Solutions

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

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

2.1

- $4.0 + 8.0$
- **12** Ω

2.2

- its resistance decreases as the light intensity increases
- e.g. a light sensor for street lights

2.3

- **0.80** A
- the current splits between the branches and the branch currents add up

2.4

- no current in the reverse direction
- in the forward direction, current flows only above about 0.6 V and then rises steeply

3.1

- $Q = 2.0 \times 300 = 600$ C
- $E = 600 \times 12 =$ **7200** J

3.2

- a larger current makes the filament hotter
- the metal ions vibrate more
- electrons collide with the ions more often, so the resistance is higher

3.3

(a) any pair, e.g. $6.0 \div 0.60 =$ **10** Ω

(b) $2.0 \div 0.30 =$ **6.7** Ω; $6.0 \div 0.52 =$ **11.5** Ω; at higher voltage the current is larger, so the filament is hotter; its ions vibrate more, so its resistance is higher

(c) $0.40 + 0.44 = 0.84$ A; $P = 0.84 \times 4.0 =$ **3.4** W

(d) points to include:

- connect the lamp in series with an ammeter, a variable resistor and the supply (K)
- connect a voltmeter in parallel across the lamp (K)
- change the variable resistor (or supply) to set the voltage in steps, e.g. 1.0 V (K)
- record the current at each voltage (K)
- reverse the connections to take readings for negative voltages (App)
- switch off between readings so the lamp's temperature is not changed by the test itself; repeat and plot I against V (An)

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