Sample Paper-01 (2016-17)
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.

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1. Give the IUPAC name of $(CH_3) - CO - CO - CH_3$.
2. Give an example of a) Miscelles system and b) Macromolecular colloid.
3. Give reasons: NO_2 is paramagnetic while N_2O_4 is diamagnetic.
4. Why it is necessary to wash the precipitate with water before estimating it quantitatively?
5. Explain why vitamin C cannot be stored in our body?
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. Give a short note on:
    (i) Reimer – Tiemann Reaction.
    (ii) Friedel Crafts Reaction.
12. Show that in a first order reaction, time needed for completion of 99.9% is ten times of half- life of the reaction.
13. Complete the following reactions:
    (i) $KNO_2 + O_3 \rightarrow$
    (ii) $KI + O_3 + H_2O \rightarrow$
    (iii) $HCl + O_3 \rightarrow$
14. Differentiate between rate of reaction and reaction rate constant.

15. Explain the fact that in aryl alkyl ethers the alkoxy group activates the benzene ring towards electrophilic substitution reaction and it also directs the incoming substituents to o- and p-positions in benzene ring.
16. (i) Why bithional is added to soaps?
    (ii) Sulpha drugs work like antibiotics, but are not antibiotics. Comment.
    (iii) What type of drug is phenacetin?
17. Give the formulae of the following complexes:
    (a) Tetraaminedichloridocobalt (III) ion
    (b) Amminechloridobis (ethane-1,2-diamine) cobalt (III) ion
    (c) Potassium trioxalatoaluminate (III)

    Or

    Give some limitations of valence bond theory.
18. Calculate the values of *E*a and *A*.
19. Differentiate globular proteins and fibrous proteins.
20. What are the different types of polymers based on the structure? Give an example each.
21. How are drugs classified?
22. Differentiate ideal and non-ideal solution.
23. Sara went to market to buy fruits and vegetables. The vendor put the fruits and vegetables in the polythene bag but Sara ask the vendor to put the things in the jute bag which he carried with him.
    Now answer the following question
    (a) Why did Sara refuse to use polythene bags?
    (b) As a student of chemistry why would you advocate the use of jute bags instead of polythene bags? Which values are promoted through the use of jute bag?
    (c) Suggest two activities to promote these activities
24. Resistance of a conductivity cell filled with 0.1 mol L^{-1}KCl solution is 100 W. If the resistance of the same cell when filled with 0.02 mol L^{-1}KCl solution is 520 W, calculate the conductivity and molar conductivity of 0.02 mol L^{-1}KCl solution. The conductivity of 0.1 mol L^{-1}KClsolution is 1.29 S/m.

    Or

    Represent the cell in which the following reaction takes place
    $Mg(s) + 2Ag^{+}(0.0001M) \rightarrow Mg^{2+}(0.130M) + 2Ag(s)$
    Calculate its $E_{(cell)}$ *if* $E^{\theta}_{(cell)} = 3.17V$
25. (a) Why scandium (Z = 21) is a transition element but zinc (Z = 30) is not?
    (b) Why do the transition elements exhibit higher enthalpies of atomisation?
    (c) Differentiate electrochemical cell and electrolytic cell (three points).

    Or

    (a) Define corrosion.
    (b) Suggest two materials other than hydrogen that can be used as fuels in fuel cells.
    (c) What are the factors affecting corrosion?
26. (a) How is the variability in oxidation states of transition metals different from that of the non-transition metals? Illustrate with examples.
    (b) Why is the highest oxidation state of a metal exhibited in its oxide or fluoride only?

    Or

    Describe the preparation of potassium dichromate from iron chromite ore. Give the effect of increasing pH on a solution of potassium dichromate.

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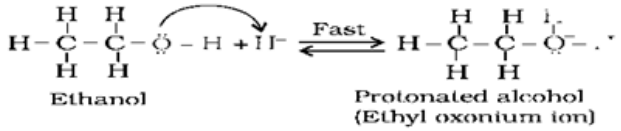
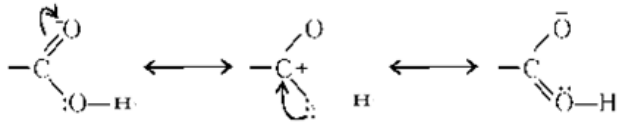
Answers

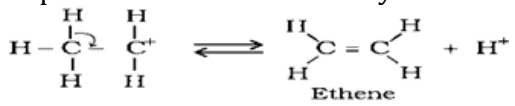
1. Butane-2, 3-dione.
2. (a) Sodium stearate
   (b) Proteins
3. Since NO_2 contains odd number of valence electrons, it is a typical molecule. But in the liquid and solid state, it dimerises to form stable N_2O_4 molecule with even number of electrons. Therefore, NO_2 is paramagnetic while N_2O_4 is diamagnetic.
4. Since the precipitates may be contaminated with the adsorbed particles of some other impurities which may be used or formed during precipitation, it is necessary to wash the precipitate with water before estimating it quantitatively.
5. Vitamin C cannot be stored in our body because it is soluble in water and is readily excreted in urine.
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.

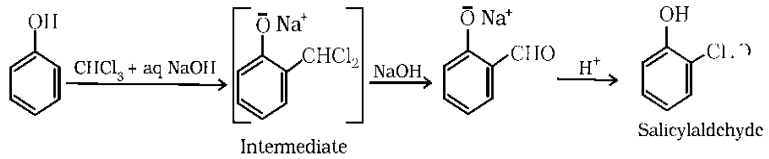
(ii) Concentrated sulphuric acid at 443 K.
(iii) Acidified potassium permanganate or potassium dichromate.
(iv) PPC in Cu at 573 K.

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.

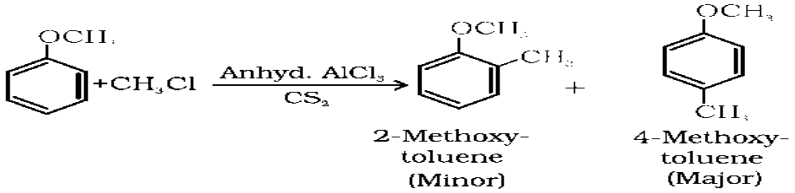
11. (a) Reimer – Tiemann Reaction.

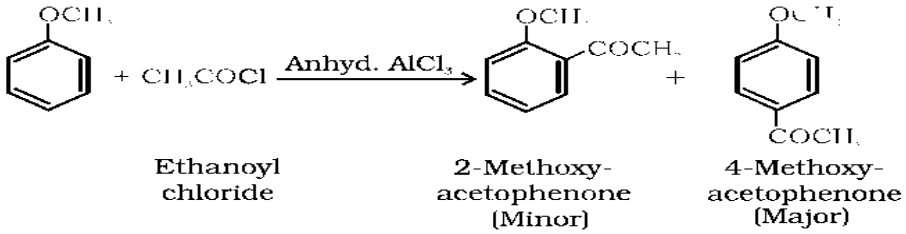
On treating phenol with chloroform in the presence of sodium hydroxide, a –CHO group is introduced at orthoposition of benzene ring. This reaction is known as Reimer - Tiemannreaction. The intermediate substituted benzal chloride is hydrolysed in the presence of alkali to produce salicylaldehyde.



(b) Friedel –Crafts Reaction:

Anisole undergoes Friedel-Crafts reaction, *i.e.*, the alkyl and acyl groups are introduced at orthoandparapositions by reaction with alkyl halide and acyl halide in the presence of anhydrous aluminium chloride (a Lewis acid) as catalyst.





12. When reaction is completed 99.9% $[R]_n = [R]_0 - 0.999[R]_0$

$$k = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$$

$$k = \frac{2.303}{t}\log\frac{[R]_0}{[R]_0 - 0.999[R]_0} = \frac{2.303}{t}\log 10^3$$

t = 6.909/k

For half-life of the reaction

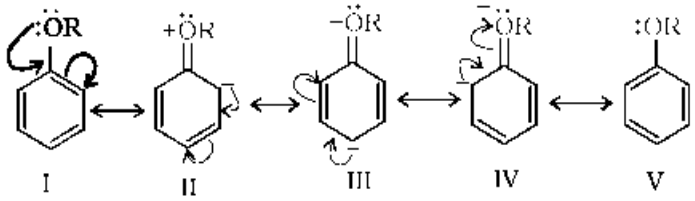
$t_{1/2} = 0.6963 / k$

$$\frac{t}{t_{1/2}} = \frac{6.909}{k} x \frac{k}{0.693} = 10$$

13. (a) $KNO_2 + O_3 \rightarrow KNO_3 + O_2$
    (b) $2\ KI + O_3 + H_2O \rightarrow 2\ KOH + I_2 + O_2$
    (c) $2\ HCl + O_3 \rightarrow H_2O + Cl_2 + O_2$
14.

Rate of reaction	Reaction rate constant
It is the speed with which reactants are converted into products.	It is the proportionality constant in the rate law which is defined as the rate of reaction when the concentration of the reactants is unity.
It depends on the initial concentration of the reactants.	It does not depend on the initial concentration of the reactants.
Its units are mol/L/time.	Its unit depend on the order of the reaction.

15. The alkoxy group increases the electron density on the benzene ring and so activates the aromatic ring towards electrophilic substitution reaction as given below:



The structures, III – V show high electron density at o-and p-positions and so direct the incoming substituents to o- and p- positions in the benzene ring.

16. (i) Bithional acts as an antiseptic agent and reduces the odours produced by bacterial decomposition of organic matter on the skin.
    (ii) Sulpha drugs act against micro-organism like antibiotics. But these are not obtained from micro-organism like antibiotics.
    (iii) It is antipyretic.
17. (a) $[CoCl_2(NH_3)_4]^+$ion.
    (b) $[CoCl(en)_2(NH_3)]^{2+}$ ion.
    (c) $K_3[Al(C_2O_4)_3]$

Or

(a) It involves a number of assumptions.
(b) It does not distinguish between weak and strong ligands.
(c) It gives only the qualitative explanations for complexes.
(d) It does not explain the thermodynamic and kinetic stabilities of different coordination compounds.
(e) It does not explain the detailed magnetic properties of the complexes.
(f) It does not explain the spectral properties of the coordination compounds.
(g) The rate constants of a reaction at 500K and 700K are $0.02s^{-1}$ and $0.07s^{-1}$ respectively.

18. $$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

$$\log \frac{0.07}{0.02} = \left(\frac{E_a}{2.303 x 8.314 JK^{-1}mol^{-1}}\right)\left[\frac{700 - 500}{700 x 500}\right]$$

$0.544 = E_a \times 5.714 \times 10^{-4} / 19.15$

E_a = 0.544 x 19.15 / 5.714 x 10^{-4} = 18230.8 J

Since k = $Ae^{-Ea/RT}$

0.02 = $Ae^{-18230.8/8.314x500}$

A = 0.02/0.012 = 1.61

19.

Globular proteins	Fibrous proteins
These proteins are cross linked condensation products of basic and acidic amino acids.	These proteins are linear condensation products.
These are soluble in water and insoluble in strong acids and bases.	These are insoluble in water but are soluble in strong acids and bases.
It includes all enzymes and hormones.	It includes bifroin in silk, collagen in tendons, myosin in muscles and keratin in hair.

20. Based on the structure, polymers are classified into three types namely,
    (a) Linear polymers
    (b) Branched chain polymers
    (c) Cross linked polymers

    Linear polymers: These are polymers in which monomeric units are linked together to form long and linear chains. Example – PVC.

    Branched chain polymers: These are polymers in which monomeric units are joined together to form chains with side chains or branches of different lengths. Example – starch.

    Cross linked polymers: These are polymers in which monomeric units are cross linked to form a three dimensional network. Example – Bakelite.
21. Drugs are classified as follows:
    (a) On the basis of pharmacological effect.
    (b) On the basis of action on a particular biochemical process.
    (c) On the basis of chemical structure.
    (d) On the basis of molecular targets.
22.

Ideal solution	Non-ideal solution
The interactions between the components are similar to those in the pure components.	The interaction between the components are different from those in the pure components.
There is no enthalpy change on mixing.	There is enthalpy change on mixing.
There is no volume change on mixing.	There is volume change on mixing.

23. (a) Polythene is non-biodegradable hence causes environmental pollutions
    (b) Jute bag are biodegradable revenue, hence do not cause any environmental pollution. Promoted Values Reducing environmental pollution, concern for environmental protection.
    (c) Use paper bags instead of polythene bags. Organizing mass campaigns for spreading awareness.
24. The cell constant is given by the equation: Cell constant = G^* - conductivity x resistance
    = 1.29 s/m x 100 Ω = 129 m^{-1} = 1.29 cm^{-1}

    Conductivity of 0.02 mol L^{-1}KCl solution = cell constant / resistance

    $$= \frac{G^*}{R} = \frac{129\ m^{-1}}{520\ \Omega} = 0.248\ S\ m^{-1}$$

    Concentration = 0.02 mol L^{-1}

= 1000 x 0.02 mol m^{-3} = 20 mol m^{-3}

Molar conductivity = $\wedge_m = \frac{k}{c} = \frac{248\ x10^{-3}\ S\ m^{-1}}{20\ mol\ m^{-3}} = 124\ x10^{-4}\ S\ m^2\ mol^{-1}$

Or

The cell can be writer as $Mg|Mg^{2+}$ (0.130M)||Ag^{+}(0.0001M)|Ag

$$E_{(cell)} = E^{\theta}_{(cell)} - \frac{RT}{2F} in \frac{\left[Mg^{2+}\right]}{\left[Ag^{+}\right]^2}$$

$$= 3.17V - \frac{0.059V}{2} \log \frac{0.130}{(0.0001)^2}$$

= 3.17 V – 0.21 V = 2.96 V

25. (a) On the basis of incompletely filled 3d orbitals in case of scandium atom in its ground state ($3d^1$), it is regarded as a transition element. On the other hand, zinc atom has completely filled d orbitals ($3d^{10}$) in its ground state as well as in its oxidised state, hence it is not regarded as a transition element.

    (b) Because of large number of unpaired electrons in their atoms they have stronger interatomic interaction and hence stronger bonding between atoms resulting in higher enthalpies of atomisation.

    (c)

Electrochemical cell	Electrolytic cell
It is a device which converts chemical energy into electrical energy.	It is device which converts electrical energy into chemical energy.
The redox reaction is spontaneous.	The redox reaction is non-spontaneous.
Here, the anode is negative and the cathode is positive.	Here, the anode is positive and the cathode is negative.

Or

(a) It is a process of deterioration of a metal as a result of its reaction with air or water surrounding in it.

(b) (i) Methane
(ii) Ethane

(c) (i) Position of metals in EMF series.
(ii) Presence of impurities in metals.
(iii) Presence of electrolytes.
(iv) Presence of carbon dioxide in water.
(v) Presence of protective coatings.

26. (a) The variability of oxidation states in transition elements arise because of the participation of (n – 1) d-orbitals and ns orbitals. These different oxidation states of transition elements differ by unity. Example – Vanadium show oxidation states of +2, +3, +4 and +5, manganese shows oxidation states of +2, +3, +4, +5, +6 and +7. On the other hand, some non-transition elements of p-block show variable oxidation states which differ by unit of two. Example – tin has oxidation states +2 and +4 and indium shows oxidation states of +1 and +3.

    (b) This is because the oxygen and fluorine have small size and high electronegativity, so they can easily oxidize the metal to its highest oxidation state.

Or

Potassium dichromate is a very important chemical used in leather industry and as an oxidant for preparation of many azo compounds. Dichromates are generally prepared from chromate,

which in turn are obtained by the fusion of chromite ore ($FeCr_2O_4$) with sodium or potassium carbonate in free access of air. The reaction with sodium carbonate occurs as follows:

$4\ FeCr_2O_4 + 8\ Na_2CO_3 + 7\ O_2 \rightarrow 8\ Na_2CrO_4 + 2\ Fe_2O_3 + 8\ CO_2$

The yellow solution of sodium chromate is filtered and acidified with sulphuric acid to give a solution from which orange sodium dichromate, $Na_2Cr_2O_7.\ 2H_2O$ can be crystallised.

$2\ Na_2CrO_4 + 2\ H^+ \rightarrow Na_2Cr_2O_7 + 2\ Na+ + H_2O$

Sodium dichromate is more soluble than potassium dichromate. The latter is therefore, prepared by treating the solution of sodium dichromate with potassium chloride.

$Na_2Cr_2O_7 + 2\ KCl \rightarrow K_2Cr_2O_7 + 2\ NaCl$

Orange crystals of potassium dichromate crystallise out. The chromates and dichromates are interconvertible in aqueous solution depending upon pH of the solution.