INDIAN SCHOOL AL WADI AL KABIR

FINAL EXAMINATION (2023-24)
Sub: Chemistry (043)
SET-II

Date: 29.02.2024   **Max. Marks: 70**
Class: XI   **Time Allowed: 3 hours**

General instructions:
Read the following instructions carefully.
(a) There are 33 questions in this question paper with internal choice.
(b) SECTION A consists of 16 multiple -choice questions carrying 1 mark each.
(c) SECTION B consists of 5 short answer questions carrying 2 marks each.
(d) SECTION C consists of 7 short answer questions carrying 3 marks each.
(e) SECTION D consists of 2 case - based questions carrying 4 marks each.
(f) SECTION E consists of 3 long answer questions carrying 5 marks each.
(g) All questions are compulsory.
 (h) Use of log tables and calculators is not allowed.

SECTION A

The following questions are multiple -choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Two different oxides of a metal contain 20 % and 27 % oxygen by weight This is an accordance with the law of

    (a) conservation of mass

    (b) constant composition

    (c) multiple proportion

    (d) reciprocal proportion

2. The moles of Sodium chloride in 250 ml of 0.5 M NaCl are

    (a) 0.25 mol
    (b) 3 mol
    (c) 0.125 mol
    (d) 1 mol

3. The number of unpaired electrons present in Cr^{3+} is —---------- (Atomic number of Cr = 24)

    (a) 7   (b) 3   (c) 4   (d) 5

4   Which element has the highest electronegativity?

(a) F

(b) Cl

(c) Br

(d) I

5.   Hydrogen bonding occurs between molecules with _ _ _.
(a) ionic bonds
(b) metallic bonds
(c) covalent bonds involving H, N, or O
(d) noble gas atoms

6.   Which system allows transfer of both energy and matter with the surroundings?

(a) Isolated system

(b) Closed system

(c) Open system

(d) None of the above

7.   Equilibrium in a chemical reaction occurs when:

(a) the rates of the forward and reverse reactions are equal.

(b) all reactants are completely converted to products.

(c) the concentration of a particular reactant is highest.

(d) the reaction reaches its maximum speed.

8.   The equilibrium constant (Kc) is:

(a) the ratio of product concentrations to reactant concentrations at equilibrium.

(b) a measure of the rate of the reaction.

(c) dependent on the initial concentrations of reactants.

(d) always equal to 1.

9.   Redox reactions involve:
(a) transfer of electrons between atoms or ions.
(b) breaking and forming of covalent bonds.
(c) changes in the physical state of a substance.
(d) absorption or release of heat.

10.   A reducing agent is a substance that:
(a) loses electrons and is oxidized.
(b) gains electrons and is reduced.
(c) acts as a catalyst for the reaction.
(d) increases the rate of the reaction.

11. —---------- is also considered as a no bond resonance.

    (a) inductive effect
    (b) resonance effect
    (c) hyperconjugation effect
    (d) electromeric effect

12 Which of the following compounds does not show geometrical isomerism?

    (a) But -2-ene
    (b) But-1-ene
    (c) Pent-2-ene
    (d) 3-Methylpent-2-ene

From the statements labelled as Assertion and Reason given below, select the most appropriate options given below

(a) If both Assertion & Reason are true and the reason is the correct explanation of the assertion.

(b) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion.

(c) If Assertion is true but Reason is false.

(d) If Assertion is false but Reason is true

13 **Assertion:** The first ionization energy generally increases across a period from left to right

   Reason: The effective nuclear charge increases across a period.

14 **Assertion:** In the reaction $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$, both Zn and Cu undergo redox changes.

   Reason: Both Zn and Cu change their oxidation numbers during the reaction.

15 **Assertion:** Propan-1-ol and Propan-2-ol are functional group isomers.

   Reason: Functional group isomers have the same molecular formula but different functional groups.

16 **Assertion:** Alkenes readily undergo addition reactions, while alkanes do not.

    Reason: Alkenes have a double bond, creating a region of high electron density susceptible to attack.

SECTION B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Calculate the mass percentage of carbon and hydrogen in C_2H_5OH.
    (Atomic mass of C= 12u, H=1u, O=16u)

                                OR

An organic compound on analysis gave the following results:

C=54.5%, O =36.4% and H=9.1% Calculate the empirical formula of the compound

(Atomic mass of C= 12u, H=1u, O=16u)

18. Explain two factors affecting the first ionization energy of an element. Use the electronic configurations of sodium (Na) and magnesium (Mg) to illustrate your answer.

19 Consider the reaction
$H_2 + Br_2 \longrightarrow 2 HBr$

the value of K_C for the reaction is 8×10^{-3}. At a given time the composition of reaction mixture is $[H_2] = [Br_2] = 4 \times 10^{-2}$ M and $[HBr] = 6$ M. In which direction will the reaction proceed? Support your answer by showing your working to reach this conclusion.

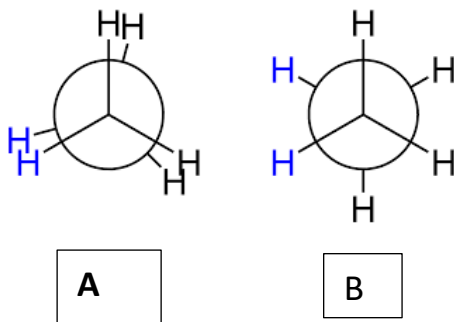20. Explain about the fission of covalent bonds resulting in the formation of Carbanion.

21 Give reason:
   (a) Alkanes are nonpolar molecules.
   (b) 2,2-Dimethylpropane has lower boiling point than 2-Methylbutane

   OR

   The Newman projection formulae of Ethane is given below

A   B

   (a) Identify A and B.

   (b) Which of the two forms is more stable. Give reason

SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. (a) What is a limiting reagent?
   (b) Identify the limiting reagent when 120g of Magnesium is mixed with 96g of Oxygen gas
      (Given atomic mass of Mg = 24u, O =16u)
      Calculate the mass of MgO formed.

23. (a) State Heisenberg's uncertainty principle.
   (b) If the hockey ball of mass 0.1 kg moves with a velocity of 30 m/s, Calculate the wavelength associated with the hockey ball. (h=6.626×10^{-34} Js)

OR

(a) How many angular and radial nodes are possible for 2p orbital?

(b) What is the energy in Joules required to shift an electron of the Hydrogen atom from the first Bohr orbit to the fifth Bohr's orbit?

24. Account for the following.

(a) Electron gain enthalpy of noble gases is positive

(b) Ionization enthalpy decreases on moving down the group

(c) First ionization energy of oxygen is less than that of Nitrogen

25. (a) What makes a bond polar?

(b) Identify the non-polar molecules from the following.
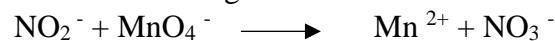
(i) H_2O (b) CO_2 (c) $CHCl_3$ (d) CCl_4

Give reason for your choice.

26. (a) For a reaction, ΔH is -ve and ΔS is +ve. Is this reaction spontaneous? Explain.

(b) Categorise the following properties as extensive or intensive properties
(i) Mass (ii) Internal energy (iii) Pressure (iv) Volume

27. (a) Balance the following Redox reaction in acid medium
$$NO_2^- + MnO_4^- \longrightarrow Mn^{2+} + NO_3^-$$

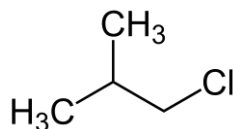(b) Using stock notation represent the following compounds
(i) FeO   (ii) $SnCl_2$

28. (a) Categorise the following molecules or ions as nucleophile or electrophile.

(i) H^+ (ii) NH_3 (iii) BF_3 (iv) OH^-

(b) Write the bond line formula of 2,3-Dimethylbutanoic acid

(c) Write the IUPAC name of

SECTION D

The following questions are case -based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

29. A large number of orbitals are possible in an atom. Qualitatively, these orbitals can be distinguished by the size, shape and orientation. The orbital of smaller size means that there is more chance of finding the electron near the nucleus. Similarly shape and orientation gives more probability of finding the electron along certain directions. Atomic orbitals are precisely distinguished by what are known as Quantum numbers.

(a) What are the values of n and l for 3s orbital?

(b) How many electrons in an atom have the following quantum numbers; n=3, m_s =+ ½

(c) Write the subshell electronic configuration of Cr.

OR

(c) The 4f subshell of an atom contains 10 electrons. What is the maximum number of electrons
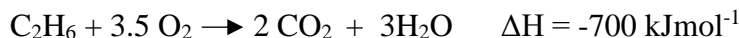
having spin in the same direction?

30. In a chemical reaction, when the reactants are converted into products then the enthalpy change accompanying a reaction is called a reaction enthalpy. Enthalpy change is a very useful quantity. The knowledge of these quantities is required when one need to plan the heating or cooling required to maintain an industrial chemical reaction at constant temperature. It is also required to calculate temperature dependence of equilibrium constant

(a) What is the value of the Enthalpy of formation of elements in their standard states?
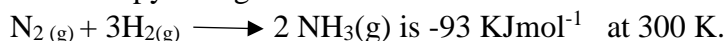(b) The equilibrium constant for a reaction is 10. What will be the value of $\Delta G°$?
    ($R = 8.3$ JK^{-1}mol^{-1}, T=300 K)

(c) Calculate the standard enthalpy of formation of ethane using the following data
    $C + O_2 \rightarrow CO_2$ $\Delta H = -390$ kJmol^{-1}
    $H_2 + O_2 \rightarrow H_2O$ $\Delta H = -280$ kJmol^{-1}
    $C_2H_6 + 3.5 O_2 \rightarrow 2 CO_2 + 3H_2O$ $\Delta H = -700$ kJmol^{-1}

OR

(c) The enthalpy changes for a reaction
    $N_{2 (g)} + 3H_{2(g)} \longrightarrow 2 NH_3(g)$ is -93 KJmol^{-1} at 300 K.
    Calculate the value of ΔU (R=8.314 JK^{-1}mol^{-1})

SECTION E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

31. Consider the following equilibrium in which forward reaction is endothermic.

$H_2O_{(g)} + C_{(s)} \longrightarrow H_{2(g)} + CO_{(g)}$

(a) What is the effect of the following factors on the yield of Hydrogen gas?

(I) on increasing the temperature

(II) on increasing the pressure

(III) using a catalyst

(b) What is the effect of the following factors on Kc of the reaction?

(I) on increasing the temperature

(II) on increasing the pressure

(III) using a catalyst

(c) What do you mean by homogeneous equilibria? Give an example

(d) Arrange the following in the increasing order of acid strength
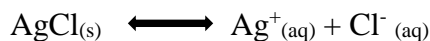
   HF, HI, HBr, HCl

OR

(a) Find the pH of 0.1M HCl

(b) Define buffer solution. Give an example of acidic buffer

(c) Identify the conjugate acid and conjugate base of H_2O

(d) A saturated solution of silver chloride (AgCl) is in equilibrium with the undissolved solid.

   $AgCl_{(s)} \rightleftharpoons Ag^+_{(aq)} + Cl^-_{(aq)}$
   If a small amount of sodium chloride (NaCl) solution is added to this equilibrium, what will happen to the following?
   (I)   Solubility of AgCl
   (II)   Concentration of Ag^+ ions in the solution

(e) State Henry's law

32. (a) How many σ and π bonds are there in the following molecule CH_3CN

(b) Calculate the formal change of Carbon in the CO_3^{2-} ion

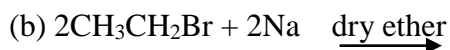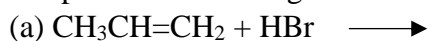(c) Give the Lewis dot structure of CO.

(d) LiCl is more covalent than NaCl. Give reason.
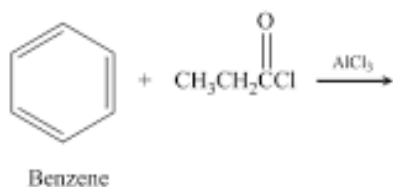
(e) Give one difference between σ bond and π bond.

(f) Using VSEPR theory predict the shape and bond angle of Ammonia

(g) Mention 2 limitations of Octet rule.

33. (i) Complete the following reaction
   (a) $CH_3CH=CH_2 + HBr \longrightarrow$

   (b) $2CH_3CH_2Br + 2Na$ $\underrightarrow{dry \ ether}$

   (c)

Benzene

(ii) An alkene on ozonolysis gives methanal and propanal. Predict the structure of the alkene and write the IUPAC name. Write the equation of the reaction involved

OR

(a) Write chemical equation

      (i) for the preparation of Ethane from Sodium propanoate

      (ii) for the preparation of Benzene from Ethyne

(b) Complete the reaction

$$CH_3\text{-}CH=CH_2 + HBr \xrightarrow{(C_6H_5CO)_2O_2}$$

(c) Which is easier to chlorinate- Benzene or Toluene? Why?

(d) Trans-But-2-ene has higher melting point than cis-But-2-ene. Justify.