INDIAN SCHOOL AL WADI AL KABIR

ASSESSMENT II (2023-24)
Sub: CHEMISTRY
SET-I

Class: XI
Date: 26.11.2023

Max. Marks: 70
Time: 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. Which of the following alkanes has 75% Carbon?

   (a) $C_2H_6$ (b) $CH_4$ (c) $C_3H_8$ (d) $C_4H_{10}$

2. Among the various quantum numbers (n, *l*, m, s) describing an electron, which one can have the largest value?

   (a) n (b) *l* (c) m (d) s

3. The expression for Bohr frequency rule is

   (a) $\nu = \Delta E / h$
   (b) $\nu = \Delta E x h$
   (c) $\nu = h/\Delta E$
   (d) $\nu = \lambda x c$

4. The basic strength of the oxides follows the order

   (a) $Al_2O_3 > MgO > Na_2O$

   (b) $Al_2O_3 < MgO < Na_2O$

   (c) $Na_2O < MgO > Al_2O_3$

   (d) $Al_2O_3 > MgO > Na_2O$

5. The element which has more negative electron gain enthalpy is

   (a) F (b) O (c) Cl (d) S

6. Which of the following compounds has the highest covalent character?

   (a) LiCl (b) LiBr (c) LiF (d) LiI

7. The state of hybridization of Sulphur in $SF_6$ is

   (a) $sp^3d$ (b) $sp^3d^2$ (c) $sp^3$ (d) $sp^2$

8. Oxidation number of P in $PO_4^{3-}$ ion is _____

   (a) -3
   (b) +7
   (c) +5
   (d) +3

9. Which of the following is **not an example** of redox reaction?

   (a) $CuO + H_2 \longrightarrow Cu + H_2O$

   (b) $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

   (c) $2K + F_2 \longrightarrow 2KF$

   (d) $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HCl$

10. Which of the following carbocation is the most stable?

    (a) $(CH_3)_3C^+$ (b) $CH_3CH_2CH_2^+$ (c) $CH_3CH^+CH_2CH_3$ (d) $(CH_3)_3CCH_2^+$

11. The IUPAC name of $CH_3COCH(CH_3)_2$

    (a) 3-methyl-2-butanone
    (b) 2-methyl-3-butanone
    (c) 1-methyl-2-butanone
    (d) 1-methyl-3-butanone

12. Which of the following has lowest boiling point?

    (a) n-Hexane
    (b) n-Pentane
    (c) 2-Methylbutane
    (d) 2,2-Dimethylpropane

13. Given below are two statements labeled as Assertion and Reason
    **Assertion:** The empirical formula of Ethane is $CH_2$
    **Reason:** The empirical formula represents the simplest whole number ratio of various atoms present in a compound.

Select the most appropriate answer from the options given below.

(a) Both Assertion & Reason are true and the reason is the correct explanation of the assertion.
(b) Both Assertion & Reason are true but the reason is not the correct explanation of the assertion.
(c) Assertion is true but Reason is false.
(d) Assertion is false but Reason is true.

14. Given below are two statements labeled as Assertion and Reason

**Assertion:** Ionic radius of $Na^+$ is smaller than Na.

**Reason:** Effective nuclear charge of $Na^+$ is higher than Na.

Select the most appropriate answer from the options given below.

(a) Both Assertion & Reason are true and the reason is the correct explanation of the assertion.
(b) Both Assertion & Reason are true but the reason is not the correct explanation of the assertion.
(c) Assertion is true but Reason is false.
(d) Assertion is false but Reason is true.

15. Given below are two statements labeled as Assertion and Reason

**Assertion:** Among the two O–H bonds in the $H_2O$ molecule, the energy required to break the first O–H bond and the other O–H bond is the same.

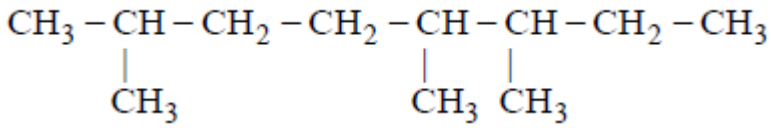
**Reason:** The electronic environment around the oxygen is not the same even after breakage of one O–H bond.

Select the most appropriate answer from the options given below.

(a) Both Assertion & Reason are true and the reason is the correct explanation of the assertion.
(b) Both Assertion & Reason are true but the reason is not the correct explanation of the assertion.
(c) Assertion is true but Reason is false.
(d) Assertion is false but Reason is true.

16. Given below are two statements labeled as Assertion and Reason.

**Assertion:** The IUPAC name of the following compound is 3,4,7-Trimethyloctane.



**Reason:** The numbering of Carbon atoms in the parent chain of the compound is done in such a way that the branch bearing Carbon atom gets the least possible number.

Select the most appropriate answer from the options given below.

(a) Both Assertion & Reason are true and the reason is the correct explanation of the assertion.
(b) Both Assertion & Reason are true but the reason is not the correct explanation of the assertion.
(c) Assertion is true but Reason is false.
(d) Assertion is false but Reason is true.

## 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. (a) How many grams of $Cl_2$ are required to completely react with 0.4 g of $H_2$ to yield HCl according to the equation ( $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$)
(b) Also calculate the amount of HCl formed. (Atomic mass of H= 1u, Atomic mass of Cl=35.5u)

**OR**

Explain the following

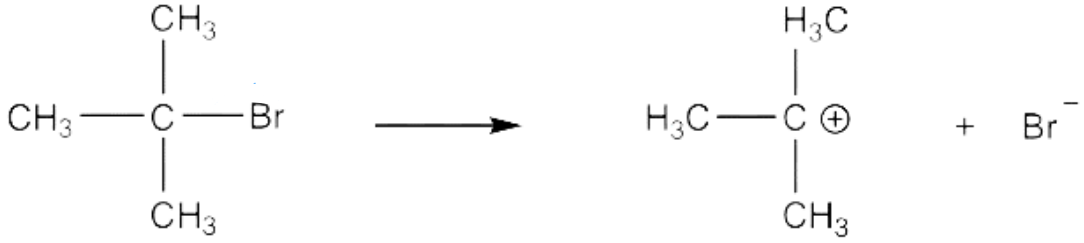
(a) Mole fraction
(b) Limiting reagent

18. How many electrons in an atom have the following quantum numbers?
a. n=4, $m_s$= -1/2 b. n =3, *l*=0

19 Which out of $NH_3$ and $NF_3$ has a higher dipole moment and why?

20 Predict whether the following reaction is feasible
$Ni + CuSO_4 \rightarrow NiSO_4 + Cu$
Given $E^{\Theta}Ni^{2+}/Ni$ = -0.25V $E^{\Theta}Cu^{2+}/Cu$ =0.34V

21 (a) Name the type of isomerism exhibited by Propan-1-ol and Propan-2-ol.
(b) Copy the diagram given below on the answer sheet and using the curved arrow notation to show the electron movement



(c) Classify the cleavage as homolytic or heterolytic.
(d) Identify the reactive intermediate.

## 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) Give two points of difference between molarity and molality.
(b) Oxygen is prepared from the decomposition of $KClO_3$ as follows
$2KClO_3 \longrightarrow 2KCl + 3O_2$
If 9 mol of Oxygen is needed for an experiment, how much grams of $KClO_3$ should be decomposed? (Atomic mass of K =39 u, Cl-35.5u, O=16u)

23. (i) Write down the quantum numbers n and *l* for the following orbitals
    a. 2p  b. 3d  c. 5f
    (ii) What is an orbital?
    (iii)What will be the wavelength of a ball of mass 200 g moving with a velocity of 3 $ms^{-1}$?
    Planck's constant $h=6.626x10^{-34}Js$

24. I Arrange the following:

    (i) Decreasing radii of ions: $O^{2-}$, $F^{-}$, $Na^{+}$, $Mg^{2+}$
    (ii) Increasing first ionisation energy: Mg, Si, Al, Na

    II. Successive ionisation enthalpies (in kJ $mol^{-1}$) of elements A, B, C and D are shown below:

| | | | | | |
|---|---|---|---|---|---|
| A | 590 | 1150 | 4900 | 6500 | 8150 |
| B | 520 | 3000 | 4700 | 6350 | 7900 |
| C | 630 | 700 | 950 | 1500 | 2130 |
| D | 1200 | 2200 | 3600 | 5000 | 6300 |

    Identify the group II metal. Give reason for your choice

25. (a)What is meant by the term bond order?
    (b) Calculate the bond order of:

    (i) $N_2$ and

    (ii) $O_2$ using Molecular Orbital Theory

**OR**

With the help of a diagram explain the hybridization and bond formation in $C_2H_6$

26.

    (a) Balance the following ionic equation:

$Cr_2O_7^{2-}{}_{(aq)} + SO_{2(g)} \longrightarrow Cr^{3+}{}_{(aq)} + SO_4^{2-}{}_{(aq)}$ (In acidic medium)

    (b) Represent the following compound in Stock notation CuO

27. (a) Give 2 uses of salt bridge.

    (b) What is a disproportionation reaction?

    (c) Identify the element that undergoes disproportionation in the following reaction.
$2\ NaOH + Cl_2 \longrightarrow NaCl + NaOCl + H_2O$

28.

Predict the products.

a. $2CH_3CH_2Br + 2Na \xrightarrow{\text{Dry ether}}$

b. $CH_3(CH_2)_4CH_3 \xrightarrow{\text{Anhyd. } AlCl_3/HCl}$

c. $CH_3CH=CH_2 + H_2 \xrightarrow{Pt}$

## 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 their size, shape and orientation. An orbital of smaller size means there is more chance of finding the electron near the nucleus. Atomic orbitals are precisely distinguished by quantum numbers. Shape, energy and orientation of the orbitals can be obtained by knowing the quantum numbers of the orbitals.

(a) The following set of quantum numbers is not possible. Give reason.
n=2, *l*=2, m*l*=0, ms= -½

(b) There are two electrons in the 4s orbital of Calcium. Name the only quantum number which will have different values for these electrons.

(c) Draw the boundary surface diagram of I) $dx^2-y^2$ II) $p_y$

**OR**

(c) Out of 3d and 4s orbitals which is filled first? Support your answer using the rule which governs this.

30. Once an organic compound is extracted from a natural resource or synthesized in the laboratory, it is essential to purify it. Various methods used for the purification of organic compounds are based on the nature of the compound and the nature of the impurity present in it. Finally, the purity of a compound is ascertained by determining its boiling point and melting point. Most of the pure compounds have sharp melting and boiling points. New methods of checking the purity of an organic compound are based on different types of chromatographic and spectroscopic methods.

(a) Boiling point of Chloroform is 334K and that of aniline is 457K. Which method will be suitable to separate mixture of aniline and chloroform?
(b) Which method is used to separate the mixture of glycerol and spent-lye in the soap industry?
(c) Under what condition can the process of steam distillation be used for purification?

**OR**

(c) Suggest a method to purify
(i) Kerosene containing water
(ii) A liquid that decomposes at its boiling point.

## Section E

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

31 (a) The Ionization enthalpy of oxygen is lesser than that of Nitrogen. Give a reason.
(b) Define electron gain enthalpy
(c) Write the name and symbol of the element with atomic number 112.
(d) First ionization energy of Boron is slightly lesser than that of Beryllium. Why?
(e) Write the general electronic configuration of f block elements.

**OR**

(a) Predict the period number and group number of an element with atomic number 17.
(b) A B and C are three elements with atomic numbers Z-1, Z and Z+1 respectively. B is an inert gas.
(i) Which out of the three has positive electron gain enthalpy? Give reason
(ii) Which of the three has least value of ionization enthalpy? Give reason
(c) How does beryllium differ from the other elements of group II?

32. (i) What is hybridisation?
(ii) Explain the geometry of (a) $CH_4$ and (b) $SF_6$ using VSEPR theory.
(iii) What shapes are associated with the following hybrid orbitals.

(a) $sp^2$ (b) $sp^3d$ (c) sp (d) $sp^3d^2$

OR

(a) Using hybridisation concept, explain the shape and bond angle of (a) $NH_3$ and (b) $BCl_3$
(b) Give two differences between Sigma and pi bonds.

33. a. Illustrate positive resonance effect in Phenol.

b. Write the structural formula of 2-Methylbutanal

c. Draw the bond line formula of.

I. 2-Hydroxybutanoic acid
II. Cyclopropane.

**OR**

a. Write the resonance structure of $CH_3COO^-$

b. Write the condensed formula of 2-Chlorohexane

c. Which bond is more polar in the following molecules $CH_3$-H or $CH_3$-Br. Why?

d. Define the term Negative electromeric effect.