INDIAN SCHOOL AL WADI AL KABIR

SAMPLE PAPER 3

CHEMISTRY (043)

Maximum Marks: 70

Class: XII Time: 3 Hours

General Instructions:

Read the following instructions carefully.

a) There are 33 questions in this question paper. All questions are compulsory.
b) Section A: Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage-based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.
c) Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.
d) Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.
e) Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.
f) There is no overall choice. However, internal choices have been provided.
g) Use of calculators and log tables is not permitted.

SECTION A (OBJECTIVE TYPE)

1. Read the passage given below and answer the following questions: (1x4=4)

In general, ions of the same charge in a given series show progressive decrease in radius with increasing atomic number. This is because the new electron enters a d orbital each time the nuclear charge increases by unity. It may be recalled that the shielding effect of a d electron is not that effective, hence the net electrostatic attraction between the nuclear charge and the outermost electron increases and the ionic radius decreases. The same trend is observed in the atomic radii of a given series. However, the variation within a series is quite small. An interesting point emerges when atomic sizes of one series are compared with those of the corresponding elements in the other series. It shows that an increase from the first (3d) to the second (4d) series of the elements but the radii of the third (5d) series are virtually the same as those of the corresponding members of the second series. This phenomenon is associated with the intervention of the 4f orbitals which must be filled before the 5d series of elements begin. The filling of 4f before 5d orbital results in a regular decrease in atomic radii called Lanthanoid contraction which essentially compensates for the expected increase in atomic size with increasing atomic number. The net result of the lanthanoid contraction is that the second and the third d series exhibit similar radii (e.g., Zr 160

pm, Hf 159 pm) and have very similar physical and chemical properties much more than that expected on the basis of usual family relationship.

i. The variation in the ionic radii of the 3d series transition elements is very small because:
   a. of the increase in the nuclear charge by unity.
   b. of the decrease in the nuclear charge by unity.
   c. of no change in the nuclear charge.
   d. None of these.

ii. The ionic radii of the 4d and 5d series are almost:
   a. incomparable.
   b. same.
   c. with large differences.
   d. cannot be measured.

OR

The Zr and Hf have similar radii because:
   a. these elements belong to 3d and 4d series.
   b. these elements belong to 3d and 5d series.
   c. these elements belong to 4d and 5d series.
   d. these elements belong to 6d series.

iii. The two consequences of the Lanthanoid contraction are:
   a. same ionic radii and same physical and chemical properties
   b. same ionic radii and different physical and chemical properties.
   c. different ionic radii and same physical and chemical properties.
   d. different ionic radii and different physical and chemical properties.

iv. The order of decreasing shielding effect is:
   a. s>p>d>f
   b. f>d>p>s
   c. s<p<d<f
   d. f<d<p<s

2. (1x4=4)

Werner in 1898, propounded his theory of coordination compounds. The main postulates are: 1. In coordination compounds metals show two types of linkages (valences)-primary and secondary. 2. The primary valences are normally ionisable and are satisfied by negative ions. 3. The secondary valences are non-ionisable. These are satisfied by neutral molecules or negative ions. The secondary valence is equal to the coordination number and is fixed for a metal. 4. The ions/groups bound by the secondary linkages to the metal have characteristic spatial arrangements corresponding to different coordination numbers. In modern formulations, such spatial arrangements are called coordination polyhedra. The species within the square bracket are coordination entities or complexes and the ions outside the square bracket are called counter ions.

He further postulated that octahedral, tetrahedral and square planar geometrical shapes are more common in coordination compounds of transition metals. Thus, $[Co(NH_3)_6]^{3+}$, $[CoCl(NH_3)_5]^{2+}$ and $[CoCl_2(NH_3)_4]^{+}$ are octahedral entities, while $[Ni(CO)_4]$ and $[PtCl_4]^{2-}$ are tetrahedral and square planar, respectively.

In these questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

a. Assertion and reason both are correct statements and reason is correct explanation for assertion.
b. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
c. Assertion is correct statement but reason is wrong statement.
d. Assertion is wrong statement but reason is correct statement.

i. Assertion: Tris(ethane-1,2-diamine)nickel(II) chloride is a homoleptic outer orbital complex.

Reason: The complex forms square planar geometry.

ii. Assertion: In this complex $[Co(NH_3)_5(NO_3)]$, the primary valence of Co is 3.

Reason: The most state oxidation state of cobalt is +3.

OR

Assertion: In this complex $[Co(NH_3)_5(NO_3)]$, the coordination number is 6

Reason: Because the central metal ion is surrounded by six ligands.

iii. Assertion: In coordination compounds metals show two types of valences.

Reason: These complexes always have ambidentate ligands.

iv. Assertion: $[PtCl_4]^{2-}$in this complex, the central metal ion is named as platinate.

Reason: Because it belongs of the geometry of ML_4 type.

Following questions (No. 3-11) are multiple choice questions carrying 1 mark each:

3. The following reaction takes place in the presence of :

a. Fe/HCl
b. Pt/HCl
c. Pd/HCl
d. Ni/HCl

4. Identify the non-essential amino acid.

a. Glycine
b. Valine
c. Leucine
d. Lysine

OR

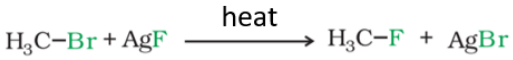
α-helix and β-pleated sheet structures have:

a. disulphide bonds
b. ionic bonds
c. hydrogen bonds
d. van der Waals forces.

5. Smoke is an example of :

a. Gel
b. Sol
c. Emulsion
d. Aerosol

6. Identify the chemical reaction shown:



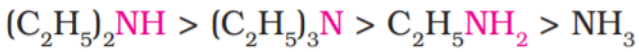
a. Stephen reaction
b. Rosenmund reduction
c. Swarts reaction
d. Etard reaction

OR

Find out the correct order in terms of boiling points, for the same alkyl group.

a. RI >RBr>RCl>RF
b. RF>RCl>RBr>RI
c. RCl>RF>RBr>RI
d. RBr>RI>RCl>RF

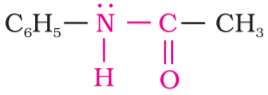
7. Identify the effect(s) that decide(s) on the basic strength of ethyl substituted amines in aqueous solution:



a. Inductive effect only
b. Both Inductive effect and Solvation effect
c. van der Waals forces of attraction only
d. Inductive effect, solvation effect and steric effect.

OR

What will be the IUPAC name of this compound?



a. Methylphenylamide
b. 1-Methyl-N-phenylamide
c. N-Phenylethanamide
d. 1-Methylbenzamide

8. When a chalk stick is dipped in ink,

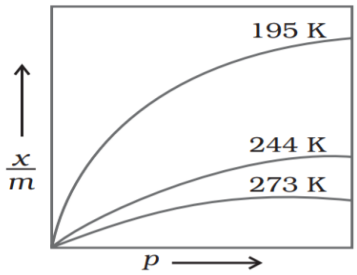
a. Only Adsorption takes place
b. Only Absorption takes place
c. Both Absorption and Adsorption take place
d. None of these

OR

During adsorption, $\triangle S$ will be :

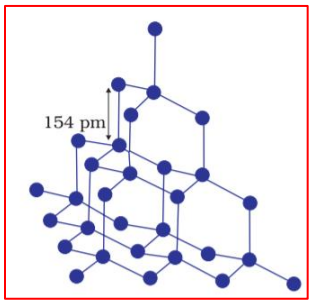
a. positive
b. negative
c. zero
d. cannot be determined.

9. Adsorption Isotherm is shown below: Study the graph and choose the correct option.



a. at a fixed pressure, there is a decrease in physical adsorption with increase in temperature.
b. at a fixed pressure, there is an increase in physical adsorption with increase in temperature.
c. at a fixed temperature, there is a decrease in physical adsorption with increase in pressure.
d. at a fixed temperature, there is an increase in physical adsorption with decrease in pressure.

10. The structure of diamond is shown below: Identify the type of crystalline solid.



a. Molecular solids
b. Ionic solids
c. Metallic solids
d. Covalent solids

11. Identify all the possible monochloro structural isomers expected to be formed on free radical monochlorination of $(CH_3)_2CHCH_2CH_3$.

a. 2 isomers
b. 3 isomers
c. 4 isomers
d. 5 isomers

In the following questions (Q. No. 12 - 16) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

12. Assertion: In a complex, the presence of CO ligand leads to pairing up of electrons.
Reason: CO is a strong field ligand.

13. Assertion: The solubility of HCl gas in cyclohexane at 293K graphically shows a straight line.
Reason: Different gases have different K_H values at the same temperature.

OR

Assertion: Solubility of gases in liquids decreases with rise in temperature.
Reason: As dissolution is an exothermic process, the solubility should decrease with increase of temperature.

14. Assertion: On prolonged heating with HI, Glucose forms n-hexane.
Reason: This indicates that the carbonyl group is present as an aldehydic group in glucose.

15. Assertion: The presence of secondary and tertiary alkyl halides leads to substitution than elimination towards formation of ethers.
Reason: If a tertiary alkyl halide is used, an alkene is the only reaction product and no ether is formed.

16. Assertion: The order of reactivity of alcohols with a given haloacid is 3°>2°>1°.
Reason: As the alkyl group increases, the stability of the carbocation also increases.

SECTION B

The following questions, Q. No. 17 – 25 are short answer type and carry 2 marks each.

17. Show the conversion of Acetophenone into Benzoic acid.

OR

How will you bring about the following conversion?

Cyclohexanecarbaldehyde into Methylcyclohexane

18. Calculate the mass of ascorbic acid (Vitamin C, $C_6H_8O_6$) to be dissolved in 75 g of acetic acid to lower its melting point by 1.5°C. K_f = 3.9 K kg mol^{-1}.

19. What is the difference between physisorption and chemisorption?

OR

Based on the following factors explain the adsorption of a gas on a solid?
(i) Surface area of the solid.
(ii) Effect of temperature.

20. A first order reaction has a rate constant 1.15 10^{-3} s^{-1}. How long will 5 g of this reactant take

to reduce to 3 g? [log 5 = 0.6990; log 3 = 0.4771]

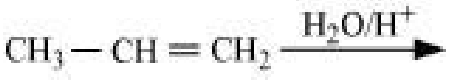
21. From the rate expression for the following reaction, determine the order of reaction and the dimension of the rate constant.

$CH_3CHO(g) \rightarrow CH_4(g) + CO(g)$

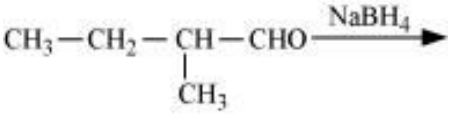
Rate = $k\,[CH_3CHO]^{3/2}$

22. Complete the following reactions:

(i)



(ii)



OR

Write short notes on:

(a) Reaction of Phenol with Zn dust

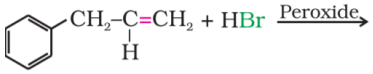
(b) Kolbe's reaction of Phenol.

23. Calculate the number of unpaired electrons in the following gaseous ions:

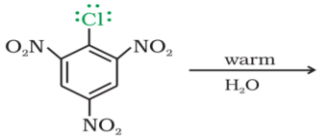
Mn^{3+} and Cr^{3+} . Which one of them is most stable in aqueous solution and why?

24. What happens when:

a.



b.



25. Classify the following as amorphous or crystalline solids:

a. Polyurethane b. Potassium nitrate c. Teflon d. Copper

SECTION C

26. Account for the following:

a. Fluorine forms only one oxoacid.

b. H_2Te has more acidic character than H_2O.

c. XeF_6 has a distorted octahedral geometry.

OR

Explain on the oxidising behaviour of the Group 17 elements

27. How will you convert?

(i) Benzene into aniline

(ii) Benzene into N, N-dimethylaniline

(iii) $Cl{-}(CH_2)_4{-}Cl$ into hexan-1, 6-diamine?

OR

Arrange the following in increasing order of their basic strength:

(i) $C_2H_5NH_2$, $C_6H_5NH_2$, NH_3, $C_6H_5CH_2NH_2$ and $(C_2H_5)_2NH$

(ii) $C_2H_5NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$, $C_6H_5NH_2$

(iii) CH_3NH_2, $(CH_3)_2NH$, $(CH_3)_3N$, $C_6H_5NH_2$, $C_6H_5CH_2NH_2$.

28. Write short notes on :

a. Tetrahedral voids

b. No. of lattice points in face centered cubic lattice.

c. Impurity defect

29. Define the following as related to proteins:

(i) Peptide linkage **(ii)** Primary structure **(iii)** Denaturation.

30. Name the reagents used for the following conversions.

i. Benzyl alcohol to benzoic acid.

ii. Dehydration of propan-2-ol to propene.

iii. Butan-2-one to butan-2-ol.

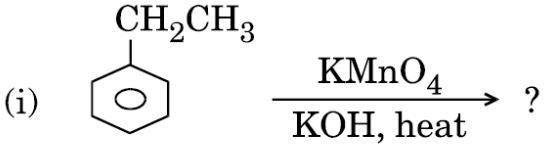
SECTION D

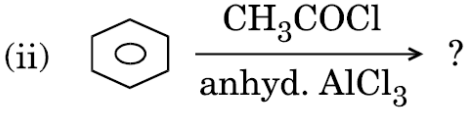
31 a. Draw the structures of the following derivatives.

(i) 2,4-DNP of benzaldehyde

(ii) Propanone oxime

b. Complete the following synthesis:

(i) 

(ii) 

c. Carboxylic acid is a stronger acid than phenol. Justify.

OR

(a) An organic compound 'A' with molecular formula $C_4H_8O_2$ was hydrolysed with dil. H_2SO_4 to give a carboxylic acid 'B' and an alcohol 'C'. 'C' on dehydration gives ethene and 'C' also on oxidation gives back 'B'. Identify 'A', 'B' and 'C' and write the chemical equations for the reactions involved.

(b) How will you convert ethanal into the following compounds ?

(i) Ethanol

(ii) Ethane

32. Account for the following:

a. Pentahalides more covalent than trihalides.

b. BiH_3 the strongest reducing agent amongst all the hydrides of Group 15 elements.

c. H_2O a liquid and H_2S a gas

d. Anomalous behaviour of fluorine among Group 17 elements

e. The study the chemistry of radon is difficult.

OR

Complete the following:

i $Li + N_2 \xrightarrow{\text{Heat}}$

ii $NO(g) + O_3(g) \rightarrow$

iii $F_2(g) + 2H_2O(1) \rightarrow$

iv $I_2 + Cl_2 \rightarrow$ (equimolar)

v $XeF_6 + NaF \rightarrow$

33. (i)

Predict the products of electrolysis in each of the following :

(a) An aqueous solution of $CuSO_4$ with Pt electrode

(b) An aqueous solution of $AgNO_3$ with Pt electrode

(ii) Calculate the potential of hydrogen electrode in contact with a solution whose pH is 10.

OR

(i)

The cell in which the following reactions occurs:

$$2Fe^{3+}_{(aq)} + 2I^{-}_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + I_{2(s)}$$

has E^{0}_{cell} = 0.236 V at 298 K.

Calculate the standard Gibbs energy and the equilibrium constant of the cell reaction.

(ii) Graphically represent the relationship between Molar conductivity versus c½ for acetic acid (weak electrolyte) and potassium chloride (strong electrolyte) in aqueous solutions.

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