SAMPLE QUESTION PAPER (2020-21)

SUBJECT-CHEMISTRY(043)

CLASS-XII

Time Allowed   :   3 Hrs   **Max Marks   :   70**

                                                                   No. of pages   : 9

General Instructions:

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)**

The dehydration of phenols and alkylation of phenols by alcohols over thoria were studied at 400–500 °C and atmospheric pressure. Phenol and cresols, when dehydrated gave diaryl ethers as main products. With *para*-substituted phenols such as *p*-methoxy, *p*-*t*-butyl, *p*-chloro, and *p*-nitrophenol no ether formation was noticed. All the reactions were accompanied by considerable amount of coke formation. Alkylation of phenols by alcohols gave a mixture of O- and C-alkylated products under the same reaction conditions. O-alkylation and C-alkylation are parallel reactions.

In addition to acting as an antiseptic, phenol is also a useful precursor in many chemical synthesis to produce pharmaceuticals, food preservatives, polymers, resins and adhesives. Phenols are also present in a number of biological systems and natural products such as neurotransmitters, flavouring agents, and vitamins to name a few.

The following questions are multiple choice questions. Choose the most appropriate

answer:

    (i)   What is the IUPAC name of o- Cresol?
    (a) 2-Methylphenol   (b) 3-Methylphenol
    (c) 4-Methylphenol   (d) 2,4-Dimethylphenol

    (ii)   p-Nitrophenol is more acidic due to :-
    (a) +R & +I effect   (b) −R& +I effect
    (c) −I & +R effect   (d) -I & -R effect

    (iii) When Phenol is reacted with $CHCl_3$ and Aq. KOH it gives :-
    (a) Salicylaldehyde   (b) Crotonaldehyde
    (b) Salicylic acid   (d) Cinnamic acid

    (iv)   Reaction used to prepare Salicylic acid from Phenol and CO_2 at 5 atm.
        is −
    (a) Williamson's reaction   (b) Kolbe's reaction
    (c) Reimer Tieman reaction   (d) Friedel – Craft reaction

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

Surface chemistry deals with phenomenon that occur at the surfaces. Corrosion electrode processes, heterogeneous catalysis, dissociation and crystallisation occur at the surface. Evaporation is a surface phenomenon. Adsorption takes place at the surface. Easily liquefiable gases are more easily adsorbed on the surface of catalyst. Gas mask contains activated charcoal to adsorb poisonous gases.

Depending on the substance being deposited and adsorbed, adsorption is classified into two types- Physisorption and Chemisorption

Physisorption is also known as physical adsorption and it is an exothermic process. Its adsorption enthalpy is low, nearly 20 to 40 kJ/mol. In physisorption, the gas is accumulated on the solid surface due to weak force, known as Van der Waals forces. Physisorption lacks specificity because of the adsorbent (the surface or the material on which the process of adsorption takes place) in the given surface does not show any particular gas. It has reversible nature that is physisorption of gas by a solid can be reversed to a solid by gas. Physisorption depends on the surface area of the adsorbent.

Chemisorption is also known as chemical adsorption. In chemisorption, adsorption takes place in adsorbed substance that is held by chemical bonds. Chemisorption has high specificity that is it is highly specific, and it takes place only if there is a chemical bonding between adsorbent and adsorbate. Chemisorption is irreversible in nature and also favours high pressure. Due to chemical bonding, enthalpy of adsorption of chemisorption is high nearly 80 to 240 kJ/mol.

Physisorption of gas adsorbed at a lower temperature may be converted into chemisorption at a higher temperature.

In these questions (Q. No i-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.

(i) Assertion – Conversion of SO_2 to SO_3 is catalyzed by V_2O_5 .
    Reason – A catalyst accelerates a chemical reaction without being consumed in the process.

(ii) Assertion – Heat of adsorption is more in Physisorption than in Chemisorption.
    Reason - Physisorption involves vander waal attractions and Chemisorption involves chemical bond formations between adsorbate and adsorbent.

OR

Assertion – Adsorption is a surface phenomenon and Absorption is a
            bulk phenomenon.
Reason - In Adsorption particles accumulate on the surface and go to the bulk
            in absorption.

(iii) Assertion - Addition of water to Calcium chloride pieces is an example of absoption.
    Reason - Water enters into the bulk particles of Calcium chloride.

(iv) Assertion – The Gas masks which are used in factories have charcoal particles.
    Reason - Charcoal particles adsorb harmful gases produced in factories.

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

3. Which of the following option will be the limiting molar conductivity of CH_3COOH if the limiting molar conductivity of CH_3COONa is 91 Scm^2mol^{-1}? Limiting molar conductivity for individual ions are given in the following table.

S.No	Ions	limiting molar conductivity / Scm^2mol^{-1}
1	H+	349.6
2	Na+	50.1
3	K+	73.5
4	OH⁻	199.1

(a) 350 Scm^2mol^{-1} (b) 375.3 Scm^2mol^{-1}
(c) 390.5 Scm^2mol^{-1} (d) 340.4 Scm^2mol^{-1}

4. The pyrimidine bases present in DNA are
(a) cytosine and adenine
(b) cytosine and guanine
(c) cytosine and thymine
(d) cytosine and uracil

OR

The term anomers of glucose refers to
(a) isomers of glucose that differ in configurations at carbons one and four (C-1 and C-4)
(b) a mixture of (D)-glucose and (L)-glucose
(c) enantiomers of glucose
(d) isomers of glucose that differ in configuration at carbon one (C-1)

5. Density of a 2.05 M solution of acetic acid in water is 1.02 g/mL. The molality of the solution is
(a) 1.14 mol kg–1
(b) 3.28 mol kg–1
(c) 0.44 mol kg–1
(d) 2.28 mol kg–1

6. Which metal in the first series of transition metals exhibits +1 oxidation state most frequently :
(a) Cu
(b) Sc
(c) V
(d)Ti

OR

Hg is not considered a transition metal due to :
(a) inert pair effect
(b) completely filled 5d subshell
(c) Completely filled 4s subshell
(d) common ion effect

7. The IUPAC name for the complex $[Co(NO_2)(NH_3)_5]Cl_2$ is :
(a) nitrito-N-pentaamminecobalt (III) chloride
(b) nitrito-N-pentaamminecobalt (II) chloride
(c) pentaammine nitrito-N-cobalt (II) chloride
(d) pentaammine nitrito-N-cobalt (III) chloride

OR

Ambidentate ligands like NO_2^- and SCN^- are:
(a) unidentate
(b) didentate
(c) polydentate
(d) has variable denticity

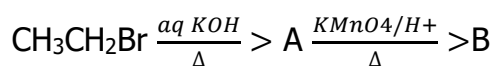**8.** Propanamide on reaction with bromine in aqueous NaOH gives:-
(a) Ethanamine
(b) Propanamine
(c) N-Methyl ethanamine
(d) Propanenitrile

9. The coordination number and the oxidation state of the element E in the complex $[E (en)_2 (C_2O_4)]NO_2$ are :-
(a) 6 & 3
(b) 6 & 2
(c) 4 & 2
(d) 4 & 3

10. Identify B

$$CH_3CH_2Br \xrightarrow[\Delta]{aq\ KOH} A \xrightarrow[\Delta]{KMnO4/H+} B$$

a) CH_3CONH_2 b) CH_3Br
c) CH_3COOH d) CH_3NH_2

11. The fraction of the total volume occupied by the atoms present in a simple cube is
(a) п / 4   (b) п / 6
(c) п3√2   (d) п4√2

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:-Ozone is a powerful oxidizing agent in comparison to oxygen
Reason:- Ozone is diamagnetic but oxygen is paramagnetic
<div align="center">**OR**</div>
Assertion:- At room temperature oxygen exist as a diatomic gas whereas sulphur exist as a solid.
Reason:- pп – pп multiple Bond in oxygen is more stable

13. Assertion: The two strands of DNA are complementary to each other
Reason:- The hydrogen bonds are formed between specific pairs of bases.

14. Assertion:- Bond angle in ethers is slightly less than tetrahedral angle .
Reason:- There is a repulsion between two bulky (-R) groups.

15. Assertion:- Alpha hydrogen atom in aldehyde and Ketone are acidic.
Reason:- Anions formed after loss of alpha hydrogen are stabilized due to inductive effect.

16. Assertion:- 0.1 molar solution of glucose has higher depression in freezing point than 0.1 molar solution solution of urea
Reason:- K_f for both glucose and urea is same.
<div align="center">**OR**</div>
Assertion :- Out of all colligative properties< osmotic pressure is used for determination of molecular masses of polymer
Reason:- Polymer solutions do not possess a constant boiling point or freezing point.

SECTION B

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

17. a) Arrange the following compounds in the increasing order of rate of reaction towards S_N^1 reaction

   Tertiary Alkyl halide, Benzyl halide, allyl halide, Methyl halide

 b) Haloarenes do not undergoes nucleophilic substation reactions. Give reason.
(1+1)

18. The boiling point of benzene is 353.23 K. When 1.80 g of a non-volatile solute was dissolved in 90 g of benzene, the boiling point is raised to 354.11 K. Calculate the molar mass of the solute. K_b for benzene is 2.53K kg mol^{-1}

19. Write the hybridization and geometry of low spin $[Fe(CN)_6]^{3-}$ion on the basis of Valence Bond Theory .

<p align="center">OR</p>

(i)   Predict the number of unpaired electrons in the tetrahedral $[MnBr_4]^{2-}$ ion and its magnetic moments.

(ii) $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CO)_4]$ is diamagnetic through both are tetrahedral why?   (1+1)

20. For a reaction the rate law expression is represented as follows:
$$Rate = k\,[A][B]^{1/2}$$

   i. Interpret whether the reaction is elementary or complex. Give reason to support your answer.

   ii. Write the units of rate constant for this reaction if concentration of A and B is expressed in moles/L.   (1+1)

<p align="center">OR</p>

In a reaction between A and B the initial rate of reaction (r_0) was measured for different initial concentrations of A and B as Given below

A/mol/L	0.20	0.20	0.40
B/mol/ L	0.30	0.10	0.05
r0/molL$^-$ s$^-$	5.07x10^{-5}	5.07x10^{-5}	1.43x10^{-4}

What is the order of reaction with respect to A & B

21. Write the mechanism of dehydration of Ethanol to yield Diethyl ether.

<p align="center">OR</p>

   Explain how does the --OH group attach to a carbon of benzene ring activate it towards electrophilic substitution.

22. For a first order reaction show that time required for 99% completion is twice, the time required for the completion of 90% of reaction.

23. The following haloalkanes are hydrolysed in presence of aq KOH.
  (i) 2- Chlorobutane (ii) 2-chloro-2-methylpropane
Which of the above is most likely to give a racemic mixture? Justify your answer.

24. Draw the structures of the following: (1+1)
  (i) SF_4
  (ii) XeF_4

25. If NaCl is doped with 10^{-3} mole percent $AlCl_3$, what will be the concentration of cation vacancies? ($N_A = 6.02 \times 10^{23}$ mol^{-1}) ?

SECTION C

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

26-(i) For the first row of transition metals the E^0 values are:-

E^0 values	V	Cr	Mn	Fe	Co	Ni	Cu
M^{2+}/M	-1.18	-0.91	-1.18	-0.44	-0.28	-0.25	+0.34

Explain the irregularity in the above values.
  (ii) Why do transition elements show variable oxidation states? (2+1)

OR

For M^{2+}/M and M^{3+}/M^{2+} systems, the E^0 values for some metals are as follows:

$Cr^{2+}/Cr = -0.9V$ $Cr^{3+}/Cr^{2+} = -0.4V$
$Mn^{2+}/Mn = -1.2V$ $Mn^{3+}/Mn^2 = 1.5V$.
$Fe^{2+}/Fe = -0.4V$ $Fe^{3+}/Fe^{2+} = +0.8V$

Use this data to comment upon :-
(i) the stability of Fe^{3+} in acid solution as compared to Cr^{3+} or Mn^{3+} and
(ii) the ease with which iron can be oxidized as compared to a similar process for either chromium or manganese metal.

27. Account for the following:
  (i) pKb of aniline is more than that of methylamine.
  (ii) Ethylamine is soluble in water whereas aniline is not.
  (iii) Aniline does not undergo Friedel-Crafts reaction.
OR
(i) Write structures and IUPAC names of the amide which gives propanamine by Hoffmann bromamide reaction.
(ii) Write short notes on diazotization.
(iii) Give one chemical test to distinguish between Methylamine and dimethylamine.

28. Differentiate primary, secondary and tertiary structure of protein.

29. The density of chromium is 7.2g cm^{-3}. If the unit cell is a cubic with length of 289 pm, determine the type of unit cell (Atomic mass of Cr=52 u and N_A = 6.022x10^{23} mol^{-1})

30. Account for the following :-
 (i) Helium is used in diving apparatus.
 (ii) Noble gases have very low boiling points.
 (iii) ICl is more reactive than I_2.

SECTION-D

31.(i) When Conc. H_2SO_4 was added to an unknown salt present in a test tube, a brown gas (A) was evolved. This gas intensified when copper turnings were added in to test tube. On cooling gas (A) changed in to a colourless gas (B).
(a) Identify the gases 'A' and 'B'
(b) Write the equations for the reactions involved

(ii) Arrange the following in the increasing order of the property mentioned.
 (a) HOCl, HClO$_2$, HClO$_3$, HClO$_4$ (Acidic strength)
 (b) HF, HCl, HBr, HI (Acidic strength)   (3+2)
                                OR
(i) Complete the following equations;
 (a) XeF$_4$ +   H$_2$O $\rightarrow$
 (b) AgCl$_{(s)}$ +NH$_3$ (aq) $\rightarrow$
 c) NaCl + MnO$_2$ + 4H$_2$SO$_4$ $\rightarrow$

(ii) How is XeOF$_4$ prepared ? Draw its structure.   (3+2)

32. (i) An organic compound (A) {$C_8H_{16}O_2$} was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and an alcohol (C). Oxidation of (C) with chromic acid produced (B). (C) on dehydration gives but-1-ene. Identity A,B,C.

(ii) Give reasons for the following:-
 (a) Cyclohexanone forms cyanohydrin in good yield but 2,2,6 trimethyle cyclo- hexanone does not.
(b) Carboxyl group in Benzoic acid is meta directing.
                                OR
 (i) An organic compound (A) with molecular formula C_8H_8O forms an orange-red precipitate with 2,4 DNP reagent and gives yellow precipitate on heating with iodine in the presence of sodium hydroxide. It neither reduces Tollen's or Fehling's reagent , nor does it decolourise bromine water or Baeyer's reagents .On drastic oxidation with chromic acid, it gives a carboxylic acid (B) having molecular formula $C_7H_6O_2$. Identify the compounds (A) and (B) and write the reaction involved.
(ii) Account for the following:-
 (a) Aldehydes have lower boiling point than corresponding alcohols.

(b) Methanal undergo Cannizaro's reaction.

33. (i) A voltaic cell is set up at 25°C with the following half-cells, Al^{3+} (0.0010 M) and Ni^{2+} (0.50 M). Write an equation for the reaction that occurs in the cell when the cell generates an electric current and determine the cell potential.
(Given $E°_{Ni^{2+}/Ni}$ = - 0.25V, $E°_{Al^{3+}/Al}$ = -1.66V)

(ii) Electrolysis of KBr(aq) gives Br2 at anode but KF(aq) does not give F_2 . Give reason.

OR

(i)Calculate emf of the following cell at 298K

Zn/Zn^{2+} (10^{-4} M) || Cu^{2+} (10^{-2}M)/Cu

Given E^0 Zn^{2+}/Zn=-0.76V ,

E^0Cu^{2+}/Cu=+0.34V

(ii)) Give two factors on which EMF of a cell depends .