Question 1

a) State and explain any **FIVE** postulates of the Kinetic theory. (10 marks)

b) If \( P_1, \ V_1 \) and \( T_1 \) are the values of pressure, volume and temperature respectively for any definite quantity of gas, and \( P_2, \ V_2 \) and \( T_2 \) are another set of desired conditions, show that

\[
\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}
\]

(5 marks)

c) If one mole of an ideal gas occupies 12 Liters at 25°C. What is the pressure of the gas? (5 marks)

d) (i) Explain the meaning of the term “colligative properties” and give three examples. (5 marks)
   (ii) In how much water should 10g of glucose \( (C_6H_{12}O_6) \) be dissolved to obtain a solution freezing at -0.35°C? \( (f = 18.6 \text{ K} \text{ for } 100 \text{ g of water}) \). (5 marks)

**SECTION B: ANSWER ANY TWO QUESTIONS FROM THIS SECTION-EACH QUESTION CARRIES 20 MARKS**

**Question 2**

a) Define the following terms; (10 marks)
   (i) Equilibrium constant
   (ii) Reversible reaction
   (iii) Order of a reaction
   (iii) Rate law
   (iv) Molecularity

b) What is a redox reaction? Explain using an example. (5 marks)

c) The lowering of vapour pressure of a solution of 108.2 g of a substance \( X \) in 1 Kg of water at 20°C is 24.79 Nm\(^{-2}\). The vapour pressure of water at this same temperature is 2.338 kNm\(^{-2}\). Calculate the RMM of \( X \). (5 marks)
Question 3

a) Two flasks of equal volumes are connected by a narrow tube of negligible volume. Initially, both flasks are at 27°C and contain 0.70 moles of H₂ gas, the pressure being 0.50 atmospheres. One of the flasks is then immersed in a hot oil bath at 127°C while the other is kept at 27°C. Calculate the final pressure and the moles of H₂ in each flask. (10 marks)

b) Distinguish the following terms; (6 marks)
   (i) Electrolysis and Electrochemistry
   (ii) Anode and cathode
   (iii) Electrolytic and galvanic/voltaic cell

c) When 1 mole of HI is allowed to dissociate in 1.0 dm³ vessel at 440°C, only 0.78 moles of HI are present at equilibrium. What is the equilibrium constant at this temperature for this reaction? (4 marks)

Question 4

a) The equilibrium constant for the reaction below at 298K is 200 mol⁻¹dm³.

\[2\text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g})\]

(i) Write the expression for the equilibrium constant for the reaction. (3 marks)
(ii) If the [NO₂] in the equilibrium mixture at this temperature is 2 x 10⁻² mol dm⁻³, what is the [N₂O₄]? (3 marks)
(iii) Calculate the equilibrium constant for this reaction at 298K. (3 marks)

d) Liquid camphor freezes at 175°C. A solution of 1.54 g of naphthalene (C₁₀H₈) in 18 g of camphor freezes at 148.3. What is the freezing point constant of camphor. (5 marks)
e) Distinguish the following terms; (6 marks)
   (i) Electrolysis and Electrochemistry
   (ii) Anode and cathode
   (iii) Electrolytic and galvanic/voltaic cell

Question 5

a) 2.0 g of phosphorus elevated the boiling point of 37.4g of carbon disulphide by 1.003°C. What is the molecular formula of phosphorus in CS₂? (M = 31 g for P; b = 2.35°C for 1 mole of P in 1000 g of CS₂) (6 marks)
b) State and explain any FOUR factors that influence the rate of a chemical reaction. (8 marks)
c) Sketch the isobar and the isotherm that defines Charles’ and Boyle’s laws respectively and show the trend in Temperature and pressure respectively (6 marks)