1. If 5 moles of $BaCl_2$ is mixed with 2 moles of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ formed is _________ (Nearest integer)
[2023 (06 Apr Shift 1)]

2. 0.5 g of an organic compound (X) with 60% carbon will produce $\times 10^{-1}$ g of CO_2 on complete combustion.
[2023 (08 Apr Shift 1)]

3. Which of the following have same number of significant figures?
(A) 0.00253
(B) 1.0003
(C) 15.0
(D)163
Choose the correct answer from the options given below
[2023 (08 Apr Shift 2)]
(1) A, B and C only
(2) C and D only
(3) B and C only
(4) A, C and D only

4. The number of molecules and moles in 2.8375 litres of O_2 at STP are respectively
[2023 (10 Apr Shift 1)]
(1) 7.527×10^{23} and 0.125 mol
(2) 7.527×10^{22} and 0.250 mol
(3) 1.505×10^{23} and 0.250 mol
(4) 7.527×10^{22} and 0.125 mol

5. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**.
Assertion A: 3.1500 g of hydrated oxalic acid dissolved in water to make 250.0 mL solution will result in 0.1 M oxalic acid solution.
Reason R: Molar mass of hydrated oxalic acid is 126 $g\ mol^{-1}$.
In the light of the above statements, choose the correct answer from the options given below:
[2023 (10 Apr Shift 2)]
(1) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**
(2) **A** is true but **R** is false
(3) Both **A** and **R** are true and **R** is the correct explanation of **A**
(4) **A** is false but **R** is true

6. Match List-I with List-II

	List-I		List-II
A	16 g of CH_4 (g)	I	Weighs 28g
B	1 g of H_2(g)	II	60.2×10^{23} electrons
C	1 mole of N_2 (g)	III	Weighs 32g
D	0.5 mol of SO_2(g)	IV	Occupies11.4 L volume at STP

Choose the correct answer from the options given below:
[2023 (10 Apr Shift 2)]
(1) A-II, B-III, C-IV, D-I
(2) A-II, B-IV, C-I, D-III
(3) A-I, B-III, C-II, D-IV
(4) A-II, B-IV, C-III, D-I

7. 25 mL of silver nitrate solution (1M) is added dropwise to 25 mL of potassium iodide (1.05 M) solution. The ion(s) present in very small quantity in the solution is/are
[2023 (11 Apr Shift 1)]
(1) I^- only
(2) K^+only
(3) NO_3^-only
(4) Ag^+ and I^-both

8. A solution of sugar is obtained by mixing 200 g of its 25% solution and 500 g of its 40% solution (both by mass). The mass percentage of the resulting sugar solution is _______ (Nearest integer)
[2023 (11 Apr Shift 1)]

9. A solution is prepared by adding 2 g of "X" to 1 mole of water. Mass percent of "X" in solution is

[2023 (11 Apr Shift 2)]

(1) 5%
(2) 20%
(3) 2%
(4) 10%

10. The volume of hydrogen liberated at STP by treating 2.4 g of magnesium with excess of hydrochloric acid is ...... $\times 10^{-2}$ L. Given Molar volume of gas is 22.4 L at STP. Molar mass of magnesium is 24 g mol^{-1}

[2023 (11 Apr Shift 2)]

11. A metal chloride contains 55.0% of chlorine by weight. 100 mL vapours of the metal chloride at STP weigh 0.57 g. The molecular formula of the metal chloride is

(Given: Atomic mass of chlorine is 35.5 u)

[2023 (12 Apr Shift 1)]

(1) MCl_4
(2) MCl_3
(3) MCl_2
(4) MCl

12. An organic compound gives 0.220 g of CO_2 and 0.126 g of H_2O on complete combustion. If the % of carbon is 24 then the % of hydrogen is _________ $\times 10^{-1}$. (Nearest integer)

[2023 (13 Apr Shift 1)]

13. 1 g of a carbonate (M_2CO_3) on treatment with excess HCl produces 0.01 mol of CO_2. The molar mass of M_2CO_3 is $gmol^{-1}$. (Nearest integer)

[2023 (13 Apr Shift 2)]

ANSWER KEYS

1. (1)	**2.** (11)	**3.** (4)	**4.** (4)	**5.** (3)	**6.** (2)	**7.** (4)	**8.** (36)
9. (4)	**10.** (224)	**11.** (3)	**12.** (56)	**13.** (100)			

1. (1)

The balanced chemical equation for the reaction between $BaCl_2$ and Na_3PO_4 is:

$3\,BaCl_2 + 2\,Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6\,NaCl$

5 moles of barium chloride will require $\frac{5\times2}{3} = 3.3$ moles of sodium phosphate.

Here, sodium phosphate is the limiting reagent.

2 moles of sodium phosphate produce 1 mole of barium phosphate.

Thus,2 moles of sodium phosphate will produce 1 mole of barium phosphate.

Hence, the maximum no. of moles of $Ba_3(PO_4)_2$ that can be formed is one mole.

2. (11)

To calculate the mass percent of an element in a compound, we divide the mass of the element in 1 mole of the compound by the compound's molar mass and multiply the result by 100.

The combustion reaction is $C(s)+O_2(g)\rightarrow CO_2(g)$

$C\% = \frac{12}{44} \times \frac{\text{Wt. of } CO_2}{\text{Wt. of organic compound}} \times 100$

$60 = \frac{12}{44} \times \frac{\text{Wt. of } CO_2}{0.5} \times 100$

Wt. of $CO_2 = 1.1$

3. (4)

All nonzero digits are significant. All zeros that are found between nonzero digits are significant. Leading zeros (to the left of the first nonzero digit) are not significant. Trailing zeros for a whole number that ends with a decimal point are significant.The number of significant figures of the given numbers are as follows:

Numbers	No. of significant figures
(A) 0.00253	3
(B) 1.0003	5
(C) 15.0	3
(D) 163	3

$\therefore$ (A), (C) and (D) have the same number of significant figures.

4. (4)

One mole of any ideal gas occupies 22.7L at standard temperature and pressure.

The number of moles $= \frac{\text{Given volume}}{\text{Volume at STP}}$

Moles $= \frac{2.8375}{22.7} = 0.125$

The number of molecules = moles $\times N_A$

Molecules $= 0.125 \times 6.022 \times 10^{23}$

$= 7.527 \times 10^{22}$

5. (3)

Molarity $(M) = \frac{wt}{mwt \times V} \times 1000$

Using this formula, we can calculate the molarity of the oxalic acid solution as follows:

1. Mass of hydrated oxalic acid $= 3.1500$ g
2. Molar mass of hydrated oxalic acid$(H_2C_2O_4 \cdot 2H_2O) = 126.064$ g/ mol
3. Volume of the solution = 250.0 mL

Molarity $(M) = \frac{3.15\times1000}{126\times250} = 0.10$

So both assertion land reason are correct.

6. (2)

The number of moles $= \frac{\text{Mass}}{\text{Molar mass}}$
The number of molecules $=$ moles $\times N_A$
One mole of any gas occupies 22.7 L at STP.
(A) Moles of $CH_4 = \frac{16}{16} = 1$
Molecules $= 6.02 \times 10^{23}$
Electrons $= 10 \times 6.02 \times 10^{23}$
$= 60.2 \times 10^{23}$
(B) Moles of $H_2 = \frac{1}{2} = 0.5$ mole
Volume at STP $= \frac{1}{2} \times 22.7 = 11.35$ lit .
(C) 1 mole $N_2 = 28$ gm
(D) 0.5 mole $SO_2 = \frac{1}{2} \times 64 = 32$ gm

7. (4)

To determine the ion(s) present in very small quantity in the solution, we need to consider the chemical reaction that occurs when silver nitrate reacts with potassium iodide. The reaction between $AgNO_3$ and KI is a double replacement reaction and can be represented as follows:
$AgNO_3 + KI \rightarrow AgI + KNO_3$
Millimoles of $AgNO_3 = 25$
Millimoles of KI $= 25 \times 1.05 = 26.25$
$\therefore$ KI is in excess & AgI forms negatively charged colloid. (Some Ag^+ remains in solution) lons Ag^+ & F^- are therefore, present in very small quantity.

8. (36)

Mass of solution $= 200 + 500 = 700$ g
25% of sugar solution means 100g solution contain 25g sugar
40% of sugar solution means 100g solution contain 40g sugar
Mass of sugar $= 0.25 \times 200 + 0.40 \times 500$
$= 50 + 200 = 250$ g
Mass % of resulting solution
$= \frac{250}{700} \times 100 = 36\%$

9. (4)

To calculate the mass percent of "X" in the solution, we need to determine the mass of "X" and the total mass of the solution.
Given:
:Solute (X) = 2 g
Solvent $(H_2O) = 1$ mole $= 18$ g
Total mass $= 2 + 18 = 20$ g
Mass percent of X $= \frac{2}{2+18} \times 100 = 10$

10. (224)

The stoichiometric equation of the reaction between magnesium and hydrogen chloride can be written as follows,
One mole magnesium can liberate one mole of hydrogen gas according to the following equation.
$\underset{\substack{2.4\text{ g} \\ =0.1\text{ mole}}}{Mg} + 2HCl \rightarrow MgCl_2 + \underset{0.1\text{ mole}}{H_2}$
Volume of 1 mole H_2 at $= 22.4$ L
$\therefore$ 0.1 mole H_2 at STP will occupy $= 2.24$ L

11. (3)

Let the formula of metal chloride be MCl_x
Mass of 100 mL of vapours of MCl_x at STP $= 0.57$ g
The mass of substance which occupies 22400 ml of volume at STP is molar mass(M)
$\therefore \frac{100 \times M}{22400} = 0.57$
$\therefore$ Molar mass of $MCl_x = 127.68$ g mol^{-1}
The mass percentage of chlorine$= \frac{\text{mass of chlorine}}{\text{mass of the compound}} \times 100$
% of Cl $= \frac{35.5x \times 100}{127.68} = 55$
$\Rightarrow x = 2$
$\therefore$ Formula of metal chloride is MCl_2

12. (56)

Moles of $CO_2 = \frac{0.22}{44} = \frac{1}{200}$

Then,

Mass of C $= \frac{0.220}{44} \times 12 = 0.06$ g

% of C $= \frac{0.06}{W} \times 100 = 24$

(W= Wt.of organic compound)

$W = 0.25$

Moles of $H_2O = \frac{0.126}{18} = 0.007$

Moles of H $= 0.007 \times 2 = 0.014$ g

$$\begin{aligned} \% \text{ of Hydrogen} &= \frac{0.014 \times 1}{W} \times 100 \\ &= \frac{0.014 \times 1}{0.25} \times 100 \\ &= 5.6 \\ &= 56 \times 10^{-1} \end{aligned}$$

13. (100)

From Balanced chemical reaction,

$M_2CO_3 + 2HCl \rightarrow 2MCl + H_2O + CO_2$

Here from this, we get:

$0.01 \text{ mol } CO_2 \equiv 0.01 \text{ mol } M_2CO_3 \equiv 1 \text{ g } M_2CO_3$

We know that,

Number of moles $= \frac{\text{Given mass}}{\text{Molar mass}}$

$\Rightarrow$Molar mass of $M_2CO_3 = \frac{\text{Given mass of } M_2CO_3}{\text{Number of Moles of } M_2CO_3} = \frac{1}{0.01} = 100$ g/ mol