1. 18.0 g of H_2O

a. Moles of H_2O

Molar mass of H_2O = (2 × 1) + 16 = 18 g mol $^{-1}$

$$n = \frac{m}{M} = \frac{18.0}{18} = 1.00\ mol$$

b. Number of molecules

$$N = n \times N_A = 1.00 \times 6.02 \times 10^{23}$$
$$= 6.02 \times 10^{23}\ molecules$$

2. 2.4.40 g of CO_2

Molar mass CO_2 = 12 + (2 × 16) = 44 g mol $^{-1}$

a. Moles of CO_2

$$n = \frac{4.40}{44} = 0.100\ mol$$

b. Moles of O atoms

Each CO_2 has 2 O atoms

$$n(O) = 0.100 \times 2 = 0.200\ mol$$

c. Mass of oxygen

$$m = n \times M = 0.200 \times 16 = 3.20\ \mathrm{g}$$

3. 4.20 g of Na

Molar mass Na = 23 g mol $^{-1}$

Step 1: Moles

$$n = \frac{4.20}{23} = 0.183\ mol$$

Step 2: Number of atoms

$$\mathrm{N} = 0.183 \times 6.022 \times 10^{23}$$
$$= 1.10 \times 10^{23}\ \text{atoms}$$

4. 1.96 g of H_2SO_4

Molar mass H_2SO_4 = (2×1) + 32 + (4×16) = 98 g mol $^{-1}$

a. Moles of H_2SO_4

$$\mathrm{n} = \frac{1.96}{98} = 0.0200\ \mathrm{mol}$$

b. Oxygen

i. Moles of O

4 O atoms per molecule:

$$n(O) = 0.0200 \times 4 = 0.0800\ mol$$

ii. Mass of O

$$m = 0.0800 \times 16 = 1.28\ g$$

c. Sulfur

i. Moles of S

1 S per molecule:

$$n(S) = 0.0200\ mol$$

ii. Mass of S

$$m = 0.0200 \times 32 = 0.64\ g$$

5. 3.01×10^{24} HNO_3 molecules

a. Moles

$$n = \frac{3.01 \times 10^{24}}{6.022 \times 10^{23}} = 5.00\ mol$$

b. Mass

Molar mass HNO_3 = 1 + 14 + (3×16) = 63 g mol $^{-1}$

$$m = 5.00 \times 63 = 315\ g$$

6. **6.02×10^{22} SO_3 molecules**

a. Moles

$$n = \frac{6.02 \times 10^{22}}{6.022 \times 10^{23}} = 0.100 \text{ mol}$$

b. Mass

Molar mass SO_3 = 32 + (3×16) = 80 g mol $^{-1}$

$$m = 0.100 \times 80 = 8.00\, g$$

7. **3.00 g of Fe_2O_3**

Molar mass Fe_2O_3 = (2×56) + (3×16) = 160 g mol $^{-1}$

a. Moles of Fe_2O_3

$$n = \frac{3.00}{160} = 0.01875 \text{ mol}$$

b. Mass of Fe

2 Fe atoms per formula unit:

$$n(Fe) = 0.01875 \times 2 = 0.0375\, mol$$
$$m = 0.0375 \times 56 = 2.10\, g$$