



OSDAV Public School, Kaithal  
First Unit Test (May,2024)  
Class : XI  
Subject : Chemistry

SET-A

Time: 1 hr

M.M. : 30

General Instructions:-

All questions are compulsory.

- (a) There are 16 questions in this question paper with internal choice.
- (b) SECTION A consists of 8 multiple -choice questions carrying 1 mark each.
- (c) SECTION B consists of 4 short answer questions carrying 2 marks each.
- (d) SECTION C consists of 3 short answer questions carrying 3 marks each.
- (e) SECTION D consists of 1 long answer questions carrying 5 marks.
- (f) Use of log tables and calculators is not allowed.

Q.No.	Questions	Marks
<b>SECTION-A</b>		
1	Which has the maximum number of molecules among the following: a. 44g of CO <sub>2</sub> b. 48g of O <sub>2</sub> c. 8g of H <sub>2</sub> d. 64g of SO <sub>2</sub>	1
2	Which of the following statement about the electron is incorrect? a. It is a negatively charged particle. b. The mass of electron is equal to the mass of neutron c. It is basic constituent of all atoms d. It is a constituent of cathode rays	1
3	Which of the following terms are unitless? a. Molarity b. Mole fraction c. Normality d. Molality	1
4	The no. of significant figures in 000.0457 are: 7 a. 3 b. 3 c. 4 d. 2	1
5	Two atoms are said to be isobars if: a. They have same atomic number but different mass no. b. They have same no. of electrons but different no. of neutrons c. Sum of protons and neutrons is same but number of protons is different d. They have same no. of neutrons but different no. of electrons	1
6	Given below are two statements labelled as Assertion (A) and Reason (R) 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 <b>Assertion:</b> The empirical mass of ethene is half of its molecular mass <b>Reason:</b> The empirical formula represents the simplest whole no. ratio of various atoms present in a compound	1
7	<b>Assertion:</b> Different electromagnetic radiations travel with different velocities. <b>Reason:</b> Different electromagnetic radiations have different frequencies.	1
8	<b>Assertion:</b> Gay lussac law does not follow from Dalton's atomic theory <b>Reason:</b> Dalton's atomic theory explains the laws of chemical combination by mass only	1

	<b>SECTION-B</b>	
<b>9</b>	Calculate the mole fraction of solute in 2.5m aqueous solution	2
<b>10</b>	a. Red FM broadcasts at a frequency of 1368 KHz. Calculate the wavelength of electromagnetic radiation emitted by the transmitter?	1
	b. Write the main postulate of electromagnetic wave theory.	1
<b>11</b>	a . State Law of multiple proportion with example	2
	b . What is atomic mass unit?	
<b>12</b>	Write observations and explanations put forward by Rutherford from his alpha scattering experiment.	2
	<b>SECTION-C</b>	
<b>13</b>	Calculate the no. of atoms of the constituent elements in 53g of Na <sub>2</sub> CO <sub>3</sub>	3
<b>14</b>	a. A monoatomic anion of unit charge contains 45 neutrons and 36 electrons. Find out the atomic number and mass number of ion.	1
	b. Write properties of cathode rays.	2
<b>15</b>	Calcium carbonate reacts with aq. HCl according to reaction: $\text{CaCO}_3 + 2 \text{HCl} \longrightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ What mass of CaCO <sub>3</sub> is required to react completely with 25 ml of 0.75M HCl?	3
	<b>SECTION -D</b>	
<b>16</b>	a. A compound contains 31.84% Potassium, 28.98% Chlorine and 39.18% Oxygen. It molar mass is 122.5 g . What are its empirical and molecular formula.	3
	b. Lead chloride is formed by following reaction: $\text{PbO} + 2\text{HCl} \longrightarrow \text{PbCl}_2 + \text{H}_2\text{O}$ Calculate the moles of lead chloride formed from a reaction between 6.5g of PbO and 3.2 g of HCl . ( At. Mass of Pb = 207 )	2



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Q.No.	Questions	Marks
	<b>SECTION-A</b>	
1	The litres of CO <sub>2</sub> represented by 4.4g of CO <sub>2</sub> at STP are: a. 2.4 L b. 2.24 L c. 44 L d. 22.4 L	1
2	Two atoms are said to be isobars if: a. They have same atomic number but different mass no. b. They have same no. of electrons but different no. of neutrons c. Sum of protons and neutrons is same but number of protons is different d. They have same no. of neutrons but different no. of electrons	1
3	Which of the following terms depend on temperature? a. Molarity b. Mole fraction c. Mass percent d. Molality	1
4	The no. of significant figures in 000.40457 are: a. 7 b. 3 c. 4 d. 5	1
5	Which of the following statement about the electron is incorrect? a. It is a negatively charged particle. b. The mass of electron is equal to the mass of neutron c. It is basic constituent of all atoms d. It is a constituent of cathode rays	1
6	Given below are two statements labelled as Assertion (A) and Reason (R) 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 <b>Assertion:</b> The empirical mass of ethene is half of its molecular mass <b>Reason:</b> The empirical formula represents the simplest whole no. ratio of various atoms present in a compound	1
7	<b>Assertion:</b> Different electromagnetic radiations travel with different velocities. <b>Reason:</b> Different electromagnetic radiations have different frequencies.	1
8	<b>Assertion:</b> Atomic mass of Calcium is 40 u <b>Reason:</b> An atom of calcium is 40 times heavier than an atom of carbon with mass 12u	1

	<b>SECTION-B</b>	
<b>9</b>	Calculate the molarity of a solution of ethanol in water in which mole fraction of ethanol is 0.04	2
<b>10</b>	a. The wavelength of blue light is $480 \times 10^{-9}$ m. Calculate the frequency. b. Write the main postulate of electromagnetic wave theory.	1 1
<b>11</b>	a . State Gay Lusac law of combining volume with example b . What is atomic mass unit?	2
<b>12</b>	What is the origin of anode and cathode rays?	2
	<b>SECTION-C</b>	
<b>13</b>	a. A monoatomic anion of unit charge contains 45 neutrons and 36 electrons. Find out the atomic number and mass number of ion. b. Write Postulates of Rutherford Model of Atom.	1 2
<b>14</b>	Calcium carbonate reacts with aq. HCl according to reaction: $\text{CaCO}_3 + 2 \text{HCl} \longrightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ What mass of $\text{CaCO}_3$ is required to react completely with 25 ml of 0.75M HCl?	3
<b>15</b>	Calculate the no. of atoms of the constituent elements in 53g of $\text{Na}_2\text{CO}_3$	3
	<b>SECTION -D</b>	
<b>16</b>	a. A compound contains 31.84% Potassium, 28.98% Chlorine and 39.18% Oxygen. Its molar mass is 122.5 g . What are its empirical and molecular formula. b. Lead chloride is formed by following reaction: $\text{PbO} + 2\text{HCl} \longrightarrow \text{PbCl}_2 + \text{H}_2\text{O}$ Calculate the moles of lead chloride formed from a reaction between 6.5g of PbO and 3.2 g of HCl . ( At. Mass of Pb = 207 )	3 2



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Marking Scheme

Section -A		
A.1	c. 8 g of H <sub>2</sub>	1
A.2	b. The mass of electron is equal to mass of neutron.	1
A.3	b. Mole Fraction.	1
A.4	b. 3	1
A.5	c. Sum of protons and neutrons is same but no. of protons is different	1
A.6	a. Both A and R are true and R is the correct explanation of A.	1
A.7	d. A is false but R is true.	1
A.8	a. Both A and R are true and R is the correct explanation of A	1
Section- B		
A.9	2.5 molal $\Rightarrow$ 2.5 moles of solute in 1000 g of solvent Number of moles of solute = 2.5 mol Number of moles of solvent = $1000/18=55.56$ mol Mole fraction of the solute = $2.5/2.5+55.56=0.043$	2
A.10	a. <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 10px auto;"><p>We know,</p><math display="block">v = \frac{c}{\lambda}</math><p>Given, <math>v = 1368</math> KHz</p><math display="block">c = 3 \times 10^8 \text{ m/s}</math><math display="block">\lambda = \frac{3 \times 10^8}{1368 \times 10^3}</math><math display="block">= 219.298 \text{ m}</math></div>	1

A-11	<p>b. According to electromagnetic wave theory energy is released or absorbed continuously from a body in the form of radiations and the energy is known as radiant energy.</p>	1
(a)	<p>The law of multiple proportions states that whenever the same two elements form more than one compound, the different masses of one element that combine with the same mass of the other element are in the ratio of small whole numbers.</p>	1
(b)	<p>An atomic mass unit is defined as accurately 1/12 the mass of a carbon-12 atom.</p>	
A.12	<p>The observations made by Rutherford led him to conclude that:</p> <ol style="list-style-type: none"> <li>1. A major fraction of the <math>\alpha</math>-particles bombarded towards the gold sheet passed through the sheet without any deflection, and hence <b>most of the space in an atom is empty</b>.</li> <li>2. Some of the <math>\alpha</math>-particles were deflected by the gold sheet by very small angles, and hence the <b>positive charge in an atom is not uniformly distributed. The positive charge in an atom is concentrated in a very small volume</b>.</li> <li>3. Very few of the <math>\alpha</math>-particles were deflected back, that is only a few <math>\alpha</math>-particles had nearly <math>180^\circ</math> angle of deflection. So the <b>volume occupied by the positively charged particles in an atom is very small as compared to the total volume of an atom</b>.</li> </ol>	2
A.13	<p>Molecular mass of <math>\text{Na}_2\text{CO}_3 = (2 \times 23) + 12 + (3 \times 16) = 46 + 12 + 48 = 106</math>  Given mass of <math>\text{Na}_2\text{CO}_3 = 53 \text{ g}</math>  106 g of <math>\text{Na}_2\text{CO}_3</math> Contain = 1 mol  53 g of <math>\text{Na}_2\text{CO}_3</math> Contain = <math>\frac{53}{106} = \frac{1}{2} \text{ mol}</math></p> <p>No of atoms of Na = <math>\frac{1}{2} \times 2 \times 6.022 \times 10^{23} = 6.022 \times 10^{23}</math>  No of atoms of C = <math>\frac{1}{2} \times 6.022 \times 10^{23}</math>  = <math>3.011 \times 10^{23}</math>  No of atoms of O = <math>\frac{1}{2} \times 3 \times 6.022 \times 10^{23} = 9.033 \times 10^{23}</math></p>	3

A.14

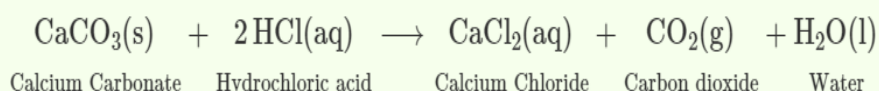
- a. Atomic no. = 35  
Mass no. = 35 + 45 = 80
- b. Properties of cathode ray:
1. They travel in straight line
  2. They consists of material particles.
  3. They are negatively charged
  4. They ionize the gas through which they pass.

1

2

A.15

The given equation is



Number of moles of HCl = Molarity x Volume

$$= 0.75\text{M} \times 0.025\text{L} = 0.01875 \text{ mol}$$

As, the mole ratio between  $\text{CaCO}_3$  and HCl is 1:2. So, the number of moles of  $\text{CaCO}_3$  should be half of the number of moles of HCl

$$\text{Number of moles of CaCO}_3 = \frac{1}{2} \times 0.01875 \text{ mol} = 0.009375 \text{ mol}$$

Molar mass of  $\text{CaCO}_3 = 100\text{g/mol}$

Mass of Calcium Carbonate = Moles x Molar mass

$$= 0.009375 \text{ mol} \times 100\text{g/mol} = 0.9375\text{g}$$

2

A.16

a.

Element	Percentage composition	Atomic weight	Atomic ratio	Simplest ratio
K	31.84	39	$\frac{31.84}{39} = 0.82$	$\frac{0.82}{0.82} = 1$
Cl	28.98	35.5	$\frac{28.98}{35.5} = 0.82$	$\frac{0.82}{0.82} = 1$
O	39.18	16	$\frac{39.18}{16} = 2.45$	$\frac{2.45}{0.82} = 3$

- The simplest ratio of K : Cl : O = 1 : 1 : 3 is a whole number ratio.
- Thus, the empirical formula of the compound is  $\text{KClO}_3$ .

**Step 4: Calculation of value of  $n$ :**

- The empirical formula weight is calculated as follows:

$$\text{Empirical formula weight} = 36 + 35.5 + (16 \times 3) = 122.5$$

- Determine the value of  $n$  as follows:

$$n = \frac{\text{Molecular weight}}{\text{Empirical formula weight}} = \frac{122.5}{122.5} = 1$$

**Step 5: Determination of the molecular formula:**

- The molecular formula is determined as follows:

$$\begin{aligned} \text{Molecular formula} &= (\text{Empirical formula})_n \\ &= (\text{KClO}_3)_1 \\ &= \text{KClO}_3 \end{aligned}$$

Therefore, the molecular formula of the compound is  $\text{KClO}_3$ .

3

<p>b.</p>	<p>Given as:</p> <p><math>n_{\text{PbO}} = 6.5/223 = 0.029</math> (atomic mass of PbO=223)</p> <p><math>n_{\text{HCl}} = 3.2/36.5 = 0.0877</math> (atomic mass of HCl=36.5)</p> <p>The reaction is,</p> <p><math>\text{PbO} + 2\text{HCl} \rightarrow \text{PbCl}_2 + \text{H}_2\text{O}</math></p> <p>In the given reaction PbO will be limiting reagent because it is completely consumed and produce 0.029 mol of PbCl<sub>2</sub>.</p> <p style="text-align: center;">SET-B ( Different Questions)</p>	<p>2</p>
<p>A.1</p>	<p>B 2.24L</p>	<p>1</p>
<p>A.3</p>	<p>A Molarity</p>	<p>1</p>
<p>A.7</p>	<p>D Assertion is false but R is true.</p>	<p>1</p>
<p>A.8</p>	<p>C Assertion is true but R is false.</p>	<p>1</p>
<p>A.11</p>	<p>Gay luscac law of combining volume: The law of combining volumes states that, when gases react together to form other gases, all volumes are measured at the same temperature and pressure: The ratio between the volumes of the reactant gases and the products can be expressed in simple whole numbers.</p>	<p>1</p>



A.12	Origin of Cathode rays: Cathode rays originate from cathode terminal and anode rays originate from the space between cathode and anode.	2
A.13	Postulates of Rutherford's model of an atom: i) The mass of an atom is concentrated in a small space called the nucleus. ii) Atoms majorly consist of positively charged particles. iii) Negatively charged electrons revolve around atoms in circular paths called orbits at very high speed.	2

