Exam-style questions

1 What is the equivalent of 80 years in seconds?

   **A** 10^7 **B** 10^9 **C** 10^{11} **D** 10^{13}

2 A book has 500 pages (printed on both sides). The width of the book excluding the covers is 2.5 cm. What is the approximate width in mm of one sheet of paper?

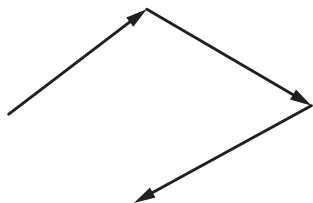   **A** 0.01   **B** 0.1   **C** 0.5   **D** 1.0

3 The speed of sound is approximately $330 \, \mathrm{m \, s^{-1}}$. A storm is 3 km away. Approximately how much later after seeing lightning will thunder be heard?

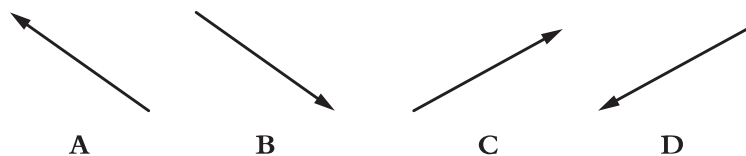   **A** 0.1 s   **B** 1 s   **C** 3 s   **D** 10 s

4 In which of the following diagrams do the three forces add up to zero?
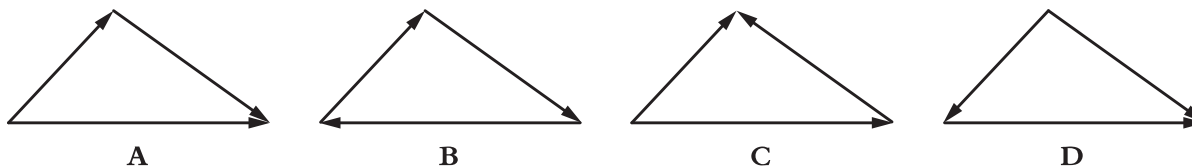
5 Three forces act on a body as shown.

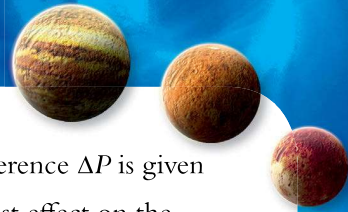Which fourth force is required so that the four forces add up to zero?

6 A force of 25 N acts normally on a surface of area $5.0 \, \mathrm{cm^2}$. What is the pressure on the surface in $\mathrm{N \, m^{-2}}$?

    A 5   **B** 5×10^4 **C** 5.0   **D** 5.0×10^4

7 The side of a cube is measured with an uncertainty of 2%. What is the uncertainty in the volume of the cube?

    A 2%   **B** 4%   **C** 6%   **D** 8%

8 The flow rate Q through a tube of length L and radius r whose ends are kept at a pressure difference ΔP is given by $Q = \dfrac{cr^4 \Delta P}{L}$, where c is a constant. The percentage uncertainty of which quantity has the largest effect on the percentage uncertainty in Q?

        A r

        B ΔP

        C L

        D r, L and ΔP each give the same contribution

9 The force of air resistance F on a car depends on speed v through the formula $F = av^2 + bv$, where a and b are constants. Which of the following graphs will result in a straight–line graph?

        A F against v

        B F against v^2

        C $\dfrac{F}{v}$ against v

        D $\dfrac{F}{v}$ against $\dfrac{1}{v}$

10 The diagram shows the temperature of a liquid before and after heating.


What is the best estimate for the temperature increase of the liquid?

        A (44.0 ± 0.5) degrees

        B (44 ± 1.0) degrees

        C (44 ± 1) degrees

        D (44.0 ± 2.0) degrees

11 A student wishes to measure the acceleration of free fall by letting a ping pong ball drop from one fixed height from the floor. He measures the height. Using a stopwatch, he measures the time for the ball to drop to the floor. He then uses the equation $h = \frac{1}{2}gt^2$ to calculate g.

State and discuss **three** improvements to the student's lab experiment.   **[6]**

12 A man wants to cross a river with a motorboat. The speed of the motorboat in still water is $4.0\,\mathrm{m\,s^{-1}}$. The river is 30 m wide. There is a current in the river whose speed with respect to the shore is $3.0\,\mathrm{m\,s^{-1}}$.
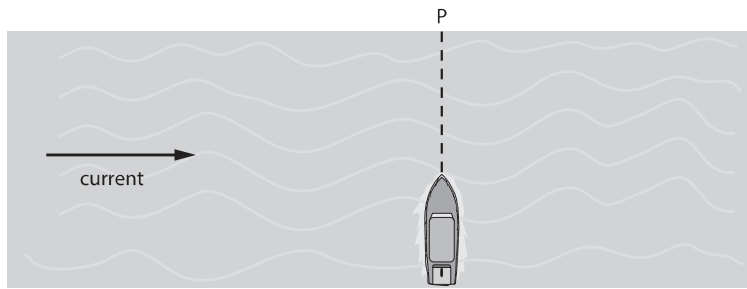
    a The man aims the boat towards P. Determine the distance from P at which he will reach the shore. **[2]**

    b A woman in an identical boat leaves from the same spot as the man but wants to land at P. Determine the direction in which she has to turn her boat to do this. **[3]**

    c Determine which person reaches the shore in the least time. **[2]**

13 A student investigated the oscillation period, T, of a clamped rod for various loads F applied to the rod.

She graphed the following results.
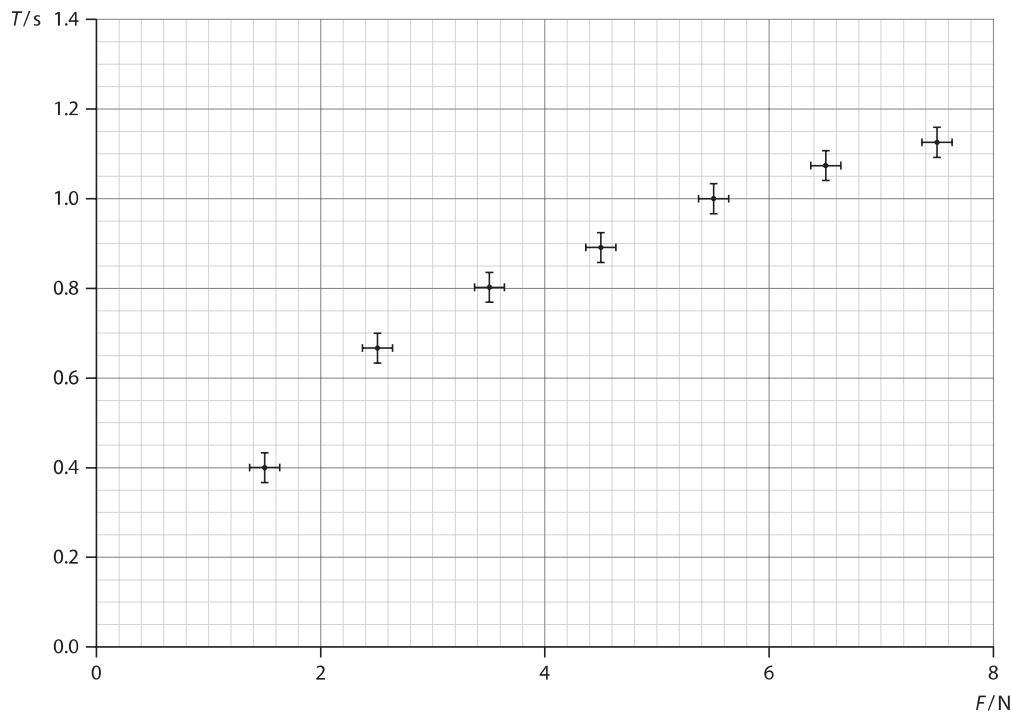
    a Copy the graph and draw the best-fit line for these data. **[2]**

    b Predict the period of oscillation of the rod when no load is applied to it. **[1]**

    c The student claims that T is proportional to F. Explain to the student how the results show she is not correct. **[2]**

    d Determine the absolute uncertainty in T^2 for the data point corresponding to $F = 5.5\,\mathrm{N}$. **[2]**

    e Another student suspects that T^2 is proportional to F. By drawing a graph of T^2 against F discuss whether this student's claim is correct. **[4]**

    f Calculate the slope of the graph drawn in **e**, including its uncertainty. **[3]**