AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

A-level PHYSICS

Paper 1

Wednesday 20 May 2026 Afternoon Time allowed: 2 hours

Materials

For this paper you must have:
- a pencil and a ruler
- a scientific calculator
- a Data and Formulae Booklet
- a protractor.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show all your working.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 85.
- You are expected to use a scientific calculator where appropriate.
- A Data and Formulae Booklet is provided as a loose insert.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7–31	
TOTAL	

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Section A

Answer **all** questions in this section.

0 1 . 1 Describe the simple model of the nitrogen-17 $\left({}^{17}_{7}\mathrm{N}\right)$ atom.

[2 marks]

A nitrogen-17 nucleus is unstable and decays in two steps:

step 1

The nitrogen-17 nucleus decays to form an oxygen-17 $\left({}^{17}_{8}\mathrm{O}\right)$ nucleus in an excited state.

step 2

The excited oxygen-17 nucleus becomes a stable isotope by emitting a neutron.

0 1 . 2 State the fundamental force involved in **step 1**.
Go on to explain your answer.

[2 marks]

Do not write outside the box

0 1 . 3 Describe, for **step 2**, the properties of the force that keeps the de-excited oxygen-17 nucleus stable.

[2 marks]

The neutron emitted in **step 2** decays into a baryon and other particles.

0 1 . 4 State the names of the leptons that are produced in neutron decay.

[1 mark]

0 1 . 5 State the name of the baryon that is produced in neutron decay.
Go on to comment on the stability of this baryon.

[1 mark]

8

Turn over for the next question

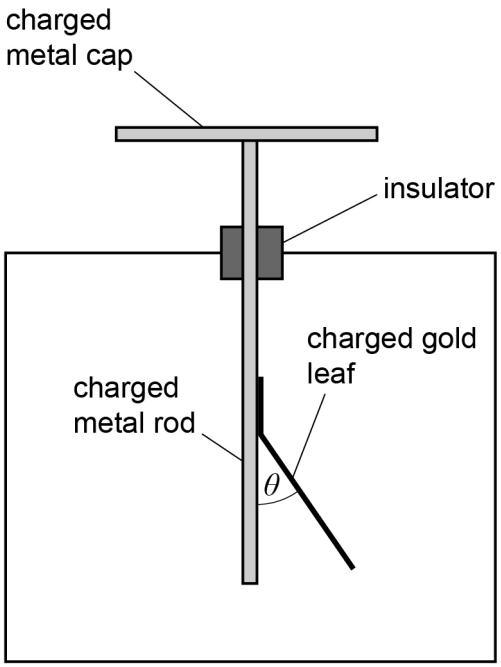
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0 2 This question is about the photoelectric effect.

Figure 1 shows an electroscope.
In this electroscope, the top of a gold leaf is attached to a metal rod. The metal rod is attached to a metal cap.
When the cap is given a charge, the bottom of the leaf is repelled from the rod through an angle θ as shown in **Figure 1**.

The greater the charge on the electroscope, the greater the angle θ.

Figure 1



In a demonstration, the cap is given a negative charge.
Monochromatic light is then incident on the cap.
When the light has a frequency less than a particular threshold frequency f_0, the angle θ does not change.
When the light has a frequency greater than f_0, the gold leaf immediately falls back to the rod so that θ is zero.

The cap is made from a metal **M**. The work function of **M** is $5.01\ \text{eV}$.

0 2 . 1 Explain what is meant by a work function of $5.01\ \text{eV}$.

[1 mark]

Do not write outside the box

0 2 . 2 Calculate f_0.
State the SI fundamental (base) unit for your answer.

[3 marks]

$f_0 =$ _____

fundamental (base) unit = _____

0 2 . 3 Explain, with reference to photons, why there is a threshold frequency.

[2 marks]

_____

_____

_____

_____

_____

0 2 . 4 The cap is now given a **positive** charge so that the leaf is again at an angle θ as shown in **Figure 1**.
Monochromatic light with a frequency greater than f_0 is incident on the cap.

Suggest what happens to θ.
Explain your answer.

[2 marks]

_____

_____

_____

_____

_____

_____

Question 2 continues on the next page

Do not write outside the box

0 2 . 5 The existence of a threshold frequency supports the suggestion that electromagnetic waves have a particulate nature.

State **two** other observations from photoelectric experiments that support this suggestion.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

10

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0 3 A student with normal vision can detect light with a wavelength in the range 380 nm to 750 nm.

Monochromatic light is incident on a single slit and produces a pattern on a screen. The light has a wavelength of 570 nm.

Figure 2 shows the screen and the pattern seen by the student.

Figure 2



0 3 . 1 Describe the feature of **Figure 2** that shows that the pattern was produced by light passing through a single slit rather than through a double slit.

[1 mark]

0 3 . 2 A change is made. As a result, the student now sees the pattern shown in **Figure 3** on the same screen as in **Figure 2**.

Figure 3



Figure 2 and **Figure 3** are to the same scale.
The student suggests that the pattern in **Figure 3** was produced by changing only the wavelength of the light.

Explain why the student is **not** correct.

[2 marks]

Question 3 continues on the next page

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0 3 . 3 Suggest and explain **two** independent changes to the experiment that produced **Figure 2** that would each produce the pattern in **Figure 3**.

[4 marks]

1 _____

_____

_____

_____

_____

2 _____

_____

_____

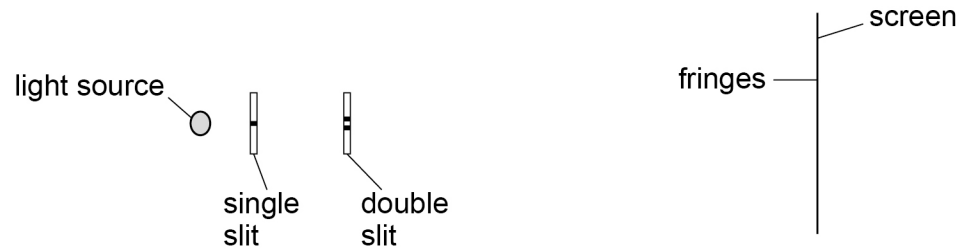
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Figure 4 shows a single slit and a monochromatic light source being used in a practical arrangement of Young's double-slit experiment.

Figure 4



plan view **not to scale**

0 3 . 4 Explain why a single slit is used in this practical arrangement.

[2 marks]

0 3 . 5 The wavelength of the light is $570\ \text{nm}$.
The distance between the double slit and the screen is $1.50\ \text{m}$.
The screen is $8.2\ \text{cm}$ wide.
There is a maximum at each edge of the screen and 11 maxima between them.

Calculate the double-slit separation.

[3 marks]

double-slit separation = _____ m

12

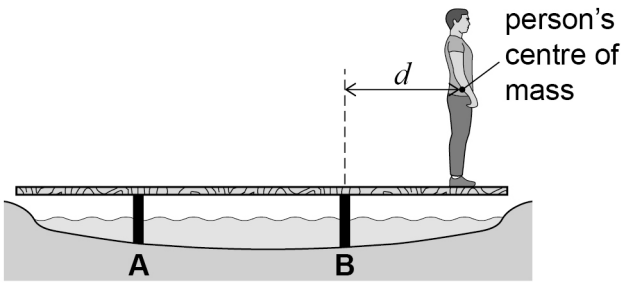
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0 4 . 1 State the principle of moments.

[1 mark]

0 4 . 2 **Figure 5** shows a person standing on a simple bridge.

Figure 5



The bridge consists of a horizontal plank of wood resting on two vertical pillars **A** and **B**.
The plank has a length of $3.72\ \text{m}$ and a weight of $912\ \text{N}$.

A is $0.85\ \text{m}$ from the left-hand end of the plank.

The horizontal distance between **A** and **B** is $1.35\ \text{m}$.

The person has a mass of $75\ \text{kg}$.
The horizontal distance between his centre of mass and **B** is d, as shown in **Figure 5**.

When d is $1.22\ \text{m}$, the plank just loses contact with **A**.

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Deduce whether the centre of mass of the plank is at its midpoint.

[3 marks]

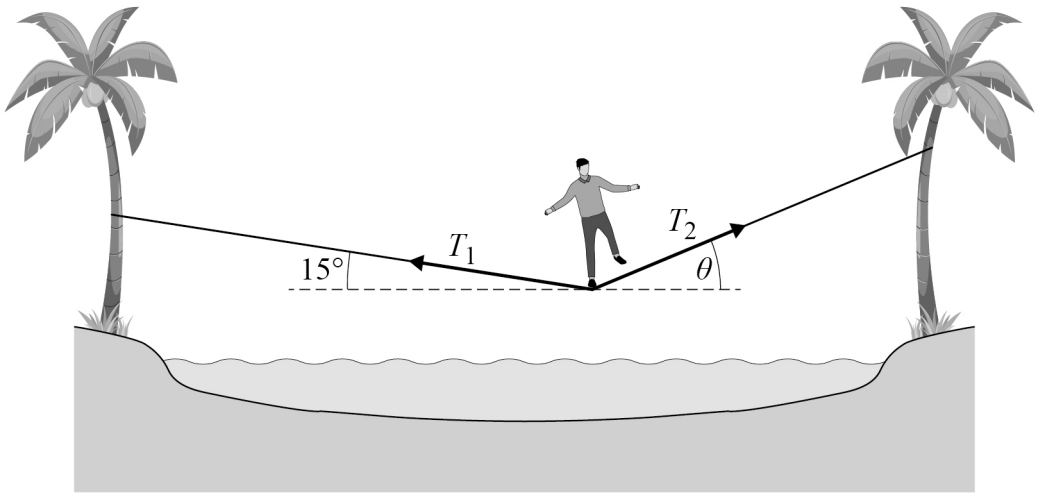
Question 4 continues on the next page

Do not write outside the box

Figure 6 shows a different person balancing on one leg on a tightrope. The person is in equilibrium.

Figure 6

not to scale



This person weighs 640 N.

The tensions in the rope are T_1 and T_2 as shown in **Figure 6**.
T_1 is 420 N and it acts at an angle of 15° to the horizontal.
T_2 acts at an angle of θ to the horizontal.

All of the forces act in the plane of the diagram.
Friction between the rope and the person is negligible.

0 4 . 3 Draw an arrow on **Figure 6** to represent the person's weight.

[1 mark]

Do not write outside the box

0 4 . 4 Determine T_2 and θ.

[4 marks]

$T_2 =$ _____ N

$\theta =$ _____ °

0 4 . 5 The two trees in **Figure 6** now bend towards each other. This means that the person is closer to the water.

Discuss the effect that this change has on the magnitude of T_2.

[2 marks]

_____

_____

_____

_____

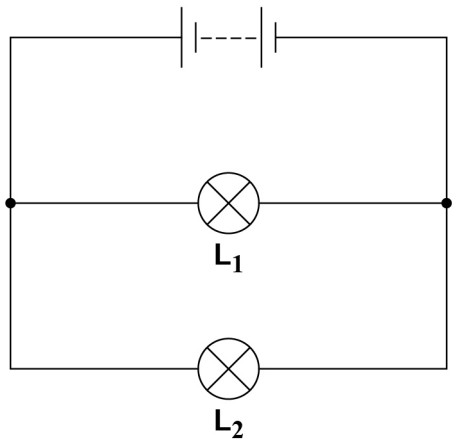
11

Turn over for the next question

Do not write outside the box

0 5 **Figure 7** shows a circuit with a battery of negligible internal resistance and emf $5.8\ \text{V}$.

Figure 7



$\mathbf{L_1}$ has a power rating of $2.5\ \text{mW}$ at its working voltage of $5.8\ \text{V}$.
$\mathbf{L_2}$ has a resistance of $1.9\ \text{k}\Omega$ at its working voltage of $5.8\ \text{V}$.

0 5 . 1 Calculate the current in the battery.

[2 marks]

current = _____ A

Do not write outside the box

0 5 . 2 L_1 and L_2 are now connected in series to the battery.

Deduce which of L_1 or L_2 is operating closer to its working voltage.
Support your answer with calculations.

[3 marks]

5

Turn over for the next question

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0 6 **Figure 8** shows a child on a playground swing.
Assume that the system behaves as a simple pendulum and performs simple harmonic motion.

Figure 8

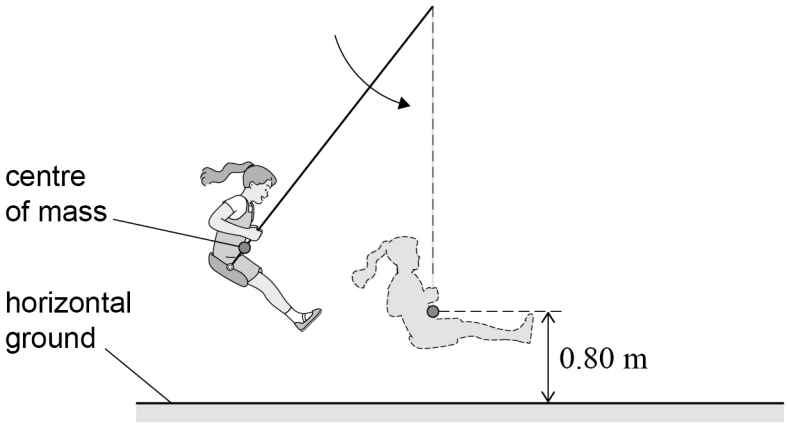
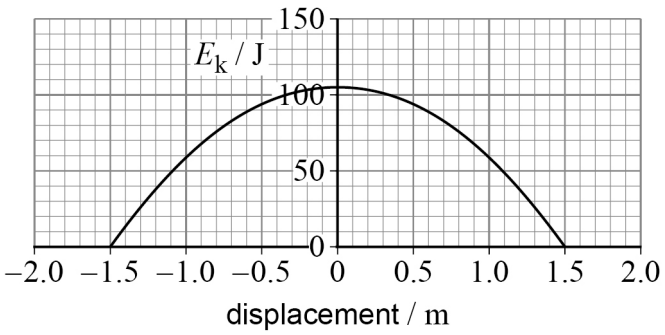


Figure 9 shows how the kinetic energy E_k of the system varies with displacement.

Figure 9



The total mass of the child and swing is $25\ \text{kg}$.

0 6 . 1 Show that the maximum speed of the centre of mass is about $2.9\ \text{m s}^{-1}$.

[2 marks]

Do not write outside the box

0 6 . 2 Show that the length of the pendulum is about $2.6\ \text{m}$.

[2 marks]

Question 6 continues on the next page

Do not write outside the box

0 6 . 3 The gravitational potential energy E_p is zero at ground level.

The centre of mass of the system is $0.80\ \text{m}$ above the ground at the lowest point of the oscillation.

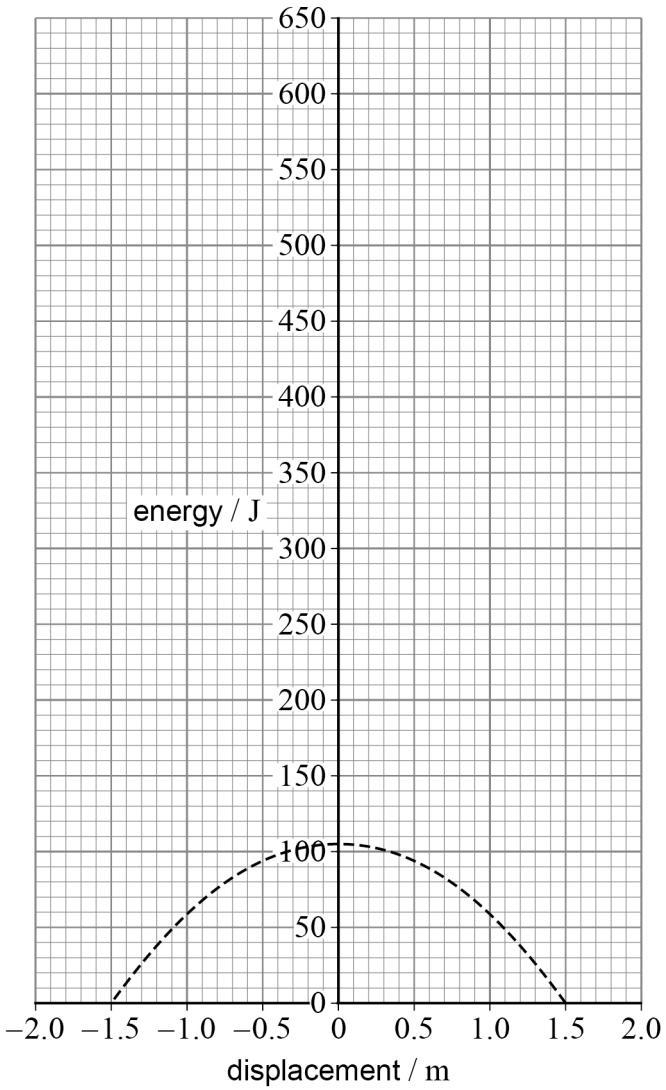
Figure 10 shows the variation of E_k from **Figure 9**.

Sketch, on **Figure 10**, the variation with displacement of:

- E_p and label this **P**
- the total energy $E_k + E_p$ and label this **Q**.

[3 marks]

Figure 10



Do not write outside the box

0 6 . 4 The swing consists of a seat attached to a rod.
The rod has negligible mass and a circular cross-section of diameter $10\ \text{mm}$.

The material of the rod has a Young modulus of $2.5\ \text{GPa}$.
For safety reasons, the maximum strain allowed in the rod is 1.0%.

The maximum tension in the rod occurs at the lowest point of the oscillation.
The maximum speed of the centre of mass of the system is $2.9\ \text{m s}^{-1}$.

Assume that the distance between the centre of mass of the system and the top of the swing does not change.

Suggest a safe weight limit for the system.

[5 marks]

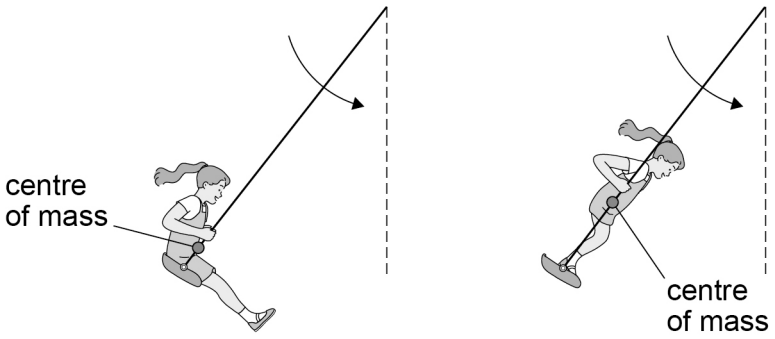
safe weight limit = _____ N

Question 6 continues on the next page

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0 6 . 5 The child can be in a sitting or standing position, as shown in **Figure 11**.

Figure 11



Discuss how the position of the child affects the period of oscillation of the system.
[2 marks]

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END OF SECTION A

Do not write outside the box

Section B

Each of Questions **07** to **31** is followed by four responses, **A**, **B**, **C** and **D**.

For each question select the best response.

Only **one** answer per question is allowed.
For each question, completely fill in the circle alongside the appropriate answer.

CORRECT METHOD  WRONG METHODS 

If you want to change your answer you must cross out your original answer as shown. 

If you wish to return to an answer previously crossed out, ring the answer you now wish to select as shown. 

You may do your working in the blank space around each question but this will not be marked. Do **not** use additional sheets for this working.

0 7 The existence of the neutrino was proposed in order to:

[1 mark]

A provide a symmetry of particle classification. ⬭

B explain why strange particles are created in pairs. ⬭

C ensure conservation of lepton number in weak interactions. ⬭

D account for conservation of energy in beta decay. ⬭

0 8 A photon of energy $280\ \mathrm{MeV}$ undergoes pair production.

Which pair of particles could be produced?

[1 mark]

A $\mathrm{n} + \mathrm{n}$ ⬭

B $\pi^0 + \pi^0$ ⬭

C $\mathrm{p} + \overline{\mathrm{p}}$ ⬭

D $\mathrm{K}^0 + \overline{\mathrm{K}}^0$ ⬭

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0 9 In a fluorescent tube:

[1 mark]

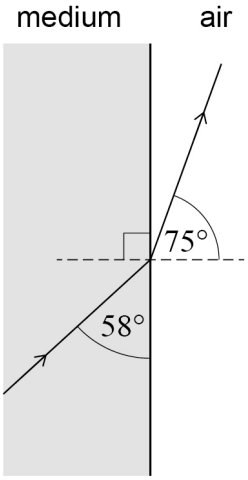
A mercury atoms become ionised and then emit white light. ⬭

B atoms in the coating become ionised and then emit white light. ⬭

C atoms in the coating become excited and then emit ultraviolet light. ⬭

D mercury atoms become excited and then emit ultraviolet light. ⬭

1 0 A ray of light passes from a medium into air.



Which row gives the speed of light in the medium and the refractive index of the medium?

[1 mark]

	Speed of light / m s^{-1}	**Refractive index**	
A	1.65×10^8	1.82	⬭
B	1.65×10^8	1.14	⬭
C	2.63×10^8	1.14	⬭
D	2.63×10^8	1.82	⬭

Do not write outside the box

1 1 A pulse of white light travels along the axis of a straight optical fibre of length $100\ \text{km}$.



Which row describes the amount of material dispersion and the amount of modal dispersion of the pulse caused by passing through the fibre?

[1 mark]

	Material dispersion	**Modal dispersion**	
A	negligible	negligible	⬭
B	significant	negligible	⬭
C	negligible	significant	⬭
D	significant	significant	⬭

1 2 A car is moving at a constant initial speed. It then travels in a straight line with a constant acceleration of $0.49\ \text{m s}^{-2}$.
During the acceleration, the car travels a distance of $1440\ \text{m}$ and reaches a final speed of $46\ \text{m s}^{-1}$.

Which row gives the average speed and the time taken for the acceleration?

[1 mark]

	Average speed / m s^{-1}	**Time / s**	
A	23	40	⬭
B	36	40	⬭
C	23	94	⬭
D	36	94	⬭

Do not write outside the box

1 3 A rocket is launched from the Earth's surface.
At launch, the rocket has a mass of 2.97×10^6 kg.
The initial vertical acceleration of the rocket is $41.2\ \text{m s}^{-2}$.

What is the initial vertical thrust from the rocket's engines?

[1 mark]

A 1.22×10^7 N ⬭

B 4.14×10^7 N ⬭

C 1.22×10^8 N ⬭

D 1.51×10^8 N ⬭

1 4 A rocket is moving vertically through air at its constant maximum velocity.

Which **must** be true?

[1 mark]

A The rocket is moving upwards. ⬭

B The rocket has used up all of its fuel. ⬭

C The acceleration of the rocket is g. ⬭

D The resultant force on the rocket is zero. ⬭

1 5 Which shows the results of the decay of a μ^- particle?

[1 mark]

A $e^- + \nu_\mu$ ⬭

B $e^- + \bar{\nu}_\mu + \nu_e$ ⬭

C $e^- + \nu_\mu + \bar{\nu}_e$ ⬭

D $e^- + \bar{\nu}_\mu + \bar{\nu}_e$ ⬭

Do not write outside the box

1 6 This equation represents the decay of a kaon K^+.

$$K^+ \rightarrow \mathbf{X} + \pi^0$$

What is the quark configuration of **X**?

[1 mark]

A $u\bar{s}$ ⬭

B $u\bar{d}$ ⬭

C uud ⬭

D uds ⬭

1 7 A horizontal air track and gliders are used to investigate frictionless motion.

A glider of mass $225\ g$ is travelling to the right at $0.80\ m\ s^{-1}$ on the air track.
A glider of mass $340\ g$ is travelling to the left at $0.70\ m\ s^{-1}$ on the same track.

The two gliders collide and stick together.

Which row gives the speed and direction of the gliders immediately after they collide?

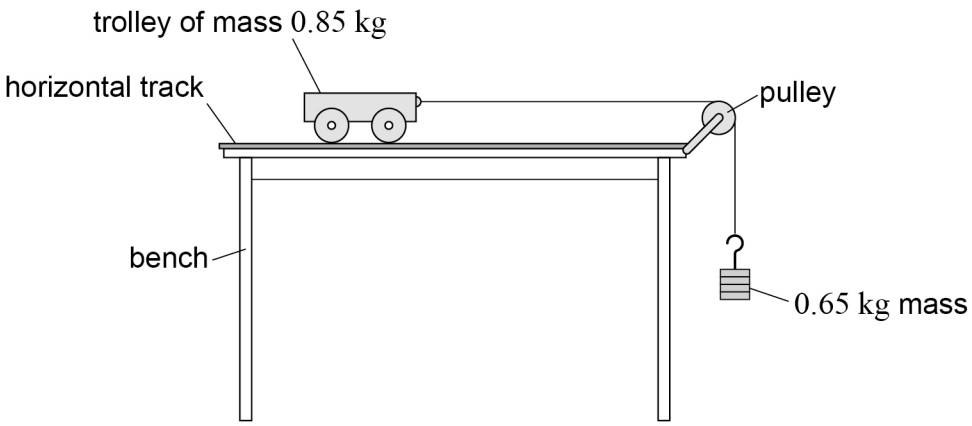
[1 mark]

	Speed / m s^{-1}	**Direction**	
A	0.10	to the left	⬭
B	0.10	to the right	⬭
C	0.74	to the left	⬭
D	0.74	to the right	⬭

Turn over ►

Do not write outside the box

1 8 A trolley of mass $0.85\ \text{kg}$ is attached to a mass of $0.65\ \text{kg}$ by a string that passes over a smooth pulley. The string has negligible mass.



The trolley is released and accelerates from rest along a horizontal track.
Friction is negligible.

What is the kinetic energy of the trolley when the $0.65\ \text{kg}$ mass has fallen $0.20\ \text{m}$?

[1 mark]

A $0.72\ \text{J}$ ⬭

B $1.18\ \text{J}$ ⬭

C $1.28\ \text{J}$ ⬭

D $1.67\ \text{J}$ ⬭

1 9 Which is equivalent to the ohm?

[1 mark]

A J s^{-1} ⬭

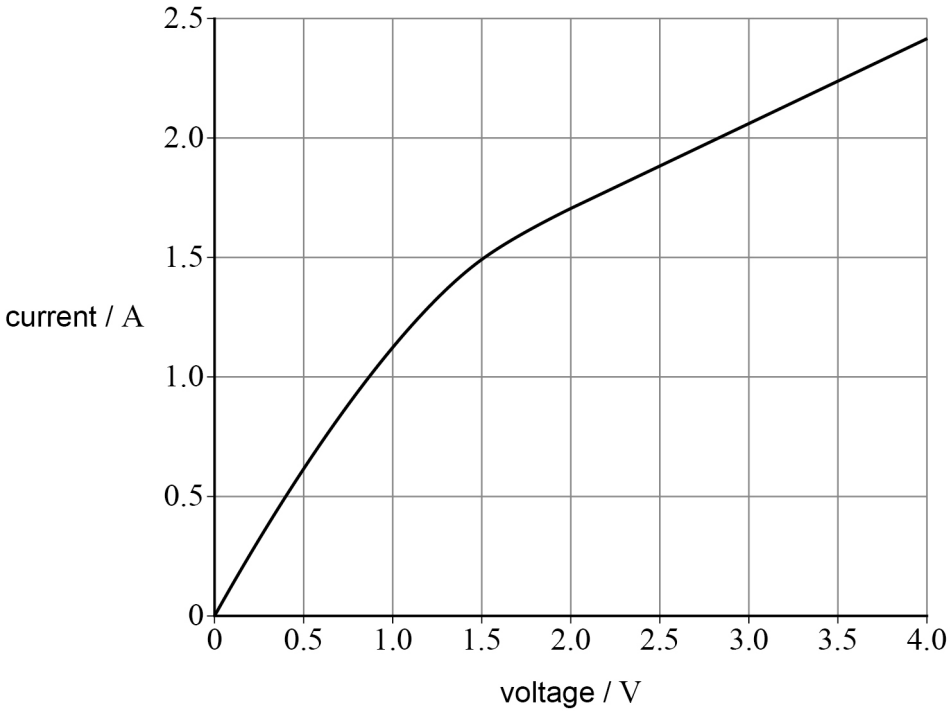
B $\text{J C}^{-2}\ \text{s}^{-1}$ ⬭

C $\text{C J}^{-1}\ \text{s}^{-1}$ ⬭

D J s C^{-2} ⬭

Do not write outside the box

2 0 The graph is the characteristic of a lamp.



Which statement is correct?

[1 mark]

A The resistance of the lamp is a maximum between 0 and 0.5 V. ⬭

B The lamp is ohmic between 2.0 V and 4.0 V. ⬭

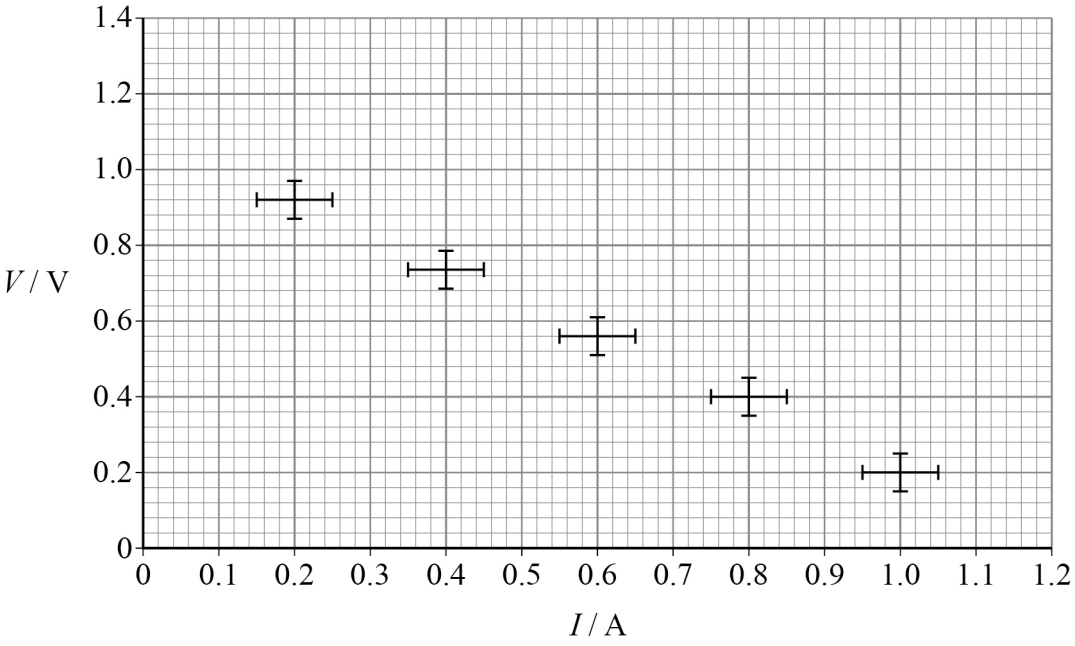
C When the resistance is 1.0 Ω, the power developed in the lamp is 2.25 W. ⬭

D At 4.0 V the lamp transfers about 300 J of energy in one minute. ⬭

Turn over for the next question

Do not write outside the box

2 1 A student measures the terminal potential difference V for a battery for different values of current I. The results, including error bars, are plotted.



The graph is used to determine the emf of the battery.

What is the percentage uncertainty in the emf of the battery?

[1 mark]

A 1% ⬭

B 3% ⬭

C 6% ⬭

D 12% ⬭

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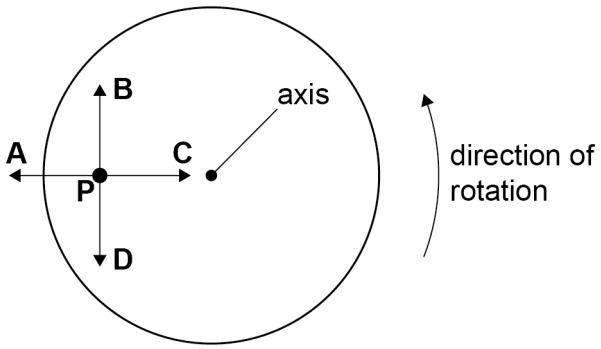
Questions **22** and **23** are about a point object **P** on a horizontal disc.

The mass of **P** is $2.5\ \text{g}$. The radius of the disc is $1.0\ \text{m}$.

2 2 **P** is moving about the axis at a constant angular speed. **P** does not slip.

Which arrow shows the direction of the resultant force on **P**?

[1 mark]



A ⬭

B ⬭

C ⬭

D ⬭

2 3 The distance from the edge of the disc to **P** is $0.10\ \text{m}$.
P starts to slip when the linear velocity of **P** is $5.0\ \text{m s}^{-1}$.

What is the frictional force between **P** and the disc when **P** starts to slip?

[1 mark]

A $0.015\ \text{N}$ ⬭

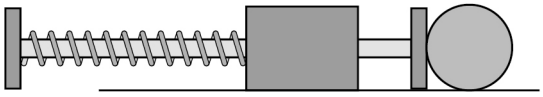
B $0.025\ \text{N}$ ⬭

C $0.069\ \text{N}$ ⬭

D $0.625\ \text{N}$ ⬭

Do not write outside the box

2 4 A spring of spring constant $200\ \text{N m}^{-1}$ is extended by a distance x.
The extended spring is released and launches a ball of mass m horizontally.



Which combination of x and m gives the greatest launch velocity?

[1 mark]

	x / m	m / g	
A	0.10	5	⬭
B	0.15	5	⬭
C	0.10	10	⬭
D	0.15	10	⬭

2 5 A ball is thrown vertically upwards and returns to its starting point.

Assume that air resistance is negligible.

From the moment of release until just before it is caught, the ball experiences a resultant force that has:

[1 mark]

A a constant magnitude and constant direction. ⬭

B a changing magnitude and constant direction. ⬭

C a constant magnitude and changing direction. ⬭

D a changing magnitude and changing direction. ⬭

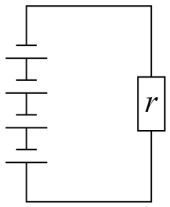
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2 6 Four cells are connected to an external resistor of resistance r.
Each cell has emf ε and internal resistance r.

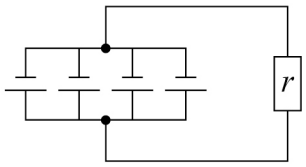
Which circuit has the largest current in the external resistor?

[1 mark]

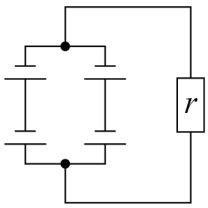
A



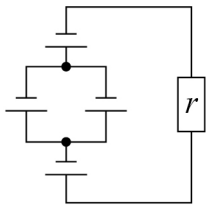
B



C



D



A ⬭

B ⬭

C ⬭

D ⬭

2 7 Two points on a progressive wave are a distance of $1.5\ \text{mm}$ apart.
The two points oscillate with a phase difference of $\frac{\pi}{6}\ \text{rad}$.

What is a possible value for the wavelength of the wave?

[1 mark]

A $1.4\ \text{mm}$ ⬭

B $9.0\ \text{mm}$ ⬭

C $16.5\ \text{mm}$ ⬭

D $20.5\ \text{mm}$ ⬭

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2 8 The energy levels of an atom include three levels L_1, L_2 and L_3.
Transitions between L_2 and L_1 produce light of wavelength 587 nm.
Transitions between L_3 and L_1 produce light of wavelength 447 nm.

Transitions from L_3 to L_2 produce light of wavelength:

[1 mark]

A 140 nm ⬭

B 254 nm ⬭

C 1034 nm ⬭

D 1874 nm ⬭

2 9 Which row shows an example of a wave with its type and the direction of particle displacement?

[1 mark]

	Example	Type	Direction of particle displacement	
A	sound wave	longitudinal	parallel to direction of energy propagation	⬭
B	sound wave	transverse	perpendicular to direction of energy propagation	⬭
C	wave on a plucked string	longitudinal	perpendicular to direction of energy propagation	⬭
D	wave on a plucked string	transverse	parallel to direction of energy propagation	⬭

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3 0 Stationary waves are produced on a stretched string.

Three points on the string are labelled **P**, **Q** and **R**.

At one instant, the displacement of **P** is $1.0\ \text{mm}$, the displacement of **Q** is $1.0\ \text{mm}$ and the displacement of **R** is $-1.0\ \text{mm}$.

Which statement must be correct?

[1 mark]

A **P**, **Q** and **R** are antinodes. ⬭

B **Q** and **R** are one wavelength apart. ⬭

C **P** and **R** are in antiphase. ⬭

D The amplitude of **P** is greater than the amplitude of **R**. ⬭

3 1 A string of mass m is connected horizontally between two points.
The length of the string is $1.8\ \text{m}$ and the tension in the string is $2.4\ \text{N}$.

The string is made to vibrate so that stationary waves are formed on the string.

The frequency of the third harmonic is $75\ \text{Hz}$.

What is m?

[1 mark]

A $3.3 \times 10^{-5}\ \text{kg}$ ⬭

B $5.9 \times 10^{-5}\ \text{kg}$ ⬭

C $3.0 \times 10^{-4}\ \text{kg}$ ⬭

D $5.3 \times 10^{-4}\ \text{kg}$ ⬭

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END OF QUESTIONS

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