Chemistry Test Paper
UNIT: SOLUTIONS

Time: 90 minutes **M.M. 40**

General Instructions:
(1) All questions are Compulsory.
(2)The question paper consists of 15 questions divided in to four sections A, B,C&D
(3) Section A contains 2 questions of 1 mark each.
Section B contains 5 questions of 2 marks each.
Section C contains 6 questions of 3 marks each.
***Section D contains 2 questions of 5 marks each*.**

Section –A

1. State Henry law with its mathematical expressions?
2. Define colligative properties.

Section –B

3. An antifreeze solution is prepared from 222.6g of ethylene glycol. C_2H_4 $(OH)_2$ and 200g of water. Calculate molality of solution. If the density of the solution is 1.072 g/ml then what shall be the molarity of the solution?
4. Explain along with diagrams the conditions for the Non ideal solutions exhibiting Positive deviations. Write some examples of Non ideal solutions exhibiting Positive deviations.
5. What are Azeotropes? Give one example each of minimum boiling and maximum boiling azeotropes.
6. Calculate the mass of a nonvolatile solute (molecular mass = 40) which should be dissolved in 114g octane to reduce its vapour pressure to 80%.
7. What is value of Van't Hoff's factor when the solute undergoes (a) association (b) dissociation?

Section –C

8 100 mg of a protein is dissolved in enough water to make 10ml of a solution. If this solution has an osomotic pressure of 13.3 mm Hg at 25^0C,what is the molar mass of protein?(R=0.0821Latmmol^{-1}K^{-1} and 760mmHg=1atm)
9. Heptane and Octane form ideal solution .At 373 K, the vapour pressures of the two liquid components are 105.2kPa and 46.8kPa respectively. What will be the vapour pressure, in bar of a mixture of 25.0g heptane and 35.0g of octane?
10 Boiling point of water at 750 mHg is 99.63^0C.How much sucrose is to added to 500 g water such that it boils at 100^o C.
11. What is osmosis, osmotic pressure & reverse osmosis?
12. Amongst the following compounds, identify which are insoluble, partially soluble and highly soluble in water?(i) phenol (ii) toluene (iii) formic acid(iv) ethylene glycol (v) chloroform (vi) Pentanol.
13. If N_2 gas is bubbled through water at 298 K, how many millimoles of N_2 gas would dissolve in 1 litre of water .Assume that N_2 exerts a partial pressure of 0.987 bar .Given that Henry's law constant for N_2 at 293K is 76.48 bar.

Section –D

14.Two elements A & B form compounds having molecular formula AB_2 & AB_4. When dissolved in 20g of C_6H_6, 1g AB_2 lowers the freezing point by 2.3 & 1.0g AB_4 lowers it by 1.3K.The molar depression constant for benzene is 5.1Kg mol^{-1}. Calculate atomic mass A & B.
15. 19.5 g of CH_2FCOOH is dissolved in 500 g of water. The depression in the freezing point of water observed is 1.00 C. Calculate the van't Hoff factor and dissociation constant of fluoroacetic acid.)

Chemistry Test Paper
Unit-3: Electrochemistry

Time: 90 minutes **M.M. 40**

General Instructions:
(1) All questions are Compulsory.
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Section B contains 5 questions of 2 marks each.
Section C contains 6 questions of 3 marks each.
***Section D contains 2 questions of 5 marks each*.**

Section A

1. How much electricity in terms of Coulomb is required to reduce 1 mol of $Cr_2O_7^{2-}$ to Cr^{3+}.
2. What is Fuel Cell?

Section B

3. A solution of $CuSO_4$ is electrolysed using a current of 1.5 amperes for 10 minutes. What mass of Cu is deposited at the cathode?(Atomic mass of Cu =63.7)
4. Calculate the equilibrium constant for the reaction $Cu(s) + 2Ag^+ \Leftrightarrow Cu^{+2} + 2Ag(s)$ $E^o_{Cu^{2+}/Cu} = +0.34V$, $E^o_{Ag^+/Ag} = +0.80V$.
5. Write the Nernst equation and emf of the following cells at 298K: $Sn/Sn^{2+}(0.050M)//H^+(0.020M)/H_2(g)/Pt(s)$ $E^o_{Sn^{2+}/Sn} = -0.13V$
6. Calculate the standard free energy change for the following reaction at 25^0C,$Au(s) + Ca^{+2}$ (1 M)$\rightarrow Au^{3+}$(1M) + Ca (s) ,The electrode values are Ca^{2+} / Ca = –2.87V,Au^{3+} / Au = +1.50V. Predict whether the reaction will be spontaneous or not at 25^0C.
7. How do you account for conductivity of strong and weak electrolyte with concentration? Plot the graphs also.

Section C

8. State Kohlrausch law . Calculate Limiting molar conductivity of NaCl, HCl and NaAc are 126.4, 425.9 &91 $SCm^2\ mol^{-1}$.Calculate Limiting molar conductivity of HAc.
9. Resistance of conductivity cell filled with $0.1molL^{-1}$ KCl solution is 100 ohm. If the resistance of the same cell when filled with $0.02molL^{-1}$ KCl solution is 520 ohm. Calculate the conductivity & molar conductivity of $0.02molL^{-1}$ KCl solution. The conductivity of 0.1 $molL^{-1}$ solution of KCl is $1.29Sm^{-1}$.
10. A Copper –silver is set up.The copper ion concentration in its is 0.10M.The concentration of silver is not known.The cell potential measured 0.422V.Determine the concentration of silver ion in the cell. $E^o_{Ag^+/Ag}$ = + 0.80V, $E^o_{Cu^{2+}/Cu}$ = +0.34V.
11. A voltaic cell is set up at 25^0C With the following half cells :$Al(s)/Al^{3+}(0.001M)$ and $Ni^{2+}(0.50)/Ni(s)$,Write the equation for the cell reaction that occurs when the cell generates an electric current and determine the cell potential (given$E^o_{Ni^{2+}/Ni}$ = -0.25V, $E^o_{Al(s)/Al3+}$=-1.66V)
12. Write the reaction involved in the following cells: (a) Fuel Cell (b) Lead Storage Battery.
13. Three electrolytic cells A,B,C containing solutions $ZnSO_4$,$AgNO_3$,and $CuSO_4$ respectively are connected in series .a Steady current of 1.5 amperes was respectively are connected in series .A steady current of 1.5 amperes was passed though them until 1.45g of silver deposited at the cathode of cell B.How long did the current flow? What mass of copper and zinc were deposited?

Section D

14. Conductivity of 0.00241M acetic acid is 7.896×10^{-6} S cm^{-1}. Calculate its molar conductivity. If Λ^0 for acetic acid is 390.5 S $cm^2\ mol^{-1}$. What is its dissociation constant?
15. (a) Two half cell reactions of an electrochemical cell are given below:

$MnO_4^- + 8\ H^+ + 5\ e^- \rightarrow Mn^{2+} + 4\ H_2O$ E^o =+1.51V

$Sn^{2+} \rightarrow Sn^{4+} + 2e^-$ E^o = +0.15V.

Construct the redox reaction from the two half cell reaction and predict if the reaction favours formation of reactants or product shown in the reaction

(b). How much electricity in terms of Faraday is required to produce (i)20g of Ca from molten $CaCl_2$ (ii) 40g of Al from molten $AlCl_3$

Chemistry Test Paper

UNIT: CHEMICAL KINETICS

Time: 90 minutes **M.M. 40**

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Section –A

1. **Define Pseudounimolecular reaction?**
2. **The decomposition reaction of ammonia gas on platinum surface has a rate constant = 2.3×10^{-5} L $mol^{-1}s^{-1}$. What is the order of the reaction?. .**

Section –B

3. **Mention the factors that affect the rate of a chemical reaction.**
4. **From the rate expression for the following reactions determine their order of reaction and dimensions of the rate constants.**

   a) H_2O_2 (aq) + 3 I^- (aq) + $2H^+ \rightarrow 2H_2O$ (l) + $3I^{-1}$ Rate = k $[H_2O]$ $[I^-]$

   b) CH_3CHO (g) $\rightarrow CH_4$(g) + CO(g) Rate = k $[CH_3CHO]^{3/2}$
5. **A reaction is first order in A and second order in B.**

   i) Write differential rate equation.

   ii) How is the rate affected when concentration of B is tripled?

   iii) How is the rate affected when the concentration of both A and B is doubled?
6. **The decomposition of NH_3 on platinum surface is zero order reaction. What are the rates of production of N_2 and H_2 if k = 2.5×10^{-4} mol L^{-1} S^{-1}?**
7. **Derive the Integrated rate equation for first order reaction. also find half life period and plot the graph associated to it.**

Section –C

8. **For a first order reaction, show that time required for 99% completion is twice the time required for the completion of 90% of reaction.**
9. **A first order reaction has a rate constant $0.0051min^{-1}$ .If we begin with 0.10 M concentration of the reactant ,what concentration of the reactant will be left after 3 hours.**
10. **The half-life for radioactive decay of ^{14}C is 5730 years. An archaeological artifact containing wood had only 80% of the ^{14}C found in a living tree.**

Estimate the age of the sample

11. **What is the effect of temperature on the rate constant of a reaction? How can this temperature effect on rate constant be represented quantitatively?**
12. **The rate of a reaction quadruples when the temperature changes from 293 K to 313 K. Calculate the energy of activation of the reaction assuming that it does not change with temperature.**
13. **A first order reaction takes 40 min for 30% decomposition. Calculate $t_{1/2}$..**

Section –D

14(a) Distinguish between order of reaction & Molecularity.

(b) For a decomposition reaction the values of rate constant k at two different temperatures are given below: $k_1 = 2.15 \times 10^{-8}$ L $mol^{-1}s^{-1}$ at 650K, $k_2 = 2.39 \times 10^{-7}$ L $mol^{-1}s^{-1}$ at 700K Calculate the value of Activation Energy for this reaction.

15.(i) Write short notes on the following:

(a) Activation energy of a reaction (b)Elementary step in a reaction (c)Rate of a reaction

(ii) The following result has been obtained during the kinetic studies of the reaction

$2A + B \rightarrow C+D$

Experiment	[A] mol L^{-1}	[B] mol L^{-1}	Initial rate mol $L^{-1}min^{-1}$
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

Determine the rate law and rate constant for the reaction