## EXAM-STYLE QUESTIONS

### Multiple-choice questions

**1** Which of the following statements is a correct definition for work done?

**A** The product of force and distance

**B** The product of force and distance moved in the direction of the force

**C** The product of force and displacement

**D** The product of power and time

**2** A child pushes with a force of 100 N on a wall of mass 250 kg. The wall does not move. The work done by the child on the wall is

**A** 0 J.

**B** 100 J.

**C** 25 kJ.

**D** 250 kJ.

**3** The best estimate of the kinetic energy of a hydrogen atom of mass $1.67 \times 10^{-24}$ g moving at 500 $ms^{-1}$ is

**A** $4 \times 10^{-25}$ J.

**B** $2 \times 10^{-22}$ J.

**C** $4 \times 10^{-22}$ J.

**D** $2 \times 10^{-19}$ J.

**4** The best estimate of the tension in a piece of elastic of spring constant 30 $Nm^{-1}$ stretched by 12.5 cm is

**A** 1.9 N.

**B** 3.8 N.

**C** 190 N.

**D** 380 N.

**5** A centripetal force of 45 N causes a mass to move in a circular path of circumference 12.0 m. The work done on the mass by the centripetal force is

**A** 0 J.

**B** 45 J.

**C** 540 J.

**D** 5.4 kJ.

**6** A book of mass 0.80 kg is pulled along a smooth surface by a force of 6.0 N applied at an angle of 60° to the horizontal. The book slides along the surface a distance of 1.5 m. The work done on the book by the force is

**A** 0 J.

**B** 4.5 J.

**C** 7.2 J.

**D** 9.0 J.

47

**7** A moving body has kinetic energy of *E*. How much work must be done on the body to increase its speed by a factor of three?

**A** $\frac{1}{3}E$

**B** $3E$

**C** $8E$

**D** $9E$

**8** If a car's engine provides a driving force, $F$, and the car travels a distance, $s$, at a speed, $v$, during a time, $t$, which of the following statements about the power, $P$, developed by the engine is correct:

**A** $P = \frac{\mathrm{F}s^2}{\mathrm{t}}$

**B** $P = \mathrm{Ft}$

**C** $P = \mathrm{Fv}$

**D** $P = \frac{\mathrm{F}v^2}{2}$

**9** A firework rocket of mass 100 g uses 150 J of chemical energy to reach a height of 60 m. Which of the following is the best estimate of the efficiency of the rocket?

**A** 0.2

**B** 0.3

**C** 0.4

**D** 0.5

**10** The human body is about 25% efficient. If an athlete accelerates a 7.3 kg shot from rest to a speed of 14 $ms^{-1}$ in a time of 1.5 s, the power he needs to generate is approximately:

**A** 120 W

**B** 480 W

**C** 960 W

**D** 1900 W

**Short-answer questions**

**11** A hammer of mass 1.6 kg moving at 2.0 $ms^{-1}$ hits the head of a nail, comes to a stop, and drives the nail into a block of wood by a distance of 1.2 cm.

**a** Calculate the kinetic energy lost by the hammer. **[2]**

**b** Calculate the average force applied to the nail. **[2]**

**12** A 5 kg mass is moving at 6 $ms^{-1}$.

**a** Calculate the kinetic energy of the mass. **[2]**

**b** Determine how much work must be done on the mass to increase its kinetic energy to 200 J. **[1]**

**c** Calculate the speed of the mass if its kinetic energy = 200 J. **[2]**

**13** Figure 3.3 shows the force required to extend a spring plotted against the spring's extension.

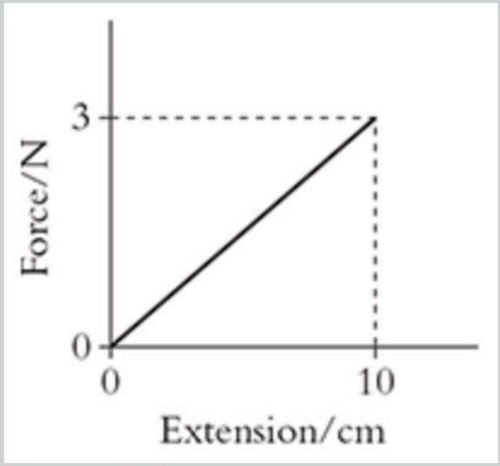


**Figure 3.3**

**a** Outline how the graph shows that the spring obeys Hooke's law. **[1]**

**b** Use the graph to calculate the

**i** spring constant of the spring. **[2]**

**ii** amount of elastic potential energy stored in the spring when it has been extended by 10 cm. **[2]**

**14** A drinking glass falls to the floor from a table of height 1.2 m. Manufacturing statistics claim that the glass is likely to break if it hits the floor at a speed of more than 3.0 $ms^{-1}$. If the drinking glass has a mass of 150 g, taking $g$ = 9.81 $ms^{-2}$ and ignoring any effects due to air friction,

**a** show that the glass loses about 1.8 J of gravitational potential energy in falling to the floor. **[1]**

**b** state the kinetic energy of the glass just before it hits the floor. **[1]**

**c** determine whether the glass is likely to break. **[2]**

**15** A bow has an effective spring constant of 270 $Nm^{-1}$, and its string is drawn back a distance of 12 cm. When released, the bow fires an arrow of mass 30 g at an initial speed of X $ms^{-1}$.

**a** Calculate the elastic potential energy stored in the bow when its string is drawn back. **[1]**

**b** Calculate the kinetic energy of the arrow when the string is released. **[1]**

**c** Calculate the efficiency of the bow. **[1]**

**d** Suggest in which forms the 'lost' energy has been transferred. **[2]**

**16** A librarian is filling a shelf with Physics books, each of which has a weight of 19.0 N. The librarian lifts each book a distance of 1.4 m, using up 798 J of energy in a time of 8 minutes.

**a** Calculate how many books the librarian is able to put on the shelf. ($g$ = 10 $Nkg^{-1}$) **[2]**

**b** Calculate the useful power developed by the librarian. **[1]**

**c** Suggest why the actual power developed by the librarian is likely to be significantly higher than your answer to **part b**. **[2]**

**17 a** Define what is meant by the term *power*. **[1]**

**b** A boy, of mass 50 kg, climbing a ladder, reaches a height of 4.5 m in a time of 12 s. Calculate the power developed by the boy. **[2]**

**c** If the boy is 25% efficient, determine how much energy he used up to make the climb. **[2]**

**18** A keen engineering student wants to build a set of weighing scales to find his own weight—and that of his friends. He has a large bag full of springs of spring constant 250 $Nm^{-1}$

**a** Suggest how the student can determine his weight using the springs he has as well as any other equipment he will require. **[3]**

**b** If the maximum amount that one of his springs can compress is 5.0 cm and the student's mass is 65 kg, calculate the minimum number of springs he will need to use. ($g$ = 9.81 $Nkg^{-1}$) **[2]**

**19** Three boys are trying to find out who is the most powerful. Table 3.2 shows some data on how they performed during a climbing test. ($g$ = 10 $Nkg^{-1}$)

| Name | Mass / kg | Height climbed / m | Time taken / s |
|---|---|---|---|
| George | 75.0 | 4.5 | 8.0 |
| Remy | 68.0 | 5.5 | 9.0 |
| Andreas | 82.0 | 4.0 | 7.0 |

**Table 3.2**

**a** Which boy does the most work? **[3]**

**b** Which boy is the most powerful? **[2]**