

# Additional Topic 1 answers

## Topic 1 Measurements and uncertainties

### 1.1 Measurement in physics

Many of the calculations in the problems of this section have been performed without a calculator and are estimates. Your answers may differ.

- 1  $6.4 \times 10^{41}$
- 2  $3 \times 10^{79}$
- 3 16 000 (assuming a 4000 kg elephant)
- 4 100 000 years
- 5  $2 \times 10^{-7} \text{ N}$
- 6  $6.2 \times 10^9 \text{ m s}^{-2}$

### 1.2 Uncertainties and errors

- 7  $(1.8 \pm 0.4) \times 10^4 \text{ kg m}^{-3}$
- 8 a  $(6.5 \pm 0.1) \times 10^3 \text{ cm}^2$   
b  $(4.9 \pm 0.1) \times 10^4 \text{ cm}^3$
- 9 17%
- 10 a no  
b systematic
- 11 The line of best fit intersects at 12 mA. The extreme line within the error bars intersects at 6 mA. So no line can be made to go through the origin for this data. A systematic error of about 1 mA is required.
- 12  $2.4 \text{ m s}^{-2}$ ;  $3.1 \text{ m s}^{-1}$
- 13 sphere
- 14  $\nu = 0.2(1 - e^{-0.5t})$
- 15 b  $c = 2$

### 1.3 Vectors and scalars

- 16 7.79 km at  $34.5^\circ$
- 17  $C = (-4.00, 1.00)$
- 18 a  $(x_2 - x_1, y_2 - y_1)$   
b  $(x_1 - x_2, y_1 - y_2)$   
c  $\sqrt{x_1^2 + y_1^2}$
- 19 a  $704 \text{ m s}^{-1}$  in magnitude  
b zero