

Solutions

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

2.1

- “the mass is 60” gives a magnitude only
- a physical quantity also needs a **unit** — e.g. 60 kg

2.2

- an apple is about 100 g (from the estimate table)
- $1\text{ g} = 10^{-3}\text{ kg}$, so $100\text{ g} = 100 \times 10^{-3}\text{ kg} = \mathbf{0.1\text{ kg}}$
- any value $\sim 0.05\text{--}0.2\text{ kg}$ with a unit is accepted

2.3

- speed of light $= 3.0 \times 10^8\text{ m s}^{-1}$
- write as $a \times 10^n$ with $1 \leq a < 10$: here $3.0 \times 10^8\text{ m s}^{-1}$
- coefficient 3.0 is nearer 1 than 10, so the order of magnitude is $\mathbf{10^8\text{ m s}^{-1}}$

2.4

- an adult is about 1.7 m tall, so a room is a little taller: $\mathbf{2.5\text{ m}}$
- any value $\sim 2\text{--}3\text{ m}$ with a unit is accepted

3.1 D

- every physical quantity has a **magnitude** and a **unit**
- “1.5” is not a length; “1.5 m” is
- **A** and **B** add a direction — that describes a *vector*, not every quantity
- **C** a prefix (k, m, μ) is not a unit

3.2 B

- the estimate table gives an adult’s mass $\sim 70\text{ kg}$
- **A** 7 kg is a cat; **C** 700 kg a horse; **D** 7000 kg a truck

3.3

- 1 day $= 24\text{ h}$; keep the units so they cancel

$$24\text{ h} \times \frac{60\text{ min}}{1\text{ h}} \times \frac{60\text{ s}}{1\text{ min}} = 86\,400\text{ s}$$

- $86\,400\text{ s} = 8.64 \times 10^4\text{ s} \approx 9 \times 10^4\text{ s}$ (1 s.f.)
- leading digit $9 \geq 5$, so round up: order of magnitude $\mathbf{10^5\text{ s}}$

3.4

- $s = 1\text{ km} = 1000\text{ m}$, $v = 30\text{ m s}^{-1}$

$$t = \frac{s}{v} = \frac{1000\text{ m}}{30\text{ m s}^{-1}} \approx 33\text{ s}$$

- $33\text{ s} = 3.3 \times 10^1\text{ s} \approx 3 \times 10^1\text{ s}$ (1 s.f.)
- leading digit $3 < 5$, so order of magnitude $\mathbf{10^1\text{ s}}$

3.5 B

$$p = \frac{F}{A} = \frac{700\text{ N}}{0.02\text{ m}^2} = 3.5 \times 10^4\text{ N m}^{-2} = \mathbf{3.5 \times 10^4\text{ Pa}}$$

- **A** is too small (wrong A , or $F \times A$)
- **C** and **D** are far too large (area probably left in cm^2)