GradeMax

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Thursday 8 January 2026

Afternoon (Time: 1 hour 30 minutes)

Paper reference **WPH11/01**

Physics

International Advanced Subsidiary/Advanced Level
UNIT 1: Mechanics and Materials

You must have:
Scientific calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Show all your working out** in calculations and **include units** where appropriate.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In the question marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.
- The list of data, formulae and relationships is printed at the end of this booklet.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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SECTION A

Answer ALL questions.

For questions 1–10, in Section A, select one answer from A to D and put a cross in the box ☒. If you change your mind, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Which of the following units can only be used for a vector quantity?

☒ **A** J

☒ **B** kg

☒ **C** N

☒ **D** W

(Total for Question 1 = 1 mark)

2 An apple falls freely from rest until it reaches the ground.

The apple falls a distance s in a time t.

Which of the following gives the relationship between s and t?

☒ **A** $s \propto t^{-1}$

☒ **B** $s \propto \sqrt{t}$

☒ **C** $s \propto t$

☒ **D** $s \propto t^2$

(Total for Question 2 = 1 mark)

3 A white ball moving with velocity v collides with a stationary red ball of the same mass.

After the collision, the white ball is stationary and the red ball moves with velocity v.

Which row of the table describes what happens to the total kinetic energy and total momentum of the balls during the collision?

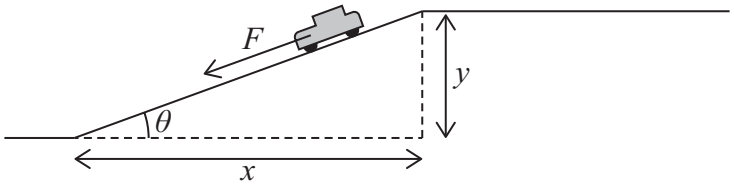
	Total kinetic energy	Total momentum
☒ **A**	decreases	decreases
☒ **B**	decreases	stays the same
☒ **C**	stays the same	decreases
☒ **D**	stays the same	stays the same

(Total for Question 3 = 1 mark)

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4 A toy car rolled down a ramp. The ramp was at an angle θ to the horizontal. The resultant force on the car was F. The car moved a horizontal distance x and a vertical distance y, as shown.



Which of the following expressions gives the work done by F as the car moved down the ramp?

☒ **A** Fx

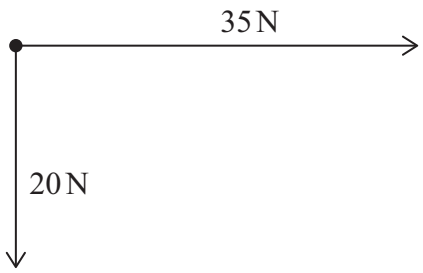
☒ **B** $\dfrac{Fx}{\cos\theta}$

☒ **C** Fy

☒ **D** $Fy\sin\theta$

(Total for Question 4 = 1 mark)

5 A force of 20 N and a force of 35 N act at a point. The forces act at right angles to each other, as shown.



Which of the following expressions gives the magnitude of the resultant of these forces in N?

☒ **A** $20 + 35$

☒ **B** $\sqrt{20 + 35}$

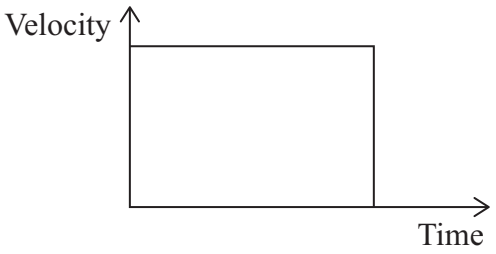
☒ **C** $20^2 + 35^2$

☒ **D** $\sqrt{(20^2 + 35^2)}$

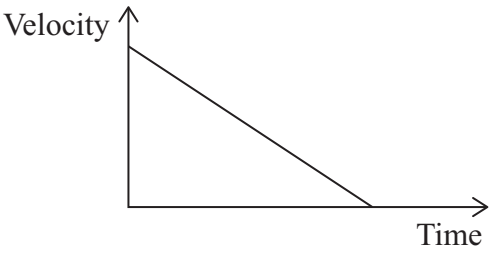
(Total for Question 5 = 1 mark)

6 A driver applies the brakes to stop a car. The car has a constant deceleration.

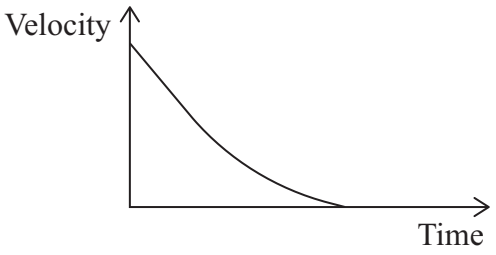
Which of the following shows the velocity-time graph for the car as the brakes are applied?



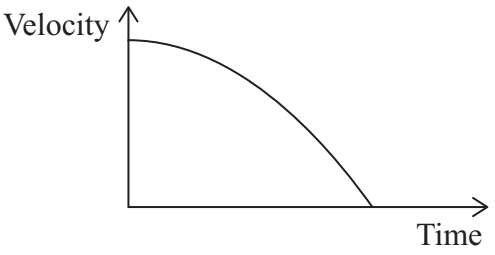
☒ **A**



☒ **B**



☒ **C**



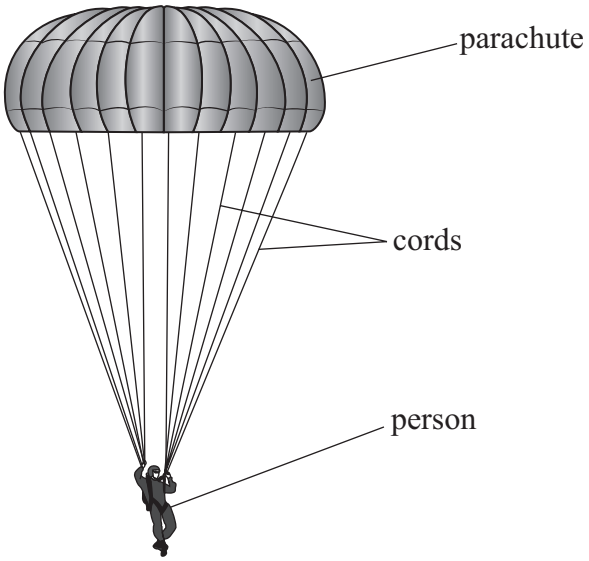
☒ **D**

(Total for Question 6 = 1 mark)

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7 A person doing a parachute jump falls at terminal velocity. The person is connected to the parachute by cords, as shown.



Which of the following is the Newton's third law pair to the force of the cords on the parachute?

- ☒ **A** The air resistance on the parachute
- ☒ **B** The force of the cords on the person
- ☒ **C** The force of the parachute on the cords
- ☒ **D** The weight of the person

(Total for Question 7 = 1 mark)

8 A student applied a tensile force to a metal wire of length x and cross-sectional area A.

The extension of the wire was Δx.

The student applied the same force to a second wire made of the same material.

The extension of the second wire was $\frac{\Delta x}{2}$.

Which row of the table could show the length and cross-sectional area of the second wire?

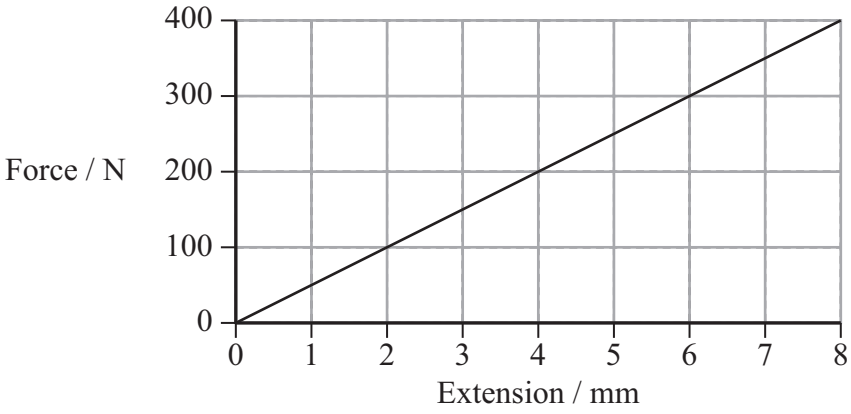
	Length	Cross-sectional area
☒ **A**	x	$0.5A$
☒ **B**	x	$2A$
☒ **C**	$2x$	$0.5A$
☒ **D**	$2x$	$2A$

(Total for Question 8 = 1 mark)

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9 The force-extension graph for a spring is shown.



A tensile force of 50 N is applied to the spring.

An additional tensile force of 300 N is then applied to the spring.

Which expression gives the change in elastic strain energy, in J, when the additional force is applied?

☒ **A** $\dfrac{300 \times 6 \times 10^{-3}}{2}$

☒ **B** $\dfrac{(300 + 50) \times 6 \times 10^{-3}}{2}$

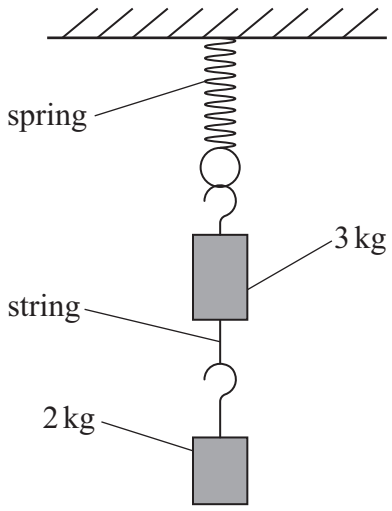
☒ **C** $\dfrac{(300 + 50 + 50) \times 6 \times 10^{-3}}{2}$

☒ **D** $\dfrac{(300 + 50) \times 7 \times 10^{-3}}{2}$

(Total for Question 9 = 1 mark)

10 A student hangs a 3 kg mass and a 2 kg mass from a spring, as shown.

The forces on the 3 kg mass are in equilibrium.



The string holding the 2 kg mass breaks.

Which expression gives the initial upward acceleration of the 3 kg mass in terms of g?

☒ **A** $\frac{2g}{3}$

☒ **B** $\frac{5g}{3}$

☒ **C** $2g$

☒ **D** $5g$

(Total for Question 10 = 1 mark)

TOTAL FOR SECTION A = 10 MARKS

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SECTION B

Answer ALL questions in the spaces provided.

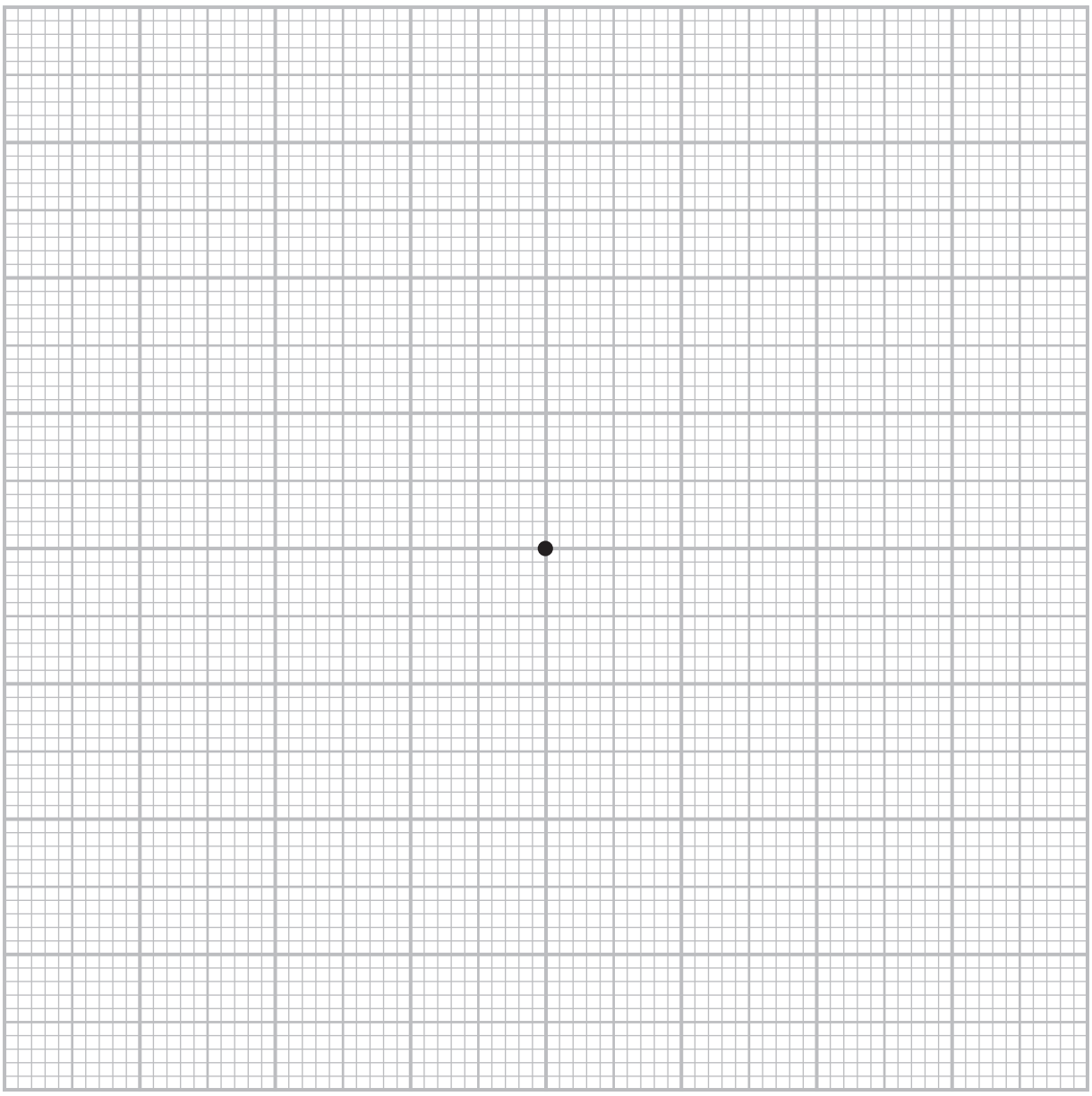
11 A car accelerates from rest on a horizontal road.

The engine causes a forward force F on the car of 7500 N.

The weight W of the car is 15 000 N.

The road exerts a normal contact force N on the car.

Complete the free-body force diagram for the car at the instant the acceleration begins.



(Total for Question 11 = 2 marks)

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12 A crane lifts a load of 3400 N through a distance of 26 m.

The power input to the crane is 5.7 kW. The efficiency is 0.38

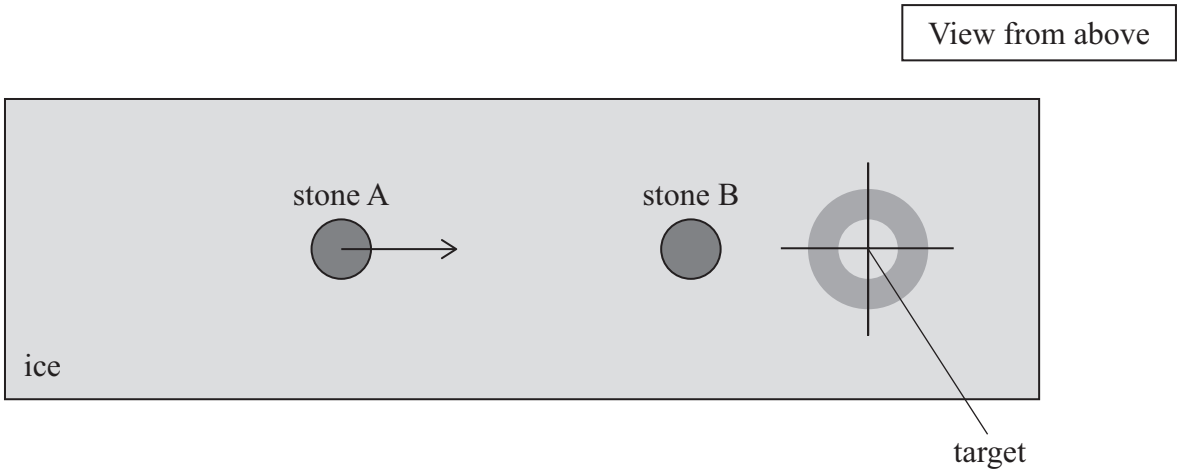
Calculate the time taken for the crane to lift the load.

Time taken = ...

(Total for Question 12 = 4 marks)

13 In a game called 'curling', players slide circular 'stones' across ice towards a target.

In one game, stone A moves towards the target, and stone B is stationary. Stone A is about to collide with stone B, as shown.



(a) During the collision, there is a resultant force on stone A and a resultant force on stone B in the opposite direction. These forces have the same magnitude and act for the same time.

Explain how Newton's second law predicts that momentum is conserved when stone A collides with stone B.

(2)

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(b) Before the collision, stone A had a kinetic energy of 3.8 J. Stone B was stationary.

After the collision, stone B moved with a speed of 0.45 m s^{-1}.

Stone A will slide past the target if the momentum of stone A after the collision is greater than 5.5 kg m s^{-1}.

Deduce whether stone A will slide past the target.

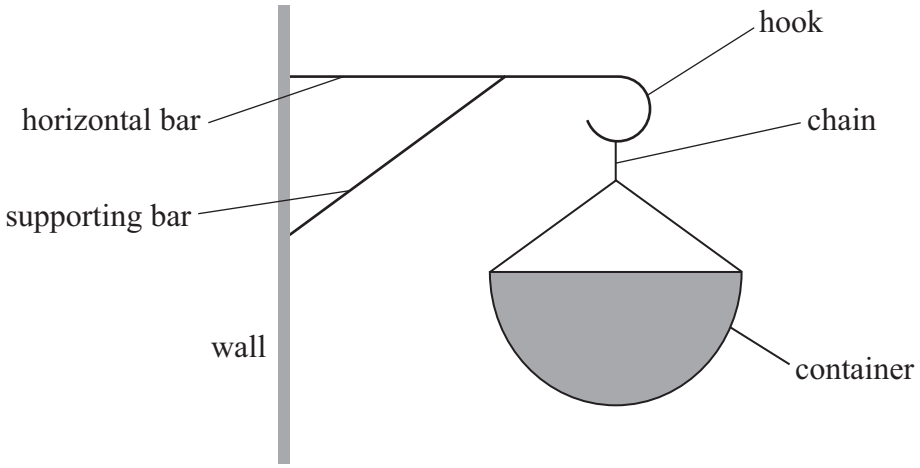
mass of stone A = 18 kg
mass of stone B = 17 kg

(5)

(Total for Question 13 = 7 marks)

14 A container is used to hold plants. The container hangs by a chain from a bracket attached to a wall, as shown.

Not to scale



The bracket has a horizontal bar with a hook at one end. There is a supporting bar beneath the horizontal bar.

(a) The container is in equilibrium.

State why the centre of gravity of the container is vertically below the chain.

(1)

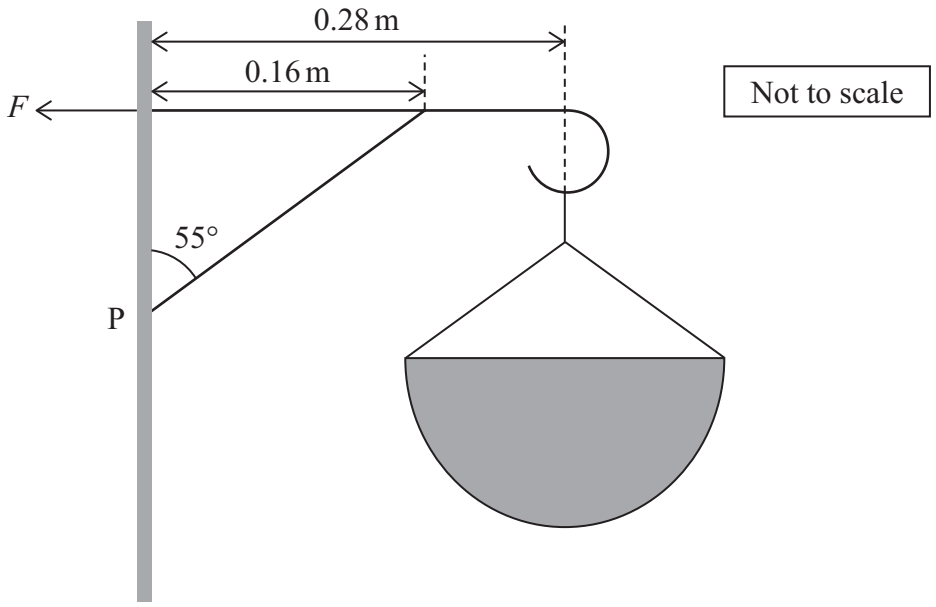
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(b) A screw in the wall exerts a force F on the horizontal bar, as shown.



The weight of the container is 34 N.

The mass of the bracket is negligible.

Determine force F.
You should take moments about point P.

(4)

$F =$ .....

(Total for Question 14 = 5 marks)

15 A can of spray-paint contains a paint and a solvent, which are both liquids. The can also contains a ball bearing.

When the can is moved, the ball bearing moves through the paint.

(a) Stokes' law applies as the ball bearing moves through the paint.

State the conditions for Stokes' law to apply.

(2)

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(b) Stokes' law applies as the ball bearing moves through the paint at a constant velocity. The ball bearing moves a distance of 5.6 cm in a time of 1.3 s.

Calculate the viscous drag due to the paint acting on the ball bearing.

radius of ball bearing = 0.90 mm
viscosity of paint = 0.15 Pa s

(3)

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Viscous drag due to paint = ...

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(c) When the can is shaken, the ball bearing moves. This causes the paint and the solvent to form a mixture.

The viscosity of the mixture is different from the viscosity of the paint.

The ball bearing falls through the mixture at terminal velocity.

Calculate the viscous drag due to the mixture on the ball bearing.

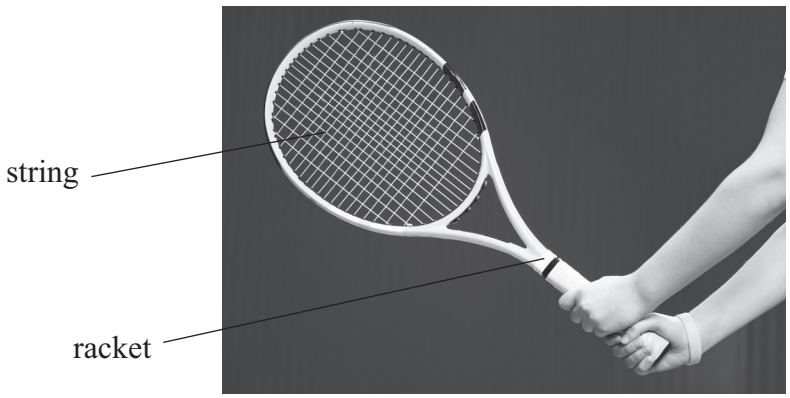
mass of ball bearing = 2.4×10^{-5} kg
density of mixture = 1.5×10^{3} kg m^{-3}
radius of ball bearing = 0.90 mm

(5)

Viscous drag due to mixture = ...

(Total for Question 15 = 10 marks)

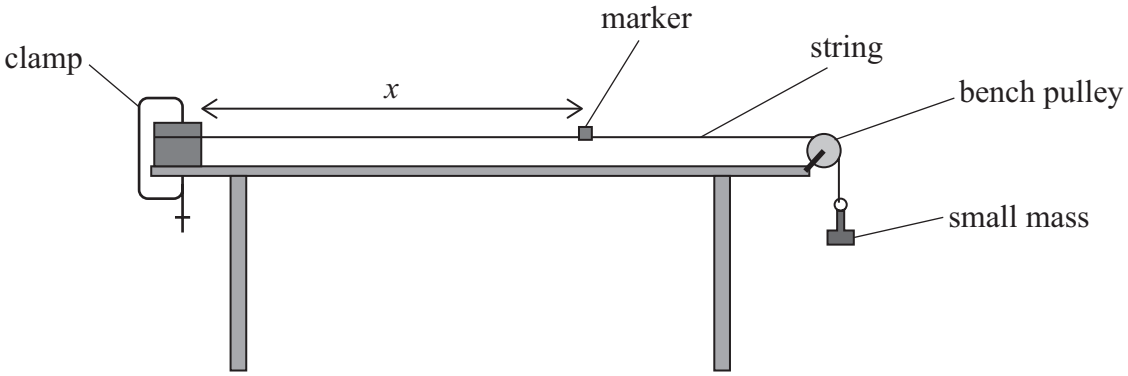
16 The photograph shows a tennis racket.



(Source: © Diy13/Getty Images)

A student determined the Young modulus of the material of the string from a tennis racket.

She used the apparatus shown below.



The student determined the cross-sectional area of the string. She measured the original length x of the string between the clamp and the marker.

She increased the tension in the string and measured the new length of the string between the clamp and the marker. She used her results to calculate the Young modulus of the string.

(a) State why the student should suspend a small mass from the string before measuring x.

(1)

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(b) Explain how the student could decrease the percentage uncertainty in the value of x.

(3)

(c) The table shows the Young modulus of different materials used to make string for tennis rackets.

Material	Young modulus / GPa
gut	6.0
nylon	5.0
polyester	0.92

The string used by the student had a cross-sectional area of $1.2 \times 10^{-6}\,m^2$.
The initial length of the string was 1.6 m.

When the student increased the force on the string by 15 N, the length of the string increased by 4.2 mm.

Deduce which material the string was made from.

(4)

(Total for Question 16 = 8 marks)

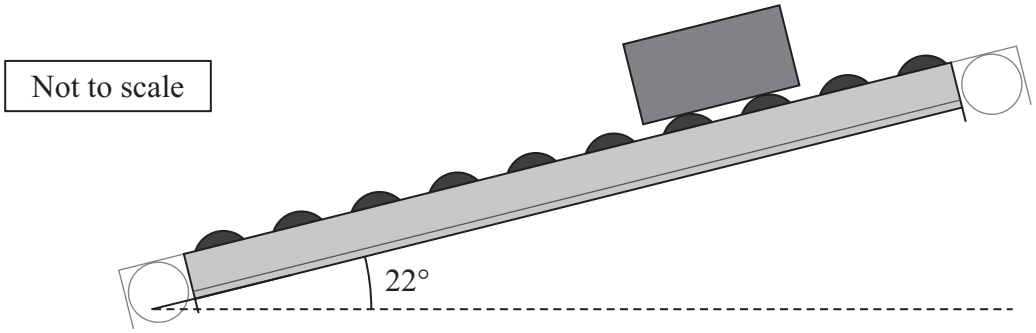
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17 In a factory, boxes move along tracks.

(a) One track forms an inclined plane at an angle of 22° to the horizontal.
A box of mass 5.0 kg is placed on the track, as shown.



The box slides down the track from rest. Friction acting on the box is negligible.

Calculate the velocity of the box when it has moved 2.5 m along the track.

(4)

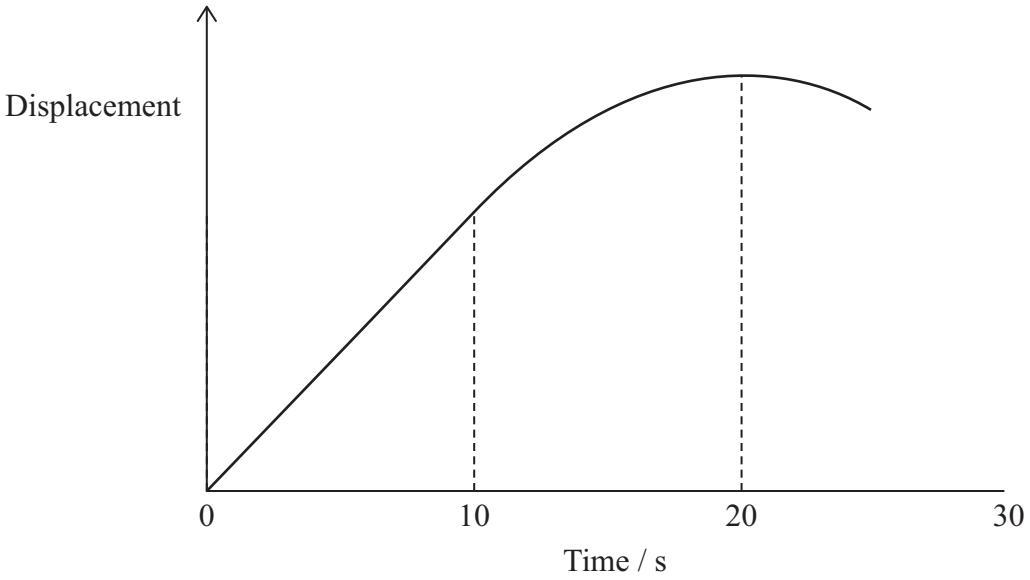
Velocity = ...

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*(b) The box is placed on a different track in the factory.

The sketch graph shows how the displacement of the box varies with time.



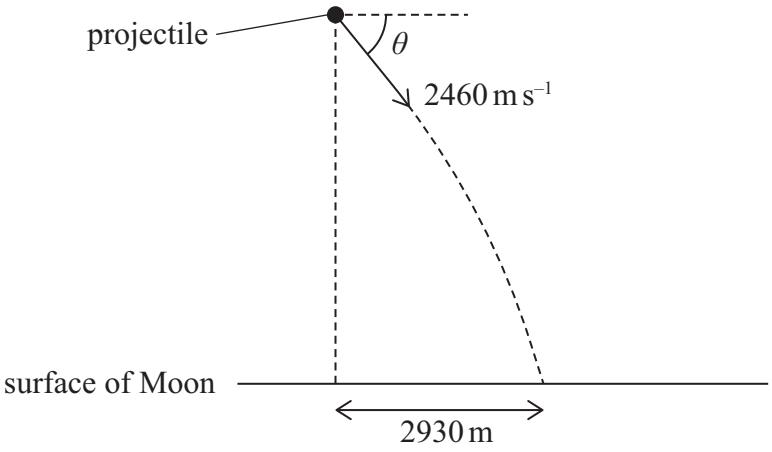
Explain what the graph shows about the velocity and acceleration of the box.

(6)

(Total for Question 17 = 10 marks)

18 In 2009, a satellite orbiting the Moon fired a projectile towards the surface of the Moon.

(a) The initial velocity of the projectile was 2460 m s^{-1} at an angle θ to the horizontal.
The horizontal distance travelled by the projectile was 2930 m, as shown.



The time taken for the projectile to reach the surface of the Moon was 7.50 s.

(i) Show that θ was about 81°.

(3)

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(ii) Calculate the speed of the projectile as it reached the surface of the Moon.

Assume the acceleration due to gravity is constant and has a value of $1.63\,m\,s^{-2}$.

(4)

Speed = ...

(b) A satellite orbiting the Earth could fire a projectile towards the surface of the Earth with the same initial height and velocity as the projectile fired towards the Moon.

(i) A student used the equations of motion to predict the motion of this projectile.

Explain how the predicted horizontal distance travelled by this projectile would be different from the horizontal distance travelled by the projectile fired towards the Moon.

Assume the acceleration due to gravity is constant and has a value of $9.81\,m\,s^{-2}$.

You do not need to do any calculations.

(3)

(ii) The student used the equations of motion to calculate the speed of the projectile at the surface of the Earth. The student used a value of $9.81\,m\,s^{-2}$ for the acceleration of the projectile.

Give two reasons why the student's value for the speed would **not** be accurate.

(2)

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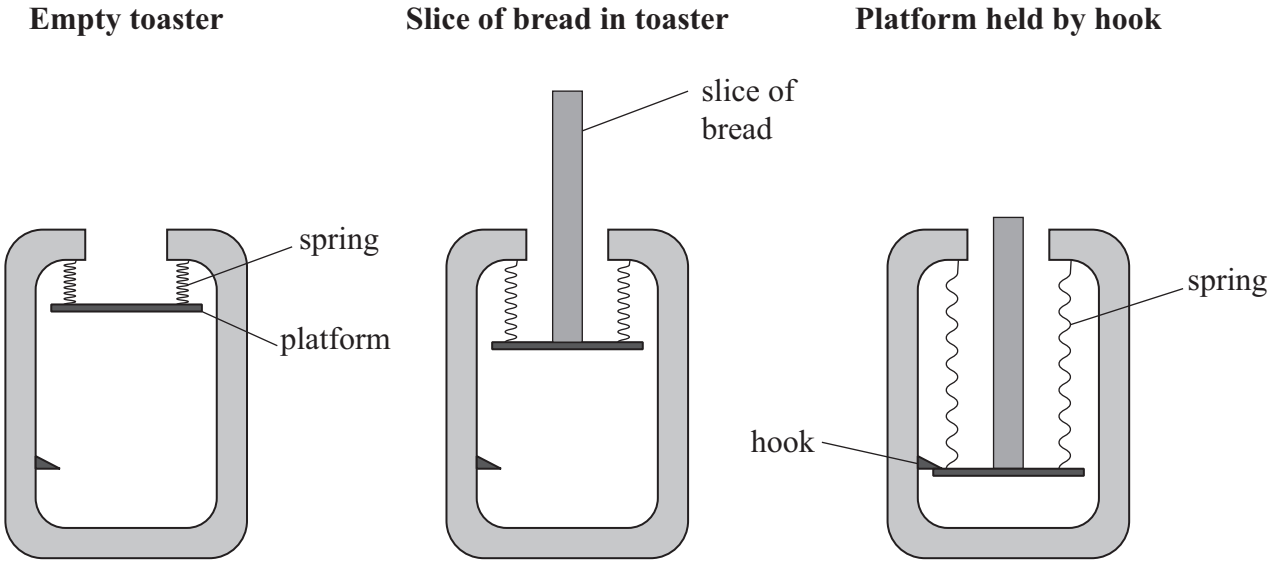
(Total for Question 18 = 12 marks)

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19 A toaster is a device used to heat a slice of bread.

A platform in the toaster is supported by four springs. A slice of bread is placed in the toaster and a person pushes the platform downwards, stretching the springs. A hook then holds the platform in place, as shown.



(a) Explain how the elastic strain energy stored by the springs compares with the work done by the person to push the platform downwards.

(3)

(b) The platform is supported by one spring at each corner. The 4 springs are identical.

A person places a slice of bread of weight 0.52 N in the toaster. The weight of the bread causes the platform to move 2.1 cm downwards.

(i) Show that the stiffness of each spring is about 6 N m^{-1}.

(3)

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(ii) The hook exerts a downwards force of 1.2 N on the platform.

The toaster heats the slice of bread and then releases the hook. The springs return to their unstretched length and the bread is launched upwards.

The mass of the platform is negligible.

Determine the speed of the bread at the instant the springs return to their unstretched length.

(6)

Speed = ...

(Total for Question 19 = 12 marks)

TOTAL FOR SECTION B = 70 MARKS
TOTAL FOR PAPER = 80 MARKS

List of data, formulae and relationships

Acceleration of free fall	$g = 9.81\ \text{m s}^{-2}$	(close to Earth's surface)
Gravitational field strength	$g = 9.81\ \text{N kg}^{-1}$	(close to Earth's surface)

Unit 1

Mechanics

Kinematic equations of motion

$$s = \frac{(u + v)t}{2}$$

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

Forces

$$\Sigma F = ma$$

$$g = \frac{F}{m}$$

$$W = mg$$

Momentum

$$p = mv$$

Moment of force

$$\text{moment} = Fx$$

Work and energy

$$\Delta W = F\Delta s$$

$$E_k = \frac{1}{2}mv^2$$

$$\Delta E_{grav} = mg\Delta h$$

Power

$$P = \frac{E}{t}$$

$$P = \frac{W}{t}$$

Efficiency

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

$$\text{efficiency} = \frac{\text{useful power output}}{\text{total power input}}$$

Materials

Density

$$\rho = \frac{m}{V}$$

Stokes' law

$$F = 6\pi\eta rv$$

Hooke's law

$$\Delta F = k\Delta x$$

Elastic strain energy

$$\Delta E_{el} = \frac{1}{2}F\Delta x$$

Young modulus

$$E = \frac{\sigma}{\varepsilon} \text{ where}$$

$$\text{Stress } \sigma = \frac{F}{A}$$

$$\text{Strain } \varepsilon = \frac{\Delta x}{x}$$

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