Pearson Edexcel International Advanced Level

Thursday 8 January 2026

Afternoon (Time: 1 hour 30 minutes) | Paper reference **WPH11/01A**

Physics

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

You must have:
Scientific calculator, ruler and answer book (sent separately)
Do not return this question paper with the answer book.

Information

- The list of data, formulae and relationships is printed at the end of this booklet.

Turn over ▶

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C:1/1/1/1/

P 8 7 6 3 1 A

Pearson

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 is a scalar quantity?

A force

B momentum

C velocity

D work

(Total for Question 1 = 1 mark)

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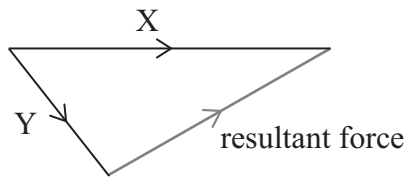
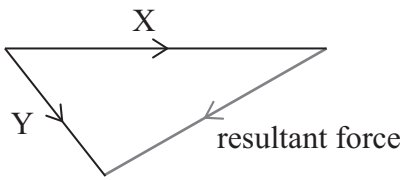
2 Two forces, X and Y, act at a point.

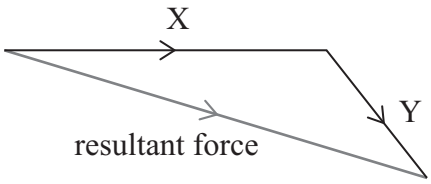
Which of the following vector diagrams shows the magnitude and direction of the resultant of the two forces?



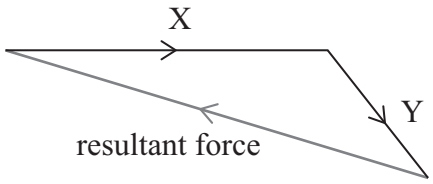
A



B



C



D

(Total for Question 2 = 1 mark)

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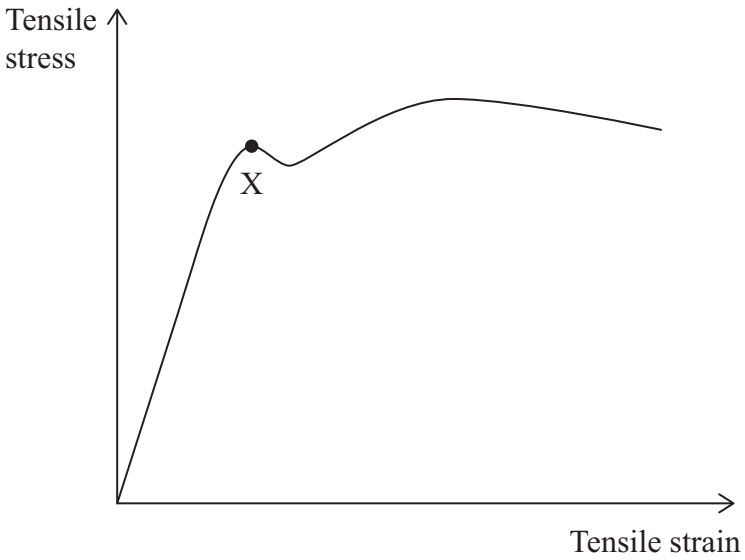
3 A copper rod was placed under tensile stress and the tensile strain in the rod was measured.

The graph shows how the tensile stress required to cause a tensile strain in the rod depends upon the tensile strain.



What does point X represent?

A the fracture point of the rod

B the limit of proportionality for copper

C the maximum tensile strength in the rod

D the yield point of copper

(Total for Question 3 = 1 mark)

---

4 A tractor pulls a trailer a distance s in time t. The useful power output of the tractor is P.

Which of the following equations gives the force F of the tractor on the trailer?

A $F = Pts$

B $F = \frac{Pt}{s}$

C $F = \frac{Ps}{t}$

D $F = \frac{st}{P}$

(Total for Question 4 = 1 mark)

---

5 A cylinder of aluminium has a weight of 35.0 N and a volume of $1.32 \times 10^{-3}\,m^3$.

Which of the following calculations gives the density of aluminium in $kg\,m^{-3}$?

A $\dfrac{9.81 \times 1.32 \times 10^{-3}}{35.0}$

B $\dfrac{1.32 \times 10^{-3}}{35.0 \times 9.81}$

C $\dfrac{35.0}{9.81 \times 1.32 \times 10^{-3}}$

D $\dfrac{35.0 \times 9.81}{1.32 \times 10^{-3}}$

(Total for Question 5 = 1 mark)

---

6 An object on the Moon falls a vertical distance of 0.32 m, from rest, in a time of 0.63 s.

Which of the following expressions gives the acceleration due to gravity on the Moon in $m\,s^{-2}$?

A $\dfrac{0.32}{2 \times 0.63}$

B $\dfrac{0.32}{2 \times 0.63^2}$

C $\dfrac{2 \times 0.32}{0.63^2}$

D $\dfrac{2 \times 0.32}{0.63}$

(Total for Question 6 = 1 mark)

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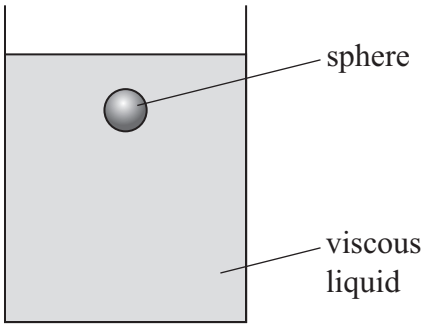
7 A sphere falls through a viscous liquid as shown.

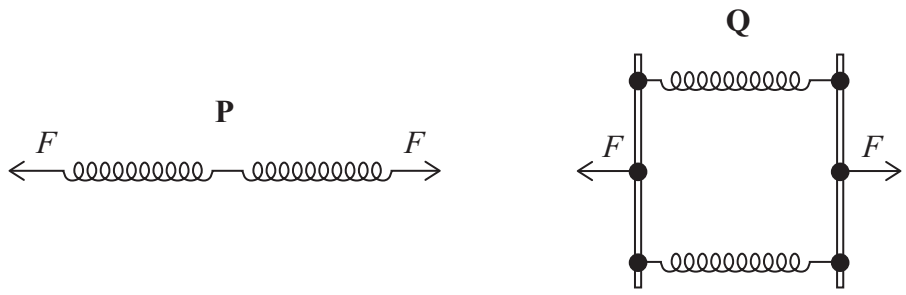


Which row of the table describes the upthrust and the viscous drag on the sphere as it accelerates downwards?

	Upthrust	**Viscous drag**
A	increasing	increasing
B	constant	increasing
C	increasing	constant
D	constant	constant

(Total for Question 7 = 1 mark)

8 Two arrangements, **P** and **Q**, of identical springs are subjected to the same tensile force *F,* as shown.



When one spring is subjected to a tensile force *F*, the elastic strain energy for the spring is *E*.

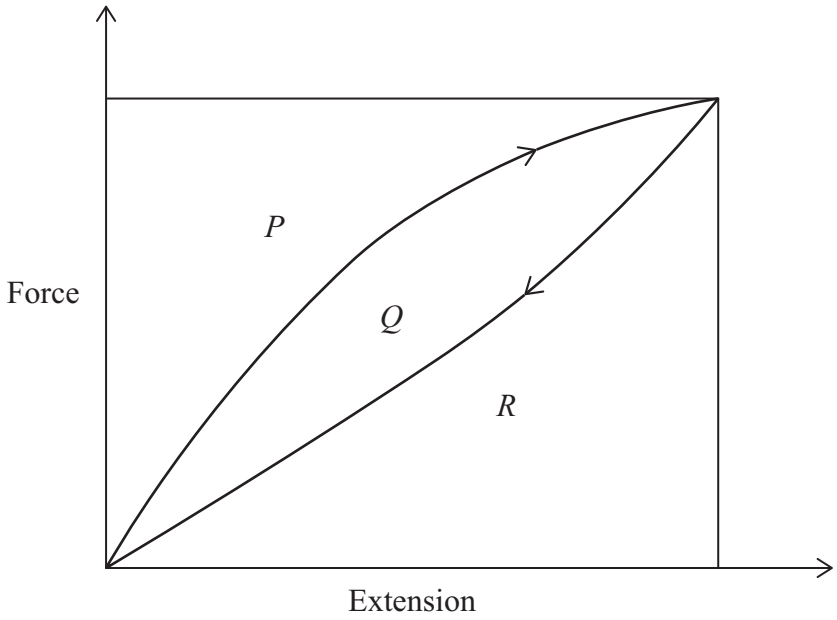
Which row of the table gives the total elastic strain energy for each arrangement?

	P	Q
A	½*E*	2*E*
B	½*E*	½*E*
C	2*E*	2*E*
D	2*E*	½*E*

(Total for Question 8 = 1 mark)

9 A rubber band is initially stretched by an increasing force. When the force is gradually decreased, the rubber band returns to its original length.

The force-extension graph for the rubber band is shown.



P, *Q* and *R* represent different areas of the graph.

Which of the following gives the work done in stretching the rubber band up to its maximum extension?

A $P + Q$

B $Q + R$

C R

D Q

(Total for Question 9 = 1 mark)

10 A person is pushing a trolley at a constant velocity.

The floor exerts a force *W* on the person. The person exerts a force *X* on the trolley.

The trolley exerts a force *Y* on the person and the total drag force on the trolley is *Z*.

(Source: Andy Dossett / Alamy Stock Photo)

Which pair of forces is a Newton's Third Law pair?

A *W* and *Y*

B *X* and *Y*

C *X* and *Z*

D *W* and *Z*

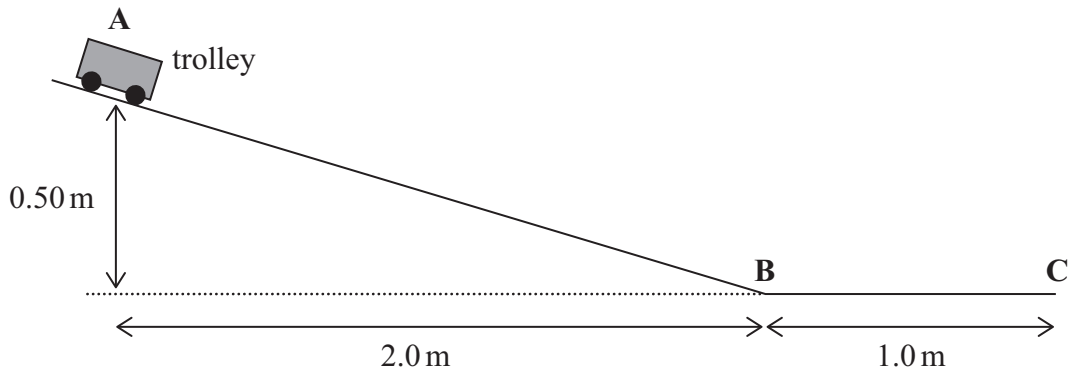
(Total for Question 10 = 1 mark)

TOTAL FOR SECTION A = 10 MARKS

SECTION B

Answer ALL questions in the spaces provided.

11 A trolley accelerates from rest at point A, down a straight track to point B. The trolley then continues along a horizontal track to point C, as shown.



The effects of air resistance and friction are negligible.

(a) Show that the trolley reaches point B with a speed of about $3\,m\,s^{-1}$.

(3)

(b) Determine the time taken by the object to move from point A to point C.

(4)

(Total for Question 11 = 7 marks)

12 A student carried out an experiment to determine the Young modulus of constantan.

The student had a constantan wire with cross-sectional area A of $3.97 \times 10^{-7}\,m^2$.

The unstretched length x of the wire was 4.00 m.

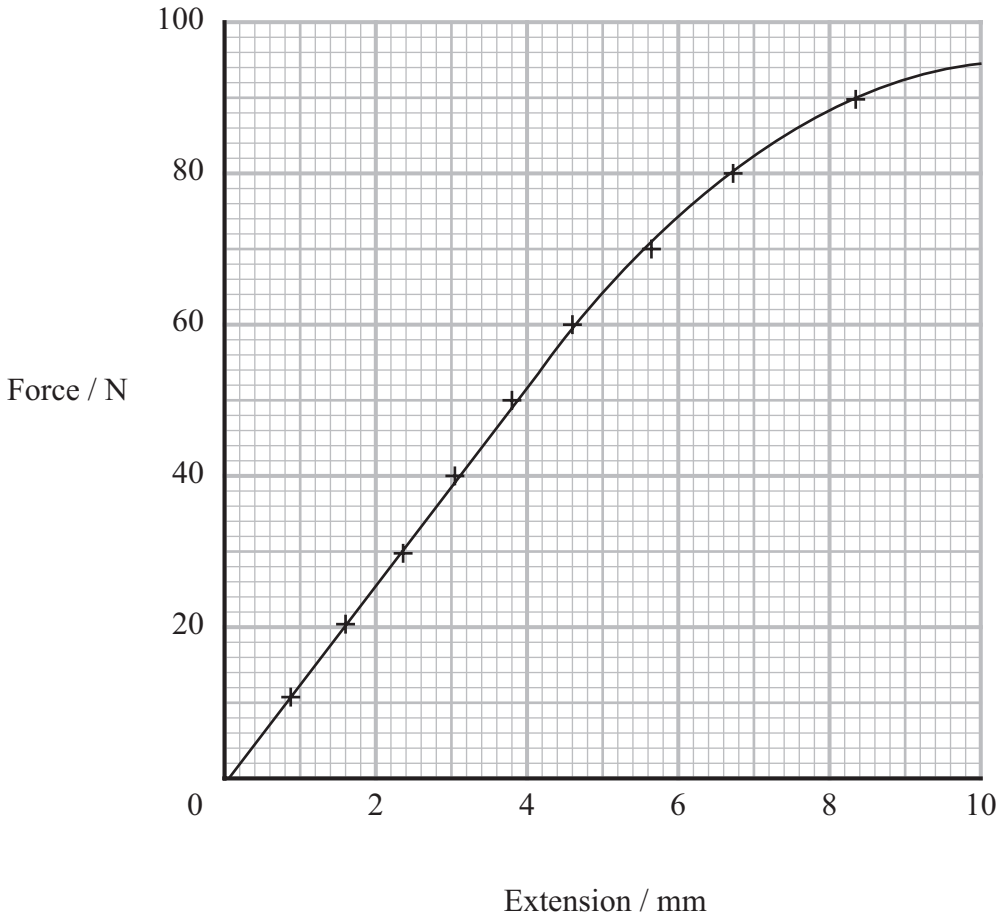
(a) The student had enough slotted masses to apply a weight of up to 150 N to the wire.

The breaking stress for constantan is about 420 MPa.

Deduce whether the wire could support a weight of 150 N.

(3)

(b) The student added slotted masses to the wire and determined the corresponding extensions. The student plotted a graph of force against extension, as shown.



(i) Show that the stiffness of the wire is about $1.3 \times 10^4\,N\,m^{-1}$.

(2)

(ii) The relationship between the stiffness k of the wire and the Young modulus E is given by

$$k = \frac{EA}{x}$$

where x is the unstretched length of the wire and A is the cross-sectional area of the wire.

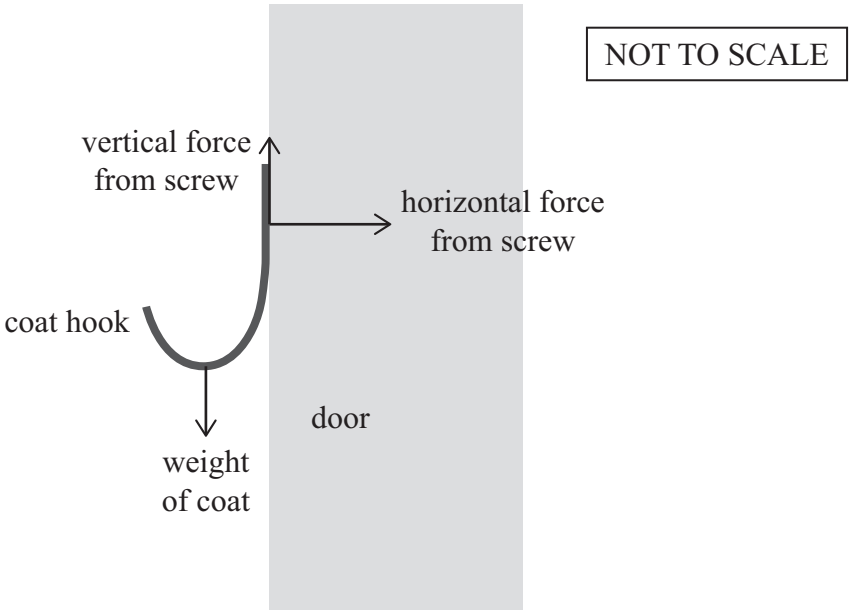
Determine a value for the Young modulus of constantan using the student's data.

(2)

(Total for Question 12 = 7 marks)

13 A coat hook is attached to a smooth door by a screw, as shown.

(a) The diagram below shows three of the forces that act on the coat hook when a coat is hung from it. The weight of the coat hook may be neglected.

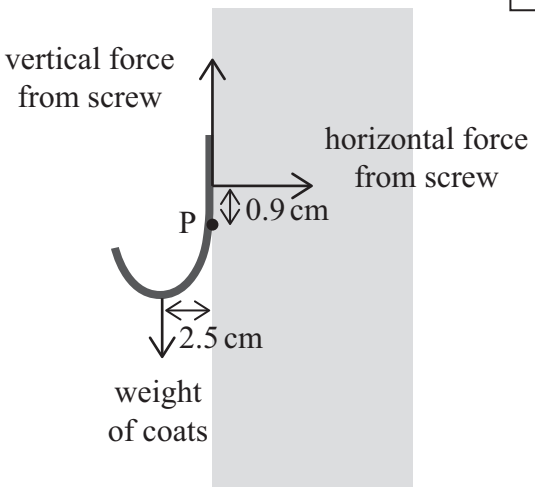


Add a labelled arrow to the diagram in the answer book to show the additional force required for the coat hook to be in equilibrium.

(2)

(b) If too many coats are hung on the coat hook, the hook will rotate and pull the screw out of the door. Point P is the position of the pivot as shown.

NOT TO SCALE



The maximum horizontal force from the screw is 150 N.

The mass of one coat is 2.6 kg.

Deduce whether a person could hang more than two of these coats from the hook.

(4)

(Total for Question 13 = 6 marks)

14 A small sphere is moving horizontally through a viscous liquid.

(a) Stokes' law can be used to calculate the drag force on an object.

State the conditions that must apply for Stokes' law to be valid.

(2)

(b) There is a constant force of 2.3×10^{-5} N acting horizontally on the sphere in the same direction that the sphere is moving.

diameter of sphere = 4.5×10^{-3} m
viscosity of liquid = 7.1×10^{-2} Pa s

(i) At one instant, the speed of the sphere is 5.2×10^{-3} m s^{-1}.

Calculate the resultant horizontal force on the sphere.

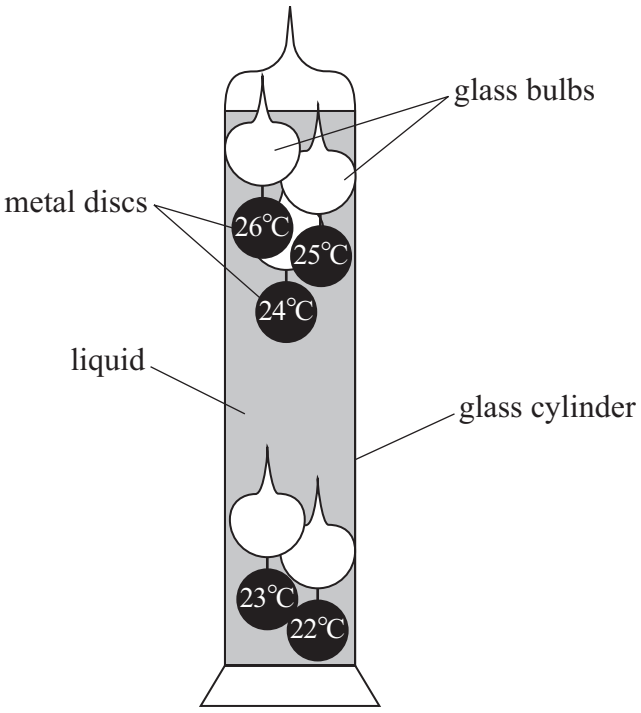
(3)

(ii) Calculate the maximum speed of the sphere in the horizontal direction.

(2)

(Total for Question 14 = 7 marks)

***15** A Galilean thermometer consists of a closed glass cylinder containing a liquid. In the liquid there are several identical sealed glass bulbs, as shown. Attached to each bulb is a metal disc labelled with a temperature. Each disc has a different mass.

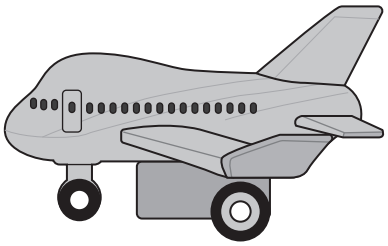


As the temperature increases, the density of the liquid decreases. This can cause the bulbs to move within the liquid.

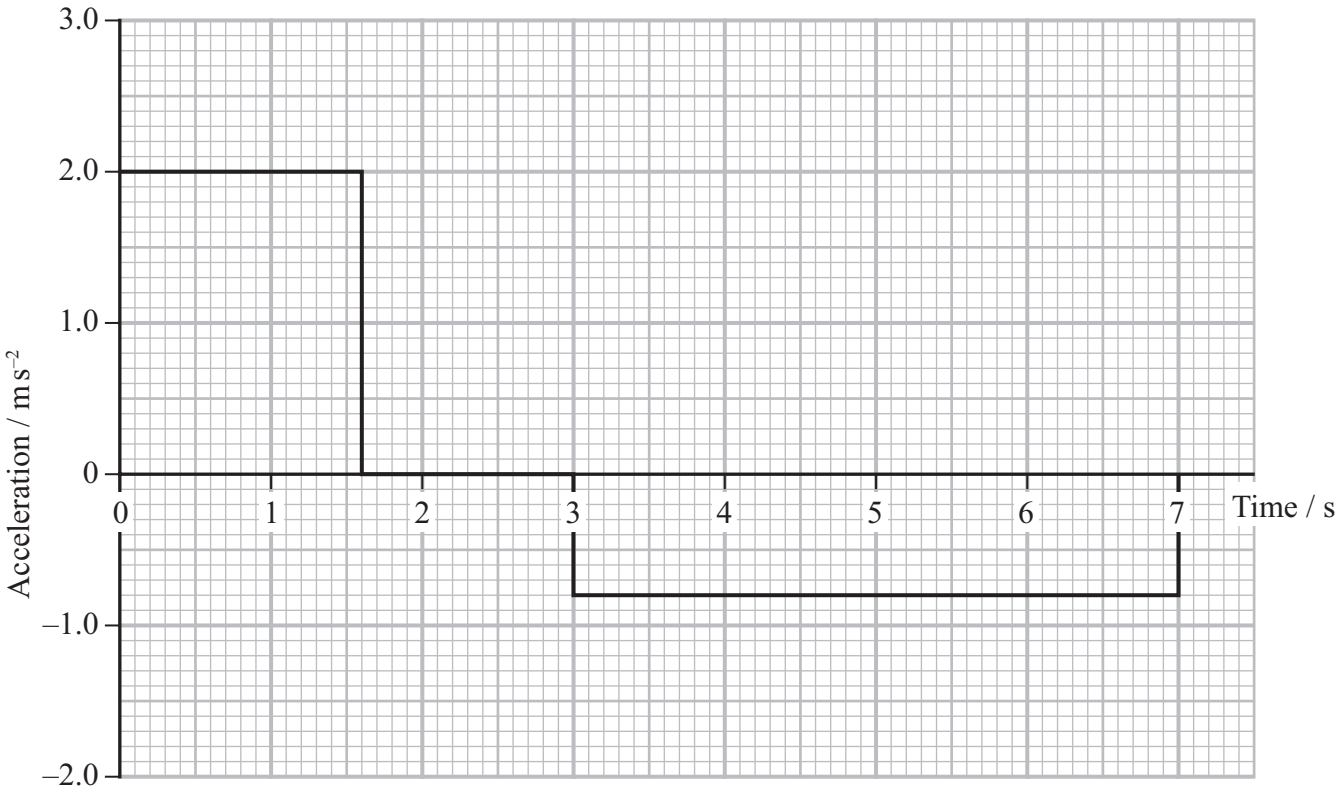
Explain why a particular bulb will float until the temperature of the liquid exceeds a certain value.

(Total for Question 15 = 6 marks)

16 The toy aeroplane in the diagram has a spring mechanism connected to the wheels. When the aeroplane is pulled backwards, the wheels rotate backwards and a spring is compressed. When the aeroplane is released, the force from the spring propels the aeroplane forwards.



The aeroplane is pulled backwards and released from rest. The aeroplane then moves forward in a straight line along a flat surface. The simplified acceleration-time graph for the forward motion of the aeroplane is shown.



(a) Show that the maximum velocity of the aeroplane is about 3 m s^{-1}.

(2)

(b) On the axes in the answer book, draw the corresponding velocity-time graph for the aeroplane.

(3)

(c) Calculate the total distance travelled by the aeroplane after release.

(3)

(Total for Question 16 = 8 marks)

17 The diagram shows two bumper cars, P and Q, at an amusement park.

Q was stationary. P was moving at a speed of $2.10\,m\,s^{-1}$ towards Q.

P collided with Q. After the collision, P and Q moved off in the same direction. P moved with a speed of $1.15\,m\,s^{-1}$. Q moved with a speed of $1.57\,m\,s^{-1}$.

(a) (i) Show that the total mass of Q was about 150 kg.

total mass of P = 250 kg

(3)

(ii) State one assumption you made in your calculation in (a)(i).

(1)

(iii) The collision lasted a total time of 1.35 s.

Calculate the average horizontal force on Q during the collision.

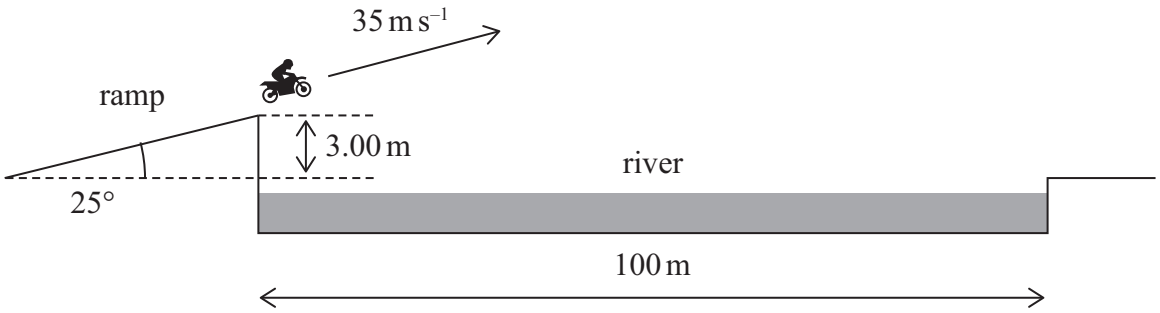
(3)

(b) Explain why P decelerates during the collision. Your answer should make reference to Newton's laws of motion.

(3)

(Total for Question 17 = 10 marks)

18 A stunt motorcyclist wants to jump across a river to land on the other side. The diagram shows the motorcyclist driving off a ramp at the edge of a river.



The ramp is at an angle of 25° to the horizontal and the height at the end of the ramp is 3.0 m. The width of the river is 100 m. The initial velocity of the motorcyclist is 35 m s^{-1}.

(a) Calculate the horizontal and vertical components of the motorcycle's initial velocity as it leaves the ramp.

(2)

(b) Deduce whether the rider lands on the other side of the river.

The effects of air resistance can be ignored.

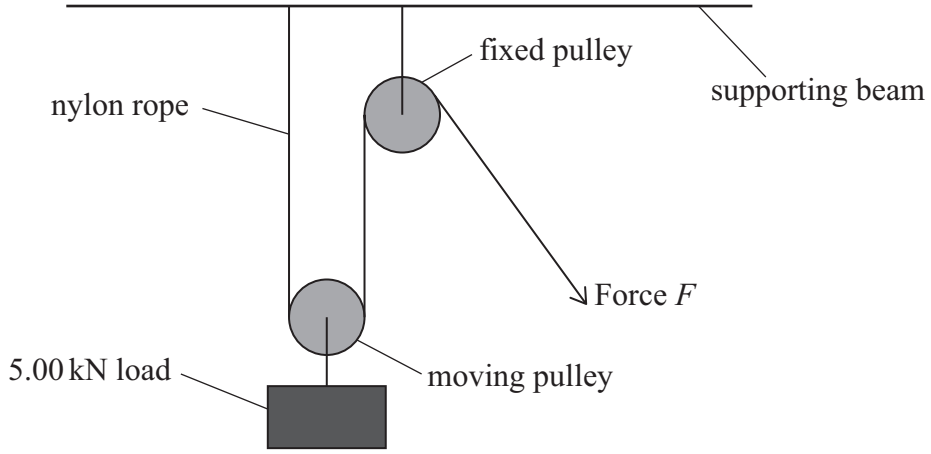
(4)

(c) Explain how air resistance would affect the jump.

(3)

(Total for Question 18 = 9 marks)

19 A pulley system is used to lift a 5.00 kN load. The system consists of one fixed pulley and one pulley that can move. The pulleys are connected by a nylon rope, as shown.



The nylon rope will stretch when it is used in this way. The weight of the pulleys and the rope can be ignored, and you may assume that there is no friction in the pulleys.

The properties of the nylon rope are:

Young modulus of nylon = 2.70 GPa
overall length of rope before adding the load = 6.00 m
area of cross-section of nylon rope = $3.00 \times 10^{-4}\,m^2$

(a) The greater the length of a rope, the smaller the stiffness of the rope.

Explain why.

(2)

(b) (i) Show that the stiffness k of the nylon rope is about $1.4 \times 10^5\,N\,m^{-1}$.

(3)

(ii) The pulley system lifts the 5.00 kN weight at a steady rate.

Determine the extension of the rope while the lift is taking place.

(3)

(iii) Calculate the work done in stretching the rope.

(2)

(Total for Question 19 = 10 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

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

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

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

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 **WPH11/01A**

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Physics

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

You must have:
Scientific calculator, ruler and question paper (sent separately)

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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P 8 7 6 2 0 A 0 1 1 6

Pearson

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

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 1 = 1 mark)

2

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 2 = 1 mark)

3

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 3 = 1 mark)

4

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 4 = 1 mark)

5

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 5 = 1 mark)

6

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 6 = 1 mark)

7

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 7 = 1 mark)

8

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 8 = 1 mark)

9

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 9 = 1 mark)

10

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 10 = 1 mark)

TOTAL FOR SECTION A = 10 MARKS

SECTION B

Answer ALL questions in the spaces provided.

11

(a)

(3)

(b)

(4)

Time taken = ...

(Total for Question 11 = 7 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

12

(a)

(3)

(b)

(i)

(2)

(ii)

(2)

Young modulus = ...

(Total for Question 12 = 7 marks)

DO NOT WRITE IN THIS AREA

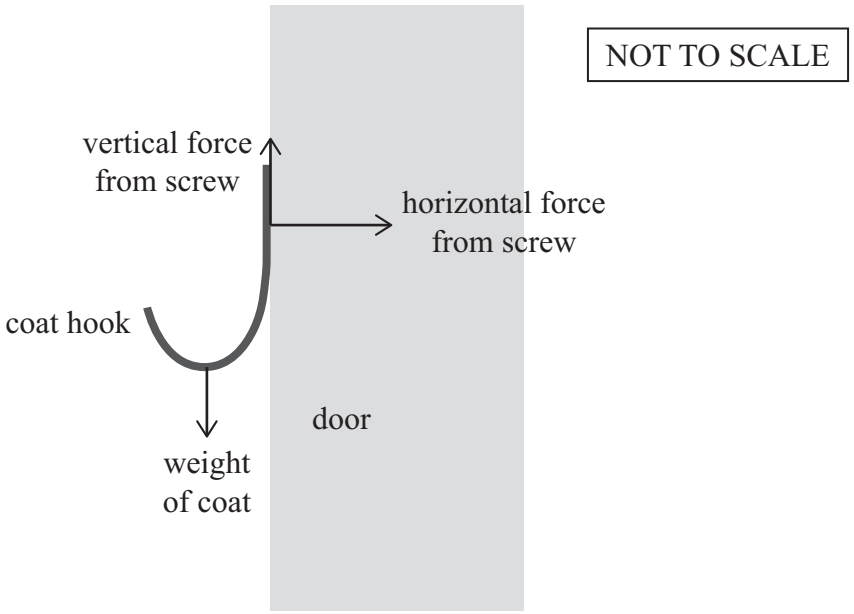
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

13

(a)

(2)



(b)

(4)

(Total for Question 13 = 6 marks)

14

(a)

(2)

.....

.....

.....

.....

(b)

(i)

(3)

.....

.....

.....

.....

Resultant horizontal force = ...

(ii)

(2)

.....

.....

.....

.....

Maximum horizontal speed = ...

(Total for Question 14 = 7 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

*15

(Total for Question 15 = 6 marks)

16

(a)

(2)

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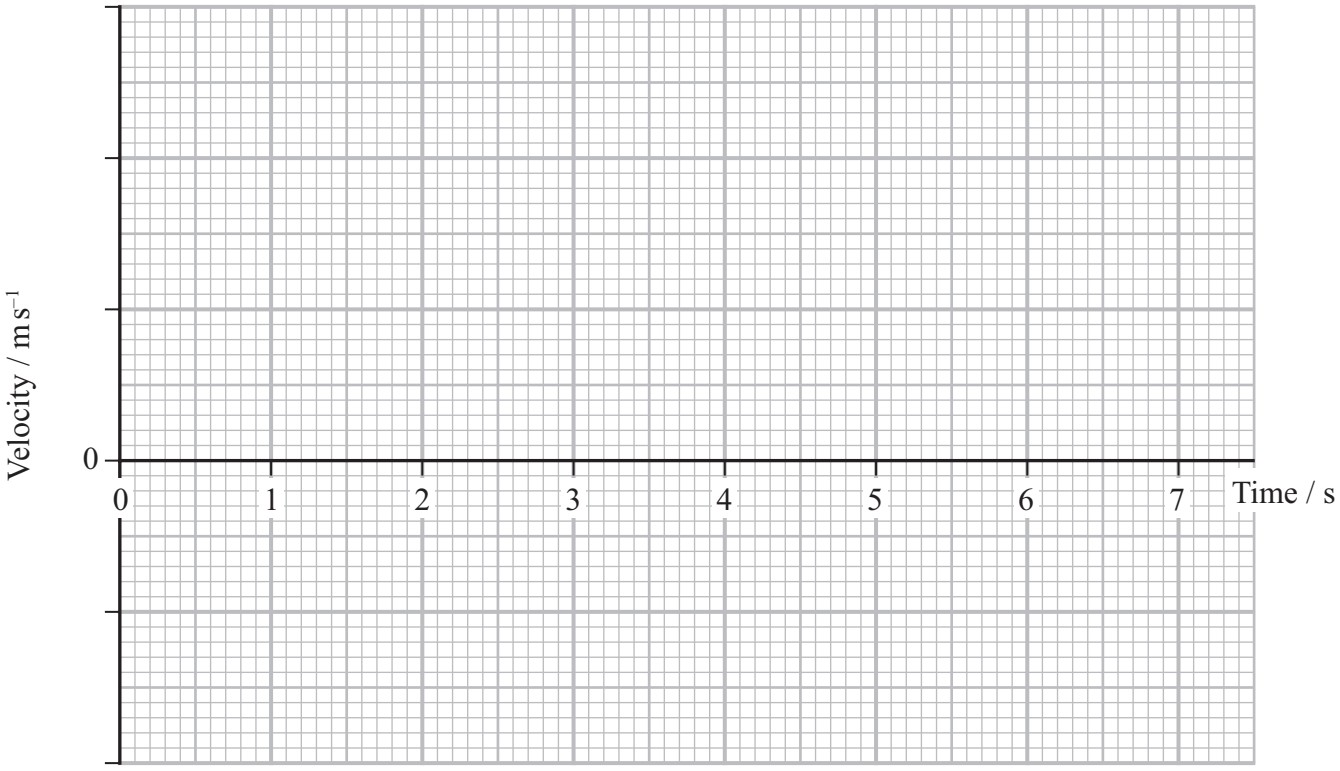
.....

.....

.....

(b)

(3)



(c)

(3)

Distance travelled = ...

(Total for Question 16 = 8 marks)

17

(a) (i)

(3)

(ii)

(1)

(iii)

(3)

.....

.....

.....

.....

Average horizontal force = ...

(b)

(3)

.....

.....

.....

.....

.....

.....

(Total for Question 17 = 10 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

18

(a)

(2)

Horizontal component = ...

Vertical component = ...

(b)

(4)

(c)

(3)

(Total for Question 18 = 9 marks)

19

(a)

(2)

.....

.....

.....

.....

(b) (i)

(3)

.....

.....

.....

.....

.....

(ii)

(3)

.....

.....

.....

.....

.....

.....

Extension of rope = ...

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(iii)

(2)

.....

.....

.....

.....

Work done in stretching rope = ...

(Total for Question 19 = 10 marks)

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

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

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$$v = u + at$$

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

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

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

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

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

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