Roll No. | | | | | | | Answer Sheet No._____

Sig. of Candidate._____ Sig. of Invigilator._____

BIOLOGY HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes

Punjab Text Book Board
Old / Revised Syllabus

NOTE: **Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.**

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) The rate of transpiration decreases when:
A. Intensity of light is strong B. Relative humidity of air is high
C. Wind velocity is high D. Temperature is increased

(ii) In case of a snake bite when you treat a person by Antivenom serum which type of immunity is provided by this action?
A. Humoral immune response B. Passive immunity
C. Active immunity D. Naturally induced immunity

(iii) Select the one which is **NOT** an example of polysaccharide.
A. Pectin B. Glucose C. Glycogen D. Cellulose

(iv) Which period is **NOT** included in the Palaeozoic era?
A. Permian B. Silurian C. Carboniferous D. Cretaceous

(v) If there is a protein molecule of about 2,000 amino acids how many nucleotides are present in the mRNA specific for this protein?
A. 3,000 B. 4,000 C. 2,000 D. 6,000

(vi) Which of the following statements is incorrect about enzymes?
A. Enzymes are sensitive to change in temperature
B. Enzymes are fibrous proteins
C. All enzymes are not solely made up of proteins
D. Enzymes are specific in nature

(vii) Indicate the one which is called serum Hepatitis:
A. Hepatitis C B. Hepatitis D C. Hepatitis A D. Hepatitis B

(viii) Choose the one which is **NOT** a function of smooth endoplasmic Reticulum:
A. Detoxification of drugs B. Transmission of impulse
C. Metabolism of lipids D. Production of glycolipids

(ix) All are the characteristics of plasmid except:
A. It is double stranded DNA molecule B. It is essential for metabolism
C. It is self-replicating D. It contains drug resistant genes

(x) Indicate the one which is a zooflagellate?
A. *Plasmodium* B. *Stentor* C. *Vorticella* D. *Trypanosoma*

(xi) Phycoerythrin and chlorophyll a is present in phylum:
A. Rhodophyta B. Phaeophyta C. Chrysophyta D. Pyrrophyta

(xii) Which plant is used against snake bite?
A. *Atropa belladona* B. *Arachis hypogea*
C. *Clitoria ternatea* D. *Glycyrrihiza glabra*

(xiii) Which one is **NOT** a bryophyte?
A. Funaria B. Selaginella C. Marchantia D. Polytrichum

(xiv) Which of the following is **NOT** a characteristic of class cyclostomata?
A. Suctorial mouth B. 6 – 14 pairs of gills
C. Body is long eel-like D. Skeleton is bony

(xv) In the respiratory electron transport chain the last cytochrome to accept electron is:
A. Cytochrome a_3 B. Cytochrome c C. Cytochrome b D. Cytochrome a

(xvi) In the digestive system of a cockroach partly digested food is stored in:
A. Gizzard B. Hepatic caecum C. Mesenteron D. Crop

(xvii) Which pair is incorrectly matched?
A. Tuberculosis – Contagious disease B. Emphysema – Alveoli with increase surface area
C. Asthma – Allergic reaction D. Smoking – Lung cancer

For Examiner's use only:

Total Marks: 17

Marks Obtained:

BIOLOGY HSSC–I

Punjab Text Book Board
Old / Revised Syllabus

Time allowed: 2:35 Hours **Total Marks Sections B, C and D: 68**

NOTE: The Questions of sections B, C and D are to be answered on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 21)

(Chapters 1 – 8)

Q. 2 Answer any SEVEN parts from the following. All parts carry equal marks. **(7 x 3 = 21)**

(i) Define the following terms:
a. Biome b. Prion c. Polysome

(ii) a. Draw structure of a triacyl glycerol.
b. How is tertiary structure of protein formed?

(iii) How are congenital diseases related to lysosomal enzymes? Briefly explain.

(iv) State the functions of following with respect to a bacterial cell:
a. Slime b. Mesosomes c. Pili

(v) What is meant by Mycorrhizae? Explain its types briefly.

(vi) a. How are the ciliates different from other protozoans?
b. Describe the structure of feeding stage of a slime mold.

(vii) Describe techniques which are applied to control microorganisms physically.

(viii) Complete the table for the three types of Hepatitis given below:

Characteristic	HAV	HAB	HAC
Mode of transmission			
Genome of virus			

(ix) What are reversible inhibitors? Describe their types briefly.

(x) a. What do you mean by parasexuallity?
b. What are the characteristics of Dinoflagellates?

SECTION – C (Marks 21)

(Chapters 9 – 14)

Q. 3 Answer any SEVEN parts from the following. All parts carry equal marks. **(7 x 3 = 21)**

(i) Write down characteristics of Class Hirudinea.

(ii) Summarize economic importance of phylum Mollusca.

(iii) Write down the biological names of:
a. Amaltas b. Red pepper c. Pin worm

(iv) Differentiate between Chlorophyll a and Chlorophyll b.

(v) How does a hydra capture its prey? How is food digested in its body?

(vi) Describe any two factors which affect capacity of haemoglobin to combine with oxygen?

(vii) Relate starch sugar hypothesis to the opening closing of stomata.

(viii) Enlist any three functions of the lymphatic system.

(ix) Differentiate between Alcoholic and lactic acid fermentation.

(x) Describe how a sporophyte of a horn wort is much advanced than other bryophytes?

SECTION – D (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. **(2 x 13 = 26)**

Q. 4 a. How is carbondioxide transported in the body? **05**

b. Explain life cycle of Adiantum. **08**

Q. 5 a. Draw infection Cycle of HIV. **07**

b. Describe Cyclic Phosphorylation with the help of a diagram. **06**

Q. 6 a. Explain role of stomach in the digestion of food. **08**

b. Give an account of animal diseases caused by fungi. **05**

Roll No. | | | | | | |

Answer Sheet No._____

Sig. of Candidate._____

Sig. of Invigilator._____

BIOLOGY HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes

Punjab Text Book Board
Old / Revised Syllabus

NOTE: Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) Monocytes stay in blood for about _____ hours.
A. 10 – 30 B. 10 – 12 C. 10 – 20 D. 10 – 15

(ii) Mg makes about _____ % of the total mass of a human being.
A. 0.15 B. 0.05 C. 0.17 D. 0.10

(iii) Hair of a human being are made up of protein:
A. Keratin B. Actin C. Fibrin D. Tubulin

(iv) Which one is **NOT** an inhibitor?
A. Antimetabolites B. Cyanide C. Antibiotics D. Antigens

(v) Indicate which statement is **NOT** related to HIV?
A. Single stranded DNA in genome B. Helper T. Lymphocyte
C. Reverse transcriptase D. Single stranded RNA in genome

(vi) Select the mismatched pair.
A. Centriole – Formation of cilia B. Lysosomes – Extracellular digestion
C. Secondary cell wall – Cutin D. Microtubules – Internal cell motion

(vii) The arrangement of cocci in grape like cluster is known as:
A. Staphylococcus B. Tetrad C. Streptococcus D. Sarcina

(viii) Radiolarians belong to the group of protozoa called:
A. Foraminiferans B. Zooflagellates C. Apicomplexans D. Actinopods

(ix) All are the characteristics of class crustacea except:
A. Absence of Antennae B. Presence of cephalothorax
C. Presence of gills for respiration D. Presence of Carapace for exoskeleton

(x) Fungi can tolerate a range of pH form:
A. 3 – 6 B. 2 – 6 C. 2 – 9 D. 3 – 9

(xi) Select the mismatched pair.
A. Penicillium – antibiotic B. Aspergillus – Soyasauce
C. Neurospora – Genetic research D. Lovastatin – Inhibit fungal growth

(xii) Which characteristic is **NOT** related to phylum Mollusca?
A. Rasping tongue radula B. Triploblastic coelomates
C. Bilaterally symmetrical D. Excretory organ flame cells

(xiii) Each mesophyll cell has about _____ chloroplasts.
A. 30 – 100 B. 20 – 50 C. 30 – 50 D. 20 – 100

(xiv) Which enzyme converts proteins into amino acids?
A. Trypsin B. Pepsin
C. Aminopeptidase D. Erypsin

(xv) Botanical name of oats is:
A. *Hordeum vulgare* B. *Zea mays* C. *Avena sativa* D. *Oryza sativa*

(xvi) Which one is incorrect for inspiration?
A. Increase in space of the chest cavity B. Ribcage move upwards
C. Muscles of diaphragm relax D. Diaphragm becomes less dome shaped

(xvii) Choose the one which is **NOT** maintaining flow of lymph.
A. Breathing movement B. Activity of skeletal muscles
C. Movement of viscera D. Contraction of heart

For Examiner's use only:

Total Marks: 17

Marks Obtained:

BIOLOGY HSSC–I

Punjab Text Book Board
Old / Revised Syllabus

Time allowed: 2:35 Hours **Total Marks Sections B, C and D: 68**

NOTE: The Questions of sections B, C and D are to be answered on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 21)

(Chapters 1 – 8)

Q. 2 Answer any SEVEN parts from the following. All parts carry equal marks. **(7 x 3 = 21)**

(i) Define following terms:
a. Cytosol b. Coenzyme c. Anticeptics

(ii) "Water is an excellent solvent" Justify this statement by your answer.

(iii) a. Briefly describe composition and function of stroma.
b. In which types of seeds glyoxysomes are present. What is their function?

(iv) How cyanobacteria resemble eukaryotes in relation to photosynthesis?

(v) What is penicillium? Give an account of asexual reproduction in it.

(vi) a. What is the chemical composition of cell wall in Diatoms? What is a special feature about their cell wall?
b. Briefly describe a symbiotic zooflagellate.

(vii) Complete the table with reference to bacteria:

Characteristic	Gram-Positive	Gram-Negative
Chemical makeup of cell wall		

(viii) What are the two basic ways to formulate a hypothesis? Briefly describe.

(ix) a. What would happen if enzyme concentration is kept constant and amount of substrate is increased?
b. Into how many regions active site of an enzyme is divided and what are their functions?

(x) Describe characteristics of a virus.

SECTION – C (Marks 21)

(Chapters 9 – 14)

Q. 3 Answer any SEVEN parts from the following. All parts carry equal marks. **(7 x 3 = 21)**

(i) Write down biological names of:
a. Tape worm b. Corn d. Hook worm

(ii) Describe any three differences between proterostomes and Deuterostomes.

(iii) Define polymorphism. In which phylum it exists? Give example of organism showing this phenomena.

(iv) Write a briefly account of chemiosmosis.

(v) a. Define compensation point.
b. How would you distinguish between Absorption spectrum and Action spectrum?

(vi) What is the composition and function of saliva?

(vii) What are the factors which help in exchanging gases across alveoli?

(viii) How would you compare a thrombus and an embolus? Give reasons for thrombus formation.

(ix) Explain briefly the structure of gametophyte of Adiantum.

(x) Classify various proteins in plasma of blood and also write down their functions.

SECTION – D (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. **(2 x 13 = 26)**

Q. 4 a. What is a Megaphyllous leaf? Describe the evolution of a Megaphyllous leaf. **07**

b. What are the general characteristics of polysaccharides? Explain any two examples. **06**

Q. 5 a. Explain life Cycte of a Bacteriophage. **08**

b. Draw Z-Scheme of light reaction. **05**

Q. 6 a. Explain process of Digestion in cockroach. **08**

b. What is lymph? Describe various functions performed by lymphatic system. **05**

Roll No. | | | | | | |

Answer Sheet No._____

Sig. of Candidate._____

Sig. of Invigilator._____

BIOLOGY HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes National Book Foundation **Version Number** 1 7 0 1

NOTE: Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) The suppressor T cells release Cytokines that inhibit the activity of:
A. T and B Cells B. Helper T Cell C. Macrophages D. Natural Killer Cells

(ii) Trypsinogen is secreted by pancreas. Trypsinogen is converted into its active form, trypsin in the Duodenum in the presence of:
A. Gastrin B. Secretin C. Enterokinase D. *HCl*

(iii) The _____ are exclusively marine animals.
A. Coelentrates B. Echinodermates
C. Platyhelminthes D. Mulluscans

(iv) The low level of _____ in the leaf favours the opening of stomata.
A. Carbondioxide B. Glucose C. Water D. Oxygen

(v) One of the important features of Pteropsida is:
A. Heterospory B. Club Shaped Strobili
C. Presence of Rhizoids D. Circinate Vernation

(vi) _____ is the procedure that separates molecules on the basis of their size, shape, molecular weight and surface charge.
A. Centrifugation B. Electrophoresis
C. Chromatography D. Spectrophotometry

(vii) Which of the following is **NOT** true about Cellulose?
A. It is an polymer of glucose B. It is an abundant carbohydrate
C. It is an important food source for animals D. It is highly branched Polysaccharide

(viii) In the life cycle of HIV, penetration of virus into host cell is followed by:
A. Reverse transcription B. Replication
C. Biosynthesis D. Breakdown

(ix) All **EXCEPT** _____ is not associated with Protostomes.
A. Spiral cleavage B. Schizocoelome
C. Blastopore develop into anus D. Annelids

(x) _____ cells of stomach secrete hydrochloric acid.
A. Goblet Cells B. Chief cells
C. Zymogen Cells D. Parietal cells

(xi) The largest multicellular algae, Kelps belongs to:
A. Brown algae B. Red algae
C. Dinoflagellates D. Green algae

(xii) _____ is the example of facultative bacteria.
A. Pseudomonas B. E.Coli
C. Comphylobactor D. Spirochaeta

(xiii) Within the liver, blood is passed through a series of dilated capillaries called:
A. Sinusoids B. Sinus venosus
C. Sinus Channels D. Vena Cava

(xiv) _____ organelle is more active in the germinating seeds, the enzymes of which convert stored fats into carbohydrates.
A. Leucoplast B. Lysosomes C. Golgi bodies D. Glyoxisomes

(xv) _____ is **NOT** the property of enzymes.
A. Proteinecious molecules
B. Non-Specificity to substrate
C. Sensitive to pH and Temperature variation
D. Decrease activation energy

(xvi) The precursor molecule to initiate Krebs Cycle is:
A. Pyrovate B. Acetyle Co-A C. Malate D. Citrate

(xvii) _____ is a fibrous protein.
A. Collagen B. Haemoglobin C. Enzyme D. Insulin

For Examiner's use only:

Total Marks: 17

Marks Obtained:

BIOLOGY HSSC–I

National Book Foundation

Time allowed: 2:35 Hours **Total Marks Sections B and C: 68**

NOTE: Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2 Answer any FOURTEEN parts. The answer to each part should not exceed 3 to 4 lines. (14 x 3 = 42)

(i) The oxidative activity of RUBISCO enzyme is affected by temperature. Briefly describe.

(ii) Give similarities and differences between Chloroplast and Mitochondria.

(iii) Write down three functions of Proteins.

(iv) How can the transmission of HIV be prevented?

(v) Draw the structures of Aldo and Keto Triose Sugar.

(vi) Write one function of each (a) Rough Endoplasmic reticulum (b) Golgi Bodies (c) Lysosomes

(vii) What is endospore? When and why is it formed in a bacterium?

(viii) Give common features of Bryophytes.

(ix) How do Xerophytes maintain their osmoregulation?

(x) State the digestion of food in oral cavity?

(xi) What are the advantages of Fever?

(xii) Draw the label Diagram of Antibody.

(xiii) What are the risks associated with atherosclerosis?

(xiv) Differentiate between primary and secondary growth in Plants.

(xv) What do you know about Pulmonary circuit?

(xvi) Name the two types of Zoids in Cnidarian with their functions.

(xvii) How does the substrate concentration affect the rate of enzyme action?

(xviii) Enlist three functions of large intestine.

(xix) What is bacterial conjugation? Give its importance for a Bacterium.

SECTION – C (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. (2 x 13 = 26)

Q. 3 **a.** Give the detail mechanism and Schematic representation of Calvin cycle. **07**

b. Describe different classes of Enzymes. **06**

Q. 4 **a.** How do the digestion and absorption of food occur in small intestine? **07**

b. Describe the evolution of seed in plants. **06**

Q. 5 **a.** Write the characteristics of Ascomycota. **06**

b. Give a detail note on Human Lymphatic System. **07**

Roll No. | | | | | | |

Answer Sheet No._____

Sig. of Candidate._____

Sig. of Invigilator._____

CHEMISTRY HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes (Revised Syllabus) | Version Number | 1 | 7 | 0 | 2 |

NOTE:- Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) Which one of the following metal cannot displace H_2 from H_2O ?

A. Cu B. Na C. K D. Ca

(ii) The number of covalent bonds present in $8\ g\ CH_4$ are:

A. 1.204×10^{24} B. 3.01×10^{23} C. 6.02×10^{23} D. 6.02×10^{24}

(iii) Paschen series of spectral lines is produced due to transition of electrons from higher orbit to the:

A. 4th orbit B. 1st orbit C. 2nd orbit D. 3rd orbit

(iv) Which set of quantum numbers is **NOT** valid for an electron?

A. $n=3\ ,\ l=2\ ,\ m=-2$ B. $n=1\ ,\ l=1\ ,\ m=0$

C. $n=2\ ,\ l=0\ ,\ m=0$ D. $n=3\ ,\ l=1\ ,\ m=-1$

(v) The central atom is sp^2 hybridized in:

A. CH_4 B. $BeCl_2$ C. BF_3 D. H_2O

(vi) Which one of the following has greater bond energy?

A. $N\equiv N$ B. $C\equiv O$ C. $C\equiv N$ D. $C\equiv C$

(vii) Which one of the following gases possesses lowest density?

A. CH_4 B. CO_2 C. N_2 D. NH_3

(viii) If both the pressure and temperature of a gas are doubled, the volume will:

A Remain same B. Become double

C. Increase four times D. Become half

(ix) The boiling points of NH_3 , H_2O and HF decrease in the order:

A $HF > NH_3 > H_2O$ B. $H_2O > NH_3 > HF$

C. $H_2O > HF > NH_3$ D. $HF > H_2O > NH_3$

(x) The existence of two compounds in the same crystalline form is known as:

A. Allotropy B. Anisotropy C. Isomorphism D. Polymorphism

(xi) In the reaction $N_2O_4 \rightleftharpoons 2NO_2$ $\Delta H = +57.2\ kj$ the equilibrium will be shifted in forward direction by:

A. Increasing the concentration of NO_2 B. Increasing the temperature

C. Increasing the pressure D. Decreasing the volume

(xii) Which salt will form acidic solution in water?

A. K_2CO_3 B. KCl C. $NaBr$ D. NH_4Cl

(xiii) The order of enzyme catalysed reaction is:

A. 3 B. 0 C. 1 D. 2

(xiv) The boiling point of 0.1 molal solution of glucose in water is:

A. $105.2\,^\circ C$ B. $100.52\,^\circ C$ C. $100.052\,^\circ C$ D. $101.86\,^\circ C$

(xv) 18 g glucose is dissolved in 180 g water. The relative lowering in vapour pressure is:

A. 0.001 B. 10 C. 1.8 D. 0.01

(xvi) The standard enthalpy of formation is zero for:

A. $C_6H_{12}O_6$ B. O_2 C. H_2O D. $NaCl$

(xvii) One coulomb is the charge carried by:

A. 9.11×10^{31} electrons B. 6.25×10^{18} electrons

C. 1.602×10^{19} electrons D. 6.02×10^{23} electrons

For Examiner's use only:

Total Marks: 17

Marks Obtained:

CHEMISTRY HSSC–I

(Revised Syllabus)

Time allowed: 2:35 Hours **Total Marks Sections B, C and D: 68**

NOTE: The Questions of sections B, C and D are to be answered on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 21)

(Chapters 1 to 6)

Q. 2 Answer any SEVEN parts. All parts carry equal marks. **(7 x3 = 21)**

(i) One mole of H_2SO_4 should completely react with two moles of $NaOH$. How does Avogadro's number help to explain it?

(ii) Calculate the radius of first orbit of Hydrogen atom and Helium ion. Which one has smaller radius? Give reason.

(iii) Describe the reason for the production of X-rays.

(iv) Draw the molecular orbital diagram for F_2 and calculate its bond order.

(v) State and explain Joule – Thomson effect.

(vi) a. State Graham's law.

b. Determine the molar mass of a gas which diffuses four times faster as compared to SO_2 gas.

(vii) Calculate the bond energy of HBr. Bond energy of H_2 is 436 kj/mol and that of Br_2 is 193 kj/mol.

(viii) Explain why?

a. Evaporation is a cooling process.

b. C_6H_{14} is a liquid whereas C_2H_6 is a gas.

(ix) Write any three differences between molecular and metallic solids.

(x) What is absolute zero? How will you derive it from Charles' law?

SECTION – C (Marks 21)

(Chapters 7 to 12)

Q. 3 Answer any SEVEN parts. All parts carry equal marks. **(7 x3 = 21)**

(i) Describe the effect of increase in pressure and temperature on the following reaction at equilibrium: $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \qquad \Delta H = -198\ kj$

(ii) a. What is a precipitation reaction?

b. How will you predict the formation of precipitates when two solutions are mixed together?

(iii) What is levelling effect? Describe giving an example.

(iv) Write down any three applications of buffer solutions.

(v) a. For the reaction $NO_2 + CO \longrightarrow NO + CO_2$ Rate $= K[NO_2]^2$ write down the mechanism.

b. What will happen if the concentration of CO is increased three times in the above reaction? Justify your answer.

(vi) What is Arrhenius equation? How this equation describes the effect of increase in temperature on the rate constant and rate of a reaction?

(vii) Concentration of H_2SO_4 is 98% w/w. Its density is $1.84\ g/cm^3$. Calculate the molarity and molality of this solution.

(viii) Define Osmotic pressure, Colloids, and Molal Freezing point Depression constant.

(ix) What is Calorimetry? Briefly describe its types.

(x) Describe the rusting of iron, giving the reactions taking place during the process.

SECTION – D (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. **(13 x 2 = 26)**

(Question 4 from Chapters 1 to 6)

Q. 4 **a.** Define hybridization. Name its types? Explain the structure of ethyne on the basis of hybridization. **(1+1+5)**

b. Derive a relationship for total energy of electron present in nth orbit of hydrogen atom. **(6)**

(Question 5 from Chapters 7 to 12)

Q. 5 **a.** Describe the quantitative aspect of elevation in boiling point. **(6)**

b. What is Born Haber cycle? Draw a labelled Born-Haber cycle for the formation of $NaCl$. **(2+5)**

(Question 6 Part (a) from Chapters 1 to 6 and Part (b) Chapters 7 to 12)

Q. 6 **a.** Differentiate between limiting and non-limiting reactants. Calculate the mass of NH_3 produced when $100\ g\ Ca(OH)_2$ is reacted with $100\ g\ NH_4Cl$.

$$Ca(OH)_2 + 2NH_4Cl \longrightarrow CaCl_2 + 2NH_3 + 2H_2O$$ **(2+4)**

b. Describe the construction and working of an ordinary dry cell and alkaline dry cell, giving the reactions taking place at anode and cathode. **(7)**

Roll No. | | | | | | | Answer Sheet No._____

Sig. of Candidate._____ Sig. of Invigilator._____

CHEMISTRY HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes (Revised Syllabus) | Version Number | 1 | 7 | 0 | 5 |

NOTE:- Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) The number of H^+ ions produced by complete ionization of $9.8\ g\ \ H_3PO_4$ is:

A. 6.022×10^{22} B. 1.204×10^{23} C. 1.806×10^{23} D. 2.40×10^{23}

(ii) When $^{65}_{29}Cu$ is bombarded with slow neutrons, the radiations emitted are:

A. α – rays B. β – rays C. γ – rays D. X – rays

(iii) The radius of 1st orbit of Li^{+2} ion is:

A. $0.176\,A^\circ$ B. $0.2645\,A^\circ$ C. $0.529\,A^\circ$ D. $2.116\,A^\circ$

(iv) The molecular geometry is determined by the repulsion between only the bond pairs in:

A. $SnCl_2$ B. $PbCl_2$ C. PCl_3 D. BCl_3

(v) The energy of σ_{2px} orbital is higher than $\pi 2py$ & $\pi 2pz$ orbitals in the molecular orbital diagram of:

A. N_2 B. O_2 C. O_2^{+2} D. F_2

(vi) The volume occupied by $14\ g\ N_2$ gas at STP is:

A. $1.12dm^3$ B. $2.24dm^3$ C. $11.2dm^3$ D. $22.4dm^3$

(vii) The relative rate diffusion of CH_4 and SO_2 gases is:

A 2:1 B. 1:2 C. 1:4 D. 4:1

(viii) Hydrogen bonding is **NOT** involved in:

A High b.p. of H_2O B. Solubility of CH_3OH in water

C. Cleansing action of soap D. Existence of C_6H_{14} in liquid state

(ix) Which one of the following ionic compound possesses greater lattice energy:

A. $NaCl$ B. KCl C. $MgCl_2$ D. $CaCl_2$

(x) The value of Kc and Kp will be the same for the reaction:

A. $N_2+3H_2 \rightleftharpoons 2NH_3$ B. $2SO_2+O_2 \rightleftharpoons 2SO_3$

C. $N_2+O_2 \rightleftharpoons 2NO$ D. $N_2O_4 \rightleftharpoons 2NO_2$

(xi) pH of $0.001\ M\ \ Ca(OH)_2$ is:

A. 3 B. 2.7 C. 11 D. 11.3

(xii) The rate constant is equal to the rate of reaction if the order of reaction is:

A. 0 B. 1 C. 2 D. 3

(xiii) The molarity of $100cm^3$ solution containing $4\ g\ NaOH$ is:

A. 0.1 M B. 0.5 M C. 1.0 M D. 1.5 M

(xiv) A colloid containing a liquid dispersed into another liquid is called:

A. Sol B. Gel C. Aerosol D. Emulsion

(xv) Which one of the following enthalpy is always negative?

A. Enthalpy of formation B. Enthalpy of solution

C. Enthalpy of atomization D. Enthalpy of combustion

(xvi) The number of moles of Cr deposited by passing 1.5 F electricity in the following reaction $Cr^{+3}+3\bar{e} \rightarrow Cr$ is:

A. 0.5 moles B. 1.0 mole C. 1.5 moles D. 3 moles

(xvii) The number of electrons required to balance the following half equation $SO_2+2H_2O \rightarrow SO_4^{2-}+4H^+$ is:

A. $1\,e$ B. $2\,e$ C. $3\,e$ D. $4\,e$

For Examiner's use only:

Total Marks: 17

Marks Obtained:

CHEMISTRY HSSC–I

(Revised Syllabus)

Time allowed: 2:35 Hours **Total Marks Sections B, C and D: 68**

NOTE: The Questions of sections B, C and D are to be answered on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B If required. Write your answers neatly and legibly.

SECTION – B (Marks 21)

(Chapters 1 to 6)

Q. 2 Answer any SEVEN parts. All parts carry equal marks. **(7 x3 = 21)**

(i) Why the actual yield in a chemical reaction is less as compared to the theoretical yield?

(ii) Calculate the wave number of radiation emitted when an electron shifts from 4th and 2nd orbit in hydrogen atom. Also name the series of spectral lines formed by these radiations.

(iii) Justify that the e/m ratio of cathode rays is independent of nature of gas whereas that of positive rays depends upon it.

(iv) Explain briefly the structure of $SnCl_2$ and PCl_5 on the basis of VSEPR theory.

(v) The observed dipole moment of HCl is 1.03D and bond length is 127 pm. Calculate percentage ionic character in HCl .

(vi) $150\ cm^3$ of H_2 gas effuses through a porous partition in 10 seconds. In how much time the same volume of O_2 gas will effuse?

(vii) a. State Dalton's law of partial pressure.

b. How this law describes the process of breathing at high altitude?

(viii) Describe vacuum distillation, giving its one application.

(ix) Define Anisotropy, Transition Temperature, and Cleavage plane.

(x) What are the liquid crystals? Write down their two uses in medical science.

SECTION – C (Marks 21)

(Chapters 7 to 12)

Q. 3 Answer any SEVEN parts. All parts carry equal marks. **(7 x3 = 21)**

(i) a. Define solubility product.

b. Calculate the solubility of $PbSO_4$ when $Ksp = 1.96\times10^{-8}$ at 25^oC .

(ii) What is the effect of increase in temperature on equilibrium position and the value of Kc on the given reaction? $N_2O_4 \rightleftharpoons 2NO_2 \quad \Delta H = +57.2 \ kj/mol$

(iii) a. State Bronsted – Lowry concept of acids and bases.

b. Prove that CH_3COOH acts as a Bronsted acid as well as a base.

(iv) What is a zero order reaction? Give two examples.

(v) Differentiate between homogeneous and heterogeneous catalysis, giving one example of each.

(vi) Write down the three statements of Raoult's law.

(vii) Write down three differences between molarity and molality.

(viii) Balance the equation by oxidation number method. $MnO_2 + HCl \rightarrow MnCl_2 + H_2O + Cl_2$

(ix) Find out the cell potential for Ni/Mg cell. The values of reduction potential for half reactions are:

$$Ni^{+2} + 2e \rightleftharpoons Ni \qquad E^o = -0.25\ V$$
$$Mg^{+2} + 2e \rightleftharpoons Mg \qquad E^o = -2.38\ V$$

(x) Calculate ΔH for the following reaction $S + O_2 \rightarrow SO_2$ from the following data:

$$S + \frac{3}{2}O_2 \longrightarrow SO_3 \qquad \Delta H = -395.2\ kj$$
$$2SO_2 + O_2 \longrightarrow 2SO_3 \qquad \Delta H = -198.2\ kj$$

SECTION – D (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. **(13 x 2 = 26)**

(Question 4 from Chapters 1 to 6)

Q. 4 **a.** Derive Vander Waal equation for a non-ideal gas. **(07)**

b. Differentiate between Sp^3 , Sp^2 and Sp hybridizations. Write any two differences. **(06)**

(Question 5 from Chapters 7 to 12)

Q. 5 **a.** Describe the quantitative aspects of depression in Freezing point with the help of a graph. **(06)**

b. Explain the construction and working of lead storage battery. Write down the reactions taking place at the electrodes during the discharging process. **(07)**

(Question 6 Part (a) from Chapters 1 to 6 and Part (b) Chapters 7 to 12)

Q. 6 **a.** Explain the origin of spectrum of hydrogen atom on the basis of Bohr's atomic model. What are the different series of spectral lines present in the infrared region of this spectrum and how they are formed? **(06)**

b. Explain how the mixture of CH_3COOH and CH_3COONa acts as a buffer. Also calculate the pH of a buffer containing $0.1\ M\ CH_3COOH$ and $1.0\ M\ CH_3COONa$. The value of PKa for CH_3COOH is 4.76 . **(07)**

Roll No. | | | | | | | Answer Sheet No._____

Sig. of Candidate._____ Sig. of Invigilator._____

CHEMISTRY HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes **(Old Syllabus)**

NOTE: Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) The spectrum of the different isotopes in the Mass-spectrometer is done on the basis of:
- A. Different amount of positive charge on each ion
- B. Different e/m value
- C. Different m/e value
- D. Velocities of the ions

(ii) The volume occupied by 1.8 g of O_2 at STP is:
A. $22.4\ dm^3$ B. $1.26\ dm^3$ C. $1.12\ dm^3$ D. $112\ dm^3$

(iii) When hot saturated solution is cooled very rapidly we get?
- A. Medium sized crystals
- B. Large sized crystals
- C. Premature crystallization of the substance
- D. No crystallization

(iv) A graph obtained from Boyle's law is:
A. A straight line B. A curve with maximum
C. A curve with minimum D. A parabolic curve called Isotherm

(v) The critical temperature of Ar gas is low as compared to NH_3 and SO_2 due to the reason that:
A. Ar is monoatomic gas B. It has a small size
C. It has low polarizability D. It has four lone pairs in it

(vi) Which one of the following liquids has lowest vapour pressure at 32^oC ?
A. Ether B. Chloroform C. Ethanol D. Water

(vii) $NaCl$ is a face-centered cubic structure. The Na^+ ion at the face of the unit cell is shared by:
A. Two unit cells B. Four unit cells
C. Only one unit cell D. Eight unit cells

(viii) When 6d orbital is complete, the entering electron goes into:
A. 7f B. 7s C. 7p D. 7d

(ix) Which of the following molecules has zero-dipole moment?
A. NH_3 B. $CHCl_3$ C. H_2O D. BF_3

(x) Calorie is equivalent to:
A. 0.418 J B. 41.84 J C. 4.184 J D. 418.4 J

(xi) The unit of equilibrium constant Kc for the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ will be:
A. $dm^{+6}mole^{-2}$ B. $mole^2dm^{-6}$ C. $mole\ dm^{-3}$ D. Having no units

(xii) If more solvent is added to solution, the value of heat of solution:
- A. Increases
- B. Decreases
- C. Is not affected
- D. Is affected only when the solution is infinitely diluted

(xiii) If a strip of Cu metal is placed in a solution of $FeSO_4$ then:
A. Cu will be deposited B. Fe is precipitated out
C. Cu and Fe both dissolve D. No reaction takes place

(xiv) The unit of rate constant is the same as that of the rate of reaction in:
A. First order reaction B. Second order reaction
C. Third order reaction D. Zero order reaction

(xv) After 3-half-lives of a chemical reaction the percentage fraction of the amount left is:
A. 6.25 B. 75 C. 12.5 D. 50

(xvi) Number of sigma bond(s) between two carbon atoms in C_2H_2 is/are:
A. One B. Two C. Three D. Four

(xvii) The Iodine present in water can be separated by which one of the following techniques?
A. Sublimation B. Filtration C. Chromatography D. Solvent extraction

For Examiner's use only:

Total Marks: 17

Marks Obtained:

CHEMISTRY HSSC–I

(Old Syllabus)

Time allowed: 2:35 Hours **Total Marks Sections B and C: 68**

NOTE: Sections B and C comprise pages 1 – 2. Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly. Periodic table will be provided on demand.

SECTION – B (Marks 42)

Q. 2 Answer any FOURTEEN parts. The answer to each part should not exceed 5 to 6 lines. (14 x 3 = 42)

(i) What are the number of covalent bonds in $8g$ of CH_4?

(ii) What is the distribution co-efficient K? To which technique is it applicable?

(iii) Justify that the volume of the given mass of a gas becomes theoretically zero at $-273^{o}C$.

(iv) Propanone (CH_3COCH_3), Propanol $(CH_3CH_2CH_2OH)$ and butane $(CH_3CH_2CH_2CH_3)$ have very similar relative molar masses. List them in order of increasing boiling points. Explain your answer.

(v) What is the $H\alpha$ – line in hydrogen spectrum?

(vi) How do you justify that the distances between adjacent orbitals of H atoms go on increasing from lower to higher orbits?

(vii) Define Zeeman effect and stark effect.

(viii) Calculate the number of electrons in s, p, d, f subshells with the help of formula.

(ix) Calculate the value of principal quantum number if an electron in hydrogen atom revolves in an orbit of energy $-0.242\times10^{-18}J$.

(x) How can the percentage of ionic character of the polar bond be determined?

(xi) When do different types of chemical equilibrium constant for a reaction become equal?

(xii) Define Raoult's law in three different ways.

(xiii) The solubility product of Ag_2CrO_4 is 2.6×10^{-2} at $25\,°C$. Calculate the solubility of the compound.

(xiv) 4.675 g of a compound with empirical formula C_3H_3O were dissolved in 212.5 g of pure benzene. The freezing point of solution was found $1.02\,°C$ less than that of pure benzene. The molal freezing point constant of benzene is $5.1\,°C$. Calculate the relative molar mass.

(xv) Write down the reactions in Alkaline battery. What is its voltage?

(xvi) How is the Voltaic cell represented?

(xvii) When does the reaction become Zero-order?

(xviii) Balance the given equation by acidic medium $IO_3^{1-} + AsO_3^{3-} \longrightarrow AsO_4^{3-} + I^-$

(xix) Differentiate between the internal energy change and enthalpy change.

SECTION – C (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. (2 x 13 = 26)

Q. 3 **a.** Calculate the number of grams of Al_2S_3 which can be prepared by the reaction of 20 g of Al and 30 g of sulphur. How much non-limiting reactant is in excess? **04**
Atomic masses: $Al = 27$ $S = 32$

b. Why is experimental yield mostly less than the theoretical yield? **03**

c. Write down the postulates of VSEPR theory. Discuss the structures of NH_3, SO_2 with reference to this theory. **2+2+2**

Q. 4 **a.** How can the lattice energy of the ionic compound be measured by Born-Haber cycle? **06**

b. What is Le-Chatelier's principle? Write down the effect of catalyst on equilibrium constant. **1+3**

c. Explain how is the pressure of dry gas equal to the difference of total pressure and aqueous tension of water? **03**

Q. 5 **a.** Define and explain the Arrhenius equation. How does Arrhenius equation help us to calculate the energy of activation of a reaction? **2+4**

b. What are the advantages of vacuum distillation? **04**

c. State the biological applications of liquid crystal. **03**

Roll No. | | | | | | |

Answer Sheet No._____

Sig. of Candidate._____

Sig. of Invigilator._____

COMPUTER SCIENCE HSSC–I

SECTION – A (Marks 15)

Time allowed: 20 Minutes

NOTE: Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) Which of the following is a non-impact printer?

A. Dot-matrix B. Daisy wheel C. Line printer D. Inkjet printer

(ii) The process of converting analogue signals into digital signals is called:

A. Modulation B. Switching C. Signalling D. Demodulation

(iii) Which problem occurs when two workstations on shared Ethernet try to access LAN at the same time?

A. Termination B. Deadlock C. Collision D. Concession

(iv) The individual images that make up a video are called:

A. Frames B. Pixels C. Digits D. Bytes

(v) What comes after analysis phase in the SDLC?

A. Support B. Design C. Testing D. Implementation

(vi) Testing all program components together is called:

A. Volume testing B. Group testing C. System testing D. Composite testing

(vii) A connection for just similar networks uses:

A. Bridge B. Gateway C. Hub D. Route

(viii) Data link layer have two sub layers:

A. LLC and MAC B. CS and MA

C. Token and Ring D. Intranet and extranet

(ix) The most common protocol used for E-mail is:

A. FTP B. SMTP C. JPEG D. Telnet

(x) Which of the following topology uses switch?

A. Bus B. Star C. Ring D. Mesh

(xi) Internet surfing is an example of:

A. Simplex B. Half duplex C. Full Duplex D. Uploading

(xii) The step that obtains the next instruction from memory is called:

A. Read B. Fetch C. Get D. Decode

(xiii) Which of the following is faster?

A. Register B. Cache C. RAM D. Buffer

(xiv) Which of the following technique uses modulation?

A. Bandwidth B. Broadband C. Baseband D. Encryption

(xv) The tool used to find a similar or alternative word in a document is called:

A. Finder B. Thesaurus C. Dictionary D. Style checker

For Examiner's use only:

Total Marks: 15

Marks Obtained:

COMPUTER SCIENCE HSSC–I

Time allowed: 2:40 Hours **Total Marks Sections B, C and D: 60**

NOTE: The Questions of sections B, C and D are to be answered on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 21)

Note: Section – B consists of following topics of the syllabus:

a.	Basic concepts of IT	**b.**	Data Communication
c.	Hardware and System Software	**d.**	Information Networks
e.	Applications and use of computers		

Q. 2 Answer any SEVEN parts. All parts carry equal marks. (7 x3 = 21)

(i) What are features of an operating system?

(ii) Define computer Bus. Describe System Bus and Expansion Bus.

(iii) Describe different types of computer software.

(iv) Describe Asynchronous and Synchronous transmission.

(v) Explain briefly the working of Inkjet printer.

(vi) Define computer Network. Also give two uses of computer Network.

(vii) Briefly differentiate between hard disk and floppy disk.

(viii) What is fiber optics cable? Give two disadvantages of fiber optics cable.

(ix) Describe the importance of testing phase. How the system is tested?

(x) Explain briefly computer Simulation. What are its benefits?

SECTION – C (Marks 21)

Note: Section – C consists of following topics of the syllabus:

a.	Security, copyright and the law	**b.**	Operating systems (Windows)
c.	Word processing (using MS-Word 2000)	**d.**	Spreadsheet (Using MS-Excel 2000)
e.	Internet, Internet browsing and E-mail		

Q. 3 Answer any SEVEN parts. All parts carry equal marks. (7 x3 = 21)

(i) Describe some ways in which the security of data may be violated.

(ii) Write the procedure to insert page number in a document.

(iii) How can we protect the computer system from a virus? Give any two precautionary steps.

(iv) Define Recycle Bin. Write steps to restore files or folders from recycle bin.

(v) Briefly write a note on Newsgroup.

(vi) How is the use of Internet affecting Society negatively?

(vii) Briefly discuss the rules for files and folders names.

(viii) What is difference between function and formula?

(ix) Explain briefly the following terms:

a. Word Wrap b. Thesaurus

(x) What is copyright and what types of works are protected by copyright?

SECTION – D (Marks 18)

Note: Attempt any THREE questions. All questions carry equal marks. (3 x 6 = 18)

Q. 4 What is data protection act? Explain the data protection principles. **(06)**

Q. 5 Explain the Fetch-Decode-Execute cycle of CPU. **(06)**

Q. 6 Discuss the functions of transport layer, session layer and presentation layer. **(06)**

Q. 7 Discuss the advantages of Internet in detail. **(06)**

Roll No. | | | | | | |

Answer Sheet No._____

Sig. of Candidate._____

Sig. of Invigilator._____

MATHEMATICS HSSC–I

SECTION – A (Marks 20)

Time allowed: 25 Minutes

Version Number	1	7	0	2

NOTE: **Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.**

Q. 1 **Circle the correct option i.e. A / B / C / D. Each part carries one mark.**

(i) Reference angle lies in quadrant:
A. IV B. I C. II D. III

(ii) The set $\{0,1\}$ is closed w.r.t:
A. Division B. Addition C. Subtraction D. Multiplication

(iii) $\sqrt{-5}$ belongs to the set of:
A. Rational Numbers B. Real Numbers
C. Complex Numbers D. Integers

(iv) The set of integers Z is a group under:
A. Addition B. Subtraction C. Division D. Multiplication

(v) A declarative statement which may be true or false but not both is called:
A. Tautology B. Proposition C. Deduction D. Induction

(vi) If $A=\begin{bmatrix} x & 1 \\ 1 & 1 \end{bmatrix}$ and A is singular matrix, then $x=$
A. 3 B. 0 C. 1 D. 2

(vii) The product of all fourth roots of unity is:
A. 2 B. 1 C. 0 D. -1

(viii) A fraction in which the degree of numerator is less than the degree of the denominator is called:
A. Algebraic Relation B. Improper Fraction
C. Proper Fraction D. Equation

(ix) $1^3+2^3+3^3+.....+n^3=$
A. $\frac{n^2(n+1)^2}{4}$ B. $\frac{n(n+1)(2n+1)}{6}$ C. $\left[\frac{n(n+1)}{2}\right]^3$ D. $\frac{n(n+1)(2n+1)}{3}$

(x) An infinite Geometric series converges only if:
A. $r=-1$ B. $r=1$ C. $|r|>1$ D. $|r|<1$

(xi) An event E is said to be sure if:
A. $P(E)=\infty$ B. $P(E)=0$ C. $P(E)=1$ D. $P(E)=-1$

(xii) Numbers of terms in the expansion of $(a+b)^n$ is:
A. n^2+1 B. $n+1$ C. $n-1$ D. n

(xiii) The sum of odd coefficients in the expansion of $(1+x)^n$ is:
A. 2^{n+1} B. n^2 C. 2^n D. 2^{n-1}

(xiv) $\tan\left(\frac{3\pi}{2}-\theta\right)=$
A. $-\cot\theta$ B. $\tan\theta$ C. $-\tan\theta$ D. $\cot\theta$

(xv) If $\cot\theta<0$ and if $\cos\theta>0$, then the terminal arm of angle lies in the quadrant:
A. IV B. I C. II D. III

(xvi) $\sin 3\alpha=$
A. $4\sin\alpha-3\sin^3\alpha$ B. $4\cos^3\alpha-3\cos\alpha$ C. $3\cos^3\alpha-4\cos\alpha$ D. $3\sin\alpha-4\sin^3\alpha$

(xvii) The period of $3\sin 3x$ is:
A. 6π B. $\frac{\pi}{3}$ C. $\frac{\pi}{2}$ D. $\frac{2\pi}{3}$

(xviii) The range of $\cot x$ is:
A. R^- B. R C. $[-1,1]$ D. R^+

(xix) The circle passing through the vertices of the triangle is called:
A. Unit circle B. Circum circle C. In-circle D. Escribed circle

(xx) The domain of principal cosine function is:
A. $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ B. $\left[0,\frac{\pi}{2}\right]$ C. $[0,\pi]$ D. $\left[0,\frac{3\pi}{2}\right]$

For Examiner's use only:

Total Marks: 20

Marks Obtained:

MATHEMATICS HSSC–I

Time allowed: 2:35 Hours **Total Marks Sections B and C: 80**

NOTE: Attempt any ten parts from Section 'B' and any five questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly. Graph paper will be provided on request.

SECTION – B (Marks 40)

Q. 2 Attempt any TEN parts. All parts carry equal marks. **(10 x 4 = 40)**

(i) Simplify by using De Moivre's Theorem $\left(\frac{-1}{2}+\frac{\sqrt{3}}{2}i\right)^3$

(ii) Give logical prove of the theorem $(A\cup B)' = A'\cap B'$

(iii) Without expansion verify that $\begin{vmatrix} -a & 0 & c \\ 0 & a & -b \\ b & -c & 0 \end{vmatrix} = 0$

(iv) Find the values of a and b if -2 and 2 are the roots of the polynomial $x^3 - 4x^2 + ax + b$.

(v) Resolve into partial fractions $\frac{x^2+1}{x^3+1}$

(vi) Insert four harmonic means between $\frac{7}{3}$ and $\frac{7}{11}$.

(vii) Find the values of n and r, when ${}^{n-1}C_{r-1} : {}^nC_r : {}^{n+1}C_{r+1} = 3:6:10$

(viii) Show that the middle term of $(1+x)^{2n}$ is $\frac{1.3.5....(2n-1)}{n!}2^n x^n$.

(ix) Prove that $\frac{\tan\theta+\sec\theta-1}{\tan\theta-\sec\theta+1} = \tan\theta+\sec\theta$

(x) Without using table or calculator, prove that $\sin 19^\circ \cos 11^\circ + \sin 71^\circ \sin 11^\circ = \frac{1}{2}$

(xi) Find the period of cosine function.

(xii) The sides of the triangle are x^2+x+1, $2x+1$ and x^2-1. Prove that the greatest angle of the triangle is 120°.

(xiii) Show that $\cos^{-1}(-x) = \pi - \cos^{-1} x$

(xiv) Solve $\sin x + \cos x = 0$

SECTION – C (Marks 40)

Note: Attempt any FIVE questions. All questions carry equal marks. **(5 x 8 = 40)**

Q. 3 Use matrices to solve the following system

$$x+y = 2$$
$$2x-z = 1$$
$$2y-3z = -1$$

Q. 4 Show that the roots of equation $(x-a)(x-b)+(x-b)(x-c)+(x-c)(x-a)=0$ are real.

Also show that the roots will be equal only if $a=b=c$.

Q. 5 Show that the sum of n A.Ms between a and b is equal to n times their A.M.

Q. 6 Expand $\frac{(4+2x)^{\frac{1}{2}}}{2-x}$ up to 4 terms.

Q. 7 Prove that: $\sin\frac{\pi}{9}\sin\frac{2\pi}{9}\sin\frac{\pi}{3}\sin\frac{4\pi}{9} = \frac{3}{16}$

Q. 8 Prove that in an equilateral triangle $r : R : r_1 = 1:2:3$

Q. 9 Solve the equation $\operatorname{cosec} x = \sqrt{3} + \cot x$

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Roll No. | | | | | | |

Answer Sheet No._____

Sig. of Candidate._____

Sig. of Invigilator._____

MATHEMATICS HSSC–I

SECTION – A (Marks 20)

ıe allowed: 25 Minutes

Version Number | 1 | 7 | 0 | 5 |

ΓE: Section–A is compulsor. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) $\sqrt{3}$ is:
A. Odd Number B. Comlex Number
C. An Irrational Number D. Rational Number

(ii) The value of i in ordered pair is:
A. $(0,0)$ B. $(1,0)$ C. $(0,1)$ D. $(-1,0)$

(iii) The function from A to B is called on to function if its range is:
A. A B. B C. A – B D. $A \cup B$

(iv) The set of all cube roots of unity is group under the binary operation:
A. Addition B. Subtraction C. Multiplication D. Division

(v) If $A=\begin{bmatrix} x & 1 \\ 1 & 1 \end{bmatrix}$ and A is singular matrix, then $x=$
A. 0 B. 1 C. -1 D. 2

(vi) The cube roots of -27 are:
A. $-3,-3\omega,-3\omega^2$ B. $3,3\omega,3\omega^2$ C. $9,9\omega,9\omega^2$ D. $3,\omega,\omega^2$

(vii) $(x+2)^2=x^2+4x+4$ is:
A. A linear equation B. Cubic equation
C. An identity D. An Equation

(viii) No term of the geometric sequence is:
A. 1 B. 2 C. 0 D. 3

(lx) ${}^4C_4$ =
A. 4 B. 16 C. 1 D. 8

(x) An event is said to be impossible if:
A. $P(E)=1$ B. $P(E)=\frac{1}{2}$ C. $P(E)=0$ D. $P(E)=\infty$

(xi) The middle term in the expansion of $(1+2x)^6$ is:
A. 3rd B. 4th C. 5th D. 3rd and 4th

(xii) The sum of odd coefficients in the expansion of $(1+x)^3$ is:
A. 8 B. 4 C. 12 D. 16

(xiii) Which angle is quadrental angle?
A. 120° B. 270° C. 60° D. 45°

(xiv) $1^\circ \approx$
A. 1 radian B. 0.5 radian C. 0.01745 radian D. 2.5 radian

(xv) If $\tan\theta > 0$ and if $\sin\theta < 0$, then the terminal arm of angle lies in the quadrant:
A. I B. II C. III D. IV

(xvi) The range of $\cot x$ is:
A. $[-1,1]$ B. R C. R^+ D. R^-

(xvii) Radius of inscribed circle is:
A. $r=\frac{\Delta}{S}$ B. $r=\frac{abc}{4\Delta}$ C. $r=\frac{S}{\Delta}$ D. $r=\frac{\Delta}{S-a}$

(xviii) The inverse of a function is function if it is:
A. On to B. One-One C. Bijective D. In-to

(xix) The domain of principal sine function is:
A. $\left[0,\frac{\pi}{2}\right]$ B. $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ C. $[0,2\pi]$ D. R

(xx) Reference angle lies in quadrant:
A. I B. II C. III D. IV

For Examiner's use only:

Total Marks: 20

Marks Obtained:

MATHEMATICS HSSC–I

Time allowed: 2:35 Hours **Total Marks Sections B and C: 80**

NOTE: Attempt any ten parts from Section 'B' and any five questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly. Graph paper will be provided on request.

SECTION – B (Marks 40)

Q. 2 Attempt any TEN parts. All parts carry equal marks. **(10 x 4 = 40)**

(i) Find out real and imaginary parts of $\left(\sqrt{3}+i\right)^3$ by using De Moivre's theorem.

(ii) Without expansion show that $\begin{vmatrix} x & a+x & b+c \\ x & b+x & c+a \\ x & c+x & a+b \end{vmatrix} = 0$

(iii) If the roots of $px^2+qx+q=0$ are α and β then prove that: $\sqrt{\frac{\alpha}{\beta}}+\sqrt{\frac{\beta}{\alpha}}+\sqrt{\frac{q}{p}}=0$

(iv) Resolve $\frac{x^4}{1-x^4}$ in to partial fractions.

(v) If $a=1-x+x^2-x^3+.....$ and $b=1+x+x^2+x^3+.....$, and $|x|<1$. Show that $2ab=a+b$

(vi) Sum to n terms the series $0.2+0.22+0.222+.....$

(vii) How many signals can be made by 4 different flags when any number of them is to be used at a time?

(viii) Find the term involving y^3 in the expansion of $\left(x-\sqrt{y}\right)^{11}$.

(ix) Find the value of trigonometric functions of the angle $\frac{-71\pi}{6}$

(x) Reduce $\cos^4\theta$ to an expression involving only function of multiples of θ raised to the first power.

(xi) Find the period of cosine function.

(xii) Prove that $R=\frac{abc}{4\Delta}$

(xiii) Show that $\text{Cos}^{-1}(-x)=\pi-\text{Cos}^{-1}x$

(xiv) Find the value of θ satisfying the equation $4\text{Sin}^2\theta-8\text{Cos}\theta+1=0$

SECTION – C (Marks 40)

Note: Attempt any FIVE questions. All questions carry equal marks. **(5 x 8 = 40)**

Q. 3 Show that the set $S=\{1,-1,i,-i\}$ is an abelian group under multiplication.

Q. 4 Solve the equation $x^2-\frac{x}{2}-7=x-3\sqrt{2x^2-3x+2}$

Q. 5 If three consecutive numbers in A.P are increased by 1, 4, 15 respectively, the resulting numbers are in G.P. find the original numbers if their sum is 6.

Q. 6 If $2y=\frac{1}{2^2}+\frac{1.3}{2!}.\frac{1}{2^4}+\frac{1.3.5}{3!}.\frac{1}{2^6}+.....$, then prove that $4y^2+4y-1=0$

Q. 7 If α,β and γ are the angles of a triangle ABC, then prove that $\cot\frac{\alpha}{2}+\cot\frac{\beta}{2}+\cot\frac{\gamma}{2}=\cot\frac{\alpha}{2}\ \cot\frac{\beta}{2}\ \cot\frac{\gamma}{2}$

Q. 8 Prove that $r_1+r_2+r_3-r=4R$

Q. 9 Find the rank of the matrix $\begin{bmatrix} 1 & -1 & 2 & -3 \\ 2 & 0 & 7 & -7 \\ 3 & 1 & 12 & -11 \end{bmatrix}$

Roll No. | | | | | | | Answer Sheet No._____

Sig. of Candidate._____ Sig. of Invigilator._____

PHYSICS HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes

NOTE: Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) The dimensions of Power are:
A. $[M\,L\,T^{-2}]$ B. $[M\,L\,T^{-3}]$ C. $[M^2L^2T^{-2}]$ D. $[M\,L^2\,T^{-3}]$

(ii) The significant figures in 34.678 are:
A. 4 B. 3 C. 5 D. 2

(iii) Two forces are acting together on an object. The magnitude of their resultant is minimum, when the angle between the forces is:
A. 120° B. 180° C. 45° D. 60°

(iv) If the Scalar product of two vectors is $2\sqrt{3}$ and the magnitude of their vector product is 2. The angle between them is:
A. 30° B. 60° C. 180° D. 120°

(v) A car starts from rest and covers a distance of 100 m in one second with uniform acceleration. Its acceleration is:
A. $100\,m/s^2$ B. $200\,m/s^2$ C. $300\,m/s^2$ D. $50\,m/s^2$

(vi) A ball rolls off the edge of a table. The horizontal component of the ball's velocity remains constant during its entire trajectory because:
A. The net force acting on the ball is zero
B. The ball is not acted upon by a force in the horizontal direction
C. The ball is acted upon by a force in the horizontal direction
D. The ball is acted upon by a force in the only vertical direction

(vii) Which of the following is the example of conservative force?
A. Tension in the string B. Propulsion force of rocket
C. Gravitational field D. Restoring force in compressed spring

(viii) Anybody requires _____ escape velocity, to escape from the gravitational pull of the mars.
A. 2.4 km/s B. 4.3 km/s C. 5 km/s D. 10.4 km/s

(ix) In dryer, water is pushed out of wet clothes due to:
A. Abundance of centripetal force B. Lack of centripetal force
C. Friction D. Retarding force

(x) The SI-unit of co-efficient of viscosity is:
A. $Kgm^{-1}s^{-1}$ B. $Kgm^{-1}s^{-2}$ C. $Kgm^{-2}s^{-1}$ D. $Kgm^{-3}s^{-2}$

(xi) A stone of mass 16 kg is attached to a string 144 m long and is whirled in a horizontal circle. The maximum tension the string can withstand is 16 N. the maximum velocity of revolution that can be given to the stone without breaking it, will be:
A. $20ms^{-1}$ B. $16ms^{-1}$ C. $14ms^{-1}$ D. $12ms^{-1}$

(xii) The property of fluid by which its own molecules are attracted is said to be:
A. Adhesion B. Cohesion C. Viscosity D. Surface Tension

(xiii) A simple pendulum is moved from the Earth to the Moon. How does it change the period of oscillations? (Acceleration due to gravity on moon= $1.6m/s^2$)
A. The period is increased by factor $\sqrt{6}$ B. The period is increased by factor four
C. The period is decreased by factor $\sqrt{6}$ D. The period remains the same

(xiv) Which of the following conditions is best for cooking purpose?
A. Isobaric B. Isochoric C. Adiabatic D. Isothermal

(xv) What would be the efficiency of a Carnot engine operating with boiling water as one reservoir and a freezing mixture of ice and water as the other reservoir?
A. 27% B. 67% C. 12% D. 100%

(xvi) Power of magnifying glasses is given by:
A. $f+p$ B. $1+\left(\frac{d}{f}\right)$ C. $1-\left(\frac{f}{d}\right)$ D. $1+fd$

(xvii) Optically active substances are those substances which:
A. Produce Polarized light
B. Produce double refraction
C. Rotate the plane of polarization of polarized light
D. Convert a plane polarized light into circulatory polarized light

For Examiner's use only:

Total Marks: 17

Marks Obtained:

PHYSICS HSSC–I

Time allowed: 2:35 Hours **Total Marks Sections B, C and D: 68**

NOTE: The Questions of sections B, C and D are to be answered on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 21)

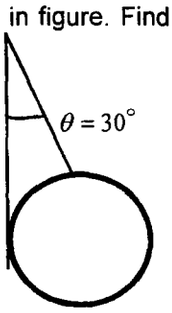
(Chapters 1 to 6)

Q. 2 Answer any SEVEN parts. All parts carry equal marks. **(7 x3 = 21)**

(i) Write all possible rules for finding significant figures and significant zeros.

(ii) Find the value of 'g' and its uncertainty using $T = 2\pi\sqrt{\frac{l}{g}}$ from the following measurements made during an experiment while $l = 100cm$ and time for 20 vibrations is $40.2s$. Length was measured by a meter scale of accuracy up to 1 mm and time by stop watch of accuracy up to 0.1 second.

(iii) A uniform sphere of weight 10N is held by a string attached to a frictionless wall so that the string makes an angle of 30° with the wall as shown in figure. Find the tension in the string and the force exerted on the sphere by the wall.



(iv) Find the angle between two forces of equal magnitudes when the magnitude of their resultant is also equal to the magnitudes of either of these forces.

(v) Find the angle of projection for which its maximum height (Vertical range) achieved and horizontal range of projectile are equal?

(vi) A truck weighing 2500 kg and moving with a velocity of 21 m/s collides with stationary car weighing 1000 kg. The truck and the car move together after the impact. Calculate their common velocity.

(vii) How large a force is required to accelerate an object from rest to a speed of $2\times10^7 m/s$ through a distance of 5cm, while the mass of electron is 9.1×10^{-31} kg?

(viii) A disc and hoop start moving down form the top of an inclined plane at the same time. Which one will be moving faster on reaching the bottom and Why? (Justify your answer by using mathematical equations)

(ix) What is the least speed at which an aeroplane can execute a vertical loop of 1 km radius so that there will be no tendency for the pilot to fall at the highest point.

(x) Water flows downhill through a closed vertical funnel. The flow speed at the top is 12 cm/s, the flow speed at the bottom is twice the speed at the top. If the funnel is 40 cm long and the pressure at the top is $1\times10^5 N/m^2$, what is the pressure at the bottom?

SECTION – C (Marks 21)

(Chapters 7 to 11)

Q. 3 Answer any SEVEN parts. All parts carry equal marks. **(7 x3 = 21)**

(i) Name two characteristics of simple harmonic motion. Does Frequency depend on amplitude for harmonic oscillators? Also name some common phenomenon in which resonance plays an important role.

(ii) Define simple pendulum. What are the drawbacks of simple pendulum? Can simple pendulum experiment be done inside a satellite?

(iii) A pipe has length one meter, determine the frequencies of the fundamental and first two harmonics:

a. If the pipe is open at its both ends

b. If the pipe is closed at its both ends

(iv) Define Doppler's Effect. And also write its few applications.

(v) Sketch out three differences between Interference and diffraction of light.

(vi) State Huygens's principle. Also distinguish between a wave-front and a wavelet by graphical sketch. (Graph paper is not required)

(vii) 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? (The refractive Index of water is 1.33)

(viii) Define Near Point, Resolving Power and Continuous Refraction.

(ix) Why do we say that molar specific heat at constant pressure is greater than molar specific heat at constant Volume? $(C_p > C_v)$

(x) A steam engine has a boiler that operates at 450 k. The heat changes water to steam, which drives the piston. If the exhaust temperature of the outside air is about 300 k then calculate maximum efficiency of this steam engine?

SECTION – D (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. **(13 x 2 = 26)**

Q. 4 **a.** Define Absolute Potential energy. Derive relation for Absolute P.E of body having mass 'm' at distance 'r' from the centre of the earth. **(1+5)**

b. What is the gravitational field? Also discuss the factors on which work done by anybody in conservative field depends. **(1+3)**

c. What do you understand by the terms Critical velocity and Weightlessness. **(1.5+1.5)**

Q. 5 **a.** What is Carnot Engine? Explain its all working steps, graphical sketch and also calculate its efficiency. Why do we say that Carnot cycle is reversible? **(06)**

b. Prove Boyle's law and Charles' law on the basis of kinetic theory of gases. **(04)**

c. Find the average speed of Oxygen molecule in the air at S.T.P. **(03)**

Q. 6 **a.** What is Doppler's Effect? Discuss the following cases of Doppler's effect when: **(1+5)**

(i) Both Observer and Source are at rest

(ii) Observer moves towards stationary Source

(iii) Observer moves away from stationary Source

(iv) Source moves towards the stationary Observer

(v) Source moves away from the stationary Observer

b. What are beats? Explain it with the help of example as well as graphically. Also mention some of its uses. **(04)**

c. 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. **(03)**

Roll No. | | | | | | |

Answer Sheet No._____

Sig. of Candidate._____

Sig. of Invigilator._____

PHYSICS HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes

NOTE: Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) A sound wave travelling in air has a wavelength of $1.6\times10^{-2}\ m$. If the velocity of sound is $320\,m/s$, calculate the frequency of sound.

A. $2.0\times10^{8}\,Hz$ B. $2.0\times10^{2}\,Hz$ C. $2.0\times10^{5}\,Hz$ D. $2.0\times10^{7}\,Hz$

(ii) Which of the following pairs of units are both derived units?

A. Kilogram, Angstrom B. Ampere, Degree
C. Newton, Candela D. Joule, Watt

(iii) When two reference lines are drawn at right angles to each other, their point of intersection is called:

A. Coordinate system B. Origin
C. Coordinate Axis D. Rectangular components

(iv) Maximum number of components of a vector may be:

A. Infinite B. One C. Two D. Three

(v) Motorcycle safety helmet extends the time of collision and decreases:

A. Impulse B. Change of collision
C. Force acting D. Velocity of Vehicle

(vi) A brick of mass 2 kg is dropped from a rest position 5 m above the ground. What is its velocity at a height of 3 m above the ground?

A. 12.4 m/s B. 6.3 m/s C. 7 m/s D. 1.2 m/s

(vii) Anybody requires _____ escape velocity, to escape from the gravitational pull of the Venus.

A. 5.5 km/s B. 2.4 km/s C. 4.3 km/s D. 10.4 km/s

(viii) One radian is equal to:

A. 47.6° B. 34.3° C. 53.7° D. 57.3°

(ix) The Dimensions of co-efficient of viscosity are:

A. $ML^{-3}T^{-2}$ B. $ML^{-1}T^{-1}$ C. $ML^{-1}T^{-2}$ D. $ML^{-2}T^{-3}$

(x) A simple pendulum on earth has period of 6.0 s. What is the approximate period of this pendulum on the moon where the acceleration due to gravity is roughly $\frac{1}{6}$th of earth's gravity.

A. 15s B. 1.0 s C. 36 s D. 2.4 s

(xi) The temperature at which a system undergoes a reversible isothermal process without transfer of heat is called as:

A. Reversible temperature B. Critical temperature
C. Kelvin temperature D. Absolute zero temperature

(xii) A frictionless heat engine can be 100% efficient only if its exhaust temperature is:

A. Zero kelvin B. Equal to its input temperature
C. Less than its input temperature D. Freezing point of water

(xiii) The limit to which a microscope can be used to resolve details depends on:

A. The width of eye piece and Longer Wavelength
B. The width of objective and Short Wavelength
C. The width of eye piece and Short Wavelength
D. The width of objective and Longer Wavelength

(xiv) According to Laplace's point of view, sound waves travel in air under the conditions of:

A. Isothermal B. Isobaric C. Isochoric D. Adiabatic

(xv) The refractive index of rarer medium with respect to a denser medium is:

A. Zero B. 1 C. Greater than 1 D. Smaller than 1

(xvi) In a reversible cycle, the entropy of the system:

A. First increases and then decreases B. Increases
C. Decreases D. Does not change

(xvii) A telescope is made of an objective of focal length 20 cm and an eye piece of focal length 5 cm, both are convex lenses. Calculate the angular magnification.

A. 15 B. 4 C. 5 D. 10

For Examiner's use only:

Total Marks: 17

Marks Obtained:

PHYSICS HSSC–I

Time allowed: 2:35 Hours **Total Marks Sections B, C and D: 68**

NOTE: The Questions of sections B, C and D are to be answered on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 21)

(Chapters 1 to 6)

Q. 2 Answer any SEVEN parts. All parts carry equal marks. **(7 x3 = 21)**

(i) The diameter and length of a metal cylinder measured with the help of Vernier Callipers of least count 0.01 cm are 1.22 cm and 5.35 cm. Calculate the volume of the cylinder and uncertainty in it.

(ii) Check the correctness of the relation $v = \sqrt{F \times \left(\frac{\ell}{m}\right)}$.

Whereas: v = speed of transverse wave F = Tension in string

ℓ = Length m = mass

(iii) Define: Parallel vectors, Equal vectors and Position vectors.

(iv) The magnitudes of dot and cross products of two vectors are $6\sqrt{3}$ and 6 respectively. Find the angle between the vectors.

(v) Prove that angles of projection, which exceed or fall short of 45° by equal amounts, the ranges are equal.

(vi) Two spherical balls of 2 kg and 3 kg masses are moving towards each other with velocities of 6 m/s and 4 m/s respectively. What must be the velocity of the smaller ball after collision, if the velocity of the bigger ball is 3 m/s?

(vii) What is the escape velocity? Discuss the factors on which escape velocity depends.

(viii) Discuss briefly the following energy sources:

a. Energy from tides b. Energy form waves

(ix) Discuss briefly the Newton's and Einstein's views of gravitation.

(x) Define: Laminar and turbulent flow. Also write the characteristics of ideal fluid.

SECTION – C (Marks 21)

(Chapters 7 to 11)

Q. 3 Answer any SEVEN parts. All parts carry equal marks. **(7 x3 = 21)**

(i) Can we realize an ideal simple pendulum? What happens to the period of a simple pendulum if its length is doubled? What happens if the suspended mass is doubled?

(ii) Under what conditions does the addition of two simple harmonic motions produce a resultant, which is also simple harmonic? When a mass spring system is hung vertically and is set into vibration then oscillation eventually stops. Why?

(iii) Why sound travels faster in warm air than in cold air? How should a sound source move with respect to an observer so that the frequency of its sound does not change?

(iv) What is stationary wave? Also define the terms: NODE, ANTINODE, FUNDAMENTAL FREQUENCY.

(v) Can sound waves be polarized? Explain briefly. What is Polaroid? Mention the uses of Polaroid.

(vi) In the white light spectrum obtained with diffraction grating, the third order image of a wavelength coincides with the fourth order image of second wavelength. Calculate the ratio of the two wavelength.

(vii) Explain briefly the difference between angular magnification and resolving power of an optical instrument. What limits are required for the magnification of an optical instrument?

(viii) Draw sketches showing the different light paths through a single-mode and multi-mode fibre. Why is the single-mode fibre preferred in telecommunications?

(ix) Why do we say that adiabatic curve is more steeper than isothermal curve?

(x) Calculate the efficiency of heat engine if it operates between freezing and boiling points of water.

SECTION – D (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. **(13 x 2 = 26)**

Q. 4 **a.** What is Projectile? Also derive expression for: **(1+5)**

(i) Instantaneous Velocity

(ii) Instantaneous displacement

(iii) Instantaneous Height

(iv) Instantaneous Horizontal Range

(v) Total Time of flight

b. Differentiate between: Ballistic missile, Ballistic trajectory **(04)**

c. A boy places a fire cracker of negligible mass in an empty can of 40 g mass. He plugs the end with a wooden block of mass 200 g. after igniting the fire cracker he throws the can straight up. It explodes at the top of its path. If the block shoots out with a speed of 3 m/s, how fast will the can be going? **(03)**

Q. 5 **a.** Prove that simple pendulum obeys simple harmonic motion during its oscillation. Also derive Mathematical relations for time period and frequency of simple pendulum. **(06)**

b. Write the characteristics of horizontal mass spring system. **(04)**

c. Find the amplitude, frequency and period of an object vibrating at the end of a spring, if the equation for its position, as a function of time, is $x = 0.25 \cos\left[\frac{\pi}{8}\right]t$. What is the displacement of the object after 2 second. **(03)**

Q. 6 **a.** Describe the young's double slit experiment for demonstration of interference of light. Derive an expression for fringe spacing. Also write the conditions for interference of light. **(06)**

b. Discuss Interference of thin film. **(04)**

c. Yellow sodium light of wavelength 589 nm emitted by a single source passes through two narrow slits 1 mm apart. The interference pattern is observed on a screen 225 cm away. How far apart are two adjacent bright fringes? **(03)**