Solutions

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

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

2.1

- 6.0×10
- **60** N

2.2

- $500 - 350 =$ **150** N
- forwards

2.3

- a scalar has size only, e.g. speed, mass, energy
- a vector has size and direction, e.g. velocity, force

2.4

Any two (1 mark each): greater speed, tiredness, alcohol or drugs, distractions such as a phone

3.1

- at first her weight is greater than air resistance, so she accelerates
- as her speed increases, air resistance increases
- when air resistance equals her weight, the resultant force is zero and she falls at constant speed

3.2

- $a = 4500 \div 900 = 5.0$ m/s^2
- $t = 20 \div 5.0 =$ **4.0** s

3.3

(a) $26.0 - 20.0 = 6.0$ cm; $k = 3.0 \div 0.060 =$ **50** N/m

(b) up to 4.0 N each newton adds 2.0 cm; from 4.0 to 5.0 N it adds 2.5 cm, and from 5.0 to 6.0 N, 3.5 cm; so extension is no longer proportional to force; limit of proportionality at about 4.0 N

(c) extension 5.0 cm; $F = 50 \times 0.050 = 2.5$ N; mass $= 2.5 \div 10 =$ **0.25** kg

(d) points to include:

- clamp the spring to a stand, with a metre rule held vertically beside it (K)
- measure the length with no load, reading at eye level to avoid parallax (K)
- use a fixed pointer on the bottom of the spring (App)
- add loads in equal steps and measure the length each time (K)
- calculate extension = length − original length; plot force against extension (An)
- safety: clamp the stand to the bench and keep feet away in case the masses fall (App)

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.