s \quad (approx)$$

Topic IV: Simple Pendulum:

5. A simple pendulum is 50 cm long. What will be its frequency of vibration at a place where $g = 9.8\ ms^{-2}$. (7 Times)

Sol: Given that

$$length\ of\ simple\ pendulum = l = 50\ cm = 0.5\ m$$
$$acceleration\ due\ to\ gravity = g = 9.8\ ms^{-2}$$
$$frequency\ of\ simple\ pendulum = f = ?$$

Time period of simple pendulum is

$$T = 2\pi\sqrt{\frac{l}{g}}$$

$$T = 2(3.14)\sqrt{\frac{0.5}{9.8}}$$

$$T = 1.42\ s$$

And

$$f = \frac{1}{T}$$

$$f = \frac{1}{1.41}$$

$$\boxed{f = 0.70\ Hz}$$

6. What should be the length of a simple pendulum whose period is 1.0 second at a place where g = 9.8ms^{-2}. What is the frequency of such a pendulum? (3 Times)

Sol: T = 1.0 S

g = 9.8 ms^{-2}

ℓ = ?

f = ?

As $T = 2\pi\sqrt{\ell/g}$

Squaring on both sides

$$T^2 = 4\pi^2\frac{\ell}{g}$$

$$\ell = \frac{gT^2}{4\pi^2}$$

$$\ell = \frac{9.8 \times (1.0)^2}{4(3.14)^2}$$

$$\ell = 0.25m$$

As $f = \frac{1}{T}$

$$f = \frac{1}{1.0} = 1\ Hz$$

7. What should be the length of a simple pendulum whose period is 2s at a place where g = 9.8 m/s² ? What is the frequency of such a pendulum?

Ans:

$$T = 2\ s$$
$$g = 9.8\ m/s^2$$
$$l = ?$$
$$f = ?$$

$$Time\ period.\ T = 2\pi\sqrt{l/g}$$

Squaring both sides

$$T^2 = 4\pi^2\frac{l}{g}$$

$$l = \frac{gT^2}{4\pi^2}$$

$$l = \frac{9.8\ (2)^2}{4\ (3.14)^2}$$

$$l = 1\ m\ or\ 100\ cm$$

$$\text{Frequency } f = \frac{1}{T} = \frac{1}{2} = 0.5\ Hz$$

8. A simple pendulum is 80 cm long what will be its period and frequency at a place where $g = 9.8ms^{-2}$

Sol: $l = 80cm = 0.80m$

$g = 9.8\,m/s$

$T = ?$

$f = ?$

For a simple pendulum

$T = 2\pi\sqrt{l/g}$

$= 2(3.14)\sqrt{\frac{0.80}{9.8}}$

$= (6.28)\times(0.286)$

$= 1.80s$

We know that

$f = \frac{1}{T}$

$= \frac{1}{1.80}$

$= 0.56\ Hz$

2021

9. A spring, whose spring constant is 80 Nm^{-1} vertically supports a mass of 1.0 kg in the rest position. Find the distance by which the mass must be pulled down, so that on being released, it may pass the mean position with a velocity of 1.0 ms^{-1}.

Sol:

$$\text{spring constant} = k = 80\ N/m$$
$$\text{mass} = m = 1\ kg$$
$$\text{maximum speed} = v_0 = 1\ ms^{-1}$$
$$\text{amplitude} = x_0 = ?$$

$$v_o = x_o\sqrt{\frac{k}{m}} \quad \text{or } x_o = \frac{v_o}{\sqrt{\frac{k}{m}}}$$

$$x_o = v_o\sqrt{\frac{m}{k}} = 1 \times \sqrt{\frac{1}{80}} = 0.11\ m.$$

OBJECTIVES (MCQ'S) OF CHAPTER-8 IN ALL PUNJAB BOARD 2011-2021

Topic I: Waves:

1. Longitudinal waves did not exhibit: **(6 Times)**
(A) reflection (B) refraction (C) diffraction (D) polarization

2. 10 waves pass through the medium in one sec with speed of 10m/s. The wavelength of waves is:
(A) 1 m (B) 10 m (C) 20 m (D) 100 m

3. Distance between two consecutive nodes is: **(9 Times)**
(A) λ (B) $\frac{\lambda}{4}$ (C) $\frac{\lambda}{2}$ (D) 2λ

4. Both transverse and longitudinal waves can be setup in which one of the following media?
(A) Solid (B) Liquid (C) Gas (D) Plasma

5. Which electromagnetic waves are used as medium in satellite communication system:
(A) Microwaves (B) Radio waves (C) Infrared waves (D) Ultraviolet waves

6. Electromagnetic wave travel in free space with velocity equal to:
(A) $3\times10^{6}\,ms^{-1}$ (B) $3\times10^{7}\,ms^{-1}$ (C) $3\times10^{8}\,ms^{-1}$ (D) $3\times10^{9}\,ms^{-1}$

7. Appropriate range of audible frequencies for younger person is:
(A) 20-200 Hz (B) 20-2000 Hz (C) 20-20000 Hz (D) 2000-20000 Hz

8. The number of anti-node between two nodes is: **(2 Times)**
(A) 1 (B) 2 (C) 3 (D) 4

9. The frequency of waves produce in microwave oven is:
(A) 1450 MHz (B) 1650 MHz (C) 2450 MHz (D) 2850 MHz

10. Distance between crest and trough is: **(2 Times)**
(A) λ (B) $\lambda/2$ (C) $\lambda/4$ (D) 2λ

11. The example of mechanical wave is: **(2 Times)**
(A) Water and air waves (B) Radio waves
(C) Infrared waves (D) Ultraviolet waves

12. The portion of wave above mean level is called:
(A) Node (B) Anti-node (C) Crest (D) Trough

13. The distance between two consecutive anti-nodes is:
(A) λ (B) $\frac{\lambda}{4}$ (C) 2λ (D) $\frac{\lambda}{2}$

14. The distance between node and next antinode is: **(2 Times)**
(A) λ (B) 2λ (C) $\frac{\lambda}{2}$ (D) $\frac{\lambda}{4}$

15. The correct relation is:
(A) $V=\lambda T$ (B) $\lambda=\frac{V}{T}$ (C) $v=\frac{\lambda}{f}$ (D) $v=f\lambda$

16. Transverse waves are distinguished from longitudinal waves by the property:
(A) Interference (B) Diffraction (C) Reflection (D) Polarization

17. When the amplitude of a wave increases to doubled its energy:
(A) Remain the same (B) Increases by two times
(C) Increases by 4 times (D) Decrease to half

18. The distance covered by wave in 1-sec is:
(a) wavelength (b) wave number (c) frequency (d) wave speed

19. Half wavelength corresponds to:
(a) 0° (b) 90° (c) 180° (d) 360°

20. longitudinal waves are also known as:
(a) stationary waves (b) transverse waves
(c) compressional waves (d) electromagnetic waves

21. Tuning fork is a source of :
(a) Energy (b) heat (c) light (d) sound

22. Two waves of equal frequency travelling in opposite directions produce: **(2 Times)**
(A) Interference (B) Stationary waves (C) Beats (D) Doppler effect

23. The distance between 1st node and 4th antinode is:
(A) $\frac{7}{4}\lambda$ (B) $5\frac{\lambda}{4}$ (C) $13\frac{\lambda}{4}$ (D) $11\frac{\lambda}{4}$

24. When sound waves enter in different medium, the quantity that remains unchanged is:
(A) Intensity (B) Speed (C) Frequency (D) Wavelength

25. The pitch of sound depends upon.
(A) Intensity of sound (B) Wavelength of sound
(C) Frequency of sound (D) Loudness of sound

26. The number of node(s) between two consecutive antinodes is: **(2 Times)**
(A) One (B) Two (C) Three (D) Four

27. If 332 waves pass through a medium in one second with speed of 332 ms^{-1} then wavelength will be:
(A) 7m (B) 332 m (C) 664 m (D) 1 m

28. Longitudinal waves of frequencies less than 20Hz are known as:
(A) Infra Sound (B) Ultra Sound (C) Super Sonics (D) Audible Sound

29. Crests and troughs are formed in:
(A) Longitudinal waves (B) Transvers waves
(C) Stationary waves (D) Compressional waves

30. The wave length of a transverse wave travelling with speed "V" having frequency "f"
(A) f/v (B) vf (C) v/f (D) f/v^2

31. Frequency range of hearing of cats is:
(A) 20 – 20000 Hz (B) 10 - 10000 Hz (C) 60 – 20000 Hz (D)60 – 70000 Hz

32. The waves used in rander speed trap are.
(A) Longitudinal (B) Sound waves (C) Microwaves (D) Matter waves

33. The light from stars can be reflected by their:
(A) Mass (B) Distance (C) Radius (D)Gravity

34. The distance between a compression and its adjacent rarefaction is:
(A) $\frac{\lambda}{2}$ (B) λ (C) $\lambda 2$ (D) $\frac{\lambda}{4}$

Topic II: Speed of Sound in Air:

35. The value of "γ" for diatomic gas is:
(A) 1.67 (B) 1.40 (C) 1.29 (D) infinity

36. The speed of sound in air depends upon:
(A) Temperature (B) Humidity (C) Density (D) All of these

37. The speed of sound has maximum value in:
(A) Oxygen (B) Air (C) Hydrogen (D) Helium

38. Sound waves cannot be: **(2 Times)**
(A) Reflected (B) Refracted (C) Polarized (D) Diffracted

39. If the speed of sound in air at a given pressure is V, then by increasing the pressure to double, the new speed becomes: **(2 Times)**
(A) 0.5V (B) V (C) 2V (D) 4V

40. Velocity of sound in free space at $0°C$: **(6 Times)**
(A) 332 ms^{-1} (B) 224 ms^{-1} (C) 76 ms^{-1} (D) 0

41. Laplace expression for the speed of sound in a gas is: **(3 Times)**
(A) $v = \sqrt{\frac{P}{\rho}}$ (B) $v = \frac{P}{\rho}$ (C) $v = \sqrt{\frac{\gamma P}{\rho}}$ (D) $v = \frac{\gamma P}{\rho}$

42. Speed of sound at t°C is given as:
(A) $v_t = v_o + 0.61\,t$ (B) $v_t = v_o - 0.61\,t$ (C) $v_t = v_o + 61\,t$ (D) $v_t = v_o - 61\,t$

43. Sound waves can travel only through:
(A) Vacuum (B) Ether
(C) Material medium (D) Non metals

44. Newton's formula for velocity of sound in gas/air is related as under:
(A) $V = E/\rho$ (B) $V = \sqrt{\frac{E}{\rho}}$ (C) $V = \sqrt{P/\rho}$ (D) $v = P/\rho$

45. According to Newton sound travels in air under conditions of:
(A) Adiabatic (B) Isothermal (C) Isobaric (D) Isochoric

46. The apparent change in the pitch of sound due to relative motion is called:
(A) Carnot theorem (B) Interference (C) Doppler Effect (D) Beats

47. According to Newton's formula the speed of sound in air at STP is:
(A) $332\,ms^{-1}$ (B) $340\,ms^{-1}$ (C) $350\,ms^{-1}$ (D) $280\,ms^{-1}$

48. Speed of sound in copper is:
(A) 38000 m s^{-1} (B) 3600 m s^{-1} (C) 3500 m s^{-1} (D) 3400 m s^{-1}

49. Sound waves in air are:
(A) Longitudinal waves (B) Transverse waves (C) Matter waves (D) Electromagnetic waves

50. The speed of sound in air is 340 m/s. If the pressure of air is doubled then the speed becomes.
(A) Double (B) Half (C) Four times (D) Remains same

51. Velocity of sound in vacuum is:
(A) 332 ms^{-1} (B) 320 ms^{-1} (C) Zero (D) 224 ms^{-1}

52. The velocity of sound is greatest in:
(A) Aluminium (B) Air (C) Iron (D) Water

53. Speed of sound in aluminium at 20°C is: (2 Times)
(A) 3600 m/s (B) 5100 m/s (C) 5130 m/s (D) 5500 m/s

54. If the pressure of a gas is doubled, then speed of sound is: (3 times)
(a) *doubled* (b) become half (c) not affected (d) increases by four times

55. Sound travels faster in:
(a) CO_2 (b) H_2 (c) O_2 (d) He

56. The speed of sound is greater in solids than in gases due to their high.
(A) Temperature (B) Pressure (C) Denisty (D) Elasticity

57. The Velocity of sound is maximum at 20° C in:
(A) Lead (B) Copper (C) Glass (D) Iron

58. Error in calculation of Newton's formula for speed of sound is about.
(A) 6% (B) 10% (C) 16% (D) 26%

59. In which medium the speed of sound is greater?
(A) Oxygen (B) Air (C) Water (D) Copper

Topic III: Effect if Variation of Pressure, Density and Temperature on the speed of Sound in a Gas:

60. For each degree Celsius rise in temperature of gas, the speed of sound through it increase by: (7 Times)
(A) 0.60 ms^{-1} (B) 0.61 ms^{-1} (C) 61 ms^{-1} (D) 6.1 ms^{-1}

61. Which of the following does not have any effect on the speed of sound in gasses? (6 Times)
(A) Temperature (B) Density (C) $\gamma = \frac{C_p}{C_v}$ (D) Pressure

62. The louder the sound, the greater will be its:
(A) Amplitude (B) Wavelength (C) Speed (D) Frequency

63. With increase of temperature, speed of sound: (2 Times)
(A) Remain constant (B) Becomes zero (C) Decreases (D) Increases

64. What is the value of constant β in the expression $v_t = v_o(1+\beta t)$:
(A) 273 (B) 1/273 (C) 0.61 (D) 1.42

65. The louder the sound, the greater will be its.
(A) Speed (B) Frequency (C) Amplitude (D) Wavelength

Topic V: Interference:

66. Two waves can interfere only if they have:
(A) Phase coherence (B) same velocity
(C) Different frequencies (D) Different wavelengths

67. Two waves of same frequency and moving in the same direction produces:
(A) Interference (B) Diffraction (C) Beats (D) Stationary waves

68. The path difference for constructive interference should be:
(a) $\frac{\lambda}{2}$ (b) $\frac{5\lambda}{2}$ (c) m λ (d) $\frac{3\lambda}{2}$

Topic VI: Beats:

69. Beats are used to find:
(A) Frequency (B) wavelength (C) Intensity (D) Speed

70. Beats detectable easily up to frequency difference between two sound is: (6 Times)
(A) 2 Hz (B) 6 Hz (C) 10 Hz (D) 32 Hz

71. For same mass and length if tension of a vibrating string is increased four times the speed of wave increased by:
(A) 6 times (B) 4 times (C) 8 times (D) 2 times

72. Tuning a radio is example of:
(A) Mechanical resonance (B) Light wave resonance
(C) Electrical resonance (D) Physical resonance

73. Periodic alternations of sound between maximum and minimum loudness are called: (2 times)
(A) Interference (B) Resonance (C) Doppler's Effect (D) Beats

74. Two tuning forks of frequencies 240Hz and 243Hz are sounded together, the number of beats per second is:
(A) Zero (B) 4 (C) 3 (D) 2

75. The basic principle of beats is:
(a) Interference (b) diffraction (c) reflection (d) refraction

76. Two tuning forks of frequencies 260 Hz and 256 Hz are sounded together, the number of beats per second is:
(a) 4 (b) 258 (c) 2 (d) 516

77. When two notes of frequencies f_1 and f_2 are sounded together, beats are formed. If $f_1 > f_2$ what will be the beat frequency?
(A) $f_1 + f_2$ (B) $\frac{1}{2}(f_1+f_2)$ (C) $f_1 - f_2$ (D) $\frac{1}{2}(f_1-f_2)$

Topic VII: Law of Reflection:

78. Radar system is an application of:
(A) Interference (B) beats (C) stationary waves (D) Doppler effect (5 Times)

Topic VIII: Stationary Waves:

79. The wavelength of the fundamental mode of vibration of a pipe closed at one end is: (3 Times)
(A) $\frac{\ell}{2}$ (B) ℓ (C) 2ℓ (D) 4ℓ

80. The time period of a wave is 0.2 s. Its frequency will be:
(A) 2 s (B) 0.4 s (C) 0.5 s (D) 5 s^{-1}

81. In stationary wave one mode of vibration of the string having length ℓ is equal to:
(A) λ (B) $\lambda/2$ (C) $\lambda/4$ (D) 2λ

82. At the open end of an organ pipe:
(A) Nodes are formed (B) Anti-nodes are formed
(C) Nodes or anti-nodes are formed (D) Neither node or anti-node is formed

83. If the organ pipe is open at both ends the frequency of fundamental harmonic is: (4 Times)

(A) $f_1 = \frac{v}{2\ell}$ (B) $f_1 = \frac{v}{4\ell}$ (C) $f_1 = \frac{4\ell}{v}$ (D) $f_1 = \frac{2\ell}{v}$

84. If the string is made to vibrate in n loops, then the wavelength of the stationary wave will: (3 Times)

(A) $\lambda_n = \frac{n}{2}\ell$ (B) $\lambda_n = \frac{2}{n}\ell$ (C) $\lambda_n = \frac{2n}{\ell}$ (D) $\lambda_n = \frac{\ell}{2n}$

85. Which one is correct relation for one end closed pipe:

(A) $\lambda_n = 2\ell/n$ (B) $\lambda_n = 4\ell/n$ (C) $\lambda_n = nv/\ell$ (D) $\lambda_n = nv/4\ell$

86. Wavelength of the fundamental mode of vibration of a closed end pipe is:

(A) 2ℓ (B) ℓ (C) 4ℓ (D) $1/2\ell$

87. For standing wave in a stretched string if $\lambda = \ell$ (length of string) the number of loops will be:

(A) 1 (B) 2 (C) 3 (D) 4

88. In stationary waves the points which always remain at rest are:

(A) Nodes (B) antinodes (C) crest (D) trough

89. In a Stationary Wave, the velocity of the particle at the node is:

(A) Maximum (B) Minimum (C) Zero (D) Constant

90. If the tension of a stretched string is made four times then the velocity of wave:

(A) Remains same (B) Is halved (C) Becomes twice (D) Becomes 4 times

91. When two identical waves superimposed, which can change:

(A) Wavelength (B) Frequency (C) Velocity (D) Amplitude

92. The wavelength of fundamental mode of vibration of an open end pipe is:

(a) $4l$ (b) $2l$ (c) l (d) $\frac{1}{4}l$

93. In an organ pipe which is open at one end and closed at other, the frequency of fundamental note is.

(A) $f_1 = \frac{v}{4l}$ (B) $f_1 = \frac{4l}{v}$ (C) $f_1 = \frac{v}{2l}$ (D) $f_1 = \frac{2l}{v}$

94. A stretched string 4m long and it has 4 loops of stationary waves, then the wave length is

(A) 1m (B) 2 m (C) 3m (D) 4m

95. A stationary wave is established in a string which vibrates in four segments at a frequency 120 Hz. Its fundamental frequency is:

(A) 15 Hz (B) 30 Hz (C) 60 Hz (D) 480 Hz

96. When a transverse wave in incident on rarer medium from a denser medium, the phase change will be:

(A) 90° (B) 60° (C) 180° (D) 0°

Topic IX: Doopler Effect:

97. Star moving away from the earth shows: (7 Times)

(A) Red shift (B) Blue shift (C) Doppler's shift (D) Frequency shift

98. Stars moving towards the earth show:

(A) Red shift (B) blue shift (C) yellow shift (D) green shift

2018

99. When an observer is moving away from the source with velocity U_o from a stationary source then relative velocity of the waves and the observer is:

(a) $V + U_o$ (b) $V - U_o$ (c) $\frac{V + U_o}{2}$ (d) zero

100. _____ is correct relation.

(a) $\frac{v_t}{v_0} = \frac{\rho_0}{\rho_t}$ (b) $\frac{v_t}{v_0} = \frac{\rho_t}{\rho_0}$ (c) $\frac{v_t}{v_0} = \sqrt{\frac{\rho_t}{\rho_0}}$ (d) $\frac{v_t}{v_0} = \sqrt{\frac{\rho_0}{\rho_t}}$

101. The speed of sound in air at 0 °C is 332 ms^{-1}. Then speed of sound at 40 °C will be:
(a) 372 ms^{-1} (b) 356.4 ms^{-1} (c) 346. 4 ms^{-1} (d) 332 ms^{-1}

102. If a stretched string vibrate in three loops. Then relation between its length and wave length of stationary wave is:
(a) $l = \frac{3\lambda}{2}$ (b) $l = 3\lambda$ (c) $l = \frac{2\lambda}{3}$ (d) $\lambda = 3l$

103. The speed of sound is greater in solid than gases due to their high:
(A) density (B) elasticity (C) temperature (D) oscillation

104. Waves produced in organ pipes are:
(A) transverse stationary waves (B) longitudinal stationary waves
(C) Electromagnetic waves (D) Matter waves

105. If the period of wavemotion is 0.01 Sec and wave speed is 100ms^{-1} then frequency of wave is:
(A) 0.5 Hz (B) 1 Hz (C) 10 Hz (D) 100 Hz

106. A bat finding its correct location by sending:
(A) Matter waves (B) Ultrasonic waves
(C) Infrasonic waves (D) Electromagnetic waves

107. The distance between two consecutive crests is called:
(A) displacement (B) amplitude (C) wave front (D) wavelength

108. If a stretched string is 2m, and it has 2 loops of stationary waves then wavelength is:
(A) 4 m (B) 3 m (C) 2 m (D) 1 m

109. In sonar we use:
(A) Sound waves (B) Ultrasonic waves (C) Radio waves (D) Microwaves

110. In which of following Speed of Sound Wave is gretest:
(A) Air (B) Water (C) Vaccum (D) Steel

111. In a Sretched String, if speed of Wave is doubled the tension will be:
(A) 2 (B) 4 (C) 8 (D) 6

112. The distance between two consecutive troughs is called:
(A) Displacement (B) Amplitude (C) wavelength (D) Wave-front

113. In the stretched string, if speed of the wave is doubled, the tension will be:
(A) 2 (B) 4 (C) 8 (D) 6

114. Sound waves are:
(A) electromagnetic waves (B) Transverse waves
(C) Compressional waves (D) Matter waves

2019

115. It becomes difficult to recognize the beats when the difference between the frequencies of two sounds is more than: **(3 Times)**
(A) 10 Hz (B) 20 Hz (C) 30 Hz (D) 40 Hz

116. Increase in velocity of sound in air per degree Celsius is: **(2 Times)**
(A) 0.61 m/s (B) 0.61 cm/s (C) 0.61 dm/s (D) 0.61 km/s

117. Speed of sound in Hydrogen is higher than in Oxygen by times:
(A) 4 (B) 6 (C) 8 (D) 16

118. Sound waves can not pass through.
(A) Liquid (B) Solids (C) Air (D) Vacuum

119. Two tuning forks of frequency 261 Hz and 258 Hz are sounded together, the number of beats per second are.
(A) 3 (B) 2 (C) 261 (D) 258

120. The number of beats produced per sec. in two tuning forks is equal to:
(A) Sum of two frequencies (B) ratio of two frequencies
(C) The frequency of either of two tuning fork
(D) the difference of the frequencies of two tuning forks

121. The waves which do not require any medium for their propagation are called:
(A) Mechanical waves (B) matter waves
(C) electromagnetic waves (D) longitudinal waves

122. The louder the sound, the greater will be its:
(A) wavelength (B) amplitude (C) speed (D) frequency

123. Tuning fork is a souce of: (2 Times)
(A) Energy (B) heat (C) light (D) sound

124. On loading the prong of tuning fork with wax, the frequency of sound: (2 Times)
(A) Increases (B) Decreases
(C) Remains same (D) Periodic increases and decreases

125. When an observer is moving away from a stationary source, sending waves with spee v, the waves received by him at the rate of:
(A) $\frac{v-u_o}{\lambda}$ (B) $\frac{v+u_o}{\lambda}$ (C) $\frac{\lambda}{v-u_o}$ (D) $\frac{\lambda}{v+u_o}$

126. In a stretched string, If speed of the wave is doubled, the tension in string will increase by:
(A) 2 (B) 4 (C) 6 (D) 8

127. Newton calculated speed of sound in air using the process:
(A) adiabatic (B) Isobaric (C) Isochoric (D) Isothermal

128. Two identical waves moving in same direction produce.
(A) Interference (B) Beats (C) Stationary waves (D) Diffraction

129. Distance between adjacent node and antinode is:
(A) λ (B) $\frac{\lambda}{2}$ (C) $\frac{\lambda}{4}$ (D) $\frac{\lambda}{3}$

130. Types of wave used in sonar are:
(A) Sound waves (B) Light waves (C) Heat waves (D) Water waves

2021

131. When both ends of organ pipe are open then the frequency of stationary waves of nth harmonic is given by:
(A) $fn=\frac{nv}{4l}$ (B) $fn=\frac{v}{2nl}$ (C) $fn=\frac{nv}{2l}$ (D) $fn=\frac{2v}{nl}$

132. The value of constant γ for the mono atomic gas is:
(A) 1.67 (B) 1.40 (C) 1.29 (D) 2.45

133. Speed of sound in lead at $20^{\circ}C$ is
(A) $1320\,m/s$ (B) $1330\,m/s$ (C) $1340\,m/s$ (D) $1350\,m/s$

134. The frequency range of Dog ear is:
(A) $20-20,000\,Hz$ (B) $60-70,000\,Hz$
(C) $1000-120,000\,Hz$ (D) $15-50,000\,Hz$

135. Beats can be heard by man when difference of frequency is not more than:
(A) 3 Hz (B) 9 Hz (C) 10 Hz (D) 16 Hz

136. If 20 waves pass through the medium in 1 second with speed of $20ms^{-1}$, then the wavelength is
(A) 20 m (B) 10 m (C) 2 m (D) 1 m

137. The increase in velocity of sound in air for $1^{\circ}C$ rise in temperature is:
(A) 61 cm/s (B) 0.61 cm/s (C) 61 m/s (D) 1.61 m/s

138. The speed of sound in air at 30° is approximately equal to:
(A) $332\,m/s$ (B) $350\,m/s$ (C) $340\,m/s$ (D) $335\,m/s$

139. The distance between 1^{st} node and 4^{th} antinode is:
(A) $\frac{5}{4}\lambda$ (B) $\frac{13}{4}\lambda$ (C) $\frac{7}{4}\lambda$ (D) $\frac{11}{4}\lambda$

140. Escape velocity of object depends upon:
(A) Mass of object (B) Size of object (C) Shape of object (D) Radius of planet

141. Speed of sound in air ar S.T.P is:
(A) 280 m/s (B) 330 m/s (C) 331 m/s (D) 332 m/s

142. When the stretched string is plucked from one quarter of length, then stretched string will vibrate in:
(A) One loop (B) Two loops (C) Three loops (D) Four loops

143. If 20 waves pass through medium in one second with speed of 20 ms^{-1}, the wavelength is:
(A) 20 m (B) 2 m (C) 400 m (D) 1 m

144. The stretched string of length 2 m vibrates in 2 segments:
(A) 1 m (B) 2 m (C) 0.5 m (D) 4 m

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	A	C	A	A	C	C	A	C	B	A	C	D	D	D
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
D	A	D	C	C	D	B	A	C	C	A	D	A	B	C
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
D	C	D	A	B	D	C	C	B	A	C	A	C	C	B
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
C	D	B	C	B	C	C	B	B	B	D	C	C	D	B
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
D	C	D	B	A	A	A	C	A	C	D	C	D	C	A
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
A	C	D	D	D	B	B	A	B	B	C	B	A	C	C
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
D	B	A	B	B	D	A	B	B	D	B	A	B	B	D
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
D	D	C	B	D	B	C	B	C	A	A	A	D	A	D
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
C	B	D	B	A	B	D	A	C	A	C	A	A	D	C
136	137	138	139	140	141	142	143	144						
D	A	B	C	D	D	B	D	B						

SHORT QUESTIONS OF CHAPTER-8 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Waves:

1. **Define mechanical and electromagnetic waves. Give examples of each.** **(3 Times)**

Ans: **Mechanical waves:** The waves which require any medium for their propagation by the oscillation of material particles are called mechanical waves e.g., sound waves, water waves etc.

Electromagnetic waves: The waves which do not require any medium for their propagation are called electromagnetic waves. For example, visible light, radio waves, television signals, and x-rays.

2. **Differentiate between longitudinal and transverse waves.** **(7 Times)**

Ans: **Longitudinal waves:** A traveling wave that causes the elements of the medium to move parallel to the direction of propagation is called a longitudinal wave.

Transverse waves: A traveling wave that causes the elements of the disturbed medium to move perpendicular to the direction of propagation is called a transverse wave.

3. **What features do longitudinal waves have in common with transverse waves?** **(11 Times)**

Ans: The common features are:

i. Both are mechanical waves.
ii. Both transport energy from one place to another.
iii. Both satisfy the equation. $v = f\lambda$

4. **What is progressive wave? Give the name of two progressive waves.** **(3 Times)**

Ans: A wave which transfer energy by moving away from the source of disturbance is called progressive wave. For example, longitudinal and transverse waves.

5. **Why ultrasonic waves are preferred on radio waves for the use of undersea communication?**

Ans: Ultrasonic is a high frequency sound wave. It is not a part of electromagnetic spectrum. Ultrasonic waves transmit energy from one place to another using elastic properties of matter. They are preferred on radio waves for the use of undersea communication because they can travel longer distances in water.

6. Explain the terms Crest, Trough, Node and Antinode. **(16 Times)**

Ans: **Crest:** The portion of the wave above the mean level is called crest.
Trough: The portion of the wave below the mean level is called trough.
Nodes: The points of zero displacement in stationary waves are called nodes.
Anti-nodes: The points of maximum displacement in stationary waves are called antinodes.

Distance between the two consecutive nodes or anti-nodes is equal to $\frac{\lambda}{2}$ and distance between node and its neighboring anti-node is equal to $\frac{\lambda}{4}$.

7. Why can micro waves not detect under water objects?

Ans: Microwaves are strongly absorbed by sea water within feet of their transmission. Ultrasonic is a high frequency sound wave. It is not a part of electromagnetic spectrum. They are preferred on micro waves for the use of undersea communication because they can travel longer distances in water.

8. Differentiate between travelling waves and stationary waves.

Ans: A wave, which transfers energy by moving away from the source of disturbance, is called a travelling wave. The ripples produced in the water are the examples of travelling waves.

Two waves of equal frequency travelling in opposite direction produce stationary waves. In stationary waves energy cannot flow past the nodes and remains "standing" in the medium between nodes. Waves produced in a stretched string and air column are the examples of stationary waves.

9. What do you observe in the collective effect of dots in the form of a picture?

Ans: We observe that the picture is made up of many closely spaced dots.
In case of mechanical waves, it is actually the effect of cooperative oscillations of a very large number of the particles of the medium through which the wave is passing.

10. Taking an example of periodic wave, prove that $V = f\lambda$.

Ans: Let one end of a rope is fastened to a mass spring vibrator. As the mass vibrates up and down, a transverse periodic wave travelling along the length of rope is observed. We observe that the crest moves one wavelength λ in one period of oscillation T. The speed of crest or wave is therefore,

$$V = \frac{distance\ moved}{corresponding\ time\ interval} = \frac{\lambda}{T}$$

But $f = \frac{1}{T}$

Where f is the frequency of wave. Thus we can write

$$V = f\lambda.$$

11. Define transverse waves, give two examples.

Ans: Transverse waves are those in which particles of the medium are displaced in a direction perpendicular to the direction of propagation of waves.
Waves produced in a stretched string and ripples produced in water are good examples of transverse waves.

Topic II: Speed of Sound in Air:

12. Why does sound travel faster in solids than in gases? **(21 Times)**

Ans: The speed of sound is

$$v = \sqrt{\frac{E}{\rho}}$$

Since the modulus of elasticity for solids is much greater than gases.

$$E_{solids} >> E_{gases}$$

$$\rho_{solids} > \rho_{gases}$$

Thus $$\sqrt{\frac{E}{\rho}}_{Solids} > \sqrt{\frac{E}{\rho}}_{Gases}$$

Hence, sound travel faster in solids than in gases.

13. Explain why sound travels faster in warm air than in cold air? (19 Times)

Ans: The speed of sound varies inversely as the square root of density, i.e.

$$v \propto \sqrt{\frac{1}{\rho}}$$

With the increase in temperature, the volume increases and density decreases. That's why sound travels faster in warm air than in cold air.

14. Speed of sound in air at 0 °C is 332 ms^{-1}. Find its speed 20 °C.

Ans: Since $$v_t = v_0 + 0.61t$$

$$v_t = 332 + 0.61(20)$$

$$v_t = 332 + 12.2 = 344.2\ ms^{-1}$$

15. As the result of distant explosion an observer senses a ground tremor and then hears the explosions. Explain the time difference. (11 Times)

Ans: The waves produced by the explosion reach the observer quickly through the ground as compared to the sound waves reaching through the air. This is due to the reason that sound travels faster in solid than gases.

16. Find the temperature of air, if the velocity of sound is 340 ms^{-1} at that temperature.

Ans: Since $$v_t = v_o + 0.61t$$

Given that $v_t = 340\ ms^{-1}$

and $v_o = 332\ ms^{-1}$

So $$v_t - v_o = 0.61t$$

$$340 - 332 = 0.61t$$

$$8 = 0.61t$$

$$\frac{8}{0.61} = t$$

$$t = 13.1°C$$

$$t = 13.1 + 273 = 286.1\ K$$

17. Speed of sound in air at 0°C is 332 ms^{-1}. Find its speed at 15°C.

Ans: $t_1 = 0°C = 273k$

$t_2 = 15°C = (15 + 273)k = 288k$

$t = t_2 - t_1 = 288 - 273 = 15k$

Speed of sound waves is given by

$V_t = v_o + 0.61\ t$

$V_t = 332 + 0.61\ (15)$

$V_t = 341.15\ m/s$

18. What are the factors on which speed of sound in air depends? (3 Times)

Ans: (i) Speed of sound is inversely proportional to the square root of densities of gases.
(ii) Speed of sound increases with the increase in temperature.
(iii) Speed of sound is not affected by a variation in the pressure of the gas.

19. Why sound travels faster in hydrogen than in oxygen? (3 Times)

Ans: Speed of sound in air is

$$v = \sqrt{\frac{\gamma P}{\rho}} \quad \text{or} \quad v \propto \frac{1}{\sqrt{\rho}}$$

The speed is inversely proportional to the square root of the density of gas which shows that smaller the density greater is the speed. That is why sound travels faster in hydrogen than in oxygen.

20. How the speed of sound changes with the density of the medium?

Ans: As $v = \sqrt{\frac{rp}{p}}$ or $v \propto \frac{1}{\sqrt{p}}$ The speed of sound is inversely proportional to the square root of density of medium provided that r & p are kept constant.

21. As we know PV^{γ} = Constant. What do you know about in γ in this relation?

Ans: In this relation γ is a constant for the medium. For air its value is 1.40. γ is defined as the ratio of the molar specific heat of the gas at constant pressure to molar specific heat at constant volume

$$\gamma = \frac{C_p}{C_v}$$

Topic: III Speed of Sound in a Gas:

22. What is effect of pressure on the speed of sound in gases? (2 Times)

Ans: Speed of sound in gases is given by $v = \sqrt{\frac{\gamma P}{\rho}}$

Since density of a gas is proportional to the pressure, the speed of sound is not affected by the variation in the pressure of the gas.

23. Describe the effect of density on the speed of sound in gases. (12 Times)

Ans: Speed of sound in air is $v = \sqrt{\frac{\gamma P}{\rho}}$

The speed is inversely proportional to the square root of their densities.

$$v \propto \frac{1}{\sqrt{\rho}}$$

So, the speed of sound is less in a denser medium and vice versa.

24. What is effect of pressure and temperature on the speed of sound? (6 Times)

Ans: Speed of sound in gases is given by $v = \sqrt{\frac{\gamma P}{\rho}}$

Effect of pressure: Since density of a gas is proportional to the pressure, the speed of sound is not affected by the variation in the pressure of the gas.

Effect of temperature: Whereas when a gas is heated at constant pressure then its volume is increased and density is decreased, so the speed of sound is increased with rise in temperature and vice versa. $v_t = v_o + 0.61\,t$

One degree Celsius rise in temperature produces approximately 0.61m/s increase in the speed of sound.

25. What happens when a jet plane like a concorde flies faster than the speed of sound? (3 Times)

Ans: A conical surface of concentrated sound energy sweeps over the ground as a supersonic plane passes overhead. It is known as sonic boom.

Topic IV: Principle of Superposition:

26. State the principle of superposition. (6 Times)

Ans: It states that

If the particle of the medium is simultaneously acted upon by n waves such that its displacement due to each of the individual n waves be $y_1, y_2, \ldots, y_n$, then the resultant displacement of the particle, under the simultaneous action of these n waves is algebraic sum of all displacement. $y = y_1 + y_2 + \cdots + y_n$

Topic V: Interference:

27. Differentiate between constructive and destructive interference.
OR
Write conditions for constructive and destructive interference. (6 times)

Ans: **Constructive Interference:** Whenever the path difference between the two waves is an integral multiple of wavelength, then the both waves reinforce each other. This effect is called constructive interference. $\Delta S = n\lambda$

Destructive Interference: Whenever the path difference between the two waves is an odd integral multiple of half of wavelength, then the both waves cancel each other's effect. This effect is called destructive interference.

$$\Delta S = (2n + 1)\frac{\lambda}{2}$$

28. What are the conditions for interference of two sound waves?

Ans: Superposition of two waves having same frequency and travelling in the same direction results in interference.

Condition for constructive interference:

Path difference $\Delta S = n\lambda$

Condition for destructive interference:

Path difference $\Delta S = (2n+1)\frac{\lambda}{2}$

Where $n = 0, \pm1, \pm2, \pm3, ...$

Topic VI: Beats:

29. Explain the term "Beats".

Ans: Two waves that are travelling in the same direction with a slight difference in frequencies will produce beats. Number of beats per second is equal to the difference in frequencies.

30. How are beats useful in tuning musical instruments? (20 Times)

Ans: Beats are used in tuning musical instruments. One can use beats to tune a string of musical instrument such as piano by beating a note against a note of known frequency. The string is then adjusted to the desired frequency by tightening or loosening it until no beats are heard.

31. Define Beat and beat frequency.

Ans: **Beat:** Two waves of slightly different frequencies and travelling in the same direction produce beats.

Beat frequency: Number of beats per second is called beat frequency which is equal to the difference in frequencies.

32. Define beats and explain it with an example. (3 Times)

Ans: Beats are produced when two waves of slightly different frequencies and travelling in the same direction superpose to each other.

If two tuning forks of slightly different frequencies say 256Hz and 254Hz are sounded together, a note of alternately increasing and decreasing intensity will be heard. This note is called beat which is due to interference between the sound waves from two tuning forks.

33. What are beats and name its one use. (2 Times)

Ans: Beats are produced in a medium, when two slightly different frequencies travelling in the same direction interfere in that medium. One can use beats to tune a string instrument, such as piano.

34. What is difference between interference and beats.

Ans: Interference is produced due to superposition of two waves having same frequency. Beats are produced when two waves of slightly different frequencies superpose with each other.

Topic VII: Stationary Waves:

35. Is it possible for two identical waves travelling in the same direction along the string to give rise to a stationary wave? (15 Times)

Ans: No, it is not possible for two identical waves travelling in the same direction along a string to give rise to stationary waves. For stationary waves, two identical waves must travel in opposite direction.

36. A wave is produce along a stretched string but some of its particles permanently show zero displacement. What type of wave is it? (2 Times)

Ans: A wave is produced along a stretched string but some of its particles permanently show zero displacement. It is a stationary wave and points at zero displacement are called nodes.

37. Which is richer in harmonics? An open organ pipe or a closed organ pipe?

Ans: For closed organ pipe

$$f_n = \frac{nv}{4l}$$

For open organ pipe

$$f_n = \frac{nv}{2l}$$

This shows that the pipe, which is open at both ends i.e. open organ pipe is richer in harmonics.

38. How stationary waves are produced in a medium.

Ans: These waves are produced by the superposition of two identical waves traveling in opposite direction. When a stretched string clamped at its two ends is plucked then the stationary waves are produced.

39. Write the effect on Transverse wave when it is reflected from: (2 times)
(i) Denser Medium (ii) Rare Medium

Ans: **Denser Medium:** If a transverse wave traveling in a rarer medium is incident on a denser medium, it is reflected such that it undergoes a phase change of 180°.
Rare Medium: If a transverse wave traveling in a denser medium is incident on a rarer medium, it is reflected without any change in phase.

40. What do you mean by the term progressive waves?

Ans: A wave which transfers energy by moving away from the source of disturbance is called progressive wave. For example, longitudinal and transverse waves.

41. Why "stationary waves" are called standing waves?

Ans: In stationary waves energy cannot flow past the nodes and remains "standing" in the medium between nodes. Therefore, stationary waves are called standing waves.

42. Which is richer in harmonics, and why:
(a) an open organ pipe (b) A closed organ pipe.

Ans: The pipe, which is open at both ends, is richer in harmonics.
At open end molecules of the air are free to move and an antinode is formed while the movement of air molecules is restricted at the closed end and a node is formed.
Therefore, the pipe open at both ends have antinode at each end and is richer in harmonics.

43. What are the quantities which affect the frequency of standing waves along a string?

Ans: The frequency of standing waves along a stretched string in given as

$$f_n = \frac{nv}{2l} \quad \text{or} \quad f_n = \frac{n}{2l}\sqrt{\frac{F}{m}}$$

Thus frequency depends upon mass per unit length of string "m" tension of the string "F" and length of the string "l".

44. Give the rules for the reflection of waves from the boundary of a
(I) denser medium (II) rarer medium.

Ans: i. If a transverse wave travelling in a rarer medium is incident on a denser medium, it is reflected such that if undergoes a phase change of 180°.
ii. If a transverse wave travelling in a denser medium is incident on a rarer medium, it is reflected without any change in phase.

45. On what factors does the fundamental frequency in a stretched string depends?

Ans: Fundamental frequency is given as $f_1 = \frac{1}{2l}\sqrt{\frac{F}{m}}$

Thus, f_1 depends upon

i. Mass per unit length of the string "m"
ii. Tension in the string "F"
iii. Length of the string "l"

46. What do you mean by harmonic series?

Ans: The stationary waves have a discrete set of frequencies $f_1, 2f_1, 3f_1, \ldots\ldots nf_1$ which is known as harmonic series.

47. What are the conditions for points which are in phase and out of phase?

Ans: Any two points repeated from one another by distance $\lambda, 2\lambda, 3\lambda\ldots\ldots$ are all in phase with each other. Any two points separated from one another by distance $\frac{\lambda}{2}, \frac{3\lambda}{2}, \frac{5\lambda}{2}\ldots\ldots$ are all out of phase with each other.

Topic IX: Doopler Effect:

48. What is radar?

Ans: It is an acronym for Radio Detection and Ranging. It is a device which transmits and receives radio waves which are used to determine height and speed of aeroplane.

49. Define Doppler Effect.

Ans: The apparent change in the frequency of sound due to relative motion between the observer and source of sound is called Doppler Effect. If the observer and source of sound are approaching then the frequency of sound will increase and vice versa.

50. Can Doppler Effect be applied to electromagnetic waves? Give an example.

Ans: Yes, Doppler effect can be applied to electromagnetic waves. For example, in radar systems, the Doppler effect is used to determine the elevation and speed of aeroplane.

51. What is apparent change in frequency when source is moving away from stationary observer?

Ans: When the source is moving away from the observer, apparent frequency decreases.

$$f_D = \left(\frac{v}{v + u_S}\right) t$$

52. How should a source of sound move w.r.t an observer so that the frequency of its sound does not change? **(7 Times)**

Ans: If sound source is moving in circular path with the observer at the center of the circle then relative velocity of the observer with respect to the source of sound is zero, there will be no change in the frequency of sound.

53. How Doppler Effect is applied to a radar system? **(3 Times)**

Ans: In radar systems, the Doppler effect is used to determine the elevation and speed of aeroplane.

If the aeroplane approaches towards the radar, then the wavelength of the wave reflected from the aeroplane would be shorter and if the aero plane moves away from radar, then the wavelength of the wave reflected from the aero plane would be larger

54. How astronomers use the Doppler Effect to calculate the speed of different stars?

Ans: Astronomers use the Doppler Effect to calculate the speed of distant stars and galaxies. Stars moving towards the Earth show a blue shift, while stars moving away from the Earth show a red shift.

By comparing the line spectrum of light from the star with light from a laboratory source, the Doppler shift of the star's light can be measured. Then the speed of star can be calculated.

55. Explain the term red shift and blue shift in Doppler's Effect. **(4 Times)**

Ans: Stars moving away from the Earth show red shift. The emitted waves have a longer wavelength than if the star had been at rest. So the spectrum is shifted towards longer wavelength.

Stars moving towards the Earth show blue shift. This is because the wavelength of light emitted by the star is shorter than if the star had been at rest. So the spectrum is shifted towards shorter wavelength.

56. Write four applications of Doppler's Effect. **(3 Times)**

Ans: (i) Radar system uses radio waves to determine the elevation and speed of an aeroplane.
(ii) Sonar is a technique for detecting the presence of objects under water by acoustical echo.
(iii) Astronomers calculate the speeds of distant stars and galaxies.
(iv) In radar speed trap, by measuring the Doppler shift, the speed at which the car moves is calculated by computer programme.

57. What is meant by Sonar? Explain. **(2 Times)**

Ans: Sonar is an acronym derived from "sound navigation and ranging". Sonar is the name of a technique for detecting the presence of objects under water by acoustical echo.
It employs the Doppler Effect, in which an apparent change in frequency occurs when the source and the observer are in relative motion. Its applications are detection of submarines, mine hunting and depth measurement of sea.

58. How can Doppler effect be used to monitor blood flow through major artaries? **(2 Times)**

Ans: Ultrasound waves of frequencies 5MHz to 10MHz are directed towards the artery and a receiver detects the back scattered signal. The apparent frequency depends upon the velocity of flow of the blood.

59. State Doppler Effect. Write down its one application.

Ans: The apparent change in the frequency of sound due to relative motion between the observer and source of sound is called Doppler Effect.
In radar systems, The Doppler Effect is used to determine the elevation and speed of Aeroplane.

60. What is effect on frequency of sound waves, when source and observer are moving towards each other?

Ans: According to Doppler Effect when source and observer are moving towards each other, frequency of sound waves will increase.

61. What do you know about radar speed trap?

Ans: In radar speed trap microwaves are emitted from a transmitter in short bursts. After reflecting from a car or any moving obstacle waves are received by the transmitter. By measuring the Doppler shift, the speed at which the car moves is calculated by computer programme.

2021

62. Write down the characteristics of stationary waves.

Ans:

i. The points of zero displacement in the stationary waves are called nodes.
ii. The points of maximum displacement in the stationary waves are called anti-nodes.
iii. No energy is transferred from particle to particle in stationary waves.
iv. Particles, except nodes perform SHM with the same period as the component waves.
v. Distance between the two consecutive nodes or anti-nodes is equal to $\lambda/2$.
vi. Distance between node and its neighboring anti-nodes is equal to $\lambda/4$.

63. If a string vibrates in four segments at a frequency of 120 Hz, determine its fundamental frequency?

Ans:

$$f_4 = 120\ Hz$$
$$n = 4$$
$$f_1 = ?$$
$$f_4 = 4f_1$$

$$f_1 = \frac{f_4}{4}$$

$$f_1 = \frac{120}{4} = 30 \text{ Hz}$$

64. How temperature and density of the medium effect the speed of sound?

Ans: **Effect of temperature:** Whereas when a gas is heated at constant pressure then its volume is increased and density is decreased, so the speed of sound is increased with rise in temperature and vice versa. $v_t = v_o + 0.61$ t. One degree Celsius rise in temperature produces approximately 0.61m/s increase in the speed of sound.

Effect of density:

Speed of sound in air is $v = \sqrt{\frac{\gamma P}{\rho}}$

The speed is inversely proportional to the square root of their densities.

$$v \propto \frac{1}{\sqrt{\rho}}$$

So, the speed of sound is less in a denser medium and vice versa.

65. Speed of sound in air at 0 °C is 332 ms^{-1}. Find its speed at 20 °C.

Sol:

Since $v_t = v_0 + 0.61t$

$$v_t = 332 + 0.61(20)$$

$$v_t = 332 + 12.2 = 344.2\ ms^{-1}$$

66. If velocity of sound is 332 ms^{-1} at 0 °C then what will be its velocity at 10 °C.

Sol:

Since $v_t = v_0 + 0.61t$

$$v_t = 332 + 0.61(10)$$

$$v_t = 332 + 6.1 = 338.1\ ms^{-1}$$

67. What do you meant by quantization of frequency for stationary wave?

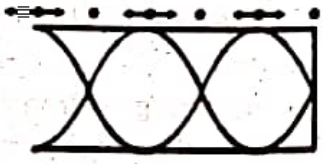
Ans: If the string is made to vibrate in n loops, then its frequency f_n is described by the relation;

$$f_n = nf_1$$

This proves that the frequencies of stationary waves are stretched string are quantized. This phenomenon is known as quantization of frequency for stationary wave.

68. What is the frequency and the wavelength of third harmonic in a closed organ pipe?

Ans:



From figure;

$$l = \frac{\lambda}{4} + \frac{\lambda}{2} + \frac{\lambda}{2} = \frac{\lambda + 2\lambda + 2\lambda}{4} = \frac{5\lambda}{4}$$

$$\lambda = \frac{4l}{5}$$

As $v = f\lambda$ or $f = \frac{v}{\lambda} = \frac{v}{\frac{4l}{5}}$

$$f_5 = \frac{5v}{4l}$$

69. Define Beat and stationary waves.

Ans: **Beat:** Two waves of slightly different frequencies and travelling in the same direction produce beats.

Stationary waves: When two identical waves have same frequency travelling in opposite direction superpose each other, the waves are produced called stationary wave.

70. **What is period of 250 cycles per second of sound waves?**

Ans: As Time period = 1/frequency
therefore, time period = 1/250 = 0.004 s

71. **Find the temperature at which the velocity of sound in air is two times its velocity at 10 °C.**

Ans: Given that

$$10\,^{o}C = 10 + 273 = 283\ K$$

Suppose at $T\ K$, the velocity is two times its value at $283\ K$.

$$\frac{v_t}{v_{283}} = \sqrt{\frac{T}{283\ K}}$$

By applying given condition

$$\sqrt{\frac{T}{283\ K}} = 2$$

$$\frac{T}{283\ K} = 4$$

$$T = 4\,(283\ K) = 1132\ K = 859\ °C$$

LONG QUESTIONS OF CHAPTER-8 IN ALL PUNJAB BOARDS 2011-2021

Topic II: Speed of Sound in Air:

1. What is the limitation of Newton's formula for the speed of sound in air? How Laplace corrected it.
2. Derive Newton's formula for the spreed of sound in air and describe the correction by Laplace in it. **(5 Times)**

Topic III: Sspeed of Sound in a Gas:

3. What is the effect of temperature on the speed of sound and derive the relation $V_t = V_0 + 0.61t$. **(2 Times)**

Topic VI: Beats:

3. Explain beats with example. Write its two uses.
4. Define and explain the phenomenon of beats. How beats are graphically represented? Also mention the uses of beats.

Topic VIII: Stationary Waves:

5. What are stationary waves? Describe the stationary waves produced in a stretched string and prove that their frequencies are quantized. **(5 Times)**

Topic IX: Doopler Effect:

6. What is Doppler's effect? Find the relations for modified frequencies, when (i) An observer moves towards a stationary source. (ii) A source moves towards a stationary observer.
7. What is Doppler's effect? Discuss the cases when its source moves towards and away from a stationary observer. **(2 Times)**
8. What is Doppler's effect? Explain it for two cases.
9. State Doppler's effect and discuss the case when the observer moves towards the staticonary source. Also write at least one application. **(2 Times)**
10. What is Doppler's effect? What is the change in pitch of the sound wave when observer is moving towards and away from stationary source.
11. What is Doppler's effect? Discuss its for cases. **(3 Times)**

NUMEICAL PRROBLEMS OF CHAPTER-8 IN ALL PUNJAB BOARDS 2011-2021

Topic II: Speed of Sound in Air:

1. Find the temperature at which the velocity of sound in air is two times its velocity at $10°C$. (14 Times)

Sol: Given that

$$10\,^oC = 10 + 273 = 283\ K$$

Suppose at $T\ K$, the velocity is two times its value at $283\ K$.

$$\frac{v_t}{v_{283}} = \sqrt{\frac{T}{283\ K}}$$

By applying given condition

$$\sqrt{\frac{T}{283\ K}} = 2$$

$$\frac{T}{283\ K} = 4$$

$$T = 4(283\ K)$$

$$\boxed{T = 1132\ K} \text{ or } 859°C$$

Topic VI: Beats:

2. Two tuning forks exhibit beats at a beat frequency of 3 Hz. The frequency of one of the fork is 256 Hz. Its frequency is then lowered adding a bit of wax to one of its prongs. The two tuning forks then exhibit a beat frequency of 1 Hz. Determine the frequency of second tuning fork. (2 Times)

Sol: Given that

$$beat\ frequency = 3\ Hz$$

$$frequency\ of\ one\ tuning\ fork = 256\ Hz$$

So, there are two possibilities.

$$256 + 3 = 259\ Hz$$

Or

$$256 - 3 = 253\ Hz$$

But the frequency of first tuning fork is lowered and beat frequency becomes 1Hz. Hence,

$$\boxed{frequency\ of\ second\ tuning\ fork = 253\ Hz}$$

Topic VIII: Stationary Waves:

3. A pipe has length of 1 $meter$. Determine the frequencies of the fundamental and the first two harmonics if the pipe opens at both ends. (Speed of sound in air is $340\ ms^{-1}$). (2 Times)

Sol:

Given that

$$l = 1\ m$$

$$v = 340\ ms^{-1}$$

$$f_1 = ?$$

$$f_2 = ?$$

$f_3 = ?$

We know that $f_n = \frac{nv}{2l}$

For fundamental harmonic

$$f_1 = \frac{1 \times 340}{2 \times 1}$$

$$f_1 = 170\ s^{-1}$$

$$\boxed{f_1 = 170\ Hz}$$

For second harmonic $f_2 = 2f_1$

$$f_2 = 2 \times 170$$

$$\boxed{f_2 = 340\ Hz}$$

For third harmonic $f_3 = 3f_1$

$$f_3 = 3 \times 170$$

$$\boxed{f_3 = 510\ Hz}$$

4. A stationary wave is established in a string which in 120 cm long and fixed at both ends. The string vibrated in four segments, at a frequency of 120 Hz. Determine its wavelength and the fundamental frequency. (9 Times)

Sol:

Given that $l = 120\ cm = 0.12\ m$

$f = 120\ Hz$

$n = 4$

$\lambda = ?$

$f_1 = ?$

Since $\lambda = \frac{2l}{n}$

$$\lambda = \frac{2 \times 0.12}{4}$$

$$\boxed{\lambda = 0.6\ m}$$

And $f_4 = 4f_1$

$$f_1 = \frac{f_4}{4}$$

$$f_1 = \frac{120}{4}$$

$$\boxed{f_2 = 30\ Hz}$$

5. The frequency of note emitted by stretched string in 300 Hz. What will be frequency of this note when the length of the wire is reduced by one third without changing the tension of wire? (4 Times)

Sol:

Given that $f = 300\ Hz$

$f' = ?$

The change in length will be $l' = \left(1 - \frac{1}{3}\right) l = \frac{2}{3} l$

Since $f_1 = \frac{1}{2l}\sqrt{\frac{F}{m}}$

$$f_1' = \frac{1}{2l'}\sqrt{\frac{F}{m}}$$

$$f_1' = \frac{1}{2\left(\frac{2}{3}l\right)}\sqrt{\frac{F}{m}}$$

$$f_1' = \frac{3}{2}\left(\frac{1}{2l}\sqrt{\frac{F}{m}}\right)$$

$$f_1' = \frac{3}{2}f_1$$

$$f_1' = \frac{3}{2}(300)$$

$$\boxed{f_1' = 450\ Hz}$$

6. **A church organ consists of pipes each open at one end of different lengths the minimum length is 30 mm and the longest is 4 m. Calculate the frequency range of the fundamental notes (Speed of sound in air is $340\ ms^{-1}$). (6 Times)**

Sol:

Given that $minimum\ length = 30\ mm = \frac{30}{1000}m$

$longest\ length = 4\ m$

For one end open $f_n = \frac{nv}{4l}$

For minimum length $f_1 = \frac{v}{4l}$

$$f_1 = \frac{340}{4 \times \frac{30}{1000}}$$

$$\boxed{f_1 = 2833\ Hz}$$

For maximum length $f_1 = \frac{v}{4l}$

$$f_1 = \frac{340}{4 \times 4}$$

$$\boxed{f_1 = 21\ Hz}$$

Hence the frequency of fundamental note ranges from 21 Hz to 2833 Hz.

7. **A pipe has a length of 1 m, determine the frequencies of fundamental and the first two harmonics: (i) If pipe is open at both ends (ii) If pipe is closed at one end. (2 Times)**

Sol:

Given that $l = 1\ m$

$v = 340\ ms^{-1}$

$f_1 = ?$

$f_2 = ?$

$f_3 = ?$

(i) We know that when pipe is open at both ends $f_n = \frac{nv}{2l}$

For fundamental harmonic

$$f_1 = \frac{1 \times 340}{2 \times 1}$$

$$f_1 = 170\ s^{-1}$$

$$\boxed{f_1 = 170\ Hz}$$

For second harmonic $f_2 = 2f_1$

$$f_2 = 2 \times 170$$

$$\boxed{f_2 = 340\ Hz}$$

For third harmonic $f_3 = 3f_1$

$$f_3 = 3 \times 170$$

$$\boxed{f_3 = 510\ Hz}$$

(ii) We know that when pipe is open at both ends $f_n = \frac{nv}{4l}$

For fundamental harmonic put n = 1

$$f_1 = \frac{1 \times 340}{4 \times 1}$$

$$f_1 = 85\ s^{-1}$$

$$\boxed{f_1 = 85\ Hz}$$

In this case only odd harmonics are present. So, for second harmonic $f_3 = 3f_1$

$$f_3 = 3 \times 85$$

$$\boxed{f_3 = 255\ Hz}$$

For third harmonic $f_5 = 5f_1$

$$f_5 = 5 \times 85$$

$$\boxed{f_3 = 425\ Hz}$$

8. **An organ pipe has a length of 50 cm. Find the frequency of its fundamental note and the next harmonic when it is open at both ends. (Speed of sound = 350ms^{-1})** **(4 Times)**

Sol: Given that

$$l = 50\ cm = 0.5\ m$$

$$v = 350\ ms^{-1}$$

$$f_1 = ?$$

$$f_2 = ?$$

We know that when pipe is open at both ends $f_n = \frac{nv}{2l}$

For fundamental harmonic

$$f_1 = \frac{1 \times 350}{2 \times 0.5}$$

$$\boxed{f_1 = 350\ Hz}$$

For second harmonic $f_2 = 2f_1$

$$f_2 = 2 \times 350$$

$$\boxed{f_2 = 700\ Hz}$$

Topic IX: Doopler Effect:

9. The absorption spectrum of faint galaxy is measured and wavelength of one of the lines identified as the calcium α-line is found to be 478 nm. The same line has wavelength of 397 nm, when measured in laboratory. Find speed of galaxy relative to earth.

Sol:

$$\lambda = 397 \text{ nm} = 397 \times 10^{-9} \text{m}$$
$$\lambda' = 478 \text{ nm} = 478 \times 10^{-9} \text{ m}$$
$$C = 3 \times 10^8 \text{ m/s}$$

Speed of galaxy relative to earth = U_s =?

As $C = f\lambda$

or $f = \frac{C}{\lambda}$

$$f = \frac{3 \times 10^8}{397 \times 10^{-9}} = 7.56 \times 10^{14} \text{ Hz}$$

Similarly

$$f' = \frac{C}{\lambda'} = \frac{3 \times 10^8}{397 \times 10^{-9}} = 6.28 \times 10^{14} \text{ Hz}$$

Since $f' < f$, so glaxy is moving away from earth. According to Doppler's effect.

$$f' = \left(\frac{V}{V + U_s}\right) f$$

or $$f' = \left(\frac{C}{C + U_s}\right) f$$

$$U_s = \frac{c(f - f')}{f'}$$

$$U_s = \frac{3 \times 10^8 (7.56 \times 10^{14} - 6.28 \times 10^{14})}{6.28 \times 10^{14}} = \frac{3 \times 10^8 (1.28 \times 10^{14})}{6.28 \times 10^{14}}$$

$$U_s = 6.12 \times 10^7 \text{ ms}^{-1}$$

10. A train is approaching a station at 90 kmh^{-1}, sounding a whistle of frequency 1000 Hz. What will be the apparent frequency of the whistle as heard by a listener sitting on the platform? (2 Times)

Sol:

$$f = 1000 \text{ Hz}$$
$$V = 340 \text{ ms}^{-1}$$
$$U_s = 90 \text{ kmh}^{-1} = \frac{90 \times 1000}{60 \times 60} \text{ ms}^{-1} = 25 \text{ ms}^{-1}$$
$$f' = ?$$

When train is approaching towards the listener

$$f' = \left(\frac{V}{V - U_s}\right) f$$
$$f' = \left(\frac{340}{340 - 25}\right) 1000\text{s}$$
$$f' = 1079.4 \text{ Hz}$$

2021

11. The wavelength of signal from a radio transmitter is 1500 m and frequency is 200 kHz. What is wavelength for a transmitter operating at 1000 kHz and with what speed the radio wave travel?

Sol:

wavelength of signals = λ_1 = 1500 m

frequency of signals = f = 200 kHz = 200×1000 Hz = 2×10^5 Hz

frequency for transmitter = f = 1000 kHz = 1000×1000 Hz = 1×10^6 Hz

wavelength for transmitter = λ_2=?

Speed of radio waves = v =?

As $v = f_1 \lambda_1 = 2 \times 10^5 \times 1500 = 3 \times 10^8 \text{ ms}^{-1}$

and $v = f_2 \lambda_2$ or $\lambda_2 = v/f_2$

$$\lambda_2 = 3 \times 10^8 / 1 \times 10^6 = 3 \times 10^2 = 300 \text{ m}$$

OBJECTIVES (MCQ'S) OF CHAPTER-9 IN ALL PUNJAB BOARD 2011-2021

Topic I: Wavefronsts:

1.A surface on which all the points have same phase of vibration known as:
(A) Crest (B) Trough (C) Wave front (D) Wavelength

2.Light from sun reaches the earth in form of:
(A) Spherical wave front (B) Plane wave front
(C) Elliptical wave front (D) Hyperbolic wave front

3.The light emitted from LED has a typical wavelength:
(A) 1.3 pm (B) $1.3\,\mu m$ (C) 1.3 mm (D) Variable quantity

4.The phase difference between two points on wave front is:
(A) Zero (B) $\pi/4$ (C) $\pi/2$ (D) π

5.When path difference is an integral multiple of wavelengths the effect is called:
(A) Coherency (B) Distractive interference
(C) Constructive interference (D) Phase leg

6.In case of point source, the shape of wave front is: **(2 Times)**
(A) Plane (B) Spherical (C) Circular (D) Elliptical

7.Angle between ray of light and wave front is: **(3 Times)**
(a) 0^0 (b) 60^0 (c) 90^0 (d) 120^0

Topic II: Huygen's Principle:

8.The wave nature of light was proposed by:
(A) Young (B) Galileo (C) Huygen (D) Newton

9. "The light energy travels in space as waves", was firstly proposed by:
(A) Maxwell (B) Young (C) Einstein (D) Huygen

10. According to Hygen's principle, each point on a wave front acts as a source of:
(A) Secondary wavelet (B) Primary wavelet (C) New wave front (D) Sound

Topic III: Interference of Light:

11.Which phenomena shows that light wave is transverse wave: **(2 Times)**
(A) Interference (B) Diffraction (C) Polarization (D) Reflection

Topic IV: Young Double Slit Experiment:

12. The fringe spacing increase if we use: **(5 Times)**
(A) Red light (B) Blue light (C) Green light (D) Yellow light

13.The young's double slit experiment the position of dark fringes is given by:
(A) $Y_m = \frac{m\lambda L}{d}$ (B) $Y_m = \frac{m\lambda d}{L}$ (C) $Y_m = \left(m+\frac{1}{2}\right)\frac{\lambda L}{d}$ (D) $Y_m = \left(m+\frac{1}{2}\right)\frac{\lambda d}{L}$

14. In Young's double slit experiment, the position for bright fringe is: (2 Times)
(A) $Y_m = m\frac{\lambda d}{L}$ (B) $Y_m = \frac{m\lambda}{Ld}$ (C) $Y_m = \frac{m\lambda L}{d}$ (D) $Y_m = \frac{mLd}{\lambda}$

15. Fringe spacing is Inversely Proportional to:
(A) Wavelength (B) Slit Separation
(C) Distance between the slits and screen (D) Frequency of Light

16. Fringe spacing is equal to: **(2 Times)**
(A) $\frac{\lambda d}{L}$ (B) $\frac{\lambda L}{d}$ (C) $\frac{L}{\lambda d}$ (D) $\frac{m\lambda L}{d}$

Topic V: Interference in thin Films:

17.The refractive index of water is 1.33. The speed of light in water is:
(A) $3\times10^8\,ms^{-1}$ (B) $1.8\times10^8\,ms^{-1}$ (C) $2.3\times10^8\,ms^{-1}$ (D) zero

18.The distance between two consecutive wave fronts is called:
(A) Time period (B) frequency (C) wavelength (D) displacement

19.Brilliant and beautiful colors in soap bubbles are due to:
(A) Diffraction of light (B) Polarization of light
(C) Interference of light (D) Reflection of light

20.The value of critical angle of glass-air boundary is:
(A) $41.8°$ (B) $41.5°$ (C) $42.8°$ (D) 42

21.Thin oil film on water surface shows colour due to: **(2 Times)**
(A) Diffraction (B) Interference (C) Polarization (D) Dispersion

22.Two wave light which are not coherent cannot produce:
(A) Interference (B) Diffraction
(C) Polarization in same plane (D) Return back

Topic VI: Newton's Rings:

23.The center of Newton's rings is dark due to: **(2 Times)**
(A) Constructive interference (B) destructive interference
(C) Diffraction (D) Polarization

24.The distance between two adjacent bright fringes: **(2 Times)**
(A) $\frac{2\lambda L}{d}$ (B) $\frac{3\lambda L}{d}$ (C) $\frac{\lambda L}{2d}$ (D) $\frac{\lambda L}{d}$

25.The central point of Newton's Ring is:
(A) Bright (B) Dark (C) Blue (D) Red

26. Newton's sings are formed due to phenomenon of:
(A) Diffraction of light (B) Interference of light
(C) Polarization of light (D) Total Internal reflection

Topic VII: Michelson's Interferometer:

27.The equation of Michelson's interferometre is:
(A) $L=\frac{m\lambda}{2}$ (B) $L=\frac{m\lambda}{4}$ (C) $L=m\lambda$ (D) $L=2m\lambda$

28.The Michelson interferometre is used to find: **(2 Times)**
(A) The refractive index of glass (B) the thickness of glass plate
(C) The distance with very high precision (D) Optical rotation

29. In Michelson's experiment the equation used to find the speed of light: (2 times)
(A) 16fc (B) $\frac{1}{16}fd$ (C) 16fd (D) $\frac{16}{fd}$

30.In Michelson interferometer to switch the fringe from bright to dark, the mirror should be displaced by:
(A) $\frac{\lambda}{4}$ (B) $\frac{\lambda}{3}$ (C) $\frac{\lambda}{2}$ (D) λ

31. In Michelson's experiment, the angle subtended by a side of the eight sided mirror is:
(A) $\frac{\pi}{8}rad$ (B) $\frac{\pi}{4}rad$ (C) $\frac{\pi}{2}rad$ (D) $\frac{\pi}{6}rad$

32. Michelson interferometer can be used to find the:
(A) Wavelength of light (B) Wavelength of sound
(C) Velocity of sound (D) Velocity of light

Topic VIII: Difraction of Light:

33. Bending of light around the edges of an obstacle is known as: **(4 Times)**
(A) Refraction (B) Polarization (C) Diffraction (D) Interference

34.Optical rotation a property of optically active substance can be used to determine their:
(A) Density (B) Viscosity (C) Concentration in solutions (D) Elasticity

35.Using a graded index fiber, the time difference is reduced to about:
(A) 33 ns per 100 km (B) 33 ns per km (C) 1 ns per km (D) 1 ns per 100 km

36. At some angle of incidence when the angle of refraction become $90°$ this angle is called:
(A) Phase angle (B) Incident angle (C)Refractive angle (D) Critical angle

37. Diffraction is a special type of: **(4 Times)**
(A) Polarization (B) Interference (C) Reflection (D) Refraction

38. A diffraction grating has 5000 lines/cm. Its grating element will be:
(A) $2.0\times10^{-6}\,m$ (B) $2.0\times10^{-4}\,m$ (C) $1.0\times10^{-6}\,m$ (D) $1.0\times10^{-4}\,m$

39. Light entering into glass prism from air does not give change in its: (2 Times)
(A) Frequency (B) Wavelength (C) Velocity (D) Direction

40. A typical diffraction grating has certain number of lines per cm whose range is:
(A) 40 to 50 (B) 400 to 5000 (C) 400 to 500 (D) 4000 to 5000

41. Constructive interference of two coherent beams is obtained if path difference is:
(A) $\frac{n\lambda}{2}$ (B) $\frac{n\lambda}{4}$ (C) $\frac{n(3\lambda)}{2}$ (D) $n\lambda$

42. If 'N' is number of lines ruled on the grating having length "L" then grating element "d" is given by.
(A) $\frac{N}{L}$ (B) $\frac{2N}{L}$ (C) $\frac{L}{N}$ (D) $\frac{N}{2L}$

Topic IX: Difraction of X-Rays by Crystals:

43. The effective path difference between two reflected beams, in x-rays diffraction by crystals is:
(A) $d\sin\theta$ (B) $2d\sin\theta$ (C) $d\sin\frac{\theta}{2}$ (D) $d\sin(2\theta)$

44. The distance between two adjacent dark fringes is given by: (5 Times)
(A) $\Delta y=\frac{\lambda L}{d}$ (B) $\Delta y=\frac{m\lambda L}{d}$ (C) $\Delta y=\left(m+\frac{1}{2}\right)\frac{L\lambda}{d}$ (D) $\Delta y=\frac{\lambda d}{L}$

45. The wavelength of x- rays is of the order of:
(A) 10^{-8}m (B) 10^{-9}m (C) 10^{-7}m (D) 10^{-10}m

Topic X: Polarization:

46. Which characteristics of light is evident from polarization of light:
(A) Wave nature (B) Particle nature
(C) Dual nature (D) Light waves are transverse

47. The blue colour of the sky is due to: (2 Times)
(A) Diffraction (B) Reflection (C) Polarization (D) Scattering

48. Optically active crystal rotates the.....
(A) Vibrating plane (B) Polarization plane
(C) Diffraction plane (D) Interference plane

49. Which one of the following can not be polarized? (3 Times)
(A) Ultra violet rays (B) Radio waves (C) T.V Waves (D) Sound Waves

50. To distinguish between transverse and longitudinal wave ---- is used:
(A) Refraction (B) Interference (C) Polarization (D) Diffraction

2018

51. A ray of light shows the direction of propagation of light. It is a line which is:
(a) Normal to the wave front (b) Parallel to wave front
(c) Opposite to wave front (d) Equal to wave front

52. Light waves are:
(a) Longitudinal waves (b) Transverse waves (c) Stationary waves (d) Mechanical waves

53. X-ray diffraction has been very useful in determining the structure of:
(a) Haemoglobin (b) Stars (c) Galaxies (d) Stones

54. Distance between two consecutive bright fringes in young's experiment is:
(A) $\frac{\lambda L}{2d}$ (B) $\frac{\lambda L}{d}$ (C) $\frac{d}{\lambda L}$ (D) $\frac{d\lambda}{L}$

55. If blue light is used as compared to red light then fringe spacing:
(A) increases (B) decreases (C) remains same (D) becomes zero

56. Which is not Optical Active:
(A) Sugar (B) Tartaric (C) Water (D) Sodium Chlorate

57. The locus of all points in the same Phase of Vibration is called: (2 Times)
(A) Wave Front (B) Interference (C) Diffraction (D) Polarization

58. When light enters glass, it suffers a change in:
(A) Frequency (B) Wavelength
(C) Velocity (D) Both velocity and wavelength

59. In a Michelson interferometer by moving the mirror through a distance of $\lambda/4$. The path difference changes by: (3 Times)
(A) $\frac{\lambda}{2}$ (B) λ (C) $\frac{\lambda}{4}$ (D) 2λ

60. When Newton's Rings are seen through the transmitted light, then the central spot is:
(A) Dark (B) Blue (C) Bright (D) Red

2019

61. Bragg's equation is: (2 Times)
(A) $2d \sin\theta = n\frac{\lambda}{2}$ (B) $d \sin\theta = n\lambda$ (C) $d \sin\theta = n\frac{\lambda}{2}$ (D) $d \sin\theta = 2\lambda$

62. Phase difference of 180° between two waves is equal to a path difference of:
(A) λ (B) $\lambda/2$ (C) $\lambda/4$ (D) $3\lambda/4$

63. Which of the followings can not produce colours with white light?
(A) Diffraction (B) Interference (C) Polarization (D) Dispersion

64. When a mirror of Michelson interferometer is moved a distance of 0.5 mm, then 2000 frings are observed, the wavelength of light used is:
(A) 5000×10^{-10}m (B) 5000×10^{-9}m (C) 1000×10^{-7}m (D) 5000×10^{-7}m

65. For which of the following colours will the fringe width be minimum in the double slit experiment:
(A) violt (B) red (C) green (D) yellow

66. Soap film shows colours due to:
(A) Interference (B) Diffractin (C) Polarization (D) Reflection

67. Polarization proves that light waves are:
(A) Longitudinal (B) Stationary (C) Matter (D) Transvers

2021

68. In Michelson method time taken by the rotational mirror to rotate through an angle $\frac{2\pi}{8}$ (If f is the frequency of rotation) is:
(A) $\frac{2\pi}{8}$ (B) $\frac{1}{2f}$ (C) $\frac{1}{8f}$ (D) $\frac{1}{6f}$

69. The regular array of atoms in a crystal forms a natural diffraction grating with spacing of the order of:
(A) $10^{-8}m$ (B) $10^{-9}m$ (C) $10^{-10}m$ (D) $10^{-11}m$

70. A Diffraction grating has 3000 lines per centimeter, its grating element is
(A) $3.33\times10^{-4}cm$ (B) $3.33m$ (C) $333\times10^{-4}cm$ (D) $3.33cm$

71. The light from the Sun reaches the Earth with:
(A) Circular wave fronts (B) Plane wave fronts
(C) Spherical wave fronts (D) Elliptical wave fronts

72. In Michelson interferometer a fring is shifted each time the mirror is displaced through:
(A) λ (B) $\frac{\lambda}{2}$ (C) $\frac{\lambda}{4}$ (D) Zero

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C	B	B	A	C	B	C	C	D	A	C	A	C	C	B
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
B	C	C	C	D	B	A	B	D	B	B	A	C	C	A
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
B	A	C	C	C	D	B	A	A	B	D	C	B	A	D
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
D	D	B	D	C	A	B	A	B	B	C	A	D	A	C
61	62	63	64	65	66	67	68	69	70	71	72			
C	B	C	A	A	A	D	C	C	A	B	B			

SHORT QUESTIONS OF CHAPTER-9 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Wavefronsts:

1. Under what conditions two or more sources of light behave as coherent sources? (15 Times)

Ans: Two or more sources of light behave as coherent sources if
i. They emit monochromatic wave. ii. They are phase coherent.

2. Define wave fronts, also give its types. (3 Times)

Ans: Such a surface on which all the points have same phase of vibration is known as wavefront.
It is of two types.
i. Spherical wavefront ii. Plane wavefront

3. Define wave front and spherical wave front.

Ans: **Wave front:** Such a surface on which all the points have same phase of vibration is known as wavefront.
Spherical wave fronts: If a point source is sending out waves in three dimensions, the wave fronts are spheres centered on the source. Such wave fronts are called a spherical wave fronts.

4. What are coherent sources? Under what conditions two or more sources behave as coherent sources?

Ans: **Coherent sources:** The monochromatic sources of light which emit waves having a constant phase difference are called coherent sources.
Conditions: Two or more sources of light can only behave as coherent sources if they have no phase difference or have a constant phase difference and same wavelength. Two independent light sources are never coherent as each source emits waves with random phases.
A common method for producing two coherent light sources is to use monochromatic source to illuminate a screen containing two slits, the light emerging from both the slits in this way is coherent.

5. What do you mean by the term wavefront and ray of light? (4 times)

Ans: Such a surface on which all the points have same phase of vibration is known as wavefront.
A line normal to wavefront including the direction of motion is called a ray of light.

6. What do you mean by coherent sources? Explain a common method for producing two coherent sources.

Ans: The monochromatic sources of light which emit waves, having a constant phase difference are called coherent sources.
A common method of producing two coherent light beams is to use a monochromatic source to illuminate a screen containing two small holes, usually in the shape of slits. The light emerging from the two slits is coherent because a single source produces the original beam and two slits serve only to split it into two parts.

7. What is the usual way to obtain plane wavefront from a point source?

Ans: A usual way to obtain a plane wavefront is to place a point source of light at the focus of a convex lens. The rays coming out of the lens will constitute plane waves.

8. How coherent light beams can be produced? Explain.

Ans: A monochromatic source is used to illuminate a screen containing two small holes (slits). The light emerging from the two slits is coherent because a single source produces the original beam and two slits serve only to split it into two parts.

9. How does one can obtain a plane wave?

Ans: A usual way to obtain a plane wave is to place a point source of light at the focus of a convex lens. The rays coming out of the lens will constitute plane waves.

10. Define Ray of Light and Beam of Light.

Ans: A line normal to the wavefront, showing the direction of propagation of light is called a ray.

A group of parallel rays of light is called a beam of light.

Topic II: Huygen's Principle:

11. Write two steps of Huygens's principle. **(10 Times)**

OR State Huygen's principle. **(5 Times)**

Ans: i) Each point of a wave front may be considered as a source of secondary wavelets.

iii) The new position of the wave front after a certain interval of time can be found by constructing a surface that touches all the secondary wavelets.

12. For what purpose Huygen's Principle is used?

Ans: Knowing the shape and location of a wavefront at any instant t, Huygen's principle enables us to determine the shape and location of the new wavefront at a later time $t + \Delta t$.

The points on a Huygen's wavefront which send out secondary wavelets provide coherent sources of light.

Topic III: Interference of Light:

13. Can visible light produce interference fringes? Explain. **(16 Times)**

Ans: Yes, visible light or white light can produce interference fringes. But each color will produce its own interference fringe pattern. These patterns overlap to give rise to a resultant diffused coloured interference pattern.

14. If white light is incident on a film of irregular thickness at all possible angles, what will be the pattern of interference fringes? Explain your answer.

Ans: If white light is incident on a film of irregular thickness at all possible angles, we should consider the interference pattern due to each spectral colour separately. If at a certain place condition of destructive interference of one colour is satisfied then that portion of film will exhibit the remaining constituent colours of white light.

15. What are conditions for detectable interference of light? **(3 Times)**

Ans: For detectable interference, light beam should be

i. Monochromatic
ii. Coherent

Topic IV: Young Double Slit Experiment:

16. Explain whether the Young's experiment is an experiment for studying interference or diffraction effect of light. **(5 Times)**

Ans: Mainly, Young's experiment was performed to study the interference of light. However, it also involves diffraction. So diffraction can also be studied by this experiment because when light passes through the slit, it bends towards the corner.

17. What are dependence factors of fringe spacing in Young's double slit experiment?

OR On what factors, the distance between adjeacent bright fringes in Young's double slit experiment depends?

OR How will you increase the fringe width in Young's double slit experiment?

Ans: Since

$$\Delta y = \frac{\lambda L}{d}$$

Fringe spacing depends upon

i. Wavelength ii. Distance between slits iii. Separation of the slits

18. **In Young's experiment, one of the slits is covered with blue filter and other with red filter, what would be the pattern of light intensity on the screen?** **(3 Times)**

Ans: No interference pattern will be observed because blue and red lights are of different wavelengths. So the sources of light will not be coherent.

19. **Find out the fringe spacing between two consecutive bright fringes.**

Ans: In order to determine the distance between two adjacent bright fringes on the screen, mth and (m + 1)th fringes are considered.

$$y_m = m\frac{\lambda L}{d}$$

And $y_{m+1} = (m+1)\frac{\lambda L}{d}$

If the distance between the adjacent bright fringes is Δy, then

$$\Delta y = y_{m+1} - y_m = (m+1)\frac{\lambda L}{d} - m\frac{\lambda L}{d}$$

Therefore

$$\Delta y = \frac{\lambda L}{d}$$

20. **How can the distance between interference fringes affect by the separation between the slits of Young's experiment? Can fringes disappear?** **(6 Times)**

Ans: Since

$$\Delta y = \frac{\lambda L}{d}$$

Fringe spacing varies inversely with distance. If the separation is too large, then fringes will disappear.

21. **How the distance between interference fringes will be affected if the distance between the slits in Young's experiment is doubled.?**

Ans: Distance between interference fringes is given as:

$$\Delta Y = \frac{\lambda L}{d}$$

This Formula shows that if the distance between the slits "d" is doubled then fringe spacing "ΔY" will be halved.

22. **If a wavelength of light 600 nm illuminates two slits 0.5 mm apart. The distance between the slits and screen is 200 cm. Calculate its fringe spacing.**

Ans: $\lambda = 600\ nm = 600 \times 10^{-9}\ m$

$d = 0.5\ mm = 0.5 \times 10^{-3}\ m$

$L = 200cm = 2m$

$\Delta y = ?$

We know that

$$\Delta y = \frac{\lambda L}{d}$$

$$= \frac{600 \times 10^{-9} \times 2}{0.5 \times 10^{-3}}$$

$$= 2.4 \times 10^{-3}\ m$$

$$= 2.4\ mm$$

Topic V: Interference in thin Films:

23. What condition must be met by interfering beams to observe the phenomena of interference? (2 Times)

Ans: The following conditions must be met, in order to observe the phenomenon.

I. The interfering beams must be monochromatic, that is, of a single wavelength.

II. The interfering beams of light must be coherent.

24. An oil film spreading over a wet footpath shows colors. Explain how does it happen? (20 Times)

Ans: It happens due to interference of light waves through thin oil fill. When light beam is incident, a part of it is reflected from the upper surface of oil film and other is reflected from the lower part of thin film. Since the two reflected beams are coherent being part of the same beam. Sun light consists of seven colours and each colour refracts differently. Hence, after reflection different colours interfere at different points as compared to others and oil film over at wet foot path shows colours.

25. How interference in thin film produces?

Ans: It happens due to interference of light waves through thin oil film. When light beam is incident, a part of it is reflected from the upper surface of oil film and other is reflected from the lower part of thin film. Since the two reflected beams are coherent being part of the same beam and sunlight consists of seven colors and each color refracts differently hence after reflection different colors interfere at different points as compared to others and an oil film over a wet footpath shows colors.

Topic VI: Newton's Rings:

26. The center of Newton's ring is dark. Why? (9 times)

Ans: The thickness of the film is effectively zero at the point of contact of the lens and the glass plate. But due to reflection at the lower surface from denser medium, an additional path difference of $\frac{\lambda}{2}$ is introduced. It results in destructive interference and the center of Newton's ring becomes dark.

27. Can you obtain Newton's rings with transmitted light? If yes, would the pattern be different from that obtained with reflected light? (9 Times)

Ans: Yes, Newton's rings can be obtained with transmitted light. But because of phase change of 180^o, the fringe pattern is opposite to the reflected pattern and the central spot will be bright.

28. What are Newton's rings?

Ans: When a plano-convex lens of long focal length is placed in contact with a plane glass plate, a thin air film is enclosed between them to form circular dark and bright fringes known as Newton's rings. **(2 Times)**

29. In Newton's rings, why are the fringes circular?

Ans: The thickness of the air film between plano-convex lens and plane glass plate is almost zero at the point of contact "o" and gradually increases as we proceed towards the periphery of the lens. Thus, points where the thickness of air film is constant will lie on a circle with "o" as centre. That is why circular fringes are produced.

Topic VII: Michelson's Interferometer:

30. What is Michelson's interferometer? Also write its working principle.

Ans: Michelson's interferometer is an instrument that is capable of measuring distance with extremely high precision.

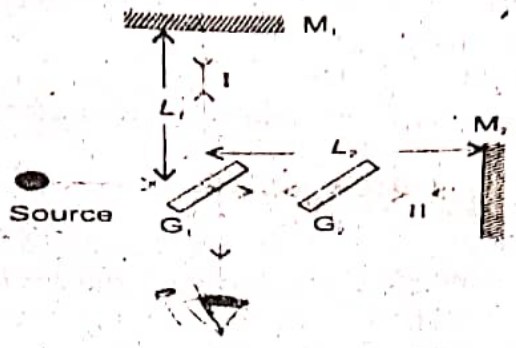
Its working is based on interference. When light from a single source splits up into two parts and then interfere, it forms an interference pattern.

31. What is the contribution of Michelson to measure the length of standard meter using interferometer?

Ans: Michelson measured the length of the standard meter in terms of wavelength of red cadmium light and showed that the standard meter is equal to 1553163.5 wavelengths of this light.

32. **Describe the construction of Michelson's interferometer with the help of diagram.**

Ans:



Here S is a source of monochromatic light,
G_1 is partially silvered glass plate,
G_2 is simple glass plate for compensation,
M_1 is a moveable mirror and M_2 is a fixed mirror

Topic VIII: Difraction of Light:

33. **What is diffraction of light?** **(2 Times)**

Ans: The slight bending of light as it passes around the edge of an object is called diffraction of light.

34. **What is difference between interference and diffraction fringes?**

Ans: **Interference fringes**: The superposition of two waves having same frequency and traveling in same direction results in bright and dark fringes is called interference fringes.

Diffraction fringes: The fringes formed due to the bending of light around edges and corners are called diffraction fringes.

35. **How would you manage to get more orders of spectra using a diffraction grating?** **(23 Times)**

Ans: The grating equation is

$$d \sin\theta = n\lambda$$

Thus by increasing the spacing between lines and using light of small wavelength. We can get more orders of spectra using diffraction grating.

36. **What is diffraction grating, write equation?** **OR** **What is meant by the diffraction of light?** **(4 Times)**

Ans: A glass plate having a large number of close parallel equidistant lines ruled over the plate mechanically is called diffraction grating. For diffraction grating,

$$d \sin\theta = n\lambda$$

Where "d sin θ" is path difference, 'n' is order of image and 'λ' is wavelength.
The slight bending of light as it passes around the obstacle or edge of an object is called diffraction of light.

37. **What is the difference between interference and Diffraction?** **(4 times)**

Ans: **Interference:** When two identical light waves travelling in the same direction are superimposed to each other in such a way that they reinforce each other at some points while at some points they cancel the effect of each other. Such phenomenon is called interference of light.

Diffraction: The property of bending of waves around obstacles and spreading of waves into the geometrical shadow of an obstacle is called diffraction.

38. **A typical diffraction grating has 5000 lines per centimeter. What will be the Grating Element of this diffraction grating in meters?** **(3 Times)**

Ans: Given that $N = 5000$
$L = 1\ cm = 0.01\ m$

Grating element is given as

$$d = \frac{L}{N}$$

$$d = \frac{0.01\ m}{5000} = 2 \times 10^{-6}\ m$$

39. Hold two fingers close together to form a slit. Look at the light bulb through the slit pattern of light being seen. What phenomenon is used in this case? Define this phenomenon.

Ans: Diffraction is used in this case. The property of bending of light around obstacles and spreading of light waves into the geometrical shadow of an obstacle is called diffraction.

Topic IX: Difraction of X-Rays by Crystals:

40. Why diffraction grating cannot be used for X – Rays diffraction?

Ans: In order to observe the effects of diffraction, the grating spacing must be of the order of wavelength of the incident light.
X-rays are of much shorter wavelength of the order of 10^{-10} m. The regular array of atoms in a crystal forms a natural diffraction grating with spacing ≈ 10^{-10} m which is not available in other diffraction grating.

41. Why X-rays can't not be diffracted by ordinary glass grating?

Ans: This is because X-rays has much shorter wavelength λ of the order of $10^{-10}m$. In order to observe the effects of diffraction, the grating spacing must be of the order of the wavelength of the radiation used. Therefore, crystals are used for X-rays diffraction.

42. Write two uses of X-rays diffraction by crystals.

Ans: X-ray diffraction has been very useful in determining the structure of biologically important molecules such as hemoglobin and double helix structure of DNA.

43. What is Bragg's law? Derive Bragg's equation.

Ans. "Bragg's law or Brag's condition:
Two beams with identical wavelength and phase approach a crystalline solid and are scattered off two different atoms within it.
The beam reflected from lower plane travels some extra distance as compared to the beam reflected from the upper plane. When a constructive interference occurs, the effective path difference between two beams $2dsin\theta$ is equal to an integral multiple of wavelength.
Thus $2dsin\theta = n\lambda$
Where n is the order of reflection.
This equation is known as Bragg's equation.

Topic X: Polarization:

44. What is polarization of light?

Ans: The phenomenon in which the vibration of waves can be oriented to any one direction, that may be vertical, horizontal, or any other direction is called polarization of light.

45. How would you distinguish between un-polarized and plane polarized lights? **(16 Times)**

Ans: **Un-polarized lights:** A beam of ordinary light consists of electric and magnetic vibrations which are perpendicular to the direction of propagation. It is called un-polarized light.
Plane polarized lights: The beam of light in which all vibrations are confined to one plane of vibration is called plane polarized light.

46. Why the polaroid sun glasses are better than ordinary sun glasses? (17 Times)

Ans: Polaroid sun glasses are better than ordinary sun glasses because they reduce the glare of light entering into the eye as a result of polarization.

47. Write any two processes to obtain plane polarized light? **(3 Times)**

Ans: The two processes to obtain plane polarized light are:

i. Selective absorption
The selective absorption method is the most common method to obtain plane polarized light by using certain types of materials called dichroic substances. These materials transmit only those waves, whose vibrations are parallel to a particular direction and will absorb those waves whose vibrations are in other directions. One such commercial polarizing material is a Polaroid.

ii. Reflection from different surfaces

Reflection of light from water, glass, snow and rough road surfaces, for larger angles of incidences, produces glare. Since the reflected light is partially polarized.

48. Define optical rotation. Give its practical use.

Ans: When a plane polarized light is passed through certain crystals, they rotate the plane of polarization. It is called optical rotation.

Organic solutions such as sugar, tartaric acid etc., show optical rotation which is used to determine their concentration in the solutions.

49. Give the list of two substance which shows optical rotation when they are in solution.

Ans: Sugar and tartaric acid show optical rotation when they are in solution.

50. Define polarization of light.

Ans: The phenomenon in which the vibration of waves can be oriented to any one direction (plane), that may be vertical, horizontal or any other direction is called polarization of light.

51. Write down selective absorption method to obtain plane polarized light from ordinary light.

Ans: **Selective absorption:** The selective absorption method is the most common method to obtain plane polarized light by using certain types of materials called dichroic substances. These materials transmit only those waves, whose vibrations are parallel to a particular direction and will absorb those waves whose vibrations are in other directions. One such commercial polarizing material is a Polaroid.

52. Write the names of any four processes to obtain plane polarized beam of light from un-polarized light.

Ans: This can be achieved by four processes such as

(i) Selective absorption (ii) Reflection from different surfaces
(iii) Refraction through crystals (iv) Scattering by small particles.

53. Can you obtain plane polarized light from un-polarized light? If your answer is yes, write the name of two processes by which plane polarized light is obtained.

Ans: Yes, we can obtain plane polarized light from un-polarized light.

This can be achieved by processes such as

(i) Selective absorption (ii) Reflection from different surfaces

2021

54. What are Newton's ring? How they are formed?

Ans: When a plano-convex lens of long focal length is placed in contact with a plane glass plate, a thin air film is enclosed between them to form circular dark and bright fringes known as Newton's rings.

55. What is meant by fringe spacing?

Ans: The distance between two consecutive dark or bright fringes is called fringe spacing. It is calculated by:

$$\Delta y = \frac{\lambda L}{d}$$

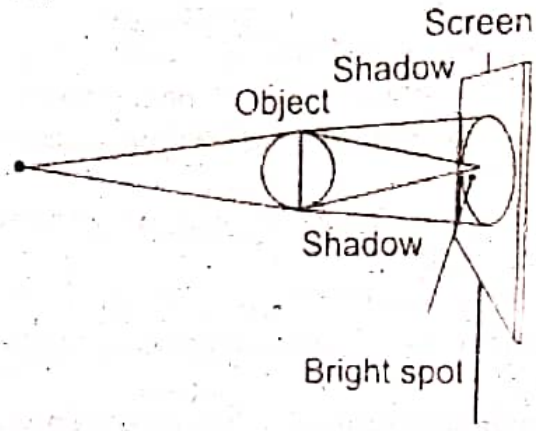
Fringe spacing varies inversely with distance. If the separation is too large, then fringes will disappear.

56. What is meant by diffraction of light? Explain with an example.

Ans: The bending of light around obstacles and spreading of light waves into the geometrical shadow of an obstacle is called diffraction.

Examples of diffraction of light:

Consider a small and smooth steel ball of about 3 mm in diameter is illuminated by a point source light. The shadow of the spherical object is not completely dark but has a small bright spot at its center. According to the Huygen's principle, each point on the rim of the sphere behaves as a source of secondary wavelet which illuminate the central region of the shadow.



LONG QUESTIONS OF CHAPTER-9 IN ALL PUNJAB BOARDS 2011-2021

Topic IV: Young Double Slit Experiment:

1. Explain Young's Double Slit Experiment to study the phenomenon of interference of light. **(2 Times)**
2. Explain Young's double slits experiment. Derive the relation for position of mth bright and dark fringe from the center of the screen. **(2 Times)**
3. What is interference of light waves? Descirbe Young's double slit experiment.
4. Explain young's double slit experiment and determine the relation for linear distance on the screen between adjacent bright fringes. **(3 Times)**

Topic VI: Newton's Rings:

5. What are Newton's rings? Describe the experiment of producing Newton's rings. Why does the central spot of Newton's rings look dark?

Topic VII: Michelson's Interferometer:

6. What is Michelson's interferometer? Explain its working and derive its equation. **(5 Times)**
7. Desribe the principle, construction and working of Michelson's interferometer. How can you find the wavelength of light used? **(2 Times)**
8. Discuss in detail the experimental arrangement made by Michelson to find speed of light and determine it.

Topic VIII: Difraction of Light:

9. What is diffraction grating? Explain diffraction using diffracting grating.

Topic IX: Difraction of X-Rays by Crystals:

10. Explain the diffraction of x-rays by crystals. What are uses of diffraction of x-rays? **(2 Times)**
11. Explain the diffraction of x-rays by crystals.
12. Define diffraction of light. Explain diffraction of x-rays by crystal and derive Bragg's equation.

NUMERICAL PROBLEMS OF CHAPTER-9 IN ALL PUNJAB BOARDS 2011-2021

Topic III: Interference of Light:

1. Yellow sodium light of wavelength 589 nm, emitted by a single source passes through two narrow slits 1.00 mm apart. The interference pattern is observed on a screen 225 cm away. How far apart are two adjacent bright fringes?

Sol:

$$\lambda = 589\ nm = 589 \times 10^{-9}\ m$$
$$d = 1\ mm = 1 \times 10^{-3}\ m$$
$$L = 225\ cm = 2.25\ m$$
$$\Delta y = ?$$

We know that $\Delta y = \frac{\lambda L}{d}$

$$\Delta y = \frac{589 \times 10^{-9} \times 2.25}{1 \times 10^{-3}} = 1.33 \times 10^{-3}\ m \boxed{= 1.33\ mm}$$

Topic IV: Young Double Slit Experiment:

2. In Young's double slit experiment, the second order maximum occur at $\theta = 0.25^o$ the wavelength is 650 nm. Determine the slit separation. (11 Times)

$$\lambda = 650\ nm = 650 \times 10^{-9}\ m$$
$$m = 2$$
$$\theta = 0.25^o$$
$$d = ?$$

Since $d \sin\theta = m\lambda$

$$d = \frac{m\lambda}{\sin\theta}$$
$$d = \frac{2 \times 650 \times 10^{-9}}{\sin 0.25^o}$$
$$d = 2.98 \times 10^{-4}\ m$$
$$d = 3 \times 10^{-4}\ m = 0.3 \times 10^{-3}\ m \boxed{= 0.3\ mm}$$

3. The distance between the slits in Young's double slip experiment is 0.25cm. Interference fringes are formed on a screen placed at a distance of 100cm from the slits. The distance of third dark fringe from the central bright fringe is 0.059cm. Find the wavelength of the incident light.

Sol:
$$d = 0.25cm = 0.025m$$
$$L = 100cm = 1m$$
$$Y = 0.059cm = 0.0059m$$
$$\lambda = ?$$

For the 3rd dark fringe, m=2 for dark fringe

$$Y = \left(m + \frac{1}{2}\right)\frac{\lambda L}{d}$$

Or $$\lambda = \frac{Yd}{L\left(m + \frac{1}{2}\right)}$$

Putting values,

$$\lambda = \frac{0.00059 \times 0.0025}{1 \times \left(2 + \frac{1}{2}\right)}$$
$$\lambda = 5.9 \times 10^{-7}\ m$$

or $\lambda = 590 \times 10^{-9} m$

or $\lambda = 590\ nm$

Topic V: Interference in thin Films:

4. Calculate the wavelength of light which illuminates two slits 0.5 mm apart and produces an interference pattern on a screen placed 200 cm away from the slits. The first Bright Fringe is observed at a distance of 2.4 mm from the central fringe.

Sol: $L = 200cm = 2m$

$Y = 2.40 \times 10^{-3} m$

$m = 1$

Wavelength of light = λ = ?

$$Y = m\frac{\lambda L}{d}$$

$$\lambda = \frac{yd}{mL}$$

$$= \frac{1.20 \times 10^{-3} \times 0.5 \times 10^{-3}}{1 \times 2}$$

$$= 1.20 \times 0.5 \times 10^{-6}$$

$$= 0.6 \times 10^{-6} m$$

$$\lambda = 600nm$$

Topic VIII: Difraction of Light:

5. A light is incident normally on a grating which has 2500 *lines per cm*. Compute the wavelength of a spectral line for which the deviation in second order is 15°. **(6 Times)**

Sol: $N = 2500\ lines\ per\ cm = 250000\ lines\ per\ m$

$n = 2$

$\theta = 15^o$

$\lambda = ?$

Since $d \sin\theta = n\lambda$

$$\lambda = \frac{d \sin\theta}{n}$$

Putting $d = \frac{1}{N}$, we get $\lambda = \frac{1}{N}\frac{\sin\theta}{n}$

$$\lambda = \frac{1}{250000}\frac{\sin 15^o}{2}$$

$$\lambda = 5.18 \times 10^{-7} m = 518 \times 10^{-9} m \boxed{= 518\ nm}$$

6. Sodium light ($\lambda = 589\ nm$) in incident normally on a grating having 3000 *lines per cm*. What is the highest order of the spectrum obtained with the grating? **(6 Times)**

Sol: $\lambda = 589\ nm = 589 \times 10^{-9} m$

$N = 3000\ lines\ per\ cm$

$N = 300000\ lines\ per\ m$

$\theta = 90^o$

$n = ?$

Since $d \sin\theta = n\lambda$

$$n = \frac{d \sin\theta}{\lambda}$$

Putting $d = \frac{1}{N}$, we get $n = \frac{1}{N}\frac{\sin\theta}{\lambda}$

$$n = \frac{1}{300000}\frac{\sin 90^o}{589 \times 10^{-9}} \boxed{= 5.66}$$

Hence 5th order of spectrum is the highest one.

7. **X-rays wavelength of 0.150 nm is observed to undergo a first order reflection at a brag angle of 13.3° from a quartz crystal. What is the interplanar spacing of the reflecting places in the crystal? (2 times)**

Sol:

$$\lambda = 0.150\ nm = 0.150 \times 10^{-9}\ m$$
$$n = 1\ ,\quad \theta = 13.3^{o}$$
$$d = ?$$

According to Bragg's law $2d \sin\theta = n\lambda$

$$d = \frac{n\lambda}{2\sin\theta}$$
$$d = \frac{1 \times 0.150 \times 10^{-9}}{2\sin 13.3^{o}}$$
$$d = 3.26 \times 10^{-10}\ m = 0.326 \times 10^{-9}\ m \quad \boxed{= 0.326\ nm}$$

8. **Blue light of wavelength 480 nm illuminates a diffraction grating, the second order image is formed at an angle of 30° from central image. How many lines in a centimeter of the grating have been ruled?**

Sol: $\lambda = 480nm = 480\times10^{-9}\ m$

$n = 2$

$\theta = 30^{0}$

$N = ?$

$d\sin\theta = n\lambda$

$$\frac{1}{N}\sin\theta = n\lambda \quad \left(As \quad d = \frac{1}{N}\right)$$
$$N = \frac{\sin\theta}{n\lambda}$$
$$N = \frac{\sin 30^{0}}{n\lambda}$$
$$N = \frac{0.5}{2\times480\times10^{-9}}$$
$$N = 5.2\times10^{5} \quad lines\ per\ meter$$
$$N = 5.2\times10^{3} \quad lines\ per\ cm$$

9. **A second order spectrum is formed at an angle of 38.0°. When light falls normally on a diffraction grating having 5400 lines per centimeter. Determine wavelength of the light used.**

Ans:

$$\theta = 38.0^{0}$$
$$N = 5400\ lines/cm$$
$$= 540000\ lines/m$$
$$n = 2$$
$$\lambda = ?$$

For diffraction grating

$$d\sin\theta = n\lambda$$

Or $\lambda = \frac{d\sin\theta}{n}$

But $d = \frac{1}{N}$

Thus $\lambda = \frac{Sin\,\theta}{Nn}$

$$= \frac{sin\ 38.0^{0}}{540000 \times 2}$$
$$\lambda = 570 \times 10^{-9}\ m$$
$$\lambda = 570\ nm$$

OBJECTIVES (MCQ'S) OF CHAPTER-10 IN ALL PUNJAB BOARD 2011-2021

Topic I: Least Distance of distinct vision:

1.The minimum distance from the eye at which an object appears to be distinct is: **(2 Times)**

(A) 15 cm (B) 20 cm (C) 25 cm (D) 30 cm

2. The least distance of distinct vision is: **(2 Times)**

(A) 5 cm (B) 10 cm (C) 25 cm (D) 50 cm

3.If d is the least distance of distinct vision, then the magnification of a convex lens of focal length f will be: **(2 Times)**

(A) $1+\frac{d}{f}$ (B) $1-\frac{d}{f}$ (C) $1+\frac{f}{d}$ (D) $1-\frac{f}{d}$

4.A device used for viewing distant objects is called:

(A) Telescope (B) Spectrometer (C) Microscope (D) Magnifying glass

5.Least distance of distinct vision:

(A) Increase with age (B) Decrease with age

(C) Remains constant with age (D) Becomes infinite after 60 years

6.The distance of near point from the eye is about:

(A) 25 cm (B) 25 dm (C) 10 cm (D) 25 m

Topic II: Magnifying Power and Resolving Power of Optical Instruments:

7.If N is the number of rulings on the grating then the resolving power in the mth order diffraction is equal to: **(3 Times)**

(A) R = Nm (B) R = N/m (C) R = 1/Nm (D) R = m/N

8.The ratio of the size of image to the size of object is called:

(A) Focal length (B) Visual length (C) Resolving power (D) Magnification

9.The magnification of a convex lens of f= 5cm and d=25 cm is:

(A) 3 (B) 5 (C) 6 (D) 20

10.The magnification of a convex lens of focal length 10cm is:

(A) 2.5 (B) 3.5 (C) 4.5 (D) 5

11.If an object is placed in between focus point and optical center of a convex lens, the image formed by lens is:

(A) Real inverted (B) Virtual diminished (C) Virtual inverted (D) Virtual erected

12.If a convex lens is used as a magnifying glass, which lens will give higher magnification that has

(A) Short size (B) long focal length (C) Large size (D) short focal length

13.Rayleigh formula for resolving power:

(A) $R = {}^{1.22\lambda}/_{D}$ (B) $R = {}^{1.22D}/_{\lambda}$ (C) $R = {}^{D}/_{1.22\lambda}$ (D) $R = {}^{\lambda}/_{1.22D}$

14. The detector in Photo – Phone is made up of:

(A) Cadmium (B) Germanium (C) Selenium (D) Silicon

15. A convex lens acts as diverging lens if the object is placed at

(A) F (B) 2F (C) Between f and 2F (D) within the F

Topic III: Microscope:

16.The final image formed by simple microscope is: **(3 Times)**

(A) virtual and inverted (B) virtual and erect (C) real and erect (D) real and inverted

17.If a single convex lens is placed close to eye, then it is being used as:

(A) Telescope (B) Microscope (C) Magnifying glass (D) None of these

18.Which communication can ensure less diffraction and more details to be seen by compound microscope:

(A) A wider objective and red light (B) a wider objective and blue light

(C) A wider eye piece and red light (D) a wider eye piece and blue light

19.Final image of compound microscope is: (3 Times)
(A) Virtual and erect (B) Virtual and inverted
(C) Real and inverted (D) Real and erect

20.If a convex lens of focal length 5 cm is used as simple microscope then its magnifying power will be:
(a) 5 (b) 6 (c) 10 (d) 25

21. The lens of simple microscope magnifying power will be.
(A) 5 (B) 10 (C) 15 (D) 25

22. The units of magnifying power of microscope or telescope are.
(A) Meter (B) m^{-1} (C) Diopter (D) No unit

Topic V: Astronomical Telescope:

23.For normal adjustment, the length of astronomical telescope is: (4 Times)
(A) $f_o - f_e$ (B) $f_o f_e$ (C) $f_o + f_e$ (D) f_o / f_e

24.The magnification power of a telescope in normal adjustment is equal to:
(A) $\frac{f_o}{f_e}$ (B) $\frac{f_e}{f_o}$ (C) $f_o \times f_e$ (D) $\frac{1}{f_e f_o}$

25.In the focal length of objective and eye piece is 0.5 m and 10 cm respectively, then magnifying power of telescope will be:
(A) 5 (B) 0.5 (C) 10 (D) 20

26.If the objective is placed with in the focal length of a convex lens its image will be:
(A) Magnified (B) Erect (C) Virtual (D) All of these

27.The final image seen through eye-piece in telescope is:
(A) Real, enlarge and inverted (B) Virtual, enlarge and erect
(C) Virtual, enlarge and inverted (D) Real, enlarge and erect

28.The focal length of Convex lens is:
(a) negative (b) positive (c) large (d) small

29. The final image obtained by astronomical telescope is:
(A) Erect (B) Virtual (C) Magnified (D) All of these

30. If focal length of objective and eye piece is 0.5 m and 10 cm respectively then magnifying power of telescope will be:
(A) 5 (B) 0.5 (C) 10 (D) 20

Topic VI: Spectrometer:

31.The collimator in a spectrometer is used to:
(A) Disperse the light beam (B) Reflect the light beam
(C) Make the light beam parallel (D) Coverage the light beam

Topic VIII: Introduction to Fibre Optics:

32.Which of the phenomena of light is used in propagation of light through optical fibers:
(A) Total internal reflection (B) Polarization
(C) Interference (D) Diffraction

33.Using a graded index fiber, the time difference is reduced to about: (3 times)
(A) 1 ns per km (B) 33ns per km (C) 2 ns per km (D) 32 ns per km

34.It becomes possible to send light into inaccessible place due to:
(A) Coaxial cable (B) Fiber optics (C) Copper wire (D) Glass wire

35.The infrared light used in fiber optics communication system has typical wave length equal to: (5 Times)
(A) $1.1\,\mu m$ (B) $1.3\,\mu m$ (C) $1.5\,\mu m$ (D) $1.7\,\mu m$

36.Multimode graded index fiber has core whose diametre range lie from:
(A) 5 to $50\,\mu m$ (B) 50 to $100\,\mu m$ (C) 50 to $1000\,\mu m$ (D) 50 to $10000\,\mu m$

37. Critical angle is that incident angle in denser medium for which angle of refraction is:
(A) 0° (B) 45° (C) 180° (D) 90°

38. Which of the following will travel much faster than others, through the optical fibers?
(A) Ultraviolet light (B) Visible light (C) Invisible infrared light (D) White light

39.In multimode step index fiber, the diameter of core is:
(A) 50 μ m (B) 5 μ m (C) 100 μ m (D) 150 μ m

40. For glass – air boundary, the value of critical angle is:
(A) 41.4° (B) 41.6° (C) 41.8° (D) 42.2°

41. Multimode step index fiber is useful for:
(A) Long distance (B) Short distance (C) No distance (D) Infinite distance

42. Information carrying capacity of optical fiber is called: **(2 Times)**
(A) Capacity (B) Band width (C) Immunity (D) Ability

43. A layer over the central core of the fibre is called:
(A) Jacket (B) Plastic (C) Cladding (D)Rubber

44. If the speed of light in vacuum is C, then its velocity in a medium of refractive index 1.3 is:
(A) 1.3 c (B) $\frac{1.3}{c}$ (C) $\frac{c}{1.3}$ (D) c

2018

45. The magnification of a convex lens of focal length 5 cm is equal to:
(a) $\frac{1}{5}$ (b) 5 (c) 6 (d) 25

46. When an object is placed within the focal point of a convex lens then its image will be:
(a) Real (b) Inverted (c) Virtual (d) Of same size

47. _____ will travel faster than others through an optical fibre.
(A) Ultraviolet light (B) Visible light (C) Infrared light (D) White light

48. The first person who attempted to measure the speed of light was:
(A) Michelson (B) Huygen (C) Galileo (D) Newton

49. The magnifying power of an astronomical telescope is 10. If the focal length of objective is 100 cm then what is the cocal lenth of eye-piece:
(A) 10 cm (B) 100 cm (C) 1000 cm (D) 5 cm

50. In normal adjustment of length of telescope is:
(A) $\frac{f_o}{f_e}$ (B) $\frac{f_e}{f_o}$ (C) $1+\frac{d}{f_e}$ (D) $f_o + f_e$

51. For normal adjustment, what is the length of astronomical telescope if focal lengths of objective and eye piece are 100 cm and 20 cm respectively?
(A) 100 cm (B) 20 cm (C) 5 cm (D) 120 cm

52. In newer Optical fiber systems, repeaters are placed at:
(A) 300 km (B) 100 m (C) 30 km (D) 100 km

2019

53. In multimode step index fiber, the value of refractive index of core is:
(A) 1.33 (B) 1.52 (C) 1.67 (D) 1.48

54. In single mode step index fiber core diameter is:
(A) 5 μm (B) 5 nm (C) 5 pm (D) 5 cm

55. The image formed by eyepiece of compound microscope is:
(A) Real and magnified (B) Real and diminished
(C) Virtual and enlarge (D) Virtual and diminished

56. If a convex Lens of focal length "F" is cut into two identical halves along the Lens diameter, the focal length of each half is:
(A) $\frac{3}{2}f$ (B) $2f$ (C) $\frac{f}{2}$ (D) f

57. Magnifying power of telescope is:
(A) $f_o + f_e$ (B) $f_o - f_e$ (C) $\frac{f_o}{f_e}$ (D) $\frac{f_e}{f_o}$

58. Microphone converts.
(A) electrical signal into sound signal (B) electrical signal into light signal
(C) light signal into electrical signal (D) sound signal into electrical signal

59. The magnifying power of convex lens of focal length 10cm is:
(A) 7 (B) 9.6 (C) 3.5 (D) 11

60. A layer over the central core of the jacket is called:
(A) jacket (B) plastic (C) cladding (D) rubber

61. Magnifying power of the lens is 6 then its focal length will be:
(A) 4 (B) 6 (C) 5 (D) 4.5

62. Equation of continuity gives conservation of:
(A) Energy (B) Power (C) Mass (D) Density

63. Product of area of cross section, velocity and time gives:
(A) Volume (B) Density (C) Mass (D) Weight

64. The magnifying power of a magnifying glass is.
(A) $1 - \frac{d}{f}$ (B) $1 - \frac{f}{d}$ (C) $\frac{f}{d}$ (D) $\frac{d}{f} + 1$

65. When light ray travels from one medium to another, the characteristic which does not change is:
(A) Velocity (B) Wavelength (C) Amplitude (D) Frequency

66. If f_o= 100 cm fe=5cm length and magnifying power of an astronomical telescope is:
(A) 0.05 cm; 20 (B) 95 cm ; 20 (C) 20 cm ; 500 (D) 105 cm ; 20

2021

67. The unit of magnifying power of a lens are
(A) Watt (B) Joule (C) No unit (D) N – m

68. The least distance of distinct vision for normal eyeis:
(A) 10 cm (B) 20 cm (C) 25 cm (D) 30 cm

69. Refractive index of water is:
(A) 1.5 (B) 1.33 (C) 1.0 (D) 1.2

70. Final image formed by compound microscope is:
(A) Real; Inverted; Magnified (B) Virtual; Erect; Magnified
(C) Real; Erect; Diminished (D) Virtual; Inverted; Diminished

71. Venturi relation is given by:
(A) $P_1 + P_2 = \frac{1}{2}\rho v_2^2$ (B) $P_1 - P_2 = \frac{1}{2}\rho v_2^2$
(C) $P_1 + P_2 = \frac{1}{2}\rho v_2$ (D) $P_1 - P_2 = \frac{1}{2}\rho^2 v_2$

72. Compound microscope consist of:
(A) Two convex lens (B) Two concave lens
(C) Convex lens and concave mirror (D) Concave lens and convex mirror

73. A Telescope with objective of focal length 40 cm and eyepiece of focal length 5 cm, when focused for infinity has length equal to
(A) 35 cm (B) 8 cm (C) 45 cm (D) 200 cm

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C	C	A	A	B	A	A	D	C	B	D	D	C	C	D	B
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
B	A	A	B	A	D	C	A	A	D	C	B	B	A	C	A
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
A	B	B	C	D	A	A	C	B	B	C	C	C	C	C	C
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
A	D	D	D	B	A	C	B	C	D	C	C	C	C	A	D
65	66	67	68	69	70	71	72	73							
D	D	C	C	B	B	B	A	C							

SHORT QUESTIONS OF CHAPTER-10 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Least Distance of distinct vision:

1. What is the near point? Give its numerical value?

Ans: The minimum distance from the eye at which an object appears to be distinct is called near point or least distance of distinct vision.
Its numerical value is $25\ cm$.
The location of the near point, however, changes with age.

2. Define magnification.

Ans: The size of the object goes on increasing, when the object brought from a far off point to the focus of the lens. This phenomenon of enlargement is called magnification. It is the ratio of size of image to the size of object.

3. Why is a Convex Lens of small focal length preferred for a magnifying glass?

Ans: A Convex Lens of small focal length is preferred for a magnifying glass because for high angular magnification the focal length should be small. Magnification can be found by using the equation $M = 1 + \frac{d}{f}$

4. What is angular magnification?

Ans: Angular magnification or magnifying power of an optical instrument means how large or magnified is the image formed by the instrument.

$$M = \frac{\beta}{\alpha}$$

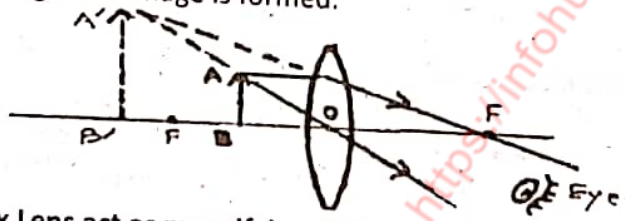
5. Define resolving power of an optical instrument.

Ans: The resolving power of an instrument is its ability to reveal the minor details of an object under examination. It is measured in terms of minimum angle.

$$R = \frac{1}{\alpha_{min}}$$

6. Describe with the help of ray diagrams, how a single biconvex lens can be used as a magnifying glass? **(2 Times)**

Ans: **A single biconvex lens as a magnifying glass:**
When the object is placed within the focal length of the lens then an erect, virtual and magnified image is formed.



7. How Convex Lens act as magnifying glass? **(3 Times)**

Ans: A convex lens of shorter focal length can be used as a magnifier when the object is placed very close to it i.e. when it lies between the lens and its focus. The image then formed is virtual, erect and magnified.

8. Define near point and resolving power.

Ans: The minimum distance from the eye at which an object appears to be distinct is called near point. Its numerical value is $25\ cm$.
The resolving power of an instrument is its ability to reveal the minor details of an object under examination.

$$R = \frac{1}{\alpha_{min}}$$

9. Focal length of convex lens is 5 cm, calculate its magnification.

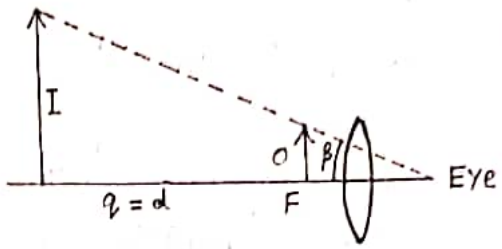
Ans: As we know that

$$M = 1 + \frac{d}{f} = 1 + \frac{25\ cm}{5cm} = 1 + 5 = 6$$

Where d is least distance of distinct vision.

10. **Describe with diagram, how a convex lens can be used as magnifying glass?**

Ans: The object is placed inside the focal point of the lens. The magnified and virtual image is formed at least distance of distinct vision as shown in figure.



11. **Define Resolving Power. Give its expression.**

Ans: Resolving power is the ability of the instrument to reveal the minor details of an object under examination.

Mathematically,

$$R \propto \frac{1}{\alpha_{min}}$$

Where α_{min} the minimum angle is which two point sources subtends at the instrument.

For diffraction grating Resolving power R=Nm

12. **Define resolving power and the magnification.**

Ans: The **resolving power** of an instrument is its ability to reveal the minor details of the object under examination.

The ratio of the size of the image to the size of the object is called **magnification.**

Topic II: Magnifying Power and Resolving Power of Optical Instruments:

13. **Differentiate between angular magnification and resolving power of an instrument. What limits the magnification of an optical instrument? (6 times)**

Ans: **Angular magnification**: The ratio of the angle subtended by the image as seen through the optical instrument to the angle subtended by the object at the unaided eye is called angular magnification i.e. $M = \frac{\beta}{\alpha}$

Resolving power is the ability of the instrument to reveal the minor details of an object under examination. It is measured in terms of minimum angle.

$$R = \frac{1}{\alpha_{min}}$$

The magnification of an optical instrument is limited due to defects in the lenses. Such as chromatic and spherical aberrations.

14. **What is resolving power in optical instruments? Write formula for grating.**

Ans: Resolving power is the ability of the instrument to reveal the minor details of an object under examination.

And formula for grating is $R = \frac{\lambda}{\Delta\lambda}$

Where $\Delta\lambda = \lambda_2 - \lambda_1$ and $\lambda \approx \lambda_1 \approx \lambda_2$

15. **Find magnifying power of a convex lens of 25cm focal length act as a magnifying glass. (2 Times)**

Ans: $magnifying\ power = M = ?$

$focal\ length = f = 25\ cm$

$M = 1 + \frac{d}{f}$

As

$$M = 1 + \frac{25cm}{25cm} = 1 + 1 = 2$$

16. **When object lie within the principle focus of convex lens what is the nature of image and where it is formed?**

Ans: When object lie within the principle focus of convex lens, then image will be virtual, erect and magnified and will be formed at least distance of distinct vision.

17. **Find the magnifying power of a convex lens of 10cm focal length.**

Ans: $magnifying\ power = M = ?$

$$focal\ length = f = 10\ cm$$

As $$M = 1 + \frac{d}{f}$$

$$M = 1 + \frac{10cm}{25cm}$$

$$M = 1.4$$

18. What is difference between magnifying power and resolving power of optical instrument? (6 Times)

Ans: **Magnifying power:** The ratio of the angles subtended by the image as seen through the optical device to that subtended by the object at the unaided eye is called angular magnification or magnifying power of an optical instrument.

$$M = \frac{\beta}{\alpha}$$

But the magnification alone is of no use unless we can see details of the object distinctly.

Resolving power: The resolving power of an instrument is its ability to reveal the minor details of an object under examination. It is measured in terms of minimum angle.

19. What do you understand by Linear Magnification?

Ans: Linear magnification is the ratio of the size of the image to the size of object. Angular magnification is the ratio of the angle subtended by the image as seen through the optical device to that subtended by the object at the naked eye placed at least distance of distinct vision.

20. What do you understand by linear magnification and angular magnification? Explain how a convex lens is used as magnifier? (4 Times)

Ans: **Linear magnification** is the ratio of the size of the image to the size of object.

Angular magnification is the ratio of the angle subtended by the image as seen through the optical device to that subtended by the object at the naked eye placed at near point.

A convex lens of shorter focal length can be used as a magnifier when the object is placed very close to it i.e. when it lies between the lens and its focus. The image then formed is virtual, erect and magnified.

21. A magnifying glass gives a five time enlarged image at a distance of 25 cm from the lens. What will be the focal length of the lens?

Ans: d = 25 cm

M = 5

$$f = ?$$

As $$M = 1 + \frac{d}{f}$$

$$5 = 1 + \frac{25cm}{f}$$

$$4 = \frac{25cm}{f}$$

$$f = \frac{25cm}{4} = 6.25\ cm$$

22. Define critical angle and least distance of distinct vision.

Ans: The angle of incidence in denser medium for which its corresponding angle of refraction is 90^0 is called critical angle.

The minimum distance from the eye at which an object appears to be distinct is called least distance of distinct vision. Its numerical value is 25 cm.

Topic III: Microscope:

23. In simple microscope the focal length of its lens is $\frac{1}{5}d$, where'd' is least distance of distinct vision. Find its magnifying power.

Ans: $magnifying\ power = M = ?$

$$focal\ length = f = \frac{1}{5}d$$

As
$$M = 1 + \frac{d}{f}$$
$$M = 1 + \frac{d}{\frac{1}{5}d}$$
$$M = 1 + 5$$
$$M = 6$$

24. Why would it be advantageous to use blue light with a compound microscope? (29 Times)

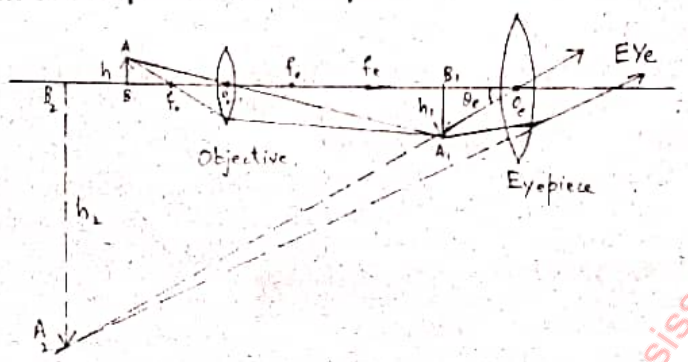
Ans: The use of blue light in compound microscope is advantageous because of its short wavelength. It results in a decrease in diffraction and increase in resolution because
$$R = \frac{D}{1.22\,\lambda}$$

25. One can buy a cheap microscope for use by the children. The image seen in such a microscope has coloured edges. Why is this so? (5 Times)

Ans: It is due to the defects of lenses known as chromatic aberrations. This is because of the prism like formation of the lens which causes dispersion of white light.

26. Draw ray diagram of compound microscope.

Ans:



27. How can the resolving power of compound microscope be increased?

Ans: A wider objective and use of blue light of short wavelength produces less diffraction and allows more details to be seen. In this way resolving power can be increased.

Topic IV: Astronomical Telescope:

28. If the person was looking through a telescope at the full moon, how would the appearance of the moon be changed by covering half of the objective lens? (9 Times)

Ans: He will see the full moon still but the brightness will be reduced because less light is transmitting through the half covered lens.

29. A telescope is made an objective of focal length 20 cm and eye-piece of 5 cm, both convex lenses. Find the magnifying power of telescope. (2 Times)

Ans: $magnifying\ power = M = ?$
$$focal\ length\ of\ objective = f_o = 20\ cm$$
$$focal\ length\ of\ eyepiece = f_e = 5\ cm$$

As
$$M = \frac{f_o}{f_e} = \frac{20}{5} = 4$$

30. What are the problems having a high magnifying power in astronomical telescope?

Ans: High magnifying power in astronomical telescope was accompanied by more spherical and chromatic aberration, geometric distortion and false colors.

31. Differentiate between microscope and telescope.

Ans: Microscope is a device which is used to see the magnified image of very small and near object. Whereas telescope is an optical instrument used for viewing distant objects.

32. What do you mean by "Normal adjustment" in an astronomical telescope? **(5 Times)**

Ans: In normal adjustment, the image formed by the objective lies at the focus of both the objective and the eye-piece and the final Image appears to be formed at infinity. The distance between the objective and eye-piece of a telescope in normal adjustment is f_o+f_e which equals the length of the telescope.

33. An astronomical telescope of long focal length and large aperture is considered to be a good telescope. Why?

Ans: Objective of long focal length and large aperture is used to collect a great amount of light from the astronomical objects.

Topic V: Spectrometer:

34. What is spectrometer? **(4 Times)**

OR What is the spectrometer? Write the names of its essential components.

Ans: Spectrometer is a device which is used to study the spectra from different light sources.

Its main parts are

i. Collimator ii. Turntable iii. Telescope

35. What is the function of collimator in a spectrometer? **(5 Times)**

Ans: Collimator is used to make the light rays parallel. It consists of a fixed metallic tube, a convex lens and an adjustable slit.

36. Write any two uses of spectrometer. **(3 Times)**

Ans: It is used to study spectra from different sources of light.
It is used to determine the wavelength of light.

37. What are uses of spectrometer? **(2 Times)**

Ans: It is used to study spectra from different sources of light. Determine the wavelength of light by grating. Study the deviation of light by glass prism. Calculate refractive index of prism material.

Topic VII: Introduction to Fibre Optics:

38. Define total internal reflection.

Ans: For glass–air boundary, when a propagating wave strikes the boundary at an angle larger than critical angle with respect to the normal to the surface, all the light is reflected and none is refracted to the air. This phenomenon is called total internal reflection.

39. Why we use infrared light in a fiber optics communication system?

Ans: Infrared light travels faster through optical fiber than visible light. So, it is preferred.

40. What are different types of optical fibre?

Ans: There are three types of optical fibres.

i. Single mode step index fibre
ii. Multimode step index fibre
iii. Multimode graded index fibre

41. Define critical angle and total internal reflection. **(4 times)**

Ans: **Critical Angle:** The angle of incidence in denser medium for which its corresponding angle of refraction is 90° is called critical angle. It is denoted by θ_c.
Total internal reflection: When a light ray traveling from a denser medium towards a rare medium, makes an angle of incidence greater than critical angle of the medium, then the ray is totally reflected back into the same denser medium. This phenomenon is called total internal reflection.

$$R = \frac{1}{\alpha_{min}}$$

42. Define total internal reflection and continuous refraction.

Ans: **Total internal reflection:** When a light ray traveling from a denser medium towards a rare medium, makes an angle of incidence greater than critical angle of the medium, then the ray is totally reflected back into the same denser medium. This phenomenon is called total internal reflection.
Continuous refraction: It is the mode of propagation of light in which light is

continuously refracted inside the different graded index fibers which are used in fibre optics.

43. **Define Snell's law and write its mathematical form.**

Ans: Snell's Law states that the ratio of the sines of the angles of incidence and refraction of a wave are constant when it passes between two given media. OR Snell's Law is a formula used to describe the relationship between the angles of incidence and refraction, when referring to light or other waves passing through a boundary between two different isotropic media such as water, glass, or air. Mathematically, $n_1 \sin \theta_1 = n_2 \sin \theta_2$

44. **What is the condition for total internal reflection?** **(4 Times)**

Ans: For glass–air boundary, when a propagating wave strikes the boundary at an angle larger than critical angle with respect to the normal to the surface, all the light is reflected and none is refracted to the air. This phenomenon is called total internal reflection. When a light ray traveling from a denser medium towards a rare medium, makes an angle of incidence greater than critical angle of the medium, then the ray is totally reflected back into the same denser medium.

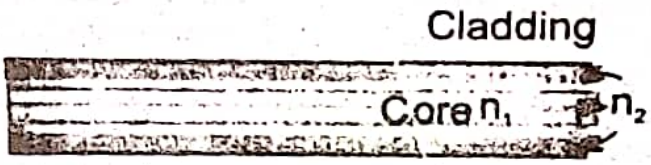
45. **Write down the three major components on which a fibre communication system consists.** **(6 Times)**

Ans: A fibre communication system consists of

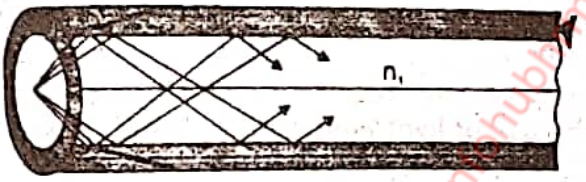
i) Transmitter ii. Optical fibre iii. Receiver

46. **Draw sketches showing the different light paths through a single-mode and a multi-mode fiber.**

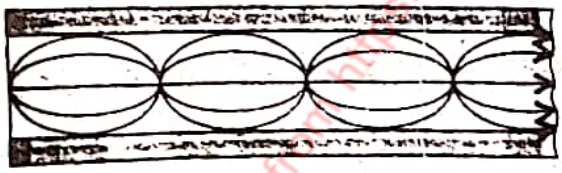
Ans: **Single mode step index fibre**



Multimode step index fibre



Multimode graded index fibre



47. **Calculate the critical angle for glass – air boundary, if refractive index of glass is 1.5 and the ray of light is passing from glass to air.**

Ans: When a ray of light is passing through glass to air, the angle of incidence for which angle of refraction is equal to 90° is called critical angle

From Snell's Law

$n_1 \sin \theta_1 = n_2 \sin \theta_2$

$n_1 \sin \theta_c = n_2 \sin 90°$

$n_1 \sin \theta_c = n_2$

$\sin \theta_c = n_2 / n_1$

$\sin \theta_c = 1.0 / 1.5$ (for air $n_2 = 1.0$)

$\theta_c = 41°$

48. **Write the advantages of using light as transmission carrier wave over radio wave carriers.** **(2 times)**

Ans: The use of light as transmission carrier wave in fibre optics has several advantages over radio wave carriers such as a much wider bandwidth capability and immunity from electromagnetic interference.

49. Define refractive index of a medium. Write its two mathematical forms.

Ans: Refractive index is the ratio of speed of light in vacuum to the speed of light in the material.

Two mathematical forms are:

(i) $n = \frac{c}{v}$

(ii) $n = \frac{1}{Sin\theta_c}$

Where θ_c is critical angle.

50. Differentiate between multimode step index and multimode graded index fibre.

Ans:

Multimode step index fibre.	Multimode graded index fibre.
It has a core of diameter such as 50 µm.	It has a core of diameter from 50 µm to 1000 µm.
It is mostly used for carrying white light. It is useful for a short distance only.	It is useful for long distance applications in which white light is used.
Core and cladding has constant refractive index such as 1.52 and 1.48 respectively.	It has a core of relatively high refractive index and the refractive index decreases gradually from middle to the outer surface of fibre.

51. What is Repeater? Why it is necessary in the optical communication system?

Ans: The repeater regenerates the light signals in the optical fibre communication system. Despite the ultra-purity (99.99% glass) of the optical fibre, the light signals eventually become dim and must be regenerated.

52. Describe two causes of power losses in optical fibre during transmission of light signals.

Ans: i. some light is absorbed due to impurities in the glass.

ii. Some light is scattered by groups of atoms which are formed at places such as joints of fibres.

iv. The information can be inaccurate due to dispersion or spreading of the light signals.

53. What is the use of light emitting diode and microphone in signal transmission in optical fiber?

Ans: Light emitting diode is used as light source. Such light travel much faster through optical fibres. Electrical signals are converted into light signals by digital modulation. Microphone converts sound signal into electrical signal.

Topic VIII: Signal Transmission and Conversion to sound:

54. How light signal is transmitted through optical fibre? **(14 Times)**

Ans: The light signals are transmitted through the optical fibre on the principle of

i. Total internal reflection

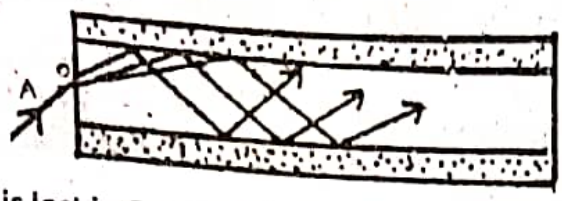
ii. Continuous refraction

In multimode step index fiber, the signal is transmitted by mean of total internal reflection while in case of multimode graded index fiber, the signal is transmitted by total internal reflection and continuous refraction.

Topic IX: Cosses of Power:

55. How the power is lost in optical fibre through dispersion? Explain. **(7 Times)**

Ans: If the source of light signal is not monochromatic, then the light will disperse while propagating through the core of the optical fibre into different wavelengths λ_1, λ_2 and λ_3 etc as shown in fig. λ_1 meets the core and cladding at the critical angle and λ_2 and λ_3 at slightly greater angles. The light paths of different wavelengths have thus different lengths. So they reach the other end at different times and the signal received is distorted or faulty.



56. **How the power is lost in Optical fibre?**

Ans: If light is not perfectly monochromatic, power is lost due to dispersion (or spreading of the light signal). Some light is absorbed due to impurities in the glass. Some light is scattered by groups of atoms which are formed at places such as joints when fibres are joined together.

2021

57. **How convex lens is used as a magnifier? What limits the magnification of an optical instrument?**

Ans: Convex lens is called simple microscope as it is often used as a magnifier when an object is brought within the focal length of convex lens. The magnified and virtual image is formed at least distance of distinct vision d.
The magnification of an optical instrument is limited due to defects in lenses such as chromatic and spherical aberrations.

58. **If the magnifying glass has magnifying power 6 then find the focal length of convex lens.**

Ans:

magnifying power = M = 6

$$focal\ length = f = ?$$

As

$$M = 1 + \frac{d}{f}$$

$$6 = 1 + \frac{25\ cm}{f}$$

$$6 - 1 = \frac{25\ cm}{f}$$

$$5 = \frac{25}{f}$$

$$f = \frac{25}{5} = 5\ cm$$

59. **What is optical fibre? Write down two uses of fibre optics.** **(2 Times)**

Ans: A thin flexible fibre with a glass core through which light signals can be sent with very little loss of strength.
i) It is used for to transmit light around corners and into inaccessible places so that the formerly unobservable could be viewed.
ii)The use of fibre optic tools in industry is now very common, and their importance as diagnostic tools in medicine.

60. **What is meant by least distance of distinct vision?**

Ans: The minimum distance from the eye at which an object appears to be distinct is called least distance of distinct vision OR near point. The distance is about 25 cm from the eye. It is denoted by d. If the object is held closer to the eye than this distance the image formed will be blurred and fuzzy. The location of the near point however changes with age.

61. **What is the length of the telescope in state of normal adjustment?**

Ans: In normal adjustment, the image formed by the objective lies at the focus of both the objective and the eye-piece and the final image appears to be formed at infinity. The distance between the objective and eye-piece of a telescope in normal adjustment is f_o+f_e which equals the length of the telescope.

LONG QUESTIONS OF CHAPTER-10 IN ALL PUNJAB BOARDS 2011-2021

Topic III: Microscope:

1. What is compound microscope? Draw rays diagram and derive expression for the magnification of compound microscope. **(7 Times)**
2. What is simple microscope? Draw rays diagram and find the magnifying power of simple microscope. **(5 Times)**
3. What is compound microscope? Explain its working and drive formula for its magnifying power. **(5 Times)**

Topic IV: Astronomical Telescope:

4. What is Astronomical Telescope? Describe its construction and working. Derive a formula to calculate its magnifying power. **(7 Times)**
5. What is a telescope? Draw its ray – diagram and derive a relation for its magnificiation power.

Topic V: Spectrometer:

6. What is spectrometer? Describe its construction and working. Also write down its two uses. **(2 Times)**
7. What is spectrometer? Describe its construction, working and uses.

Topic VII: Introduction to Fibre Optics:

8. What is optical fibre? Write its principle and how light is propagated through optical fibre. **(3 Times)**

NUMERICAL PROBLEMS OF CHAPTER-10 IN ALL PUNJAB BOARDS 2011-2018

Topic II: Magnifying Power and Resolving Power of Optical Instruments:

1. An astronomical telescope having magnifying power 5 consists of two thin lenses 25 cm apart. Find the focal length of lenses. (4 Times)

$$magnification\ of\ telescope = M = 5$$
$$distance\ between\ lenses = L = 25\ cm$$
$$focal\ length\ of\ objective = f_o = ?$$
$$focal\ length\ of\ eyepiece = f_e = ?$$

Since
$$M = \frac{f_o}{f_e}$$
$$f_o = Mf_e$$
$$f_o = 5f_e$$

We know that
$$L = f_o + f_e$$
$$L = 5f_e + f_e$$
$$25 = 6f_e$$
$$f_e = \frac{25}{6} \boxed{= 4.17\ cm}$$

And
$$f_o = 5f_e$$
$$f_o = 5(4.17) \boxed{= 20.83\ cm}$$

2. A simple astronomical telescope is normal adjustment has an objective of focal length 100 cm and eye piece of focal length 5 cm. Find the position of the final image and its angular magnification. (2 Times)

$$focal\ length\ of\ objective = f_o = 100\ cm$$
$$focal\ length\ of\ eyepiece = f_e = 5\ cm$$
$$distance\ of\ the\ image = q_e = ?$$

angular magnification = $M = ?$

Position of the Final Image

$p_e = 5\ cm$; $f_e = 5\ cm$; $q_e = ?$

Using the formula $\frac{1}{f_e} = \frac{1}{p_e} - \frac{1}{q_e}$

$$\frac{1}{q_e} = \frac{1}{p_e} - \frac{1}{f_e}$$

$$\frac{1}{q_e} = \frac{1}{5} - \frac{1}{5}$$

$$\frac{1}{q_e} = 0$$

$$\boxed{q_e = \frac{1}{0} = \infty}$$

In an astronomical telescope, final image is always formed at infinity.

Angular Magnification

We know that $M = \frac{f_o}{f_e} = \frac{100cm}{5cm}$ **= 20**

3. A telescope is made of an objective of focal length 20 cm and an eyepiece of 5.0 cm, both convex lenses. Find the angular magnification.

Sol:

$f_0 = 20\,cm$

$f_e = 5.0\,cm$

M=?

For a telescope

$$M = \frac{f_0}{f_e}$$

Putting values,

$$M = \frac{20\,cm}{5.0\,cm} = 4$$

Topic III: Microscope:

4. A microscope has an objective lens of 10mm focal length, and an eye piece of 25mm focal length. What is the distance between the lenses and its magnification, if the object is in sharp focus when it is 10.5mm from the objective?

Sol: $f_o = 10$ mm , $f_e = 25$ mm

Distance between the lenses = $q_1 + p_2 = ?$, M = ?

For objective alone $\frac{1}{p_1} + \frac{1}{q_1} = \frac{1}{f_o}$

$$\frac{1}{q_1} = \frac{1}{f_o} - \frac{1}{p_1}$$

$$\frac{1}{q_1} = \frac{1}{10} - \frac{1}{10.5} = \frac{10.5-10}{10 \times 10.5} = \frac{0.5}{105}$$

$$q_1 = \frac{105}{0.5} = 210 \text{ mm}$$

For eye piece alone virtual image is formed at least distance of distinct vision.

So, $q_2 = d = -25$ cm $= -250$ mm

and $\frac{1}{p_2} + \frac{1}{q_2} = \frac{1}{f_e}$

$$\frac{1}{p_2} = \frac{1}{f_e} - \frac{1}{q_2}$$

$$\frac{1}{p_2} = \frac{1}{25} - \frac{1}{(-250)} = \frac{1}{25} + \frac{1}{250} = \frac{250+25}{25 \times 250}$$

$$\frac{1}{p_2} = \frac{275}{6250} = \frac{6250}{275} = 22.72 \text{ mm}$$

Distance between the lenses = $q_1 + p_2 = 210 + 22.72 = 232.7$ mm

$q_1 + p_2 = 233$ mm

Magnification by objective $M_1 = \frac{q_1}{p_1} = \frac{210}{10.5} = 20.0$

Magnification by eye piece $M_2 = \frac{q_2}{p_2} = \frac{-250}{22.7} = -11.0$

Total magnification $M = M_1M_2 = 20.0 \times (-11.0) = -220$

Negative sign shows that the image is virtual.

5. A compound microscope has lenses of focal length 1.0 cm and 3.0 cm an object is placed 1.2cm from the object lens. If a virtual image is formed 25 cm from the eyes, calculate the separation of the lenses. (4 times)

Sol:

$f_0 = 1.0$ cm

$F_e = 3.0$ cm

$p = 1.2$ cm

$q = -25$ cm (virtual image)

$L = ?$

$M = ?$

$$\frac{1}{f_0} = \frac{1}{p} + \frac{1}{q}$$

$$OR \quad \frac{1}{q} = \frac{1}{f_0} - \frac{1}{p}$$

$$OR \quad \frac{1}{q} = \frac{1}{1} - \frac{1}{1.2}$$

$$\frac{1}{q} = \frac{1.2-1}{1.2}$$

$$\frac{1}{q} = \frac{0.2}{1.2}$$

$$q = 6\,cm$$

$$Again \quad \frac{1}{f_e} = \frac{1}{p'} + \frac{1}{q'}$$

$$\frac{1}{p'} = \frac{1}{f_e} + \frac{1}{q'}$$

$$\frac{1}{p'} = \frac{1}{3} - \left(-\frac{1}{25}\right)$$

$$\frac{1}{p'} = \frac{1}{3} + \frac{1}{25}$$

$$\frac{1}{p'} = \frac{25+3}{75}$$

$$\frac{1}{p'} = \frac{28}{75}$$

$$\frac{1}{p'} = \frac{75}{28}$$

$$p' = 2.7\,cm$$

Seperation between lens

$$L = q + p' = 6 + 2.7 = 8.7\,cm$$

Topic IV: Astronomical Telescope:

6. An astronomical telescope having magnifying power 5 consists of two thin lenses 24 cm apart. Find the focal length of lenses. (9 Times)

Sol:

$magnification\ of\ telescope = M = 5$

$distance\ between\ lenses = L = 24\ cm$

$focal\ length\ of\ objective = f_o = ?$

$focal\ length\ of\ eyepiece = f_e = ?$

Since $$M = \frac{f_o}{f_e}$$

$$f_o = M f_e$$

$$f_o = 5 f_e$$

We know that $$L = f_o + f_e$$

$$L = 5f_e + f_e$$

$$24 = 6f_e$$

$$f_e = \frac{24}{6} \boxed{= 4\ cm}$$

And $$f_o = 5f_e = 5(4) \boxed{= 20\ cm}$$

7. **A telescope is made of an objective of focal length 20 cm and an eye piece of focal length 5 cm, both convex lenses. Find the angular magnification. (5 Times)**

Sol: $$focal\ length\ of\ objective = f_o = 20\ cm$$

$$focal\ length\ of\ eyepiece = f_e = 5\ cm$$

$$angular\ magnification = M = ?$$

We know that $$M = \frac{f_o}{f_e} = \frac{20}{5} \boxed{= 4}$$

Topic VII: Introduction to Fibre Optics:

8. **A glass light pipe in air will totally internally reflect a light ray if its angle of incidence is at least 39°. What is the minimum angle for total internal reflection if pipe is in water? (7 Times)**

Sol: $$angle\ of\ incidence\ for\ glass = \theta_c = 39^o$$

$$angle\ of\ incidence\ for\ water = \theta_c = ?$$

The refractive index of glass light pipe is

$$n = \frac{1}{\sin\theta_c} = \frac{1}{\sin 39^o} = \frac{1}{0.629} = 1.59$$

Snell's law is $$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

Where $$refractive\ index\ for\ glass = n_1 = 1.59$$

$$refractive\ index\ for\ water = n_2 = 1.33$$

$$total\ internal\ reflection = \theta_2 = 90^o$$

$$minimum\ angle\ for\ total\ internal\ reflection = \theta_1 = \theta_c = ?$$

So $$n_1 \sin\theta_c = n_2 \sin\theta_2$$

$$\sin\theta_c = \frac{n_2 \sin\theta_2}{n_1}$$

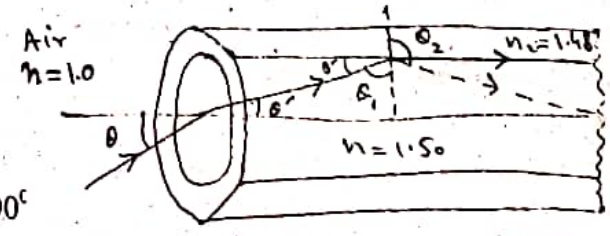
$$\sin\theta_c = \frac{(1.33)\sin 90^o}{1.59}$$

$$\sin\theta_c = 0.84$$

$$\theta_c = \sin^{-1}(0.84) \boxed{= 57^o}$$

9. **Calculate the critical angle and angle of entry for an optical fibre having core of refractive index 1.50 and cladding of refractive index 1.48. (2 Times)**

Sol: We have $n_1 = 1.50$, $n_2 = 1.48$



(i) From snell's law

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

When $\theta_1 = \theta_c$, $\theta_2 = 90^0$

So, $1.50 \sin\theta_c = 1.48 \sin 90^c$

$$\sin\theta_c = \frac{1.48(1)}{1.50} = 0.987$$

$$\theta_c = \sin^{-1}(0.987)$$

$$\theta_c = 80.6^0$$

From fig., $\theta' = 90^0 - \theta_c = 90^0 - 80.6^0 = 9.4^0$

(ii) Again, using Snell's law, we get

$$n\sin\theta = 1.5\sin\theta'$$

$$= 1.5\sin 9.4^0$$

$$\sin\theta = 0.245$$

$$\theta = \sin^{-1}(0.245) = 14.2^0$$

OBJECTIVES (MCQ'S) OF CHAPTER-11 IN ALL PUNJAB BOARD 2011-2021

Topic I: Kinetic Theory of Gases:

1. Boltzman constant 'k' is equal to:

(A) $\frac{R}{N_A}$ (B) $\frac{1}{RN_A}$ (C) $\frac{N_A}{R}$ (D) RN_A

2. An ideal gas is one whose molecules have:

(A) Kinetic energy only (B) Potential energy only
(C) Rotational kinetic energy only (D) Vibrational kinetic energy only

3. Boyle's law is applicable to:

(A) Isobaric process (B) Isochoric process (C) Isothermal process (D) Adiabatic process

4. A graph between V and T of a gas at constant pressure is:

(A) Hyperbola (B) Parabola (C) Straight line (D) Exponential curve

5. Average translational K.E of molecules for an ideal gas given by relation: (4 Times)

(A) $\frac{2}{3}kT$ (B) $\frac{3}{2}kT$ (C) $\frac{2}{3k}T$ (D) $\frac{3}{2k}T$

6. Pressure of a gas is given by the relation: (2 Times)

(A) $\frac{2}{3}\rho < v^2 >$ (B) $\frac{1}{3}\rho < v^2 >$ (C) $\frac{3}{2}\rho < v^2 >$ (D) $\rho < v^2 >$

7. According to Charles law:

(A) $V \propto T$ (B) $V \propto n$ (C) $P \propto \frac{1}{T}$ (D) $P \propto \frac{1}{V}$

8. The ideal gas law is:

(A) PV = NVK (B) P = NKT (C) PV = nRT (D) P = nRT

9. The Boltzman constant 'k' in terms of universal gas constant 'R' and Avogadro no 'NA' is given as: (2 Times)

(A) $k = N_A R$ (B) $K = \frac{R}{N_A}$ (C) $k = \frac{N_A}{R}$ (D) k = nRN

10. The value of Boltzman constant K is: (3 Times)

(A) 1.38×10^{23} JK^{-1} (B) 1.38×10^{-23} JK^{-1} (C) 1.38×10^{26} JK^{-1} (D) 1.38×10^{-26} JK^{-1}

11. S.I unit pressure of gas is:

(A) Nm^{-2} (B) N.m (C) N^2/m (D) N^2.m

12. Temperature of a gas is increased from 27° C to 127° C. The ratio of its mean K.E will be:

(A) 3/4 (B) 9/16 (C) 4/3 (D) 10/9

13. A Diatomic gas molecules has:
(A) Translation energy only (B) Rotational energy only
(C) Vibrational energy only (D) All

14. At constant temperature, if pressure of a given mass of a gas is halved then its volume become: (2 Times)
(A) Halved (B) Doubled (C) Four Times (D) Constant

15. Average translational K.E. of molecules for an ideal gas is given as.
(A) $\frac{2}{3}KT$ (B) $\frac{3}{2}KT$ (C) $\frac{2}{3K}T$ (D) $\frac{3}{2K}T$

16. At constant temperature and pressure, if volume of given mass of a gas is doubled, then density of the gas becomes:
(A) Dobule (B) $\frac{1}{4}$ of original (C) $\frac{1}{2}$ of original (D) Unchanged

Topic II: Internal Energy:

17. The internal energy of a piece of lead when beaten by hammer will:
(A) Increase (B) Decrease
(C) Remains constant (D) First increase and then decrease

18. The latent heat of fusion of ice is: (2 Times)
(A) $3.36\times10^{5}\,Jkg^{-1}$ (B) $3.36\times10^{6}\,Jkg^{-1}$ (C) $3.36\times10^{7}\,Jkg^{-1}$ (D) $3.36\times10\,Jkg^{-1}$

19. For an ideal gas system, the internal energy is directly proportional to:
(A) Pressure (B) Volume (C) Mass (D) Temperature

20. At which of the following temperature a body has maximum internal energy:
(A) -273 °C (B) 0 K (C) 273 K (D) -273 K

21. In thermodynamics system internal energy decreases by 100 J and 100 J of work is done on the system then heat lost will be:
(A) Zero (B) 100 J (C) 200 J (D) -200 J

22. For an ideal gas, the potential energy associated with its molecules is:
(A) Maximum (B) Zero (C) $\frac{1}{2}kx_0^2$ (D) $\frac{1}{2}kx_0$

23. The change in internal energy is defined as:
(A) Q – W (B) Q – T (C) Q + P (D) Q – P

Topic III: Work and Heat:

24. Heat is a form of: (3 Times)
(A) Power (B) Work (C) Energy (D) Motion

25. The measure of hotness or coldness of a substance is:
(A) Temperature (B) Heat (C) Internal energy (D) Energy

26. If the temperature of a system is kept constant, the process is called:
(A) Isobaric (B) Isochoric (C) Isothermal (D) Adiabatic

Topic IV: First Law of thermodynamics:

27. First law of Thermodynamics for an Adiabatic Process will be written as: (3 Times)
(a) Q=W (b) Q=-W (c) $W=-\Delta U$ (d) $W=\Delta U$

Topic V: Molar Specific Heat of Gas:

28. The pressure exerted by a column of mercury 76 cm high and at $0°C$ is called:
(A) 1 atm (B) $1\,Nm^{-2}$ (C) 1 Pascal (D) None of these

29. The difference between C_P and C_V is equal to:
(A) Avogadro's constant (B) Planck's constant
(C) Universal gas constant (D) Boltzmann constant

30.In _____ case the work done is zero.
(a) Constant pressure (b) Constant volume
(c) Constant temperature (d) Constant mass

31. Pascal is the unit of:
(A) pressure (b) force (c) tension (d)weight

32. The difference between C_p and C_v is equal to: (3 Times)
(a) Plank's constant (b) General gas constant
(c) Molar gas constant (d) Boltzman constant
(Note: Correct answer is "universal gas constant" which is not given in the options. So, most close option is "General gas constant")

33. The ratio of $\frac{C_p}{C_v} = \gamma$ for diatomic gas like air is:
(A) 1.40 (B) 1.30 (C) 1.29 (D) 1.67

Topic VI: Reversible and Irreversible Processes:

34.Which of the following process is practically reversible?
(A) Explosion (B) Human metabolism
(C) Evaporation of substance (D) Cloud formation

35.In reversible process the entropy of system.
(A) Remains constant (B) Decreases (C) Increases (D) Becomes zero

Topic VII: Heat Engine:

36.The efficiency of a diesel engine ranges from about: (3 Times)
(A) 25-30% (B) 30-35% (C) 35-40% (D) 40-45%

37. Number of spark plug needed in diesel engine is: (5 Times)
(A) 0 (B) 2 (C) 3 (D) 4

38.A heat engine operates between the temperatures 1000K and 400K. its efficiency can be equal to: (4 Times)
(A) 50% (B) 60% (C) 70% (D) 100%

39.An ideal heat engine can only be 100% efficiency if its cold temperature reservoir is at: (2 Times)
(A) 0 K (B) $0°C$ (C) 100 K (D) $100°C$

40.For working heat engine there must be:
(A) Source (B) Sink (C) Either of these (D) All of these

41.Efficiency of steam locomotive is:
(A) 10 % (B) 8% (C) 9 % (D) 7 %

42.No spark plug is needed in the: (2 Times)
(A) Petrol engine (B) Gas engine (C) Diesel engine (D) Water engine

43. The efficiency of heat engine whose sink is at 17^0C and source at 200^0C is: (2 Times)
(A) 35% (b) 65% (c) 80% (d) 90 %

44. If heat engine absorbs 400 J and rejects 200 J heat energy. Its efficiency will be.
(A) 25% (B) 50% (C) 70% (D) 25

Topic IX: Carnot Engine and Carnot's Theorem:

45.The efficiency of Carnot engine depends upon:
(A) Sink temperature (B) Source temperature
(C) Both (A) and (B) (D) The working substance

46.Isothermal process is carried out at constant:
(A) Volume (B) Pressure (C) Energy (D) Temperature

47.The most important factor regarding the significance of the Carnot engine is:
(A) It is practically possible (B) Its efficiency is 100%
(C) It sets an upper limit on the efficiency (D) it sets a lower limit on the efficiency

48.Which is not the example of adiabatic process:
(A) Rapid escape of air from burst tyre (B) Rapid expansion of air
(C) Conversion of water into ice in a refrigerator (D) Cloud formation in the atmosphere

49.An adiabatic process is that which has constant:
(A) Entropy (B) Volume (C) Pressure (D) Temperature

50.The efficiency of carnot engine depends on:
(A) Nature of working substance (B) Size of engine
(C) Construction of the engine (D) Temperature of hot and cold reservoir

51. Cloud formation in the atmosphere is an example of: **(3 Times)**
(A) Isothermal process (B) Adiabatic process
(C) Isobaric process (D) Isochoric process

52.For an Adiabatic process, first law of thermodynamics becomes: **(3 Times)**
(A) $Q = \Delta U + W$ (B) $Q = \Delta U$ (C) $Q = W$ (D) $\Delta U = -W$

53. The number of steps in Carnot engine are: **(3 Times)**
(A) 2 (B) 3 (C) 4 (D) 5

54. Which one is true for isothermal process? **(2 Times)**
(A) Q = W (B) Q = 0 (C) W = 0 (D) $W = \Delta U$

55.In an adiabatic process:
(A) $Q = \Delta U + W$ (B) $Q = \Delta U$ (C) Q = W (D) Q = 0

56.The curve representing an adiabatic process is called:
(A) Adiabat (B) Isotherm (C) Both of these (D) None

57.During adiabatic process which factor remains constant:
(A) Entropy (B) Pressure (C) Volume (D) Temperature

58.The Carnot cycle can be shown by which graph:
(A) P – T graph (B) V – T graph (C) P – V graph (D) PV –T graph

59.Isothermal process is carried out at constant
(a) Volume (b) pressure (c) entropy (d) temperature

60. For a diatomic gas $Cv = \frac{5R}{2}$ then Gamma "γ" for this gas is:
(a) $\frac{5}{7}$ (b) $\frac{4}{35}$ (c) $\frac{7}{5}$ (d) $\frac{35}{4}$

61. A Carnot engine has an efficiency of 50 %, when its sink temperature is at 27° C the temperature of the source is: **(2 Times)**
(A) 273° C (B) 300° C (C) 327° C (D) 373° C

Topic X: Thermodynamics Scale of temperature:

62.The value of triple point of water is: **(7 Times)**
(A) 373.16K (B) 273.16K (C) 212K (D) 100K

63. Unit of thermodynamic scale of temperature is: **(2 Times)**
(A) Kelvin (B) Centigrade (C) Fahrenheit (D) Celsius

64.Absolute zero temperature means:
(A) 0°C (B) 0°F (C) 0 K (D) 273 K

65.A devise based upon the Thermodynamic property of matter is called:
(a) Calorimeter (b) Heat engine (c) Thermometer (d) Voltmeter

66.The Celsius scale starts from:
(a) 32^0C (b) 273^0C (c) 0^0C (d) 100^0C

67. The temperature scale which is independent of nature of substance is:
(A) Theromodynamic scale (B) Centigrade scale (C) Fahrenheit scale (D) Regnault scale

Topic XI: Petrol Engine: (2 Times)

68.The efficiency of a petrol engine is about:
(A) 25-30% (B) 30-35% (C) 35-40% (D) 40-45%

69.Working cycle of a typical petrol engine consists of:
(A) Two strokes (B) four strokes (C) six strokes (D) eight strokes

70.How much energy petrol engine converts into work?
(A) 100% (B) 75% (C) 50% (D) 25%

Topic XII: Entropy: (3 Times)

71.The unit of entropy is:
(A) JK (B) $\frac{K}{J}$ (C) $\frac{J}{K^2}$ (D) $\frac{J}{K}$

72.Change in entropy of a reversible process is: (2 Times)
(A) Positive (B) negative (C) Zero (D) Maximum

73.The concept of entropy was introduced by Rudolph Clausius in:
(A) 1840 (B) 1856 (C) 1857 (D) 1905

74. Entropy remains constant in: (2 Times)
(A) Isothermal process (B) Adiabatic process (C) Isobaric process (D) Isochoric process

75. Entropy is measure of:
(A) Internal Energy of system (B) Order of system
(C) Disorder of system (D) Potential Energy of System

Topic XIII: Enviromental Crises Entropy Crises:

76.The change in entropy of a system is given by: (6 Times)
(A) $\Delta Q = \frac{\Delta S}{T}$ (B) $\Delta S = \frac{\Delta Q}{T}$ (C) $\Delta S = \frac{T}{\Delta Q}$ (D) $\Delta S = \Delta Q \times T$

77.Environmental Crisis are also known as:
(A) Population Crisis (B) Entropy Crisis (C) War Crisis (D) Mass Crisis

78. Net change in entropy of a system after one complete Carnot cycle is:
(A) Positive (B) Negative
(C) Zero (D) Sometimes postivtie and sometimes negative

2018

79. If the temperature of a gas is constant then $<\frac{1}{2}mv^2>$ of the molecules of gas will be:
(a) constant (b) zero (c) increased (d) decreased

80. For diatomic gas r = 1.4 and $C_v \frac{5R}{2}$ (R is gas constant) then C_v will be:
(a) $\frac{2}{5}R$ (b) $\frac{7}{2}R$ (c) $\frac{9}{2}R$ (d) $\frac{11}{2}R$

81. Efficiency of a heat engine can be increased by:
(A) increasing sink temperature (B) decreasing sink temperature
(C) decreasing source temperature (D) using ideal working substance

82. Boltzman constant 'k' has same unit as:
(A) temperature (B) energy (C) entropy (D) pressure

83. In thermodynamics process, the equation $W = -\Delta U$ represent:
(A) Isothermal expansion (B) Isothermal compression
(C) Adiabatic expansion (D) Adiabatic expression

84. The potential energy to the molecules of an ideal gas is considered to be:
(A) 100 J (B) 212 J (C) 23 J (D) Zero J

85. Which one of the following processes is irreversible:
(A) slow compression of an elastic spring
(B) slow evaporation of a substance in an isolated vessel
(C) slow compression of a gas (D) a chemical explosion

86. When temperature of source and sink of a heat engine becomes equal then the entropy change will be:
(A) zero (B) minimum (C) maximum (D) negative

87. The Mean Kinetic Energy of Gas is zero it:
(A) 0^0C (B) -273 ^{0}C (C) 100 K (D) 100 ^{0}C

88. The Internal Energy of System does not depend on:
(A) Temperature (B) Pressure (C) Path (D) Initial and Final State

89. If the temperature of sink is absolute zero then the efficiency of heat engine should be : **(2 Times)**
(A) 100 % (B) 50 % (C) Zero (D) Infinite

2019

90. The approximate efficiency of dry cell battery is:
(A) 70% (B) 80% (C) 90% (D) 93%

91. For an ideal gas, the P.E. associated with its molecules is equal to:
(A) $\frac{1}{2}$KX (B) $\frac{1}{2}$Kx_0^2 (C) 2 KX_0 (D) Zero

92. If internal energy decreases by 300 J and 120 J of work is done on the system then heat will be:
(A) 420 J (B) 320 J (C) 400 J (D) 300 J

93. If $T_H = T_1 = 327°$ and $T_L = T_2 = 27$ C°, then efficiency will be.
(A) 50% (B) 52% (C) 100% (D) Zero

94. The direction of flow of heat between two bodies in thermal contact is determined by:
(A) Internal energies (B) kinetic energies (C) potential energies (D) atmospheric pressure

95. Solid ice, Liquid water and water vapours consist in thermal equilbrium at a Temperature:
(A) 273 K (B) 273.16 K (C) 273 °C (D) 100 °C

96. The Sum of all the energies of molecules is known as: **(2 Times)**
(A) Elastic potential energy (B) Kinetic energy
(C) Internal energy (D) Gravitational potential energy

97. If temperature of sink is decresed, the efficiency of Carnot engine.
(A) Decreases (B) Increases
(C) Remain same (D) First increases then decreases

98. No entropy change takes place in.
(A) Isothermal process (B) adiabatic proces (C) isobaric process (D) isochoric process

99. A system does 700 Joules of work and at the same time its internal energy increases to 400 Joules, heat supplied by the source is:
(A) 700 Joules (B) 400 Joules (C) 1100 Joules (D) 300 Joules

100. According to first law of thermodynamics the quantity which is conserved is:
(A) Force (B) momentum (C) power (D) energy

101. What remains constant in adiabatic process?
(A) Volume (B) pressure (C) entropy (D) temperature

102. The SI unit of product of pressure and volume is:
(A) Watt (B) Joule (C) Pascal (D) N.m

103. If C_p for a gas is $\frac{7R}{2}$ then the value of C_v will be:
(A) $\frac{3R}{2}$ (B) $\frac{5R}{2}$ (C) $\frac{9R}{2}$ (D) R

104. Root mean square velocity is related to the absolute temperature of a ideal gas as:
(A) $V_{rms} \propto T$ (B) $Vrms \propto T^2$ (C) $V_{rms} \propto \sqrt{T}$ (D) $V_{rms} \propto \frac{1}{\sqrt{T}}$

105. If P= Pressure; V=Volume of a gas PΔV represent:
(A) Work (B) Density (C) Power (D) Temperature

2021

106. Sadi Carnot described an ideal engine in:
(A) 1640 (B) 1740 (C) 1940 (D) 1840

107. A system does 600 J of work and at the same time internal energy increases by 320 J , The heat supplied is:
(A) 200 J (B) 600 J (C) 280 J (D) 920 J

108. If one mole of an ideal gas is heated at constant volume then
(A) $Qp = Cv\,\Delta T$ (B) $W = Cv\,\Delta T$ (C) $Qv = Cp\,\Delta T$ (D) $\Delta U = Cv\,\Delta T$

109. The K.E of molecules of an ideal gas at absolute zero will be:
(A) Zero (B) Infinite (C) Very high (D) Below zero

110. Pressure of an ideal gas can be written in terme of its density:
(A) $P = \rho = < v^2 >$ (B) $P = \frac{1}{3}\rho < v^2 >$ (C) $P = \frac{2}{3}\rho < v^2 >$ (D) $P = \frac{1}{2}\rho < v^2 >$

111. The efficiency of a carnot angine is:
(A) infinite (B) Zero (C) Greater than one (D) Less than one

112. An ideal gas performs 10J of work while expanding adiabatically. The change in its internal energy is:
(A) 10 J (B) - 10 J (C) 100 J (D) – 200 J

113. A carnot engine operating between the temperatures has greatest efficiency:
(A) 40k and 20k (B) 60k and 40k (C) 80k and 60k (D) 100k and 80k

114. If one mole of an ideal gas is heated at constant pressure; then:
(A) $Q_p = C_p \Delta T$ (B) $\Delta U = C_p \Delta T$ (C) $\Delta U = C_v \Delta T$ (D) $Q_p = C_v \Delta T$

115. In carnot engine, each process is:
(A) Reversible (B) Perfectly reversible (C) Irreversible (D) Perfectly irreversible

116. If the Temperature of the source increases, the Efficiency of a carnot engine,
(A) Decreases (B) Increases
(C) Remains constant (D) First increase then decreases

117. For mono atomic gas $C_v = \frac{3R}{2}$ therefore nodes is:
(A) $3/5$ (B) $5/3$ (C) $4/15$ (D) $15/4$

118. Average velocity of molecules in gas is:
(A) Zero (B) Positive (C) negative (D) infinity

119. SI unit of molar specific heat is:

(A) $J\,mol^{-1}\,K^{-1}$ (B) $J\,mol\,K^{-1}$ (C) $J\,mol\,K$ (D) $J\,mol^{-1}$

ANSWERS OF THE MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	A	C	C	B	B	A	C	B	B	A	A	D	B	B	C
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
A	A	D	C	A	B	A	C	A	C	C	A	C	B	A	B
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
A	C	A	C	A	B	A	D	B	C	A	B	C	D	C	C
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
A	D	B	D	C	A	D	A	A	C	D	C	C	B	A	C
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
C	C	A	A	B	D	D	C	B	B	C	B	B	C	A	B
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
B	C	C	D	D	A	B	C	A	C	D	A	A	A	B	C
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112
B	B	C	D	C	B	B	C	A	D	D	D	A	B	D	B
113	114	115	116	117	118	119									
D	A	A	B	B	A	A									

SHORT QUESTIONS OF CHAPTER-11 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Kinetic Theory of Gases:

1. Write the four postulates of kinetic theory of gasses. (11 Times)

Ans: i) A finite volume of gas consists of consists of very large number of molecules.
ii) The size of molecules is much smaller than the separation between them.
iii) The molecules do not exert force on each other except during a collision.
iv) The collision between gas molecules themselves and with the walls of container is assumed to be perfectly elastic.

2. Why is the average velocity of the molecules in a gas zero but the average of the square of the velocities is not zero? (14 Times)

Ans: The motion of gas molecules is random. So the number of molecules moving in any direction with certain velocity is equal to the number of molecules moving in opposite direction with the same velocity. That is

$$\langle v\rangle = \frac{\langle v_x\rangle + \langle -v_x\rangle}{2} = 0$$

But the average of the square of velocities will not be zero because square of negative is always a positive number.

$$\langle v\rangle^2 = \frac{\langle v_x\rangle^2 + \langle -v_x\rangle^2}{2} \neq 0$$

3. Derive Boyle's law from kinetic theory of gases. (7 Times)

Ans: According to kinetic theory of gases

$$PV = \frac{2}{3}N\langle\frac{1}{2}mv^2\rangle$$

When temperature is kept constant, then right hand side will be a constant.

$$PV = constant$$

$$P = \frac{constant}{V}$$

$$P \propto \frac{1}{V}$$

16. Find the relation for work done by heat at constant pressure. (4 Times)

Or Prove that $W = P\Delta V$

Ans: Since $W = Fd$

$W = F\Delta Y$

Since $P = \frac{F}{A}$

$F = PA$

So $W = PA\Delta Y$

As $A\Delta Y = \Delta V$

Thus $W = P\Delta V$

17. What happens to the temperature of the room, when an air conditioner in left running on a table in the middle of a room? (4 Times)

Ans: No change will be observed because the heat is absorbed and expelled in the same room. Hence there will be no effect on the room's temperature.

18. Justify! Work and heat are similar.

Ans. Both work and heat are two different forms of energy. Both are measured in joule. For isothermal process 1st law of thermodynamics gives:

$$Q = W$$

Heat engine converts heat into useful work.

Topic IV: First Law of thermodynamics:

19. Can the mechanical energy be converted completely into heat energy? If so give an example. (12 Times)

Ans: Yes, the mechanical energy can be converted completely into heat energy. The adiabatic process is an example of such conversion.

According to first law of thermodynamics

$$Q = \Delta U + W$$

When $Q = 0$, work done is negative so

$$0 = \Delta U - W$$

$$\Delta U = W$$

20. Stat First Law of thermodynamics, how it is applicable on human body.

Ans: It states when heat Q is added to a system, this energy appears as an increase in the internal energy ΔU stored in the system plus the work done W by the system on its surroundings. Mathematically,

$$Q = \Delta U + W$$

Humans do works when the walk, talk or run and this work requires energy. Work done results in decrease in internal energy of body. i.e. law holds shape,

$$\Delta U = Q - W$$

Hence the internal energy of body or temperature is maintained by the food we eat.

21. State the first law of thermodynamic. Write down its mathematical from. (4 Times)

Ans: It states when heat Q is added to a system, this energy appears as an increase in the internal energy ΔU stored in the system plus the work done W by the system on its surroundings. Mathematically,

$$Q = \Delta U + W$$

22. Write two limitations of first law of thermodynamics.

Ans: **(i)** 1st law of thermodynamics does not specify the conditions under which conversion of heat into work is possible.

(ii) It does not specify the direction in which heat transfer takes place (high to low or low to high).

(iii) The fact that heat cannot be completely converted into work, is a fact that the first law cannot explain.

23. Explain bicycle pump as an example of 1st law of thermodynamics.

Ans: 1st law of thermodynamics is based on law of conservations of energy. Mathematically, it states as

$$Q = \Delta U + W$$

A bicycle pump provides a good example. When we pump on the handle rapidly, it becomes hot due to mechanical work done on the gas, raising thereby its internal energy.

24. What would be the heat lost if internal energy decreases by 10J and 20J of work is done on the system simultaneously.

Ans:

$$\Delta U = -10J$$

$$W = -20J$$

From 1st law of thermodynamics

$$Q = \Delta U + W = -10 - 20 = -30J$$

Negative sign shows that the heat is lost.

25. What is metabolism? How first law of thermodynamics explain it? OR How first law of thermodynamics explain human metabolism? (2 Times)

Ans: Energy transforming processes that occur within an organism are named as metabolism.

Humans do work when they walk, talk or run and this work requires energy. Work done results in decrease in internal energy of body. i.e. 1st law holds shape

$$\Delta U = Q - W$$

Hence the internal energy of body or temperature is maintained by the food we eat.

26. Define Thermodynamics.

Ans: Thermodynamics deals with various phenomena of energy and related properties of matter, especially the transformation of heat into other forms of energy.

Topic V: Molar Specific Heat of Gas:

27. Define C_P and C_V. **(3 Times)**

Ans: C_P: The amount of heat transfer required to raise the temperature of one mole of gas through $1\ K$ at constant pressure is called molar specific heat at constant pressure. It is denoted by C_P.

C_V:The amount of heat transfer required to raise the temperature of one mole of gas through $1\ K$ at constant volume is called molar specific heat at constant volume. It is denoted by C_V.

28. Specific heat of a gas at constant pressure is greater than specific heat at constant volume why? (28 Times)

Ans: At constant volume, no work is done and the entire heat is utilized in raising the internal energy of the system.

But under constant pressure, heat is not only required to raise the internal energy but also to do work against constant pressure.

Hence specific heat of a gas at constant pressure is greater than specific heat at constant volume.

29. We talk about molar specific heat of gases but not talk about molar specific heat of solids and liquids. Why?

Ans: In case of solids and liquids the change in volume and hence work done against external pressure during a change of temperature is negligibly small. But same can not be said about gases which suffer variation in pressure as well as in volume with the rise in temperature.

Topic VI: Reversible and Irreversible Processes:

30. Define reversible and irreversible processes. Give one example of each. (7 Times)

OR What is meant by reversible process? Give its example.

Ans: **Reversible process:** A process which can be retraced in exactly reverse order without producing any change in the surroundings is called reversible process. For example, melting of ice into water and freezing of water into ice.
Irreversible processes: A process which cannot be retraced in the backward direction by reversing the controlling factors is called an irreversible process. For example, work done against friction.

31. No spark plug is used in Diesel Engine. How it gets ignition?

Ans: Diesel is sprayed into the cylinder at maximum compression. Because air is at very high temperature immediately after compression, the fuel mixture ignites on contact with the air in the cylinder.

Topic VII: Heat Engine:

32. Define heat engine.

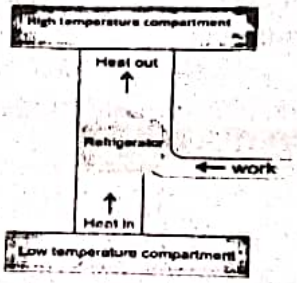
Ans: A device which converts heat energy into mechanical work is called heat engine.

33. What is Diesel Engine? **(2 Times)**

Ans: No spark plug is needed in diesel engine. Diesel is sprayed into cylinder at maximum compression. Because air is at high temperature after compression, fuel mixture ignites on contact with air in cylinder and pushes the piston outward. Its efficiency is about 35% to 40%.

34. Sketch the schematic diagram of refrigerator.

Ans:



35. What is heat engine? Define efficiency.

Ans: A device which converts heat energy into mechanical work is called heat engine. Efficiency of heat engine is defined as output divided by input.

$$\text{Percentage efficiency} = (1 - \frac{T_2}{T_1})100\ \%$$

36. A real heat engine is less efficient than cannot engine. Why?

Ans: Carnot engine operates in an ideal reversible cycle and ideal gas is used as the working substance.
No practical heat engine can be perfectly reversible. All real heat engines are less efficient than Carnot engine due to friction and other heat losses.

37. What is the similarity and difference between internal energy and gravitational P.E?

Ans: Internal energy is similar to the gravitational P.E. So like the potential energy, it is the change in internal energy and not its absolute value, which is important. Internal energy depends upon temperature of the system while gravitational P.E depends on position of the particle.

38. How can the efficiency of real heat engine be increased?

Ans: The efficiency of Heat Engine is given as:

$$\eta = \left(1 - \frac{T_2}{T_1}\right) \times 100\%$$

This shows that efficiency of engine can be increased by increasing temperature of source T_1.

39. What is a refrigerator? Draw its block diagram.

Ans: A refrigerator transfers heat from a low-temperature compartment to higher temperature surroundings with the help of external work. It is a heat engine operating in reverse order.

Topic VIII: Second Law of thermodynamics:

40. Is it possible to construct a heat engine that will not expel heat into the atmosphere? (23 Times)

Ans: No, it is not possible to construct a heat engine that will not expel heat into the atmosphere. It is against 2nd law of thermodynamics. A heat engine works only when some of the total heat absorbed from the source is expelled to a sink or atmosphere.

41. State second law of thermodynamics in terms of entropy. (7 Times)

Ans: It states that If a system undergoes a natural process, it will go in the direction that causes the entropy of the system plus the environment to increase.

42. Write Kelvin statement of the second law of thermodynamics. (2 times)

Ans: It is impossible to devise a process which may convert heat, extracted from a single reservoir, entirely into work without leaving any change in the working system.

43. Explain with example that heat can be added to a system without heating.

Ans: When two objects are rubbed together, work done is dissipated in the form of heat.

i. When an object slides over any surface and comes to rest because of frictional forces, work done is dissipated in the form of heat.

Topic IX: Carnot Engine and Carnot's Theorem:

44. What is the difference between isothermal and adiabatic process? (4 Times)

Ans: <u>Isothermal process:</u> The process in which temperature of the system remains constant is called isothermal process. $T = constant$

<u>Adiabatic system:</u> The process in which no heat enters or leaves the system is called adiabatic system. $Q = 0$

45. Why adiabat is steeper than isotherm? Explain. (3 Times)

Ans: Adiabat is steeper than isotherm because

$$slope\ of\ isotherm = -\frac{P}{V}$$

And

$$slope\ of\ adiabat = -\frac{\gamma P}{V}$$

where $\gamma > 1$.

46. State Carnot's theorem. (4 Times)

Ans: It states that no heat engine can be more efficient than a Carnot engine operating between the same two temperatures.

47. Write down three example of adiabatic process. (4 Times)

Ans: Three example of adiabatic process are

a. Cloud formation in the atmosphere
b. The rapid escape or air from a burst tyre.
c. The rapid expansion or compression of a gas through which sound wave is passing.

48. What is an Adiabatic Process? Also give its two examples. (4 Times)

OR Give an example of a process in which no heat is tranfered to or from a system but the temperature of the system changes. (2 Times)

Ans: <u>Adiabatic Process:</u> An adiabatic process is the process in which no heat is transferred to or from the system but the temperature of the system changes.

<u>Examples:</u> Passage of sound through the air, rapid escape of air from a burst tyre and cloud formation etc.

49. Define absolute zero using the Carnot cycle.

Ans: The Carnot cycle provides us the basis to define a temperature scale that is independent of material properties. Absolute zero is the lower limit of the thermodynamic temperature scale, a state at which the enthalpy and entropy of a cooled ideal gas reaches its minimum value, taken as zero (0). By international agreement, absolute zero is taken as - 273.15°C.

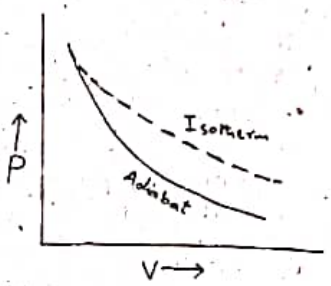
50. What is adiabatic process? Under what conditions this process occurs?

Ans: **Adiabatic Process:** The process in which no heat enters or leaves the system but the temperature of the system changes.
Adiabatic change occurs when the gas expands or is compressed rapidly, particularly when the gas is contained in an insulated cylinder.

51. Under what circumstances the efficiency of a Carnot engine will be 100 %? Is it possible?

Ans: No, it is impossible.
The efficiency of a Carnot engine will be 100% only when cold reservoir is at absolute zero temperature (0 K). Such reservoirs are not available and hence the maximum efficiency is always less than one or 100%.

52. In which process more work is done?



Ans: Work W = PV
More work is done in isothermal process.

53. Carnot Cycle provides the basis to define a temperature scale that is independent of material properties. Explain.

Ans: If heat Q is absorbed or rejected by the system at corresponding temperature T when the system is taken through a Carnot cycle and Q_3 is the heat absorbed or rejected by the system when it is at the temperature of triple point of water, then unknown temperature T in Kelvin is given by

$$T = 273.16 \frac{Q}{Q_3}.$$

The ratio $\frac{Q}{Q_3}$ depends only on the temperature of two heat reservoirs and is independent of the property of the working substance.

Topic X: Thermodynamics Scale of temperature:

54. What is thermodynamic scale of temperature? Give its unit. **(2 Times)**

Ans: The thermodynamic scale of temperature is defined by choosing 273.16 K as the absolute temperature of the triple point of water as one fixed point and absolute zero as the other.
The unit of thermodynamic scale is $kelvin$.

55. What do you mean by triple point of water? **(6 Times)**

Ans: The triple point of water is a state in which ice, water and vapour coexists in equilibrium and it occurs uniquely at one particular pressure and temperature. Its value is 273.16 K.

56. What is a triple point cell? Also define thermo dynamic scale.

Ans: A triple point cell, in which solid ice, liquid water, and water vapour co-exist in thermal equilibrium at 273.16K.
The thermodynamic scale of temperature is defined by choosing 273.16 K as the absolute temperature of the triple point of water as one fixed point and absolute zero, as the other. The unit of thermodynamic scale is kelvin.

57. What is triple point of water? Define Kelvin in terms of triple point of water. **(2 Times)**

Ans: The temperature at which all the three states of water coexist is called **tripple point of water**. Its value is 273.16K.
One Kelvin is defined as $\frac{1}{273.16}$ of the thermodynamic temperature of the tripple point of water.

Topic XI: Petrol Engine:

58. Name the four strokes of the petrol engine. (2 Times)

Ans: Four strokes of the petrol engine are

i. Intake stroke ii. Compression stroke iii.Power stroke iv. Exhaust stroke

Topic XII: Entropy:

59. Does entropy of a system increase or decrease due to friction? (9 Times)

Ans: The entropy of a system increases due to the friction as work done against friction is changed into heat and heat added to the system increases its entropy.

60. Define entropy and write its relation. (2 Times)

Ans: It is state variable of thermodynamic system and is a measure of disorder of molecules of a system. The relation for entropy change is,

$$\Delta S = \frac{\Delta Q}{T}$$

Its unit is J/K.

61. Define entropy, how it changes with temperature.

Ans: It is state variable of thermodynamic system and is a measure of disorder of molecules of a system. The relation for entropy change is,

$$\Delta S = \frac{\Delta Q}{T}$$

62. Show that: Change in entropy is always positive.

Ans: Suppose an amount of heat Q flows from a reservoir at temperature T_1 through a conducting rod to a reservoir at temperature T_2 when $T_1 > T_2$. The change in entropy of the reservoir which loses heat, decreases by $\frac{Q}{T_1}$ and of the reservoir which gain heat increases by $\frac{Q}{T_2}$.

As $T_1 > T_2$ so $\frac{Q}{T_2} > \frac{Q}{T_1}$

Hence, net change in entropy

$= \frac{Q}{T_2} - \frac{Q}{T_1}$ is positive

63. Define Entropy. Explain in terms of Second Law of Thermodynamics.

Ans: Entropy is a measure of disorder of molecules of a system.

$$\Delta S = \frac{\Delta Q}{T}$$

The 2nd law of thermodynamics can be stated as "The total entropy of any system plus that of its environment increases as a result of any natural process". Thermal pollution is an inevitable consequence of this law.

64. A system absorbs 200 Joule heat at an absolute temperature 200 K. Calculate the change in entropy.

Ans:

$\Delta Q = 200J$

$T = 200K$

$\Delta S = ?$

As $\Delta S = \frac{\Delta Q}{T}$

$= \frac{200J}{200K}$

$= 1 \ J/K$

65. What is degradation of energy?

Ans: Increase in entropy means degradation of energy. The energy goes from more orderly form to less orderly form.

For example, when hot and cold waters are mixed. Then warm water which results cannot be separated into a hot layer and a cold layer. There has been no loss of energy but some of the energy is no longer available for conversion into work.

Topic XIII: Enviromental Crises Entropy Crises:

66. Give an example of a natural process that involves an increase in entropy. (2 Times)

Ans: The melting of ice into water due to high temperature of its surroundings results in an increase in entropy. $\Delta S = \frac{\Delta Q}{T}$

67. What is negative entropy? Give example and its unit. (2 Times)

Ans: When heat is removed from the system, then it is referred as negative entropy. Conversion of water into ice in the refrigerator is an example of negative entropy. Its unit is JK^{-1}.

Increase in temperature will increase the entropy of the system.

68. Why the entropy of the universe always increase.

Ans: In all processes, heat flows from one system to another and there is always a net increase in entropy.

Suppose, the total energy passed from the hot region to the cold region is Q, the beginning temperature of the hot region is T_1 and the beginning temperature of the cold region is T_2. So during the energy transfer, the hot region's entropy decreases by Q/T_1 and the cold region's entropy increases by Q/T_2. Since $T_1 > T_2$ so Q/T_2 will be greater than Q/T_1. Hence, net change in entropy = $Q/T_2 - Q/T_1$ is positive.

2021

69. Calculate the work done during isothermal process?

Ans: "The process, in which temperature of the system remains constant is called an isothermal process".

As in isothermal process temperature remains constant, hence change in internal energy is zero i.e., $\Delta U = 0$. Apply 1st law of thermodynamics;

$$\Delta Q = \Delta U + W$$
$$\Delta Q = 0 + W$$
$$\Delta Q = W$$

70. Draw PV diagram which show four steps of Carnot engine.

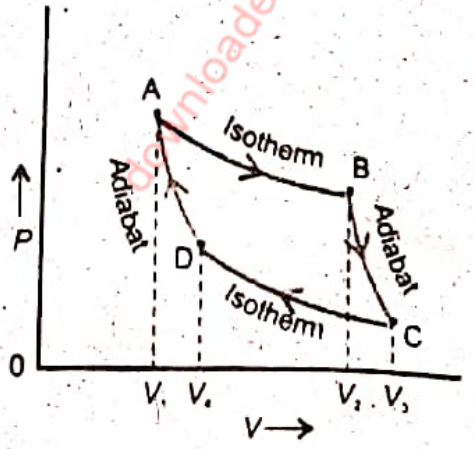
Ans: The operating cycle of Carnot engine is called Carnot cycle. A Carnot cycle consists of isothermal and adiabatic processes as shown in the PV diagram. It consists of following four steps:

Isothermal Expansion: The gas is allowed to expand isothermally at temperature T_1, absorbing heat Q_1 from hot reservoir. This process is represented by the curve AB.

Adiabatic Expansion: The gas is then allowed to expand adiabatically until its temperature drops to T_2. This process is represented by the curve BC.

Isothermal Compression: The gas at this stage is compressed isothermally at temperature T_2 rejecting heat Q_2 to the cold reservoir. This represented by the curve CD.

Adiabatic Compression: Finally, the gas is compressed adiabatically to restore in initial T_1. This process is represented temperature curve DA.



71. Prove that the maximum efficiency is always less than one or 100%.

Ans: As, the efficiency is given as;

$$\eta = \left(1 - \frac{T_2}{T_1}\right)$$

This expression tells that efficiency of Carnot engine depends upon the temperatures difference of two reservoirs. The larger the temperature difference, the greater is the efficiency. At absolute zero, $T_2 = 0$ K

$$\eta = \left(1 - \frac{T_2}{T_1}\right) = \left(1 - \frac{0}{T_1}\right) = 1 - 0 = 1 \text{ or } 100\%$$

But it can never be 100 % unless the cold reservoir is at absolute zero temperature ($T_2 = 0$ K). Such reservoirs are not available and hence the maximum efficiency is always less than one or 100%.

72. Find the average speed of oxygen molecule in the air at STP.

Ans:

At S.T.P

$T = 0\ ^\circ C = 273$ k

$N_A = 6.022 \times 10^{23}$

$k = 1.38 \times 10^{-23}$ Jk^{-1}

Molecular mass of oxygen = $M = 32$ g $= 32 \times 10^{-3}$ kg

Mass of one molecule of oxygen = $m = \frac{M}{N_A}$

$$m = \frac{32 \times 10^{-3}}{6.022 \times 10^{23}} = 5.14 \times 10^{-26} \text{ kg}$$

Since $T = \frac{2}{3k} \left\langle \frac{1}{2} mv^2 \right\rangle$

$$\langle v^2 \rangle = \frac{3kT}{m}$$

$$\langle v^2 \rangle = \frac{3 \times 1.38 \times 10^{-23} \times 273}{5.14 \times 10^{-26}}$$

$$\langle v^2 \rangle = 212693$$

$$\langle v \rangle = \sqrt{212693}$$

$$\langle v \rangle = 461 \text{ ms}^{-1}$$

73. A mechanical engineer develops an engine, working between 600 K and 300 K and claim to have an efficiency of 52%. Does he claim correctly? Explain.

$$T_1 = 600\ K$$

$$T_2 = 300\ K$$

$$efficiency = \eta = ?$$

We know that $\eta = \left(1 - \frac{T_2}{T_1}\right) \times 100$

$$\eta = \left(1 - \frac{300}{600}\right) \times 100 = 50\ \%$$

But the mechanical engineer claimed it to be 52 %. So, he claimed wrong.

74. Starting from the relation of pressure of a gas prove that absolute temperature of an ideal gas is directly proportional to the average translational K. E. of gas molecules.

Ans:

According to kinetic theory of gases;

$$PV = \frac{2}{3} N \left\langle \frac{1}{2} mv^2 \right\rangle \quad \text{---------- (1)}$$

and ideal gas equation;

$$PV = nRT$$

$$PV = \frac{N}{N_A} RT = N \frac{R}{N_A} T = NkT \quad \text{----------(2)}$$

Comparing eq. (1) and eq. (2)

$$NkT = \frac{2}{3} N \left\langle \frac{1}{2} mv^2 \right\rangle$$

$$T = \frac{2}{3k} \left\langle \frac{1}{2} mv^2 \right\rangle$$

$$T \propto \left(\frac{1}{2}mv^2\right)$$

Hence proved.

75. How can we increase the internal energy? Explain.

Ans: As a temperature increases, the molecules will move faster, thus have more kinetic energy and thus the internal energy will increase.

76. Differentiate between internal energy of a substance and internal energy of an ideal gas.

Ans: The sum of all forms of molecular energies (kinetic and potential) of a substance is termed as its internal energy.

The molecules of an ideal gas don't exert forces on one another. So, the internal energy of an ideal gas system is generally the translational K.E. of its molecules. Since the temperature of a system is defined as the average K.E of its molecules, thus for an ideal as system, the internal energy is directly proportional to its temperature.

77. Define internal energy of a substance. Is it state function?

Ans: The sum of all forms of molecular energies (kinetic and potential) of a substance is termed as its internal energy.

By experiment it has been seen that the change in internal energy is independent of paths and it only depends upon change from initial to final state of the system. It is a function of state.

LONG QUESTIONS OF CHAPTER-11 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Kinetic Theory of Gases:

1. Define pressure of a gas. Prove that $P = \frac{2}{3}N_o < \frac{1}{2}mv^2 >$. **(2 Times)**

Topic IV: First Law of thermodynamics:

2. Define first law of thermodynamics. Explain Isothermal and Adiabatic process. **(3 Times)**

Topic V: Molar Specific Heat of Gas:

3. Define Molar Specific Heat of a Gas at constant pressure (C_p) and at constant volume (C_v). Also prove that $C_p - C_v = R$. **(11 Times)**

Topic IX: Carnot Engine and Carnot's Theorem:

4. What is Carnot engine? Explain the Carnot cycle and calculate the efficiency of Carnot heat engine. **(5 Times)**
5. What is a Carrot Heat Engine? Explain four process of Carrot's Cycle and derive formula for it efficiency. **(3 Times)**
6. What is a Carnot heat engine? Show that efficiency of a Carnot heat engine depends on the temperatures of the hot and cold reservoirs.
7. Describe the construction and working of CARNOT engine. Also find its efficiency.

Topic XI: Petrol Engine:

8. Explain four stroke petrol engines in detail. What is the efficincey of a diesel engine?

NUMERICAL PROBLEMS OF CHAPTER-11 IN ALL PUNJAB BOARDS 2011-2021

Topic I: Kinetic Theory of Gases:

1. What is average translational kinetic energy of molecules in a gas at temperature 27 °C?

Sol:

$$T = 27\ ^{\circ}C = 27 + 273 = 300\ K$$

$$Boltzmann\ constant = k = 1.38 \times 10^{-23}\ JK^{-1}$$

$$\langle K.E. \rangle = ?$$

Since

$$T = \frac{2}{3k}\langle K.E. \rangle$$

$$\langle K.E. \rangle = \frac{3kT}{2}$$

$$\langle K.E. \rangle = \frac{3 \times 1.38 \times 10^{-23} \times 300}{2}$$

$$\boxed{\langle K.E. \rangle = 6.21 \times 10^{-21}\ J}$$

2. Estimate the average speed of nitrogen molecules in air under standard conditions of pressure and temperature. (7 Times)

Sol: As given for N_2 molecule

$$T = 0\ ^{\circ}C = 0 + 273 = 273\ K$$

$$P = 1\ atm$$

$$Boltzmann\ constant = k = 1.38 \times 10^{-23}\ JK^{-1}$$

$$mass\ of\ N_2\ molecule = m = \frac{molecular\ mass}{avogadro\ number}$$

$$m = \frac{28}{6.022 \times 10^{23}} = 4.65 \times 10^{-26}\ kg$$

$$\langle v \rangle = ?$$

We know that

$$T = \frac{2}{3k}\langle K.E. \rangle$$

$$T = \frac{2}{3k}\langle \frac{1}{2}mv^2 \rangle$$

$$T = \frac{m}{3k}\langle v^2 \rangle$$

$$\langle v^2 \rangle = \frac{3kT}{m}$$

$$\langle v^2 \rangle = \frac{3 \times 1.38 \times 10^{-23} \times 273}{4.65 \times 10^{-26}}$$

$$\langle v^2 \rangle = 2.43 \times 10^5$$

$$\sqrt{\langle v^2 \rangle} = \sqrt{2.43 \times 10^5}$$

$$\boxed{\langle v \rangle = 493\ ms^{-1}}$$

3. Find the average speed of oxygen molecule in the air at S.T.P. (4 Times)

Sol:

At S.T.P

$T = 0°C = 273\ k$

$N_A = 6.022 \times 10^{23}$

$k = 1.38 \times 10^{-23}\ Jk^{-1}$

Molecular mass of oxygen = $M = 32\ g = 32 \times 10^{-3}\ kg$

Mass of one molecule of oxygen = $m = \frac{M}{N_A}$

$$m = \frac{32 \times 10^{-3}}{6.022 \times 10^{23}} = 5.14 \times 10^{-26}\ kg$$

Since $T = \frac{2}{3k} < \frac{1}{2} mv^2 >$

$$< v^2 > = \frac{3kT}{m}$$

$$< v^2 > = \frac{3 \times 1.38 \times 10^{-23} \times 273}{5.14 \times 10^{-26}}$$

$$< v^2 > = 212693$$

$$< v > = \sqrt{212693}$$

$$< v > = 461\ ms^{-1}$$

Topic IV: First Law of thermodynamics:

4. **A thermodynamic system undergoes a process in which its internal energy decreases by $300\ J$. If at the same time $120\ J$ of work is done on the system. Find the heat lost by the system.**

Sol: Due to decrease in internal energy

$$\Delta U = -300\ J$$

$$\Delta W = -120\ J$$

$$\Delta Q = ?$$

From first law of thermodynamics

$$\Delta Q = \Delta U + \Delta W$$

$$\Delta Q = (-300) + (-120)$$

$$\boxed{\Delta Q = -420\ J}$$

Heat loss by the system is negative.

Topic VII: Heat Engine:

5. **The turbine in a steam power plant takes steam from a boiler at $427\ ^oC$ and exhausts into a low temperature reservoir at $77\ ^oC$. What is the maximum possible efficiency?**

Sol:

$$T_1 = 427\ ^oC = 427 + 273 = 700\ K$$

$$T_2 = 77\ ^oC = 77 + 273 = 350\ K$$

$$efficiency = \eta = ?$$

We know that $\eta = \left(1 - \frac{T_2}{T_1}\right) \times 100\%$

$$\eta = \left(1 - \frac{350}{700}\right) \times 100\%$$

$$\boxed{\eta = 50\ \%}$$

6. **A heat engine performs $100\ J$ of work and at the same time rejects $400\ J$ of heat energy to the cold reservoirs. What is efficiency of the engine? (6 Times)**

Sol:

$$work = W = 100\ J$$

$$Q_2 = 400\ J$$

$$Q_1 = ?$$

$$\eta = ?$$

We know that $W = Q_1 - Q_2$

$$Q_1 = W + Q_2$$

$$Q_1 = 100 + 400$$

$$\boxed{Q_1 = 500\ J}$$

And $$\eta = \frac{W}{Q_1}$$

$$\eta = \frac{100}{500}$$

$$\boxed{\eta = 0.2}$$

And percentage efficiency is

$$percentage\ efficiency = 0.2 \times 100$$

$$\boxed{percentage\ efficiency = 20\ \%}$$

1. **A mechanical engineer develops an engine, working between 327 °C and 27 °C and claim to have an efficiency of 52%. Does he claim correctly? Explain.** **(5 Times)**

Sol:

$$T_1 = 327\ ^oC = 327 + 273 = 600\ K$$
$$T_2 = 27\ ^oC = 27 + 273 = 300\ K$$
$$efficiency = \eta = ?$$

We know that $$\eta = \left(1 - \frac{T_2}{T_1}\right) \times 100$$

$$\eta = \left(1 - \frac{300}{600}\right) \times 100$$

$$\boxed{\eta = 50\ \%}$$

But the mechanical engineer claimed it to be 52 %. So he claimed wrong.

Topic IX: Carnot Engine and Carnot's Theorem:

8. **A Carnot engine utilizes an ideal gas. The source temperature is 227 °C and sink temperature is 127 °C. Find the efficiency of the engine.** **(2 Times)**

Sol:

$$T_1 = 227\ ^oC = 227 + 273 = 500\ K$$
$$T_2 = 127\ ^oC = 127 + 273 = 400\ K$$
$$efficiency = \eta = ?$$

We know that $$\eta = \left(1 - \frac{T_2}{T_1}\right) \times 100$$

$$\eta = \left(1 - \frac{400}{500}\right) \times 100$$

$$\boxed{\eta = 20\ \%}$$

9. **A carnot engine whose low temperature reservoir at 7°C has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how much degrees the temperature of source be increased?**

Ans:

$$T_2 = 7^oC = (7 + 273)K = 280K$$
$$T_1 = ?$$
$$\eta_1 = 50\%$$

We know that $$\eta_1 = \left(1 - \frac{T_2}{T_1}\right) \times 100\%$$

$$50\% = \left(1 - \frac{280}{T_1}\right) \times 100\%$$

$$50 = 100 - \frac{280 \times 100}{T_1}$$

$$50 - 100 = -\frac{28000}{T_1}$$

$$\frac{28000}{T_1} = 50$$

$$T_1 = 560\ K$$

Now $\eta_2 = 70\%$, $T_2 = 280\ K$, $T_1' = ?$

$$As \quad \eta_2 = \left(1 - \frac{T_2}{T_1'}\right) \times 100\%$$

$$70\% = \left(1 - \frac{280}{T_1'}\right) \times 100\%$$

$$70 = 100 - \frac{280 \times 100}{T_1'}$$

$$\frac{-2888}{T_1'} = -30$$

$$T_1' = 933\ K$$

$$Increase\ in\ temperature$$

$$T_1' - T_1 = 933 - 560$$

$$= 373\ K$$

Topic XII: Entropy:

10. **Calculate entropy change when $1\ kg$ ice at $0\ ^oC$ melts into water at $0\ ^oC$ latent heat of fusion of ice $L_f = 3.36 \times 10^5\ J/_{kg}$.** **(5 Times)**

Sol:

$$m = 1\ kg$$

$$T = 0\ ^oC = 0 + 273 = 273\ K$$

$$L_f = 3.36 \times 10^5\ J/_{kg}$$

$$\Delta S = ?$$

Since

$$\Delta S = \frac{\Delta Q}{T}$$

$$\Delta S = \frac{mL_f}{T}$$

$$\Delta S = \frac{1 \times 3.36 \times 10^5}{273}$$

$$\boxed{\Delta S = 1.23 \times 10^3\ JK^{-1}}$$

Thus entropy increases as ice changes into water.

11. **$336\ J$ of energy is required to melt $1\ g$ of ice at $0\ ^oC$. What is the change in entropy of $30\ g$ of water at $0\ ^oC$ as it is changed into ice at $0\ ^oC$ by a refrigerator?** **(9 Times)**

Sol:

$$heat\ of\ fusion = L_f = \frac{336\ J}{1\ g}$$

$$L_f = \frac{336\ J}{1 \times 10^{-3}\ kg} = 336000\ J/_{kg}$$

$$mass = m = 30\ g = 0.03\ kg$$

$$T = 0\ ^oC = 0 + 273 = 273\ K$$

$$\Delta S = ?$$

Since entropy decreases to freeze water into ice, so ΔS will be negative.

$$\Delta S = -\frac{\Delta Q}{T}$$

$$\Delta S = -\frac{mL_f}{T}$$

$$\Delta S = -\frac{0.03 \times 336000}{273}$$

$$\boxed{\Delta S = -36.8\ JK^{-1}}$$

Board Papers 2019

SAHIWAL BOARD

Physics (New Scheme) Session (2019)
(Group – I–Class 11th)
Objective
Time : 20 Minutes
Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **The speed of efflux is equal to the velocity gained by the falling fluid under the action of gravity through a certain height is called:**
   (A) Torricelli's theorem (B) Bernoulli's theorem (C) Stoke's theorem (D) Venturi's theorem
2. **Formula oen racing cars have a:**
   (A) steamlined design (B) turbulented design (C) rectangular design (D) elliptical design
3. **The frequency of waves produced in microwave oven is:**
   (A) 2850 MHz (B) 2450 MHz (C) 2400 MHz (D) 2750 MHz
4. **The number of beats produced per sec. in two tuning forks is equal to:**
   (A) Sum of two frequencies (B) ratio of two frequencies
   (C) the frequency of either of two tuning fork (D) the difference of the frequencies of two tuning forks
5. **When a mirror of Michelson interferometer is moved a distance of 0.5 mm, then 2000 frings are observed, the wavelength of light used is:**
   (A) 5000×10^{-10}m (B) 5000×10^{-9}m (C) 1000×10^{-7}m (D) 5000×10^{-7}m
6. **The waves which do not require any medium for their propagation are called:**
   (A) mechanical waves (B) matter waves (C) electromagnetic waves (D) longitudinal waves
7. **Microphone converts.**
   (A) electrical signal into sound signal (B) electrical signal into light signal
   (C) light signal into electrical signal (D) sound signal into electrical signal
8. **No entropy change takes place in.**
   (A) isothermal process (B) adiabatic proces (C) isobaric process (D) isochoric process
9. **A system does 700 Joules of work and at the same time its internal energy increases to 400 Joules, heat supplied by the source is:**
   (A) 700 Joules (B) 400 Joules (C) 1100 Joules (D) 300 Joules
10. **Light year is the unit of:**
    (A) time (B) distance (C) energy (D) time and distance
11. **How many years in one second:**
    (A) 3.1536×10^{7} years (B) 1.536 years (C) 3.1×10^{-8} years (D) 3.1×10^{8} years
12. **Magnitude of unit vectors $\hat{i}\times\hat{j}$ is.**
    (A) 1 (B) -1 (C) $-\hat{j}$ (D) $+\hat{k}$
13. **If cross product of two vectors $\vec{A}\times\vec{B}$ points along positive z-axis, then the vectos $\vec{A}$ and $\vec{B}$ must lie in.**
    (A) yz – plane (B) xz – plane (C) xy – plane (D) No plane
14. **If a shell explodes in mind air, its fragments fly off in different directions. The total momentum of the fragments.**
    (A) decreases (B) increases (C) becomes zero (D) remains the same
15. **The maximum velocity required of an object to go out from the gravitational field in heavenly body is:**
    (A) moon (B) mercury (C) mars (D) earth
16. **When a body moves in a circular path, the angle between its linear velocity and angular velocity is.**
    (A) 180° (B) zero degree (C) 90° (D) 45°
17. **In one revolution the angular displacement covered is:**
    (A) 60° (B) 360° (C) 90° (D) 180°

Physics (New Scheme)
Session (2019)

SAHIWAL BOARD
(Group - I, Class 11th)
Subjective

Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Give the drawbacks to use the period of simple pendulum as time standards.
ii. How the digit 5 if, insignificant, will be rounded off?
iii. Define the terms. (a)Unit vector (b) Position vector and write their mathematical expressions.
iv. Is it possible to add a vector quantity to a scalar quantity ? Explain.
v. How would the two vectors of the same magnitude heave to be oriented, if they were to be combined to give the resultant equal to a vector of the same magnitude?
vi. Calculate the work done in kilo joules in lifting a masss of 10 kg (at a steady velocity) through vertical height of 10m?
vii. What sort of energy is in the following? a) compressed spring b) a moving car
viii. A person is standing near a fast moving train. Is there any danger that he will fall towards it?
ix. In a orbiting space station, would the blood pressure in major arteries in the legs ever be greater than the blood pressure in major arteries in the neck?
x. What is meant by phase angle? Does it define the angle between maximum displacement and the driving force?
xi. Differentiate between Resonance and Damping.
xii. Under what conditions does the addition of two simple harmonic motions produce a resultant, which is also simple harmonic?

3. Write short answer to any EIGHT parts.

i. State Law of Conservation of Momentum. What is its limitation?
ii. Explain the circumstances in which the velocity $\vec{v}$ and acceleration $\vec{a}$ are parallel and anti parallel.
iii. If angle of projection of a projectile is 90°. Find its range.
iv. How can acceleration be found by velocity-time graph?
v. What is meant by weightlessness?
vi. Prove that orbital angular momentum depends upon the radius of the orbit.
vii. What is meant by moment of inertia? Explain its significance.
viii. Derive relation $S = r\theta$.
ix. What do you know about radar speed trap?
x. What are the quantities which affect the frequency of standing waves along a string?
xi. What are the conditions for points which are in phase and out of phase?
xii. As we know PV^{γ} = Constant. What do you know about γ in this relation?

4. Write short answer to any SIX parts.

i. Define the term Wavefront.
ii. How would you manage to get more orders of spectra using diffraction grating?
iii. Explain whether the Young's experiment is an experiment for studying interference or diffraction effects of light.
iv. Why would it be advantageous to use blue light with a compound microscope?
v. Define critical angle and least distance of distinct vision.
vi. State First Law of Thermodynamics.
vii. Does the entropy of a system increase or decrese due to friction?
viii. Explain why molar specific heat at constant pressure is greater than specific heat a constant volume.
ix. A thermos flask containing milk as a system a shaken rapidly. Does the temperature of milk rise?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Show that pressure exerted by the gas is directly proportional to the average translation kinetic energy of the gas molecules.
(b) Show that the expression $v_f = v_i + at$ is dimensionally correct, where v_i is the velocity at $t = 0$, a is acceleration and v_f is the velocity at time t.

6.(a) What do you mean by torque? Derive the expression for the torque acting on a rigid body.
(b) A ball is thrown horizontally from a height of 10 m with velocity of 21 ms^{-1}. How far off it will hit the ground?

7. (a) Describe Newton's formula for the speed of sound in air and explain how it was corrected by Laplace?
(b) A car of mass 800kg travellig at 54 km/h is brought to rest in 60 meter. Find average retarding.

8. (a) Define simple prdulum. Show that motion of simple pendulum is simple harmonic motion. Also derive expression for its time period.
(b) What should be the orbiting speed to launch a satellite in a circular orbit 900 km above the surface of the earth. Mass of earth = 6×10^{24} kg and radius of earth = 6400 km.

9. (a) Describe the Young's double slit experiment to derive the relation for fringe spacing.
(b) A telescope is made of a objective of focal length 20cm and an eye piece of 5.0 cm, both are convex lenses. Find the angular magnification.

D.G.K. BOARD

Physics (New Scheme) (Group – I –Class 11th) Time : 20 Minutes
Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **The prefix femto is equal to:**
   (A) 10^{-9} (B) 10^{-12} (C) 10^{-14} (D) 10^{-15}
2. **The time taken by light from moon to earth is:**
   (A) 1 min 10 sec. (B) 1 min 20 sec. (C) 1 min 30 sec. (D) 1 min 40 sec.
3. **If the magnitudes of scalar and vector product of two vectors are $2\sqrt{3}$ and 2 respectively. The angle between vectors is:**
   (A) 30° (B) 6 (C) 120° (D) 180°
4. **The resultant two perpendicular vectors each of magnitude A is:**
   (A) A (B) 2A (C) $\sqrt{2}$ A (D) A^2
5. **Ballistic missiles are used for:**
   (A) short ranges (B) long ranges (C) very long ranges (D) any range
6. **Power of an electric heater is (approximate power):**
   (A) 1 KW (B) 2 KW (C) 3 KW (D) 4 KW
7. **A man in a lift moving upward with constant velocity will conclude that his weight has:**
   (A) Increased (B) Decreased (C) Reduced to zero (D) Not changed
8. **The number of satellites in global positioning system is:**
   (A) 3 (B) 12 (C) 24 (D) 36
9. **If the radius of droplet becomes half, then terminal velocity will become:**
   (A) Half (B) Four times (C) One third (D) One fourth
10. **The systolic pressure for a normal healthy person is:**
    (A) 75 – 80 torr (B) 100 torr (C) 120 torr (D) 140 torr
11. **If the length of simple pendulum is doubled then its time period becomes.**
    (A) half (B) 2 times (C) $\sqrt{2}$ times (D) 4 times
12. **The speed of sound in vacuume is:**
    (A) 330 ms^{-1} (B) 332 ms^{-1} (C) $3 \times 10^8 ms^{-1}$ (D) Zero
13. **IT becomes difficult to recognize the beats when the difference between the frequencies of two sounds is more than.**
    (A) 10 Hz (B) 20 Hz (C) 30 Hz (D) 40 Hz
14. **Bending of light around the edges of an obstacle is called:**
    (A) Refraction (B) Interference (C) polarization (D) diffraction
15. **In multimode step index fiber, the value of refractive index of core is:**
    (A) 1.33 (B) 1.52 (C) 1.67 (D) 1.48
16. **The approximate efficiency of dry cell battery is:**
    (A) 70% (B) 80% (C) 90% (D) 93%
17. **For an ideal gas, the P.E. associated with its molecules is equal to:**
    (A) $\frac{1}{2}$ KX (B) $\frac{1}{2}KX_0^2$ (C) 2 KX_0 (D) Zero

D.G.K. BOARD

Physics (New Scheme)
Session (2019)

(Group -I, Class 11th)
Subjective

Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Give the drawbacks to use the period of pendulum as a time standard.
ii. Is zero significant or not? Explain?
iii. Define the null vector and give two examples.
iv. Is it possible to add a vector quantity to scalar quantity? Explain.
v. Can a body rotate about its centre of gravity under the action of its weight? Explain briefly.
vi. A girl drops a cup from a certain height, which breaks into pieces. What energy changes are involved?
vii. Define kilowatt hours and show that 1 KWh=3.6 MJ.
viii. Why fog droplets appear to be suspended in air? Explain briefly.
ix. Write the three characteristics of an ideal fluid.
x. Name two characteristics of simple harmonic motion.
xi. State Hoo's law. Give SI unit of spring constatnt.
xii. What is driven harmonic oscillator? Give example.

3. Write short answer to any EIGHT parts.

i. At what point or points in its path does a projectile have its minimum speed, its maximum speed?
ii. Explain the difference between a) Elastic collision and b). In-elastic collision.
iii. State and derive second law of motion in terms of momentum.
iv. What is a) Ballistic missile b) Ballistic Trajectory.
v. Define angular velocity and give its formula.
vi. Prove that $a = r\alpha$
vii. State the direction of the following vectors in simple situation.
a) Angular momentum b) Angulary velocity.
viii. What is meant by moment of inertia? Explain its significance.
ix. Exlain the effect of variation of density on the speed of sound in gas.
x. Give the rules for the reflection of waves from the boundary of a.
a) denser medium b) rarer medium
xi. Explain why sound travels faster in warm air than in cold air?
xii. Is it possible for two identical waves travelling in the same direction along a string to give rise to a stationary wave? Explain

4. Write short answer to any SIX parts.

i. Can visible light produce the interference fringes? Explain.
ii. An oil film spreding over wet foot path show colours. Explain.
iii. What are Newton's rings? Explain briefly.
iv. Define resolving power and the magnification.
v. If person was looking through telescope at the full moon, how would the appearance of moon be changed by covering half of the objective lens?
vi. Internal energy is a state function. Explain.
vii. Give two examples of the adiabatic process.
viii. Is it possible to construct a heat engine without sink? Explain.
ix. Does entropy of a system increase or decrease due to friction? Explain.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Defie Molar specific heat at constant pressure and at constant valoume and also derive relation between them.
(b) Calculate, how many seconds are there in one year and many years in one second?

6.(a) What is scalar product of two vectors? Discuss its four characteristics.
(b) A truck weighing 2500 kg and moving with a velocity of 21 ms^{-1} collides with a stationary car weighing 1000 kg. The truck and the car move together after the impact. Calculate their common velocity?

7. (a) Show that frequencies of stationary waves in a stretched string are quantized.
(b) A car of mass 800 kg travelling at 54 km/h is brought to rest in 60 meters. Find the average retarding force on the car. What has happened to original kinetic energy?

8. (a) Define centripetal force and derive its relation.
(b) A block of mass 4.0 kg is dropped from a height of 0.80 m on the a spring of spring constatnt k = 1960 Nm^{-1}

9. (a) Describe the construction of a simple microscope and derive and expression for its magnifying power.
(b) In a double slit experiment the second order maximum occurs at θ=0.25o. The wavelength is 650 nm. Determine the slit separation.

SARGODHA BOARD

Physics (New Scheme) (Group – I –Class 11th) Time : 20 Minutes
Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **The term 134.7 can be written scientific notation as:**
   (A) 1.347×10^2 (B) 1.347×10^3 (C) 1.347×10^1 (D) 1.347×10^4
2. **The quantity 0.00467 has significant figures.**
   (A) 3 (B) 4 (C) 5 (D) 6
3. **If two components of a vector are equal in magnitude, the vector making angle with x-axis will be.**
   (A) 30° (B) 45° (C) 60° (D) 90°
4. **Two forces of magnitudes 10 N and 20 N act on a body in directions making angle of 30°, the X-component of the resultant force will be:**
   (A) 25.98 N (B) 30.98 N (C) 20.98 N (D) 17.98 N
5. **If maxium height of the projectile is equal to the range then angle of projection of projectile will be:**
   (A) 30° (B) 45° (C) 60° (D) 76°
6. **If 50 kg crate is pushed through 2 m across the floor with a force of 50 N, the work done will be:**
   (A) 245 J (B) 150 J (C) 200 J (D) 100 J
7. **A body rotates with a constant angular velocity of 100 rad/sec about a vertical axis the required torque to sustain his motion will be.**
   (A) zero Nm (B) 100 Nm (C) 200 Nm (D) 300 Nm
8. **Moment of inertia of 100 kg sphere having radius 50 cm will be.**
   (A) 10 Kg m^2 (B) 5 Kg m^2 (C) 500 Kg m^2 (D) 2.5 Kg m^2
9. **Laminar flow occurs at:**
   (A) High speed (B) Low speed (C) Zero speed (D) very high speed
10. **High concentration of red blood cells increases the viscosity of blood from.**
    (A) 2 – 3 times that of water (B) 3 – 5 times that of water
    (C) 5 – 7 times that of water (D) 7 – 9 times that of water
11. **Distance covered by a body in one vibration us 20 cm. The amplitude of the vibration will be.**
    (A) 10 cm (B) 5 cm (C) 15 cm (D) 20 cm
12. **Speed of sound in Hydrogen is higher than in Oxygen by times:**
    (A) 4 (B) 6 (C) 8 (D) 16
13. **Sound waves can not pass through.**
    (A) Liquid (B) Solids (C) Air (D) Vacuum
14. **Which of the followings can not produce colours with white light?**
    (A) Diffraction (B) Interference (C) Polarization (D) Dispersion
15. **The image formed by eyeplece of compound microscope is:**
    (A) Real and magnified (B) Real and diminished
    (C) Virtual and enlarge (D) Virtual and diminished
16. **The direction of flow of heat between two bodies in thermal contact is determined by:**
    (A) internal energies (B) kinetic energies (C) potential energies (D) atmospheric pressure
17. **A carnot engine has an efficiency of 50% when its sink temperature is 270 °C. The temperature of source is.**
    (A) 300 °C (B) 327 °C (C) 373 °C (D) 273 °C

SARGODHA BOARD

Physics (New Scheme)
Session (2019)

(Group -I, Class 11th)
Subjective

Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Write any two points which should be kept in mind, while using units.
ii. How many micro seconds one year?
iii. Find the angle between $\vec{A} = 2\hat{i} - 2\hat{j}$ and $\vec{B} = 2\hat{i} + 2\hat{j}$
iv. Can the magnitude of a vector ever be zero? Explain.
v. What are the steps, taken to add vectors by rectangular components?
vi. In which case more work is done, when a 50 kg crate is pushed through 10 m across a floor with a force of 30 N or same crate is lifted through 5 m height?
vii. Derive work-energy principle.
viii. Explain, how the swing is produced in a fast moving tennis ball?
ix. What you know about viscosity and what is its effect on drag force?
x. What are the factors on which frequency of a spring-mass system depends?
xi. What is the difference between free and driven harmonic oscillators?
xii. Explain phase and initial phase.

3. Write short answer to any EIGHT parts.

i. Can the velocity of an object reverse direction when acceleration is constant? If so give an example.
ii. Define impulse and show how it is related to linear momentum.
iii. What does the slope of velocity-time graph represent?
iv. An object is thrown vertically upward. Discuss the sign of acceleration due to gravity, relative to velocity while the object is in air.
v. Define angular velocity. How its direction is determined?
vi. Prove that 1 radian = 57.3°
vii. When mud flies off the tyre of a moving bicycle. In what direction does it fly? Explain.
viii. Show that angular momentum, $L_o = mvr$
ix. What is difference between interference and beats?
x. What is the difference between constructive and distructive interference?
xi. Explain why sound travels faster in warm air than in cold air?
xii. How should a sound source move with respect to an observer so that the frequency of its sound does not change?

4. Write short answer to any SIX parts.

i. Can visible light produce interference fringes? Explain.
ii. Why the Polaroid sungleasses are better than ordinary sunglasses?
iii. How coherent light beams can be produced? Explain.
iv. How the light signal is transmitted through the optical fibre?
v. How can the resolving power of compound microscope be increased?
vi. Specific heat of a gas at constant pressure is greater than specific heat at constant volume. Why?
vii. Is it possible to convert internal energy into mechanical energy? Explain with example.
viii. What would be average speed of oxygen molecule in the air at S.T.P.?
ix. Differentiate between isothermal and adiabatic process.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) What is Carnot engine? Discuss carnot cycle, also derive expression of its efficiency.
(b) Suppose, we are told that the acceleration of a particle moving in a circle or radius r with uniform speed is proportional to some power of r, say r^n and some power of v, say v^m, determine the powers of r and v?

6.(a) What is isolated system? Also state and explain the law of conservation of linear momentum.
(b) Two particles are located at $\vec{r_1} = 3\hat{i} + 7\hat{j}$ and $\vec{r_2} = 2\hat{i} + 3\hat{j}$

7. (a) Define Doppler effect. Discuss the case when source moves towards the stationary observer and when observer moves towards the stationary source.
(b) A brick of mass 2 kg is dropped from a rest position 5 m above the ground. What is its velocity at height of 3 m above the ground?

8. (a) What is meant by gravity free system. How gravity like earth is produced in a space ship? Explain.
(b) A simpe pendulum is 80 cm long what will be its period and frequency at a place where $g = 9.8\ ms^{-2}$

9. (a) What is magnifying glass? How is it used as a microscope? Derive the relation for its magnifying power?
(b) In a double slit experiment, the second order maximum occurs at $\theta = 0.25°$, The wavelength is 700 nm. Determine its slit separation?

Multan BOARD

Physics (New Scheme) (Group – I–Class 11th) Time : 20 Minutes
Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. Tidal energy is due to the gravitational pull of:
(A) Sun (B) Moon (C) Earth (D) Mars

2. Moment of inertia for a particle is given by:
(A) m^2r^2 (B) mr^2 (C) m^2r (D) mr^{-2}

3. S.I unit of angular momentum is:
(A) Kg m^2s^{-1} (B) Kg $m^{-2}s^{-2}$ (C) Kg $m^{-1}s$ (D) Kg m^2s^{-2}

4. Fluid dynamics is the study of the behavior of:
(A) Fluid at rest (B) Liquids at rest
(C) Liquids in motion (D) Liquids and gases in motion

5. Blood has density equal to that of:
(A) Oil (B) Honey (C) Thick tar (D) Water

6. Acceleration in S.H.M is proportional to the:
(A) Velocity (B) Displacement (C) Time period (D) Water

7. If speed of sound in air at a given pressure is "V" and now if pressure is doubled then new speed will be.
(A) $2V$ (B) $V/2$ (C) V (D) $4V$

8. Stars moving away from Earth show.
(A) Red shift (B) Blue shift (C) Green shift (D) Yellow shift

9. In case of point source, shape of the wavefront is:
(A) plane (B) spherical (C) circular (D) ellipitical

10. Magnifying power of telescope is:
(A) $f_o + f_e$ (B) $f_o - f_e$ (C) $\frac{f_o}{f_e}$ (D) $\frac{f_e}{f_o}$

11. In case of adiabatic process, the 1st law of thermodynamic is written as:
(A) $W = \Delta U$ (B) $W = Q$ (C) $W = Q - \Delta U$ (D) $W = -\Delta U$

12. If temperature of sink is decresed, the efficiency of Carnot engine.
(A) Decreases (B) Increases
(C) Remain same (D) First increases then decreases

13. Which is the base quanity?
(A) Area (B) Volume (C) Length (D) Density

14. If least count is 10 kg, then 8.00×10^3 kg has significant figures:
(A) 1 (B) 2 (C) 3 (D) 4

15. If the initial velocity of a projectile becomes doubled. The time of flight will become:
(A) Double (B) Same (C) 3 times (D) 4 times

16. Unit vector of a given vector $\vec{A} = 4\hat{i} + 3\hat{j}$ is.
(A) $\frac{4\hat{i}+3\hat{j}}{25}$ (B) 1 (C) $\frac{4\hat{i}+3\hat{j}}{5}$ (D) $\sqrt{\frac{4\hat{i}+3\hat{j}}{5}}$

17. Time of flight of a projectile is:
(A) $\frac{Vi \sin\theta}{g}$ (B) $\frac{Vi \sin\theta}{2g}$ (C) $\frac{Vi^2 \sin\theta}{g}$ (D) $\frac{2Vi \sin\theta}{g}$

MULTAN BOARD
(Group -I, Class 11th)
Subjective

Time : 2:40 Hours
Marks : 68

Physics (New Scheme)
Session (2019)

SECTION - I

2. Write short answers to any EIGHT parts.

i. What is the cause of random error and how can it be reduce?
ii. If a precise measurement is also an accurate measurement. Explain your answer.
iii. Is it possible to add 5 in $2\hat{i}$? Explain.
iv. Can the magnitude of a vector ever be negative? Explain.
v. If a vector lies in x – y plane. Is it possible, one of its rectangular components is zero? Explain.
vi. Define conservative force. Give at least its two examples.
vii. Explain Geyser and Aquifer.
viii. Why fog droplets appear to be suspended in air?
ix. Derive the relation between speeds a pressure of the fluid.
x. What is damping and give its one application.
xi. How does resonance play role in heating and cooking food?
xii. If mass of a simple pendulum is doubled, what is the effect on its period? Explain.

3. Write short answer to any EIGHT parts.

i. What are two differences between uniform and variable velocity?
ii. Can the velocity of an object reverse the direction when acceleration is constant? If so, give an example.
iii. Explain the two differences between Elastic and in-elastic collision.
iv. How would you find the distravelled by velocity-time graph?
v. Show that: $S = r\theta$ (Where θ is in radian).
vi. Show that velocity of hoop rolling down on an inclined plane is; $v=\sqrt{gh}$.
vii. What is meant by moment of inertia? Explain.
viii. Why does a diver change his body positions before and after diving in the pool?
ix. Write down two differences between Transverse and longitudinal waves.
x. Explain the terms Crest and Trough.
xi. Why does sound travel faster in solids than in gases?
xii. How are beats useful in tuning musical instruments? Explain.

4. Write short answer to any SIX parts.

i. How is the distance between interference fringes affected by the separation between the slits of Young's experiment? Can fringes disappear?
ii. An oil film spreading over a wet footpath shows colours. Explain how does it happen?
iii. Write two differences between interference and diffraction phenomena of light waves.
iv. Describe two causes of power losses in optical fibre during transmission of light signals.
v. Why would it be advantageous to use blue light with a compound microscope?
vi. Specific heat of a gas at constant pressure is greater than specific heat at constant volume Why?
vii. Does entropy of a system increase or decrese due to friction? Explain.
viii. Give an example of a natural process that involves an increase in entropy.
ix. Define triple point of water and write its equation.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) What is the difference between Petrol Engine and Diesel engine? Explain the four stroke of Petrol Engine.
(b) Derive a relation for the time period of a simple pendulum by using Dimensional analysis.

6.(a) What is Troque? Derive an expression for torque due to force acting on a rigid body.
(b) A bomber dropped a bomb at a height of 490m when ites velocity along the horizontal was 300 Kmh^{-1}. How long was it in air?

7. (a) Explain work done in gravitational field. Also define conservative field.
(b) A stationary wave is established in a string which is 120cm long and fixed at both ends. The string vibrates in four segments, at a frequency of 120 Hz. Determine tis wavelength and the fundamental frequency.

8. (a) Define simple harmonic motion. Prove that the projection of a particle moving along a circular path performs simple harmonic motion.
(b) What is the least speed at which an aeroplane can execute a vertical loop of 1km radius so that there will be no tendency for the pilot to fall down at the highest point?

9. (a) Discuss the Young's double slit experiment and determine the position where the dark and bright fringes will be observed.
(b) A glass light pipe in air will totally internally reflect a light ray if its angle of incidence is a least 39°. What is the minimum angle for total internal reflection if pipe is in water? (Refractive index of water = 1.33)

GUJRANWALA BOARD

hysics (New Scheme) (Group – I–Class 11th) Time : 20 Minutes
ession (2019) Objective Marks : 17

ote: You have four choices for each objective type question as A, B, C and D. The hoice which you think is correct; fill that circle in front of that question numbr with arker or pen. Cutting of filling two or more circles will result in zero mark in that uestion.

. The magnifying power of convex lens of focal length 10cm is:
(A) 7 (B) 9.6 (C) 3.5 (D) 11

. If AB Sin θ= AB Cosθ the the angle between $\vec{A}$ and $\vec{B}$ is:
(A) 30° (B) 45° (C) 60° (D) 180°

. As the speed of object moving through a fluid increases then the drag force experienced by it:
(A) increases (B) decreases (C) remains constant (D) becomes zero

. In a Michelson interforometer by moving the mirror through a distance of λ/4, the path difference changes by:
(A) $\frac{\lambda}{4}$ (B) $\frac{\lambda}{2}$ (C) λ (D) 2λ

5. The ratio of moment of inertia of disc and hoop is:
(A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) $\frac{3}{4}$ (D) $\frac{3}{2}$

6. _____ has the same dimensions.
(A) work and power (B) momentum and energy (C) work and torque (D) power and pressure

7. The louder the sound, the greater will be its:
(A) wavelength (B) amplitude (C) speed (D) frequency

8. IF the resultant of two vectors each of magnitude of 'F' is also of magnitude 'F' then the angle between them will be:
(A) 30° (B) 60° (C) 90° (D) 120°

9. _____ is derived unit:
(A) Candela (B) Ampere (C) Kelvin (D) Newton

10. At constant temperature, if pressure is halved then its volume is:
(A) constant (B) halved (C) four times (D) doubled

11. _____ is non-conservative force.
(A) electric force (B) magnetic force (C) gravitational force (D) frictional force

12. Change in entropy of reversible process is.
(A) positive (B) negative (C) zero (D) maximum

13. The total energy of mass-spring system is independent of.
(A) mass of the body (B) amplitude
(C) spring constant (D) nature of material of spring

14. Pull of earth on a mass of 10 Kg on the surface of the earth is:
(A) 95 N (B) 96 N (C) 97 N (D) 98 N

15. One radian is equal to:
(A) 77.3° (B) 67.3° (C) 57.3° (D) 47.3°

16. Pascal is the unit of:
(A) pressure (B) force (C) tension (D) weight

17. Distance between two adjacent crests and troughs is:
(A) λ (B) $\frac{\lambda}{2}$ (C) $\frac{\lambda}{4}$ (D) 2λ

GUJRANWALA BOARD

(Group -I, Class 11th)

Physics (New Scheme)
Session (2019)

Subjective

Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. How many nanoseconds are thre in one year?
ii. Give the drawbacks to use the period of a pendulum as a time standard.
iii. State right hand rule for the cross product of two vectors.
iv. If $\vec{A} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{B} = 2\hat{i} - \hat{j} + \hat{k}$ then find $\vec{A} \cdot \vec{B}$
v. Can a body rotate about its centre of gravity under the action of its weight?
vi. What is the biomass? Write the names of two methods to obtain energy from biomass.
vii. What is Aquifer?
viii. State Bernoulli's relation for a liquid in motion and describe some of its applications.
ix. A person is standing near a fast moving train. Is there any danger that he will fall towards it?
x. Define freee oscillations and forced oscillations.
xi. Can we realize an ideal simple pendulum? Explain briefly.
xii. Does frequency depends on amplitude for harmonic oscillators?

3. Write short answer to any EIGHT parts.

i. An object is thrown vertifcally upward. Discuss the sign of acceleration due to gravity, relative to velocity, while the object is in air.
ii. Motion with constant velocity is a special case of motion with constant acceleration. Is this statement true? Discuss.
iii. Which quantity remains same at all points on the trajectory of projectile; either velocity or acceleration? Explain.
iv. Define impulse. Does a moving object having uniform velocity has impulse?
v. Explain how many minimum number of geo-stationary satellites are required for global coverage of T.V. transmission.
vi. Why does a diver change his body positions before and after diving in the pool?
vii. A disc without slipping rolls down a hill of height 10.0m. If the disc starts from rest at the top of hill, what is its speed at the bottom?
viii. Define angular acceleration. Write its unit.
ix. Why does sound travel faster in solids than in gases?
x. As a result of a distant explosion, an observer senses a ground tremor and then hears the explosion. Explain the time difference.
xi. What do you mean by harmonic series?
xii. What is the effect of density on speed of sound in a gas?

4. Write short answer to any SIX parts.

i. Explain whether the Young's experiment is an experiment for studying interferences or differaction effect of light.
ii. What is the function of collimator in a spectrometer?
iii. Why central spot of Newton's ring is dark?
iv. Could you obtain Newton's ring with transmitted light? If yes, would the pattern be different from that obtained with reflected light?
v. How the light signal is transmitted through the optical fibre?
vi. Give an example of natural process that involves an increase in entropy.
vii. A thermo flask containing milk as a system is shaken rapidly. Does the temperature of milk rise?
viii. Is it possible to convert internal energy into mcchanical energy? Explain with an example.
ix. Define triple point, what is triple point of water?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Differentiate between precision and accuracy with example.
(b) Find the average speed of Nitrogen molecules in air under standard conditions of pressure and temperature.

6.(a) What are rectangular components, explain. How a vector is obtained from its rectangular components.
(b) A truck weighing 2500 Kg and moving with velocity of $21 ms^{-1}$ collides with a stationary car weighing 1000 Kg. The truck and the car move together after the impact. Calculate their common velocity.?

7. (a) Define standing waves. Find the relations for frequencies of these waves in different air columns.
(b) A force (Thrust) of 400 N is required to overscome road friction and air resistance propelling an automobile at 80 Kmh^{-1}. What power must the engine develop?

8. (a) Derive the relation for Artificial Gravity.
(b) What should be the length of a simple Pendulum whose period is 1.0 second at a place where $g=9.8ms^{-2}$? What is the frequency of such a pendulum?

9. (a) What is a bandwidth? Discuss the fibre optic principles?
(b) A light is incident normally on a grating which has 2500 lines per centimeter. Computer the wavelength of a spectral line for which the deviation in a second order is 15.0°?

RAWALPINDI BOARD

Physics (New Scheme) (Group – I–Class 11th) Time : 20 Minutes
Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **Soap film shows colours due to:**
   (A) Interference (B) Diffractin (C) Polarization (D) Reflection
2. **Magnifying power of the lens is 6 then its focal length will be:**
   (A) 4 (B) 6 (C) 5 (D) 4.5
3. **The SI unit of product of pressure and volume is:**
   (A) Watt (B) Joule (C) Pascal (D) N.m
4. **Carnot engine cycle consists of:**
   (A) Four steps (B) Three steps (C) Single step (D) Two steps
5. **Mass is highly concentrated form of:**
   (A) Inertia (B) Energy (C) Plasma (D) Charge
6. **Dimensions of $\sqrt{\frac{g}{l}}$ is same as:**
   (A) Angular frequency (B) Force (C) Torque (D) Time period
7. **Force of 10N makes an angle of 30° with y-axis, its x-component will be:**
   (A) 5N (B) 8.66 (C) $\frac{10}{\sqrt{2}}$ N (D) $10\sqrt{2}$ N
8. **In which quadrant vector $-2\hat{i}-3\hat{j}$ lies.**
   (A) 1st (B) 2nd (C) 4th (D) 3rd
9. **Distance travelled by free falling object in first second is:**
   (A) 4.9m (B) 9.8m (C) 19.6m (D) 10m
10. **Choice of zero potential energy level is:**
    (A) Surface of the Earth (B) at infinity
    (C) Just above the surface of Earth (D) arbitary
11. **2° is equal to:**
    (A) 0.035 rad (B) 0.30 rad (C) 0.35 rad (D) 0.0035 rad
12. **Centripetal force is directed along.**
    (A) Tangent to circle (B) radius (C) axis of rotation (D) x-axis
13. **Terminal velocity of a particle in the fluid depends on:**
    (A) Nature of fluid (B) Acceleration of particle
    (C) Force of particle (D) Angular velocity of particle
14. **Radar system is an application of:**
    (A) Electric effect (B) Doppler's effect (C) Magnetic effect (D) Chemical effect
15. $\sqrt{\frac{l}{g}}$ *and* $\sqrt{\frac{m}{k}}$ *has same.*
    (A) Numerical value (B) Units (C) Damping (D) Time period
16. **On loading the prong of tuning fork with wax, the frequency of sound:**
    (A) Increases (B) Decreases
    (C) Remains same (D) Periodic increases and decreases
17. **Fringe spacing increases if we use:**
    (A) Lowest order (B) highest order (C) red light (D) blue light

Physics (New Scheme)
Session (2019)

RAWALPINDI BOARD
(Inter Part-I, Class 11th)
Subjective

Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Find unit of vectors in the direction of vector $\vec{A}$, $\vec{A} = 8\hat{i} + 4\hat{j}$.
ii. What do you mean by scientific notations? Give one example.
iii. Time period of a simple pendulum is measured by stop watch. What type of errors are possible in the time period?
iv. Differentiate between base units and derived units with examples.
v. Calculate the number of seconds in one year.
vi. Write briefly about Ballistic Missile.
vii. Define viscosity and give its units.
viii. Explain the circumstance in which $\vec{V}$ and $\vec{a}$ are: (i) in parallel. (ii) are prependicular.
ix. Vector $\vec{A}$ lies in xy plane. For what orientations will both of its rectangular components be negative and for what orientations, its rectangular components be positive.
x. Describe Newton's second law of motion in terms of momentum.
xi. Explain briefly how the swing is produced in a fast moving cricket ball with figure.
xii. Define positive and negative acceleration along with their directions.

3. Write short answer to any EIGHT parts.

i. Calculate the work done in Killo jouls in lifting a mass of 10kg, through vertical height of 10m.
ii. A boy uses a catapault to throw a stone which accidently smashes a green house window. Discuss the possible energy changes.
iii. Convert 1.4kw into joule/sec.
iv. Prove that 1 rad=57.3°.
v. Show that for a body attached with a spring $\vec{a} = \frac{-k \rightarrow}{m} x$.
vi. Can we realize an ideal simple pendulum?
vii. Why does sound travel faster in solids than in gasses?
viii. What are the uses of beats?
ix. What is meant by moment of inertia? Explain its role in angular motion.
x. How artificial gravity is produced in a satellite orbiting around the Earth.
xi. What happens to the period of a simple pendulum if its length is doubled?
xii. Differentiate beteen mechanical waves and electromagnetic waves.

4. Write short answer to any SIX parts.

i. Under what conditions two or more sources of light behave as coherent sources?
ii. How would you manage to get more orders of spectra using a diffraction grating?
iii. Can visible light produce interference fringes? Explain.
iv. How the light signal is transmitted through the optical fibre?
v. Why would it be advantageous to use blue light with a compound microscope?
vi. Specific heat of a gas at constant pressure is greater than specific heat at constant volume. Why?
vii. Is it possible to construct a heat engine that will not expel heat into the atmosphere?
viii. Can the mechanical energy be converted completely into heat energy? If so give an example.
ix. Define isothermal process and adiabatic process.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) How can a vector be resolved into its rectangular components? How a vector is determined if its rectangular components are given?
(b) A ball is thrown with a speed of $30ms^{-1}$ in a directin 60° with horizontal. Calculate the range of the ball.

6.(a) Define absolute potential energy. Derive an expression for the absolute potential energy on the surface of the Earth, considering r=R(Radius of the Earth).
(b) A body of moment of Inertia $I=080Kgm^2$ about a fixed axis, rotates with a constnt angular velocity of 100 $radS^{-1}$.Calculate its angular momentum L and the torque to sustain this motion.

7. (a) What is "Carnot Engine"? Derive formula for its effeciency.
(b) How large must a heating dust be if air moving $3.0mS^{-1}$ along it can replenish the air in a room of $300m^3$ volume every 15min? Assume air's density remains constant.

8. (a) Derive Newton's formula for velocity of sound in air and edescribe the correction made by Laplace.
(b) A simple pendulum is 50cm long. What will be its frequency of vibration at a place where $g=9.8mS^{-2}$?

9. (a) Explain Young's double slits experiment. Derive the relation for position of mth bright and dark fringes from the center of the screen.
(b) A telescope is made of an objective of focal length 20cm and an eye piece of 5.0cm, both convex lenses. Find the angular maghification.

FAISALABAD BOARD

Physics (New Scheme) (Group – I –Class 11th) Time : 20 Minutes
Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. Light year is the unit of:
(A) Light (B) Time (C) Velocity (D) Distance

2. The quantity 2.3×10^{-3} can be written as:
(A) 0.0023 (B) 0.023 (C) 0.23 (D) 2.3

3. Rectangular components have angle between them is:
(A) 30° (B) 45° (C) 60° (D) 90°

4. Cross-product of $\hat{j} \times \hat{k}$ is:
(A) Zero (B) 1 (C) $\hat{i}$ (D) $-\hat{i}$

5. Impulse has same unit as that of:
(A) Force (B) Energy (C) Mass (D) Linear momentum

6. Scalar product of force and velocity is:
(A) Work (B) Power (C) Energy (D) Acceleration

7. In rotational motion analogous of force is:
(A) Torque (B) Inertia (C) Velocity (D) Momentum

8. Orbital velocity of a satellite of mass "m_s" orbiting around earth of mass "M" is:
(A) $\sqrt{\frac{GM}{r}}$ (B) $\sqrt{\frac{GM_s}{r}}$ (C) $\frac{GM}{r}$ (D) $\sqrt{gR}$

9. Equation of continuity gives conservation of:
(A) Energy (B) Power (C) Mass (D) Density

10. Product of area of cross section, velocity and time gives:
(A) Volume (B) Density (C) Mass (D) Weight

11. Product of frequency "f" and time "t" is:
(A) 1 (B) Displacement (C) Velocity (D) Amplitude

12. If a string vibrates in "n" loops, the wavelength of stationary wave will be:
(A) $\frac{2l}{n}$ (B) $\frac{nl}{2}$ (C) $\frac{2n}{l}$ (D) $\frac{l}{2n}$

13. Speed of sound in vacuum is.
(A) $332\frac{m}{s}$ (B) $333\frac{m}{s}$ (C) $280\frac{m}{s}$ (D) Zero

14. Angle between ray of light and wave front is:
(A) Zero (B) 60° (C) 45° (D) 90°

15. Near point for a person is at:
(A) 25cm (B) 25mm (C) 25nm (D) 25dm

16. Average translational K.E of a gas molecule:
(A) $\frac{1}{2}kT$ (B) kT (C) $\frac{2}{3}kT$ (D) $\frac{3}{2}kT$

17. An ideal heat engine can only be 100% efficient if its cold temperature is:
(A) 0K (B) 0°C (C) 100K (D) 100°C

Physics (New Scheme)
Session (2019)

FAISALABAD BOARD
(Group -I, Class 11th)
Subjective

Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Write the dimensions of pressure and density.
ii. Define radian and steradian.
iii. Two vectors have unequal magnitudes. Can their sum be zero? Explain.
iv. Suppose the sides of a closed polygon represent vectors arranged head to tail. What is the sum of these vectors?
v. Give two factors on which turning effect depends.
vi. When a rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this heat energy come from?
vii. Define law of conservation of energy.
viii. Explain the difference between laiminar flow and turbulent flow.
ix. Define venture effect. Also write its relation.
x. If a mass spring system is hung vertically and set into oscillations, why does the motion eventually stop?
xi. Describe some common phenomena in which resonance plays an important role.
xii. Defien periodic motion. Give example.

3. Write short answer to any EIGHT parts.

i. At what point or points in its path does a projectile have its minimum speed, its maximum speed?
ii. Can the velocity of object reverse the direction when acceleration is constant? If so, give an example.
iii. The horizontal range of projectile is four times of its maximum height. What is angle of projection?
iv. Define ballistic flight and ballistic trajectory?
v. When mud flies off the tyre of a moving bicycle, in which direction does it fly? Explain.
vi. Why does a diver change his body positions before and after diving in the pool?
vii. Differentiate between real weight and apparent weight.
viii. How many radians are there in 2 degree?
ix. Explain the terms crest, trough node and anti-node.
x. How are beats useful in tuning musical instruments?
xi. Why sound travel faster in hydrogen than in oxygen?
xii. What do you mean by sonar technique? Explain briefly.

4. Write short answer to any SIX parts.

i. How would you distinguish between un-polarized light and polarized light?
ii. An oil film spreading over a wet footpath shows colours. Explain how does it happen?
iii. Under what conditions two or more sources of light behave as coherent sources?
iv. Why would it be advantageous to sue blue light with a compound microscope?
v. Differentiate between linear magnification and angular magnification.
vi. Why does the pressure of a gas in a car tyre increase when it is driven through some distance?
vii. Is it possible to convrt internal energy into mechanical energy? Explain with an example.
viii. Does the entropy of a sytem increase or decrease du to friction? Explain briefly.
ix. State first law of thermodynamics.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Derive Boyle's law and Charle's law from the pressure of a gas equation.
(b) Suppose, we are told that the acceleration of a particle moving in a circle of radius r with uniform velocity v is proportional to some power of r, say r^n, and some power of v, say v^m, determine the powers of r and v.

6.(a) Define vecotor product. Write any four characteristic of vectr product.
(b) A 100g golf ball is moving to the right with a speed of 20ms-1. It makes a head on collision with an 8kg steel ball, initially at rest. Compute velocities of the balls after collision.

7. (a) Discuss the inter-conversion of potential and kinetic energy in absence of air friction. Also discuss the effect of air resistance.
(b) A stationary wave is established in a string which is 120cm long and fixed at both ends. The string vibrates in four segments, at a frequency of 120Hz. Determine its wavelength and the fundamental frequency.

8. (a) What is simple pendulum? Show that motion of simple pendulum is simple harmonic. Also derive expression for its time period.
(b) A gramophone record turntable accelerates from rest to an angular velcotiy of 45 rev./min in 1.60s.
What is its average angular acceleration?

9. (a) What is simple microscope? Discribe its construction, working and also derive the relation for its angular magnification.
(b) A light of λ = 589nm is incident normally on grating having 3000 lines per centimeter. What is the highest order, the spectrum obtained with this grating?

BAHAWALPUR BOARD

Physics (New Scheme) (Group – I –Class 11th) Time : 20 Minutes
Session (2019) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **The unit Vector in the direction of $\vec{A}$ is:**
   (A) $\hat{A} = \frac{A}{\vec{A}}$ (B) $\hat{A} = A\vec{A}$ (C) $\hat{A} = \frac{\vec{A}}{A}$ (D) $\vec{A} = \frac{A}{\hat{A}}$
2. **A measurement taken by Varnier Calliper with least count as 0.01cm is recorded as 0.45cm, it has fractional uncertainity:**
   (A) 0.01 (B) 0.02 (C) 0.03 (D) 0.45
3. **The numerical value of constant in any formula canot be determined by dimensional analysis, however it can be found by:**
   (A) Addition (B) Physical Quantities (C) Experiments (D) Uncertainity
4. **If $\vec{A} \times \vec{B}$ is along y-axis, then $\vec{A}$ and $\vec{B}$ are in:**
   (A) x-y plane (B) y-z plane (C) Space (D) x-y plane
5. **Angel 30° is equal to:**
   (A) $\frac{\pi}{2}$ rad (B) $\frac{\pi}{3}$ rad (C) $\frac{\pi}{4}$ rad (D) $\frac{\pi}{6}$ rad
6. **One watt Hour is equal to:**
   (A) 3.6 MJ (B) 3.6 KJ (C) 36 KJ (D) 36 MJ
7. **Everythig in the vastness of space is in a state of:**
   (A) Rest (B) REstilllinear Motion (C) Prepetual Motion (D) Projectile Motion
8. **The Rotational K.E. of Disc is equal to:**
   (A) $\frac{1}{4}$ mv² (B) $\frac{1}{2}$ mv² (C) $\frac{1}{4}$ Iw² D) Iw²
9. **If the initial Phase is $\frac{\pi}{2}$ then displacement of SHO is:**
   (A) $x = x^2_0$ Sin wt (B) x = Sin wt (C) $x = x_0$ Cos wt (D) Zero
10. **Bernoulli's Equation based upon Law of Conservation of:**
    (A) Mass (B) Linear Momentum (C) Angular Momentum (D) Energy
11. **A 20 meter high tank is full of water. A hole appears at its middle. The speed of efflux will be:**
    (A) 10 ms^{-1} (B) 14 ms^{-1} (C) 11.5 ms^{-1} (D) 9.8 ms^{-1}
12. **When an observer is moving away from a stationary source, sending waves with spee v, the waves received by him at the rate of:**
    (A) $\frac{v-u_o}{\lambda}$ (B) $\frac{v+u_o}{\lambda}$ (C) $\frac{\lambda}{v-u_o}$ (D) $\frac{\lambda}{v+u_o}$
13. **The magnifying power of a magnifying glass is.**
    (A) $1 - \frac{d}{f}$ (B) $1 - \frac{f}{d}$ (C) $\frac{f}{d}$ (D) $\frac{d}{f} + 1$
14. **If the temperature of sink is equal to absolute zero, the efficiency of heat engine shoulde be:**
    (A) 100% (B) 50% (C) Zero (D) Infinity
15. **When a Transverse Wave travelling in rare medium, incident on denser medium after reflection phase changes by:**
    (A) 360° (B) 180° (C) 90° (D) 0°
16. **If C_p for a gas is $\frac{7R}{2}$ then the value of C_v will be:**
    (A) $\frac{3R}{2}$ (B) $\frac{5R}{2}$ (C) $\frac{9R}{2}$ (D) R
17. **Polarization proves that light waves are:**
    (A) Longitudinal (B) Stationary (C) Matter (D) Transvers

BAHAWALPUR BOARD
(Group -I, Class 11th)
Subjective

Physics (New Scheme)
Session (2019)

Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Show that Einstein Equation $E=mc^2$ is dimensionally correct.
ii. Given that $V= (5.2 \pm 0.1)$ volt. Find its percentage uncertainty.
iii. What is a Unit Vector? Give its formula.
iv. Can a body rotate about its centre of gravity under the action of its weight? Explain.
v. Can the magnitude of a vector have a negative value? Discuss.
vi. Defien Joule using formula for the work done.
vii. When a rocket re-enters the atmosphere, its nose cone becomes hot. Where does this heat energy come from?
viii. Define Drag Force. Give its formula.
ix. Two row boats moving parallel in the same direction are pulled towards each other. Explain.
x. Does the Acceleration of a Simple Harmonic Oscillator remain constant during its motion? Is the Acceleration ever zero? Explain.
xi. If a mass spring system is hung vertically and set into oscillations, why does the motion eventually stop?
xii. Name two characteristic of Simple Harmonic Motion.

3. Write short answer to any EIGHT parts.

i. Explain the condition in which velocity "v" is zero and acceleration of a car is not zero.
ii. Define Isolated System. Give its example.
iii. Define Impulse. Give its units.
iv. At what point or points in its path does a projectile have its minimum speed, its maximum speed?
v. Explian what is meant by Centripetal Force? Give its formula.
vi. Show that Orbital Angular Momentum is given as $L_0 = mvr$.
vii. Give one practical application of the Rotational Kinetic Energy.
viii. Why does a Diver change his body position before and after diving in the pool?
ix. What is the effect of pressure of the Medium on the speed of sound?
x. Differentiate between Transverse and Longitudinal Waves.
xi. Explain why sound travels faster in Warm Air than Cold Air?
xii. Exaplian the term Nodes and Antinodes.

4. Write short answer to any SIX parts.

i. For what purpose Huygen's Principle is used?
ii. How would you manage to get more orders of Spectra using a differaction grating?
iii. An oil film spreading over a wet footpath shows colours. Explain how does it happen?
iv. If a person was looking through a telescope at the full moon, how would the appearance of the moon be changed by covering half of the objective lens?
v. Define Resolving Power. Give its expression.
vi. What happens to the temperature of the room, when an air conditioner is left running on a table in the middle of the room?
vii. Is it possible to construct a heat engine that will not expel heat into the atmosphere?
viii. Carnot Cycle provides the basis to define a temperature scale that is independent of material properties. Explain.
ix. Define Entropy. Explian in terms of Second Law of Thermodynamics.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Define Molar Specific Heats of Gases and prove that the relation $C_p - C_v = R$.
(b) The length and width of rectangular plate are measured to be 15.3 and 12.80 cm respectively. Find the correct area of the plate.

6.(a) State and explain law of Conservation of Linear Momentum.
(b) A load of 10 N is suspended from a clothes line. This distorts the line so that it makes an angle of 15° with the horizontal at each end. Find the tension in the clothes line.

7. (a) Prove that the work done is independent of the path followed in Gravitational Field.
(b) An Organ Pipe has a length of 50 cm. Find the frequency of its fundamental note and the next harmonic when it is open at both ends.

8. (a) Discuss the energy conservation in SHM.
(b) Calculate the angular momentum of a Star of Mass 2×10^{30} Kg and radius 7.0×10^5 Km.

9. (a) What is interference of Light? Discuss the Young's Double Slit Experiment. Also Derive the relation for Fringe Spacing.
(b) An Astronomical Telescope having magnifying power of 5 consists of two thin lenses 24 cm apart. Find the Focal Length of the lenses.

LAHORE BOARD

Physics (New Scheme) Session (2019)

(Group – I – Class 11th)

Objective

Time : 20 Minutes

Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. The ratio of 1 femtometer to nanometer is:
   (A) 10^{-6} (B) 10^{6} (C) 10^{-7} (D) 10^{8}
2. In the relation of $F=6\pi\eta r v$, Dimension of coefficient of viscosity η is:
   (A) $[M^{-1}LT^{-1}]$ (B) $[ML^{-1}T]$ (C) $[M^{-1}L^{-1}T]$ D) $ML^{-1}T^{-1}]$
3. If $\vec{F} = (2i + 4j)$ N ; d = (5I + 2j) m work done is:
   (A) 15 J (B) 18 J (C) zero (D) -18 J
4. The sum of two prependicular forces 8 N and 6 N is:
   (A) 2N (B) 14 N (C) 10 N (D) -2 N
5. The distance covered by a freely falling body in first 2 seconds, wihen its initial velocity was zero:
   (A) 9.8m (B) 39.2m (C) 19.6m (D) 4.9m
6. Value of solar constant is:
   (A) 1.4 Wm^{-2} (B) 1400 Wm^{-2} (C) 14 kWm^{-2} (D) 1.0 kWm^{-2}
7. Relation between the speed of disc and hoop at the bottom of an incline is:
   (A) $V_{disc} = \sqrt{\frac{3}{4}}V_{hoop}$ (B) $V_{disc} = \sqrt{\frac{4}{3}}V_{hoop}$
   (C) $V_{disc} = \sqrt{\frac{2}{5}}V_{hoop}$ (D) $V_{disc} = 2V_{hoop}$
8. 2 revolutions are equal to:
   (A) π rad (B) $\frac{3\pi}{2}$ rad (C) 2π rad (D) 4π rad
9. Terminal velocity V_t is related with redius r of spherical objects as:
   (A) $V_t \propto r^2$ (B) $V_t \propto r$ (C) $V_t \propto \frac{1}{r}$ (D) $V_t \propto \frac{1}{r^2}$
10. The unit of $\frac{1}{2}pV^2$ in Bernoulli's equation is same as that of:
    (A) Energy (B) Pressure (C) Work (D) Power
11. Base units of spring constant is:
    (A) $kg^{-1}s^{-1}$ (B) $Kg^{-1}ms^{-2}$ (C) $Kg\,ms^{-2}$ (D) Kgs^{-2}
12. Speed of sound at 0°C, in air is:
    (A) 332 ms^{-1} (B) 280 ms^{-1} (C) 1400 ms^{-1} (D) 5500 ms^{-1}
13. Two identical waves moving in same direction produce.
    (A) Interference (B)Beats (C) Stationary waves (D) Diffraction
14. Bragg's equation is:
    (A) $2d \sin\theta = n\frac{\lambda}{2}$ (B) $d \sin\theta = n\lambda$ (C) $d \sin\theta = n\frac{\lambda}{2}$ (D) $d \sin\theta = 2\lambda$
15. If f_o= 100 cm f_e=5cm length and magnifying power of an astronomical telescope is:
    (A) 0.05 cm ; 20 (B) 95 cm ; 20 (C) 20 cm ; 500 (D) 105 cm ; 20
16. Root mean square velocity is related to the absolute temperature of a ideal gas as:
    (A) $V_{rms} \propto T$ (B) $V_{rms} \propto T^2$ (C) $V_{rms} \propto \sqrt{T}$ (D) $V_{rms} \propto \frac{1}{\sqrt{T}}$
17. If P= Pressure ; V=Volume of a gas PΔV represent:
    (A) Work (B) Density (C) Power (D) Temperature

Physics (New Scheme)
Session (2019)

LAHORE BOARD
(Group -I, Class 11th)
Subjective

Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Write down the two uses of dimensional analysis.
ii. What are the characteristics of an ideal standard?
iii. If $\vec{A} = 4\hat{i} - 4\hat{j}$, what is the orientation of $\vec{A}$?
iv. Define resultant vector and component of a vector.
v. The magnitude of the sum of two vectors is zero. What are the conditions to get this?
vi. A car is moving along a circle of radius r. It completes four revolutions and teminates its journey at starting point. How much work is done by the car? Explain.
vii. How energy is obtained by water waves and what is the source of this energy?
viii. Explain the term systolic and diastolic pressure.
ix. Two row boats moving parallel in the water are pulled towards each other. Explain why?
x. Is any relation existed between damping and resonance? Explain.
xi. In relation to SHM, explain the equation $y=A \sin(\omega t+\emptyset)$.
xii. A mass-spring system is vibrating with amplitude 10cm. Find its K.E. and P.E at equilibrium position, when spring constant is 20 Nm^{-1}.

3. Write short answer to any EIGHT parts.

i. What is the difference between uniform velocity and uniform acceleration?
ii. Show that time rate of change of momentum of a body equals the applied force.
iii. A 1500 kg car has its velocity reduced from 20ms^{-1} to 15ms^{-1} in 3.0 seconds. How large was the average retarding force?
iv. Can the velocity of an object reverse the direction when acceleratin is constant? If so, give an example.
v. Write down the uses of telecommunication satellites.
vi. Show that $S = r\theta$ where S = Arc length, r = radius of the circle, θ= angle in radian?
vii. What do you mean INTELSAT VI? What are the frequencies on which it operates?
viii. A disc without slipping rolls down a hil of height 10.0 m. If the disc starts from rest at the top of the hill, what is the speed at the bottom?
ix. How the speed of sound change with the density of the medium?
x. A pipe has a length of 1 m. Determine the frequencies of the fundamental, if the pipe is open at both ends. Speed of sound = 340 ms^{-1}.
xi. State Doppler Effect. Write down its one application.
xii. How Doppler Effect can be used to monitor blood flow?

4. Write short answer to any SIX parts.

i. What is Bragg's law? Derive Bragg's equation.
ii. Explain whether the Young's experiment is an experiment for studying interference or differaction effects of light.
iii. How would you manage to get more orders of spectra during a diffraction grating?
iv. Write two differences between angular magnification and resolving power.
v. How a single bi-convex lens can be used as a magnifying glass?
vi. Derive Charles' law from kinetic theory of gases.
vii. Justify! Work and heat are similar.
viii. Show that: Change in entropy is always positive.
ix. What happens to the temperature of the room when an air-conditioner is left running on a table in the middle of the room?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Prove the molar specific heat of a gas at constant pressure C_P is greater than molar specific heat at constant volume C_V by an amount equal to universal gas constant R.
(b) Suppose, we are told that the acceleration of a particle moving in a circle of radius r with uniform speed v is proportional to some power of r, say r^n, and some power of v, say v^m, determine the powers of r and v.

6.(a) Explain the method of vector addition by rectangular components.
(b) A foot ball is thrown upward with an angle of 30° with respect to the horizontal. To throw a 40m pass what must be the initial speed of the ball?

7. (a) Define absolute potential energy. Derive relation for absolute P.E. of a body of mass m.
(b) A stationary wave is established in a string which is 120 cm long and fixed at both ends. The string vibrates in four segments, at a frequency of 120 Hz. Determine its wavelength and the fundamental frequency.

8. (a) Define SHM. Prove that total energy remains conserved in mass-spring system, oscillating with SHM.
(b) A gramophone record turntable accelerate from rest to an angular velocity of 45.0 rev min^{-1} in 1.60 s. What is its average angular acceleration?

9. (a) What is compound microscope? Describe its construction and working also calculate its magnification.
(b) In a double slit experiment the second order maximum occurs at θ= 0.25°. The wavelength is 650nm. Determine the slit separation.

Answers (Sahiwal Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	A	B	D	A	C	D	B	C	B	C	A	C	D	D	C	B

Answers (Faisalabad Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
D	A	D	C	D	B	A	A	C	A	A	A	D	D	A	D	A

Answers (Bahawalpur Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	B	C	D	D	B	C	A	C	D	B	A	D	A	B	B	D

Answers (D.G. Khan Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
D	B	A	C	A	B	D	C	D	C	C	D	A	D	B	C	D

Answers (Sargodha Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	A	B	A	D	D	A	A	B	B	B	A	D	C	C	A	B

Answers (Multan Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
B	B	A	D	D	B	C	A	B	C	D	B	C	C	A	C	D

Answers (Rawalpindi Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	C	B	A	B	A	A	D	A	D	A	B	A	B	B	B	C

Answers (Gujranwala Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	B	A	B	B	C	B	D	D	D	D	C	A	D	C	A	B

Answers (Lahore Board)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	D	B	C	C	B	B	D	A	B	C	A	A	C	D	C	A

Board Papers 2021

SAHIWAL BOARD
(Group – I–Class 11th)

Physics (New Scheme) Time : 20 Minutes
Session (2021) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. The term "phg" in Bernoulli's equation has the same units as:
(A) work (B) energy (C) pressure (D) flow rate

2. An ideal gas performs 10J of work while expanding adiabatically. The change in its internal energy is:
(A) 10 J (B) - 10 J (C) 100 J (D) – 200 J

3. Average translational K.E. of a gas molecule is:
(A) $\frac{3}{2}KT$ (B) $\frac{1}{2}KT$ (C) $\frac{2}{3}KT$ (D) KT

4. The K.E of an object of mass "m" is "E" its momentum will be:
(A) 2 Em (B) $\sqrt{\frac{2E}{m}}$ (C) $\sqrt{\frac{1}{2}Em}$ (D) $\sqrt{2Em}$

5. The frequency of waves produced in microwave oven is:
(A) 1435 MHz (B) 2850 MHz (C) 2450 MHz (D) 4250 MHz

6. The increase in velocity of sound in air for 1°C rise in temperature is:
(A) 61 cm/s (B) 0.61 cm/s (C) 61 m/s (D) 1.61 m/s

7. The ratio of velocity of disc to velocity of hoop is:
(A) $\frac{2}{\sqrt{3}}$ (B) $\frac{4}{\sqrt{3}}$ (C) $\frac{2}{3}$ (D) $\frac{4}{3}$

8. The wave length of nth mode of stationary waves in closed pipe is:
(A) $\frac{2l}{n}$ (B) $\frac{4l}{2n-1}$ (C) $\frac{4l}{n}$ (D) $\frac{4l}{2n+1}$

9. 1 rev / min is equal to:
(A) $\frac{\pi}{6} rad/s$ (B) $\frac{\pi}{30} rad/s$ (C) $\frac{\pi}{15} rad/s$ (D) $2\pi\ rad/s$

10. If initial velocity of projectile becomes doubled. The time of flight will become:
(A) 4 times (B) Half (C) 2 times (D) 8 times

11. Height of projectile is maximum at an angle of projection of:
(A) 45° (B) 60° (C) 30° (D) 90°

12. $\hat{i}.(\hat{k}\times\hat{j}) =$
(A) 1 (B) $\hat{j}$ (C) $\hat{i}$ (D) 0

13. If two non-zero vectors $\vec{A}$ & $\vec{B}$ are parallel to each other then:
(A) $\vec{A}.\vec{B} = 0$ (B) $|\vec{A}\times\vec{B}| = AB$ (C) $\vec{A}.\vec{B} = AB$ (D) $\vec{A}.\vec{B} = 1$

14. The uncertainty in the time period of a vibrating body is:
(A) least count × No.of vibrations (B) least count + No. of vibrations
(C) least count ÷ No.of vibrations (D) least count - No. of vibrations

15. Which pair of physical quantities have same dimensions?
(A) work and power (B) momentum and impulse
(C) force and torque (D) momentum and force

16. Refractive index of water is:
(A) 1.5 (B) 1.33 (C) 1.0 (D) 1.2

17. The fringe spacing is the greatest for:
(A) Blue light (B) Yellow light (C) Green light (D) Red light

SAHIWAL BOARD

Physics (New Scheme) Session (2021)
(Group - I, Class 11th)
Subjective
Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Check the correctness of the relation $v = \sqrt{\frac{F \times l}{m}}$ where v is the speed of transverse wave on a stretched string of tension F, length l and mass m.
ii. Does a dimensional analysis give any information on constant of proportionality that may appear in an algebraic expression? Explain.
iii. Add the following masses given in K_g upto appropriate precision. 2.189, 0.089, 11.8 and 5.32.
iv. The volume of sphere $V = 47.689\,cm^3$ with 1.2% uncertainty. What is the correct range of volume measurement?
v. Suppose the sides of closed polygon represent vector arranged head to tail. What is the sum of these vectors?
vi. Prove that $A.B = A_x B_x + A_y B_y + A_z B_z$
vii. If all the components of vectors A_1 and A_2 were reversed, would this alter $A_1 \times A_2$?
viii. Define Law of Conservation of linear momentum and write its mathematical form.
ix. Explain the difference between elastic and inelastic collisions. Explain how would a bouncing ball behave in each case? Give plausible reasons for the fact that K.E. is not conserved in most cases.
x. Derive an expression for the time of flight of projectile.
xi. What happens to the velocities of two bodies after collision when alight body collides with a massive body at rest for elastic collision?
xii. Two row boats moving parallel in the same direction are pulled towards each other. Explain.

3. Write short answer to any EIGHT parts.

i. A girl drops a cup from a certain height, which breaks into pieces. What energy changes are involved?
ii. Show that $1kWh = 3.6 \times 10^6 J$
iii. What do you mean by variable force? Give its two examples.
iv. Show that $v = r\omega$
v. What is meant by moment of inertia? Explain its significance.
vi. When mud flies off the tyre of a moving bicycle, in what direction does it fly? Explain.
vii. What is meant by phase angle? Does it define angle between maximum displacement and driving force?
viii. Define resonance, write one advantage and one disadvantage of resonance.
ix. Differentiae between free and forced oscillations.
x. Is it possible for two indentical waves travelling in the same direction along a string to give rise to a stationary wave?
xi. How temperature and density of the medium effect the speed of sound?
xii. What happens when a jet plane like Concorde flies faster than the speed of sound?

4. Write short answer to any SIX parts.

i. How is the distance between interference fringes affected by separation between the slits of Young's experiment? Can fringes disappear?
ii. How would you manage to get more orders of spectra using diffraction grating?
iii. What are Newton's rings? How they are formed?
iv. Explain the difference between angular magnification and resolving power of an optical instrument.
v. What is meant by least distance of distinct vision?
vi. Why does the pressure of a gas in a car tyre increases when it is driven through some distance?
vii. What is meant by reversible process? Give its example.
viii. Write down the postulates of kinetic theory of gases.
ix. Specific heat of a gas at constant pressure greater than specific heat at constant volume. Why?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Describe the method of addition of vectors by rectangular components.
(b) A truck weighing 2500 K_g and moving with a velocity of $21 ms^{-1}$ collides with stationary car weighing 100 k_g. The truck and the car move together after the impact. Calculate their common velocity.

6.(a) Define Absolute Potential Energy. Derive relation for absolure P.E of body of mass "m" at distance "r" from the center of earth.
(b) Find the temperature at which the velocity of sound in air is two times its velocity at 10^o C.

7. (a) State and prove Bernoulli's equation.
(b) What is the least speed at which an aeroplane can execute a vertical loop of 1.0 km radius so that there will be no tendency for the pilot to fall down at the highest point.

8. (a) State first law of thermodynamics and explain: (i) Isothermal Process (ii) Adiabatic Process
(b) A simple pendulum is 50cm long. What will be its frequency of vibration at a place where $g = 9.8 ms^{-2}$?

9. (a) Calculate the speed of light by Michelson's method.
(b) Yellow sodium light of wavelength 589 nm, emitted by a single source passes through two narrow slits 1.0 mm apart. The interference pattern is observed on a screen 225 cm away. How far apart are two adjacent bright fringes?

SAHIWAL BOARD

Physics (New Scheme) (Group – I–Class 11th) Time : 20 Minutes
Session (2021) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **The wave length of nth mode of stationary waves in closed pipe is:**
   (A) $\frac{2l}{n}$ (B) $\frac{4l}{2n-1}$ (C) $\frac{4l}{n}$ (D) $\frac{4l}{2n+1}$
2. **The ratio of velocity of disc to velocity of hoop is:**
   (A) $\frac{2}{\sqrt{3}}$ (B) $\frac{4}{\sqrt{3}}$ (C) $\frac{2}{3}$ (D) $\frac{4}{3}$
3. **1 rev / min is equal to:**
   (A) $\frac{\pi}{6} rad/s$ (B) $\frac{\pi}{30} rad/s$ (C) $\frac{\pi}{15} rad/s$ (D) $2\pi\, rad/s$
4. **If initial velocity of projectile becomes doubled. The time of flight will become:**
   (A) 4 times (B) Half (C) 2 times (D) 8 times
5. **If two non zero vectors $\vec{A}\times\vec{B}$ are parallel to each other then:**
   (A) $\vec{A}.\vec{B}=0$ (B) $\left|\vec{A}.\vec{B}\right|=AB$ (C) $\vec{A}.\vec{B}=AB$ (D) $\vec{A}.\vec{B}=1$
6. $i.\left(\hat{k}\times\hat{i}\right)=$
   (A) 1 (B) $\hat{j}$ (C) $\hat{i}$ (D) 0
7. **Height of projectile is maximum at an angle of projection of:**
   (A) 45° (B) 60° (C) 30° (D) 90°
8. **The uncertainty in the time period of a vibrating body is:**
   (A) least count x No. of vibrations (B) least count + No. of vibrations
   (C) least count ÷ No. of vibrations (D) least count – No. of vibrations
9. **Which pair of physical quantities have same dimensions?**
   (A) work and power (B) momentum and impulse
   (C) force and torque (D) momentum and force
10. **The fringe spacing is the greatest for:**
    (A) Blue light (B) Yellow light (C) Green light (D) Red light
11. **Redfractive index of water is:**
    (A) 1.5 (B) 1.33 (C) 1.0 (D) 1.2
12. **The term "phg" in Bernoulli's equation has the same units as:**
    (A) work (B) energy (C) pressure (D) flow rate
13. **An ideal gas performs 10J of work while expanding adiabatically. The change in its internal energy is:**
    (A) 10 J (B) -10 J (C) 100 J (D) -200 J
14. **Average translational K.E. of a gas molecule is:**
    (A) $\frac{3}{2}KT$ (B) $\frac{1}{2}KT$ (C) $\frac{2}{3}KT$ (D) KT
15. **The K.E of an object of mass "m" is "E", its momentum will be:**
    (A) 2 EM (B) $\sqrt{\frac{2E}{m}}$ (C) $\sqrt{\frac{1}{2}Em}$ (D) $\sqrt{2mE}$
16. **The frequency of waves produced in microwave oven is:**
    (A) 1435 MHz (B) 2850 MHz (C) 2450 MHz (D) 4250 MHz
17. **The increase in velocity of sound in air for $1^\circ C$ in termperature is:**
    (A) 61 cm/s (B) 0.61 cm/s (C) 61 m/s (D) 1.61 m/s

SAHIWAL BOARD

Physics (New Scheme) Session (2021)
(Group - I, Class 11th)
Subjective
Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Check the correctness of the relation $v = \sqrt{\frac{F \times l}{m}}$ where v is the speed of transverse wve on a stretched string of tension F, length l and mass m.
ii. Does a dimenstional analysis give any information on constant of proportionality that may appear in an algebraic expression? Explain.
iii. Add the following masses given in Kg upto appropriate precision. 2.189, 0.089, 11.8 and 5.32.
iv. The volume of sphere V=47.689 cm^3 with 1.2% uncertainty. What is the correct range of volume measurement?
v. Suppose the sides of closed polygon represent vector arranged head to ttail. What is the sum of these vectors?
vi. Prove that $A.B = A_x B_x + A_y B_y + A_z B_z$
vii. If all the components of vectors A_1 and A_2 were reversed, how would this alter $A_1 \times A_2$.
viii. Define Law of Conservation of linear momentum and write its mathematical form.
ix. Explain the difference between elastic and inelastic collisions. Explain how would a bouncing ball behave in each case?
x. Derive an expression for the time of flight of projectile.
xi. What happens to the velocities of two bodies after collision when a light body collides with a massive body at rest for elastic collision?
xii. Two row boats moving parallel in the same direction are pulled towards each other. Explain.

3. Write short answer to any EIGHT parts.

i. A girl drops a cup from a certain height, which breaks into pieces. What energy changes are involved?
ii. Show that $1\,kWh = 3.6 \times 10^6\,J$.
iii. What do you mean by variable force? Give its two examples.
iv. Show that $v = r\omega$.
v. What is meant by moment of inertia? Explain its significance.
vi. When mud flies off the tyre of a moving bicycle, in what direction does it fly? Explain.
vii. What is meant by phase angle? Does it define angle etween maximum displacement and edriving force?
viii. Define resonance, write one advantage and one disadvantage of resonance.
ix. Differentiate between free and forced oscillations.
x. Is it possible for two indentical waves travelling in the same direction along a string to give irse to a stationary wave?
xi. How temperature and density of the medium effect the speed of sound?
xii. What happens when a jet plane like Concorde flies faster than the speed of sound?

4. Write short answer to any SIX parts.

i. How is the distance between interference fringes affected by separation between the slits of Young's experiment? Can fringes disappear?
ii. How would you manage to get more orders of spectra using diffraction grating?
iii. What are Newton's rings? How they are formed?
iv. Explain the difference between angular magnification and resolving power of an optical instrument.
v. What is meant by least distance of distinct vision?
vi. Why does the pressure of a gas in a car tyre increases when it is driven through some distance?
vii. What is meant by reversible process? Give its example.
viii. Write down the postlates of kinetic theory of gases.
ix. Specific heat of a gas at constant pressure greater than specific heat at constant volume. Why?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Describe the method of addition of vectors by rectangular components.
(b) A truck weighing 2500 Kg and moving with a velocity of $21\,ms^{-1}$ collides with stationary car weighing 1000 kg. The truck and the car move together after the impact. Calculate their common velocity.

6.(a) Define Absolute Potential Energy. Derive relation for absolute P.E of body of mass "m" at distance "r" from the center of earth.
(b) Find the tempertare at which the velocity of sound in air is two times its velocity at $10\ ^oC$

7. (a) State and prove Bernoulli's equation.
(b) What is the least speed at which an aeroplane can execute a vertical loop of 1.0 km radius so that there will be no tendency for the pilot to fall down tat the highest point.

8. (a) State first law of thermodynamics and explain. (i) Isothermal Process (ii) Adiabatic Process.
(b) A simple pendulum is 50 cm long. What will be its frequency of vibration at a place where $g = 9.8 ms^{-2}$?

9. (a) Calculate the speed of light by Michelson's method.
(b) Yellow sodium light of wavelength 589 nm, emitted by a single source passes through two narrow slits 1.0 mm apart. The interference pattern is observed on a screen 225 cm away. How far apart are two adjacent bright fringes?

MULTAN BOARD
(Group – I–Class 11th)

Physics (New Scheme) Session (2021)

Objective

Time : 20 Minutes
Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. The dimensions of $\sqrt{\frac{m}{k}}$ is same as that of:
(A) Momentum (B) Time (C) Acceleration (D) Force

2. The % uncertainty in the measurement ofa sphere is 2 %. The % uncertainty in the volume of sphere is:
(A) 6 % (B) 2 % (C) 4 % (D) 8 %

3. If $|\vec{A} \times \vec{B}| = |\vec{A}.\vec{B}|$ then angle between vectors $\vec{A}$ and $\vec{B}$ is:
(A) 60° (B) 90° (C) 45° (D) 30°

4. Projection of $\vec{A}$ on $\vec{B}$ is:
(A) B cos θ (B) A sin θ (C) $\vec{B}.\hat{A}$ (D) $\vec{A}.\hat{B}$

5. The horizontal acceleration of projectile is:
(A) Equal to "g" (B) Positive (C) Negative (D) Zero

6. In a typical rocket, the fuel burns at the rate of:
(A) 4000 kg/s (B) 1000 kg/s (C) 10,000 kg/s (D) 40,000 kg/s

7. The rotational K.E of solid sphere is:
(A) $\frac{2}{5}mr^2\omega^2$ (B) $\frac{1}{5}mr^2\omega^2$ (C) $\frac{2}{3}mr^2\omega^2$ (D) $\frac{1}{5}I\omega^2$

8. The ratio of orbital velocity to the escape velocity is:
(A) $\sqrt{\frac{1}{2}}$ (B) $\frac{1}{2}$ (C) 1 (D) $\sqrt{2}$

9. The wavelength of waves produced in microwave oven is:
(A) 12 cm (B) 20 cm (C) 24 cm (D) 10 cm

10. The speed of sound in air at 30° is approximately equal to:
(A) $332\,m/s$ (B) $350\,m/s$ (C) $340\,m/s$ (D) $335\,m/s$

11. The distance between 1^{st} node and 4^{th} antinode is:
(A) $\frac{5}{4}\lambda$ (B) $\frac{13}{4}\lambda$ (C) $\frac{7}{4}\lambda$ (D) $\frac{11}{4}\lambda$

12. Escape velocity of object depends upon:
(A) Mass of object (B) Size of object (C) Shape of object (D) Radius of planet

13. A carnot engine operating between the temperatures has greatest efficiency:
(A) 40k and 20k (B) 60k and 40k (C) 80k and 60k (D) 100k and 80k

14. Which one is true for isothermal process?
(A) $Q = 0$ (B) $Q = W$ (C) $W = 0$ (D) $Q = \mu\Delta$

15. The term $\frac{1}{2}\rho v^2$ in equation represents:
(A) K.E of fluid (B) Pressure energy (C) K.E per unit volume (D) P.E of fluid

16. The phase difference between two points on the same wave front is:
(A) $\frac{\pi}{2}$ (B) π (C) $\frac{\pi}{4}$ (D) 0

17. Final image formed by compound microscope is:
(A) Real; Inverted; Magnified (B) Virtual; Erect; Magnified
(C) Real; Erect; Diminished (D) Virtual; Inverted; Diminished

Physics (New Scheme)
Session (2021)

MULTAN BOARD
(Group - I, Class 11th)
Subjective

Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Show that the expression $v_f = v_i + at$ is dimensionally correct where v_i is the velocity at $t = 0$, a is the acceleration and v_f is the velocity at time t.
ii. Write the dimension of (i) Pressure (ii) Density
iii. Define Precision and Accuracy.
iv. Find the dimensions and hence the S.I units of coefficient of viscosity η in relation of stokes law for the drag force F for a spherical object of radius r moving with velocity v given as $F = 6\pi\eta rv$
v. Define position vector and write its general formula in three dimension.
vi. Prove that $\vec{A}.\vec{B} = \vec{B}.\vec{A}$
vii. If all the components of vectors $\overrightarrow{A_1}$ and $\overrightarrow{A_2}$ were reversed, would this alter $\overrightarrow{A_1} \times \overrightarrow{A_2}$?
viii. Water flows out from a pipe at $3kgs^{-1}$ and its velocity change from $5ms^{-1}$ to zero on striking the well, then find the force due to flow of this water.
ix. Derive the formula for the vertical distance covered by the projectile when it is thrown from a certain height h.
x. Define the range of projectile and show that the range of projectile is maximum when projectile is thrown at an angle of $45°$ with the horizontal.
xi. A 100 g golf ball is moving to the right with a velocity of $20ms^{-1}$. It makes a head on collision with a $8kg$ steel ball initially at rest. Compute velocities of the balls after collision.
xii. Define Torricelli's theorem and write the formula for the speed of efflux.

3. Write short answer to any EIGHT parts.

i. Prove that $P = \vec{F}.\vec{V}$
ii. Calculate the work done in kilo joules in lifting a mass of 10kg (at a steady velocity) through a vertical height of 10m.
iii. Differentiate between conservative and non conservative force.
iv. Show that 1 rad = $57.3°$
v. Why does a diver change his body position before and after diving in the pool?
vi. What do you mean by orbital velocity? Write down its formula.
vii. What happens to the period of simple pendulum if its length is doubled? What happens if the suspended mass is doubled?
viii. Why soldiers are advised to break their steps when marching on bridge?
ix. What is driven harmonic oscillator? Give example.
x. Define beats and explain with one example.
xi. Explain why sound travel faster in warm air than in cold air.
xii. Speed of sound in air at $0°C$ is $332ms^{-1}$. Find its speed at $20°C$.

4. Write short answer to any SIX parts.

i. Under what conditions, two or more sources of light behave as coherent sources?
ii. Could you obtain Newton's rings with transmitted light if yes, would the pattern be different from that obtained with reflected light?
iii. What is meant by fringe spacing?
iv. What do you understand by linear magnification and angular magnification?
v. What is the length of the telescope in state of normal adjustment?
vi. Why is the average velocity of the molecules in a gas zero but the average of square of velocities is not zero?
vii. What is meant by reversible process? Give its example.
viii. Find the average speed of oxygen molecule in the air at STP.
ix. Why does the pressure of gas in a car tyre increase when it is driven through some distance?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Define and explain vector product of two vectors. Also write down the four characteristics of vector product of two vectors.
(b) A ball thrown horizontally from a height of 10m with velocity of 21 ms^{-1} .How far off it hit the ground?

6.(a) What is Gravitational field is a conservative field.
(b) The frequency of the note emitted by a stretched string is 300 Hz. What will be the frequency of this note when the tension is increased by one-third without changing the length of the wire?

7. (a) Define centripetal force. Derive its relation.
(b) A tiny water droplet of radius 0.01 cm descends through air from high building. Calculate its terminal velocity. Given that η for air is $19\times10^{-6}\ kgm^{-1}s^{-1}$ and density of water is $19\times10^{-6}\ kgm^{-1}s^{-1}$.

8. (a) Define and explain the phenomenon of resonance with an example.
(b) A mechanical engineer develops an engine working between $327°C$ and $27°C$ and claims to have an efficiency of 52%. Does he claim correctly? Explain.

9. (a) What is diffraction grating? Calculate the wavelength of light used by diffraction grating.
(b) A telescope is made of an objective of focal length 20 cm and an eye piece of 5.0cm. Both are convex lenses. Fine the angular magnification.

D.G KHAN BOARD

Physics (New Scheme) (Group – I–Class 11th) Time : 20 Minutes
Session (2021) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **The dimensions of volume flow rate of a fluid are:**
   (A) $[LT^{-1}]$ (B) $[L^2T^{-2}]$ (C) $[L^3T^{-1}]$ (D) $[L^3T^{-2}]$
2. **Time taken by light to travel from sun to earth is**
   (A) 8 min 20 s (B) 1 min 20 s (C) 5 h 20 s (D) 4 h 20 s
3. **At what angle Dot product and Cross product have the same magnitude**
   (A) 0° (B) 45° (C) 30° (D) 60°
4. **Magnitude of cross product of two perpendicular vectors is**
   (A) AB (B) AB $\hat{n}$ (C) 0 (D) AB
5. **A 1500 kg has its velocity reduced from 20 ms^{-1} to 15 ms^{-1} in 3.0 sec. How large was the retarding force?**
   (A) 500 N (B) 2500 N (C) 1500 N (D) 1000 N
6. **When a massive body of mass m_1 collides with lighter stationary body of mass m_2, the velocity of massive body after collision will be**
   (A) $V_1' = 2V_1$ (B) $V_2' = V_1$ (C) $V_1' = V_1$ (D) $V_2' = 2V_2$
7. **Which one of the following is conservative force**
   (A) Electric force (B) Air resistance (C) Frictional force (D) Tension in string
8. **A hoop is rolled down on an inclined plane having height of 10m. Its velocity at the bottom will be**
   (A) 4.91 m/sec (B) 9.89 m/sec (C) 28.31 m/sec (D) 31.31 m/sec
9. **Apparent weight of an object in a lift moving down with acceleration a = g is**
   (A) T= w + ma (B)T = 0 (C) T = w (D) T= Infinity
10. **Acceleratioin of a pendulum of length $\ell = 1m$ and displacement of 5 cm having S.H.M is**
    (A) 2.29 m/s^2 (B) 0.19 m/s^2 (C) 0.69 m/s^2 (D) 0.49 m/s^2
11. **If radius of droplet becomes half then its terminal velocity will be**
    (A) One fourth (B) Four times (C) Half (D) Double
12. When both ends of organ pipe are open then the frequency of stationary waves of nth harmonic is given by
    (A) $fn = \frac{nv}{4\ell}$ (B) $fn = \frac{v}{2n\ell}$ (C) $fn = \frac{nv}{2\ell}$ (D) $fn = \frac{2v}{n\ell}$
13. **The value of constant γ for the mono-atomic gas is**
    (A) 1.67 (B) 1.40 (C) 1.29 (D) 2.45
14. **In youngs double slit experiment the position of bright frings is given by**
    (A) $y = \frac{m\lambda d}{L}$ (B) $y = \frac{mLd}{\lambda}$ (C) $y = \frac{m\lambda}{Ld}$ (D) $y = \frac{m\lambda L}{d}$
15. **In Michelson method time taken by the rotational mirror to rotate through an angle $\frac{2\pi}{8}$ (If f is the frequency of rotation) is**
    (A) $\frac{1}{4f}$ (B) $\frac{1}{2f}$ (C) $\frac{1}{8f}$ (D) $\frac{1}{6f}$
16. **Sadi carnot described an ideal engine in**
    (A) 1640 (B) 1740 (C) 1940 (D) 1840
17. **A system does 600 J of work and at the same time internal energy increases by 320 J, The heat supplied is**
    (A) 200 J (B) 600 V (C) 280 J (D) 920 J

Physics (New Scheme)
Session (2021)

D.G KHAN BOARD
(Group - I, Class 11th)
Subjective

Time : 2:40 Hours
Marks : 68

SECTION - I

2. **Write short answers to any EIGHT parts.**
i. Show that the expression $Vf = Vi + at$ is dimensionally correct where Vi is the velocity at $t = 0$, a is the acceleration and Vf is the velocity at time t.
ii. What are the rules for assessment of uncertainty in case of a power factor?
iii. Three students measured the length of a needle with a scale on which minimum divisions is 1 mm and recorded as (i) 0.2145 (ii) 0.14 m. which record is correct and why?
iv. Write the dimensions of (i) Force (ii) Velocity
v. The vector sum of three vectors give a zero resultant. What can be the orientation of the vectors?
vi. Define torque. Write its unit
vii. What is the unit vector in the direction on the vector $\vec{A} = 4\hat{i} + 3\hat{j}$
viii. Does s moving object have impulse?
ix. Explain the difference between elastic and inelastic collision.
x. What is the effect on the speed of a fighter plane chasing another when it open fire? What happen to the speed of pursued plane when it returns the fire?
xi. Define an Isolated system. Give example.
xii. Two row boats moving parallel in the same direction are pulled towards each other. Explain

3. **Write short answer to any EIGHT parts.**
i. Explain what do you understand the work done by Gravitational field?
ii. An object has one joule of potential energy. Explain what does its mean?
iii. When a rocket re-enters the atmosphere, its nose cone become very hot. Where does heat energy come from?
iv. Define the terms (a) Rotational Kinetic Energy (b) Orbital velocity
v. State the direction of the following vectors in simple situation; angular velocity and angular momentum
vi. Why does a diver change his body positions before and after diving in the pool?
vii. What should be the length of a simple pendulum whose period is 1.0 second at a place where g = 9.8 ms^{-2} ?
viii. Under what conditions does the addition of two simple harmonic motions produce a result, which is also simple harmonic?
ix. Describe two common phenomena in which resonance plays important role
x. What features do transverse periodic waves have common with longitudinal periodic wves?
xi. What is the effect of density on the speed of sound? Explain.
xii. What happen when a jet plane like concorde flies faster than the speed of sound?

4. **Write short answer to any SIX parts.**
i. Can visible light produce interference fringes? Explain
ii. Explain whether the Young's experiment is an experiment for studying interference of diffraction effect of light
iii. Why the centre of the Newton's ring is dark?
iv. How convex lens is used as a magnifier? What limits the magnification of an potical instrument?
v. If a person was looking through a telescope at the full moon, how would the appearance of the moon be changed by covering half of the objective lens?
vi. Specific heat of a gas at constant pressure is greater than specific heat at constant volume. Why?
vii. What is meant by irreversible process? Give its example
viii. Calculate the work done during isothermal process?
ix. Draw PV-diagram which show four steps of Carnot engine.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) What is projectile motion?Derive expression for its height and range?
(b) Find the projection of $\vec{A} = 2\hat{i} + 8\hat{j} + \hat{k}$ in the direction of the vector $\vec{B} = 3\hat{i} + 4\hat{j} + 12\hat{k}$

6.(a) What is the effect of temperature on speed of sound? Show that $v_t = v_0 + 0.61t$
(b)How large a force is required to accelerate an electron $\left(m = 9.1\times10^{-31}kg\right)$ from rest a speed of $2\times10^{7}\,ms^{-1}$ through a distance of 10cm.

7. (a) Derive Bernoulli's equation for a non – viscous, incompressible fluid which flows in a steady state manner
(b) A 1000 kg car traveling with a speed of $144 km\,h^{-1}$ rounds a curve of radius 100 m. Find the necessary centripetal force.

8. (a) Prove Law of Conservation of energy in SHM in mass spring system
(b) Estimate the average speed of Nitrogen molecules in air under standard conditions of pressure and temperature.

9. (a) Define diffraction of light. Describe it through a diffraction grating to derive diffraction equation to determine wavelength of light.
(b) An astronomical telescope having magnifying power 5.0 consists of two thin lenesss 24 cm apart. Find focal lengths of the lenses.1q.

RAWALPINDI BOARD

Physics (New Scheme) (Class 11th) Time : 20 Minutes
Session (2021) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **If 20 waves pass through medium in one second with speed of 20 ms^{-1}, the wavelength is:**
   (A) 20 m (B) 2 m (C) 400 m (D) 1 m
2. **Distance between two consective nodes is:**
   (A) λ (B) 2λ (C) $\frac{\lambda}{2}$ (D) $\frac{\lambda}{4}$
3. For mono atomic gas $C_v = \frac{3R}{2}$ therefore nodes is:
   (A) $\frac{3}{5}$ (B) $\frac{5}{3}$ (C) $\frac{4}{15}$ (D) $\frac{15}{4}$
4. **Average velocity of molecules in gas is:**
   (A) Zero (B) Positive (C) negative (D) infinity
5. **Gravity performs zero work when body moves:**
   (A) Vertically (B) Horizontally
   (C) at 60° with vertical (D) at 60° with horizontal
6. **The SI unit of rate of flow of fluid is:**
   (A) m/s (B) m^3/s (C) m/s^2 (D) kg m/s
7. **Energy of particle executing SHM of amplitude X_0 is proportional to:**
   (A) X_0^2 (B) X_0^{-2} (C) X_0 (D) $\frac{X_0^{-2}}{2}$
8. **Formula for Fringe spacing is:**
   (A) $\frac{\lambda d}{l}$ (B) $\frac{\lambda L}{d}$ (C) $\frac{Ld}{\lambda}$ (D) $\frac{m\lambda L}{d}$
9. **Length of astronomical telescope for normal adjustment is:**
   (A) f_o+f_e (B) f_o-f_e (C) $\frac{1}{f_o}-\frac{1}{f_e}$ (D) $\frac{1}{f_o}+\frac{1}{f_e}$
10. **Least count of meter rod is:**
    (A) 0.01 cm (B) 0.001 cm (C) 0.1 cm (D) 1 cm
11. **Which one of the following is correct?**
    (A) $m = \frac{E}{C^2}$ (B) $m = \frac{C^2}{E}$ (C) $m = C^2E$ (D) $m = CE$
12. **Which of the following is perpendicular to $4\hat{i}-3\hat{j}$:**
    (A) $4\hat{i}+3\hat{j}$ (B) $6\hat{i}$ (C) $7\hat{k}+\hat{i}$ (D) $3\hat{i}+4\hat{j}$
13. **Torque is rotational analogous of:**
    (A) Momentum (B) Force (C) Weight (D) Axis of rotation
14. **A ball is dropped from a height of 4.2 meters. To what height it will rise if there loss after rebounding?**
    (A) 4.2 m (B) 8.4 m (C) 12.6 m (D) 2.4 m
15. **Total time for which the projectile remain in air is called:**
    (A) Time of projectile (B) Time of flight
    (C) Time period (D) Time constant
16. **Dimensions of angular acceleration are:**
    (A) $[T^{-1}]$ (B) $[T^{-2}]$ (C) $[T^{-3}]$ (D) $[LT^{-2}]$
17. **When a body moves in a circular path it's linear velocity:**
    (A) remains constant (B) becomes zero
    (C) changes (D) increases

RAWALPINDI BOARD

Physics (New Scheme) (Class 11th) Time : 2:40 Hours
Session (2021) Subjective Marks : 68

SECTION - I

2. **Write short answers to any EIGHT parts.**
i. Write the dimensions of (a) Pressure (b) Density
ii. Define the terms (a) Unit vector (b) Position vector
iii. Calculate the maximum height of the projectile.
iv. why fog droplets appear to be suspended in air?
v. What are the dimesions and units of coefficient of viscosity "η" in the formula $F = 6\pi\mu rv$
vi. How the uncertainty in the average value of many measurements is assessed?
vii. Which of the given equation is correct? $f = v\lambda$ or $f = \frac{v}{\lambda}$.
viii. Show tha the sum and difference of two perpendicular vectors of equal lengths are also perpendicular and of the same length.
ix. State and illustrate the "Right Hand Rule" of vector product.
x. Find the angle of projection of a projectile for which its maximum height horizontal range are equal.
xi. At what point or points in its path does a projectile have its minimum speed, its maximum speed?
xii. Define isolated system.What is the importance of an iso lated system in the conservation of linear momentum?

3. **Write short answer to any EIGHT parts.**
i. Prove that $P = \vec{F}.\vec{V}$.
ii. Derive the relation of work energy principle
iii. Define Beats and Stationary waves.
iv. Prove that $a_t = r\propto$
v. When a rocket re-enters the atmosphere, its nose becomes very hot. Where does this heat energy come from?
vi. Define angular momentum and write its different mathematical forms.
vii. When mud flies off the tyre of a moving bicycle in what direction does it fly? Explian.
viii. A block weighing 4.0 Kg extends a spring by 0.16m from its unstretched position. The block is removed and 0.50 Kg body is hung from the same spring if the spring is now stretched and then released what is its period of vibration?
ix. Define simple pendulum and find the frequency of second pendulum.
x. Does the acceleration of a simple harmomic oscillator remain constant during its motion? Is the acceleration ever zero? Explain
xi. What is the effect of pressure and density on speed of sound.
xii. Why does sound travel faster in warm air than in cold air? Explain.

4. **Write short answer to any SIX parts.**
i. Write down the main parts of spectrometer and two uses of spectrometer.
ii. Specific heat of a gas at constant pressure is greater than specific heat at constant volume. Why?
iii. Derive Charle's Law from Kinetic theory of gases.
iv. Is it possible to construct heat engine that will not expel heat into the atmosphere?
v. How can we increace the internal energy? Explain.
vi. What do you mean by the term wavefront and ray of light?
vii. What is diffrating grating? Write its equation.
viii. In the Young experiment, one of the slits is covered with blue filter and other with red filter. What would be the pattern of light intensity on the screen?
ix. What do you understand by linear magnification and angular magnification?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Define scalar product. Write down four characteristics of vector product.
(b) Find the angle of projection of a projectile for which its maximum height and horizontal range are equal.

6.(a) What is gravitational field? Show that in gravitational field work done is independent of path followed.
(b)A church organ consists of pipes, each open at one end, of different lengths. The minimum length is 30mm and the longest is 4 m. calculate the frequency range of the fundamental notes. (Speed of sound =340ms^{-1})

7. (a) Define and explain the centripetal force and derive the relation for it.
(b) What guage pressure is required in the main for a stream from a fire hose connected to the city mains to reach a vertical geight of 15.0m?

8. (a) Discuss energy conservation in SHM.
(b) Find the average speed of oxygen molecule in the air at STP.

9. (a) Write down the construction and working of a Michelson's interferometer. Give its equation.
(b) A compound microscope has lenses of focal length 1.0cm and 3.0cm. An object is placed 1.2cm from the object lens. If a virtual image is formed 25cm from the eye, calculate the magnification of the instrument.

SARGODHA BOARD

Physics (New Scheme) (Group – I–Class 11th) Time : 20 Minutes
Session (2021) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **A Telescope with objective of focal length 40 cm and eyepiece of focal length 5 cm, when focused for infinity has length equal to**
(A) 35 cm (B) 8 cm (C) 45 cm (D) 200 cm
2. **The sum of all Energies of molecules is known as:**
(A) Elastic potential (B) Kinetic energy
(C) Internal energy (D) Potential energy
3. **If the Temperature of the source increases, the Efficiency of a carnot engine,**
(A) Decreases (B) Increases
(C) Remains constant (D) First increase then decreases
4. **Dimension of Moment arm is**
(A) $[M]$ (B) $[T]$ (C) $[MT]$ (D) $[L]$
5. **Measurement taken by Vernier caliper with least count 0.01 cm is recorded as 0.45 cm.**
(A) 0.45 % (B) 0.1 % (C) 0.2 % (D) 2 %
6. If $\vec{A} \times \vec{B}$ points along +ve Z-axis, then vector $\vec{A}$ and $\vec{B}$ must lie,
(A) yz-plane (B) xz-plane (C) xy-plane (D) zz-plane
7. **In unit vectors $(\hat{i} + \hat{j}) \times \hat{k}$ is equal to**
(A) Null vector (B) $\hat{i}$ (C) $\hat{j}$ (D) 1
8. **If the angle of projection is greater that 45°, then the**
(A) Height attained is more but range is less
(B) Height attained is less but is more
(C) Range and height attained is less
(D) Both height attained and range are more
9. **A ball is thrown with an initial speed of 30 ms^{-1} in a direction 30° abovethe Horizontal. Its vertical component velocity is**
(A) 25.98 ms^{-1} (B) 30 ms^{-1} (C) 10 ms^{-1} (D) 15 ms^{-1}
10. **In work-Energy principle work done on a body is equal to**
(A) Kinetic energy (B) Potential energy
(C) Elastic potential energy (D) Change in Energy
11. **A body of mass 10 kg in free falling lift has weight**
(A) 10 N (B) 98 N (C) zero N (D) 980 N
12. In one Revolution, the angular displacement covered is
(A) 60° (B) 360° (C) 90° (D) 180°
13. **Stocke's Law holds for bodies when they have**
(A) Spherical shape (B) Curved shape
(C) Rectangular shape (D) Oblong shape
14. **A simple pendulum is completing 20 vibration in 5 second; its frequency is**
(A) 4 Hz (B) 20Hz (C) 200 Hz (D) 100 Hz
15. **The product of frequency and time period is**
(A) 2 (B) 3 (C) 1 (D) 4
16. **On loading the prong of a tuning fork with wax, its frequency**
(A) Decreases (B) Increases
(C) May increases or decreases (D) Remaining constant
17. **A Diffraction grating has 3000 lines per centimeter, its grating element is**
(A) $3.33 \times 10^{-4} cm$ (B) $3.33m$ (C) $333 \times 10^{-4} cm$ (D) $3.33cm$

SARGODHA BOARD

Physics (New Scheme)
Session (2021)

(Group - I, Class 11th)
Subjective

Time : 2:40 Hours
Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Write dimensions of (a) Pressure (b) Density
ii. Does a dimensional analasis give any information on constant of proportionality that may appear in an algebraic expression. Explain.
iii. What do you mean by precision and accuracy.
iv. What do you mean dimension of a physical quantity.
v. The vector sum of three vectors gives zero resultant. What can be orientation of vectors.
vi. Can you add zero to a null vector.
vii. Define Scalar product of two vectors.
viii. Define impulse and show how it is related to linear momentum.
ix. At what point or points in it's path does a projectile have it's minimum speed, its maximum speed.
x. Define time of flight of a projectile, give it's units.
xi. Define two Dimensional motion.
xii. Explain how Swing is produced in a fast moving cricket ball.

3. Write short answer to any EIGHT parts.

i. In which case is more work done when a 50 kg bag of books is lifted through 50 cm, or when a 50 kg crate is pushed through 2m across the floor with a force of 50 N.
ii. Define escape velocity and calculate its value.
iii. Explain the situations in which the work is positive, negative or zero.
iv. Show that orbital angular momentum $L_o = mvr$
v. State the law of conservation on angular momentum. Explain its importance.
vi. A hoop starts rolling without slipping down from the top of an inclined plane. What its speed at the bottom.
vii. Does the acceleration of a simple harmonic oscillator remain constant during its motion? Is the acceleration ever zero? Explain.
viii. If a mass spring system is hung vertically and set into oscillations, why does the motion eventually stop?
ix. Define free and forced oscillations.
x. How are beats useful in tuning musical instruments?
xi. On what factors does the speed of sound in a medium depend?
xii. What is the frequency and the wavelength of third harmonic in a closed organ pipe?

4. Write short answer to any SIX parts.

i. State Huygen's principle.
ii. Can visible light produce interference fringes? Explain
iii. Define magnifying power and resolving power of lens.
iv. Write the conditions for Interference.
v. What is meant by noramal adjustment of telescope.
vi. Prove the relation $W = P\Delta V$
vii. Starting from the relation of pressure of a gas prove that absolute temperature of an ideal gas is directly proportional to the average translational K.E of gas molecules.
viii. Is it possible to construct a heat engine that will not expel heat into the atmosphere.
ix. Derive Boyles law on basis of Kinetic molecular theory of gases.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Explain the addition of vectors by rectangular components method.
(b) A ball is thrown horizontally from a height of 10 m with velocity of 21 ms^{-1}. How far off it hit the ground and with what velocity?

6.(a) Define gravitational potential energy. Derive an expression for the absolute potential energy on the surface of the earth.
(b) An organ pipe has a length of 50 cm. Find the frequency of its fundamental note and the next harmonic, when it is closed at one end. Speed of sound = 50 m/s.

7. (a) Define rotational K.E. Also derive the relations for the velocities of disc and hoop moving down an inclined plane at its bottom.
(b) How large must a heating duct be if air moving 3 ms^{-1} along it can replenish the air in a room of 300 m^3 volume every 15 min? Assume the air's density remains constant.

8. (a) What is simple pendulum? Show that the motion of simple pendulum is simple harmonic motion. Also find relation for its time period under and frequency.
(b) Estimate the average speed of Nitrogen molecules in air under standard conditions of pressure and temperature.

9. (a) What is cmompound microscope? Describe its working. Also relation for its magnifying power.
(b) A light is incident normally on a grating which has 2500 lines per centimeter. Compute the wavelength of a spectral line for which the deviation in second order is 15^o.

LAHORE BOARD

Physics (New Scheme) (Group – I–Class 11th) Time : 20 Minutes
Session (2021) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **Travel time light from sun to earth is:**
(A) 1 min 20 s (B) 8 min 20 s (C) 10 min 20 s (D) 5 h 20 s

2. **The dimensions of relation mc^2 are equal to the dimensions of:**
(A) Force (B) Momentum (C) Energy (D) Torque

3. **Unit of torque in SI unit is:**
(A) $N-m^{-1}$ (B) $N^{-1}-m$. (C) $N^{-1}-m^{-1}$ (D) $N-m$

4. **The dot produst $\hat{i}.\hat{i}$ is equal to**
(A) 0 (B) 1 (C) -1 (D) $\hat{j}$

5. **The maximum height attained by projectile is:**
(A) $\frac{v_i^2 \sin^2\theta}{2g}$ (B) $\frac{v_i^2 \sin^2\theta}{g}$ (C) $\frac{v_i^2 \cos^2\theta}{2g}$ (D) $\frac{v_i^2 \cos^2\theta}{g}$

6. **The angle of projection of a projectile for which its maximum height and horizontal range are equal to:**
(A) 45° (B) 56° (C) 66° (D) 76°

7. **Kilowatt hour is the unit of:**
(A) Power (B) Work (C) Force (D) Momentum

8. **If a body of mass 10 kg is allowed to fall freely, its apparent weight becomes:**
(A) Zero (B) 89 N (C) 9.8 N (D) 10 N

9. **One radian is equal to:**
(A) 57.3° (B) 67.3° (C) 87.3° (D) 60°

10. **A ten meter high tank is full of water. A hole appears at ita middle. The speed of efflux be:**
(A) $5\,ms^{-1}$ (B) $9.9\,ms^{-1}$ (C) $8.9\,ms^{-1}$ (D) $5.11\,ms^{-1}$

11. **At resonance, the transfer of energy is:**
(A) Zero (B) Minimum (C) Maximum (D) Negative

12. **The frequency range of Dog ear is:**
(A) $20-20,000\,Hz$ (B) $60-70,000\,Hz$
(C) $1000-120,000\,Hz$ (D) $15-50,000\,Hz$

13. **Beats can be heard by man when difference of frequency is not more than:**
(A) 3 Hz (B) 9 Hz (C) 10 Hz (D) 16 Hz

14. **The property of bending of light around obstacles is:**
(A) Reflection (B) Refraction (C) Diffraction (D) Polarization

15. **The least distance of distinct vision for normal eyeis:**
(A) 10 cm (B) 20 cm (C) 25 cm (D) 30 cm

16. **The efficiency of diesel engine is about:**
(A) $25-30\%$ (B) $35-40\%$ (C) $35-50\%$ (D) $45-60\%$

17. **The K.E of molecules of an ideal gas at absolute zero will be:**
(A) Zero (B) Infinite (C) Very high (D) Below zero

LAHORE ABOARD

Physics (New Scheme) (Group - I, Class 11th) Time : 2:40 Hours
Session (2021) Subjective Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Write dimensions of (a) Pressure (b) Density
ii. How the uncertainty in the time period of vibrating body is found?
iii. Write two uses of dimensions.
iv. Does dimensional analysis give any information on constant of proportionality that may appear in ana algebraic expression? Explain.
v. Suppose the sides of a closed polygon represent vectors arranged head to tail. What is the sum of these vectors?
vi. Two vecors have unequal magnitudes. Can their sum be zero? Expalin.
vii. $\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$, $\vec{B} = 3\hat{i} - 2k$, Find $\vec{A} . \vec{B}$
viii. Define range of projectile. Derive its expression.
ix. State the law of conservation of linear momentum, pointing out the importance of isolated system.
x. Find the angle of projection for which range of projectile is equal to four times the maximum height.
xi. What is the principle of rocket propulsion?
xii. Explain how Swing is produced in a fast moving cricked ball.

3. Write short answer to any EIGHT parts.

i. Calculate the work done in kilo joules in lifting a mass of 10 kg (at a steady velocity) through a vertical height of 10m.
ii. When rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this heat energy come from?
iii. Define: (a) gravitational field. (b) conservative field.
iv. Prove that s = rθ where θ is in radian.
v. When mud flies off the tyre of a moving bicycle, in what direction does fly? Explain.
vi. Show that orbital angular momentum $L_o = mvr$
vii. Define forced oscillations. Give its example.
viii. If a mass spring system is hung vertically and set into oscillations, why does the motion eventually stop?
ix. What happens to the period of a simple pendulum if Its length is doubled?
x. Define the terms node and antinode.
xi. If a string vibrates in four segments at a frequency of 120 Hz, determine its fundamental frequency?
xii. If a string vibrates in four segments at a frequency of 120 Hz, determine its fundamental frequency?

4. Write short answer to any SIX parts.

i. How would you manage to get more orders of spectra using diffraction grating?
ii. Write two parts of Huygen's principle.
iii. Write two conditions for detectable interference.
iv. If a person was looking through a telescope at the full moon, how would the appearance of moon be changed by covering half of the objective lens?
v. What is optical fibre? Write down two uses of fiber optics.
vi. Is it possible to convert internal energy into mechanical energy? Explain with an example.
vii. Give an example of a process in which no heat is transferred to or from the system but the temperature of the system changes.
viii. Derive Charles's law on the basis of kinetic molecular theory of gases.
ix. Is it possible to construct a heat engine that will not expel heat into the atmosphere?

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) Distinguish between elastic and inelastic collisions. Show that when two smooth balls undergo elastic collision in one dimension the magnitude of relative velocity of approach is equal to the magnitude of relative velocity of separation.

(b) Two forces of magnitude 10 N and 20 N act on a body in directions making angle 30^o and 60^o with x-axis respectively. Find the resultant force.

6.(a) Prove that the work done in the gravitational field is independent of path followed by the body.

(b) Find the temperature at which the velovcity of sound in air is two times its velocity at 10^oC

7. (a) Define terminal velocity. Show that terminal velocity is directly proportional to the square of radius.

(b) A body of moment of inertia I=0.80kh m^2 about fixed axis, rotates with a constant angular velocity of 100 rad s^{-1}. Calculate its angular momentum L and the torque to sustain this motion.

8. (a) What is phase?Derive the formula of velocity in case of a horizontal mass-spring system.

(b) A heat engine performs 100 J of work at the same time ejects 400 J of heat energy to cold reservoirs. What is the efficiency of the engine?

9. (a) What is cmompound microscope? Describe its construction and working. Also calculate its magnifying power.

(b) A light is incident normally on a grating which has 2500 lines per centimeter. Compute the wavelength of a spectral line for which the deviation in second order is 15^o .

FAISALABAD BOARD

Physics (New Scheme) (Group – II –Class 11th) Time : 20 Minutes
Session (2021) Objective Marks : 17

Note: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question numbr with marker or pen. Cutting of filling two or more circles will result in zero mark in that question.

1. **If speed of moving body is doubled its K.E. is:**
   (A) Doubled (B) Havled (C) Unchanged (D) 4 time
2. **Bernoulli's equation is based upon law of conservation of:**
   (A) Momentum (B) Energy (C) Mass (D) Charge
3. **If pendulum vibrate with frequency 0.5Hz, then its length will be:**
   (A) 10cm (B) 50cm (C) 80cm (D) 99cm
4. **In Michelson interferometer a fring is shifted each time the mirror is displaced through:**
   (A) λ (B) $\frac{\lambda}{2}$ (C) $\frac{\lambda}{4}$ (D) $Zero$
5. **Magnifying power of telescope is:**
   (A) $\frac{f_e}{f_o}$ (B) $\frac{f_o}{f_e}$ (C) $f_e f_o$ (D) $\frac{1}{f_e f_o}$
6. **Dimensions of $\sqrt{F\frac{l}{m}}$ are:**
   (A) $[M^0LT^{-1}]$ (B) $[ML^{-1}T]$ (C) $[ML^2T^{-3}]$ (D) $[ML^{-1}T^{-1}]$
7. **Dimensions of ratio of angular momentum to linear momentum is:**
   (A) $[M^0LT^0]$ (B) $[M^1L^1T^1]$ (C) $[M^1L^2T^1]$ (D) $[M^{-1}L^{-1}T^1]$
8. **If $\vec{A}.\vec{B} = |\vec{A}\times\vec{B}|$ then angle between $\vec{A}$ and $\vec{B}$ is:**
   (A) 0 (B) $\frac{\Pi}{4}$ (C) $\frac{\Pi}{2}$ (D) Π
9. **$\hat{i}.\hat{i} = \hat{j}.\hat{j} = \hat{k}.\hat{k}$ is equal to:**
   (A) 0 (B) 1 (C) -1 (D) 2
10. **Mass of fuel consumed by a typical rocket to overcome earth's gravity is:**
    (A) 1000kg/s (B) 100kg/s (C) 10000kg/s (D) 10kg/s
11. **Rate of change of momentum is called:**
    (A) Force (B) Pressure (C) Tension (D) Impulse
12. **Pull of the Earth on 20kg body on surface of Earth is:**
    (A) 20N (B) 196N (C) 19.6N (D) 1960N
13. **Rotational kinetic energy of the hoop moving down on inclined plane is:**
    (A) $1\,mv^2$ (B) mv^2 (C) $\frac{1}{4}mV^2$ (D) $\frac{3}{4}mV^2$
14. **Tuning fork is source of:**
    (A) Heat (B) Light (C) Sound (D) Electro-magnetic waves
15. **The stretched string of length 2m vibrates in 2 segments. The distance between two consecutive nodes is:**
    (A) 1m (B) 2m (C) 0.5m (D) 4m
16. **Highest efficiency of heat engine whose lower temperature is 17°C and higher temperature is 200°C is:**
    (A) 70% (B) 100% (C) 35% (D) 38%
17. **SI unit of molar specific heat is:**
    (A) $J\,mol^{-1}K^{-1}$ (B) $J\,mol\,K^{-1}$ (C) $J\,mol\,K$ (D) $J\,mol^{-1}$

FAISALABAD BOARD

Physics (New Scheme) (Group -II, Class 11th) Time : 2:40 Hours
Session (2021) Subjective Marks : 68

SECTION - I

2. Write short answers to any EIGHT parts.

i. Show that formula $T = 2\pi\sqrt{\frac{l}{g}}$ is dimensionally correct.
ii. Add the following velocities given in nits up to appropriate precision:
23.1, 0.002, 0.00023, 5-12
iii. Define the terms (a) Precision (b) Dimensions of physical quantities.
iv. Write the dimensions of (a) Coefficient of viscosity η (b) Energy.
v. Define the terms (a) Resultant vector (b) subtraction of vector.
vi. What is the unit vector in the direction of the vector $A = 4\hat{i} - 3\hat{i}$?
vii. Suppose the sides of a closed polygon represent vector arranged head to tail. What is the sum of these vectors?
viii. Define the terms (a) The time of flight (b) the range of projectile.
ix. What happened when light body colliedes with a massive body at rest?
x. Find the time of flight of projectile when it is thrown at an angle of 30° with horizontal.
xi. Explain the difference between laminar flow and turbulent flow.
xii. Explain what do you understand by rocket motion?

3. Write short answer to any EIGHT parts.

i. Calculate the work done in kilo joules in lifting a mass of 10kg through a vertical height of 10m.
ii. A person holds a bag of groceries while standing still, talking a friend. A car is stationary with its engine running. From the stand point of work, how are these two situations similar?
iii. Derive the mathematical expression for escape velocity.
iv. What is meant by moment of inertia? Explain its significance.
v. What is meant by angular momentum? Also define law of conservation of angular momentum.
vi. Define angular acceleration. How angular and linear velocities are related? Explain.
vii. What should be the length of a simple pendulum whose period is 1 second at a place where g =9.8ms-2.
viii. If a mass spring system is hung vertically and set into oscillations, why does the motion eventually stop?
ix. Describe two common phenomena in which resonance plays an important role.
x. Is it possible for two identical waves travelling in the same direction along a string to give rise to a stationary wave? Explain.
xi. Find the frequencies produced in organ pipe when it is open at both ends.
xii. What are beats? Also mention one use of beats.

4. Write short answer to any SIX parts.

i. In the Young's experiment, one of the slits is covered with blue filter and other with red filter. What would be the pattern of light intensity on the screen?
ii. Differentiate the interference and diffraction patterns of light.
iii. Write the conditions for detectable interference of light waves.
iv. Why would it be advantageous to use blue light with a compound microscope?
v. How convex lens act as a magnifying glass? Explain.
vi. Give an example of a process in which no heat is transferred to or from the system but the temperature of the system changes.
vii. Is it possible to convert internal energy into mechanical energy? Explain with an example.
viii. Define internal energy of a substance. Is it state function?
ix. I low first law of thermodynamics explains human metabolism? Explain.

SECTION - II

Attempt any THREE questions. Each question carries 08 Marks.

5.(a) State and prove law of conservation of linear momentum.
(b) Two forces of magnitude 10N and 20N act on a body in directions making angle 30° and 60° wills -axis respectively. Find the resultant force.

6.(a) Explain the interconversion of potential energy and kinetic energy (i) when there is no frictional fore 0 when frictional force is present.
(b) The frequency of the note emitted by a stretched string is 300Hz. What will be the frequency of the note when the length of the wave is reduced by one third without? Changing the tension?

7. (a) State and prove Torricelli's Theorem with diagram.
(b) Calculate the angular momentum of a star mass 2.0×105km, if it makes one complete rotation about its axis once in 20 days. What is the kinetic energy?

8. (a) Define simple pendulum. Show that its motion is SHM. Discuss its working derive relative for its time period.
(b) Estimate average speed of nitrogen molecules in air under standard conditions of pressure and temperature.

9. (a) Explain the diffraction of X-rays by crystal and derive Bragg's law. What are the uses of diffraction of X-rays.
(b) A simple astronomical telescope in normal adjustment has an objective of focal length 100cm and eye piece of focal length 5.0cm.
(i) Where is the final image formed? (ii) Calculate the angular magnification

Answers (Sahiwal Board-I)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	B	A	D	C	A	A	C	B	C	D	D	C	C	B	B	D

Answers (Sahiwal Board-II)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	A	B	C	C	D	D	C	B	D	B	C	B	A	D	C	A

Answers (Multan Board-I)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
B	A	C	D	D	C	B	A	A	B	C	D	D	B	C	D	B

Answers (D. G Khan Board-I)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	B	B	D	B	C	A	D	B	D	A	C	A	D	C	D	D

Answers (Rawalpindi Board-I)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
D	C	B	A	B	B	A	B	A	C	A	D	B	A	C	B	C

Answers (Sargodha Board-I)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C	C	B	D	D	C	A	A	D	D	B	B	A	A	C	A	A

Answers (Lahore Board-I)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	C	D	B	A	D	B	A	A	B	C	D	C	C	C	B	A

Answers (Faisalabad Board-I)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
D	B	D	B	B	A	A	B	B	C	A	B	A	C	B	C	A

****