Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|

Centre Number | Candidate Number

# Pearson Edexcel International Advanced Level

## Friday 8 May 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, protractor

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 is an SI unit for the Young modulus of a material?

☒ **A** $kg\,m^{-3}$

☒ **B** $N\,m^{-1}$

☒ **C** $N\,m^{-2}$

☒ **D** Pa s

**(Total for Question 1 = 1 mark)**

**2** A car moves in a circular path at a constant speed.

Which row of the table describes the momentum and kinetic energy of the car?

| | | Momentum | Kinetic energy |
|---|---|---|---|
| ☒ | **A** | constant | constant |
| ☒ | **B** | constant | changing |
| ☒ | **C** | changing | constant |
| ☒ | **D** | changing | changing |

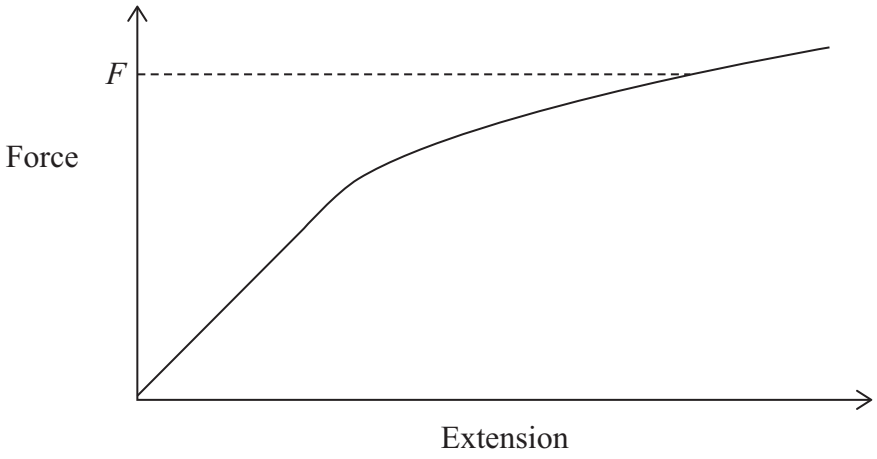
**(Total for Question 2 = 1 mark)**

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**3** A student applies a force $F$ to a wire.

The force-extension graph for the wire is shown.




Which of the following could explain what happens when the force $F$ is removed?

☒ **A** The wire will **not** return to its original length because it has deformed elastically.

☒ **B** The wire will **not** return to its original length because it has gone beyond its elastic limit.

☒ **C** The wire will return to its original length because it has deformed plastically.

☒ **D** The wire will return to its original length because it has gone beyond its yield point.

**(Total for Question 3 = 1 mark)**

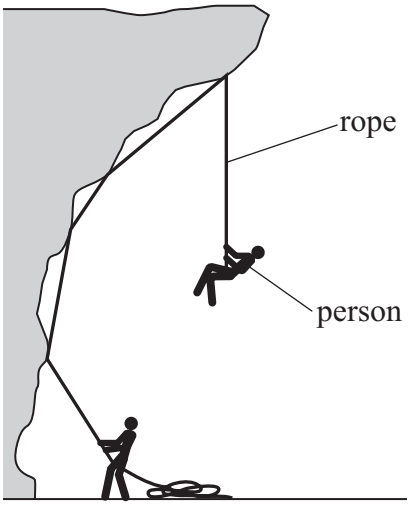
**4** A student made measurements to determine the acceleration of a free-falling object. The student dropped an object from rest.

Which of the following measurements would **not** be sufficient to determine the acceleration of the object?

- ☒ **A** distance fallen by the object and final velocity
- ☒ **B** distance fallen by the object and time taken to reach the ground
- ☒ **C** final velocity of the object and time taken to reach the ground
- ☒ **D** mass of the object and time taken to reach the ground

**(Total for Question 4 = 1 mark)**

**5** After rock climbing up a cliff, a person is lowered to the ground on a rope, as shown.




The tension in the rope and the weight of the person are **not** a Newton's third law pair.

Which of the following gives a reason why?

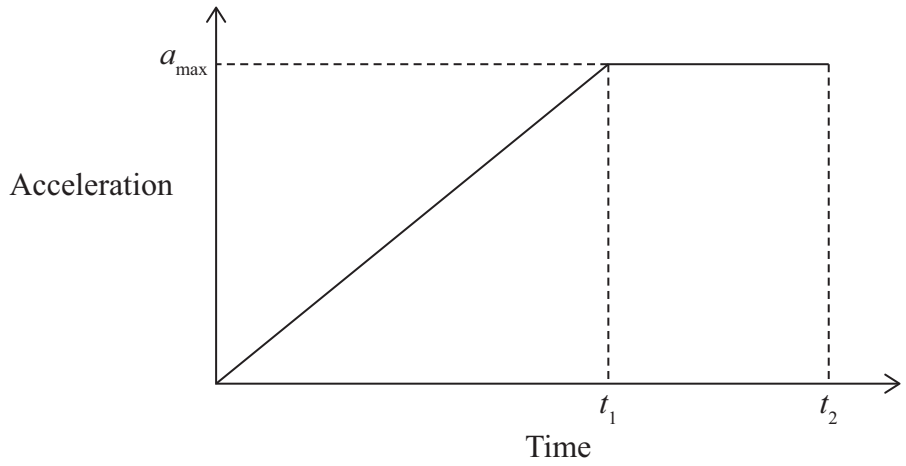
- ☒ **A** The tension is equal in magnitude to the weight of the person.
- ☒ **B** The tension acts in the opposite direction to the weight of the person.
- ☒ **C** The tension and weight of the person act on different objects.
- ☒ **D** The person is accelerating downwards.

**(Total for Question 5 = 1 mark)**

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**6** A rocket accelerates from rest. The acceleration-time graph for the rocket is shown.




Which of the following gives the velocity of the rocket at time $t_2$?

☒ **A** $(t_1 + t_2) \times a_{max}$

☒ **B** $\left(t_1 \times \frac{a_{max}}{2}\right) + (t_2 \times a_{max})$

☒ **C** $\left(t_1 \times \frac{a_{max}}{2}\right) + (t_2 - t_1) \times a_{max}$

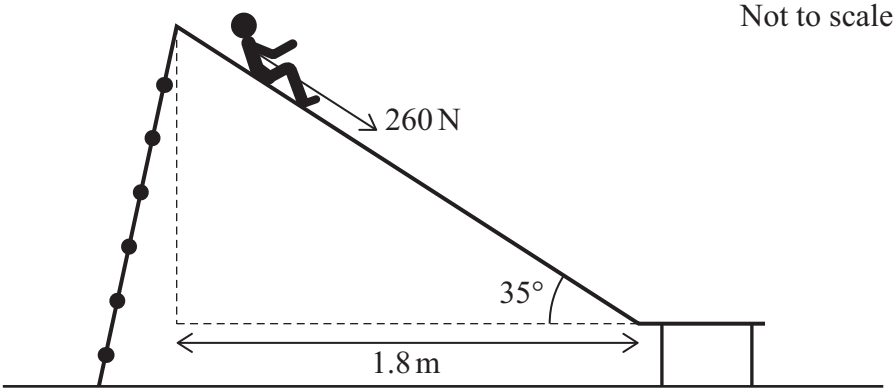
☒ **D** $(t_1 \times a_{max}) + (t_2 - t_1) \times \frac{a_{max}}{2}$

**(Total for Question 6 = 1 mark)**

**7** A child accelerates down a slide. The slide is at an angle of 35° to the horizontal.

The resultant force on the child is 260 N along the slide. The child moves a horizontal distance of 1.8 m, as shown.

Not to scale




Which of the following gives the work done, in J, by the resultant force?

☒ **A** $260 \times 1.8 \times \sin(35°)$

☒ **B** $\dfrac{260 \times 1.8}{\sin(35°)}$

☒ **C** $260 \times 1.8 \times \cos(35°)$

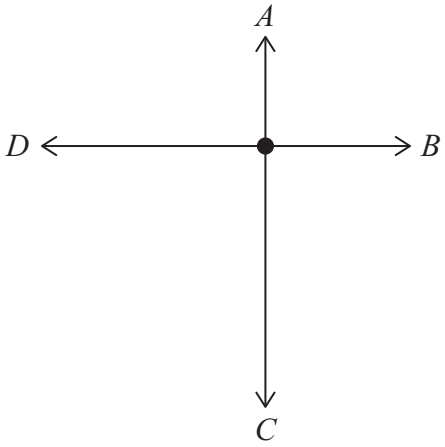
☒ **D** $\dfrac{260 \times 1.8}{\cos(35°)}$

**(Total for Question 7 = 1 mark)**

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**8** The free body force diagram shows the forces $A$, $B$, $C$ and $D$ acting on a helicopter.




Which of the following expressions gives the resultant force on the helicopter?

☒ **A** $\sqrt{(C - A)^2 + (D - B)^2}$

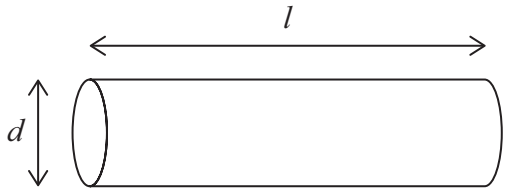
☒ **B** $(C - A)^2 + (D - B)^2$

☒ **C** $\sqrt{C^2 - A^2 + D^2 - B^2}$

☒ **D** $C^2 - A^2 + D^2 - B^2$

**(Total for Question 8 = 1 mark)**

**9** A wire of length $l$ has a diameter $d$, as shown.




The material of the wire has density $\rho$. The wire has mass $m$.

Which of the following expressions gives $d$?

☒ **A** $d = \sqrt{\dfrac{4m}{\pi l \rho}}$

☒ **B** $d = \sqrt{\dfrac{m}{\pi l \rho}}$

☒ **C** $d = \sqrt{\dfrac{2m}{\pi l \rho}}$

☒ **D** $d = \sqrt{\dfrac{m}{4\pi l \rho}}$

**(Total for Question 9 = 1 mark)**

**10** During a high jump an athlete exerts a force on the ground. The athlete accelerates vertically upwards.

The mass of the athlete is 60 kg and the acceleration of the athlete is 30 m s$^{-2}$.

Which of the following gives the force, in N, of the ground on the athlete?

☒ **A** $60 \times 30$

☒ **B** $60 \times 9.81$

☒ **C** $60 \times (30 - 9.81)$

☒ **D** $60 \times (30 + 9.81)$

**(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** The photograph shows a person on a jet-ski.



(Source: © YanLev/Getty Images)

The total mass of the jet-ski and person is 390 kg.

The kinetic energy of the jet-ski and person is 120 kJ.

Calculate the speed of the jet-ski.

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.....

.....

speed = .....

**(Total for Question 11 = 2 marks)**

**12** A student applies a force of 3.8 N to a spring. The spring extends.
The stiffness constant of the spring is 25 N m$^{-1}$.

Calculate the elastic strain energy stored in the extended spring.

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elastic strain energy = .....

**(Total for Question 12 = 3 marks)**

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**13** In a game of tennis, a ball collides with a tennis racket.

(a) During the collision, there is a change in velocity of the ball and the racket. The mass of the ball is less than the mass of the racket.

Explain how the magnitude of the change in velocity of the ball compares with the magnitude of the change in velocity of the racket.

**(3)**

(b) A tennis ball should have a mass between 56.0 g and 59.4 g.

The initial speed of the ball is 22 m $s^{-1}$ towards the racket. Immediately after the collision, the speed of the ball is 14 m $s^{-1}$ away from the racket.

When the ball hits the racket, the time taken for the collision is 0.034 s. The mean force of the racket on the ball is 61 N.

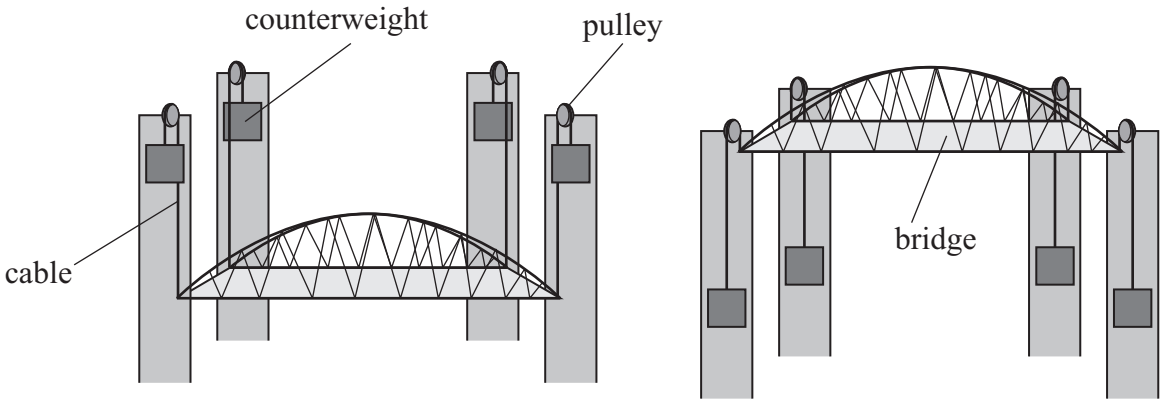
Deduce whether the mass of the ball is between 56.0 g and 59.4 g.

**(4)**

**(Total for Question 13 = 7 marks)**

**14** A 'vertical lift' over a river can be raised to different heights so that boats can pass underneath.

The diagrams show the bridge before and after being raised.




before being raised  after being raised

Each end of the bridge is attached to two 'counterweights' by a cable and pulley.

(a) As the bridge is raised, motors transfer energy to the bridge. Energy from the counterweights is also transferred to the bridge.

The bridge moves up 8.5 m and the 4 counterweights move down 8.5 m.

Calculate the minimum energy needed by the motors to move the bridge up 8.5 m.

mass of bridge = 420 000 kg
mass of each counterweight = 93 000 kg

**(3)**

minimum energy needed = .....

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(b) The bridge is sometimes raised to its maximum height. This requires a total energy input to the motors of 15 MJ.

Calculate the useful power output of the motors.

efficiency of motors = 0.36
time taken to raise bridge = 190 s

**(3)**

useful power output = .....

(c) The bridge could have been built using counterweights with a total mass equal to the mass of the bridge.

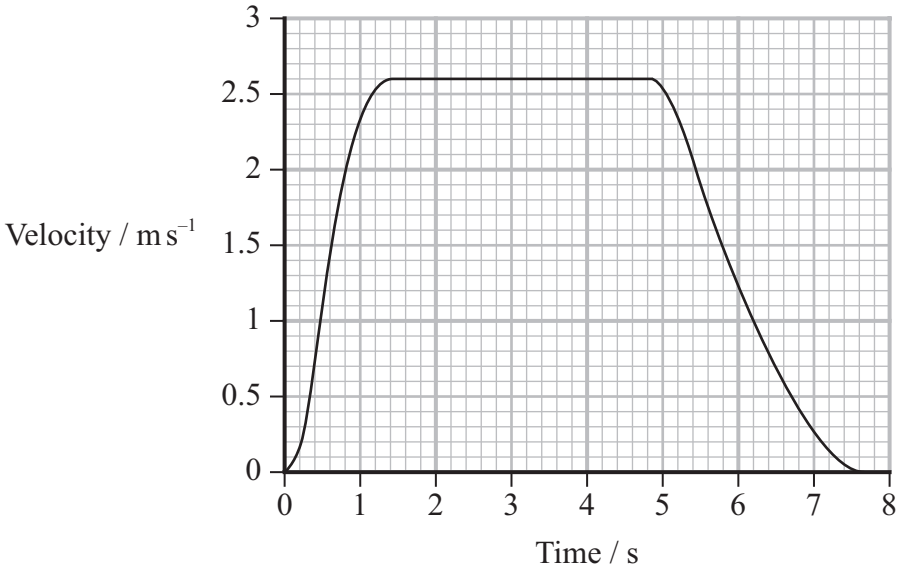
Explain how using these counterweights would affect the energy input to the motors as the bridge is raised.

**(2)**

**(Total for Question 14 = 8 marks)**

**15** A building has an elevator to help people move between different floors.

The graph shows how the velocity of the elevator changes when moving to a higher floor.



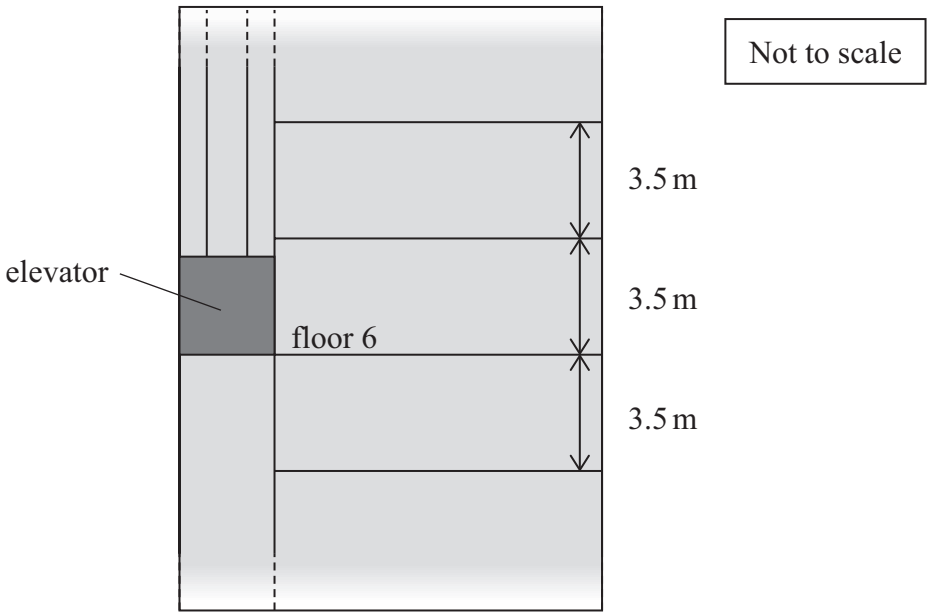

(a) Describe how the graph can be used to determine the maximum acceleration of the elevator.

**(2)**

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(b) The floors in the building are evenly spaced. The distance between floors is 3.5 m, as shown.




The elevator was on floor 6 of the building at time $t = 0$ on the graph.

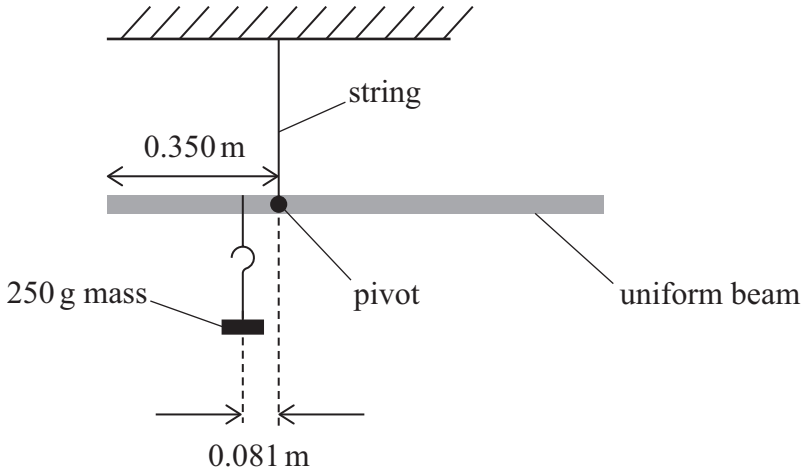
Determine the highest floor reached by the elevator.

**(3)**

highest floor reached = .....

**(Total for Question 15 = 5 marks)**

**16** A student used a string to suspend a uniform beam from a support. She attached a 250 g mass to the beam so that the beam was in equilibrium, as shown.




The weight of the beam acts from the centre of gravity of the beam.

(a) State what is meant by the term centre of gravity.

**(1)**

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(b) The distance from the end of the beam to the pivot is 0.350 m. The distance from the mass to the pivot is 0.081 m.

The table shows the weight of three different beams that the student could have used.

| Beam | Weight / N |
|---|---|
| A | 0.40 |
| B | 0.60 |
| C | 1.40 |

The length of each beam is 1.00 m.

Deduce which beam the student used.

**(5)**

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**(Total for Question 16 = 6 marks)**

**17** A plant at the bottom of a pond releases a bubble of gas.

As the bubble of gas moves upwards through the water, Stokes' law applies.

(a) The bubble of gas is small, spherical and moves at a low speed.

Give one other condition needed for Stokes' law to apply.

**(1)**

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*(b) As the bubble moves upwards through the water, the volume of the bubble increases. The mass of the gas bubble remains constant.

Explain what happens to the speed of the bubble as its volume increases.

You should include an explanation of what happens to the magnitude of each force acting on the bubble.

**(6)**

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**(Total for Question 17 = 7 marks)**

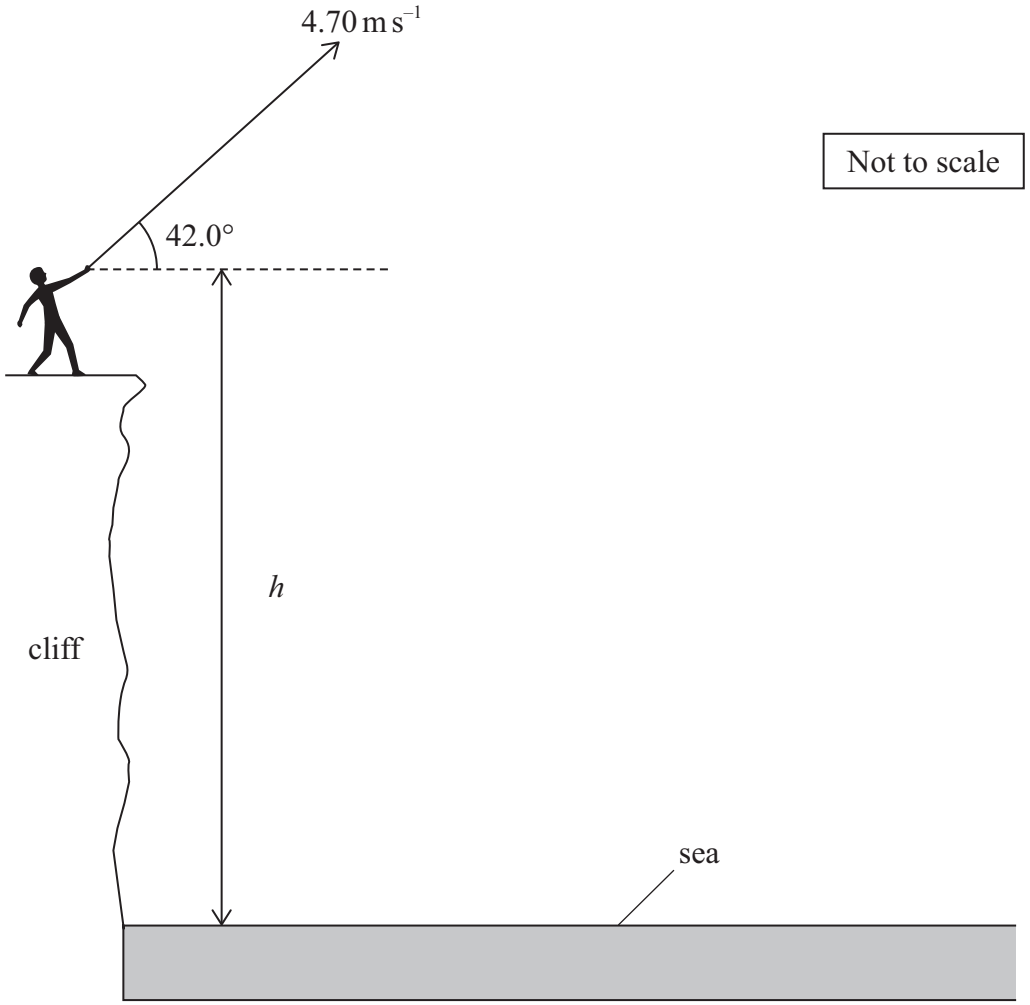
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**18** A student throws a ball from a cliff into the sea.

The student releases the ball from a height $h$ above the sea. The initial velocity of the ball is $4.70\,m\,s^{-1}$ at an angle of 42.0° to the horizontal, as shown.




(a) (i) Show that the horizontal component of the initial velocity of the ball is about $3.5\,m\,s^{-1}$.

**(2)**

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(ii) The ball travels a horizontal distance of 6.80 m before landing in the sea.

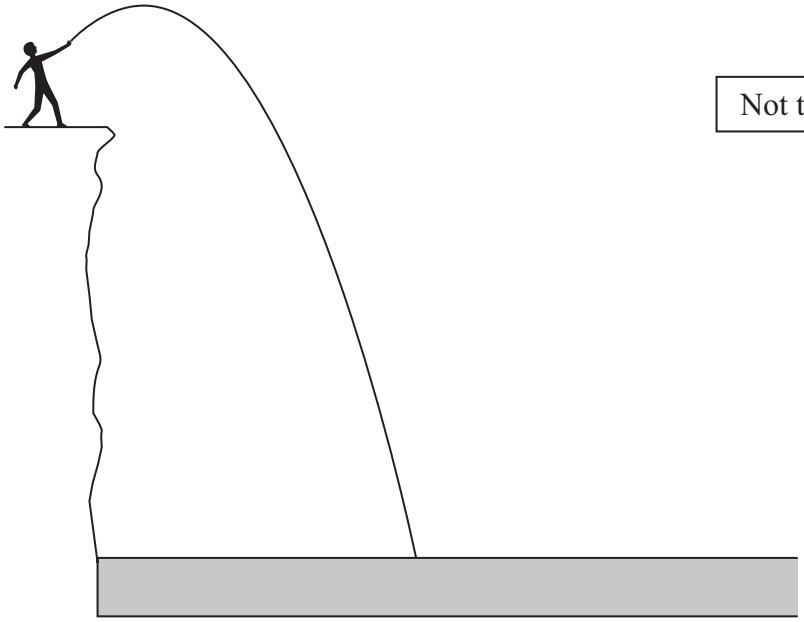
Determine the initial height $h$ of the ball above the sea.

Assume that air resistance acting on the ball is negligible.

**(4)**

$h$ = .....

(iii) The diagram shows the path of the ball if air resistance is negligible.



Not to scale

Draw a line on the diagram to show a possible path of the ball if air resistance is **not** negligible.

**(2)**

(b) A small stone falls vertically from the top of the cliff into the sea.

The stone reaches terminal velocity before landing in the sea.

Explain why the stone reaches terminal velocity.

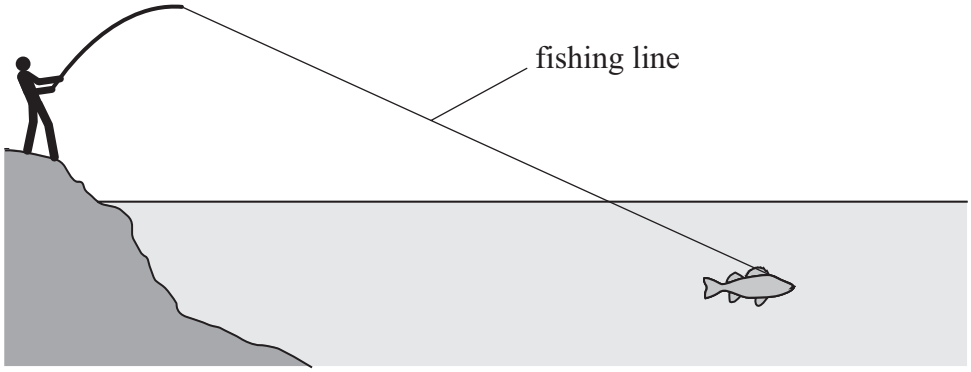
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**(Total for Question 18 = 11 marks)**

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**19** A student uses a fishing line to catch a fish, as shown.




The fishing line is uniform and has a circular cross-sectional area.

The student and the fish pull in opposite directions, causing tension in the fishing line.

(a) The fishing line will break if the tension is too great.

The student could use a fishing line made from the same material but with a larger diameter.

Explain how using a fishing line with a larger diameter affects the tension at which the fishing line will break.

**(3)**

(b) The student uses a fishing line with an original length of 36 m and a radius of 0.34 mm.

Calculate the extension of the fishing line when the tension is 17 N.

Young modulus of material used for line = 2.8 GPa

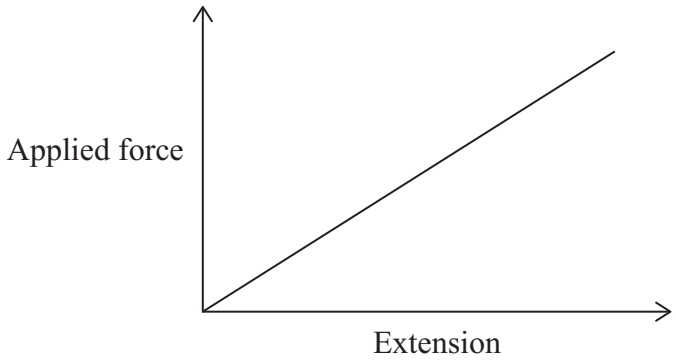
**(4)**

Extension = .....

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(c) The graph shows the relationship between the applied force and the extension of the fishing line for small tensions.




Explain what is represented by the area between the graph and the $x$-axis.

**(3)**

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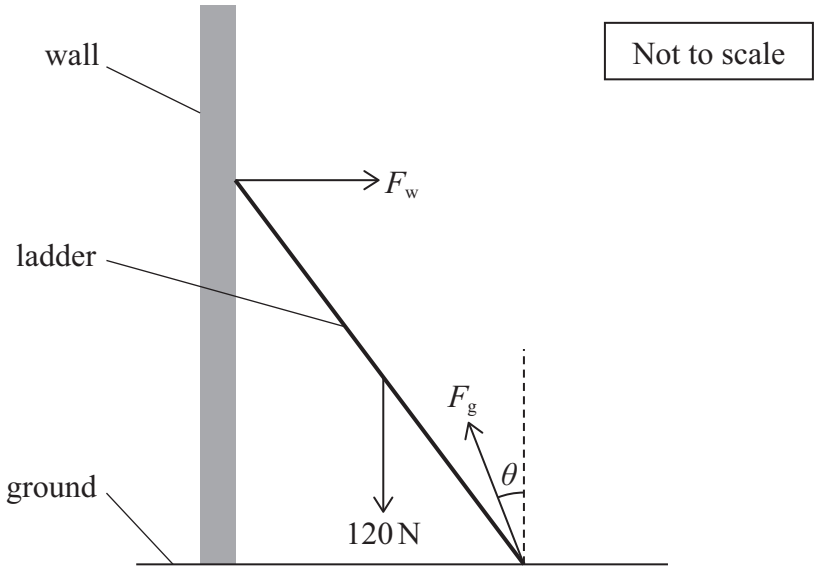
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**(Total for Question 19 = 10 marks)**

**20** A uniform ladder of weight 120 N leans against a wall. The wall exerts a normal contact force $F_w$ on the ladder. The ground exerts a force $F_g$ on the ladder at an angle $\theta$ to the vertical, as shown.




(a) Determine the magnitude of $F_g$ when $\theta = 15°$, using a scaled vector diagram.

**(4)**

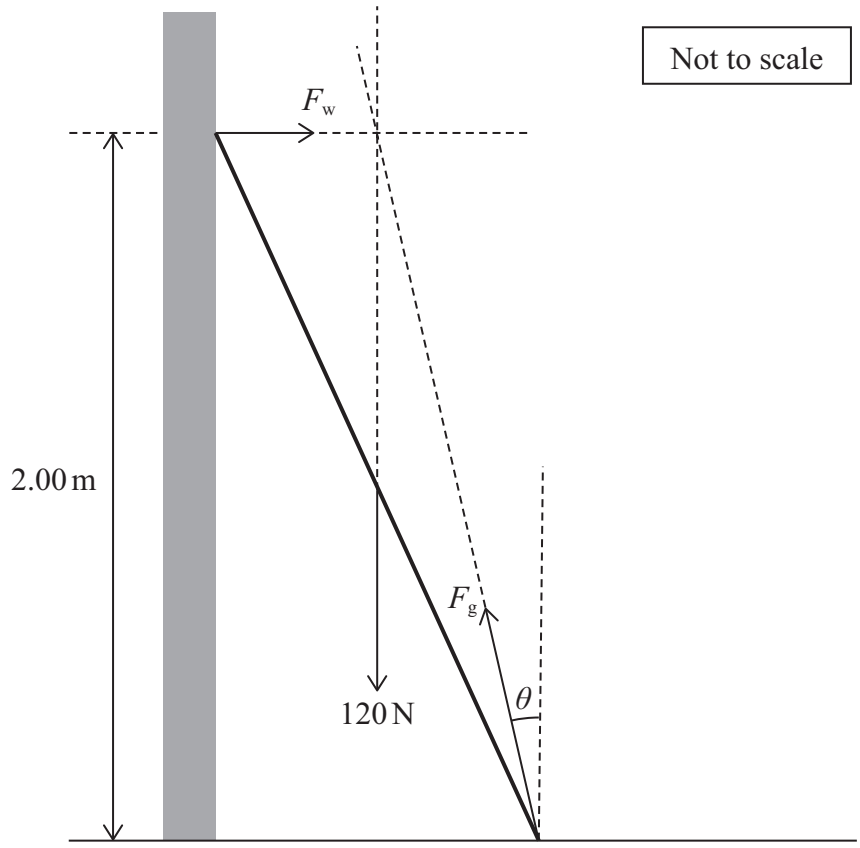
Magnitude of $F_g$ = .....

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(b) A student moves the ladder to a new position so that the vertical distance from the top of the ladder to the ground is 2.00 m.

The lines of action of the three forces acting on the ladder intersect at the same point, as shown.




Determine $\theta$ when the ladder is in the new position.

length of ladder = 2.07 m

**(3)**

$\theta$ = .....

(c) The student climbs the ladder. Explain how the magnitude of the force $F_w$ of the wall on the ladder changes as he climbs.

You should consider the resultant moment about the bottom of the ladder.

**(4)**

**(Total for Question 20 = 11 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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