1.

Which statement is correct?

A The relative atomic mass of a ^{35}Cl atom is 35.5.

B The relative formula mass of $CaCO_3$ is 100.1.

C The relative isotopic mass of a ^{24}Mg atom is 24.3.

D The relative molecular mass of O_2 is 16.0.

Ans: B

2.

Chlorine dioxide, ClO_2, reacts with aqueous sodium hydroxide to produce water and a mixture of two sodium salts, $NaClO_2$ and $NaClO_3$.

What is the mole ratio of $NaClO_2$ to $NaClO_3$ 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, Al_4C_3, reacts readily with aqueous sodium hydroxide. The two products of the reaction are $NaAlO_2$ and a hydrocarbon. Water molecules are also involved as reactants.

What is the formula of the hydrocarbon?

A CH_4 **B** C_2H_6 **C** C_3H_8 **D** C_6H_{12}

Ans: A

$Al_4C_3 + 4NaOH + 4H_2O \longrightarrow 4NaAlO_2 + C_xH_y$

balance all the Al, Na & O atoms

3Cs 12Hs required

$\therefore 3CH_4$

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 7.2 g **B** 10.6 g **C** 14.4 g **D** 21.2 g

Ans: C

$Na_2CO_3 \cdot xH_2O$

Mass of $Na^+ = 9.20\,g$

Mass of remaining $= 26.4$

$\frac{9.2}{2\times 23} = 0.2 \Rightarrow 0.2\,Na_2CO_3 \cdot xH_2O$

$0.2 \times (12 + 3\times 16) = 12 \rightarrow$ mass of CO_3

$\therefore$ mass of $H_2O = 26.4 - 12 = 14.4\,g$

6.

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

Which compound releases the largest amount of CO_2?

A 1.0 g $CaCO_3$ **B** 1.0 g Li_2CO_3 **C** 1.0 g $MgCO_3$ **D** 1.0 g Na_2CO_3

Ans: B

Calculate % of C in each case. Higher % c = most CO2.

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_2 **B** C_2H_2O **C** C_2H_4O **D** CH_2O_2

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 6×10^{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^3 of hot 6.0 mol dm^{-3} 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_3, decomposes as shown.

$$2NaN_3 \rightarrow 2Na + 3N_2$$

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^3 **B** 83 dm^3 **C** 55 dm^3 **D** 37 dm^3

Ans: B

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

- No of mol of NaN3 used = (150) / (23+3x14) = 2.308
- No of mol of N2 produced = 2.308 x 3/2 = 3.46
- 3.46 x 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 CHO_2 **B** C_2H_2O **C** C_2H_4O **D** CH_2O_2

Ans: C

12.

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

A 291 cm^3 **B** 312 cm^3 **C** 582 cm^3 **D** 624 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, $CoSO_4 \cdot xH_2O$, 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, $Na_2SO_4 \cdot xH_2O$, 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 Na_2SO_4.

What is the value of x in $Na_2SO_4 \cdot xH_2O$?

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^3 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