



ஸ்ரீ-ல-ஸ்ரீ காசிவாசி சுவாமிநாத சுவாமிகள் கலைக் கல்லூரி
தருமபனந்தாள் - 612504

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QUESTION BANK

Title of the Paper

GENERAL CHEMISTRY III

Course: II B. Sc (CHE)

Prepared by

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OBJECTIVES

1. To learn the chemistry of p-block elements.
2. To study about the preparations and properties of interhalogen compounds.
3. To understand the arrangement of atoms in space, isomers and their nomenclature.
4. To learn about the gas laws, properties of real gases and types of molecular velocities.
5. To learn the types, structure and properties of solids and liquid crystals.

UNIT I CHEMISTRY OF p-BLOCK ELEMENTS

General characteristics of p-block elements. Comparative study of elements of III A & their compounds. Compounds of boron – boric acid, borax, borazole.

Extraction of Al and Pb - alums, alloys of Al. Chemistry of oxides of carbon – CO, CO₂. Allotropic forms of carbon.

Compounds of nitrogen and phosphorous – NH₂.NH₂, H₂NOH, hydrazoic acid, N₂– Cycle, fixation of N₂, PH₃ and P₂O₅.

Unit II INTERHALOGEN COMPOUNDS

Peracids of sulphur, Thionic acids, sodium thiosulphate – preparation, properties, structure and uses.

Classification of oxides – acidic, amphoteric, neutral oxides, peroxides and superoxides.

Interhalogen compounds, Pseudohalogens, Oxyacids of halogens, Polyhalides and basic nature of iodine.

UNIT III STEREOCHEMISTRY

Principles of symmetry – symmetry elements (C_n, C_i and S_n) - asymmetry and dissymmetry – isomerism – constitutional isomers - stereoisomers – enantiomers – diastereomers - geometrical isomerism – meso and dl compounds - conventions used in stereochemistry: Newman, Sawhorse and Fischer notations and their interconversions.

Nomenclature, correlation of configuration – Cahn-Ingold-Prelog rules for simple molecules - R,S and D,L notations to express configurations - chirality - optical isomerism - optical activity – polarimeter – specific rotation - stereochemistry of allenes and spiranes

Atropisomerism - erythro and threo conventions – stereoselectivity, stereospecificity in organic reactions with examples. Resolution of racemic mixture

– *Walden Inversion – conformational analysis of cyclohexane - asymmetric induction.*

UNIT IV GASEOUS STATE

Gases – Boyle's law, Charle's law and Avagadro's law- ideal gas equation.

Real Gases- deviation from ideal behaviour – van der Waals equation of states- derivation – significance of critical constants- law of

corresponding states- compressibility factor.

Inversion temperature and liquefaction of gases- Linde and Claude – demagnetization methods.

Maxwell's distribution of molecular velocities (Derivation not needed). Types of molecular velocities- mean, most probable and root mean square velocities-Inter relationships. Collision diameter, mean free path and collision number.

UNIT V SOLID STATES AND LIQUID CRYSTALS

Classification of solids- Isotropic and anisotropic crystals- elements of symmetry- basic seven crystal systems- laws of crystallography- representation of planes- miller indices, space lattice and unit cell.

X-ray diffraction- derivation of Bragg's equation- determination of structures of NaCl by Debye Scherrer (powder method) and rotating crystal methods.

Types of crystals, close packing of identical solid spheres, interstitial sites, limiting radius ratios (derivation not needed), radius ratio rule and shapes of ionic crystals, structures of NaCl, CsCl and ZnS.

Semiconductors- intrinsic and extrinsic semi conductors- n and p-type semiconductors. Liquid crystals- types and applications.


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THIRUPPANANJAL
EDUCATION IS WEALTH

UNIT- I

CHOOSE THE CORRECT ANSWER

- Which is strong oxidizing state?
 - P(V)
 - B
 - Sb(V)
 - Bi(V)
 - General electronic configuration of p-block elements is
 - ns^2np^{1-6}
 - ns^1np^4
 - ns^2np^6
 - ns^1np^{1-6}
 - Which p-block elements does not have general electronic configuration?
 - P
 - B
 - He
 - C
 - Which is more acidic in nature?
 - PH₃
 - H₂S
 - SbH₃
 - BiH₃
 - Which is strong reducing agents?
 - SbH₃
 - PH₃
 - H₂S
 - BiH₃
 - The shape of ammonia molecule is
 - Trigonal pyramidal
 - planar
 - tetrahedral
 - squareplanar
- 

7. Why does NH_3 act as a Lewis base?
- Electron pair
 - lone pair
 - electron attraction
 - none of the above
8. General formula of Hypo phosphorous
- H_3PO_3
 - $\text{H}_4\text{P}_2\text{O}_5$
 - H_3PO_4
 - H_3PO_2
9. Which groups belong to P-block elements
- I and II
 - III & IV
 - III to zero
 - V & IV
10. Which elements act as metalloids?
- O
 - Se
 - Ca
 - Po

Answers 1(d), 2 (a), 3(c), 4 (b), 5 (d), 6(a), 7(b), 8 (d), 9 (c), 10 (d)

SHORT QUESTION (2MARKS)

- What are differences between carbon and silicon?
- Why called as P-block elements?
- Why is BBr_3 a better Lewis acid than BF_3 ?
- How inter halogen are classified?
- What is the chemical formula for potash alum? What are its uses?
- What are fertilizers? Give some example.
- What happens when P_2O_5 reacts with Con.HNO_3
- What is inorganic benzene? Why it is so called SO?
- What is meant by nitrogen fixation?
- General electronic configuration of P-block elements?

PARAGRAPH QUESTION (5 MARKS)

21. Discuss about uses of borax.
22. Describe the bonding and properties of diborane.
23. Explain the structure of boric acid with diagram.
24. Explain the cause of phosphorus deficiency in plants.
25. Write note on (i) Indane gas (ii) Gobar gas
26. What are allotropic forms of carbon?
27. Write the nitrogen cycle with diagram?
28. How is silicon prepared? Explain its physical and chemical properties. What are the uses of silicon?
29. Discuss briefly (i) Metals (ii) Nonmetals (iii) Metalloids with examples.
30. Write the preparation, properties, structure of H_2NOH .

ESSAY QUESTION (10 MARKS)

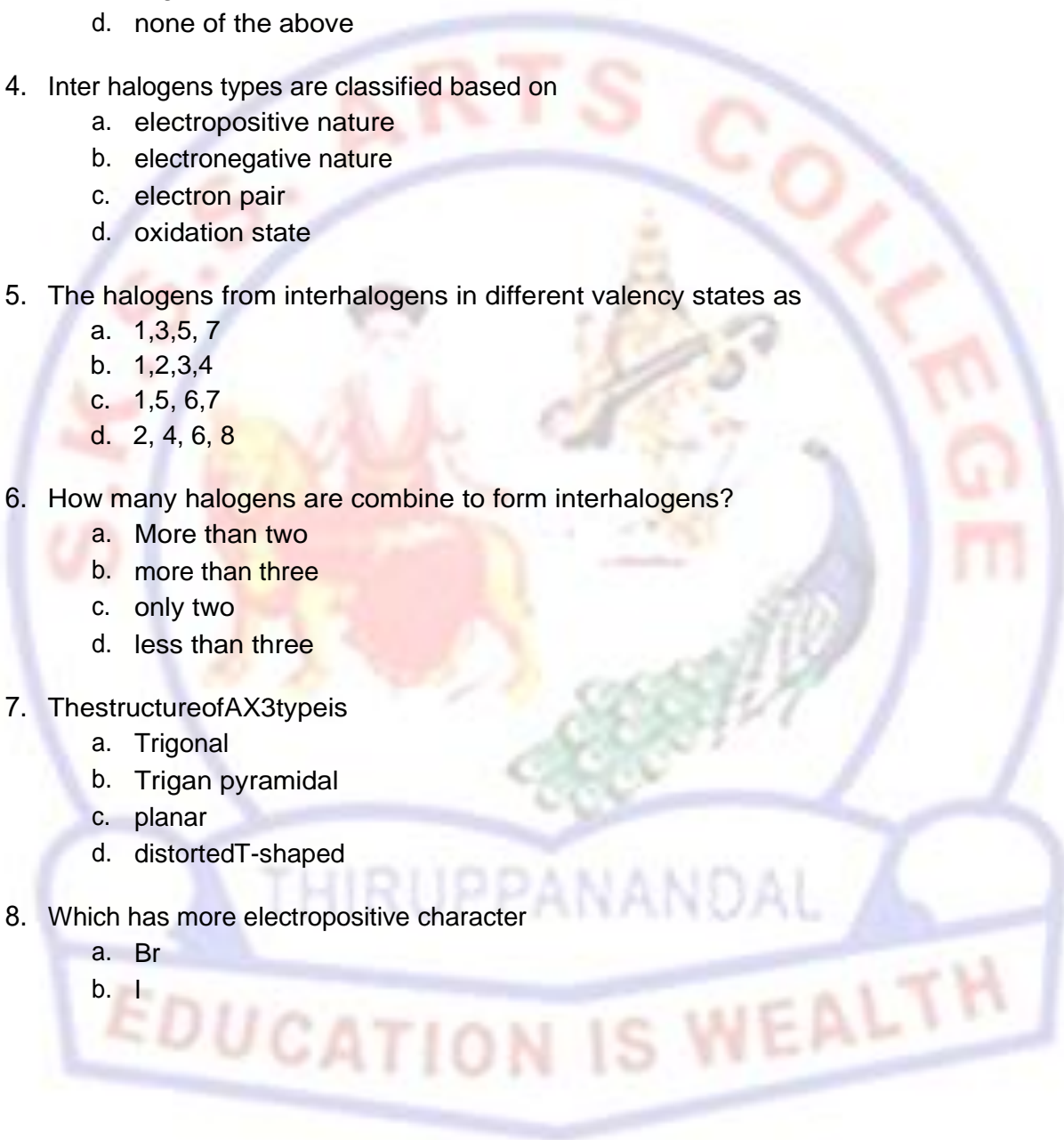
31. Describe physical and chemical properties, uses of boron?
32. Explain extraction of aluminum from ore?
33. Discuss about any two boron compounds?
34. Discuss about oxides and oxyacids of carbon?
35. Explain hydrides and halides of nitrogen compounds?
36. Write the method for fixation of nitrogen?
37. Describe synthesis, properties, uses of PH_3 and P_2O_5 ?
38. What are silicates? Explain their types.
39. Explain the industrial preparation, properties and uses of ammonia.
40. What are the applications of carbon family?

UNIT- II

Choose the Correct Answer

1. The stability of interhalogen compounds follows the order
 - a. $\text{IF}_3 > \text{BrF}_3 > \text{ClF}_3$
 - b. $\text{BrF}_3 > \text{IF}_3 > \text{ClF}_3$
 - c. $\text{ClF}_3 > \text{BrF}_3 > \text{IF}_3$
 - d. $\text{ClF}_3 > \text{IF}_3 > \text{BrF}_3$
2. In XA_5 , the central atom has (both X and A are halogens)
 - a. 5 bond pairs and no lone pairs
 - b. 5 bond pairs and one lone pair

- c. 6 bond pairs and no lone pairs
 - d. 4 bond pairs and one lone pair
3. Why halogen has intermediate character?
- a. Low oxidation state
 - b. Zero oxidation state
 - c. High oxidation state
 - d. none of the above
4. Inter halogens types are classified based on
- a. electropositive nature
 - b. electronegative nature
 - c. electron pair
 - d. oxidation state
5. The halogens from interhalogens in different valency states as
- a. 1,3,5, 7
 - b. 1,2,3,4
 - c. 1,5, 6,7
 - d. 2, 4, 6, 8
6. How many halogens are combine to form interhalogens?
- a. More than two
 - b. more than three
 - c. only two
 - d. less than three
7. The structure of AX₃ type is
- a. Trigonal
 - b. Trigonal pyramidal
 - c. planar
 - d. distorted T-shaped
8. Which has more electropositive character
- a. Br
 - b. I



- c. Cl
 - d. F
9. IF₇ has
- a. Sp³d³
 - b. sp³d²
 - c. d²sp³
 - d. Sp³d³

10. the structure of perchloric acid
- a. H₂IO₃
 - b. HI₂O₃
 - c. HIO₄
 - d. HIO₃

Answers: 1(a),2(b),3(c),4.(d), 5(a) 6.(c) 7. (d), 8 (b), 9 (a), 10(c)

SHORT QUESTION (2 MARKS)

- 11. Define inter halogen compounds with examples?
- 12. How are the inter halogen compounds formed?
- 13. Why interhalogens are more reactive than halogens?
- 14. Write the shape of ClF.
- 15. Why iodine is basic in nature?
- 16. What are pseudo halogens?
- 17. How iodine mono chloride is prepared?
- 18. How is bromobenzene prepared? Mention its uses.
- 19. How will prepare n-propylbromide from n-propylalcohol?
- 20. What are organo halogen compounds? Give examples.

PARAGRAPH QUESTION (5 MARKS)

- 21. Explain properties of interhalogen compounds?
- 22. What are the applications of interhalogen compounds?
- 23. Comparative study of halogen and pseudohalogen.
- 24. How cyanogens are prepared? Mention its properties and structure?
- 25. Explain its important characteristics and structure of interhalogen compounds?
- 26. How BrF₃ is prepared? What are its properties?
- 27. Explain the exceptional properties of fluorine.

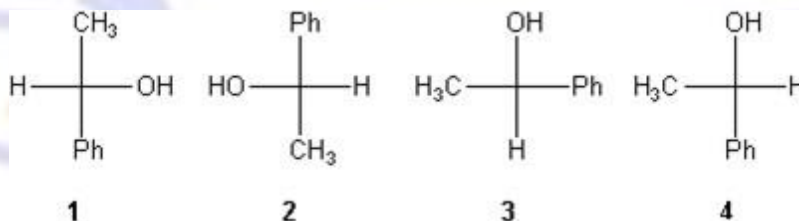
28. Explain the diagonal relationship between B and Si.
29. Explain the anomalous behavior and paramagnetic nature of oxygen.
30. Discuss the preparation and properties of XeF_4

ESSAY QUESTION (10 MARKS)

31. How halides are classified?
32. Explain preparation, properties, structure and uses of oxygen difluoride and dioxygen difluoride.
33. Give comparative study of halogen group elements.
34. Discuss about types of inter halogens with examples.
35. Explain the classification of oxides based on their chemical properties.
36. Discuss briefly about the preparation, properties and structure of ICl and IF_7
37. Explain the preparation, properties and structures of oxyacids of chlorine.
38. Write the preparation, structure and uses of XeF_4 and XeOF_4 .
39. Explain the position of noble gases in the modern periodic table.
40. Write the prepare, properties, structure of BrCl and IBr

UNIT III CHOOSE THE CORRECT ANSWER

1. Compounds which have different arrangements of atoms in space while having same atoms bonded to each other are said to have
 - a. position isomerism
 - b. functional group isomerism
 - c. chain isomerism
 - d. stereoisomerism
2. Which of the following can make difference in optical isomers?
 - a. Heat
 - b. Temperature
 - c. Polarized light
 - d. pressure
3. Which of the following Fischer projections is different from the other three?



- a. 1
- b. 2
- c. 3
- d. 4

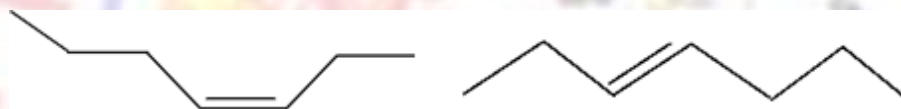
4. Which of the following are alkanes which can exhibit optical activity?

- a. Neopentane
- b. Isopentane
- c. 3-Methylpentane
- d. 3-Methylhexane

5. What is the molecular formula for the alkane of smallest molecular weight which possesses a stereogenic center?

- a. C_7H_{16}
- b. C_5H_{12}
- c. C_6H_{14}
- d. C_4H_{10}

6. Which of the following terms best describes the following pair of molecules?

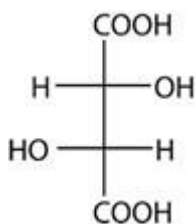


- a. Isomers
- b. Geometrical isomers
- c. Configurational isomers
- d. Constitutional isomers

7. Which of the following groups has the highest priority according to the Cahn-Ingold-Prelog sequence rules?

- a. CH_3
- b. CH_2Cl
- c. CH_2OH
- d. CHO

8. How many stereoisomers are there for the following structure?



- a. 1
- b. 2
- c. 3
- d. 4

9. How many number of stereoisomers possible for 2,3-pentanediol?

- a. 3
- b. 4
- c. 5
- d. 6

10. Which of the following compounds can exhibit geometrical isomerism?

- a. 1-Hexene
- b. 2-Methyl-2-Pentene
- c. 3-methyl-1-pentene
- d. 2-Hexene

Answers 1 (d), 2(c), 3 (d), 4 (c), 5 (a), 6 (b), 7 (b), 8 (c), 9 (b), 10 (d)

SHORT QUESTION (2 MARKS)

- 11. What is isomerism?
- 12. What do you mean by chiral carbon?
- 13. Define stereoisomerism?
- 14. What is asymmetric center?
- 15. What do you mean by chiral carbon?
- 16. Define resolution?
- 17. Briefly discuss optical isomerism with example.
- 18. What do you know about R, S notations?
- 19. Identify the asymmetric carbon(s) in the compounds $\text{CH}_3\text{-CH(OH)-CH(OH)-CH}_3$.
- 20. Define: Atropisomerism?

PARAGRAPH QUESTION (5 MARKS)

21. Discuss the optical isomerism with suitable example.
22. What is meant by isomerism? How is it classified? Give examples for each type.
23. Explain Freudenberg's rule of shift.
24. Write notes on sequence rules.
25. Describe Walden inversion using an example.
26. Write a short account of RS Notation.
27. Optical isomers are separated biochemically?
28. Explain the stereochemistry of allenes?
29. Discuss about mesotartaric and dl tartaric acid
30. Discuss the base catalysed racemisation of (-)lactic acid.

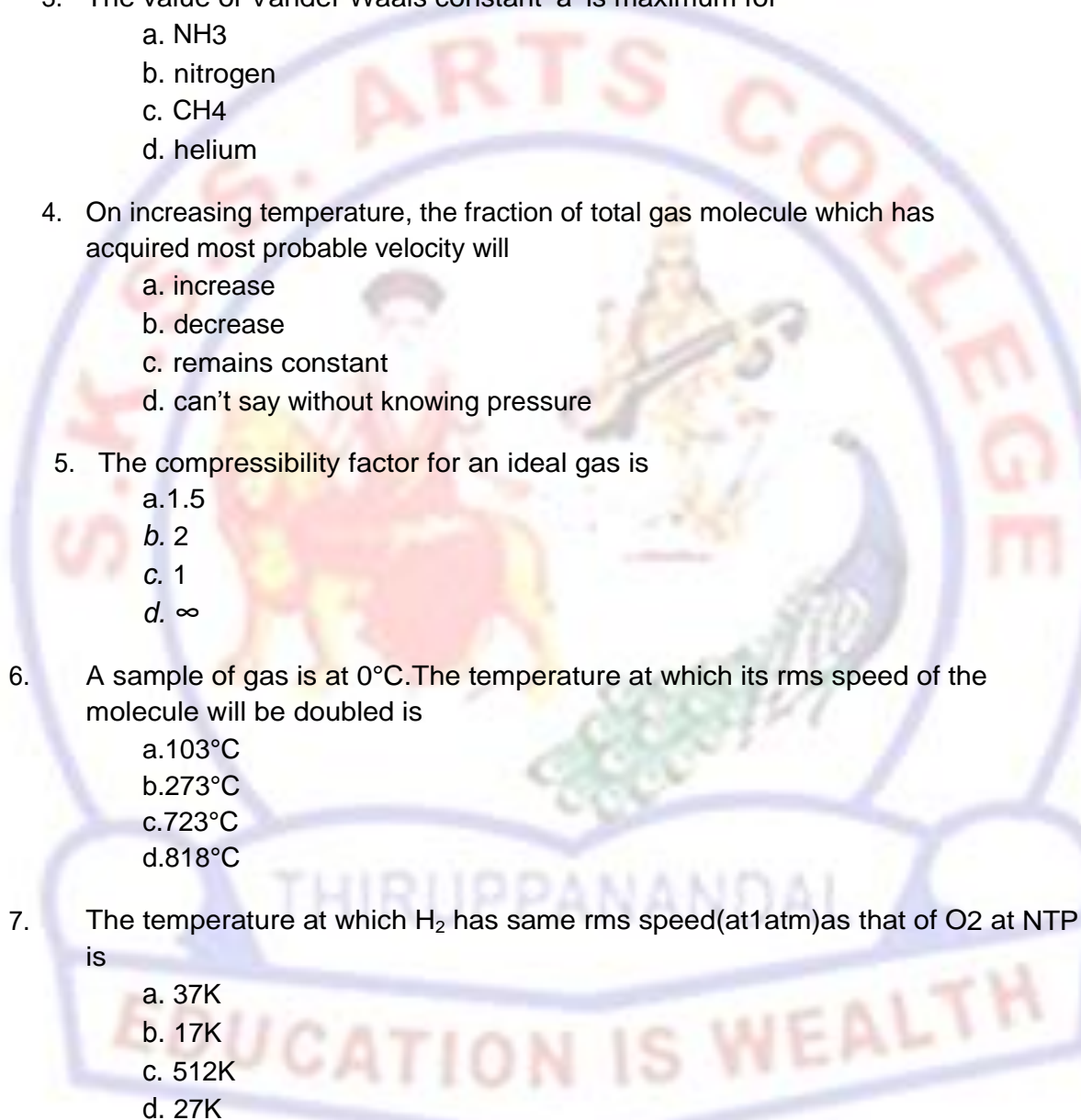
ESSAY QUESTION (10 MARKS)

31. Explain asymmetric synthesis with an example.
32. Define elements of symmetry.
33. Explain optical isomerism exhibited in lactic acid and tartaric acid.
34. Explain the conformational analysis of cyclohexane with neat diagram.
35. Give an account of assigning configuration to isomers using R and S notation.
36. Synthesized mandelic acid is optically inactive, why? How can an active sample be obtained without resolution?
37. What are the methods used for resolving racemic mixture.
38. (i) What is difference between chiral and achiral molecules with examples?
(ii) Explain dl notation with an example?
39. Describe the optical activity of allenes and spiranes.
40. What are types of stereoisomerism with examples?

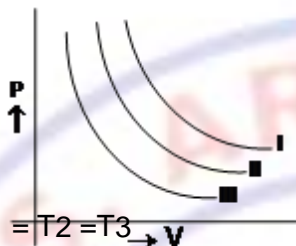
UNIT-IV

Choose the Correct Answer

1. If the pressure of a given mass of gas is reduced to half and temperature is doubled simultaneous the volume will be
 - a. Same as before
 - b. Twice as before
 - c. 1/4 the as before
 - d. None

- 
2. The temperature at which all gas obeys the ideal gas law at fairly wide range of pressure is
- Critical temperature
 - Inversion temperature
 - Boyle's temperature
 - Reduced temperature
3. The value of Vander Waals constant 'a' is maximum for
- NH₃
 - nitrogen
 - CH₄
 - helium
4. On increasing temperature, the fraction of total gas molecule which has acquired most probable velocity will
- increase
 - decrease
 - remains constant
 - can't say without knowing pressure
5. The compressibility factor for an ideal gas is
- 1.5
 - 2
 - 1
 - ∞
6. A sample of gas is at 0°C. The temperature at which its rms speed of the molecule will be doubled is
- 103°C
 - 273°C
 - 723°C
 - 818°C
7. The temperature at which H₂ has same rms speed (at 1 atm) as that of O₂ at NTP is
- 37K
 - 17K
 - 512K
 - 27K

8. NH_3 is liquefied more easily than N_2 . Hence
- a and b of $\text{NH}_3 >$ that of N_2
 - $a(\text{NH}_3) > a(\text{N}_2)$ but $b(\text{NH}_3) < b(\text{N}_2)$
 - $a(\text{NH}_3) < a(\text{N}_2)$ but $b(\text{NH}_3) > b(\text{N}_2)$
 - None
9. I, II, III are three isotherm respectively at T_1, T_2 & T_3 temperatures will be in order



- $T_1 = T_2 = T_3$
 - $T_1 > T_2 = T_3$
 - $T_1 > T_2 > T_3$
 - $T_1 < T_2 < T_3$
10. The dimension formula of R is
- $\text{ML}^2 \text{T}^{-2} \text{K}^{-1}$
 - $\text{ML}^1 \text{T}^{-1} \text{K}^{-2}$
 - $\text{ML}^2 \text{T}^{-2} \text{K}^{-1}$
 - $\text{ML}^2 \text{T}^{-2} \text{K}^{-2}$

Answers: 1(d), 2(c), 3(a), 4.(b), 5(c), 6 (d), 7(b), 8 (b), 9 (d), 10 (a)

SHORT QUESTION (2 MARKS)

- What is gaseous state?
- What is Boyle's Law?
- Write vonderWaals equation for n moles of gas.
- What is Avogadro's law?
- Explain Charles Law?
- What is the behavior of ideal gas?
- Define mean freepath.
- Define law of corresponding states
- What is Standard Atmospheric Pressure?
- Write two postulates of kinetic theory of gases.

PARAGRAPH QUESTION (5 MARKS)

21. Derive root most probable velocity and average velocity from Maxwell Boltzmann equation.
22. An aqueous solution containing 0.25g of a solute dissolved in 20g of water froze at -0.42°C . Calculate the molar mass of the solute. Molar heat of fusion of ice at 0°C is 6.025KJ and $R=8.314\text{JK}^{-1}\text{mol}^{-1}$.
23. What is the law of corresponding states? How is it derived from vander Waals equation?
24. Explain the properties of gases.
25. Derive Dalton's Law of Partia Pressures.
26. Define the following terms:
 - (a) Root mean square velocity.
 - (b) Most probable velocity.
 - (c) Average velocity
27. Write the liquefaction of gases by any one method.
28. State and explain all the gas laws?
29. Derive Bragg's equation.
30. Write notes on collision diameter.

ESSAY QUESTION (10 MARKS)

31. Discuss the causes of deviation from ideal behavior. How they are accounted for in the vonder Waals equation?
32. What are the postulates of kinetic theory of gases and show how they are justified?
33. Derive the kinetic gas equation for an ideal gas.
34. What are the limitations for equation $nPV=nRT$? What improvements have been suggested by von derWaals?
35. State and explain the principle of corresponding states. Derive an expression inter connecting critical pressure, critical volume and critical temperature.
36. Narrate the various methods of producing cold, and show how these have been used in liquefaction o fgases.
37. (i) Define Joule-Thomson effect. Explain inversion temperature. How is it related to vonder Waal's constants? (ii)The von der Waal's constants a and b for a gas are $0.045\text{ dm atm mole}^{-2}$ and $0.026\text{ dm}^3\text{ mole}^{-1}$ respectively. Calculate the inversion temperature of the gas.
38. (i)State Maxwell's law or distribution of velocities. How does a change in temperature influence this distribution? (ii)Define three different types of velocities. How are the related with each other?

39. (i) Define the terms:
- Critical temperature.
 - Boyle's temperature.
 - Conversion temperature.
- (ii) Write a note on collision diameter.
40. Derive the ideal gas equation and reason for deviation from real gas.

UNIT- V

CHOOSE THE CORRECT ANSWER

- Which of the following conditions favor the existence of a substance in the solid state?
 - High temperature
 - Low temperature
 - High thermal energy
 - Weak cohesive forces
- Which of the following is true about the value of refractive index of quartz glass?
 - Same in all directions
 - Different in different directions
 - Cannot be measured
 - Always zero
- Which of the following statement is not true about amorphous solids?
 - On heating they may become crystalline at certain temperature.
 - They may become crystalline on keeping for long time.
 - Amorphous solids can be molded by heating.
 - They are anisotropic in nature.
- Iodine molecules are held in the crystals lattice by _____.
 - London forces
 - dipole-dipole interactions
 - covalent bonds
 - coulombic forces
- Which of the following is a network solid?
 - SO₂(Solid)
 - I₂
 - Diamond
 - H₂O(Ice)

6. Graphite is a good conductor of electricity due to the presence of _____.
- lone pair of electrons
 - anions
 - cations
 - free valence electrons
7. The lattice site in a pure crystal cannot be occupied by _____.
- Molecule
 - Ion
 - Electron
 - Atom
8. Graphite cannot be classified as _____.
- Conducting solid
 - Network solid
 - Covalent solid
 - Ionic solid
9. The optical properties of liquid crystals depend on the direction of _____.
- Air
 - Solid
 - Light
 - Water
10. By which properties, the orientation of molecules in a layer of liquid crystals can be changed?
- Magnetic field
 - Electric field
 - Electromagnetic field
 - Gallois field

Answers 1.(b), 2 (a), 3(c), 4(a), 5 (c), 6 (d), 7 (c), 8 (d), 9 (c), 10 (b)

SHORT QUESTION (2 MARKS)

- What are crystalline solids?
- What are isotropic solids?
- What are anisotropic solids?
- What are amorphous solids?
- Define unit cell and space lattice.
- What are liquid crystals? Give example.
- What are types of liquid crystals?

18. What is mesomorphic state?
19. Explain Bragg's law.
20. What is center of symmetry?

PARAGRAPH QUESTION (5 MARKS)

21. Write notes on Bravais lattices.
22. Define radius, ratio and limiting radius ratio.
23. Write notes on vitreous state.
24. How is Avogadro number determined by X-ray diffraction studies?
25. State and explain the law of rational indices.
26. Draw the structure of (100), (110) and (111) planes.
27. Describe properties of crystals?
28. State and explain the law of rational indices.
29. Explain the application of liquid crystals.
30. Explain molecular arrangements in liquid crystals.

ESSAY QUESTION (10 MARKS)

31. Write short notes on following packing of atoms in crystals.
 - (i) Cubic close packed arrangement
 - (ii) Face centered cubic arrangement.
 - (iii) Body centered cubic arrangement.
32. What are the types of crystals?
33. Explain symmetry elements in crystals with neat sketch.
34. What are Miller indices? How are they obtained? Give example? What are their uses?
35. Discuss the powder method used to determine the structure of a crystal system.
36. Describe the crystal structure of sodium chloride and potassium chloride.
37. Derive Bragg's equation of X-ray diffraction and its uses.
38. What are the different types of cubic crystals? Draw the structures.
39. Describe the rotating crystal method used to determine the structure of a crystal system.
40. Explain the properties and structure of smectic and nematic liquid crystals with example

