

KENDRIYA VIDYALAYA SANGATHAN, LUCKNOW REGION
SESSION : 2020-2021
PRE-BOARD EXAMINATION
CHEMISTRY THEORY (043)
SET-2

MM:70

Time: 3 Hours

General Instructions. Read the following instructions carefully.

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

SECTION A (OBJECTIVE TYPE)

1. Read the passage given below and answer the following questions:

Combined with other functional group(s), aldehydes, ketones, carboxylic acids & esters are widespread in nature. They are responsible for fragrance and flavour of the naturally occurring compounds. For example- vanillin (from vanilla beans), salicylaldehyde (from meadow sweet), cinnamaldehyde (from cinnamon), isoamyl acetate (from bananas) etc have pleasant fragrances. Formaldehyde is the simplest aldehyde whereas acetone is the simplest ketone. Formaldehyde is a gas and its 40% solution in water forms Formalin which is used in preserving biological specimens. Acetaldehyde is largely used in the production of acetic acid through oxidation process. Both aldehydes and ketones predominantly give nucleophilic addition reactions, however the reactivity of aldehydes is greater than ketones for the same.

The following questions are multiple choice questions. Choose the most appropriate answer: (1x4=4)

(i) Which of the following compounds is most reactive towards nucleophilic addition reactions?

- (a) $\text{CH}_3\text{-CH}_2\text{-CHO}$
- (b) $\text{CH}_3\text{-CO-C}_2\text{H}_5$
- (c) $\text{C}_6\text{H}_5\text{-CHO}$
- (d) $\text{C}_6\text{H}_5\text{-CO-CH}_3$

(ii) CH_3CHO & $\text{C}_6\text{H}_5\text{CH}_2\text{CHO}$ can be distinguished chemically by.....?

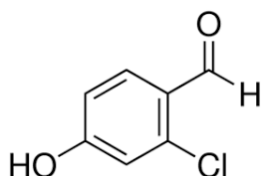
- (a) Tollen's reagent
- (b) Fehling's solution.
- (c) Iodoform test.
- (d) Benedict's test.

OR

Iodoform can be prepared from all except.....

- (a) Butan-2-one
- (b) Acetophenone
- (c) Propan-2-ol
- (d) Propan-1-ol

(iii) The IUPAC name of the following compound is.....?



- (a) 6-chloro-4-hydroxybenzaldehyde (b) 2-chloro-4-hydroxybenzaldehyde
(c) 3-chloro-4-formylphenol (d) 5-chloro-4-formylphenol

(iv) Identify the combination of compounds that undergo Aldol condensation followed by dehydration to produce but-2-enal.

- (a) methanal & ethanal
(b) two mols of ethanal
(c) methanal & propanone.
(d) ethanal & propanone.

2. Read the passage given below and answer the following questions:

(1x4=4)

α - Amino acids are the building blocks of proteins. About 20 α - amino acids have been isolated by the hydrolysis of proteins. Out of 20, 10 amino acids (i.e., valine, leucine, isoleucine, phenylalanine, methionine, tryptophan, threonine, lysine, arginine & histidine) which the body cannot synthesize are called essential amino acids. The remaining 10 are called non-essential amino acids. All α - amino acids exist as zwitterions each of which has a specific isoelectric point. α - Amino acids join together to form polypeptides or proteins.

In the following questions, [from (i) to (iv)] 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.
e) Both assertion and reason are wrong statements.

(i) Assertion: All α - amino acids except glycine are chiral.

Reason: In Glycine side chain in the structural formula- $\text{H}_2\text{N}-\text{CH}(\text{R})-\text{COOH}$ i.e., $(\text{R}) = \text{H}$.

(ii) Assertion: An α - amino acid below its isoelectric point migrates towards anode.

Reason: In alkaline medium, α - amino acids exist as anions.

OR

Assertion: Glycine must be taken through diet.

Reason: It is an essential amino acid.

(iii) Assertion: A zwitterion is a dipolar ion.

Reason: Zwitterion is formed by neutralization of only acidic centre present within the molecule.

(iv) Assertion: Phenylalanine is an essential amino acid.

Reason: All the naturally occurring amino acids have L-configuration.

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

3. Cations are present in the interstitial sites in.....?

- (i) Frenkel defect
- (ii) Schottky defect
- (iii) Vacancy defect
- (iv) Metal deficiency defect

4. The value of rate constant of a pseudo first order reaction.....?

- (i) Depends on the concentration of reactants present in small amount.
- (ii) Depends on the concentration of reactants present in excess.
- (iii) Is independent of the concentration of reactants.
- (iv) Depends only on temperature.

OR

Which of the following statements is not correct for the order of the reaction?

- (i) the order of the reaction can be fractional.
- (ii) the order of the reaction is experimentally determined
- (iii) the order of the reaction is always equal to the sum of stoichiometric coefficients of reactants in the balanced chemical equation for a reaction.
- (iv) the order of the reaction is the sum of the powers of molar concentration of reactants in the rate law expression.

5. Which one of the following will form a hydrophobic colloid?

- (i) Starch
- (ii) Gum
- (iii) Egg albumin
- (iv) Ferric hydroxide

OR

Which of the following electrolytes will be most effective in the coagulation of $\text{Fe}(\text{OH})_3/\text{Fe}^{3+}$ sol?

- (i) NaNO_3
- (ii) $\text{K}_4[\text{Fe}(\text{CN})_6]$
- (iii) Na_3PO_4
- (iv) MgCl_2

6. Which of the following gas is filled in the tyres of aeroplanes?

- (i) H_2
- (ii) He
- (iii) N_2
- (iv) Ar

OR

If Cl_2 gas is passed through cold & dil. NaOH solution, two changes are observed in the oxidation number of Cl during the reaction. These are....and.....

- (a) 0 to +5 (b) 0 to +3 (c) 0 to -1 (d) 0 to +1

- (i) a & c
- (ii) a & b

- (iii) b & c
- (iv) c & d

7. Which of the following oxidation states is common for all the lanthanoids?

- (i) +2
- (ii) +3
- (iii) +4
- (iv) +5

8. An example of ambidentate ligand is.....

- (i) Ammine
- (ii) Aqua
- (iii) Thiocyanato
- (iv) Oxalato

OR

Which of the following compound has tetrahedral geometry?

- (i) $[\text{Ni}(\text{CN})_4]^{2-}$
- (ii) $[\text{Cu}(\text{NH}_3)_4]^{2+}$
- (iii) $[\text{CoF}_6]^{3-}$
- (iv) $[\text{Ni}(\text{Cl})_4]^{2-}$

9. Which of the following compounds will react with sodium hydroxide solution in water?

- (i) $\text{C}_6\text{H}_5\text{OH}$
- (ii) $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$
- (iii) $(\text{CH}_3)_3\text{COH}$
- (iv) $\text{C}_2\text{H}_5\text{OH}$

10. Which one of the following forms propanenitrile as the major product?

- (i) Propyl bromide + KCN
- (ii) Ethyl bromide + KCN
- (iii) Propyl bromide + AgCN
- (iv) Ethyl bromide + AgCN

11. Which of the following will not give Cannizzaro reaction?

- (i) CH_3CHO
- (ii) $(\text{CH}_3)_3\text{CCHO}$
- (iii) HCHO
- (iv) $\text{C}_6\text{H}_5\text{CHO}$

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: The packing efficiency is maximum for the fcc structure.

Reason: The co-ordination number is 6 in fcc structures.

13. Assertion: In a zero order reaction, if concentration of the reactant is doubled, half-life period is also doubled.

Reason: The total time taken for a zero order reaction to complete is double of the half-life period.

14. Assertion: An ordinary filter paper impregnated with colloidal solution stops the flow of colloidal particles. Reason: Pore size of the filter paper becomes more than the size of colloidal particle.

OR

Assertion: Detergents with low CMC are more economical to use . Reason: Cleansing action of detergents involves the formation of micelles. These are formed when the concentration of detergents becomes equal to CMC.

15. Assertion: HI can be prepared by the reaction of KI with concentrated H_2SO_4 . Reason: HI has lowest H-X bond strength among halogen acids.

16. Assertion: Cu (I) ion is not stable in an aqueous solution. Reason: Although second ionization enthalpy of copper is large but Δ_{hyd} (hydration enthalpy) for $\text{Cu}^{2+}(\text{aq})$ is much more negative than that for $\text{Cu}^+(\text{aq})$

SECTION B

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

17. Silver crystallizes in fcc lattice. If the edge length of the cell is 4.077×10^{-8} cm and density is 10.5 g/cm^3 , calculate the atomic mass of silver.

OR

Write any two points of differences between Schottky and frenkel defects.

18. What is the advantage of using osmotic pressure as compared to other colligative properties for the determination of molar masses of solutes in solutions?

19. Define the following :

(i) CMC (ii) Coagulation of colloids with example

OR

What happens when- (i) KI is added in excess AgNO_3 solution. (ii) FeCl_3 is treated with excess of NaOH solution.

20. Write two consequences of lanthanoid contraction.

21. Write the name, the state of hybridization, the shape and the magnetic behaviour of the following complex : $[\text{Cr}(\text{NH}_3)_6]^{3+}$

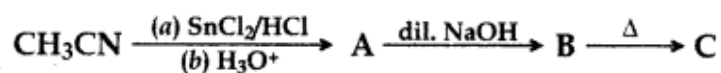
22. Explain the following terms:

(i) Chelating ligand with suitable example.

(ii) Crystal field splitting in a tetrahedral field (with diagram).

23. The predominant reaction of Haloalkanes is nucleophilic substitution whereas predominant reaction of haloarenes is electrophilic substitution. Give appropriate reasons (any two).

24. (a) Write the product and IUPAC names of compounds A, B and C in the following reaction:



(b) Name the compound when CH_3CN undergoes complete hydrolysis.

25. Give the chemical tests to distinguish between the following pairs of compounds :

(i) Methylamine and Dimethylamine.

(ii) Aniline and Ethanamine

SECTION C

Q. No 26 -30 are Short Answer Type II carrying 3 mark each.

26. Define Ebullioscopic constant. A solution of glycerol ($C_3H_8O_3$; molar mass = 92 g mol^{-1}) in water was prepared by dissolving some glycerol in 500 g of water. This solution has a boiling point of 100.42°C . What mass of glycerol was dissolved to make this solution? K_b for water = $0.512 \text{ K kg mol}^{-1}$.

OR

Define azeotropes. How many types of azeotropes define with suitable examples.

27. If the half-life period of a first order reaction is 2 minutes, how long will it take for reactant to reach 25% of its initial concentration?

OR

A first order reaction takes 20 minutes for 25% decomposition. Calculate the time when 75% of the reaction will be completed. (Given: $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 4 = 0.6021$).

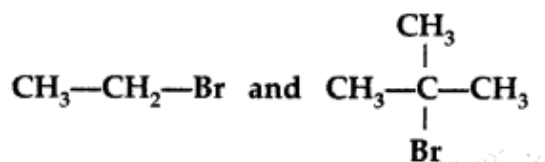
28. Assign reasons for each of the following :

(i) Transition metals generally form coloured compounds.

(ii) Cr^{2+} is reducing in nature while with the same d-orbital configuration (d^4) Mn^{3+} is an oxidising agent.

(iii) Transition metals and their compounds are generally found to be good catalysts.

29. Which out of the following compounds would undergo SN_1 reaction faster and why?



Give the mechanism of SN^1 reaction of your selected compound.

30. An aromatic compound 'A' on treatment with aqueous ammonia and heating forms compound 'B' which on heating with Br_2 and KOH forms a compound 'C' of molecular formula C_6H_7N . Write the reaction, the structures and IUPAC names of compounds A, B and C.

SECTION D

Q. No 31 to 33 are long answer type carrying 5 marks each.

31. (a) What is the difference between emf and E°_{cell} ?

(b) Calculate e.m.f. of the following cell at 298 K: $2\text{Cr}(s) + 3\text{Fe}^{2+} (0.1 \text{ M}) \rightarrow 2\text{Cr}^{3+} (0.01 \text{ M}) + 3 \text{Fe}(s)$

$E^\circ(\text{Cr}^{3+}/\text{Cr}) = -0.74$

$E^\circ(\text{Fe}^{2+}/\text{Fe}) = -0.44 \text{ V}$

OR

(a) Define molar conductivity of a substance and describe how for weak and strong electrolytes, molar conductivity varies on dilution?

(b) State Kohlrausch law of independent migration of ions. Write an expression for the molar conductivity of acetic acid at infinite dilution according to Kohlrausch law.

32. (a) What inspired N. Bartlett for carrying out reaction between Xe and PtF_6 ?
- (b) (i) O_2 and F_2 both stabilize higher oxidation states of metals but O_2 exceeds F_2 in doing so. Give reason.
(ii) Why interhalogens are more reactive than pure halogens?
- (c) Draw the structures of the following molecules: (i) XeOF_4 (ii) BrF_3

OR

- (a) Explain the following facts giving appropriate reason in each case :
- (i) NF_3 is an exothermic compound whereas NCl_3 is not.
(ii) All the bonds in SF_4 are not equivalent.
- (b) Arrange the following as directed :
- (i) H_2O , H_2S , H_2Se , H_2Te – increasing acidic character.
(ii) HF , HCl , HBr , HI – increasing bond dissociation enthalpy.
(iii) NH_3 , PH_3 , AsH_3 , SbH_3 , BiH_3 - increasing Lewis base character.

33. (a) How would you obtain
- (i) Picric acid (2, 4, 6-trinitrophenol) from phenol,
(ii) 2-Methylpropene from 2-methylpropanol?
- (b) Arrange the following compound groups in the increasing order of their property indicated:
p-nitrophenol, p-methoxyphenol, ethanol, phenol (acidic character)
- (c) Explain the mechanism of acid catalysed hydration of an alkene to form corresponding alcohol.

OR

- (a) Write the equations involved in the following reactions:
- (i) Reimer-Tiemann reaction
(ii) Williamson's ether Synthesis
- (b) Give chemical tests to distinguish between the following pairs of compounds :
- (i) Pentan-2-ol and Pentan-3-ol (ii) Methanol and Phenol
- (c) Phenol gives aromatic electrophilic very faster and ortho and para product is formed, Explain?
