

FULLY WORKED SOLUTIONS

Chapter 1: Measuring up

Chapter questions

1.
 - (a) $24.3 \text{ mm} = 24.3 \times 10^{-3} = 2.43 \times 10^{-2} \text{ m}$
 - (b) $1.5 \times 10^5 \text{ km} = 1.5 \times 10^5 \times 10^3 = 1.5 \times 10^8 \text{ m}$
 - (c) $4.05 \text{ }\mu\text{m} = 4.05 \times 10^{-6} \text{ m}$
 - (d) $170 \text{ mm} = 170 \times 10^6 = 1.7 \times 10^8 \text{ m}$
2.
 - (a) $235 \text{ g} = 235/10^3 = 2.35 \times 10^{-1} \text{ kg}$
 - (b) $0.017 \text{ g} = 1.7 \times 10^{-2}/10^3 = 1.7 \times 10^{-5} \text{ kg}$
 - (c) $1.67 \text{ mg} = 1.67 \times 10^{-3}/10^3 = 1.67 \times 10^{-6} \text{ kg}$
 - (d) $4892 \text{ }\mu\text{g} = 4892 \times 10^{-6}/10^3 = 4.892 \times 10^{-6} \text{ kg}$
 - (e) $1.2 \times 10^{-7} \text{ dg} = 1.2 \times 10^{-7} \times 10^{-1}/10^3 = 1.2 \times 10^{-11} \text{ kg}$
3.
 - (a) $34.5 \text{ m} + 1.70 \text{ km} + 4 \text{ m} + 38.37 \text{ km}$
 $= 34.5 \text{ m} + 1700 \text{ m} + 4 \text{ m} + 38370 \text{ m} = 40\,108.5 \text{ m} = 4.01085 \times 10^4 \text{ m}$
Round this to the nearest 1/100 km: 40.11 km or $4.011 \times 10^4 \text{ m}$
 - (b) $54 \text{ }\mu\text{g} + 32.56 \text{ mg} + 3.8067 \text{ cg}$
 $= 54 \text{ }\mu\text{g} + 32\,560 \text{ }\mu\text{g} + 38\,067 \text{ }\mu\text{g} = 70\,681 \text{ }\mu\text{g} = 7.0681 \times 10^{-2} \text{ g}$
Round this to nearest 1/100 mg: $7.068 \times 10^{-2} \text{ g}$ or $7.068 \times 10^1 \text{ mg}$
 - (c) $7.6 \text{ ms} + 23.78 \text{ s} + 4\,878.2 \text{ ms}$
 $= 7.6 \text{ ms} + 23\,780 \text{ ms} + 4\,878.2 \text{ ms} = 28\,665.8 \text{ ms} = 28.6658 \text{ s}$
Round this to the nearest 1/100 s: $2.867 \times 10^1 \text{ s}$ or 28.67 s
4.
 - (a) $78.2 \text{ mm} + 140 \text{ cm} - 17.28 \text{ mm}$
 $= 78.2 \text{ mm} + 1400 \text{ mm} - 17.28 \text{ mm} = 1460.92 \text{ mm} = 1.46092 \text{ m}$
Round this to the nearest 1/100 m: 1.46 m or 146 cm
 - (b) $340 \text{ m} - 23.68 \text{ cm}$
 $= 34000 \text{ cm} - 23.68 \text{ cm} = 33976.32 \text{ cm} = 339.7632 \text{ m}$
Round this to the nearest 10 m: 340 m
 - (c) $233.90 \text{ }\mu\text{s} - 5304 \text{ ns}$
 $233\,900 \text{ ns} - 5304 \text{ ns} = 228\,596 \text{ ns} = 228.596 \text{ }\mu\text{s}$
Round this to the nearest 1/100 μs : 228.60 μs
5.
 - (a) 4 (Rule 1)
 - (b) 4 (Rules 1, 2)
 - (c) 4 (Rules 1, 3, 2)

- (d) 1 (Rules 1, 4)
- (e) 5 (Rules 1, 3, 2)
6. (a) $34\,500\text{ s} \times 18\text{ N} = 6.21 \times 10^5\text{ Ns}$
Round to 2 s.d.: $6.2 \times 10^5\text{ Ns}$
- (b) $67\text{ kg} \times 9.81\text{ m s}^{-2} = 6.5727 \times 10^2\text{ kg m s}^{-2}$
Round to 2 s.d.: $6.6 \times 10^2\text{ kg m s}^{-2}$
- (c) $(3.68\text{ mm})^2 = 13.5424\text{ mm}^2$
Round to 3 s.d.: 13.5 mm^2
- (d) $650.0\text{ m}/62.14\text{ s} = 10.46025\text{ m s}^{-1}$
Round to 4 s.d.: 10.46 m s^{-1}
- (e) $3\,214\text{ N}/8.54 \times 10^3\text{ kg} = 0.376346\text{ N/kg}$
Round to 3 s.d.: 0.376 N/kg
- (f) $2.0\text{ m}/34.5\text{ mm} = 2000\text{ mm}/34.5\text{ mm} = 5.7971 \times 10^1$
Round to 2 s.d.: 5.8×10^1
- (g) $(34.7120\text{ kg} \times 35.2\text{ m})/764\text{ s} = 1.5992963\text{ kg m s}^{-1}$
Round to 3 s.d.: 1.60 kg m s^{-1}
- (h) $(200\text{ m} \times 10.3\text{ m})/(6.72\text{ s} \times 37.8\text{ s}) = 8.1097254\text{ m}^2\text{ s}^{-2}$
Round to 1 s.d.: $8\text{ m}^2\text{ s}^{-2}$

Review questions

5. (a) $403\text{ nm} = 403 \times 10^{-9}\text{ m} = 4.07 \times 10^{-7}\text{ m}$
- (b) $72\text{ km} = 72 \times 10^3\text{ m} = 7.2 \times 10^4\text{ m}$
- (c) $3.0\text{ mm} = 3.0 \times 10^{-3}\text{ m}$
- (d) $6.5 \times 10^3\text{ km} = 6.5 \times 10^3 \times 10^3\text{ m} = 6.5 \times 10^6\text{ m}$
6. (a) $23\text{ g} = \frac{23}{10^3}\text{ kg} = 2.3 \times 10^{-2}\text{ kg}$
- (b) $2.45\text{ cg} = \frac{2.45 \times 10^{-2}}{10^3}\text{ kg} = 2.45 \times 10^{-5}\text{ kg}$
- (c) $568\,900\text{ g} = \frac{568900}{10^3}\text{ kg} = 568.9\text{ kg}$
- (d) $3.8 \times 10^8\text{ mg} = \frac{3.8 \times 10^8 \times 10^{-3}}{10^3}\text{ kg} = 380\text{ kg}$
7. (a) 21.8 cm, 0.05 cm
- (b) 0.5 A, 0.025 A

- (c) 5.5 N, 0.25 N
8. (a) (i) $A = 4\pi r^2$
 $= 4\pi(1.2)^2$
 $= 18.1 \text{ mm}^2$
 $\approx 18 \text{ mm}^2$
- (ii) $V = \frac{4}{3}\pi r^3$
 $= \frac{4}{3}\pi(1.2)^3$
 $= 7.2 \text{ mm}^3$
- (b) (i) $A = 6s^2$
 $= 6 \times (3)^2$
 $= 54 \text{ cm}^2$
 $\approx 50 \text{ cm}^2$
- (ii) $V = s^3$
 $= (3)^3$
 $= 27 \text{ cm}^3$
 $\approx 30 \text{ cm}^3$
- (c) (i) $A = 2 \times (1.80 \times 0.20) + 2 \times (0.20 \times 2.05) + 2 \times (2.05 \times 1.80)$
 $= 0.72 + 0.82 + 7.38$
 $= 8.9 \text{ m}^2$
- (ii) $V = 0.2 \times 1.80 \times 2.05$
 $= 0.7 \text{ m}^3$
- (d) (i) $r = 0.10 \text{ mm}$
 $A = 2\pi r^2 + 2\pi r h$
 $= 2\pi(0.10)^2 + 2\pi(0.10 \times 100)$
 $= 0.63 + 60$
 $\approx 60 \text{ mm}^2$
- (ii) $V = \pi r^2 h$
 $= \pi \times (0.10)^2 \times 100$
 $\approx 3 \text{ mm}^3$
9. (a) 1.60×10^2
(b) 2 800 m
(c) 6.04×10^3

(d) 2×10^{-1}

(e) 4.4×10^{-19}

(f) $56.040 \text{ m} + 0.12 \text{ m} = 56.16 \text{ m}$

10. (a) $A = (5.310 \times 2.4) + 2(3.000 \times 2.4) + (4.000 \times 2.4) + (0.49 \times 2.4) + (0.82 \times 0.3)$
 $= 13 + 14 + 9.6 + 1.2 + 0.2$
 $\approx 38 \text{ m}^2$

(b) Number of litres = $\frac{38 \times 3}{10} \approx 11 \text{ L}$

13. $V = Ah$

$= (75 \times 10^4) \times 26$

$= 1.95 \times 10^7 \text{ m}^3$

As $1 \text{ km} = 1000 \text{ m}$,

$V = \frac{1.95 \times 10^7}{1000^3} \text{ km}^3$

$= 0.0195 \text{ km}^3$