

Solutions

Each answer shows the steps, then the **result**.

2.1

(a)

- $\text{Ca}(\text{NO}_3)_2$

(b)

- $\text{Al}_2(\text{SO}_4)_3$

2.2

- $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$

3.1 C

- Two Fe^{3+} balance three SO_4^{2-}
- $\text{Fe}_2(\text{SO}_4)_3$

3.2 C

- Empirical mass 14; $42/14 = 3$
- C_3H_6

3.3

- $\text{Mg}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})$

3.4

(a)

- moles: $\text{C} = 2.4/12 = 0.20$, $\text{H} = 0.4/1 = 0.40$, $\text{O} = 3.2/16 = 0.20$; divide by 0.20
- 1 : 2 : 1; empirical formula CH_2O

(b)

- empirical mass 30; $60/30 = 2$
- $\text{C}_2\text{H}_4\text{O}_2$

3.5

(a)

- mass of oxygen = $2.80 - 1.96 = 0.84$ g; $n(\text{Fe}) = \frac{1.96}{55.8} = 0.0351$ mol and $n(\text{O}) = \frac{0.84}{16.0} = 0.0525$ mol; ratio = 1 : 1.49 = 2 : 3, so the empirical formula is Fe_2O_3

(b)

- $\text{Fe}_2\text{O}_3(\text{s}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{Fe}(\text{s}) + 3\text{H}_2\text{O}(\text{g})$

(c)

- $\text{Fe(s)} + \text{H}_2\text{SO}_4\text{(aq)} \rightarrow \text{FeSO}_4\text{(aq)} + \text{H}_2\text{(g)}$; ionic: $\text{Fe(s)} + 2\text{H}^+\text{(aq)} \rightarrow \text{Fe}^{2+}\text{(aq)} + \text{H}_2\text{(g)}$
— the sulfate is a spectator

(d)

- The empirical formula gives only the **simplest whole-number ratio**; any molecule that is a whole-number multiple of that ratio has the same empirical formula, so the relative molecular mass is also needed