INDIAN SCHOOL AL WADI AL KABIR

UNIT TEST (2023 - 24)

Class: XI　　Sub: CHEMISTRY (043)　　Max Marks: 30

Date:28.05.2023　　Set - 1　　Time : 1 hour

<u>General Instructions</u>

i. There are 15 questions in this question paper.
ii. Section A consists of 8 multiple choice questions carrying 1 mark each.
iii. Section B consists of 2 short answer questions carrying 2 marks each.
iv. Section C consists of 3 short answer questions carrying 3 marks each.
v. Section D consists of one case-based question carrying 4 marks.
vi. Section E consists of one long answer type question carrying 5 marks.
vii. All questions are compulsory.
viii. Use of calculators and log table is not permitted.

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. In SO_2 and SO_3, the ratio of weight of oxygen that combines with the fixed mass of Sulphur is 2:3. This illustrates the law of
   a. Law of Constant proportion
   b. Law of Conservation of mass
   c. Law of Multiple proportion
   d. Avogadro law

2. The radius of the first stationary state, called the Bohr orbit, is
   a. 105.8 pm
   b. 52.9 pm
   c. 26.45 pm
   d. 211.6 pm

3. Which among the following is temperature dependent?
   a. Mass %
   b. Mole fraction
   c. Molarity
   d. Molality

4. If uncertainty in the position of an electron is zero, the uncertainty in its momentum will be _______
   a. $< h/4\pi$
   b. $>h/4\pi$
   c. zero
   d. infinite

5. What is the mole fraction of a component in a mixture if the number of moles of that component is 5 and the total number of moles in the mixture is 10?
   a. 1
   b. 0.5
   c. 0.1
   d. 5

6. If one mole of Ammonia contains "y" number of particles, then how many particles does one mole of glucose contain?
   a. 2y
   b. 0.5y
   c. 3y
   d. y

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

   Assertion (A): Electrons moving in the same orbit will lose or gain energy.
   Reason (R): On moving from higher level to lower level, the electron will lose energy.

   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.

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

   Assertion (A): The empirical mass of ethene (C_2H_4) is half its molecular mass.
   Reason (R): The empirical and molecular formula of a compound will always be different.

   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

9. 7.45 g of Potassium chloride (KCl) was dissolved in 100 g of water. Calculate the molality of the solution. (Atomic mass of K = 39 u, Cl = 35.5 u)

10. Write any two limitations of Bohr model of atom.

SECTION C

11. a. Define the term 'mole'.
    b. Calculate the number of atoms present in 18 g of H_2O. (Atomic mass of H = 1 u, O =16 u)

OR

   a. Find the formula unit mass of Magnesium chloride (Atomic mass of Mg = 24 u, Cl = 35.5 u)
   b. Calculate the molarity of KOH in the solution prepared by dissolving its 5.6 g in enough water to form 100 ml of the solution. (Atomic mass of K= 39 u, O =16 u, H = 1 u)

12. a. Show that the circumference of the Bohr orbit for the hydrogen atom is an integral multiple of the de Broglie wavelength associated with the electron revolving around the orbit.

b. Calculate the energy change during the transition of an electron in a H atom from an energy level with n = 2 to an energy level with n = 1?

13. 14 g of N_2 reacts with 6 g of H_2 to form NH_3 according to the reaction

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

Identify the limiting reagent and find the mass of NH_3 formed. (Atomic mass of N= 14 u, H=1u)

SECTION D

The following question is a case-based question. The question carries 4 (1+1+2) marks. Read the passage carefully and answer the questions that follow.

14. The French physicist, de Broglie, in 1924 proposed that matter, like radiation, should also exhibit dual behaviour i.e., both particle and wavelike properties. This means that just as the photon has momentum as well as wavelength, electrons should also have momentum as well as wavelength. de Broglie's prediction was confirmed experimentally when it was found that an electron beam undergoes diffraction, a phenomenon characteristic of waves.

Werner Heisenberg, a German physicist in 1927, stated uncertainty principle which is the consequence of dual behaviour of matter and radiation. One of the important implications of the Heisenberg Uncertainty Principle is that it rules out existence of definite paths or trajectories of electrons and other similar particles. The trajectory of an object is determined by its location and velocity at various moments. The effect of Heisenberg Uncertainty Principle is significant only for motion of microscopic objects and is negligible for that of macroscopic objects.

a. What is Bohr frequency rule?

b. State Heisenberg's Uncertainty principle.

c. Calculate the wavelength of an object of mass 6.6×10^{-30} kg moving with a speed of 2×10^{6} ms^{-1}. (Given $h = 6.626 \times 10^{-34}$ Js)

OR

c. A mosquito weighing 1×10^{-6} kg is moving at a speed of 1 ms^{-1}. Calculate the uncertainty in its position using Heisenberg's uncertainty principle. ($h = 6.626 \times 10^{-34}$ Js)

SECTION E

15. a. Define the term atomic mass unit.

b. What is the mass of H_2O obtained when 32g CH_4 undergoes combustion according to the reaction.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

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

c. Calculate the mass % of all the atoms in Acetic acid (CH_3COOH). (Atomic mass of C = 12 u, H = 1 u, O = 16 u)

OR

a. State Gay Lussac's law of gaseous volumes.

b. The empirical formula of a substance is CH_2O. Its molar mass is 180 g. What is its molecular formula? (Atomic mass of C = 12u, H = 1u, O = 16 u)

c. Calculate the concentration of NaOH in moles per litre in a sample which has a density, 1.41 g ml^{-1} and the mass per cent of NaOH in it being 40 %. (Atomic mass of Na = 23 u, O= 16 u, H = 1 u)

MARKING SCHEME

Q. No	Answers	Marks
1	c. Law of Multiple proportion	1
2	b. 52.9 pm	1
3	c. Molarity	1
4	d. infinite	1
5	b. 0.5	1
6	d. y	1
7	d. A is false but R is true.	1
8	c. A is true but R is false	1
9	Moles of solute = 7.45/74.5 = 0.1 mol Molality = 0.1/0.1 = 1m	½ ½ 1
10	Any two limitations	1×2
11	a. One mole is the amount of a substance that contains as many particles or entities as there are atoms in exactly 12 g (or 0.012 kg) of the ^{12}C isotope. b. No of moles = mass/molar mass =18/18 = 1 mol No of molecules = No of moles × Avogadro number = 6.022×10^{23} molecules No of atoms = $3 \times 6.022 \times 10^{23} = 18.066 \times 10^{23}$ atoms OR a. Formula unit mass = 24 + 2(35.5) = 95 u b. Moles of KOH = 5.6/56 = 0.1 mol Molarity = $0.1 / 100 \times 10^{-3}$ = 1 $molL^{-1}$	1 ½ ½ 1 1 1 1
12	a. mvr = nh/2π 2πr = nh/mv = nλ b. $\triangle E = 2.18 \times 10^{-18} (1/ni^2 - nf^2)$ $= 2.18 \times 10^{-18} (1/2^2 - 1^2)$ $= - 1.635 \times 10^{-18}$ J	½ ½ ½ ½ 1
13	Moles of N_2 = 14/28 = 0.5 mol Moles of H_2 = 6/2 = 3 mol N_2 - LR Moles of NH_3 = 1 mol Mass of NH_3 = 1 × 17 = 17 g	½ ½ ½ ½ 1

14	a. $$\nu = \frac{\Delta E}{h} = \frac{E_2 - E_1}{h}$$ Where E1 and E2 are the energies of the lower and higher allowed energy states respectively b. It states that it is impossible to determine simultaneously, the exact position and exact momentum (or velocity) of an electron. c. $\lambda = h/mv$ $= 6.626 \times 10^{-34} / 6.6 \times 10^{-30} \times 2 \times 10^{-6}$ $= 0.5 \times 10^{-10}$ OR c. $\triangle x .m\triangle v=h/4\pi$ $\triangle x = 6.626 \times 10^{-34} / 4 \times 3.14 \times 1 \times 10^{-6} \times 1$ $= 0.527 \times 10^{-28}$ m	1 1 ½ ½ 1 ½ ½ 1
15	a. One atomic mass unit is defined as a mass exactly equal to one-twelfth of the mass of one carbon - 12 atom. b. Moles of CH_4 = 2 moles Moles of H_2O = 4 moles Mass of H_2O = 72 g c. Molar mass of CH_3COOH = 60 $gmol^{-1}$ Mass% of C = 24/60×100 = 40 % Mass % of H = 4/60 × 100 = 6.6 % Mass % of O = 32/60 × 100 = 53.3 % OR a. When gases combine or are produced in a chemical reaction they do so in a simple ratio by volume, provided all gases are at the same temperature and pressure. b. Empirical formula mass = 12+2+16 = 30 u n = Molar mass/EFM = 180/30 = 6 Molecular formula = $C_6H_{12}O_6$ c. Molarity = Mass% × density × 10/Molar mass of solute = 40 × 1.41 × 10 / 40 = 14.1M	1 ½ ½ 1 ½ ½ ½ ½ 1 ½ ½ 1 ½ 1 ½