

1.

Which statement is correct?

- A** The relative atomic mass of a  $^{35}\text{Cl}$  atom is 35.5.
- B** The relative formula mass of  $\text{CaCO}_3$  is 100.1.
- C** The relative isotopic mass of a  $^{24}\text{Mg}$  atom is 24.3.
- D** The relative molecular mass of  $\text{O}_2$  is 16.0.

Ans: B

2.

Chlorine dioxide,  $\text{ClO}_2$ , reacts with aqueous sodium hydroxide to produce water and a mixture of two sodium salts,  $\text{NaClO}_2$  and  $\text{NaClO}_3$ .

What is the mole ratio of  $\text{NaClO}_2$  to  $\text{NaClO}_3$  in the product mixture?

- A** 1:2
- B** 3:5
- C** 1:1
- D** 5:3

Ans: C

3.

For which compound is there the greatest percentage loss of mass on strong heating?

- A** anhydrous calcium carbonate
- B** anhydrous calcium nitrate
- C** anhydrous magnesium carbonate
- D** anhydrous magnesium nitrate

Ans: D

- Calculate the % mass of carbon / nitrogen in each case
- Higher % mass of carbon / nitrogen, higher percentage loss

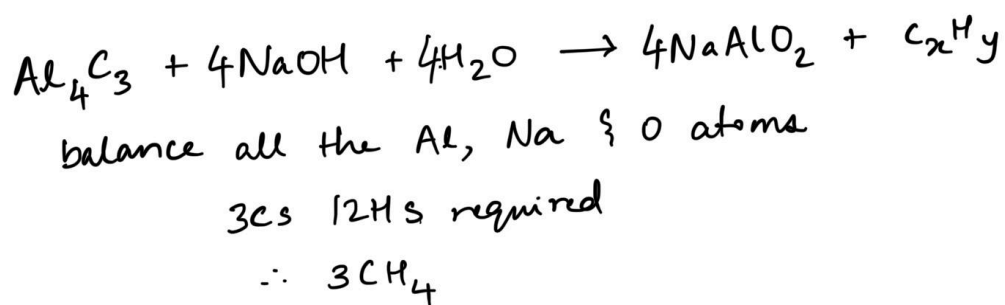
4.

Aluminium carbide,  $\text{Al}_4\text{C}_3$ , reacts readily with aqueous sodium hydroxide. The two products of the reaction are  $\text{NaAlO}_2$  and a hydrocarbon. Water molecules are also involved as reactants.

What is the formula of the hydrocarbon?

- A**  $\text{CH}_4$
- B**  $\text{C}_2\text{H}_6$
- C**  $\text{C}_3\text{H}_8$
- D**  $\text{C}_6\text{H}_{12}$

Ans: A



5.

A sample of 35.6 g of hydrated sodium carbonate contains 25.84% sodium ions by mass.

When this sample is heated, anhydrous sodium carbonate and water are formed.

Which mass of water is given off?

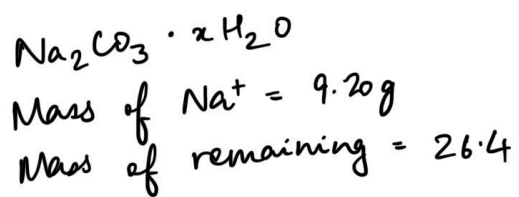
A 7.2g

B 10.6g

C 14.4g

D 21.2g

Ans: C



$$\frac{9.2}{2 \times 23} = 0.2 \quad \rightarrow \quad 0.2 \text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$$
$$0.2 \times (12 + 3 \times 16) = 12 \quad \rightarrow \quad \text{mass of CO}_3$$
$$\therefore \text{mass of H}_2\text{O} = 26.4 - 12 = 14.4\text{g}$$

6.

Separate samples, each of mass 1.0g, of the compounds listed are treated with an excess of dilute acid.

Which compound releases the largest amount of  $\text{CO}_2$ ?

A 1.0g  $\text{CaCO}_3$

B 1.0g  $\text{Li}_2\text{CO}_3$

C 1.0g  $\text{MgCO}_3$

D 1.0g  $\text{Na}_2\text{CO}_3$

Ans: B

Calculate % of C in each case. Higher % c = most  $\text{CO}_2$ .

7.

Compound X contains the elements C, H and O only.

2.00 g of X produces 4.00 g of carbon dioxide and 1.63 g of water when completely combusted.

What is the empirical formula of X?

- A** CHO<sub>2</sub>      **B** C<sub>2</sub>H<sub>2</sub>O      **C** C<sub>2</sub>H<sub>4</sub>O      **D** CH<sub>2</sub>O<sub>2</sub>

Ans: C

- Ratio of C:H = 1:2. This eliminates C & D
- D is not possible, because 2 oxygens is not possible along with 2 hydrogens

8.

Which statement about atoms and molecules is correct?

- A** The molecular formula of a compound is the simplest whole number ratio of atoms of each element in the compound.
- B** One mole of any substance contains  $6 \times 10^{23}$  atoms.
- C** The relative atomic mass of an element is the ratio of the average mass of one atom of the element to the mass of an atom of carbon-12.
- D** The relative formula mass of a compound is the sum of the individual atomic masses of all the atoms in the formula.

Ans: D

9.

An excess of chlorine was bubbled into 100 cm<sup>3</sup> of hot 6.0 mol dm<sup>-3</sup> sodium hydroxide.

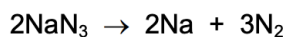
How many moles of sodium chloride would be produced in the reaction?

- A** 0.30      **B** 0.50      **C** 0.60      **D** 0.72

Ans: B

10.

Sodium azide, NaN<sub>3</sub>, decomposes as shown.



Which volume of nitrogen, measured at room temperature and pressure, will be produced by the decomposition of 150 g of sodium azide?

- A** 166 dm<sup>3</sup>      **B** 83 dm<sup>3</sup>      **C** 55 dm<sup>3</sup>      **D** 37 dm<sup>3</sup>

Ans: B

When there is a coefficient, take it into account after calculating moles of the sample used.

- No of mol of  $\text{NaN}_3$  used =  $(150) / (23+3 \times 14) = 2.308$
- No of mol of  $\text{N}_2$  produced =  $2.308 \times 3/2 = 3.46$
- $3.46 \times 24 = 83.04$

11.

Compound X contains the elements C, H and O only.

2.00 g of X produces 4.00 g of carbon dioxide and 1.63 g of water when completely combusted.

What is the empirical formula of X?

- A**  $\text{CHO}_2$       **B**  $\text{C}_2\text{H}_2\text{O}$       **C**  $\text{C}_2\text{H}_4\text{O}$       **D**  $\text{CH}_2\text{O}_2$

Ans: C

12.

What is the maximum volume of sulfur dioxide gas measured at room conditions produced from burning  $100 \text{ dm}^3$  of diesel fuel containing 0.8346 g of sulfur?

- A**  $291 \text{ cm}^3$       **B**  $312 \text{ cm}^3$       **C**  $582 \text{ cm}^3$       **D**  $624 \text{ cm}^3$

Ans: D

13.

Hydrated cobalt(II) sulfate loses water when heated to give anhydrous cobalt(II) sulfate. All the water of crystallisation is lost to the atmosphere as steam.

When 3.10 g of hydrated cobalt(II) sulfate,  $\text{CoSO}_4 \cdot x\text{H}_2\text{O}$ , is heated to constant mass the **loss** in mass is 1.39 g.

What is the value of x, to the nearest whole number?

- A** 4      **B** 6      **C** 7      **D** 11

Ans: C

14.

Glauber's salt consists of crystals of hydrated sodium sulfate,  $\text{Na}_2\text{SO}_4 \cdot x\text{H}_2\text{O}$ , which can be used for the manufacture of detergents.

When a sample of Glauber's salt was heated, 1.91 g of water was removed leaving 1.51 g of anhydrous  $\text{Na}_2\text{SO}_4$ .

What is the value of x in  $\text{Na}_2\text{SO}_4 \cdot x\text{H}_2\text{O}$ ?

- A** 1      **B** 8.85      **C** 10      **D** 11.25

Ans: C

15.

What contains the greatest number of the named particles?

**A** 6.0 dm<sup>3</sup> of argon atoms at room conditions

**B** 6.0 g of carbon dioxide molecules

**C** 6.0 g of magnesium atoms

**D** 6.0 g of water molecules

Ans: D