Indian School Al Wadi Al Kabir

Assessment I (2024-2025)

Class: XI | Sub: Chemistry (043) | Max. Marks: 70

Date: 24/09/2024 | Set - II | 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. The mass percentage of oxygen in water is: (Atomic mass of Oxygen atom = 16u)
   (a) 88.89%
   (b) 11.11%
   (c) 33.33%
   (d) 66.67%

2. Avogadro's law states that:

   (a) Equal volumes of gases at the same temperature and pressure contain an equal number of atoms.
   (b) Equal volumes of gases at the same temperature and pressure contain an equal number of molecules.
   (c) The volume of a gas is directly proportional to the number of atoms.
   (d) The volume of a gas is directly proportional to the number of molecules.

3. Which principle states that no two electrons in the same atom can have the same set of four quantum numbers?
   (a) Aufbau principle
   (b) Pauli’s exclusion principle
   (c) Hund's rule
   (d) Heisenberg's uncertainty principle

4. The energy of an electron in an atom is:
   (a) quantised.
   (b) continuous.
   (c) independent of the distance from the nucleus.
   (d) independent of its orbit.

5. Which quantum number describes the shape of an orbital?
   (a) Principal quantum number
   (b) Azimuthal quantum number
   (c) Magnetic quantum number
   (d) Spin quantum number

6. The phenomenon where electrons fill orbitals of lower energy first is known as:
   (a) Hund's rule
   (b) Pauli's exclusion principle
   (c) Aufbau principle
   (d) Heisenberg's uncertainty principle

7. The group number, number of valence electrons, and valency of an element with the atomic number 15, respectively, are:
   (a) 16, 5 and 2
   (b) 15, 5 and 3
   (c) 16, 6 and 3
   (d) 15, 6 and 2

8. The chemistry of lithium is very similar to that of magnesium even though they are placed in different groups. Its reason is:
   (a) Both are found together in nature.
   (b) Both have nearly the same size.
   (c) Both have similar electronic configuration.
   (d) The ratio of their charge and size (i.e. charge density) is nearly the same.

9. The bond angle around atom which uses sp^2 hybridisation is ——---
   (a) 120^0 (b) 180^0 (c) 107^0 (d) 109^0. 28'

10. Which of the following molecules have trigonal planar geometry?
    (a) BF_3 (b) NH_3 (c) PCl_5 (d) IF_3

11. Ionic bonds will be formed more easily between elements with comparatively:
    (a) low ionization enthalpy and high electron gain enthalpy.
    (b) high ionization enthalpy and high electron gain enthalpy.
    (c) low ionization enthalpy and low electron gain enthalpy.
    (d) high ionization enthalpy and low electron gain enthalpy.

12. In NO_3^- ion, the number of bond pairs and lone pairs of electrons on the nitrogen atom is
    (a) 2, 2
    (b) 3, 1
    (c) 1, 3
    (d) 4, 0

13. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion (A): It is impossible to determine the exact position and the exact momentum of an electron simultaneously.
Reason (R): The path of an electron in an atom is clearly defined.

Select the most appropriate answer from the options given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

14. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion (A): Generally, ionization enthalpy increases from left to right in a period.
Reason (R): When successive electrons are added to the orbitals in the same principal quantum level, the shielding effect of the inner core of electrons does not increase very much to compensate for the increased attraction of the electron to the nucleus.

Select the most appropriate answer from the options given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

15. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion (A): Boron has a smaller first ionization enthalpy than beryllium.
Reason (R): The penetration of a 2s electron to the nucleus is more than the 2p electron hence 2p electron of B is more shielded by the inner core of electrons than the 2s electrons of Be.

Select the most appropriate answer from the options given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

16. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion (A): Though the central atom of both NH_3 and H_2O molecules are sp^3 hybridised, yet the H–N–H bond angle is greater than that of H–O–H bond angle.
Reason (R): This is because the nitrogen atom has one lone pair and oxygen atom has two lone pairs.

Select the most appropriate answer from the options given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R 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) Calculate the number of moles in 88 grams of carbon dioxide (CO_2).
(Molar mass of CO_2 = 44 g/mol)
(b) If the empirical formula of a compound is CH_2 and its molar mass is 56 g/mol, what is its molecular formula?

OR

(a) How many moles are there in 0.08 L of Hydrogen gas at STP?
(b) How many molecules are present in one mole of Oxygen gas at STP? Calculate its mass.

18. Write any two limitations of Bohr's model of atom.

19. Give the electronic configuration of
(a) Scandium (Z=21)
(b) Chromium (Z=24)

20. (a) How do atomic radii vary across a period in the periodic table?
(b) Why do ionization enthalpies decrease down a group of the periodic table? Explain.

21. Explain the non-linear shape of H_2S using valence shell electron pair repulsion theory.

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 will be the mass of one atom of C-12 in grams?
(b) Give any one difference between molality and molarity.

23. Calculate the mass percent of calcium, phosphorus and oxygen in Calcium phosphate $Ca_3(PO_4)_2$ (Atomic mass of Ca = 40u, P=31u, O=16 u)

24. If 4 g of NaOH dissolves in 36 g of H_2O, calculate the mole fraction of each component in the solution. (Atomic mass of Na =23 u, O=16 u, H=1 u)

OR

The reactant which is entirely consumed in the reaction is known as limiting reagent.
In the reaction $2A + 4B \rightarrow 3C + 4D$, when 5 moles of A react with 6 moles of B, then
(i) which is the limiting reagent?
(ii) calculate the moles of C formed.

25. (a) Calculate the energy of the electron in the first shell of the He^+ nucleus.
(b) State Aufbau principle.
(c) Which of the following orbitals are possible- 1p,2s,2p,3f?

26. (a) The electron gain enthalpy of fluorine is less negative than that of chlorine. Justify.
(b) All transition elements are d-block elements, but all d-block elements are not transition elements. Explain.

27. Explain the hybridisation in PCl_5.

28. (a) Draw the Lewis dot structure of NO_2^- (Nitrite ion).
(b) Calculate the formal charge of Nitrogen in NO_2^- (Nitrite ion).

SECTION D

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

29. A mole is a collection of 6.022×10^{23} particles and the number of 6.022×10^{23} is called the Avogadro number. The mass of this number of atoms in an element is equal to its gram atomic mass and mass of this number of molecules in a compound is equal to its gram molecular mass. The volume occupied by this number of molecules of a gas at STP is 22.4L. When 6.022×10^{23} of a substance are dissolved in 1 L solution, it is known as 1 molar volume.

(a) How many litres of oxygen at STP is required to burn 60 g C_2H_6 according to the following equation?

$$2\ C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$

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

(b) How many atoms of carbon are present in 0.1 mol of $C_{12}H_{22}O_{11}$?

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

(c) What is the mass of 10 molecules of Naphthalene ($C_{10}H_8$)?

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

OR

(c) How many grams of Calcium oxide is obtained on heating 100 g of $CaCO_3$(s) according to the equation given?

$CaCO_3 \longrightarrow CaO + CO_2$ (Atomic mass of Ca = 40 u,C=12u, O=16u)

30. The properties of the elements such as atomic or ionic radii, ionization enthalpy, electron gain enthalpy and electronegativity are directly or indirectly related to their electronic configuration and are called the periodic properties.

A part of the periodic table is given below.

C	N	O	F
	P	S	Cl
		Se	Br
			I

(a) Which of the above given elements has the highest ionization enthalpy? Give reason.

(b) What happens to the electropositive character of elements on moving from left to right in a periodic table?

(i) Increases (ii) Decreases

(iii) First increases than decreases (iv) First decreases than increases

(c) The electronic configuration of an element M is 2, 8, 4. In modern periodic table, the element M is placed in

(i) 4th group (ii) 2nd group (iii) 14th group (iv) 18th group

OR

(c) The elements with atomic numbers 9, 17, 35, 53, 85 are all —-------

(i) alkali earth metals (ii) noble gases (iii) halogens (iv) transition metals

SECTION E

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

31. (a) Calculate the wavelength of a body of 10 g moving with a velocity of 10 m/s.

($h = 6.626 \times 10^{-34}$ Js)

(b) Write the expression for Bohr frequency rule.

(c) Show that the circumference of the Bohr orbit for Hydrogen atom is an integral multiple of the de Broglie wavelength associated with the electron revolving around the orbit.

OR

(a) Calculate the momentum of a moving particle which has a de Broglie wavelength of 6.626×10^{-12} m ($h = 6.626 \times 10^{-34}$ Js)

(b) Calculate the energy and frequency of the radiation emitted when an electron jumps from n=3 to n=2 in a hydrogen atom.

32. (a) Electronic configuration of the two elements are given below: Arrange these elements in the increasing order of their metallic character. Give reasons for your answer.

(i) $[Ar]4s^2$

(ii) $[Ar]3d^{10}\ 4s^2\ 4p^6\ 5s^2$

(b) What are Transuranium elements?

(c) Write any two characteristics of transition elements.

OR

(a) K^+ is smaller than K. Give reason.

(b) Arrange the following in the increasing order of size.

Na^+, F^-, O^{2-}, Mg^{2+}

(c) What are representative elements? Give an example.

(d) $[AlF_6]^{3-}$ is known but $[BF_6]^{3-}$ is unknown. Why?

(e) Write the IUPAC name and symbol of the element with atomic number 122.

33. (a) Explain the hybridisation in SF_6. Predict its shape and bond angle.

(b) Complete the following table:

Compound	Shape	Bond angle
H_2O		
NH_3		

OR

(a) How many **σ** and **Π** bonds are there in CH_3CN?

(b) Name the hybridisation of C in the following molecules: CH_4, C_2H_2, CO_2, C_2H_4.

(c) State with reasons, which is more polar CO_2 or H_2O?

(d) LiCl is more covalent than NaCl. Why?