

## SUMMARY OF QUESTIONS ASKED IN PREVIOUS BOARD EXAMS

1

### SOLID STATE

- (1) Distinguish between crystalline solid and amorphous solid. (March 2013, 2014, 2017) (2)
- (2) Gold occurs as face centered cube and has a density of  $19.30 \text{ kg dm}^{-3}$ . Calculate atomic radius of gold. (*Molar mass of Au = 197*) (March 2013) (2)
- (3) Calculate the number of atoms present in 2 gram of crystal which has face-centered cubic (fcc) crystal lattice having edge length of 100 pm and density  $10 \text{ g cm}^{-3}$ . (Oct. 2013) (3)
- (4) What are Schottky defect and Frenkel defect? (Oct. 2013) (2)
- (5) Face centered cubic crystal lattice of copper has density of  $8.966 \text{ g. cm}^{-3}$ . Calculate the volume of the unit cell. Given molar mass of copper is  $63.5 \text{ g. mol}^{-1}$  and Avogadro number  $N_A$  is  $6.022 \times 10^{23}$ . (March 2014) (3)
- (6) A unit cell of iron crystal has edge length 288 pm and density  $7.86 \text{ g.cm}^{-3}$ . Find the number of atoms per unit cell and type of the crystal lattice. [Given: *Molar mass of iron = 56 g.mol<sup>-1</sup>. Avogadro's Number,  $N_A = 6.022 \times 10^{23}$ .*] (Oct. 2014) (3)
- (7) Explain impurity defect in stainless steel with diagram. (March 2015) (2)
- (8) Niobium crystallises as body centered cube (BCC) and has density of  $8.55 \text{ kg/dm}^{-3}$ . Calculate the atomic radius of niobium. (*Given: Atomic mass of niobium = 93*). (March 2015) (3)
- (9) Silver crystallises in F.C.C. (face-centered cubic crystal) structure. The edge length of the unit cell is found to be 408.7 pm. Calculate density of the unit cell. [Given : *Molar mass of silver is 108 g. mol<sup>-1</sup>*.] (Oct. 2015) (3)
- (10) What is ferromagnetism? Iron ( $Z = 26$ ) is strongly ferromagnetic. Explain. (March 2016) (2)
- (11) Silver crystallises in FCC structure. If density of silver is  $10.51 \text{ g.cm}^{-3}$ , calculate the volume of unit cell. [*Atomic mass of silver (Ag) = 108 g. mol<sup>-1</sup>*] (March 2016) (3)
- (12) A face centered cube (FCC) consists of how many atoms? Explain. (July 2016) (2)
- (13) Determine the density of Cesium chloride which crystallizes in BCC type structure with the edge length 412.1 pm. The atomic masses of Cs and Cl are 133 and 35.5 respectively. Predict the co-ordination number of  $\text{Cs}^+$  ion if  $r_{\text{Cs}^+} = 1.69 \text{ \AA}$  and  $r_{\text{Cl}^-} = 1.81 \text{ \AA}$ . (July 2016) (3)
- (14) Calculate the percentage efficiency of packing in case of simple cubic cell. (March 2017) (2)
- (15) Classify the following molecular solids into different types:  
 (a) Ammonium phosphate    (b) Brass    (c)  $\text{S}_8$  molecule    (d) Diamond. (July 2017) (2)
- (16) A metal crystallises into two cubic faces namely face centered (FCC) and body centered (BCC), whose unit cell edge lengths are  $3.5 \text{ \AA}$  and  $3.0 \text{ \AA}$  respectively. Find the ratio of the densities of FCC and BCC. (July 2017) (3)
- (17) Calculate the number of atoms in a unit cell of a metal crystallising in face centered cubic structure. (2)
- (18) Ionic solids are hard and brittle. Explain. (March 2018) (2)
- (19) The density of iron crystal is  $8.54 \text{ gram cm}^{-3}$ . If the edge length of unit cell is  $2.8 \text{ \AA}$  and atomic mass is  $56 \text{ gram mol}^{-1}$ , find the number of atoms in the unit cell. [Given: *Avogadro's number =  $6.022 \times 10^{23}$ ,  $1 \text{ \AA} = 1 \times 10^{-8} \text{ cm}$* ] (March 2018) (3)
- (20) Classify the following molecular solids into different types:  
 (a)  $\text{HCl}$     (b)  $\text{CO}_2$     (c) Solid ice    (d)  $\text{SO}_2$ . (July 2018) (2)
- (21) The density of silver having atomic mass  $107.8 \text{ gram mol}^{-1}$  is  $10.8 \text{ gram cm}^{-3}$ . If the edge length of cubic unit cell is  $4.05 \times 10^{-8} \text{ cm}$ , find the number of silver atoms in the unit cell. [ $N_A = 6.022 \times 10^{23}$ ,  $1\text{\AA} = 10^{-8} \text{ cm}$ ] (July 2018) (3)
- (22) What is the ratio of octahedral holes to the number of anions in hexagonal closed packed structure? (March 2019) (1)
- (23) Define Anisotropy. Distinguish between crystalline solids and amorphous solids. (March 2019) (3)
- (24) Classify the following into different types:  
 (a) Silver    (b)  $\text{P}_4$     (c) Diamond    (d)  $\text{NaCl}$  (March 2020) (2)
- (25) Unit cell of a metal has edge length of 288 pm and density of  $7.86 \text{ g cm}^{-3}$ . Determine the type of crystal lattice. (*Atomic mass of metal =  $56 \text{ g mol}^{-1}$* ) (March 2020) (3)
- (26) What is the coordination number of atoms in simple cubic crystal lattice? (Sept. 2021) (1)
- (27) A compound forms hexagonal close packed (hcp) structure. What is the number of (i) Octahedral voids (ii) Tetrahedral voids (iii) Total voids formed in  $0.4 \text{ mol}$  of it? (Sept. 2021) (3)
- (28) Write the consequences of Schottky defect with reasons. (March 2022) (2)
- (29) Gold crystallises into face-centred cubic cells. The edge length of unit cell is  $4.08 \times 10^{-8} \text{ cm}$ . Calculate the density of gold. [*Molar mass of gold =  $197 \text{ g mol}^{-1}$* ] (March 2022) (2)
- (30) Explain metal deficiency defect with example. (March 2022) (2)

- (1) State and explain van't Hoff-Boyle's law. (March 2008) (2)
- (2) Define 'Colligative properties'. (Oct. 2008) (1)
- (3) Define 'Isotonic solution'. (March 2009, Oct. 2013) (1)
- (4) State van't Hoff-Avogadro's law. (March 2009) (1)
- (5) Define : "Ebullioscopic constant". (Oct. 2009) (1)
- (6) Define 'Solution'. (Oct. 2009; March 2011) (1)
- (7) Define osmotic pressure. Derive an equation for determination of molecular weight from osmotic pressure. (Oct. 2010) (2)
- (8) Define a solution. Explain the terms solute and solvent. (March 2011) (2)
- (9) Derive the relationship between relative lowering of vapour pressure and molar mass of non-volatile solute. (March 2013, 2017) (2)
- (10) Define osmosis. (March 2013) (1)
- (11) State Henry's law. How does solubility of a gas in water varies with the temperature? (Oct. 2013; July 2017) (2)
- (12) Calculate the amount of  $\text{CaCl}_2$  (van't Hoff factor,  $i = 2.47$ ) dissolved in 2.5 L solution so that its osmotic pressure at 300K is 0.75 atmosphere. (March 2013) (1)
- [Given: Molar mass of  $\text{CaCl}_2$  is 111 g.  $\text{mol}^{-1}$ ,  $R = 0.082 \text{ L. atm K}^{-1} \text{ mol}^{-1}$ .] (March 2014) (3)
- (14) Explain, why do aquatic animals prefer to stay at lower level of water during summer? (March 2014) (2)
- (15) A solution containing 0.73 g of camphor (molar mass 152 g.  $\text{mol}^{-1}$ ) in 36.8 g of acetone (boiling point 56.3°C) boils at 56.55°C. A solution of 0.564 g of unknown compound in the same weight of acetone boils at 56.46°C. Calculate the molar mass of the unknown compound. (Oct. 2014) (3)
- (16) Define van't Hoff factor. How is it related to the degree of dissociation? (Oct. 2014) (2)
- (17) Define: Cryoscopic constant. (Oct. 2014, July 2018) (1)
- (18) Derive van't Hoff general solution equation. (March 2015, 2019; July 2017) (2)
- (19)  $1.0 \times 10^{-3}$  kg of urea when dissolved in 0.0985 kg of a solvent, decreases freezing point of the solvent by 0.211 K.  $1.6 \times 10^{-3}$  kg of another non-electrolyte solute when dissolved in 0.086 g of the same solvent depresses the freezing point by 0.34 K. Calculate the molar mass of the another solute. (Given: Molar mass of urea = 60) (March 2015) (3)
- (20) Define ebullioscopic constant. Write its unit. (Oct 2015) (2)
- (21) What is the effect of temperature on solubility of gas in a liquid? (Oct 2015) (2)
- (22) Define boiling point. Write the formula to determine molar mass of a solute using freezing point depression method. (March 2016) (2)
- (23) The vapour pressure of pure benzene is 640 mm of Hg.  $2.175 \times 10^{-3}$  kg of non-volatile solute is added to 39 gram of benzene, the vapour pressure of solution is 600 mm of Hg. Calculate molar mass of solute. [C = 12, H = 1]. (March 2016) (3)
- (24) Why is molality of a solution independent of temperature? (March 2016) (1)
- (25) Define: (a) Osmosis (b) Freezing point. (July 2016) (2)
- (26) 3.795 g of sulphur is dissolved in 100 g of  $\text{CS}_2$ . This solution boils at 319.81 K. What is the molecular formula of sulphur in solution? The boiling point of  $\text{CS}_2$  is 319.45 K. (Given that  $K_b$  for  $\text{CS}_2$  = 2.42 K  $\text{kg mol}^{-1}$  and atomic mass of S = 32.) (July 2016) (3)
- (27) State Henry's law. (July 2016) (1)
- (28) A solution of a substance having mass  $1.8 \times 10^{-3}$  kg has the osmotic pressure of 0.52 atm at 280K. Calculate the molar mass of the substance used. (Volume = 1  $\text{dm}^3$ ,  $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ ) (March 2017) (2)
- (29) The boiling point of benzene is 353.23 K. When 1.80 gram of non-volatile solute was dissolved in 90 gram of benzene. The boiling point is raised to 354.11 K. Calculate the molar mass of solute. [ $K_b$  for benzene = 2.53 K  $\text{mol}^{-1}$ ] (March 2017) (2)
- (30) Define: Osmotic pressure. (July 2017) (1)
- (31) An organic substance ( $M = 169$  gram  $\text{mol}^{-1}$ ) is dissolved in 2000  $\text{cm}^3$  of water. Its osmotic pressure at 12°C was found to be 0.54 atm. If  $R = 0.0821 \text{ L atm. K}^{-1} \text{ mol}^{-1}$ , calculate the mass of the solute. (July 2017) (2)
- (32) Derive the relation between elevation of boiling point and molar mass of solute. (2)
- (33) Define: Semipermeable membrane. (2)
- (34) 22.22 gram of urea was dissolved in 300 grams of water. Calculate the number of moles of urea and molality of the urea solution. (Given: Molar mass of urea = 60 gram  $\text{mol}^{-1}$ ) (July 2017) (2)

- (35) What is freezing point of a liquid? The freezing point of pure benzene is 278.4 K. Calculate the freezing point of the solution when 2.0 gram of a solute having molecular weight 100 gram is added to 100 gram of benzene. [ $K_f$  for benzene =  $5.12 \text{ kg mol}^{-1}$ ] (July 2018) (3)
- (36) Define the following terms:  
(i) Isotonic solution (ii) Hypertonic solution (iii) Hypotonic solution (March 2019) (3)
- (37) What is the concentration of dissolved oxygen at 50°C under pressure of one atmosphere if partial pressure of oxygen at 50°C is 0.14 atm. (Henry's law constant for oxygen =  $1.3 \times 10^{-3} \text{ mol dm}^{-3} \text{ atm}^{-1}$ ) (March 2020) (2)
- (38) Define: (a) Molality (b) Osmotic pressure. (March 2020) (2)
- (39) Derive the mathematical expression between molar mass of a non-volatile solute and elevation of boiling point. State and explain van't Hoff-Avogadro's law. (March 2020) (4)
- (40) Define 'Cryoscopic constant'. Derive the relation between elevation of boiling point and molar mass of solute. (Sept. 2021) (3)
- (41) What is the molar mass of a solute if a solution prepared by dissolving 0.822 g of it in 0.3 dm<sup>3</sup> of water has an osmotic pressure of 0.196 atm. at 298 K? (Sept. 2021) (3)
- (42) Derive an expression to calculate molar mass of non volatile solute by osmotic pressure measurement. (March 2022) (2)
- (43) Henry's law constant for  $\text{CH}_3\text{Br}_{(g)}$  is  $0.159 \text{ mol dm}^{-3} \text{ bar}^{-1}$  at 25°C. What is solubility of  $\text{CH}_3\text{Br}_{(g)}$  in water at same temperature and partial pressure of 0.164 bar? (March 2022) (2)
- (44) Define the following terms: (i) Isotonic solution (ii) Osmosis. (March 2022) (2)

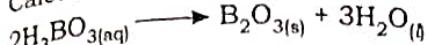
### 3 IONIC EQUILIBRIA

- (1) Derive the relationship between pH and pOH. (Sept. 2021, March 2022) (2)
- (2) Define 'Solubility product'. Derive the relationship between solubility and solubility product for  $\text{PbI}_2$ . (Sept. 2021) (3)
- (3) Calculate the pH of buffer solution composed of 0.01 M weak base BOH and 0.02 M of its salt BA. [ $K_b = 1.8 \times 10^{-5}$  for weak base] (March 2022) (3)

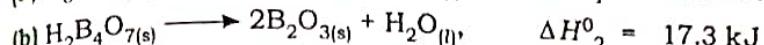
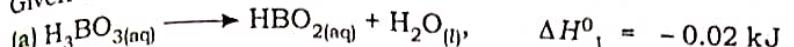
### 4 CHEMICAL THERMODYNAMICS

- (1) Give one statement of first law of thermodynamics and give its corollary. (March 2008) (2)
- (2) State and explain Hess's law of constant heat summation and give its four applications. (March 2008; Oct. 2008) (4)
- (3) Derive the relationship between the heat of reaction at constant pressure and at constant volume. (Oct. 2008) (2)
- (4) Write any two statements of first law of thermodynamics. Explain, "Internal energy is a state function". (March 2009) (4)
- (5) Prove that,  $\Delta H = \Delta E + \Delta nRT$ . (Oct. 2009) (2)
- (6) Write the applications of Hess's law. (March 2009) (4)
- (7) Derive the expression for the work done by an ideal gas in an isothermal and irreversible process. Under what conditions work done by a gas is 'zero'? (Oct. 2009) (2)
- (8) Distinguish between isothermal and adiabatic process. (March 2010) (4)
- (9) Derive an expression for maximum work done during the expansion of an ideal gas in isothermal and reversible process. (March 2011) (4)
- (10) Derive an expression for the effect of temperature on the heat of reaction at constant pressure. (Oct. 2010) (2)
- (11) Define Enthalpy. Show that  $\Delta H = \Delta E + P\Delta V$ , at constant pressure. (Oct. 2010) (3)
- (12) Explain the concept of maximum work. Derive an expression for maximum work done in isothermal reversible expansion of one mole of an ideal gas. (March 2011) (4)
- (13) Prove that  $\Delta H = \Delta U + \Delta nRT$ . What is the condition under which  $\Delta U = \Delta H$ ? (March 2013) (2)
- (14) 300 mol of perfect gas occupies 13L at 320 K. Calculate the work done in joules when the gas expands-  
(a) isothermally against a constant external pressure of 0.20 atm.  
(b) isothermal and reversible process.  
(c) into vacuum until the volume of gas is increased by 3L. ( $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$ ) (March 2013) (2)
- (15) Explain with reason sign conventions of  $\Delta S$  in the following reactions:  
(i)  $\text{N}_{2(g)} + 3\text{H}_{2(g)} \longrightarrow 2\text{NH}_{3(g)}$   
(ii)  $\text{CO}_{2(g)} \longrightarrow \text{CO}_{2(s)}$  (March 2013) (2)

(16) Calculate  $\Delta H^\circ$  for the following reactions-



Given that:



(Oct. 2013)

(3)

(17) What are the conditions for spontaneous and non-spontaneous reactions in terms of free energy change? Define entropy.

(Oct. 2013)

(2)

(18) Derive the relation  $\Delta H - \Delta U = \Delta nRT$ .

(Oct. 2013)

(2)

(19) Derive a relation between  $\Delta H$  and  $\Delta U$  for a chemical reaction.

(March 2014)

(2)

(20) One mole of a gas expands by 3L against a constant pressure of 3 atmosphere. Calculate the work done in -

(March 2014)

(3)

(a) L. atmosphere (b) Joules (c) Calories

(March 2014)

(3)

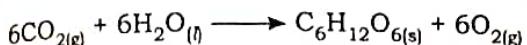
(21) Derive the relation between  $\Delta G^\circ$  and equilibrium constant (K) for the reaction-



(March 2014)

(2)

(22) What is the value of  $\Delta S_{\text{surr}}$  for the following reaction at 298K?



Given that,  $\Delta G^\circ = 2879 \text{ kJ mol}^{-1}$   $\Delta S = -210 \text{ J K}^{-1} \text{ mol}^{-1}$ .

(Oct. 2014)

(3)

(23) State and explain Hess's law of constant heat summation.

(Oct. 2014; July 2018; March 2020)

(2)

(24) Derive the equation:  $W = -P_{\text{ext}} \cdot \Delta V$ .

(March 2015)

(3)

(25) Define the following terms:

(a) Enthalpy of fusion (b) Enthalpy of atomization

(March 2015)

(2)

(26) Determine whether the reactions with the following  $\Delta H$  and  $\Delta S$  values are spontaneous or non-spontaneous. State whether the reactions are exothermic or endothermic.

(a)  $\Delta H = -110 \text{ kJ}$ ,  $\Delta S = +40 \text{ JK}^{-1}$  at 400 K (b)  $\Delta H = +40 \text{ kJ}$ ,  $\Delta S = -120 \text{ JK}^{-1}$  at 250 K

(March 2015)

(3)

(27) Write one statement of first law of thermodynamics and its mathematical expression.

(March 2015)

(2)

(28) Derive an expression for maximum work in isothermal reversible expansion of two moles of an ideal gas.

(Oct. 2015)

(2)

(29) Write mathematical equations of first law of thermodynamics for the following processes:

(a) Adiabatic process (b) Isochoric process.

(March 2016)

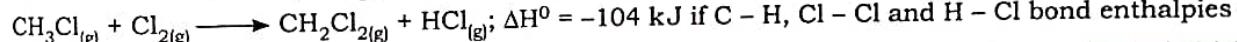
(3)

(30) Define Enthalpy of sublimation. How is it related to enthalpy of fusion and enthalpy of vaporization?

(March 2016)

(2)

(31) Calculate C – Cl bond enthalpy from following reaction:



are 414, 243 and  $431 \text{ kJ mol}^{-1}$  respectively.

(March 2016)

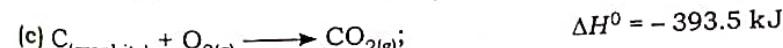
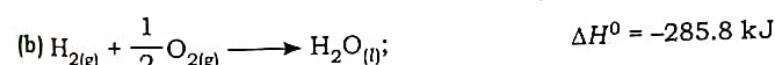
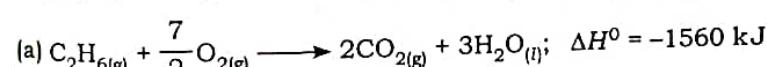
(3)

(32) Explain the relationship between Gibb's standard energy change of the reaction and equilibrium constant.

(July 2016)

(2)

(33) Calculate the standard enthalpy of the reaction,



(July 2016)

(3)

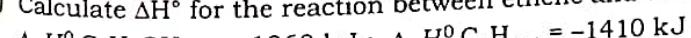
(34) Define the term 'enthalpy'.

What will happen to the internal energy if work is done by the system?

(March 2017)

(2)

(35) Calculate  $\Delta H^\circ$  for the reaction between ethene and water to form ethyl alcohol from the following data :



Does the calculated  $\Delta H^\circ$  represent the enthalpy of formation of liquid ethanol?

(March 2017)

(3)

(36) Derive an expression for maximum work.

(37) Write the mathematical expression of the first law of thermodynamics for the following processes

(a) Isothermal (b) Adiabatic (c) Isochoric (d) Isobaric

(July 2017)

(2)

- (38) Calculate the standard enthalpy of combustion of  $\text{CH}_3\text{COOH}_{(l)}$  from the following data:  
 $\Delta_f H^0(\text{CO}_2) = 393.3 \text{ kJ mol}^{-1}$ ;  $\Delta_f H^0(\text{H}_2\text{O}) = -285.8 \text{ kJ mol}^{-1}$ ;  $\Delta_f H^0(\text{CH}_3\text{COOH}) = -483.2 \text{ kJ mol}^{-1}$  (July 2017) (3)
- (39) Calculate the internal energy at 298K for the formation of one mole of ammonia, if the enthalpy change at constant pressure is  $-42.0 \text{ kJ mol}^{-1}$ . (Given:  $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ ) (March 2018) (3)
- (40) Define: (a) Enthalpy of atomization (b) Enthalpy of vaporization. (March 2018) (2)
- (41) 5 moles of helium expand isothermally and reversibly from a pressure  $40 \times 10^{-5} \text{ Nm}^{-2}$  to  $4 \times 10^{-5} \text{ Nm}^{-2}$  at 300 K. Calculate the work done, change in internal energy and heat absorbed during the expansion. ( $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ ) (July 2018) (3)
- (42) Write the conditions for maximum work done by the system. (March 2019) (2)
- (43) Calculate the work done in the following reaction at 50°C. State whether work is done on the system or by the system.  
 $\text{SO}_{2(l)} + \frac{1}{2}\text{O}_{2(g)} \longrightarrow \text{SO}_{3(g)}$  (March 2019) (3)
- (44) The standard enthalpy of combustion of formaldehyde  $\Delta_c H^0 = -571 \text{ kJ}$ . How much heat will be evolved in the formation of 22 g of  $\text{CO}_2$ ? (March 2019) (3)
- (45) For the reaction:  
 $\text{N}_2\text{O}_{4(g)} \longrightarrow 2\text{NO}_{2(g)}$ ;  $\Delta H^0 = +57.24 \text{ kJ}$ ,  $\Delta S^0 = 175.8 \text{ JK}^{-1}$ . At what temperature the reaction will be spontaneous? (March 2020) (2)
- (46) Define: (a) Reversible process  
(b) Standard enthalpy change for the reaction:  
 $\text{N}_{2(g)} + 3\text{H}_{2(g)} \longrightarrow 2\text{NH}_{3(g)}$   
The bond enthalpies are:  

Bond	$\text{N} \equiv \text{N}$	$\text{H}-\text{H}$	$\text{N}-\text{H}$
$\Delta H^0 \text{ in kJ mol}^{-1}$	946	435	389

 (March 2020) (2)
- (47) In a particular reaction, 2 kJ of heat is released by the system and 6 kJ of work is done on the system. Calculate  $\Delta U$ . (Sept. 2021) (2)
- (48) Calculate the standard enthalpy of  $\text{N}_2\text{H}_{4(g)} + \text{H}_{2(g)} \longrightarrow 2\text{NH}_{3(g)}$  if  $\Delta H^0(\text{N}-\text{H}) = 389 \text{ kJ mol}^{-1}$ ,  $\Delta H^0(\text{H}-\text{H}) = 435 \text{ kJ mol}^{-1}$ ,  $\Delta H^0(\text{N}-\text{N}) = 159 \text{ kJ mol}^{-1}$ . (Sept. 2021) (3)
- (49) Define: (i) Intensive property (ii) Enthalpy of sublimation.  
2 moles of an ideal gas are expanded isothermally and reversibly from 20L to 30L at 300 K. Calculate the work done. ( $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ ) (Sept. 2021) (4)
- (50) One mole of an ideal gas is expanded isothermally and reversibly from 10 L to 15 L at 300 K. Calculate the work done in the process. (March 2022) (2)
- (51) Calculate the standard enthalpy of formation of  $\text{CH}_3\text{OH}_{(l)}$  from the following data:  
(i)  $\text{CH}_3\text{OH}_{(l)} + \frac{3}{2}\text{O}_{2(g)} \longrightarrow \text{CO}_{2(g)} + 2\text{H}_2\text{O}_{(l)}$ ;  $\Delta H^0 = -726 \text{ kJ mol}^{-1}$   
(ii)  $\text{C}_{(s)} + \text{O}_{2(g)} \longrightarrow \text{CO}_{2(g)}$ ;  $\Delta H^0 = -393 \text{ kJ mol}^{-1}$   
(iii)  $\text{H}_{2(g)} + \frac{1}{2}\text{O}_{2(g)} \longrightarrow \text{H}_2\text{O}_{(l)}$ ;  $\Delta H^0 = -286 \text{ kJ mol}^{-1}$  (March 2022) (3)
- (52) Write the mathematical equation for the first law of thermodynamics for  
(i) Isothermal process (ii) Adiabatic process. (March 2022) (2)

## 5

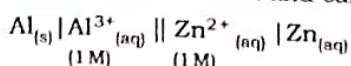
## ELECTROCHEMISTRY

- (1) Describe the construction and working of standard hydrogen electrode. Give its two disadvantages. (March 2008; Oct. 2008) (4)
- (2) Describe the construction and working of  $\text{H}_2-\text{O}_2$  fuel cell. Write its advantages. (March 2009) (4)
- (3) Write Nernst equation for single electrode potential and give the meaning of the terms involved in it. (March 2010) (3)
- (4) What is electrochemical series? Explain its applications in the determination of relative strength of oxidizing and reducing agents. (March 2010; Oct. 2010) (2)
- (5) Explain the construction and working of lead accumulator. (March 2011) (4)
- (6) State Kohlrausch Law and write mathematical expression of molar conductivity of the given solution at infinite dilution. (March 2013) (2)
- (7) Write the cell reactions in lead storage battery during discharge. (March 2013) (2)
- (8) In electrolysis of  $\text{AgNO}_3$  solution 0.7 g of Ag is deposited after a certain period of time. Calculate the quantity of electricity required in coulomb. (Molar mass of Ag is  $107.9 \text{ g mol}^{-1}$ ) (March 2013) (2)

- (9) Write electrode reaction and net cell reaction for fuel cell. Calculate e.m.f. of the following cell at 25°C:  
 $Zn_{(s)} | Zn^{2+}_{(aq)} (0.1 \text{ M}) || Cu^{2+}_{(aq)} (0.5 \text{ M}) | Cu_{(s)}$   
 Standard reduction potential (SRP) of Zn and Cu are -0.76 V and 0.334 V respectively. (Oct. 2013) (2)
- (10) Resistance and conductivity of a cell containing 0.001 M KCl solution at 298K are  $1500 \Omega$  and  $1.46 \times 10^{-4} \text{ S.cm}^{-1}$  respectively. What is the cell constant? (March 2014) (3)
- (11) State the first and second law of electrolysis. (March 2014) (2)
- (12) Write any 'four' applications of electrochemical series. (Oct. 2014) (2)
- (13) With the help of the equation,  $\Delta G^0 = -nFE^0_{\text{cell}}$  explain that cell potential is an intensive property. (Oct. 2014) (2)
- (14) How much electricity in terms of Faraday is required to produce:  
 (a) 20 g of Ca from molten  $CaCl_2$  (b) 40 g of Al from molten  $Al_2O_3$   
 (Given: Molar mass of Calcium and Aluminium are  $40 \text{ g.mol}^{-1}$  and  $27 \text{ g.mol}^{-1}$  respectively.) (Oct. 2014) (2)
- (15) Draw neat and labelled diagram of dry cell. (March 2015) (2)
- (16) Arrange the following reducing agents in the order of increasing strength under standard state conditions. Justify the answer.
- | Element | $Al_{(s)}$ | $Cu_{(s)}$ | $Cl_{(aq)}$ | $Ni_{(s)}$ |
|---------|------------|------------|-------------|------------|
| $E^0$   | -1.66 V    | 0.34 V     | 1.36 V      | -0.26 V    |
- (March 2015) (2)

- (17) Calculate  $E_{\text{cell}}$  and  $\Delta G$  for the following at 28°C:  
 $Mg_{(s)} + Sn^{2+} (0.04 \text{ M}) \longrightarrow Mg^{2+} (0.06 \text{ M}) + Sn_{(s)}$   $E^0_{\text{cell}} = 2.23 \text{ V}$ . Is the reaction spontaneous? (March 2015) (3)
- (18) Can copper sulphate solution be stored in an iron vessel? Explain. (Oct. 2015) (2)
- (19) Resistance of conductivity cell filled with 0.1 M KCl solution is 100 ohms, calculate the conductivity and molar conductivity of 0.02 M KCl solution.  
 (Given: Conductivity of 0.1 M KCl solution is  $1.29 \text{ S m}^{-1}$ .) (Oct. 2015) (3)
- (20) Define 'Molar conductivity'. (March 2016) (1)
- (21) Define cell constant. Draw a neat and well labelled diagram of primary reference electrode. (March 2016) (3)
- (22) Conductivity of a solution is  $6.23 \times 10^{-5} \Omega^{-1} \text{ cm}^{-1}$  and its resistance is  $13710 \Omega$ . If the electrodes are 0.7 cm apart, calculate the cross-sectional area of electrode. (March 2016) (3)
- (23) The conductivity of 0.02 M  $AgNO_3$  at 25°C is  $2.428 \times 10^{-3} \Omega^{-1} \text{ cm}^{-1}$ . What is its molar conductivity? (July 2016) (2)
- (24) What are 'fuel cells'? Write cathode and anode reaction in a fuel cell. (March 2017) (2)
- (25) 0.05 M NaOH solution offered a resistance of 31.6 W in a conductivity cell at 298 K. If the cell constant of the cell is  $0.367 \text{ cm}^{-1}$ . Calculate the molar conductivity of NaOH solution. (March 2017) (3)
- (26) State Faraday's first law of electrolysis. (March 2017) (1)
- (27) Construct a labelled diagram for the following cell:  
 $Zn_{(s)} | Zn^{2+} (1 \text{ M}) || H^+ (1 \text{ M}) | H_2(g, 1 \text{ atm}) | Pt$  (July 2017) (2)
- (28) Write the cell representation and calculate equilibrium constant for the following redox reaction:  
 $Ni_{(s)} + 2Ag^+_{(aq)} (1 \text{ M}) \longrightarrow Ni^{2+}_{(aq)} (1 \text{ M}) + 2Ag_{(s)}$  at 25°C  $E^0_{Ni} = -0.25 \text{ V}$  and  $E^0_{Ag} = 0.799 \text{ V}$  (July 2017) (3)
- (29) Draw a neat and labelled diagram of lead storage battery. (March 2018) (2)
- (30) How many faradays of electricity are required to produce 13 gram of aluminium from aluminium chloride solution? (Given: molar mass of Al =  $27.0 \text{ g/mol}$ ) (March 2018) (3)
- (31) Represent a cell consisting of  $Mg^{2+} | Mg$  half cell and  $Ag^+ | Ag$  half cell and write the cell reaction.  
 $(E^0_{Ag} = 0.799 \text{ V}, E^0_{Mg} = -2.37 \text{ V})$  (July 2018) (2)
- (32) How much quantity of electricity in coulomb is required to deposit  $1.346 \times 10^{-3} \text{ kg}$  of Ag in 3.5 minutes from  $AgNO_3$  solution? (Given: Molar mass of Ag is  $108 \times 10^{-3} \text{ kg/mol}$ ) (July 2018) (3)
- (33) Write features of reversible process. (July 2018) (1)
- (34) Define resistivity. (July 2018) (1)
- (35) How many Faradays of electricity are required to produce 6 g of Mg from  $MgCl_2$ ? (March 2019) (2)
- (36) The molar conductivity of 0.05 M  $BaCl_2$  solution at 25°C is  $223 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$ . What is its conductivity? (March 2019) (2)
- (37) Define electrochemical series. Write its applications. (March 2019) (3)
- (38) The standard e.m.f. of the following cell is 0.463 V  
 $Cu_{(s)} | Cu^{2+}_{(aq)} (1 \text{ M}) || Ag^+ (1 \text{ M}) | Ag_{(s)}$   
 If the standard potential of Ag electrode is 0.800 V, what is the standard potential of Cu electrode? (March 2020) (1)

- (39) Write the cell reaction and calculate  $E^0$  cell of the following electrochemical cell:



$$E^0_{\text{Al}} = -1.66 \text{ V}, E^0_{\text{Zn}} = -0.76 \text{ V.}$$

(March 2020) (2)

- (40) Define terms: (a) Electrochemical series (b) Corrosion. Write two applications of electrochemical series.

(March 2020) (3)

- (41) Write the value of  $\frac{2.303 RT}{F}$  in Nernst equation.

(Sept. 2021) (1)

- (42) The molar conductivity of 0.01 M acetic acid at 25°C is  $18 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$ .

Calculate its degree of dissociation in 0.01 M solution and dissociation constant, if the molar conductivity of acetic acid at zero concentration is  $400 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$ .

(Sept. 2021) (2)

- (43) State Kohlrausch law of independent migration of ions. Write and explain two applications of electrochemical series. Write unit of cell constant.

(Sept. 2021) (4)

- (44) How many moles of electrons are required for reduction of 2 moles of  $\text{Zn}^{2+}$  to  $\text{Zn}$ ? How many faraday of electricity will be required?

(March 2022) (2)

- (45) Define reference electrode. Write the functions of salt bridge.

Draw neat, labelled diagram of standard hydrogen electrode (SHE).

(March 2022) (4)

## 6

## CHEMICAL KINETICS

- (1) Distinguish between molecularity and order of the reaction.

(March 2008, 2009, 2011, 2020; Oct. 2008, 2009, 2010, 2013, 2014) (2)

- (2) What is 'rate law'? Show that half life of first order chemical reaction is independent of initial concentration of the reactant.

(March 2008) (3)

- (3) Define rate of reaction. Derive integrated rate equation for first order reaction.

(Oct. 2008, 2010; March 2010, 2011) (3)

- (4) State rate law. Write 'one' example of it.

(March 2009) (2)

- (5) What is half life period of a reaction? Show that half-life period does not depend upon the initial concentration for first order reaction.

(Oct. 2009) (3)

- (6) Define 'Rate law'.

(March 2010) (1)

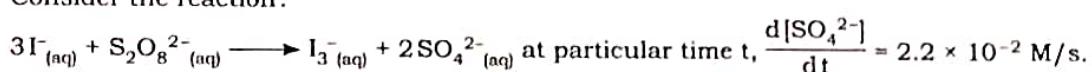
- (7) What is Pseudo first order reaction? Explain with suitable example.

(March 2009, 2010) (2)

- (8) Define 'Molecularity' of chemical reaction.

(March 2010) (1)

- (9) Consider the reaction:



What are the values of the following at the same time?

$$(a) -\frac{d[\text{I}^{-}]}{dt}$$

$$(b) -\frac{d[\text{S}_2\text{O}_8^{2-}]}{dt}$$

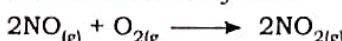
$$(c) -\frac{d[\text{I}_3^{-}]}{dt}$$

(March 2013) (3)

- (10) Define activation energy. Calculate activation energy for a reaction of which rate constant becomes four times when temperature changes from 30°C to 50°C. (Given  $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ ).

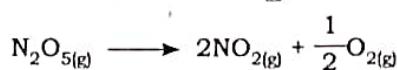
(Oct. 2013) (3)

- (11) Write molecularity of the following reaction:



(March 2014) (1)

- (12) The decomposition of  $\text{N}_2\text{O}_{5(g)}$  at 320K according to the following equation follows first order reaction:



The initial concentration of  $\text{N}_2\text{O}_{5(g)}$  is  $1.24 \times 10^{-2} \text{ mol L}^{-1}$  and after 60 minutes,  $0.20 \times 10^{-2} \text{ mol L}^{-1}$ .

Calculate the rate constant of the reaction at 320K.

(March 2014) (3)

- (13) Derive the relation between half-life period and rate constant for first order reaction.

(March 2014) (2)

- (14) Sucrose decomposes in acid solution to give glucose and fructose according to the first order rate law.

The half life of the reaction is 3 hours. Calculate fraction of sucrose which will remain after 8 hours.

(Oct. 2014; March 2015) (3)

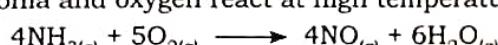
- (15) Derive the relation between half life and rate constant for a first order reaction.

(March 2015, 2017) (2)

- (16) Define: (a) Average rate of reaction (b) Instantaneous rate of reaction.

(Oct. 2015) (2)

- (17) Ammonia and oxygen react at high temperature as:



In an experiment, rate of formation of  $\text{NO}_{(g)}$  is  $3.6 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$

Calculate: (a) Rate of disappearance of ammonia. (b) Rate of formation of water.

(Oct. 2015) (3)

- (18) Define 'Zero order reaction'. (March 2016) (1)
- (19) Explain graphical method to determine activation energy of a reaction. (March 2016) (2)
- (20) In a first order reaction  $x \rightarrow y$ , 40% of the given sample of compound remains unreacted in 45 minutes. Calculate rate constant of the reaction. (March 2016) (2)
- (21) The rate constant of a first order reaction are  $0.58 \text{ s}^{-1}$  at 313 K and  $0.045 \text{ s}^{-1}$  at 293 K. What is the energy of activation for the reaction? (July 2016) (3)
- (22) In the Arrhenius equation for a first order reaction, the values of 'A' and ' $E_a$ ' are  $4 \times 10^{13} \text{ sec}^{-1}$  and  $98.6 \text{ kJ mol}^{-1}$  respectively. At what temperature will its half life period be 10 minutes? (March 2017) (3)  
 $|R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}|$
- (23) The rate law for the reaction  $2\text{H}_{2(g)} + 2\text{NO}_{(g)} \longrightarrow \text{N}_{2(g)} + 2\text{H}_2\text{O}_{(g)}$  is given by rate =  $K[\text{H}_2][\text{NO}]^2$ . The reaction occurs in the following two steps:  
(a)  $\text{H}_{2(g)} + 2\text{NO}_{(g)} \longrightarrow \text{N}_{2(g)} + \text{H}_2\text{O}_{(g)}$   
(b)  $\text{N}_{2(g)} + \text{H}_{2(g)} \longrightarrow \text{N}_{2(g)} + \text{H}_2\text{O}_{(g)}$   
What is the rate of  $\text{N}_2\text{O}$  in the mechanism? What is the molecularity of the elementary steps? (July 2017) (2)
- (24) From the following data for the liquid phase reaction  $\text{A} \rightarrow \text{B}$ , determine the order of reaction and calculate its rate constant:  

t/s	0	600	1200	1800
[A]/Mol L <sup>-1</sup>	0.624	0.446	0.318	0.226

(July 2017) (3)
- (25) A certain reaction occurs in the following steps.  
(i)  $\text{Cl}_{(g)} + \text{O}_{3(g)} \longrightarrow \text{ClO}_{(g)} + \text{O}_{2(g)}$   
(ii)  $\text{ClO}_{(g)} + \text{O}_{(g)} \longrightarrow \text{Cl}_{(g)} + \text{O}_{2(g)}$   
(a) What is the molecularity of each of the elementary steps?  
(b) Identify the reaction intermediate and write the chemical equation for overall reaction. (March 2018) (2)
- (26) The reaction  $\text{A} + \text{B} \rightarrow \text{products}$  is first order in each of the reactants.  
(a) How does the rate of reaction change if the concentration of A is increased by factor 3?  
(b) What is the change in the rate of reaction if the concentration of A is halved and concentration of B is doubled? (March 2018) (2)
- (27) Define the order of chemical reaction.  
Find the overall order of the following reactions:  
(a)  $\text{CHCl}_{3(g)} + \text{Cl}_{2(g)} \longrightarrow \text{CCl}_{4(g)} + \text{HCl}_{(g)}$ , Rate =  $k[\text{CHCl}_3][\text{Cl}_2]$  (July 2018) (2)  
(b)  $2\text{NO}_{(g)} + \text{O}_{2(g)} \longrightarrow 2\text{NO}_{2(g)}$ , Rate =  $k[\text{NO}]^2[\text{O}_2]$  (March 2019) (3)
- (28) In a first order reaction  $\text{A} \rightarrow \text{product}$ , 80 % of the given sample of compound decomposes in 40 min. What is the half life period of the reaction? (July 2018) (3)
- (29) Write Arrhenius equation. Derive an expression for temperature variations. (March 2020) (1)
- (30) The rate of a first order reaction,  $\text{A} \rightarrow \text{B}$  is  $5.4 \times 10^{-6} \text{ Ms}^{-1}$  when [A] is 0.3M. Calculate the rate constant. (March 2019) (1)
- (31) The half life period of a first order reaction is 6.0 h. Calculate the rate constant. (March 2011) (1)
- (32) Write the mathematical relation between half life of zero order reaction and its rate constant. (March 2020) (1)
- (33) Define instantaneous rate of reaction. Explain pseudo first order reaction with suitable example. (March 2020) (3)
- (34) Define isomorphism. Derive integrated law expression for first order reaction. (Sept. 2021) (4)
- (35) What is pseudo - first order reaction? Explain with suitable example. (Sept. 2021) (2)
- (36) Define half life of first order reaction. Obtain the expression for half life and rate constant of the first order reaction. (March 2022) (3)
- (37) Identify the molecularity of following elementary reaction:  
 $\text{NO}_{(g)} + \text{O}_{3(g)} \longrightarrow \text{NO}_{3(g)} + \text{O}_{(g)}$  (March 2022) (1)
- 7 ELEMENTS OF GROUPS 16, 17 AND 18**
- (1) Draw structure and write geometry of  $\text{PCl}_3$  and  $\text{PCl}_5$ . (March 2013) (2)
- (2) What is the action of the following reagents on ammonia?  
(a) Excess of air      (b) Excess of chlorine      (c) Na metal (March 2013) (3)
- (3) Explain the trends in the following properties with reference to group 16:  
(a) Atomic radii and ionic radii      (b) Density  
(c) Ionisation enthalpy      (d) Electronegativity (March 2013) (4)

- (4) What is the action of chlorine (Cl) on the following:  
 (a) Cold and dilute caustic soda. (b) Hot and concentrated caustic soda. (Oct. 2013) (3)  
 (c) Potassium bromide solution. (Oct. 2013) (2)
- (5) Write electronic configuration and two uses of neon ( $Z = 10$ ). (March 2014) (1)
- (6) Write resonating structures of ozone. (March 2014) (1)
- (7) Describe anomalous behaviour of fluorine with the other elements of group 17 with reference to:  
 (a) Hydrogen bonding (b) Oxidation state (c) Polyhalide ions. (March 2014) (3)
- (8) Describe anomalous behaviour of oxygen as compared with other elements of group 16 with reference to:  
 (a) Magnetic property (b) Oxidation state (c) Hydrides (Oct. 2014) (3)
- (9) Draw the structure of:  
 (a) Orthophosphoric acid (b) Pyrophosphoric acid (Oct. 2014) (2)
- (10) Explain the structure of sulphur dioxide. (March 2015) (2)
- (11) Write molecular formulae and structures of the following compounds:  
 (a) Dithionic acid (b) Peroxy monosulphuric acid (March 2015) (4)  
 (c) Pyrosulphuric acid (d) Dithionous acid (March 2015) (2)
- (12) Draw structures of: (a) Chlorine trifluoride (b) Chlorine pentafluoride. (July 2016) (2)
- (13) What is the action of dioxygen on:  
 (a) Calcium (b) Iron (c) Carbon disulphide? (Oct. 2015) (3)
- (14) What happens when dilute sulphuric acid is treated with (a)  $\text{Fe}$  (b)  $\text{CaF}_2$ ? (July 2016) (2)
- (15) What happens when thin copper leaves are thrown in jar containing chlorine? (July 2016) (2)
- (16)  $\text{H}_2\text{O}$  is liquid while  $\text{H}_2\text{S}$  is gas at room temperature. Explain. (July 2016) (2)
- (17) Write the electronic configuration of the following elements:  
 (a) Sulphur ( $Z = 16$ ) (b) Krypton ( $Z = 36$ ) (March 2017) (2)
- (18) Write any 'two' uses of each of the following: (a)  $\text{H}_2\text{SO}_4$  (b) Chlorine (March 2017) (2)
- (19) What is the action of concentrated sulphuric acid on the following:  
 (a) Phosphorous pentachloride (b) Copper (c) Potassium chlorate. (July 2017) (3)
- (20) Write balanced chemical equations for the following:  
 (a) Action of ozone on hydrogen peroxide. (March 2018) (1)
- (21) Write the molecular and structural formulae of:  
 (a) Thiosulphuric acid (b) Dithionous acid (March 2018) (2)
- (22) Draw the structure of  $\text{IF}_7$ . Write its geometry and the type of hybridization. (March 2018) (2)
- (23) Explain the following with the help of balanced chemical equation:  
 (a) Bleaching action of  $\text{SO}_2$ .  
 (b) Dehydration of formic acid by concentrated  $\text{H}_2\text{SO}_4$ .  
 (c) Burning of benzene in presence of excess of dioxygen. (July 2018) (3)
- (24) Write structure and molecular formula for sulphurous acid. (July 2018) (1)
- (25) Write any four points of difference between fluorine and other halogens. (July 2018) (2)
- (26) Write chemical reactions for different steps in the manufacture of sulphuric acid by lead chamber process. (March 2019) (3)
- (27) Explain the following properties of group 16 elements:  
 (i) Electro negativity (ii) Melting and boiling points  
 (iii) Metallic character (iv) Allotropy (March 2019) (4)
- (28) What are oxides? Write different types of oxides with one example each. (March 2019) (4)
- (29) Write the name and formula of one ore of zinc. (March 2020) (1)
- (30) Write two uses of each of the following: (a) Helium (b) Neon. (March 2020) (2)
- (31) Draw the structure of sulphurous acid. Explain why nitrogen does not form pentahalides. (March 2020) (3)
- (32) Explain interhalogen compounds.  
 How is oxygen prepared from the following compounds?  
 (a)  $\text{KClO}_4$  (b)  $\text{PbO}_2$ . (March 2020) (4)
- (33) Write the name of interhalogen compound of chlorine which has square pyramidal structure. (Sept. 2021) (1)
- (34) Draw the structure of sulphurous acid. Write two uses of helium. (Sept. 2021) (2)
- (35) Write chemical equations involved during manufacture of sulphuric acid by contact process. Write two uses of sulphur dioxide. (Sept. 2021) (3)
- (36) What is the action of concentrated  $\text{H}_2\text{SO}_4$  on: (i)  $\text{CaF}_2$  (ii) Cane sugar.  
 What is nucleotide? Write reaction for the preparation of polyacrylonitrile (PAN). (Sept. 2021) (4)
- (37) What is the action of selenium on magnesium metal? (March 2022) (1)
- (38) Explain the trends in the following atomic properties of group 16 elements:  
 (i) Atomic radii (ii) Ionisation enthalpy (iii) Electronegativity (iv) Electron gain enthalpy. (March 2022) (2)

(39) Write chemical composition of haematite. Write the names and electronic configurations of first two elements of group 17.

(March 2022) (3)

(40) Write chemical equation for preparation of sulphur dioxide from sulphur. Write uses of sulphur.

(March 2022) (3)

8

**TRANSITION AND INNER TRANSITION ELEMENTS**

(1) Give the observed outer electronic configuration of copper ( $Z = 29$ ).

(March 2008) (3)

Why are compounds of copper 'coloured' while those of zinc colourless?

(Oct. 2008) (2)

(2) Explain the position of d-Block elements in the periodic table.

(March 2009) (2)

(3) Why do the d-block elements form the coloured compound?

(4) Give reasons:

(a) Zinc salts are white

(Oct. 2009) (3)

(b) Transition metal shows catalytic properties.

(Oct. 2009) (2)

(c) Manganese shows variable oxidation states ( $Mn, Z = 25$ )

(March 2010) (1)

(5) Write the position of zinc ( $Z = 30$ ) in the periodic table and write its electronic configuration.

(6) What is the general outer electronic configuration of transition series elements?

(Oct. 2010) (2)

(7) Explain the following characteristics of transition elements:

(March 2011) (2)

(a) Tendency to form complexes (b) Catalytic property.

(8) Transition elements show variable oxidation states. Explain.

(9) What are transition elements? Explain their position in Modern Periodic Table and write the electronic configuration of Co (At. No. 27)

(March 2008, 2010; Oct. 2015; July 2016) (2)

(10) Distinguish between Lanthanides and Actinides.

(March 2008) (2)

(11) Why do lanthanides form coloured compounds?

(12) Why does the basicity of hydroxides of lanthanide series elements decrease with increase in atomic number.

(Oct. 2008) (2)

(13) Write the outer observed electronic configuration of:

(Oct. 2008) (2)

(a) Gadolinium (64) (b) Ytterbium (70).

(March 2009) (2)

(14) What are lanthanons? Give names and symbols of any 'two rare earths'.

(15) Explain why does lanthanum forms  $La^{3+}$  ion, while cesium forms  $Ce^{4+}$  ion.

(At. No. La = 57, Ce = 58)

(March 2009) (2)

(16) Write expected electronic configurations of (a) Nd ( $Z = 60$ ) (b) Tm ( $Z = 69$ ).

(Oct. 2009) (2)

(17) Explain  $_{63}^{Eu}$  and  $_{70}^{Yb}$  show +2 oxidation state.

(Oct. 2009) (2)

(18) Write the general outer electronic configuration of lanthanides and actinides.

(Oct. 2009) (2)

(19) Write the expected electronic configurations of (a) Europium ( $Z = 63$ ) (b) Erbium ( $Z = 68$ )

(March 2010) (2)

(20) What are 'Actinides'? Write their position in the periodic table.

(Oct. 2010) (3)

(21) Explain the cause of lanthanide contraction.

(Oct. 2010) (2)

(22) Write the different oxidation states of manganese. Why +2 oxidation state of manganese is more stable?

(March 2011, 2018) (2)

(23) Write observed electronic configuration of elements from first transition series having half filled d-orbitals.

(March 2013) (3)

(24) What is lanthanoid contraction? Explain the cause and effects of lanthanoid contraction.

(Oct. 2013) (2)

(25) What are lanthanoids? What is the position of actinoids in periodic table?

(Oct. 2013) (3)

(26) What are interstitial compounds? Why do these compounds have higher melting points than corresponding pure metals?

(March 2014) (2)

(27) Define lanthanoid contraction. Explain its effects.

(March 2015) (2)

(28) Write the reactions involved in the zone of reduction in blast furnace during extraction of iron.

(March 2015) (2)

(29) What is the position of iron ( $Z = 26$ ) in periodic table?

(Oct 2015) (3)

Explain why is  $Fe^{3+}$  more stable than  $Fe^{2+}$ ?

(March 2016) (2)

(30) Why is  $Sc^{3+}$  colourless while  $Ti^{3+}$  coloured? (Atomic number  $Sc = 21, Ti = 22$ ).

(March 2016) (3)

(31) What are f-block elements? Distinguish between lanthanoid and actinoids.

(March 2016) (1)

(32) Explain the term - Interstitial compounds.

(March 2017) (2)

(33) Write the factors which are related to the colour of transition metal ions.

(March 2017) (3)

(34) Write the different oxidation states of iron. Why oxidation state of manganese is more stable?

(Given: Z of Mn = 25.) (March 2017) (3)

(35) Write the different oxidation states of iron. Why lanthanum ( $Z = 57$ ) forms  $La^{3+}$  ion, while cerium ( $Z = 58$ ) forms  $Ce^{4+}$  ion?

(July 2017) (3)

(36) What are 'd' and 'f' block elements?

(July 2018) (2)

9 COORDINATION COMPOUNDS

- |   |   |                  |
|---|---|------------------|
| (1) Write the formulae of the following compounds-  |   |                  |
| (a) Sodium hexanitro-N-cobaltate (III)  |   |                  |
| (b) Tetraaququodichlorochromium (III) chloride.   |   |                  |
| (c) Potassium tetracyanoaurate (III) ion.   |   |                  |
| (2) Write applications of co-ordination compounds in medicine and electroplating.   |   | (March 2013) (3) |
| (3) What is effective atomic number (EAN)?  |   | (Oct. 2013) (2)  |
| Calculate EAN of cobalt (Z = 27) in $[\text{CO}(\text{NH}_3)_6]^{3+}$ and of zinc (Z = 30) in $[\text{Zn}(\text{NH}_3)_4] \text{SO}_4$ .                                  |   | (March 2014) (3) |
| (4) Classify the following ligands into monodentate and polydentate -   |   |                  |
| (a) Ammonia   | (b) Carbon monoxide                     |                  |
| (c) Ethylene diamine  | (d) Ethylene diamine tetra acetate ion. | (Oct. 2014) (2)  |
| (5) On the basis of valence bond theory explain the nature of bonding in $[\text{CoF}_6]^{3-}$ ion. Write the IUPAC name of $[\text{Co}(\text{NO}_2)_3(\text{NH}_3)_3]$ . |   | (March 2015) (3) |
| (6) Explain cationic complexes and anionic complexes of co-ordinationation compounds.   |   | (Oct. 2015) (2)  |
| (7) Illustrate with example, the difference between a double salt and a co-ordination compound.   |   | (March 2016) (2) |
| (8) Explain the terms- Ligand.  |   | (March 2016) (1) |
| (9) Write the formula of Tetraminodichloroplatinum (IV) chloride.   |   | (March 2016) (1) |
| (10) Define ligand. Write four postulates of Werner's theory.   |   | (July 2016) (3)  |
| (11) What is 'effective atomic number' (EAN)?   |   |                  |
| Calculate the effective atomic number of the central metal atom in the following compounds :  |   |                  |
| (a) $\text{K}_4\text{Fe}(\text{CN})_6$  | (b) $\text{Cr}(\text{CO})_6$            |                  |
| Fe (Z = 26)   | Cr (Z = 24)                             |                  |
| (12) How ligands are classified? Explain with suitable examples.  |   | (March 2017) (3) |
| (13) Explain the geometry of $[\text{Co}(\text{NH}_3)_6]^{3+}$ on the basis of hybridisation. (Z of Co = 27)  |   | (July 2017) (3)  |
| (14) Write the formula for pentaammine chlorocobalt (II) sulphate.  |   | (March 2018) (2) |
| (15) Explain the geometry of $[\text{Cu}(\text{NH}_3)_4]^{2+}$ on the basis of hybridisation [At. No. Cu = 29].   |   | (July 2018) (2)  |
| (16) What is effective atomic number? Calculate effective atomic number of copper (Z = 29) in $[\text{Cu}(\text{NH}_3)_4]^{2+}$   |   | (July 2018) (2)  |
| (17) Calculate the effective atomic number (E.A.N.) of copper in $[\text{Cu}(\text{NH}_3)_4]^{2+}$ . (Z of Cu = 29)   |   | (March 2019) (3) |
| (18) Explain ionisation isomerism in co-ordination compounds with a suitable example.   |   | (March 2020) (2) |
| (19) What are bidentate Ligands? Give one example.  |   | (March 2020) (2) |
| (20) Illustrate with example, the difference between a double salt and co-ordination compounds. Write two applications of coordinate compounds.                           |   | (Sept. 2021) (2) |
|   |   | (Sept. 2021) (3) |

- (21) Write IUPAC name of  $[\text{Fe}(\text{CO})_5]$  complex. (Sept. 2021) (1)
- (22) Write the name of isomerism in the following complexes:  $[\text{Cu}(\text{NH}_3)_4][\text{PtCl}_4]$  and  $\text{Pt}[(\text{NH}_3)_4]\text{CuCl}_4$  (March 2022) (1)
- (23) Explain monodentate and ambidentate ligands with example. (March 2022) (2)
- (24) Explain cationic, anionic and neutral sphere complexes with example. (March 2022) (3)

10

HALOGEN DERIVATIVES

- (1) Write a note on Wurtz reaction and mention any two uses of iodoform. (March 2008) (3)
- (2) Explain the mechanism of alkaline hydrolysis of bromomethane. (March 2008) (4)
- (3) Define optical activity. Explain optical activity of 2-chlorobutane. (March 2008, Oct. 2008) (4)
- (4) State and explain 'Markownikoff's rule' with a suitable example. (Oct. 2008, 2014) (2)
- (5) Define asymmetric carbon atom. (Oct. 2008, March 2011) (1)
- (6) What is the action of following reagents on ethyl iodide? (March 2009) (3)
- (a) Aq. KOH (b) Alcoholic KCN (c) Silver acetate
- (7) Explain the mechanism of alkaline hydrolysis of tert-butyl bromide. (March 2009, 2010, 2017) (3)
- (8) Give the structural formula and IUPAC name of iso-butyl bromide. (March 2009) (1)
- (9) Complete the following reaction and identify A, B, C and D with correct formulae. (Oct. 2010) (4)
- $$\text{C}_2\text{H}_5\text{Br} \xrightarrow[\text{H}_2\text{O}]{\text{AgO}} \text{A} \xrightarrow{\text{Pyridine}} \text{B} \xrightarrow[\Delta]{\text{C}_2\text{H}_5\text{ONa}} \text{C} \xrightarrow{\text{Cold HI}} \text{C}_2\text{H}_5\text{OH} + \text{D}$$
- (10) Why does p-nitrochlorobenzene undergo displacement reactions readily with attack of nucleophilic  $\text{OH}^-$  ion? (March 2013) (2)
- (11) Write balanced chemical equations for the action of- (a) Phosphorus trichloride on propan-2-ol. (b) Hydrogen bromide on styrene in the presence of a peroxide. (c) Methyl bromide on silver propanoate. (March 2013) (3) (March 2014) (2)
- (12) Distinguish between  $\text{SN}^1$  and  $\text{SN}^2$  mechanisms. (Oct. 2014) (3)
- (13) (a) 3-chloro-3-ethylhex-1-ene (b) 1-Iodo-2, 3-dimethylbutane (c) 1, 3, 5-tribromobenzene. (Oct. 2014) (3) (March 2015) (2)
- (14) Draw structure of DDT. Write its environmental effects. (Oct. 2015) (2)
- (15) Identify 'A' and 'B' in the following reaction : (July 2016, 2018) (2)
- $$\text{CH}_3 - \text{CH} = \text{CH}_2 \xrightarrow{\text{HBr}} \text{A} \xrightarrow{\text{alc. KOH}} \text{B}$$
- (16) Discuss the mechanism of alkaline hydrolysis of bromomethane. (Oct. 2015) (4)
- (17) How is chlorobenzene prepared from aniline? How is chlorobenzene converted into diphenyl? (March 2016) (2)
- (18) Explain the terms- Optical activity. (March 2016) (1)
- (19) How is propene converted into 1-bromopropane and 2-bromopropane? (March 2016) (2)
- (20) Write a note on Sandmeyer's reaction. (July 2016, 2018) (2)
- (21) Identify 'A' and 'B' and rewrite the reactions. (July 2016) (2)
- (a)   $\xrightarrow[\text{HBr, 273 K}]{\text{NaNO}_2} \text{A} \xrightarrow{\text{Cu}_2\text{Br}_2} \text{B} + \text{N}_2 \uparrow$
- (b)  $\text{H}_3\text{C} - \text{CH}_2 - \text{CH} - \text{CH}_3 \xrightarrow[\Delta]{\text{Alcoholic KOH}} \text{A} + \text{B} + 2\text{KBr} + 2\text{H}_2\text{O}$  (March 2017) (1)
- (22) Define racemic mixture. (July 2017) (4)
- (23) Define optical activity. Explain optical activity of lactic acid. (March 2017) (2)
- (24) Identify A and B in the following reaction: (March 2018) (2)
- $$\text{CH}_3 - \text{Br} + \text{Mg} \xrightarrow{\text{dry ether}} \text{A} + \text{CO}_2 \xrightarrow[\text{H}^+/\text{H}_2\text{O}]{\text{dry ether}} \text{B} + \text{Mg}(\text{Br})\text{OH}$$
- (25) Explain only reaction mechanism for alkaline hydrolysis of tert-butylbromide. (March 2018) (2)
- (26) Identify 'A' and 'B' in the following reaction and rewrite the complete reaction: (March 2018) (2)
- $$\text{CH}_3 - \text{CH}_2 - \text{Br} + \text{AgCN} \xrightarrow{\Delta} \text{A} \xrightarrow{\text{Na, C}_2\text{H}_5\text{OH}} \text{B}$$
- (27)  $\text{C}_2\text{H}_5 - \text{Br} + \text{NaI} \xrightarrow{\text{dry acetone}} \text{C}_2\text{H}_5 - \text{I} + \text{NaBr}$  (July 2018) (1)
- The above reaction is (b) Balz -Schiemann reaction  
 (a) Wurtz reaction (d) Finkelstein reaction  
 (c) Swarts reaction
- (28) Identify A and B from the following reaction and rewrite complete reaction: (July 2018) (2)
- $$\text{C}_6\text{H}_5 - \text{CH}_2\text{Cl} + \text{Mg} \xrightarrow{\text{dry ether}} \text{A} \xrightarrow{\text{H}_2\text{O}} \text{B} + \text{MgCl}(\text{OH})$$

- (29) Complete and rewrite the following chemical reaction:  
1- chloro -2, 4-dinitrobenzene  $\xrightarrow[\text{368 K, H}]{\text{aq. alkali}}$  ? (July 2018) (1)
- (30) What is the action of the following on ethyl bromide:  
(i) alcoholic solution of potassium hydroxide → (2) (March 2019) (3)  
(ii) moist silver oxide ~~✓~~ (March 2019) (1)  
(iii) silver acetate? (March 2019) (1)
- (31) Define Enantiomers. (March 2020) (2)
- (32) What is Grignard reagent? (March 2020) (1)
- (33) Define optical activity. How many optical isomers are possible for glucose? (March 2020) (2)
- (34) Write the chemical reactions of chlorobenzene with respect to:  
(a) Sulphonation (b) Acetylation (c) Nitration. (March 2020) (3)
- (35) What is the action of the following on chlorobenzene?  
(i) Methyl chloride in presence of anhydrous  $\text{AlCl}_3$  ✓ (Sept. 2021) (2)  
(ii) Fuming  $\text{H}_2\text{SO}_4$ . (Sept. 2021) (3)
- (36) Explain  $\text{SN}_2$  reaction mechanism for alkaline hydrolysis of bromomethane. (March 2022) (1)
- (37) Write the product formed when alkyl halide reacts with silver nitrite. (March 2022) (1)
- (38) What is the action of the following on ethyl bromide?  
(i) Na in dry ether (ii) Mg in dry ether. (March 2022) (2)
- (39) Write chemical reactions for the following conversions:  
(i) Ethyl bromide to ethyl methyl ether  
(ii) Ethyl bromide to ethene  
(iii) Bromobenzene to toluene.  
(iv) Chlorobenzene to biphenyl. (March 2022) (4)

## 11

## ALCOHOLS, PHENOLS AND ETHERS

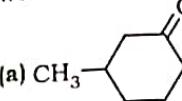
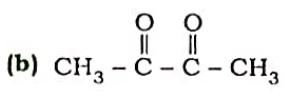
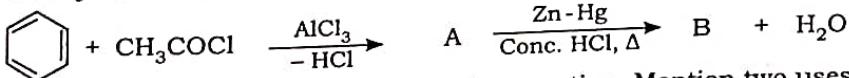
- (1) How is cumene converted into phenol? Give test to distinguish between phenol and ethanol. (March 2008, 2010; Oct. 2010) (3)
- (2) Draw the structure of 2-methyl-propan-1-ol. (March 2008) (1)
- (3) From methyl magnesium iodide how are the ethanol and propan-2-ol are prepared? (Oct. 2008) (2)
- (4) What is the action of the following on phenol?  
(a) Bromine in  $\text{CS}_2$   
(b) Conc.  $\text{H}_2\text{SO}_4$  in presence of conc.  $\text{HNO}_3$   
(c) Conc.  $\text{H}_2\text{SO}_4$  at room temperature. (Oct. 2008) (3)
- (5) What is the action of following on 2-methyl propan-2-ol?  
(a) 20%  $\text{H}_2\text{SO}_4$  at 360 K  
(b)  $\text{NaBr}$  and conc.  $\text{H}_2\text{SO}_4$  (Oct. 2008) (2)
- (6) Write the chemical test to distinguish between propan-1-ol, propan-2-ol and 2-methyl-propan-2-ol. (March 2009) (3)
- (7) What are phenols? How is carbolic acid prepared from aniline? Write a chemical test to distinguish between alcohol and phenol. (March 2009) (4)
- (8) What is the action of the following reagents on ethanol?  
(a) Thionyl chloride (b) Mixture of red phosphorus and bromine  
(c) Acidified potassium dichromate. (Oct. 2009, March 2011) (2)
- (9) How is carbolic acid prepared from benzene sulphonic acid?  
What is the action of conc.  $\text{H}_2\text{SO}_4$  on phenol at 373 K? (Oct. 2009) (2)
- (10) How is phenol prepared from (a) Aniline (b) Chlorobenzene. (March 2010; Oct. 2010) (2)
- (11) What is the action of sulphuric acid at different temperatures and different concentrations on the following compounds?  
(a) Ethanol (b) Propan-2-ol (c) 2-Methyl-propan-2-ol (March 2010) (3)
- (12) How are ethyl alcohol, iso-propyl alcohol and tertiary butyl alcohol distinguished from each other? (Oct. 2010) (3)
- (13) How is carbolic acid prepared from cumene? Give two uses of phenol. (March 2011) (3)
- (14) Boiling point of alcohols are much higher than those of the corresponding alkanes. Explain. (March 2011) (2)
- (15) Write IUPAC name of ethyl-methyl ether and explain action of cold  $\text{HI}$  and hot  $\text{HI}$  on it. (March 2008) (3)
- (16) How will you prepare diethyl ether by continuous etherification process? (Oct. 2008) (2)
- (17) What are ethers? (Oct. 2008, March 2011) (1)
- (18) Write a note on Williamson's synthesis. Mention two uses of ethoxyethane. (March 2009) (3)
- (19) What happens when, ethyl methyl ether is hydrolysed by using dil.  $\text{H}_2\text{SO}_4$ ? (Oct. 2009) (1)

- (20) What is the action of dilute sulphuric acid under pressure, on ethoxy ethane? (Oct. 2010) (1)
- (21) How is ethyl methyl ether prepared from sodium ethoxide? (March 2011) (1)
- (22) How is ethanol prepared from methanal by using Grignard reagent? (March 2013) (2)
- (23) Explain the mechanism of action of hydroiodic acid on 3-methylbutan-2-ol. (March 2013) (3)
- (24) How is phenol converted into the following? (a) benzene (b) benzoquinone (c) picric acid (Oct. 2013) (3)
- (25) Write the structural formula and IUPAC names of all possible isomers of the compound with molecular formula  $C_3H_8O$ . Write 'two' uses of phenol. (March 2014) (4)
- (26) How is methoxyethane prepared from methyl iodide. (March 2014) (1)
- (27) What is the action of the following reagents on phenol - (a) Bromine in  $CS_2$  at low temperature (b) Conc.  $H_2SO_4$  at room temperature. (Oct. 2014) (2)
- (28) How is carboxylic acid prepared from the following compounds: (i) Aniline (ii) Chlorobenzene and steam at 698K? (March 2015) (2)
- (29) (March 2015) (1)
- (29) Mention 'two' physical properties of carboxylic acid.
- (30) How are the following compounds prepared? (Oct. 2015) (2)
- (a) Benzyl alcohol from benzyl chloride. (b) Propan-1-ol from propanal
- (31) How is carboxylic acid prepared from chlorobenzene? What is the action of bromine water on carboxylic acids? Write chemical test to distinguish between carboxylic acid and alcohol. (Oct. 2015) (3)
- (31) (March 2016) (2)
- (32) Write the reactions involved in dehydration of  $1^\circ$ ,  $2^\circ$  and  $3^\circ$  alcohols.
- (33) What is metamerism? Write the structure and IUPAC name of 'methyl-n-propyl ether. (July 2016) (3)
- What is the action of hot HI on it?
- (34) How are the following conversions carried out? (July 2016) (3)
- (i) 2-methylbutan-1-ol into 2-methylbutanoic acid. (March 2017) (2)
- (ii) Phenylethene into Benzoic acid
- (iii) Benzoic acid into metanitrobenzoic acid.
- (35) Define carboxylic acid. How carboxylic acid is prepared from benzene sulphonic acid? (July 2017) (3)
- (36) How will you prepare ethanol, propan-2-ol and 2-methylpropan-2-ol from Grignard's reagent? (July 2017) (2)
- (37) How is phenol prepared from cumene?
- (38) Prepare carboxylic acid from benzene sulphonic acid. Write a chemical equation for the action of neutral ferric chloride on phenol. (March 2018) (3)
- (38) (March 2018) (2)
- (39) Why ethanol has higher boiling point than ethane?
- (40) Write a preparation of phenol from cumene? What happens when phenol is heated with zinc dust? (July 2018) (3)
- (41) Identify A and B respectively in the following reaction:   
 tert-butyl alcohol  $\xrightarrow[363\text{ K}]{20\text{ H}_2\text{SO}_4} A + H_2O \xrightarrow[H_2O_2]{\text{HBr}} B$
- (a) 2-methylpropene, 1-bromo-2-methylpropane (July 2018) (2)
- (b) 2-methylpropene, 2-bromo-2-methylpropane (July 2018) (2)
- (c) 2-methylpropane, 1-bromo-2-methylpropane (March 2019) (1)
- (d) 2-methylpropane, 2-bromo-2-methylpropane
- (42) What is the action of the following on isopropyl methyl ether? (a) cold HI (b) hot HI
- (43) What are ethers?
- (44) Write balanced chemical equations for the following: (March 2019) (2)
- (a) Action of sodium metal on ethanol
- (b) Action of zinc dust on phenol.
- (45) Write structural formula of the alcohol that results when acetaldehyde is reacted with  $CH_3MgBr$  in the presence of dry ether and the product is hydrolysed. (March 2020) (1)
- (45) (March 2020) (2)
- (46) Explain the continuous etherification process for the preparation of diethyl ether.
- (47) How is ethanol prepared from the following compounds: (March 2020) (3)
- (a) Ethanal (b) Ethene (c) Bromoethane. (Sept. 2021) (2)
- (48) Write a note on Kolbe reaction.
- (49) Convert the following: (Sept. 2021) (3)
- (i) Chlorobenzene to phenol
- (ii) Ethanal to ethanol.
- (iii) Iodomethane to methoxy methane. (March 2022) (2)
- (50) Write the preparation of phenol from aniline.
- (51) Write chemical reactions of following reagents on methoxyethane: (March 2022) (3)
- (i) Hot HI (ii)  $PCl_5$  (iii) Dilute  $H_2SO_4$ .

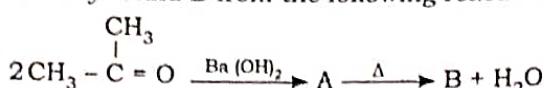
## 12

## ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

- (1) What is the action of following reagents on acetaldehyde?  
 (a) Na-Hg/H<sub>2</sub>O (March 2009) (b) Ammonia (c) Sodium bisulphite (March 2008) (3)
- (2) How will you obtain propan-2-one using  
 (a) CH<sub>3</sub>CN (b) Ca-salt of fatty acid?  
 What is the action of the following reagents on propan-2-one?  
 (a) Hydrogen cyanide (b) Hydrazine (March 2008) (4)
- (3) How will you prepare ethanal from 1, 1-dichloroethane?  
 What is the reaction of acetaldehyde with  
 (a) Ammonical silver nitrate (b) Fehlings solution? (Oct. 2008) (3)
- (4) What is the action of ammonia on: (a) Acetaldehyde (b) Formaldehyde? (Oct. 2008) (2)
- (5) Write a note on Cannizarro's reaction. (Oct. 2008, 2010; March 2011) (2)
- (6) Starting from Ca-salts of fatty acids, write the preparation of:  
 (a) Acetaldehyde (b) Acetone (March 2009) (2)
- (7) Write a note on aldol condensation. (March 2009, 2010) (4)
- (8) How is carbonyl group converted into:  
 (a) -CH<sub>2</sub>OH (b) >CH - OH (c) -CH<sub>2</sub>- (d) -C - OH (Oct. 2009, 2010) (2)
- (9) Convert the following:  
 (a) Acetone into pinacol.  
 (b) Formaldehyde into urotropine. (Oct. 2009; March 2010) (Oct. 2009) (3)
- (10) What is the action of following reagents on ethanal?  
 (a) Fehling solution (b) Tollen's reagent (March 2010) (2)
- (11) Explain: (a) Cannizzaro's reaction (b) Clemensen's reduction. (Oct. 2010) (2)
- (12) How will you obtain-  
 (a) Diacetonamine from acetone? (b) Acetaldoxime from acetaldehyde? (March 2011) (2)
- (13) What are aldehydes and ketones? Write a note on Cannizzaro's reaction. (March 2011) (4)
- (14) How is ethyl ethanoate prepared from (a) Carboxylic acid (b) Acid chloride. (March 2008) (2)
- (15) How will you bring about following conversions?  
 (a) Acetic acid to acetyl chloride (b) Methyl cyanide to acetic acid  
 (c) Acetyl chloride to ethyl acetate (d) Ethyl iodide to ethyl acetate (Oct. 2008) (4)
- (16) Convert the following:  
 (a) Dry ice into acetic acid (b) Ethyl acetate into acetone. (March 2009) (4)
- (17) How is ethyl acetate obtained from-  
 (a) Silver acetate (b) Acetic acid? (Oct. 2009) (2)
- (18) How is acetic acid converted into  
 (a) Acetamide (b) Acetic anhydride? (Oct. 2009) (2)
- (19) How is acetic acid prepared from  
 (a) Dry ice (b) Methyl cyanide? (March 2010) (2)
- (20) What is the action of ethyl magnesium iodide on ethyl methanoate in equimolar quantities? (March 2010) (2)
- (21) What happens when -  
 (a) Acetic acid is heated with P<sub>2</sub>O<sub>5</sub>?  
 (b) Silver acetate is heated with methyl iodide?  
 (c) Acetic acid is treated with sodium bicarbonate? (Oct. 2010) (3)
- (22) Define 'Ester' (Oct. 2010) (1)
- (23) What is the action of excess of methyl magnesium iodide on ethyl ethanoate? (March 2011) (4)
- (24) How is 4-methylpent-3-en-2-one obtained from propan-2-one? (March 2013) (2)
- (25) How are the following compounds prepared?  
 (a) Benzaldehyde from benzene.  
 (b) Acetophenone from benzene.  
 (c) Benzaldehyde from benzoyl chloride. (March 2013) (3)
- (26) Mention 'two' uses of propan-2-one. (March 2013) (1)
- (27) Explain the mechanism of aldol condensation. (Oct. 2013; March 2015) (3)
- (28) How is benzophenone prepared from benzonitrile ? (Oct. 2013; July 2016; March 2018) (2)
- (29) Write a note on aldol condensation. (March 2014, 2017) (2)
- (30) Write a note on self oxidation-reduction reaction of aldehyde with suitable example. (March 2014) (2)

- (31) Identify 'A' and 'B' in the following reaction :  $\text{C}_6\text{H}_5\text{MgBr} + \text{CO}_2 \xrightarrow[\text{H}^+/\text{H}_2\text{O}]{\text{Dry ether}} \text{A} \xrightarrow{\text{PCl}_5} \text{B}$  (Oct. 2014) (2)
- (32) Write the structure and IUPAC names of all the metamers represented by formula  $\text{C}_4\text{H}_{10}\text{O}$ . (Oct. 2014) (3)
- (33) Write balanced chemical equations for action of ammonia on -  
 (a) formaldehyde      (b) acetaldehyde      (c) acetone (Oct. 2014) (3)
- (34) Write a note on Friedel Craft's acylation. (March 2015) (2)
- (35) Explain, why are boiling points of carboxylic acids higher than corresponding alcohols. (March 2015) (2)
- (36) Write the structures and IUPAC names of the following compounds:  
 (a) Adipic acid      (b)  $\alpha$ -methyl butyraldehyde. (March 2015) (2)
- (37) What is Stephen reaction? (Oct. 2015) (2)
- (38) Write the structure and IUPAC names of isomeric aldehydes having molecular formula  $\text{C}_5\text{H}_{10}\text{O}$ . (Oct. 2015) (4)
- (39) What are ketones? How are ketones classified? (March 2016) (2)
- (40) Explain the mechanism of esterification. (March 2016) (4)
- (41) Write IUPAC names of the following compounds :  
 (a)  (b)  (July 2016) (2)
- (42) How is ethanoic acid prepared from dry ice? (March 2017) (2)
- (43) Give IUPAC name of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$  (March 2017) (1)
- (44) What is the action of the following reagents on propanone?  
 (a) Phenyl hydrazine      (b)  $\text{Zn-Hg}/\text{conc. HCl}$       (c) Sodium bisulphite (July 2017) (3)
- (45) Write a note on self oxidation-reduction reaction of aldehyde with suitable example. (July 2017) (2)
- (46) Complete and rewrite the balanced chemical equations:  
 (a) Chlorobenzene  $\xrightarrow[473 \text{ K, pressure}]{\text{NaCN} + \text{CuCN}} ?$   
 (b) Isobutyraldehyde  $\xrightarrow{50\% \text{ KOH}} ?$   
 (c) Butanone + 2, 4-dinitro-phenyl hydrazine  $\xrightarrow{\text{H}^+} ?$  (March 2018) (3)
- (47) What is the action of the following reagents on ethanoic acid?  
 (a)  $\text{LiAlH}_4 / \text{F}_3\text{O}^+$       (b)  $\text{PCl}_3$ , heat      (c)  $\text{P}_2\text{O}_5$ , heat (March 2018) (3)
- (48) Complete and rewrite the balanced chemical equation for the following reactions:  
 (a) Benzaldehyde  $\xrightarrow{50\% \text{ KOH}} ?$   
 (b) Acetone + phenylhydrazine  $\xrightarrow{\text{H}^+} ?$  (July 2018) (2)
- (49) Write balanced equations for the following conversions:  
 (a) Cyclopropane carboxylic acid to cyclopropylmethanol.  
 (b) Acetyl chloride to benzyl methyl ketone using dialkyl cadmium (July 2018) (2)
- (50) A compound used as pistachio flavour in ice cream is \_\_\_\_\_.  
 (a) vanillin      (b) acetophenone      (c) muscone      (d) butyraldehyde (March 2019) (1)
- (51) Write chemical equation for the following:  
 (i) Gatterman-Koch formylation      (ii) Rosenmund reduction  
 (iii) Fischer esterification (March 2019) (3)
- (52) How will you convert  
 (i) calcium acetate to acetaldehyde      (ii) acetone to acetone cyanohydrin  
 (iii) sodium acetate to methane      (iv) benzoic acid to m-bromobenzoic acid? (March 2019) (4)
- (53) Write balanced chemical reaction for preparation of acetic anhydride using acetic acid. (March 2020) (1)
- (54) Identify 'A' and 'B' in the following reaction:  
 (March 2020) (1)
- (55) Explain the mechanism of aldol addition reaction. Mention two uses of carboxylic acids. (March 2020) (4)
- (56) Write the name of reagent used during conversion of acetaldehyde to acetaldehyde cyanohydrin. (Sept. 2021) (1)
- (57) How is benzophenone prepared from benzonitrile? (Sept. 2021) (2)
- (58) Write a note on 'aldol' condensation reaction of ethanal. Write chemical reaction involved when benzaldehyde is treated with concentrated caustic potash. (Sept. 2021) (4)
- (59) Write the name of product formed, when acetone is treated with 2, 4-dinitrophenyl hydrazine. (March 2022) (1)

- (60) Identify A and B from the following reaction:



(March 2022) (2)

(March 2022) (2)

(March 2022) (2)

- (61) Write preparation of acetic acid from:

- (i) Dry ice (ii) Acetyl chloride

- (62) Write the classification of aliphatic ketones with example. What is the action of sodium hypodite on acetone?

### 13 AMINES

(March 2008) (2)

(March 2008) (2)

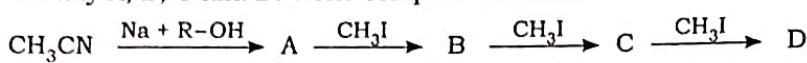
(Oct. 2008) (4)

- (1) How is ethanamine prepared by using (a) Acetaldoxime (b) Methyl cyanide.

- (2) Write acetylation reaction of: (a) Ethyl amine (b) Diethyl amine.

- (3) What are amines? What is the action of acetyl chloride on ethanamine, N-Ethylethanamine and N-N-dimethylethanamine?

- (4) Identify A, B, C and D. Write complete reactions.



(March 2009) (4)

- (5) How is ethylamine prepared from (a) Nitro-alkane (b) Oxime?  
Explain basic nature of amines.

(March 2010; Oct. 2009; July 2017) (4)

- (6) What is the action of-

- (a) Nitrous acid on ethyl amine

- (b) Mixture of sodium and alcohol on acetonitrile?

- (7) What is a 'Quaternary ammonium salt'?

(Oct. 2010) (2)

- (8) What are amines? Give IUPAC name of ethyl methyl amine.

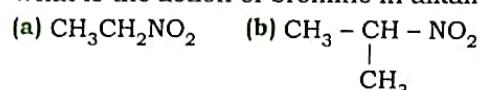
(March 2011) (2)

- (9) How will you convert?

- (a) -C≡N into -CH<sub>2</sub>-NH<sub>2</sub> (b) -NH<sub>2</sub> into -OH

(March 2011) (2)

- (10) What is the action of bromine in alkaline medium on:



(March 2013) (2)

- (11) Write a short note on Hoffmann bromamide degradation.

(March 2013) (3)

- (12) How is nitromethane prepared from the following?

- (a) alkyl halide (b)  $\alpha$ -halogen carboxylic acid (c)  $\alpha$ -nitroalkene

(Oct. 2013) (3)

- (13) Explain Hoffmann bromamide degradation reaction.

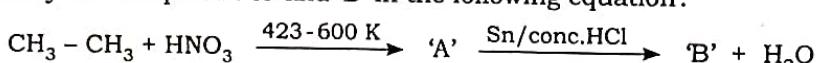
(Oct. 2013; March 2017, 2018) (2)

- (14) What is the action of the following reagents on aniline?

- (a) Bromine water (b) Acetic anhydride (c) Hot and conc. sulphuric acid

(March 2014) (3)

- (15) Identify the compound 'A' and 'B' in the following equation:



(March 2014) (2)

- (16) What will be the action of the mixture of sodium nitrite and dilute hydrochloric acid on:

- (a) Ethyl amine (b) Aniline (c) Triethyl amine?

(Oct. 2014) (3)

- (17) How are propan-1-amine and propan-2-amine prepared from oxime?

(Oct. 2014) (2)

- (18) How is ethyl amine prepared from methyl iodide?

(March 2015) (2)

- (19) Write a note on Gabriel phthalimide synthesis.

(March 2015) (3)

- (20) What is the action of acetic anhydride on:

- (a) Ethyl amine (b) Diethyl amine

(Oct 2015) (2)

- (21) What is the action of nitrous acid on-

- (a) Primary nitroalkane (b) Secondary nitroalkane (c) Tertiary nitroalkane.

(Oct. 2015) (3)

- (22) How are: (a) 1-nitropropane and

- (b) 2-nitropropane prepared from suitable oxime?

(March 2016) (2)

- (23) How are 1-nitropropane, 2-nitropropane and 2-methyl-2-nitropropane are distinguished from each other using nitrous acid?

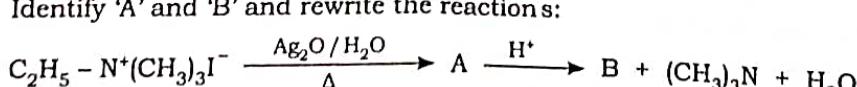
(March 2016) (3)

- (24) What is the action of benzene diazonium chloride on

- (a) Phenol in alkaline medium (b) Aniline

(July 2016) (2)

- (25) Identify 'A' and 'B' and rewrite the reaction s:



(July 2016) (1)

- (26) What is the action of mixture of  $\text{NaNO}_2$  and dil.  $\text{HCl}$  on:  
 (a) Ethylamine (b) Aniline (c) Diethylamine (March 2017) (3)
- (27) How is nitroethane converted into:  
 (a) Ethyl amine (b) N-ethylhydroxyl amine (c) acetic acid? (July 2017) (3)
- (28) What is the action of p-tolunesulphonylchloride on ethylamine and diethylamine? (March 2018) (2)
- (29) What is the action of lithium aluminium hydride in the presence of ether on the following compounds?  
 (a) nitroethane (b) 2-methyl-1-nitropropane. (July 2018) (2)
- (30) Write resonance structures of aniline. What is the action of benzene diazonium chloride on ethanol? (July 2018) (2)
- (31) Write the structure of Phenylmethanamine. (March 2019) (1)
- (32) Write a short note on Hoffmann elimination. (March 2019) (3)
- (33) What are amines? (March 2019) (1)
- (34) Define : Quaternary ammonium salt. (March 2020) (1)
- (35) Write the chemical reaction involved in the formation of ethyl amine using acetaldoxime. (March 2020) (3)
- (36) Write reactions to prepare ethanamine from  
 (i) Acetonitrile (ii) Nitroethane (iii) Propionamide. (Sept. 2021) (2)
- (37) How will you convert –  
 (i) Methyl iodide to methyl isocyanide.  
 (ii) Methyl cyanide to ethanoic acid ? (Sept. 2021) (2)
- (38) Write chemical reactions to prepare ethanamine from:  
 (i) Acetonitrile (ii) Nitroethane. (March 2022) (2)

## 14

## BIOMOLECULES

- (1) Give chemical reactions of glucose with  
 (a) Hydroxyl amine (b) Bromine water. (March 2008) (2)
- (2) How will you convert glucose into: (a) Gluconic acid (b) Saccharic acid (Oct. 2008) (2)
- (3) How is the glucose prepared from sucrose? (March 2009, 2017) (2)
- (4) Define the term 'Simple protein'. (Oct. 2009) (1)
- (5) Explain the term 'proteins'. (March 2008) (1)
- (6) Classify the following carbohydrates:  
 (a) Cellulose (b) Maltose (c) Fructose. (Oct. 2009) (2)
- (7) What are conjugated proteins? How is peptide linkage formed in proteins? (March 2010) (3)
- (8) What is the action of the following on glucose?  
 (a) Acetic anhydride (b) Hydroxyl amine. (Oct. 2010) (2)
- (9) What happens when glucose is treated with-  
 (a) Bromine water (b) Dilute nitric acid (c) Hydrogen cyanite (HCN) (March 2014) (3)
- (10) Describe laboratory method for preparation of glucose. Write the reaction that indicates the presence of – CHO group in glucose. (Oct. 2014) (3)
- (11) Draw the simple Fischer projection formulae of D-(+)-glucose and D-(-)-fructose. (Oct. 2014) (2)
- (12) How are proteins classified on the basis of molecular shapes? (March 2015) (2)
- (13) Define carbohydrates. What are reducing and non-reducing sugars? (March 2015) (3)
- (14) What are monosaccharides? Draw ring structure of  $\alpha$  - D - (+) - glucopyranose ? (Oct. 2015) (2)
- (15) What is peptide linkage? How is tripeptide formed? (Oct. 2015) (3)
- (16) What are carbohydrates? (March 2016) (1)
- (17) What is the action of following reagents on glucose?  
 (a) bromine water (b) dilute  $\text{HNO}_3$  (c) Hydroxyl amine (July 2016) (3)
- (18) Define enzymes. How is peptide linkage formed? (July 2017) (3)
- (19) What happens when glucose is treated with  
 (a) hydroxylamine (b) hydrogen cyanide. (July 2017) (2)
- (20) How glucose is prepared from cane sugar?  
 Write the formula of the complex copper (II) hexacyano ferrate (II). (March 2018) (3)
- (21) What are amino acids? Write the correct reaction for formation of peptide bond between amino acids. (March 2018) (2)
- (22) How is glucose prepared from starch? (July 2018) (2)

- (23) Draw the structure of Thymine. (July 2018) (1)

(24) The functional group present in triacylglycerol is: (July 2018) (1)  
 (a) alcohol      (b) ether      (c) ester      (d) amine

(25) What is the action of following reagents on glucose? (July 2018) (2)  
 (a) Bromine water      (b) Hydroxylamine

(26) Write the number of hydroxyl groups present in  $\alpha$  - D - (+) - Glucopyranose (trans). (March 2019) (1)

(27) How is glucose prepared by commercial method? How is peptide linkage formed? (March 2019) (3)

(28) Write Haworth projection formula of  $\alpha$  - D - (+) - glucopyranose. Define hormones. (March 2020) (2)

(29) What are monosaccharides? Explain denaturation of proteins. (March 2020) (3)

(30) Write the name of sugar present in RNA. (Sept. 2021) (1)

(31) Write classification of proteins on the basis of molecular shapes with examples. (Sept. 2021) (2)

(32) Explain formation of peptide linkage in protein with an example. (March 2022) (2)

(33) Write commercial method of preparation of glucose. Write structure of adipic acid. (March 2022) (3)

15 INTRODUCTION TO POLYMER CHEMISTRY



16 GREEN CHEMISTRY AND NANO CHEMISTRY

- (1) Write the name of nanostructural material used in tyres to increase their life. (Sept. 2021) (1)  
 (2) Explain three principles of green chemistry. (Sept. 2021) (2)  
 (3) Write the name of the alloy used in Fischer Tropsch process in the synthesis of gasoline. (March 2022) (1)  
 (4) Define green chemistry. Write two disadvantages of nanotechnology. (March 2022) (2)