Solved Paper 2015

CHEMISTRY

Class-XII

Time : 3 Hours **Max. Marks : 70**

General Instructions:

(i) ***All*** *questions are compulsory.*

(ii) *Question numbers* ***1*** *to* ***5*** *are very short-answer questions and carry* ***1*** *mark each.*

(iii) *Question numbers* ***6*** *to* ***10*** *are short-answer questions and carry* ***2*** *marks each.*

(iv) *Question numbers* ***11*** *to* ***22*** *are also short-answer questions and carry* ***3*** *marks each.*

(v) *Question numbers* ***23*** *is a value based question and carry* ***4*** *marks.*

(vi) *Question numbers 24 to 26 are long answer questions and carry* ***5*** *marks each.*

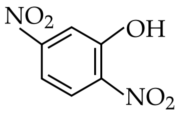
(vi) *Use Log Tables, if necessary. Use of calculators is* ***not*** *allowed.*

*** 1. Out of $BaCl_2$ and KCl, which one is more effective in causing coagulation of a negatively charged colloidal Sol? Give reason.** **1**

*** 2. What is the formula of a compound in which the element Y forms ccp lattice and atoms of X occupy $1/3^{rd}$ of tetrahedral voids?**

*** 3. What is the basicity of H_3PO_2?** **1**

4. Write the IUPAC name of the given compound: **1**



Ans. 2, 5-dinitrophenol

5. Which would undergo S_N2 reaction faster in the following pair and why ? **1**

$$CH_3-CH_2-Br_2 \text{ and } CH_3-\underset{\displaystyle Br}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}}-CH_3$$

Ans. CH_3-CH_2-Br

Because it is a primary halide(1°) halide

6. What is meant by positive deviations from Raoult's law? Give an example. What is the sign of $\Delta_{mix}H$ for positive deviation? **2**

OR

Define azeotropes. What type of azeotrope is formed by positive deviation from Raoult's law? Give an example.

Ans. When vapour pressure of solution is higher than that predicted by Raoult's law the intermolecular attractive forces between the solute-solvent (A-B) molecules are weaker than those between the solute-solute and solvent-solvent molecules (A-A or B-B molecules).

Eg. ethanol-acetone / ethanol-cyclohexane / CS_2-acetone or any other correct example $\Delta_{mix}H$ is positive

OR

(a) Azeotropes are binary mixtures having the same composition in the liquid and vapour phase and boil at a constant temperature.

(b) Minimum boiling azeotrope

eg – ethanol + water or any other example

7. (a) Following reactions occur at cathode during the electrolysis of aqueous silver chloride solution:

$$Ag^+(aq) + e^- \longrightarrow Ag(s) \quad E° = +0.80\ V$$

$$H^+(aq) + e^- \longrightarrow \frac{1}{2}H_2(g) \quad E° = 0.00\ V$$

On the basis of their standard reduction electrode potential (E°) values, which reaction is feasible at the cathode and why?

(b) Define limiting molar conductivity. Why conductivity of an electrolyte solution decreases with the decrease in concentration? **2**

Ans. (i) $Ag^+(aq) + e^- \longrightarrow Ag(s)$

Reaction with higher E° value/$\Delta G°$ negative

(ii) Molar conductivity of a solution at infinite dilution or when concentration approaches zero

Number of ions per unit volume decreases

8. What are the transition elements? Write two characteristics of the transition elements. **2**

Ans. Elements which have partially filled *d*-orbital in its ground states or any one of its oxidation states.

(i) Variable oxidation states

(ii) Form coloured ion

Or any other two correct characteristics

9. (i) Write down the IUPAC name of the following complex:

$[Cr(NH_3)_2Cl_2(en)]Cl$ (en = ethylenediamine)

(ii) Write the formula for the following complex:

Pentaamminenitrito-o-Cobalt (III). **2**

Ans. (i) Diamminedichloridoethylenediaminechromium (III) chloride

* Out of Syllabus

(ii) $[Co(NH_3)_5(ONO)]^{2+}$

10. Name the reagents used in the following reactions:

(i) $CH_3-CO-CH_3 \xrightarrow{?} CH_3-\underset{\displaystyle OH}{\underset{|}{C}H}-CH_3$

(ii) $C_6H_5-CH_2-CH_3 \xrightarrow{?} C_6H_5-COO^-K^+$ **2**

Ans. (i) $LiAlH_4$ / $NaBH_4$ / H_2, Pt

(ii) $KMnO_4$, KOH

*** 11. Write the names and structures of the monomers of the following polymers:**

(i) Nylon-6, 6

(ii) PHBV

(iii) Neoprene **3**

12. Predict the products of the following reactions:

(i) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=O \xrightarrow[\text{(ii) KOH/Glycol, }\Delta]{\text{(i) }H_2N\text{-}NH_2}$

(ii) $C_6H_5-CO-CH_3 \xrightarrow{NaOH/I_2} ? + ?$

(iii) $CH_3\ COONa \xrightarrow[\Delta]{NaOH/CaO} ?$ **3**

Ans. (i) $CH_3CH_2CH_3$

(ii) $C_6H_5COONa + CHI_3$

(iii) CH_4

13. How do you convert the following:

(i) Phenol to anisole

(ii) Propan-2-ol to 2-methylpropan-2-ol

(iii) Aniline to phenol **3**

OR

(a) Write the mechanism of the following reaction:

$$2CH_3CH_2OH \xrightarrow{H^+} CH_3CH_2-O-CH_2CH_3$$

(b) Write the equation involved in the acetylation of Salicylic acid.

Ans. (i) $C_6H_5OH + NaOH \longrightarrow C_6H_5ONa \xrightarrow{CH_3X} C_6H_5OCH_3$

Or

$C_6H_5OH + Na \longrightarrow C_6H_5ONa \xrightarrow{CH_3X} C_6H_5OCH_3$

(ii) $CH_3CH(OH)CH_3 \xrightarrow{CrO_3 \text{ or Cu/573 K}} CH_3COCH_3 \xrightarrow[\text{(ii) }H_2O]{\text{(i) }CH_3MgX} (CH_3)_2C(OH)CH_3$

(iii) $C_6H_5NH_2 \xrightarrow[273\text{ K}]{NaNO_2 + HCl} C_6H_5N^+{}_2Cl^- \xrightarrow{H_2O\text{ warm}} C_6H_5OH$

OR

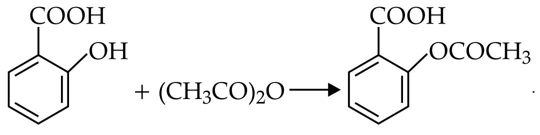
(i) $CH_3-CH_2-\ddot{\underset{..}{O}}-H \xrightarrow{H^+} CH_3-CH_2-\overset{+}{\ddot{O}}-H$ (with H on O)

(ii) $CH_3-CH_2-\underset{\displaystyle H}{\underset{|}{\ddot{O}}}: + CH_3-CH_2-\overset{+}{O}H_2 \longrightarrow CH_3CH_2-\overset{+}{\underset{H}{O}}-CH_2CH_3 + H_2O$

(iii)

$CH_3CH_2-\overset{+}{\underset{H}{O}}-CH_2CH_3 \longrightarrow CH_3CH_2-O-CH_2CH_3 + H^+$

(b)



Phenol Phenol

+ CH_3COOH

(Acetyl chloride instead of acetic anhydride may be used)

14. (i) Which one of the following is a disaccharide: Starch, Maltose, Fructose, Glucose?

(ii) What is the difference between fibrous protein and globular protein?

(iii) Write the name of vitamin whose deficiency causes bone deformities in children. **3**

Ans. (i) Maltose

(ii) Fibrous proteins: Parallel polypeptide chain, insoluble in water

Globular proteins: Spherical shape, soluble in water. (or any 1 suitable difference)

(iii) Vitamin D

15. Give reasons:

(a) ***n*-Butyl bromide has higher boiling point than t-butyl bromide.**

(b) Racemic mixture is optically inactive.

(c) The presence of nitro group ($-NO_2$) at o/p positions increases the reactivity of haloarenes towards nucleophilic substitution reactions. **3**

Ans. (i) Larger surface area, higher van der Waals' forces, higher the boiling point.

(ii) Rotation due to one enantiomer is cancelled by another enantiomer.

(iii) $-NO_2$ acts as electron withdrawing group or –I effect.

16. 3.9 g of benzoic acid dissolved in 49 g of benzene shows a depression in freezing point of 1.62 K. Calculate the van't Hoff factor and predict the nature of solute (associated or dissociated).

(Given: Molar mass of benzoic acid = 122 g mol^{-1}, K_f for benzene = 4.9 K kg mol^{-1}) **3**

Ans.

$$\Delta T_f = iK_f m$$

$$\Delta T_f = iK_f \frac{m_f \times 1000}{M_b \times m_a}$$

$$1.62 = i \times 4.9\text{K kg mol}^{-1} \times \frac{3.9\text{ g}}{122\text{ g mol}^{-1}} \times \frac{1000}{49\text{ kg}}$$

$$i = 0.506$$

* *Out of Syllabus*

Or by any other correct method

As $i < 1$, therefore solute gets associated.

*** 17. (i) Indicate the principle behind the method used for the refining of zinc.**

(ii) What is the role of silica in the extraction of copper?

(iii) Which form of the iron is the purest form of commercial iron? **3**

*** 18. An element with molar mass 27 g mol^{-1} forms a cubic unit cell with edge length 4.05×10^{-8} cm. If its density is 2.7 g cm^{-3}, what is the nature of the cubic unit cell?** **3**

19. (a) How would you account for the following:

(i) Actinoid contraction is greater than lanthanoid contraction.

(ii) Transition metals form coloured compounds.

(b) Complete the following equation:

$2MnO_4^- + 6H^+ + 5NO_2^- \longrightarrow$ **3**

Ans. (a) (i) $5f$ orbital electrons have poor shielding effect than $4f$ orbital electrons.

(ii) Due to d-d transition or the energy of excitation of an electron from lower d orbital to higher d-orbital lies in the visible region and presence of unpaired electrons in the d-orbital.

(b) $2MnO_4^- + 6H^+ + 5NO_2^- \longrightarrow 2Mn^{2+} + 3H_2O + 5NO_3^-$

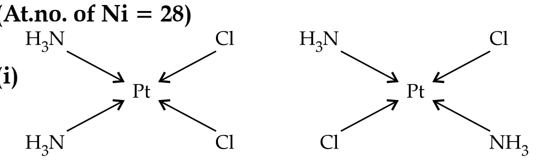
20. (i) Draw the geometrical isomers of complex $[Pt(NH_3)_2Cl_2]$.

(ii) On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_o < P$.

(iii) Write the hybridization and magnetic behaviour of the complex $[Ni(CO)_4]$. **3**

(At.no. of Ni = 28)

Ans. (i)



cis-isomer trans-isomer

(ii) $t_{2g}^3 e_g^1$

(iii) sp^3, diamagnetic

21. Calculate emf of the following cell at 25 °C:

$Fe|Fe^{2+}(0.001\ M) \ ||\ H^+(0.01\ M)|\ H_2(g)\ (1\ bar)|\ Pt(s)$

$E°(Fe^{2+}|Fe) = -0.44$ V $E°(H^+|H_2) = 0.00$ V **3**

Ans. The cell reaction:

$$Fe(s) + 2H^+(aq) \longrightarrow Fe^{2+}(aq) + H_2(g)$$

$$E^\circ_{cell} = E^\circ_c - E^\circ_a$$
$$= [0 - (-0.44)]V = 0.44V$$

$$E_{cell} = E^\circ_{cell} - \frac{0.059}{2}\log\frac{[Fe^{2+}]}{[H^+]^2}$$

$$E_{cell} = 0.44V - \frac{0.059}{2}\log\frac{(0.001)}{(0.01)^2}$$

$$= 0.44V - \frac{0.059}{2}\log(10)$$

$$= 0.44\text{ V} - 0.0295\text{ V}$$
$$\approx 0.410\text{ V}$$

*** 22. Give reasons for the following observations:**

(i) Leather gets hardened after tanning.

(ii) Lyophilic sol is more stable than lyophobic sol.

(iii) It is necessary to remove CO when ammonia is prepared by Haber's process. **3**

*** 23. Mr. Roy, the principal of one reputed school organized a seminar in which he invited parents and principals to discuss the serious issue of diabetes and depression in students. They all resolved this issue by strictly banning the junk food in schools and to introduce healthy snacks and drinks like soup, lassi, milk etc. in school canteens. They also decided to make compulsory half an hour physical activities for the students in the morning assembly daily. After six months, Mr. Roy conducted the health survey in most of the schools and discovered a tremendous improvement in the health of students.** **4**

After reading the above passage, answer the following:

(i) What are the values (at least two) displayed by Mr. Roy?

(ii) As a student, how can you spread awareness about this issue?

(iii) What are tranquilisers ? Give an example.

(iv) Why is use of aspartame limited to cold foods and drinks?

24. For the hydrolysis of methyl acetate in aqueous solution, the following results were obtained:

t/s	0	30	60
$[CH_3COOCH_3]$/mol L^{-1}	0.60	0.30	0.15

5

(i) Show that it follows pseudo first order reaction, as the concentration of water remains constant.

(ii) Calculate the average rate of reaction between the time interval 30 to 60 seconds.

(Given log 2 = 0.3010, log 4 = 0.6021)

OR

(a) For a reaction A + B $\longrightarrow$ P, the rate is given by Rate = $k[A][B]^2$

(i) How is the rate of reaction affected if the concentration of B is doubled ?

(ii) What is the overall order of reaction if A is present in large excess ?

(b) A first order reaction takes 30 minutes for 50% completion. Calculate the time required for 90% completion of this reaction.

(log 2 = 0.3010)

Ans. (i)

$$k = \frac{2.303}{t}\log\frac{[A_0]}{[A]}$$

$$k = \frac{2.303}{30}\log\frac{0.60}{0.30}$$

* *Out of Syllabus*

$$k = \frac{2.303}{30} \times 0.301 = 0.023\ s^{-1}$$

$$k = \frac{2.303}{60} \log \frac{0.60}{0.15}$$

$$k = \frac{2.303}{60} \times 0.6021 = 0.023\ s^{-1}$$

(ii) As k is constant in both the readings, hence it is a pseudo-first order reaction.

$$\text{Rate} = -\frac{\Delta[R]}{\Delta t}$$

$$= -\frac{[0.15 - 0.30]}{60 - 30}$$

$$= 0.005\ \text{mol L}^{-1}\text{s}^{-1}$$

OR

(a) (i) Rate will increase 4 times of the actual rate of reaction.

(ii) Second order reaction

(b)
$$t_{1/2} = \frac{0.693}{k}$$

$$30\ \text{min} = \frac{0.693}{k}$$

$$k = 0.0231\ \text{min}^{-1}$$

$$t = \frac{2.303}{t} \log \frac{[A_0]}{[A]}$$

$$t = \frac{2.303}{0.0231}\ \text{min}$$

$$t = 99.7\ \text{min}$$

*** 25. (a) Account for the following:**

(i) Acidic character increases from HF to HI.

(ii) There is large difference between the melting and boiling points of oxygen and sulphur.

(iii) Nitrogen does not form pentahalide.

(b) Draw the structures of the following:

(i) C/F_3

(ii) XeF_4 **5**

OR

(i) Which allotrope of phosphorus is more reactive and why?

(ii) How the supersonic jet aeroplanes are responsible for the depletion of ozone layers?

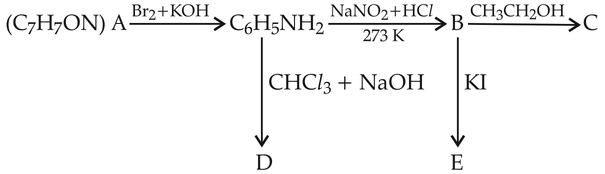
(iii) F_2 has lower bond dissociation enthalpy than Cl_2. Why?

(iv) Which noble gas is used in filling balloons for meteorological observations ?

(v) Complete the equation:

$XeF_2 + PF_5 \longrightarrow$

26. An aromatic compound 'A' of molecular formula C_7H_7ON undergoes a series of reactions as shown below. Write the structures of A, B, C, D and E in the following reactions:



OR

(a) Write the structures of main products when aniline reacts with the following reagents:

(i) Br_2/water

(ii) HCl

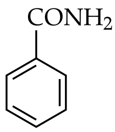
(iii) $(CH_3CO)_2O$/pyridine

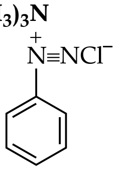
(b) Arrange the following in the increasing order of their boiling point:

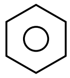
$C_2H_5NH_2$, C_2H_5OH, $(CH_3)_3N$

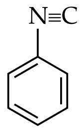
(c) Give a simple chemical test to distinguish between the following pair of compounds:

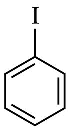
$(CH_3)_2NH$ and $(CH_3)_3N$ **5**

Ans. A = 

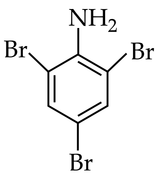
B = 

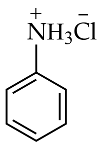
C = 

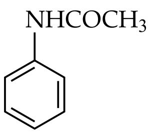
D = 

E = 

OR

(a) (i) 

(ii) 

(iii) 

(b) $(CH_3)_3N < C_2H_5NH_2 < C_2H_5OH$

(c) By Hinsberg test of secondary amines $(CH_3)_2NH$ shows ppt. formation which is insoluble KOH while in tertiary amines, $(CH_3)_3N$ do not react with benzene sulphonyl choride.

❑❑

* *Out of Syllabus*