SAMPLE PAPER-01 (solved)

CHEMISTRY (Theory)

Class – XII

Time allowed: 3 hours Maximum Marks: 70

General Instructions:

a) All the questions are compulsory.
b) There are **26** questions in total.
c) Questions **1** to **5** are very short answer type questions and carry **one** mark each.
d) Questions **6** to **10** carry **two** marks each.
e) Questions **11** to **22** carry **three** marks each.
f) Questions **23** is value based question carrying **four** marks.
g) Questions **24** to **26** carry **five** marks each.
h) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions in five marks each. You have to attempt only one of the choices in such questions.
i) Use of calculators is **not** permitted. However, you may use log tables if necessary.

1. Give the IUPAC name of $(CH_3)_3$ – C – COOH.
2. What is meant by protective colloid?
3. Define coagulation value.
4. Give the role of desorption in the process of catalysis.
5. What is an isoelectric point?
6. Explain the term chromatography.
7. Explain the mechanism of dehydration of ethanol.
8. Classify solids based on their conductivities.

   Or

   Explain anti-ferromagnetism with neat sketch.

9. Name the reagents used in the following reagents:

i. Conversion of Benzyl alcohol to benzoic acid.
ii. Dehydration of propan-2-ol to propene.
iii. Oxidation of a primary alcohol to carboxylic acid.
iv. Oxidation of a primary alcohol to aldehyde.

10. Differentiate the solutions having positive deviation from ideal behaviour and the solutions having negative deviation from ideal behaviour.
11. What mass of propene is obtained from 34.0 g of 1-iodo-propane on treating with ethanolic KOH, if the yield is 36%?
12. What are the forces that stabilize the protein structures?
13. Complete the reactions:

i. $POCl_3 + H_2O \rightarrow$

ii. $P_4O_{10} + H_2O \rightarrow$

iii. $P_4 + KOH + H_2O \rightarrow$

14. Define the following term with an example:

a) Tranquilizers

b) Analgesics

c) Antipyretics

15. Explain the termcopolymerisation with two examples.

16. Give four criterions to be followed for the selection of stationary phase in chromatography.

17.

i. Why noble gases have low boiling points?

ii. Why are the elements of group 18 known as noble gases?

iii. Why He is used in diving apparatus?

18. What are the factors which determine the magnitude of the orbital splitting energy?

Or

How the nature of the ligand affect the stability of a complex ion?

19. Differentiate addition and condensation polymers.

20. Calculate the number of active hydrogen atoms in the molecule of an organiccompound, if an ex cess of methyl magnesium iodide reacts with 0.6 g of an organic compound $C_3H_6O_3$ to evolve 295.7 mL of methane gas at STP.

21. The decomposition of N_2O_5 in CCl4 at 318K has been studied by monitoring the concentration of N_2O_5 in the solution. Initially the concentration of N_2O_5 is 2.33 mol L^{-1} and after 184 minutes, it is reduced to 2.08 mol L^{-1}. The reaction takes place according to the equation

$2N_2O_5\ (g) \rightarrow 4\ NO_2\ (g) + O_2\ (g)$

a) Calculate the average rate of this reaction in terms of hours, minutes and seconds.

b) What is the rate ofproduction of NO_2 during this period?

22. Why F shows only one oxidation state whereas other halogens show more than two positive oxidation states?

23. Ethanol is used for drinking purpose. But to refrain people from drinking industrial alcohol, it is denatured. Now a days some countries use ethanol as an additive in gasoline since it is cleaner fuel.

    a. What is denatured alcohol? Why it is denatured?
    b. Would you support the use of ethanol as an additive in gasoline for India?
    c. What are the values associated with your decision?

24. Calculate the equivalent conductivity of 1 M H_2SO_4 solution whose conductivity is 26 x 10^{-2} ohm^{-1} cm^{-1}.

Or

How long will it take to deposit 1.0 g of Cr when a current of 1.25 A flows through a solution of chromium (III) sulphate? [Molar mass of Cr = 52].

25.

a) Give the structures of chromate ion and dichromate ion.

b) Give the preparation of potassium permanganate.

Or

a) Give the structure of manganite ion and permanganate ion.
b) Give the schematic representation of chemical reactions of lanthanoids.

26. Convert the following into benzoic acid:

a. Ethylbenzene
b. Acetophenone
c. Bromobenzene
d. Styrene

Or

An organic compound X contains 69.77% C, 11.63% H and rest Oxygen. The molecular mass of the compound is 86. The compound X does not reduce Tollen's reagent, but forms an addition compound with sodium hydrogen sulphite and gives positive iodoform test. On vigorous oxidation, X gives ethanoic and propanoic acids. Identify the possible structure of X.

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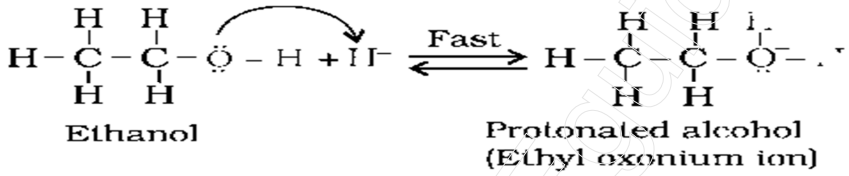
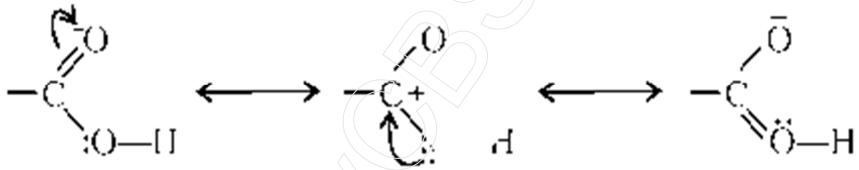
Answers

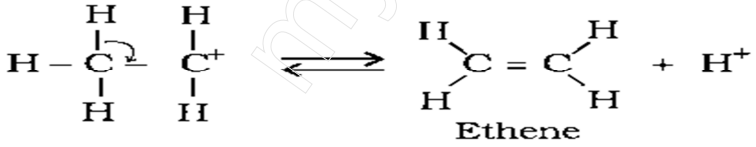
1. Triamethyl acetic acid.
2. When lyophilic sol is added to lyophobic sol to make it stable and prevent its coagulation, it is called protective colloid.
3. It is defined as the minimum number of millimoles of electrolyte required to coagulate 1 litre of colloidal solution.
4. In the process of catalysis, when desorption occurs from the surface of the catalyst, the surface becomes ready to adsorb fresh reactants and act as a catalyst.
5. The pH at which no net migration of amino acid takes place under the influence of an applied electric field is called isoelectric point.
6. It is a technique for the separation and purification based on the differences in adsorbing tendencies of the metal and its impurities on a suitable adsorbent. It is based on the principle that "different components of a mixture are differently adsorbed on an adsorbent".
7. The mechanism of dehydration of ethanol involves the following steps:
   Step 1: Formation of protonated alcohol.



   Step 2: Formation of carbocation.
   Since this step is the slowest step, it is the rate determining step of the reaction.



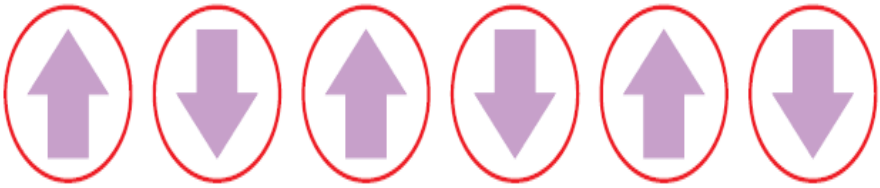
   Step 3: Formation of ethane by elimination of a proton.



8. Based on the conductivity, solids are classified into three types as follows:
   Conductors: The solids with conductivities ranging between 10^4 to 10^7 $ohm^{-1}m^{-1}$ are called conductors. Metals have conductivities in the order of 10^7 $ohm^{-1}m^{-1}$are good conductors.
   Insulators: These are the solids with very low conductivities ranging between 10^{-20} to 10^{-10} $ohm^{-1}m^{-1}$.
   Semiconductors: These are the solids with conductivities in the intermediate range from 10^{-6} to 10^4 $ohm^{-1}m^{-1}$.

Or

Substances like MnO showing antiferromagnetism have domain structure similar to ferromagnetic substance, but their domains are oppositely oriented and cancel out each other's magnetic moment.



9.

(i) Acidified or alkaline potassium permanganate.
(ii) Concentrated sulphuric acid at 443 K.
(iii) Acidified potassium permanganate or potassium dichromate.
(iv) PPC in Cu at 573 K.

10.

Solutions having positive deviation	Solutions having negative deviation
Heating increases solubility.	Heating decreases solubility.
A – B forces are less than A – A and B – B forces.	A – B forces are more than A – A and B – B forces.
Dissolution is endothermic and positive.	Dissolution is exothermic and negative.

11. $CH_3CH_2CH_2I + KOH\ (alc.) \rightarrow CH_3CH = CH_2 + KI + H_2O$
Molecular mass of iodopropane = 3 x 12 + 7 x 1 + 127 = 170
Molecular mass of propene = 3 x 12 + 6 x 1 = 42
170 g of iodopropane gives 42 g of propene
Therefore,
34 g of iodopropane gives 42/170 x 34 = 8.4 g
But the actual yield is 36%, so
The actual mass of propene obtained = 8.4 x 3.6/100 = 3.024 g.

12.

a. Hydrogen bonding – these are weak forces which arise between a partially positive hydrogen and a partially negative atom on the same or different molecule.
b. Ionic bonding – these takes place between an ionic and cationic side chains resulting side chain cross linking.
c. Covalent bonding –it is a inter chain bonding is the disulphide bond formed between the sulphur atoms of two cysteine residues.

d. Hydrophobic bonding – proteins in aqueous solutions fold so that most of the hydrophobic chains become clustered inside the folds. The polar side chains which are hydrophilic lie on the outside the protein.

13.

i. $POCl_3 + 3H_2O \rightarrow H_3PO_4 + 3HCl$

ii. $P_4O_{10} + H_2O \rightarrow 4\ H_3PO_4$

iii. $P_4 + KOH + H_2O \rightarrow PH_3 + 3\ KH_2PO_2$

14.

a) The chemical substances which are used for the treatment of stress, mild and severe mental diseases are called tranquilizers. Example – Iproniazid.

b) The chemical substances which are used to relieve pains without causing impairment of consciousness, mental confusion, paralysis and other disturbances of nervous system are called analgesics. Example – Novalgin.

c) The chemical substances which are used to lower the temperature of the body in high fever are called antipyretics. Example – Aspirin.

15. Copolymerization is defined as a process in which two or more monomers combine to form a polymer. It contains a multiple units of each monomer in the chain.
Examples – 1,3-butadiene and acrylonitrile, 1,3-butadiene and styrene

16.

a) It should be high and selective adsorption power.
b) It should be finely divided to offer greater surface area for adsorption.
c) It should be pure.
d) It should not react chemically either with the sample components.

17.

i. Noble gases are monoatomic gases and are held together by weak vander Waals forces. Therefore, they are liquefied at very low temperatures. Hence they have low boiling points.

ii. The elements in group 18 have completely filled valence shell except He. So, they have neither any tendency to lose nor to gain electrons. However, they react with few elements only under certain conditions and so are called noble gases.

iii. He is used as a diluent for oxygen in diving apparatus because of its low solubility in blood.

18.

a. Nature of the ligand.
b. Oxidation state of the metal ion.
c. Nature of the metal ion.
d. Geometry of coordination entity.

Or

The more basic a ligand, the greater is the ease with which it can donate its lone pairs of electrons and therefore, the greater is the stability of the complexes formed by it. For

anionic ligands, the higher the charge and the smaller the size, the more stable is the complex formed.

19.

S. No	Addition polymers	Condensation polymers
1.	It involves one monomer.	It involves two monomers.
2.	The monomers are unsaturated compounds.	The monomers contain two functional groups.
3.	Different monomers add to form a polymer having same molecular formula of the repeating structural unit as that of starting monomer.	A large number of monomers combine with the loss of simple molecules to form a polymer having molecular formula of the repeating structural unit different than that of starting monomers.
4.	Egs – PVC, polythene etc.	Egs – Bakelite, nylon etc.

20. Molecular mass of $C_3H_6O_3$ = 12 x 3 + 6 x 1 + 3 x 16 = 90 g
Now, 0.6 g of the compound evolve methane at STP = 295.7 mL
90 g of compound evolve methane at STP = 295.7/0.6 x 90 = 44355
Moles of methane produced = 44355/22400 = 1.98 or 2 approx.
Therefore, one mole of compound produces two moles of methane gas. There are two active hydrogen atoms present in one molecule of compound.

21.

$$\text{Average Rate} = \frac{1}{2}\left\{-\frac{\Delta[N_2O_5]}{\Delta t}\right\}$$

Substituting the values, we get 1.13 x 10^{-5} mol/L/s

$$\text{Rate} = \text{Average Rate} = \frac{1}{4}\left\{-\frac{\Delta[NO_2]}{\Delta t}\right\}$$

Substituting the values,

$$\frac{\Delta[NO_2]}{\Delta t} = 2.72 \times 10^{-3}\ \text{mol/L/min}$$

22. F is most electronegative element and so cannot show positive oxidation states whereas the other halogens are less electronegative and so show various positive oxidation states. They also have vacant d-orbitals and hence can expand their octets and show +1, +3, +5 and +7 oxidation states.

23.

a. Industrial alcohol is made unfit for drinking by adding methyl alcohol $CuSO_4$ and pyridine. This alcohol is called denatured alcohol.
Ethanol is an excellent solvent and if taken in large quantity it is harmful for humans. So in order to supply ethanol and to refrain people from drinking it is denatured.
b. Yes, because it will help im meeting energy crisis and reduce our fiscal deficit which is created due to import of gasoline.

c. Values – Concern for energy crisis and Concern for economy of country.

24. Conductivity = 26 x 10^{-2} ohm^{-1} cm^{-1}

Resistance of solution = 31.6 ohm

Concentration = 1 M H_2SO_4 = 98 g/L

Equivalent weight of sulphuric acid = 49

Gram equivalents per litre = 98/49 = 2

Equivalent conductivity = k x 1000/C

= 26 x 10^{-2} x 1000/2 = 130 ohm^{-1} cm^2 $equiv^{-1}$.

Or

Cr^{3+} + $3e^-$ → Cr(s)

3 mol of electricity are required to deposit 1 mol of Cr.

52 g of Cr require current of 3 x 96500 C

1 g of Cr will require current = 3 x 96500/52 = 5567.3 C

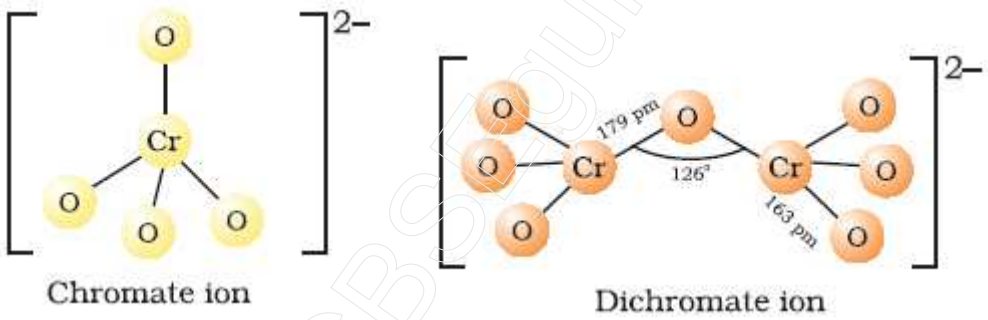
The number of coulombs = current x time

Time = no. of coloumbs/ current

= 5567.3/1.25 = 4453.8 sec or 1.24 hrs.

25.

a)



Chromate ion Dichromate ion

b)

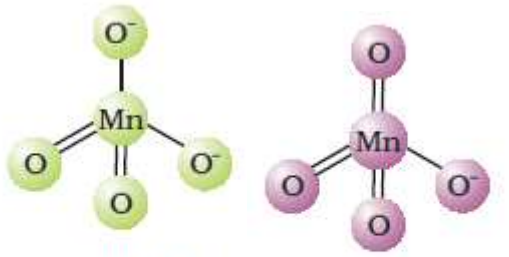
Potassium permanganate is prepared by fusion of MnO2 with an alkali metal hydroxide and an oxidising agent like KNO3. This produces the dark green K2MnO4 which disproportionates in a neutral or acidic solution to give permanganate.

$$2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$$

$$3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$$

Or

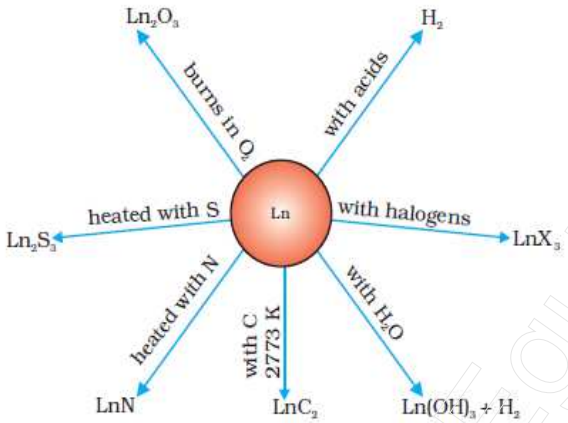
a)



Tetrahedral manganate (green) ion

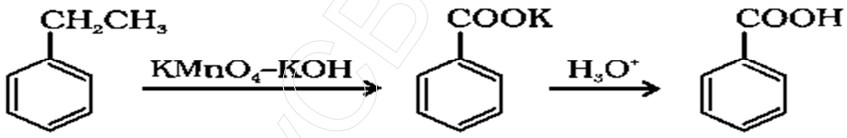
Tetrahedral permanganate (purple) ion

b)

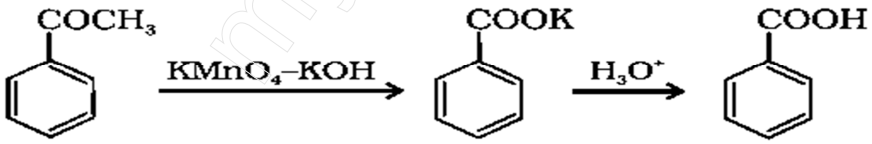


26.

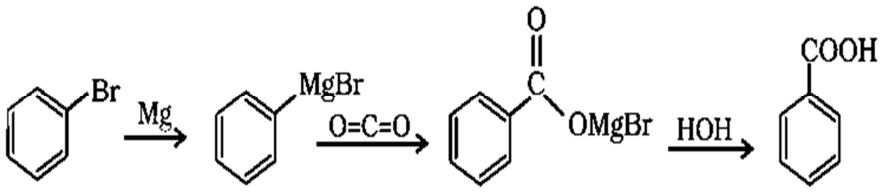
a.



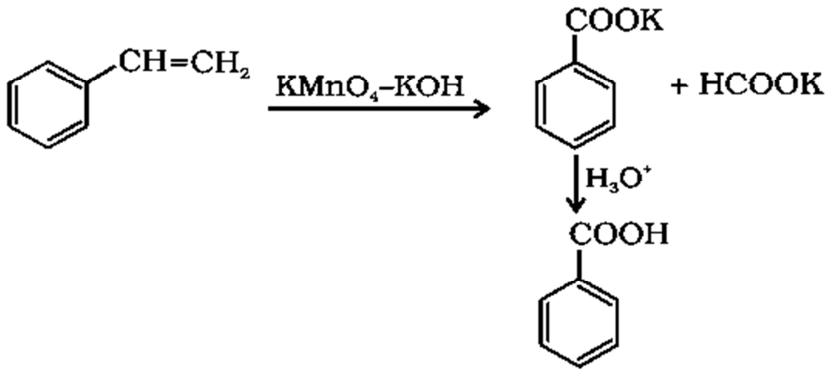
b.



c.



d.

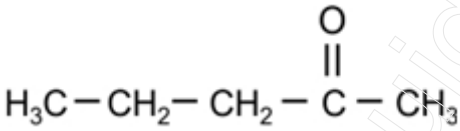


Or

Since the compound X does not reduce Tollen's reagent, the compound X must belong to ketone group.

The compound X forming an addition compound with sodium hydrogen sulphite and giving positive iodoform test confirms that the compound is methyl ketone.

Also, compound X on oxidation gives ethanoic and propanoic acid, so the compound can be



Since this compound is unsymmetrical ketone, the compound is Pentan-2-one with molecular mass 86.