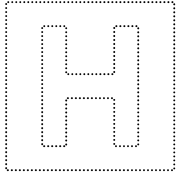


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INNOVA JUNIOR COLLEGE
JC2 PRELIMINARY EXAMINATION
in preparation for General Certificate of Education Advanced Level
Higher 1

CANDIDATE
NAME

CLASS

INDEX NUMBER

PHYSICS

8866/01

Paper 1 Multiple Choice

30 August 2016

Additional Materials:

Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, civics group and index number on the Answer sheet in the spaces provided unless this has been done for you.

There are **30** questions in this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

This document consists of **15** printed pages and 1 blank page.



Innova Junior College

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[Turn over

Data

speed of light in free space,
 elementary charge,
 the Planck constant,
 unified atomic mass constant,
 rest mass of electron,
 rest mass of proton,
 acceleration of free fall,

$$\begin{aligned}c &= 3.00 \times 10^8 \text{ m s}^{-1} \\e &= 1.60 \times 10^{-19} \text{ C} \\h &= 6.63 \times 10^{-34} \text{ J s} \\u &= 1.66 \times 10^{-27} \text{ kg} \\m_e &= 9.11 \times 10^{-31} \text{ kg} \\m_p &= 1.67 \times 10^{-27} \text{ kg} \\g &= 9.81 \text{ m s}^{-2}\end{aligned}$$

Formulae

uniformly accelerated motion,

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

work done on/by a gas,

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

hydrostatic pressure,

$$W = p \Delta V$$

resistors in series,

$$p = \rho g h$$

$$R = R_1 + R_2 + \dots$$

resistors in parallel,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

- 1 Which of the following statements about a typical household washing machine is **not** true?

- A The maximum speed of rotation of the drum is 100 revolutions per second.
- B The power consumption of a washing machine is about 500 W.
- C The mass of an unloaded machine is about 75 kg.
- D It occupies around 10^8 mm^3 of space.

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- 2 The strain energy W of a spring is determined from its spring constant k and extension x . The spring obeys Hooke's law and the value of W is calculated using the equation shown.

$$W = \frac{1}{2} kx^2$$

The spring constant is $100 \pm 2 \text{ N m}^{-1}$ and the extension is $0.050 \pm 0.002 \text{ m}$.

What is the percentage uncertainty in the calculated value of W ?

- A 6%
- B 10%
- C 16%
- D 32%

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- 3 What is the SI base unit for electrical resistance?

- A $\text{kg m}^2 \text{s}^{-2} \text{A}^{-1}$
- B $\text{kg m}^2 \text{s}^{-3} \text{A}^{-2}$
- C $\text{kg m s}^{-2} \text{A}^{-1}$
- D $\text{kg m s}^{-3} \text{A}^{-1}$

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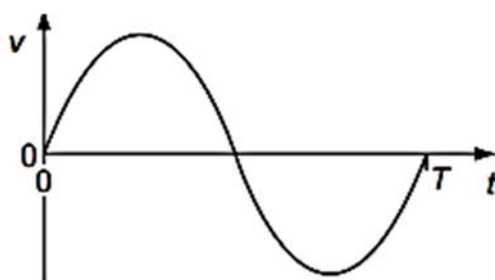
- 4 A ball is thrown vertically upwards and air resistance is not negligible. Which of the following statements is **false**?

- A At the maximum height, the acceleration is zero.
- B The distances travelled for the upward and downward motions are the same.
- C The time taken for the ball to travel up is shorter than the time taken for the downward motion.
- D The magnitude of the acceleration for the upward motion is always greater than 9.81 m s^{-2} .

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The figure contains four sub-graphs, each with displacement s on the vertical axis and time t on the horizontal axis. The horizontal axis for all graphs is marked with 0 and T .

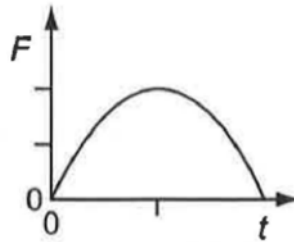
- Graph A:** A single positive pulse starting at $(0,0)$, reaching a maximum, and returning to $(T,0)$.
- Graph B:** A full sine wave cycle starting at $(0,0)$, reaching a maximum, crossing the t -axis, reaching a minimum, and returning to $(T,0)$.
- Graph C:** Two positive pulses, each starting and ending at the t -axis, with a zero-displacement interval between them.
- Graph D:** Two positive pulses, each starting and ending at the t -axis, with a zero-displacement interval between them. The pulses have a different shape than those in Graph C.

[illegible]

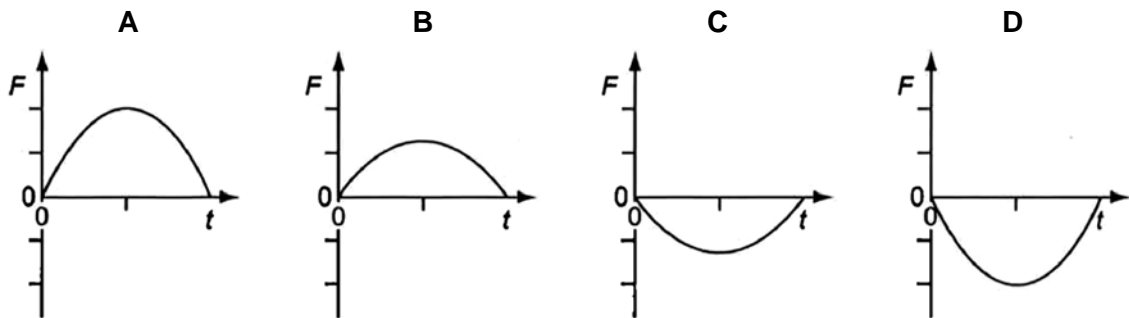
- 6 Two trolleys P and Q approach each other and collide.



The graph shows the variation with time t of the force F of P on Q.



Which graph, drawn to the same scale, shows the variation with time t of the force F of Q on P?

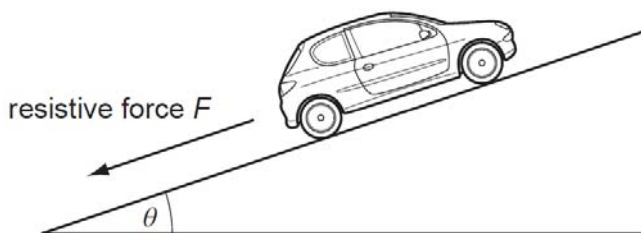


- 7 A horizontal jet of water strikes a vertical wall and flows down the wall without splashing.

Which quantity equals the force exerted by the jet on the wall?

- A change in kinetic energy of the water per length of jet stopped
- B change in momentum of the water stopped per second
- C rate of loss of kinetic energy of the water
- D weight of the water stopped per second

- 8 A car of mass m travels at constant speed up a slope at an angle θ to the horizontal, as shown in the diagram. Air resistance and friction provide a resistive force F .



What is the driving force provided by the car's engine?

- A $mg \cos \theta$
 B $mg \sin \theta$
 C $mg \cos \theta + F$
 D $mg \sin \theta + F$
- 9 An archer draws his bowstring back to position X. The bowstring and arrow are shown. The tension T in the string is also shown. Then he draws the bowstring back further to position Y.



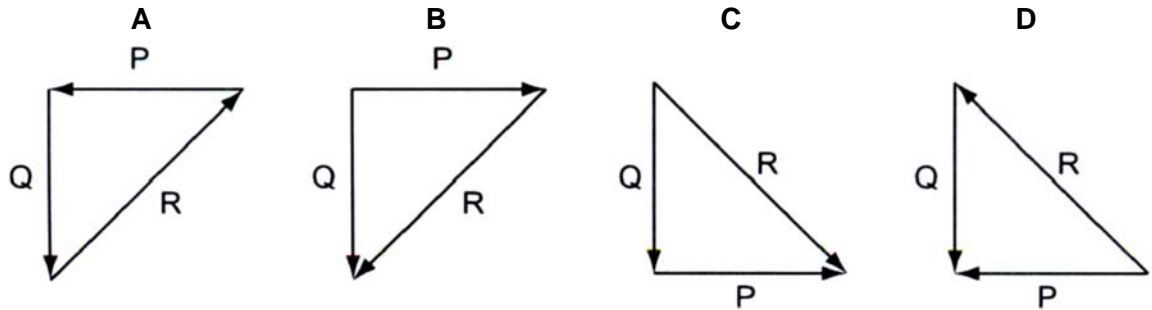
The resultant force on the arrow is greater when the arrow is released from position Y.

What is the increase in force?

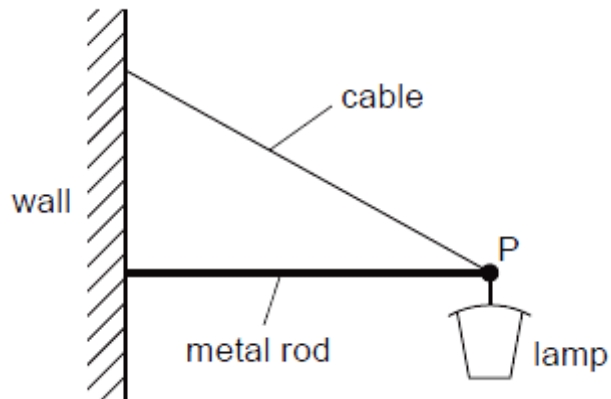
- A 15 N B 27 N C 40 N D 53 N

- 10 The initial velocity of a body is represented by the vector P , while its final velocity is represented by the vector Q . The change in the body's velocity is represented by the vector R .

Which diagram best represents P , Q and R in vectorial form?

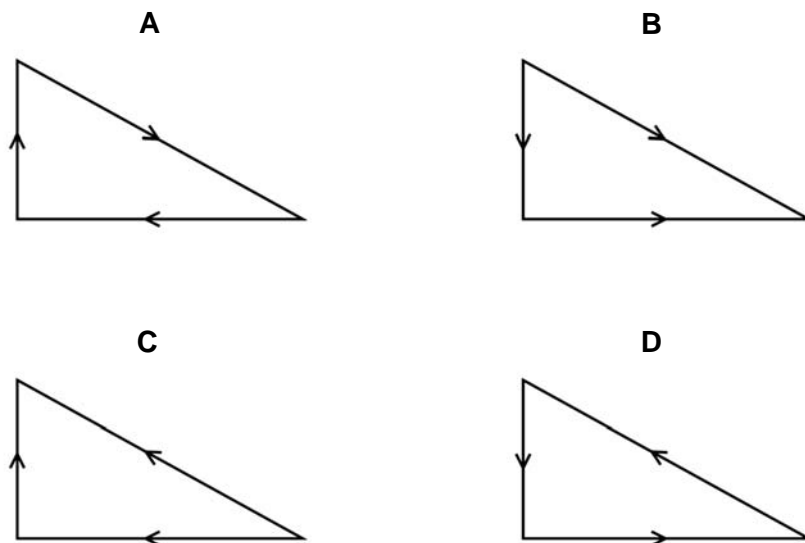


- 11 A street lamp is fixed to a wall by a metal rod and a cable.

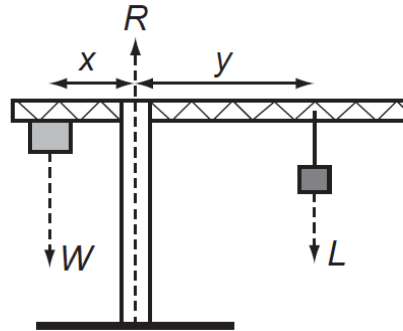


Which vector triangle represents the forces acting at point P?

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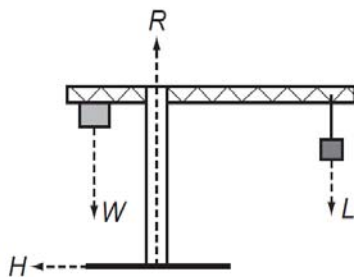
- 12 The diagram shows a crane supporting a load L .



A mass provides a balancing load W . The position of the loads are such that the system is perfectly balanced with $Wx = Ly$. The ground provides a reaction force R .

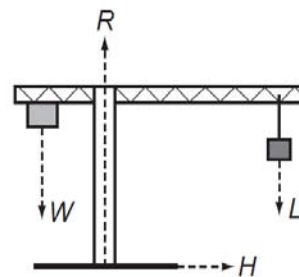
If the load L is moved further out so that the distance y increases, and the crane does not topple, which statement is correct?

A



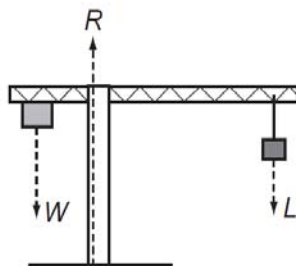
A horizontal force H acts on the base of the support column towards the left.

B



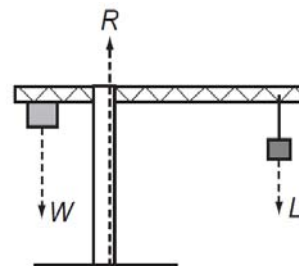
A horizontal force H acts on the base of the support column towards the right.

C



The reaction force R moves to the left.

D



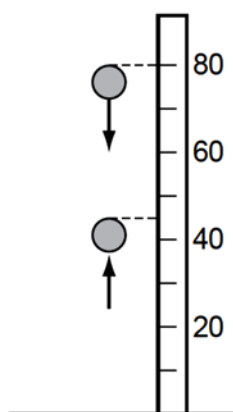
The reaction force R moves to the right.

- 13 The force resisting the motion of a car is proportional to the square of the car's speed. The magnitude of the force at a speed of 20 m s^{-1} is 800 N .

What effective power is required from the car's engine to maintain a steady speed of 40 m s^{-1} ?

- A 3.2 kW B 64 kW C 128 kW D 512 kW

- 14 A solid rubber ball has a diameter of 8.0 cm . It is released from rest with the top of the ball 80.0 cm above a horizontal surface. It falls vertically and then bounces up so that the maximum height reached by the top of the ball is 45.0 cm , as shown.

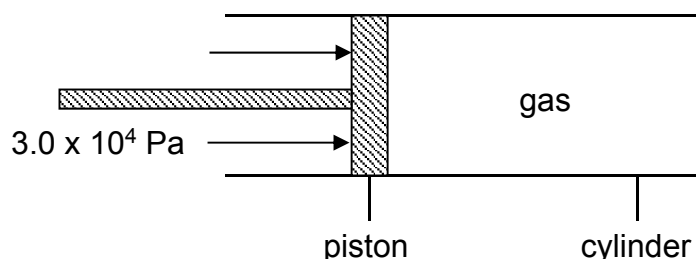


If the kinetic energy of the ball is 0.75 J just before it strikes the surface, what is its kinetic energy just after it leaves the surface?

- A 0.36 J B 0.39 J C 0.40 J D 0.42 J

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- 15 Air is enclosed in a cylinder by a gas-tight, frictionless piston of cross-sectional area 25.0 cm^2 . When a constant external pressure of $3.0 \times 10^4 \text{ Pa}$ is exerted on the piston, it settles at a distance from the end of the cylinder.



The gas is next heated and the piston moves 5.0 mm as a result.

What is the work done on the gas?

- A $-3.75 \times 10^6 \text{ J}$ B -0.375 J C 0.375 J D $3.75 \times 10^6 \text{ J}$

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- 16 The distance between two points of a progressive transverse wave having a phase difference of $\frac{\pi}{3}$ rad is 40 cm.

If the frequency of the wave is 200 Hz, what is the speed of the wave?

- A** 240 m s⁻¹ **B** 480 m s⁻¹ **C** 24 000 m s⁻¹ **D** 48 000 m s⁻¹

- 17 A plane wave of amplitude A incidents on a surface of area S placed such that it is perpendicular to the direction of travel of the wave. The energy per unit time intercepted by the surface is E .

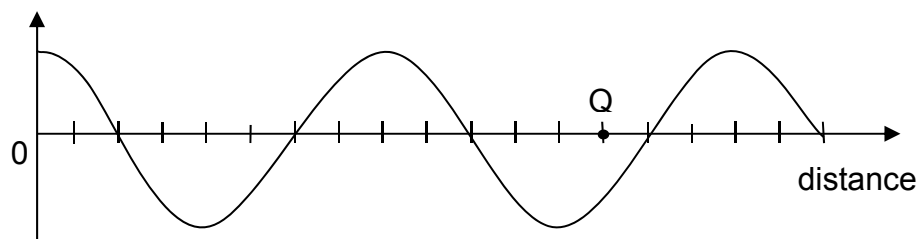
Later, the amplitude of the wave is doubled and the area of the surface is reduced by half.

How much energy per unit time is intercepted by this smaller surface?

- A** $4E$ **B** $2E$ **C** E **D** $\frac{E}{2}$

- 18 The diagram shows a transverse wave at a particular instant. The wave is travelling to the left. The frequency of the wave is 2.5 Hz.

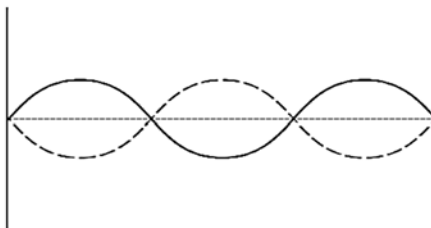
displacement



What is the shortest time after this instant for the displacement to be zero at point Q?

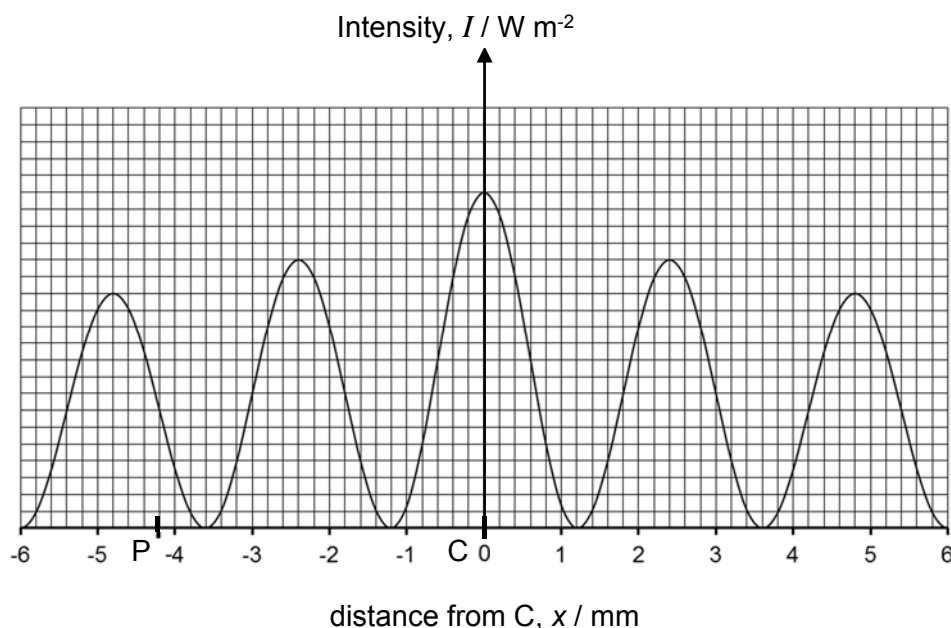
- A** 0.05 s
B 0.10 s
C 0.15 s
D 0.30 s

- 19 A stretched string fixed at two ends is plucked in the centre and vibrates between two extreme positions as shown by the bold and dashed curves in the figure below. The horizontal dashed line is the equilibrium position.



Which one of the following statements is **false**?

- A The sound generated by the vibration is a standing longitudinal wave.
 - B There are four displacement nodes and three displacement antinodes.
 - C A transverse stationary wave is formed in the string.
 - D This mode of vibration is the third lowest frequency.
- 20 In a Young's double slit experiment, coherent monochromatic light incidents normally on a double slit. The figure below shows the variation with distance from C of the intensity I of the light on the screen. C is the central bright fringe on the screen.



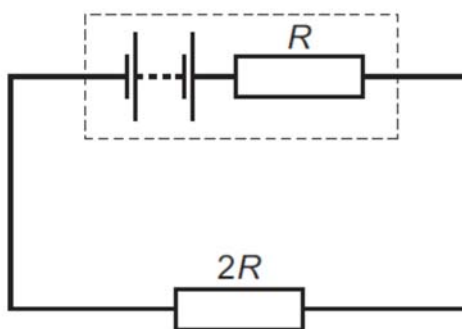
If P is a point on the screen and its position is indicated in the figure above, what is the phase angle between the two waves from the double slit, when the waves meet at P?

- A $\frac{\pi}{2}$ rad
- B $\frac{3\pi}{4}$ rad
- C $\frac{5\pi}{4}$ rad
- D $\frac{3\pi}{2}$ rad

- 21 Two lamps are connected in series to a 250 V power supply. One lamp is rated 240 V, 60 W and the other is rated 10 V, 2.5 W.

Which statement most accurately describes what happens?

- A Both lamps light at less than their normal brightness.
 - B Both lamps light normally.
 - C Only the 60 W lamp lights.
 - D The 10 V lamp blows.
- 22 The diagram shows an electric circuit in which the resistance of the external resistor is $2R$ and the internal resistance of the source is R .



What is the ratio $\frac{\text{power dissipated by external resistor}}{\text{power dissipated by internal resistor}}$?

- A 0.25
 - B 0.50
 - C 2.0
 - D 4.0
- 23 A battery is marked 9.0 V. What does this mean?
- A For each coulomb of charge that passes through the battery, it gains 9.0 J of electrical energy, converted from chemical energy.
 - B For each coulomb of charge that passes through the battery, 9.0 J of electrical energy will be converted to heat in the external resistors.
 - C The potential difference across any component connected to the battery will be 9.0 V.
 - D The potential difference across the battery terminals is always 9.0 V.

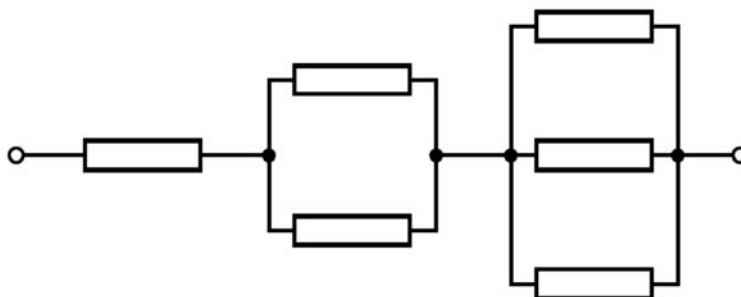
- 24 A pencil is used to draw a line of length 30 cm and width 1.2 mm.

The resistivity of the material in the pencil is $2.0 \times 10^{-5} \Omega \text{ m}$ and the resistance of the line is 40 k Ω .

What is the thickness of the line?

- A $1.25 \times 10^{-10} \text{ m}$
- B $1.25 \times 10^{-8} \text{ m}$
- C $1.25 \times 10^{-7} \text{ m}$
- D $1.25 \times 10^{-5} \text{ m}$

- 25 Six resistors, each of resistance R , are connected as shown.

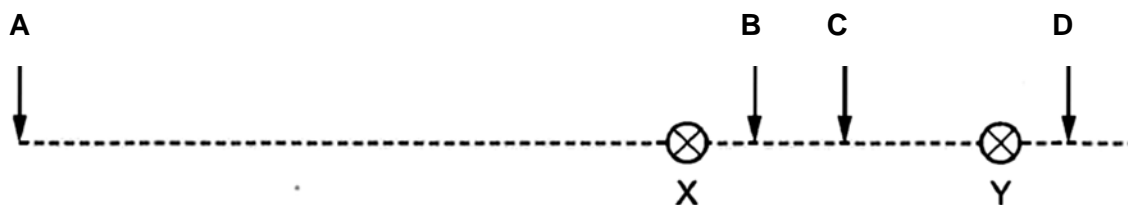


The combined resistance is 66 k Ω .

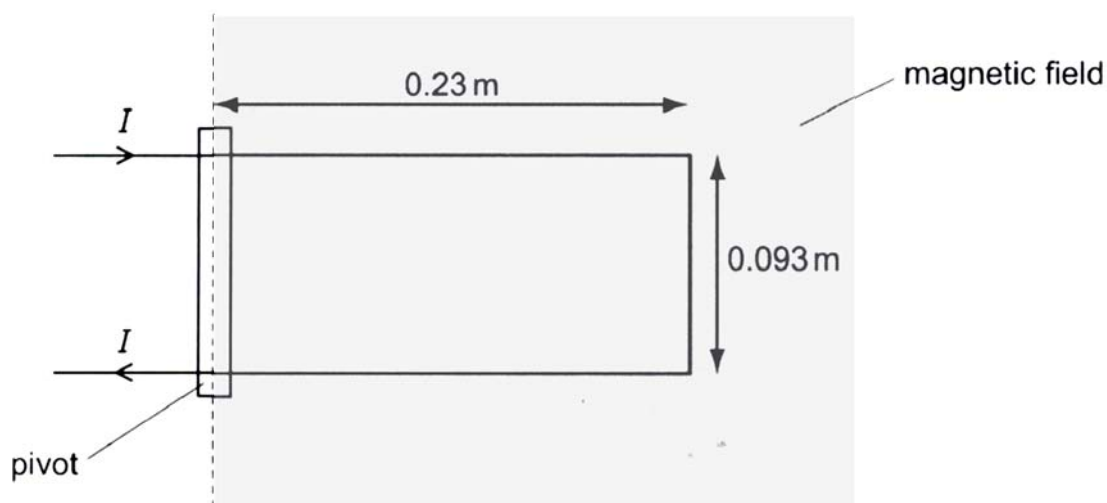
What is the value of R ?

- A 11 k Ω
 - B 18 k Ω
 - C 22 k Ω
 - D 36 k Ω
- 26 Two parallel wires X and Y carry equal currents vertically down into the paper.

At which point must a third current-carrying wire be placed so that it experiences the minimum magnetic force due to the resultant magnetic field caused by the currents in X and Y?



- 27 In order to determine the value of a current I , it is passed into a current balance. This consists of a U-shaped wire placed in a constant magnetic field of flux density $3.6 \times 10^{-2} \text{ T}$. The U-shaped wire has length 0.23 m and the arms are 0.093 m apart, as shown in the diagram.



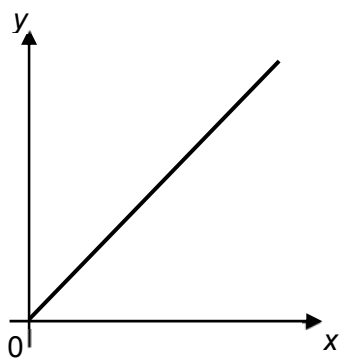
The U-shaped wire experiences a turning moment about the pivot of value $7.4 \times 10^{-3} \text{ N m}$.

What is the value of I ?

- A** 0.044 A **B** 1.6 A **C** 2.8 A **D** 9.6 A

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- 28 In a photoelectric emission experiment on a certain metal surface, two quantities, when plotted as a graph of y against x , give a straight line passing through the origin.



Which of the following correctly identifies x and y with the photoelectric quantities?

	x	y
A	photocurrent	threshold frequency
B	light intensity	maximum kinetic energy of photoelectrons
C	light intensity	photocurrent
D	frequency of incident light	maximum kinetic energy of photoelectrons

- 29 Which of the following gives the de Broglie wavelength of a particle of mass m and kinetic energy E ?

A $h\sqrt{2mE}$ B $\frac{\sqrt{2mE}}{h}$ C $\frac{h}{\sqrt{2mE}}$ D $\frac{h}{\sqrt{mE}}$

- 30 When an atom absorbs radiation of wavelength λ_1 , it makes a transition from its ground state of energy E_1 to an excited state of energy E_3 .

The atom then makes a second transition to a state of lower energy E_2 , emitting radiation of wavelength λ_2 .

What is the wavelength of the radiation emitted by the atom when it makes a third transition from its intermediate state of energy E_2 back to the ground state?

A $\lambda_1 - \lambda_2$ B $\lambda_2 - \lambda_1$ C $\frac{\lambda_1\lambda_2}{\lambda_1 - \lambda_2}$ D $\frac{\lambda_1\lambda_2}{\lambda_2 - \lambda_1}$

