## Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

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

**2.1**

- $40 + 12 + 3 \times 16$
- **100**

**2.2**

- $4.4 \div 44$
- **0.10** mol

**2.3**

- $2Mg + O_2 \rightarrow 2MgO$
- (s), (g), (s)

**2.4**

- $0.25 \div 0.500$
- **0.50** mol/dm$^3$

**3.1**

- moles $CaCO_3 = 25 \div 100 = 0.25$
- moles CaO $= 0.25$ (1 : 1)
- mass $0.25 \times 56 =$ **14** g

**3.2**

- N $1.4 \div 14 = 0.1$; O $3.2 \div 16 = 0.2$
- ratio 1 : 2
- **$NO_2$**

**3.3**

(a) Mg $20.48 - 20.00 =$ **0.48** g; oxygen $20.80 - 20.48 =$ **0.32** g

(b) moles Mg $0.48 \div 24 = 0.02$; moles O $0.32 \div 16 = 0.02$; ratio 1 : 1; so MgO

(c) theoretical: 0.02 mol MgO $\times 40 = 0.80$ g; $0.68 \div 0.80 \times 100 =$ **85**%

(d) points to include:

- some magnesium did not react, e.g. it was not heated for long enough (An)
- some magnesium oxide smoke escaped when the lid was lifted (An)
- some magnesium may have reacted with nitrogen in the air (K)
- improvement: heat strongly until there is no further change, lifting the lid only a little (App)
- heat, cool and weigh again until the mass stays the same (heating to constant mass) (App)
- clean the ribbon with sandpaper first, so the oxide layer does not affect the mass (App)

Levels: **5–6** a full, logical answer with correct chemistry and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.