Pearson Edexcel International Advanced Level

Wednesday 8 October 2025

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, protractor and answer book.
Do not return this question paper with the answer book.

Turn over ▶

P87440A

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M:1/1/1/1/

P 8 7 4 4 0 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 vector quantity?

A distance

B speed

C velocity

D work done

(Total for Question 1 = 1 mark)

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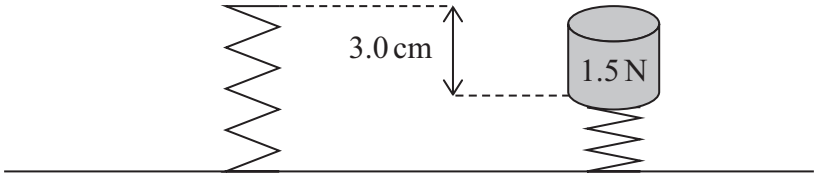
2 A cylinder of weight 1.5 N is placed on top of a vertical spring, and the spring compresses by 3.0 cm as shown.



What is the spring constant of the spring?

A $0.02\,\text{N m}^{-1}$

B $0.5\,\text{N m}^{-1}$

C $2.0\,\text{N m}^{-1}$

D $50\,\text{N m}^{-1}$

(Total for Question 2 = 1 mark)

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3 Which of the following SI units can **only** be used with a scalar quantity?

A m

B s

C m s^{-1}

D m s^{-2}

(Total for Question 3 = 1 mark)

---

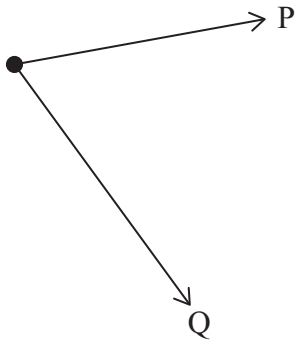
4 A student measures the time t taken for a ball bearing to fall different measured distances s from rest. The student uses his measurements to plot a graph with a gradient equal to the acceleration due to gravity g.

Which row of the table shows a graph with a gradient equal to g?

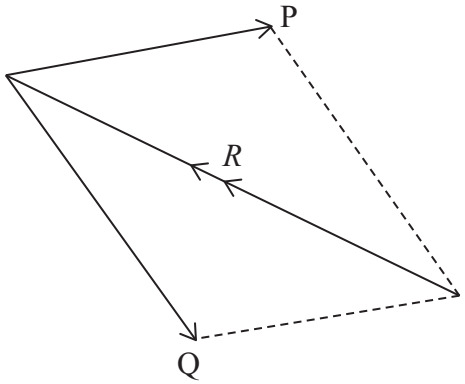
	***y*-axis**	***x*-axis**
A	s	t^2
B	$2s$	t^2
C	t^2	s
D	t^2	$2s$

(Total for Question 4 = 1 mark)

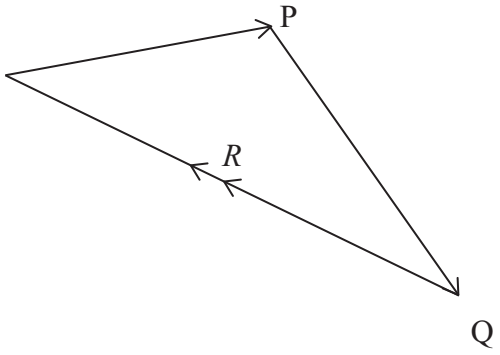
5 Two forces P and Q act on an object as shown.



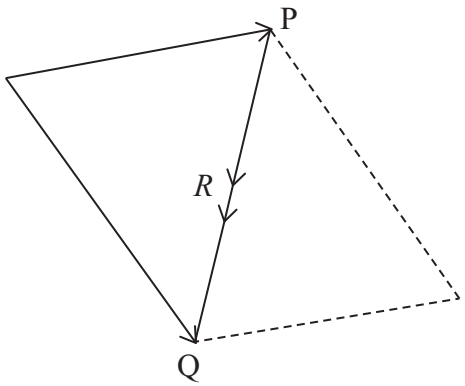
Which of the following is a correctly drawn, scaled, vector diagram for the resultant *R* of forces P and Q?



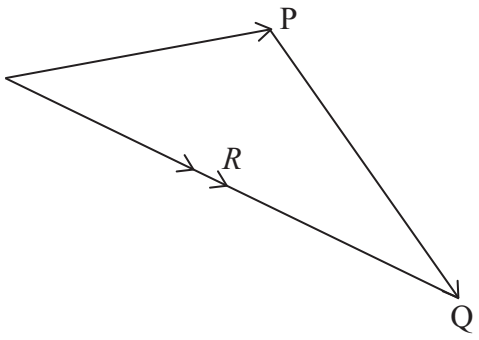
A



B



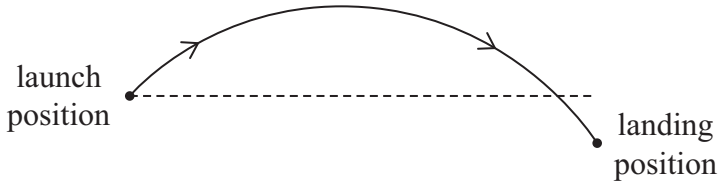
C



D

(Total for Question 5 = 1 mark)

6 The path of a projectile is shown.



The projectile landed at a height lower than the height from which it was launched.

Assuming there is no air resistance acting on the projectile, which of the following is a correct statement?

A At the maximum height, the horizontal velocity is a minimum.

B At the maximum height, the vertical velocity is a maximum.

C The initial horizontal velocity is equal to the final horizontal velocity.

D The initial vertical velocity is equal to the final vertical velocity.

(Total for Question 6 = 1 mark)

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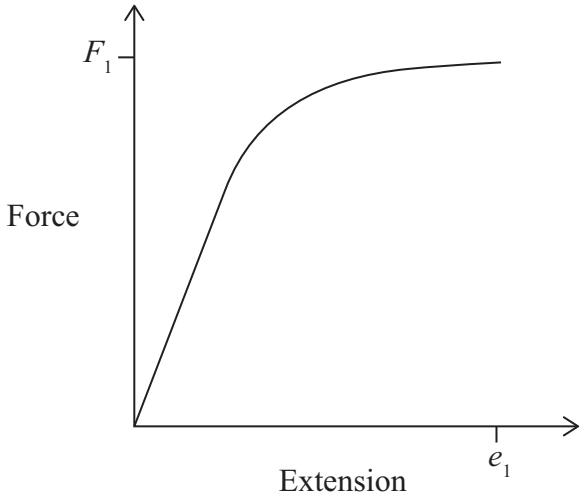
7 The force-extension graph for a wire is shown.

When a force F_1 is applied across the ends of the wire, an extension e_1 is produced.



Which of the following correctly describes the work done W to extend the wire?

A $W = 0.5 F_1 e_1$

B $W > 0.5 F_1 e_1$

C $W = 0.5 \dfrac{F_1}{e_1}$

D $W < 0.5 \dfrac{F_1}{e_1}$

(Total for Question 7 = 1 mark)

8 A ball is thrown vertically upwards with a velocity of $+3.0\,m\,s^{-1}$.

Which of the following is the acceleration of the ball at its maximum height?

A $0\,m\,s^{-2}$

B $-3.0\,m\,s^{-2}$

C $+9.8\,m\,s^{-2}$

D $-9.8\,m\,s^{-2}$

(Total for Question 8 = 1 mark)

---

9 Which of the following statements is **not** correct for a Newton's 3rd law pair of forces?

A The forces act in opposite directions.

B The forces act on the same body.

C The forces are of the same type.

D The forces have the same magnitude.

(Total for Question 9 = 1 mark)

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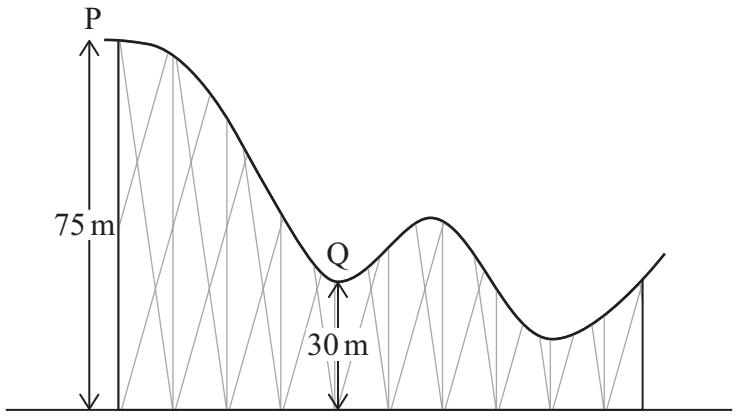
10 The diagram shows a roller coaster. A roller coaster car stops momentarily at P before descending towards Q.



Which of the following expressions could be used to determine the velocity of the roller coaster car at Q?

A $\sqrt{79g} - \sqrt{30g}$

B $\sqrt{150g} - \sqrt{60g}$

C $\sqrt{45g}$

D $\sqrt{90g}$

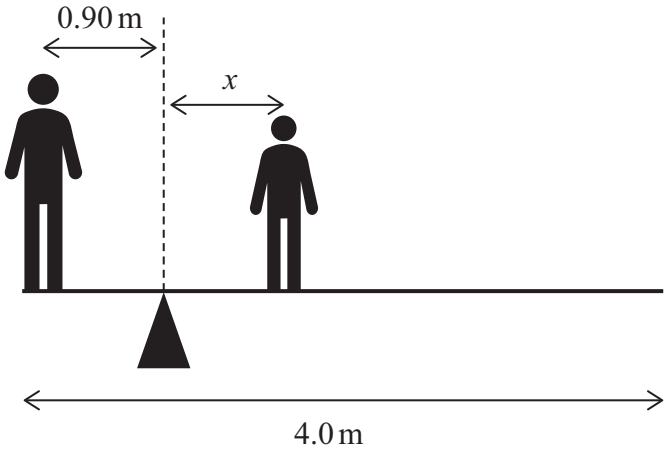
(Total for Question 10 = 1 mark)

TOTAL FOR SECTION A = 10 MARKS

SECTION B

Answer ALL questions in the spaces provided.

11 A uniform plank of length 4.0 m is pivoted 0.90 m from one end.
The weight of the plank is 250 N.
A person of weight 950 N stands at one end of the plank.
A person of weight 650 N stands a distance x from the pivot so that the plank is in equilibrium, as shown.



(a) Add to the diagram in the answer book to show the forces acting on the plank.

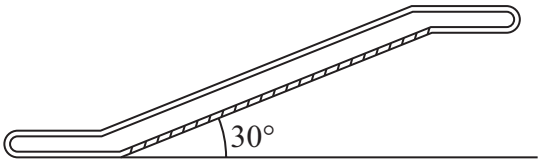
(2)

(b) Calculate the distance x.

(3)

(Total for Question 11 = 5 marks)

12 Moving walkways are often found in airports. One moving walkway carries passengers up an incline of 30°, as shown.



(Source: © ilolab/Shutterstock)

(a) A single passenger of mass 72 kg stands on the walkway.
The speed of the walkway is $0.51\,m\,s^{-1}$.

Show that the rate at which the walkway does work on the passenger is about 200 W.

(3)

(b) The walkway system has an efficiency of 78%.

Calculate the power input to the system when 15 passengers of average mass 72 kg are standing on the walkway.

(3)

(Total for Question 12 = 6 marks)

---

13 Stokes' law can be used to determine the magnitude of the viscous drag for small, spherical objects moving through a fluid.

(a) State one other condition that must be met in order for Stokes' law to apply to the moving object.

(1)

(b) A sphere falls through water at a constant speed of $0.50\,m\,s^{-1}$.

Assess whether Stokes' law can be applied to the falling sphere.

You should include calculations in your answer.

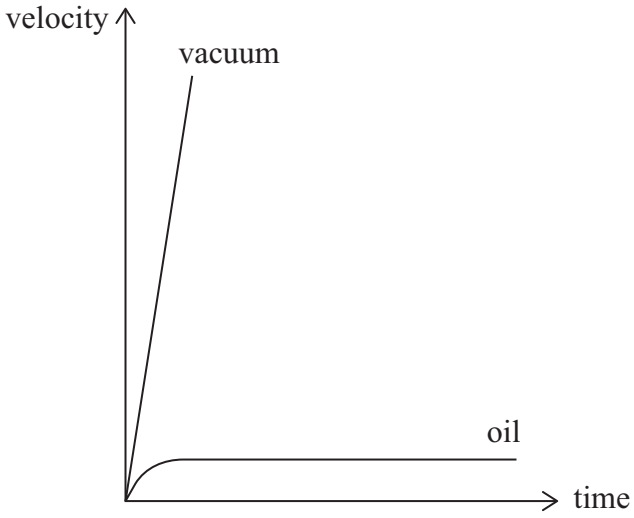
diameter of sphere = 6.0×10^{-3} m
mass of sphere = 9.1×10^{-4} kg
upthrust on sphere = 1.1×10^{-3} N
viscosity of water = 8.9×10^{-4} Pa s.

(5)

(Total for Question 13 = 6 marks)

***14** A teacher demonstrated the motion of a small sphere falling through a vacuum and through oil. The teacher used a motion sensor and data logger connected to a computer.

The computer plotted graphs of velocity against time for the sphere as shown.



Explain the differences between the shapes of the graphs.

(Total for Question 14 = 6 marks)

15 A student carried out an experiment to determine the Young modulus of copper.

She added a mass m to the free end of a sample of copper in the form of a long thin wire and the corresponding extension Δx was measured. This was repeated for increasing masses.

(a) State the meaning of the term Young modulus.

(1)

(b) The student repeated the measurement of the diameter of the wire at different positions and orientations of the wire.
She obtained the following results.

Diameter / mm	0.230	0.235	0.230	0.240

(i) Determine the cross-sectional area of the sample of wire used.

(3)

(ii) The student plotted a graph of m against Δx. She measured the gradient and obtained a value of $195\,\text{kg}\,\text{m}^{-1}$.

Determine the Young modulus of the copper.

length of sample of copper used = 3.50 m

(3)

(iii) The experiment was repeated by another student, using a 2.00 m length of the copper wire.

Suggest how the values obtained for the gradient and hence the Young modulus will differ between the students.

(2)

(Total for Question 15 = 9 marks)

16 The photograph shows a fireboat used to put out fires on ships at sea. A pump, fixed to the boat, pumps water from the sea. The seawater is projected at high speed out of a pipe connected to the pump.

(Source: © Konrad Zelazowski/age fotostock/Superstock)

(a) The mass of seawater pumped each second is 300 kg. The pipe has a radius of 5.0 cm.

density of seawater = $1030\,\text{kg}\,\text{m}^{-3}$.

Show that the speed at which the seawater is projected from the pipe is about $37\,\text{m}\,\text{s}^{-1}$.

(4)

(b) Projecting water from the pipe causes a force to be exerted on the pump.

Explain the direction of the force on the pump.

(2)

(c) Initially the pump is turned off and the fireboat moves forwards through the water at a constant speed. The boat's engine provides a constant forward force.
When the pump is turned on, water is projected forwards and the fireboat slows to a lower constant speed.

Explain why the boat now has a lower constant speed.

(3)

(Total for Question 16 = 9 marks)

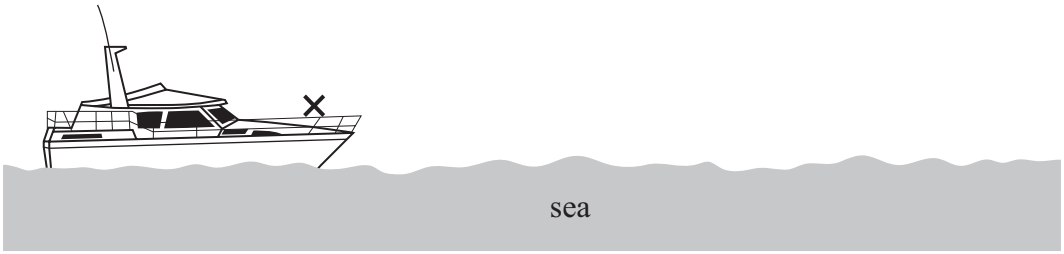
17 A distress flare may be launched from a boat, to signal for help.

(a) A flare was launched from a stationary boat at an angle of 30° to the horizontal.

(i) The flare was launched to the right from the launch position marked ✕ on the boat in the diagram below.

Complete the diagram to show the path taken by the flare before it hit the sea.

(1)



(ii) The maximum height of the flare above the launch position was 42 m.

Show that the flare was launched at a speed of about 60 m s^{-1}.

(3)

(iii) The flare was visible from a maximum distance of 8 km. A rescue boat was 8.2 km from the boat in distress.

Determine whether the flare travelled a sufficient distance to be visible from the rescue boat.
You should assume that the flare was launched in the direction of the rescue boat.

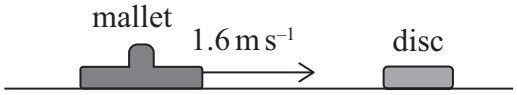
(4)

(Total for Question 17 = 8 marks)

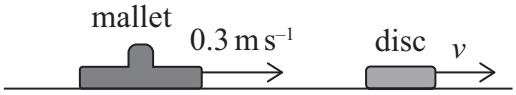
18 A game is played where each player must use a 'mallet' to hit a disc across a table into the opponent's goal.

One player accidentally lets go of a mallet. The mallet travels at a speed of $1.6\,m\,s^{-1}$ and collides with a stationary disc.

After the collision, the mallet continues in the same direction at a lower speed of $0.3\,m\,s^{-1}$. The disc moves in the same direction as the mallet with a velocity v, as shown.



before collision



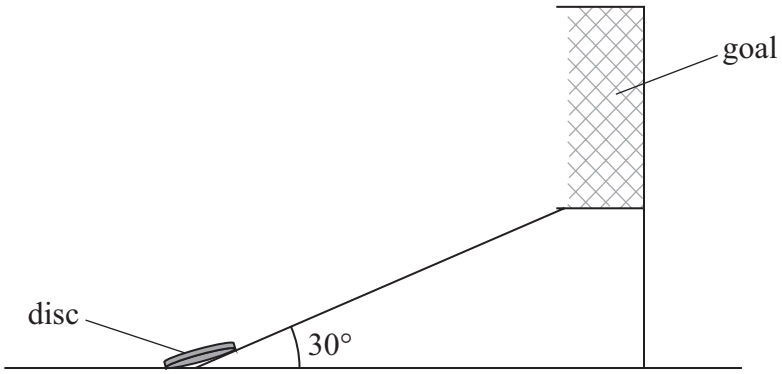
after collision

(a) Calculate a value for v.
Assume that frictional forces are negligible.

mass of disc = 0.035 kg
mass of mallet = 0.17 kg.

(3)

(b) To reach the goal, the disc must move up a ramp which is at an angle of 30° to the horizontal.



The velocity of the disc at the bottom of the ramp is $5.0\,m\,s^{-1}$. The disc moves up the ramp and work is done by the disc against the frictional force. The disc moves a distance of 6.5 cm up the ramp before moving back down.

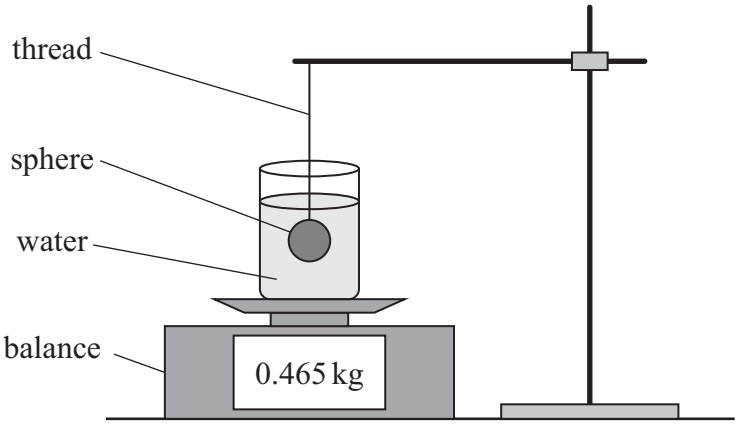
Determine the frictional force acting on the disc.

mass of disc = 0.035 kg

(6)

(Total for Question 18 = 9 marks)

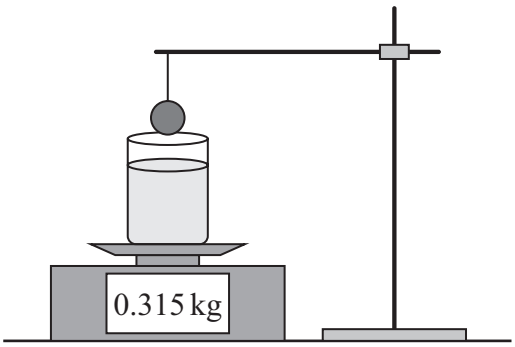
19 A student used the apparatus shown to investigate the forces acting on a uniform, solid sphere placed in water.

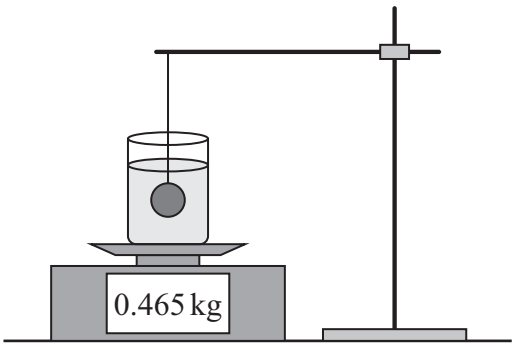


(a) Draw a free-body force diagram for the sphere when it is suspended in water as shown in the answer book.

(3)

(b) As the sphere was lowered into the water, the reading on the balance increased from 315 g to 465 g as shown.





(i) Explain the increase in the reading on the balance. Your answer should include a reference to Newton's third law.

(3)

(ii) Determine the mass of the sphere.

density of water = $1000\,kg\,m^{-3}$
density of sphere = $2000\,kg\,m^{-3}$

(4)

(iii) The water was replaced with the same mass of oil and the experiment repeated. The density of the oil is less than the density of water.

Explain the change in the reading on the balance when the sphere was suspended in oil.

(2)

(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

$$moment = Fx$$

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

Wednesday 8 October 2025

Afternoon (Time: 1 hour 30 minutes)

Paper reference **WPH11/01A**

Physics

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

You must have:
Scientific calculator, ruler, protractor 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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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)

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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)

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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

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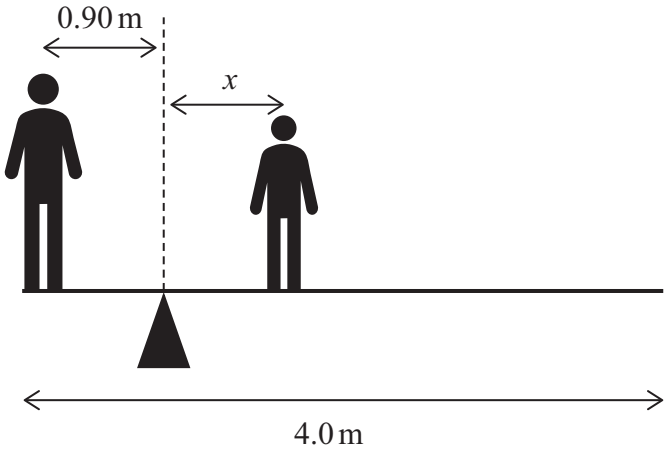
SECTION B

Answer ALL questions in the spaces provided.

11



(a)

(2)

(b)

(3)

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x = ...

(Total for Question 11 = 5 marks)

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12

(a)

(3)

(b)

(3)

Power input = ...

(Total for Question 12 = 6 marks)

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13

(a)

(1)

(b)

(5)

(Total for Question 13 = 6 marks)

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***14**

(Total for Question 14 = 6 marks)

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15

(a)

(1)

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.....

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(b)

(i)

(3)

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Cross-sectional area = ...

(ii)

(3)

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Young modulus = ...

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(iii)

(2)

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(Total for Question 15 = 9 marks)

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16

(a)

(4)

(b)

(2)

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DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(c)

(3)

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(Total for Question 16 = 9 marks)

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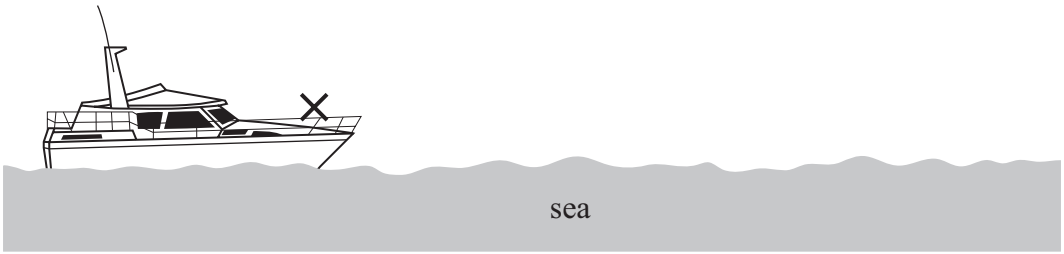
DO NOT WRITE IN THIS AREA

17

(a)

(i)

(1)



(ii)

(3)

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(iii)

(4)

(Total for Question 17 = 8 marks)

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18

(a)

(3)

(b)

(6)

Frictional force = ...

(Total for Question 18 = 9 marks)

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19

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Mass of sphere = ...

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(Total for Question 19 = 12 marks)

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

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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

$$moment = Fx$$

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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