

Holiday Homework 2018-19
CHEMISTRY (Class-XII)

SOLUTION

- Q. 1.** How many millimoles of N_2 gas would dissolve in 1 litre of water at 293 K? N_2 exerts a partial pressure of 0.987 bar. (Henry's Law constant at 293 K for N_2 is 76.4 K bar)
- Q. 2.** Na_2CO_3 and $NaHCO_3$ mixture containing 1g is neutralised by 0.1M HCl. Find the volume of HCl required if the mixture contains equimolar amounts of Na_2CO_3 and $NaHCO_3$.
- Q. 3.** Calculate the percentage composition in terms of mass of a solution obtained by mixing 300g of 25% and 400g of 40% solution by mass.
- Q. 4.** A sample of drinking water contains 15 ppm of $CHCl_3$ (by mass). Express this in percentage by mass. Determine the molality of $CHCl_3$ in solution.
- Q. 5.** The partial pressure of ethane over a saturated solution containing 6.56×10^{-2} g of ethane is 1 bar. If the solution containing 5.00×10^{-2} g, then what will be the partial pressure of the gas.
- Q. 6.** An aqueous solution @2% non-volatile solute exerts a pressure of 1.004 bar at the boiling point of the solvent. Find the molar mass of the solute.
- Q. 7.** Heptane and octane form an ideal solution at 373K. Vapour pressure of heptane and octane are 105.2 kPa and 46.8 kPa respectively. Find the vapour pressure in bar of a mixture of 25g heptane and 35g octane.
- Q. 8.** Vapour pressure of water is 12.3 kPa at 300K. Calculate the vapour pressure of 1 molal solute in it.
- Q. 9.** Two elements A and B form compounds AB_2 and AB_4 . When dissolved in 20g benzene, 1g of AB_2 lowers the freezing point by 2.3K, Whereas 1g AB_4 lowers the freezing point by 1.3K. K_f for benzene = $5.1 \text{ K kg mole}^{-1}$. Calculate the atomic mass of A and B.
- Q. 10.** At 300K, 36g glucose (molar mass 180) in 1 litre solution exerted an osmotic pressure of 4.98 bar. What would be the concentration of the solution at 300K if the osmotic pressure is 1.52 bar.
- Q. 11.** Concentrated HNO_3 is 63% by mass. Density of the solution is 1.5g/cm^3 . Calculate the volume of the solution which contains 20g HNO_3 (Molar mass $HNO_3 = 63$).
- Q. 12.** Concentrated H_2SO_4 is 49% by mass. Density of the solution is 1.5g/cm^3 . Determine molarity, molality and normality of the solution. (Molar mass of $H_2SO_4 = 98$)
- Q. 13.** Calculate the molality of 1M solution of $NaNO_3$. Density is 1.25 g/cm^3 . (Molar mass of $NaNO_3 = 85$)
- Q. 14.** Calculate the number of moles of CH_3OH in 5 litres of 2 molal solution. Density is 0.981 g/cm^3 . Molar mass of $CH_3OH = 32$)
- Q. 15.** Calculate the volume of 80% H_2SO_4 ($D = 1.8 \text{ g/cm}^3$) required to prepare 1 litre of 20% H_2SO_4 ($D = 1.25 \text{ g/cm}^3$)
- Q. 16.** 1.8 grams glucose (Molar mass = 180) is dissolved in 36g of water. Calculate the molality and the mole fraction of glucose in the solution.
- Q. 17.** Sea water contains 5.8×10^{-3} g dissolved O_2 per kilogram. Express the concentration in ppm.
- Q. 18.** Calculate the resulting molarity of the solution prepared by adding 5g NaOH to 200ml M/4 NaOH solution. ($D = 1.05\text{g/cm}^3$). Density of the resulting solution is 1.08 g/cm^3 .
- Q. 19.** Benzene and toluene forms an ideal solution at 300K. p° benzene = 160mm Hg. p° toluene = 60mm Hg. Calculate the partial pressure of benzene and toluene and the total pressure under the following conditions:-
- Mixing equal number of moles of benzene and toluene
 - Equal masses of benzene and toluene
 - Equal amount of benzene and toluene

Q. 20. A solution containing 1 mole of X and 3 moles of Y gave a vapour pressure of 550mm Hg. The same solution containing 1 mole of X and 4 moles of Y gave a vapour pressure of 560mm Hg. Find the vapour pressure of pure X and pure Y.

Q. 21. Vapour pressure of a solution containing benzene and toluene is $180x + 120$ at 200K where x is the mole fraction of toluene. Find vapour pressure of pure benzene and pure toluene.

Q. 22. Vapour pressure of aqueous dilute solution of glucose is 750mm Hg at 373K. Find the molality and mole fraction of glucose in the solution.

Q. 23. Vapour pressure of ethanol (Molecular mass = 46) and methanol (Molecular mass = 32) at 300K are 45mm Hg and 90mm Hg respectively. Find the total pressure of the solution containing 92g ethanol and 16g methanol.

Q. 24. (a) Vapour pressure of pure benzene (Molecular mass = 78) at 300K is 640mm Hg. 2.175g of non-volatile solute in 39g benzene gave a vapour pressure of 600mm Hg. Determine the molar mass of the solute.

(b). 5% Solution of Sucrose(Molarmass=342)is isotonic with 0.877%Solution of urea.Find the molar mass of urea

Q. 25. A very small amount of solute in 60cm^3 benzene showed a vapour pressure of 98.88mm Hg. Vapour pressure of pure benzene is 100mm Hg at this temperature. Find the molality of the solution. If $\Delta T_f = 0.73\text{K}$ find K_f of benzene.

Q. 26. A solution of sucrose (Molecular mass = 342) is prepared by dissolving 68.4g in 100g H_2O . Determine

- i. Vapour pressure of solution at 298K.
 - ii. Osmotic pressure at 298K.
 - iii. Boiling point of the solution
 - iv. Freezing point of the solution
- Given $K_b = 0.52 \text{ K Kg mole}^{-1}$, $K_f = 1.86 \text{ K Kg mole}^{-1}$, $R = 0.0821 \text{ l atm K-mole}^{-1}$

Q. 27. 34.2g sucrose and 36g glucose are dissolved in 81g H_2O . Find the vapour pressure of the solution. Vapour pressure of $\text{H}_2\text{O} = 30\text{mm Hg}$. Molecular mass of sucrose = 342, Glucose = 180.

Q. 28. Calculate the boiling point and freezing point of 1M solution of KCl. $D = 1.04 \text{ g/cm}^3$. Molar mass of KCl = 74.5. $K_b = 0.52 \text{ K Kg mole}^{-1}$ $K_f = 1.86 \text{ K Kg mole}^{-1}$. Assume KCl is 90% dissociated.

Q. 29. BaCl_2 and KCl mixed in 1:1 molal ration showed $\Delta T_b = 2.6\text{K}$. Determine the amount of each solute in 100 g of the solvent. $K_b = 0.52 \text{ K Kg mole}^{-1}$. Molar mass KCl = 74.5, $\text{BaCl}_2 = 208$.

Q. 30. K_f of benzene $4.90\text{K kg mole}^{-1}$. 3.26g Se (Atomic mass = 78.8) in 226g of benzene showed a freezing point of 0.112°C lower than pure benzene. Find the molecular formula of Se.

Q. 31. A solution containing 1.017g Naphthalene (C_{10}H_8) in 100g CCl_4 gave $\Delta T_b = 0.4^\circ\text{C}$. 1.24g of an unknown solute in 100g CCl_4 gave $\Delta T_b = 0.62^\circ\text{C}$. Find molar mass of the unknown solute.

Q. 32. 1.8g glucose in 100ml solution is added to 34.2g sucrose in 100ml. Find the osmotic pressure of the resulting solution.

Q. 33. 2 grams benzoic acid ($\text{C}_6\text{H}_6\text{COOH}$) in 25g benzene gave $\Delta T_f = 1.62\text{K}$. $K_f = 4.9\text{K kg mole}^{-1}$. Find the %association of benzoic acid if it exist as a dimer in solution.

Q. 34. Which of the following aqueous solution will have:-

1. Lowest freezing point
2. Highest freezing point
3. 0.1M NaCl, 0.1M BaCl_2 , 0.1M $\text{Al}_2(\text{SO}_4)_3$, 0.1M Urea

SOLID STATE

- Q. 1. A sample of solid scatters a beam of Xrays from a crystal plane at an angle of 11.8° . Find the wave length of e crystal if inter planar distance is 0.3nm and it is a first order diffraction.
- Q. 2. A sample of crystalline solid scatters a beam of Xrays of $\lambda = 2.3\text{\AA}$ at an angle of $2\theta=27^\circ 8'$. If it is a first order diffraction find the interplanar distance.
- Q. 3. Iron(II) oxide crystallize as $\text{Fe}_{0.93}\text{O}$. Find the % Fe^{2+} and Fe^{3+} in this compound.
- Q. 4. A solid AB has NaCl structure. If the radius of cation is 100pm, what is the possible maximum and minimum radius of anion B.
- Q. 5. If the radius of Mg^{2+} , Cs^+ , O^{2-} , S^{2-} and Cl^- ion are 0.65\AA , 1.69\AA , 1.40\AA , 1.84\AA and 1.81\AA respectively. Find the Coordination numbers of cation in MgO, MgS, and CsCl.
- Q. 6. In corundum, Oxide ion are in hcp and Al^{3+} ion occupy 2/3 of the Octahedral void. What is the formula of corundum?
- Q. 7. A Cubic solid is made up of 2 elements P and Q. Q occupies the corners of the cube and P at the body centre. What is the formula of the compound?. What are the coordination Numbers of P and Q?
- Q. 8. In a crystalline solid anion C occupies Ccp, cation A occupy 50% tetrahedral void and cation B occupies 50% octahedral void. What is the formula of the solid?
- Q. 9. If NaCl is doped with 10^{-3} mole% of SrCl_2 . What is the concentration of Cation Vacancies?
- Q. 10. Sodium metal crystallizes in bcc. $a = 4.3\text{\AA}$ What is the radius of Sodium atom?
- Q. 11. Copper crystallize in Fcc with a density of 9 g/cm^3 . Calculate the radius of Copper atom (Atomic mass of copper = 63).
- Q. 12. Chromium crystallize in bcc with an atomic diameter of 250 pm. Determine the density of unit cell. (Atomic mass of Cr=52).
- Q. 13. Calculate the value of Avagadronumber D of NaCl = 2.165 g/cm^3 . Distance between Na^+ and Cl^- is 281pm (Molar mass of NaCl = 58.5.).
- Q. 14. Cs Br has bcc structure. $a = 400\text{pm}$. Calculate the distance between Cs^+ and Br^- .
- Q. 15. KF has NaCl structure. Find the distance between K^+ and F^- D = 2.5 g/cm^3 . Molar mass of KF = 58.
- Q. 16. An element crystallizes as bcc. $a=288\text{pm}$. D = 7.2 g/cm^3 . How many atoms are there in 208g of this element?
- Q. 17. CuCl has ZnS structure. D = 3.4 g/cm^3 Find the edge length of the unit cell (molar mass of CuCl=99)
- Q. 18. An element crystallizes in FCC with an edge length of 200pm. Calculate its density if 200g of this element contains 24×10^{23} atoms.
- Q. 19. Unit cell of an element has atomic mass 108. D = 10.5 g/cm^3 . Edge length = 409pm. Find the structure of the crystal lattice .
- Q. 20. An element crystallizes into a structure which is a cubic type unit cell having one atom at each corner and two atoms in one of its diagonal. Volume of unit cell is $24 \times 10^{-24} \text{ cm}^3$ D = 7.2 g/cm^3 . Find the number of atoms in 200g of this element.

ELECTRO-CHEMISTRY

- Q. 1. Resistance of a conductivity cell filled with 0.1M KCl is 100ohm. If the resistance of the same cell filled with 0.02M KCl is 520ohm, calculate the conductivity and molar conductivity of 0.02M KCl solution. Conductivity of 0.1M KCl is 1.29 S/m
- Q. 2. Resistance of a column of 0.05M NaOH solution of diameter 1cm and length 50cm is $5.55 \times 10^3 \text{ ohm}$. Calculate its resistivity and conductivity. Calculate its molar conductivity in $\text{S m}^2 \text{ mol}^{-1}$
- Q. 3. Resistance of 0.01M CH_3COOH solution is 2220 ohm. Cell constant (G^*) = 0.366 cm^{-1} . Calculate the degree of dissociation of CH_3COOH at this concentration. Given $\Lambda^\circ \text{ HCl}$, NaCl and CH_3COONa are 425, 128 and $96 \text{ Scm}^2 \text{ mol}^{-1}$ respectively. Also find dissociation constant K_a .

Q. 4. Λ of $\text{Al}_2(\text{SO}_4)_3$ is $858 \text{ S cm}^2 \text{ mol}^{-1}$. Determine Λ° of Al^{3+} if Λ° of SO_4^{2-} is $160 \text{ S cm}^2 \text{ mol}^{-1}$.

Q. 5. Calculate the amount of chlorine gas by passing a current of 1.5 amperes for 90 minutes through molten NaCl.

Q. 6. How many coulomb of electricity is needed for the following reactions ; (a) 2 moles of MnO_4^- to Mn^{2+} (b) 1 mole of H_2O to O_2 (c) 9 grams of Al from molten AlCl_3 .

Q. 7. Silver is electrodeposited by passing a current of 0.2 amperes for 3 hours on a vessel of surface area 800 cm^2 . Calculate the thickness of silver deposited. Density of Ag is 10.8 g/cm^3 .

Q. 8. Three electrolytes A, B, C containing solution of ZnSO_4 , AgNO_3 and CuSO_4 respectively are connected in series. 1.45 g of silver deposited by passing 1.5 amperes. How long did the current flow? Calculate the amount of silver and copper deposited. Atomic masses Ag = 108 Cu = 63.5 Zn = 65.5

Q. 9. Calculate the e.m.f. of the cell. $\text{Cr}/\text{Cr}^{3+} \parallel \text{Fe}^{2+}/\text{Fe}$ Given $E^\circ \text{Cr}^{3+}/\text{Cr} = -0.74 \text{ V}$ $E^\circ \text{Fe}^{2+}/\text{Fe} = -0.44 \text{ V}$ (0.01M) (0.01M)

Q. 10. Calculate the cell potential at 298K. $\text{Sn}^{4+} + \text{Zn(s)} \rightarrow \text{Sn}^{2+} + \text{Zn}^{2+}$ $E^\circ \text{Sn}^{2+}/\text{Sn}^{4+} = 0.13 \text{ V}$ $E^\circ \text{Zn}^{2+}/\text{Zn} = -0.76 \text{ V}$ (1.5M) (0.5M) (2M)

Q. 11. Calculate the equilibrium constant and the work done by the cell.

$\text{Ni(s)} + \text{Cu}^{2+} \rightarrow \text{Cu(s)} + \text{Ni}^{2+}$ $E^\circ \text{Ni}^{2+}/\text{Ni} = -0.25 \text{ V}$ $E^\circ \text{Cu}^{2+}/\text{Cu} = +0.34 \text{ V}$

Q. 12. Find the potential of the electrode Mg^{2+}/Mg

$\text{Mg}^{2+} + 2\text{e}^- \rightarrow \text{Mg}$ $E^\circ \text{Mg}^{2+}/\text{Mg} = -2.36 \text{ V}$ (Mg^{2+}) = 0.1M

Q. 13. Find the e.m.f. of the cell Pb/Pb^{2+} (0.001M) \parallel $\text{Pt}, \text{Cl}_2(1.5 \text{ atm})/\text{Cl}^-$ (1M) $E^\circ \text{Cl}_2/\text{Cl}^- = 1.36 \text{ V}$ $E^\circ \text{Pb}^{2+}/\text{Pb} = -0.13 \text{ V}$

Q. 14. Electrolysis of a metal salt solution resulted in deposition of 1g of the metal by passing a current of 1.5 amperes for 2 hours. Determine the charge carried by the metal if it has an atomic mass of 27g/mole.

CHEMICAL KINETICS

Q. 1. $2\text{NO}_2 + \text{F}_2 \rightarrow 2\text{NO}_2\text{F}$. Write the rate of reaction in terms of (a) rate of formation of NO_2F (b) rate of disappearance of NO_2 (c) rate of disappearance of F_2 .

Q. 2. The decomposition of NH_3 follows zero order. $2\text{NH}_3 \rightarrow \text{N}_2 + 3\text{H}_2$. Find the rate of production of N_2 and H_2 . $K = 2.5 \times 10^{-4} \text{ MS}^{-1}$. Also find rate of decomposition of NH_3 .

Q. 3. $2\text{A} + \text{B} + \text{C} \rightarrow \text{A}_2\text{B} + \text{C}$ Rate = $k(\text{A})(\text{B})^2$ $k = 2 \times 10^{-6} \text{ M}^{-2}\text{S}^{-1}$. Calculate the initial rate when (A) = 0.1M (B) = 0.2M (C) = 0.6M. Find the rate when 0.04 mole of (A) is consumed.

Q. 4. $2\text{NO}_2 + \text{F}_2 \rightarrow 2\text{NO}_2\text{F}$

Experiment ;	$(\text{NO}_2) \text{M}$	$(\text{F}_2) \text{M}$	Rate(M/S)
1	0.2	0.05	0.006
2	0.4	0.05	0.012
3	0.8	0.10	0.048

Find the order with respect to NO_2 and F_2 . Also find the overall order of the reaction. Deduce the mechanism of the reaction.

Q. 5. A first order reaction is 20% complete in 10 minutes. Find the time taken for 80% completion of the reaction. Also find the half life of the reaction.

Q. 6. Show that (a) $2t_{1/2} = t_{3/4}$ (b) Half life of a reaction is 10 seconds. Find $t_{2/3}$,

Q. 7. The pressure of a gas decomposing at a metal surface of a solid catalyst are given below:

t/s	0	100	200	300
P/Pa	4.00×10^2	3.50×10^3	3.00×10^3	2.5×10^3

Determine the order of the reaction. Find the rate Constant and the half life of the reaction.

Q. 8. Hydrolysis of methyl acetate in aqueous solution has been studied by titrating liberated acetic acid with NaOH rate = $k(\text{CH}_3\text{COOCH}_3)(\text{H}_2\text{O})$

t/min	0	30	60	90
c/M	0.8500	0.8004	0.7538	0.7096

Show that it follows pseudo first order reaction as the concentration of water remains constant (1L of water = 1000g Of water = $1000/18 = 55.5\text{M}$)
What is the value of k?

Q. 9. The rates of a reaction starting with initial concentrations $2 \times 10^{-3}\text{M}$ and $1 \times 10^{-3}\text{M}$ are $2.4 \times 10^{-4}\text{M/s}$ and $0.6 \times 10^{-4}\text{M/s}$ respectively. Find the order of the reaction and rate constant K.

Q. 10. $\text{A} + 5\text{B} + 6\text{C} \rightarrow 3\text{L} + 3\text{M}$

Experiment	(A)M	(B)M	(C)M	Rate M/minute
1.	0.02	0.02	0.02	0.00208
2.	0.01	0.02	0.02	0.00104
3.	0.02	0.04	0.02	0.00416
4.	0.02	0.02	0.04	0.00832

Determine the order with respect to each reactant. Find K .Calculate the initial rate when concentration of each reactant is 0.01M. Find the initial rate of change in concentrations of B and L

Q. 11. Rate of a reaction becomes 1.414 times when concentration of the reactant is doubled. Find the order of the reaction.

Q. 12. (a) show that for a first order reaction $t_{1/2}$ is independent of the initial concentration of the reactant. (b) show that for a zero order reaction $t_{1/2}$ is directly proportional to initial concentration of the reactant and inversely proportional to rate constant.

Q. 13. Rate constant of a reaction is $2\text{M}^{-1}\text{S}^{-1}$ at 700K and $32\text{M}^{-1}\text{S}^{-1}$ at 800K. Find E_a

Q. 14. Rate of a reaction becomes 4 times when temperature changes from 27°C to 37°C . Find E_a .

Q. 15. Rate constant of a reaction at 700K and 760K are $0.01\text{M}^{-1}\text{S}^{-1}$ and $0.105\text{M}^{-1}\text{S}^{-1}$ respectively. Find A and E_a .

Q. 16. Rate constant of a reaction increases by 7% and the equilibrium constant increases by 3% when the temperature changes from 300K to 301k. Find E_a for the forward and backward reaction.

Q. 17. Rate = $k_1(\text{NH}_3) + k_2(\text{NH}_3)^2$ Find the order when concentration of (a) NH_3 is very low (b) when Pt surface is completely covered
 $\text{NH}_3 + 2\text{NH}_3 \rightarrow \text{N}_2 + 3\text{H}_2$ using Pt as a catalyst.