EUNOIA JUNIOR COLLEGE
JC2 PRELIMINARY YEAR EXAMINATIONS 2025
General Certificate of Education Advanced Level
Higher 2

CANDIDATE NAME							
CIVICS GROUP	**2**	**4**	**-**			REGISTRATION NUMBER	

PHYSICS 9749/01

Multiple Choice Questions

September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, civics group and registration number on all the work you hand in.
The use of an approved scientific calculator is expected where appropriate.
Answer **all** questions.

There are **thirty** questions in this section.
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.

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 **21** printed pages and **3** blank pages.

Data

speed of light in free space,	$c = 3.00 \times 10^{8}$ m s^{-1}
permeability of free space,	$\mu_0 = 4\pi \times 10^{-7}$ H m^{-1}
permittivity of free space,	$\varepsilon_0 = 8.85 \times 10^{-12}$ F m^{-1}
	$\left(1 / \left(36\pi\right)\right) \times 10^{-9}$ F m^{-1}
elementary charge,	$e = 1.60 \times 10^{-19}$ C
the Planck constant,	$h = 6.63 \times 10^{-34}$ J s
unified atomic mass constant,	$u = 1.66 \times 10^{-27}$ kg
rest mass of electron,	$m_e = 9.11 \times 10^{-31}$ kg
rest mass of proton,	$m_p = 1.67 \times 10^{-27}$ kg
molar gas constant,	$R = 8.31$ J K^{-1} mol^{-1}
the Avogadro constant,	$N_A = 6.02 \times 10^{23}$ mol^{-1}
the Boltzmann constant,	$k = 1.38 \times 10^{-23}$ J K^{-1}
gravitational constant,	$G = 6.67 \times 10^{-11}$ N m^2 kg^{-2}
acceleration of free fall,	$g = 9.81$ m s^{-2}

Formulae

uniformly accelerated motion,	$s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$
work done on/by a gas,	$W = p\Delta V$
hydrostatic pressure,	$p = \rho gh$
gravitational potential,	$\phi = -\frac{Gm}{r}$
temperature,	$T\ /\ \mathrm{K} = T\ /\ ^\circ\mathrm{C} + 273.15$
pressure of an ideal gas,	$p = \frac{1}{3}\frac{Nm}{V}\langle c^2 \rangle$
mean translational kinetic energy of an ideal gas molecule	$E = \frac{3}{2}kT$
displacement of particle in s.h.m.	$x = x_0 \sin \omega t$
velocity of particle in s.h.m.	$v = v_0 \cos \omega t$ $= \pm\ \omega \sqrt{\left(x_0^2 - x^2\right)}$
electric current,	$I = Anvq$
resistors in series,	$R = R_1 + R_2 + \ldots$
resistors in parallel,	$1/R = 1/R_1 + 1/R_2 + \ldots$
electric potential,	$V = \frac{Q}{4\pi\varepsilon_0 r}$
alternating current/voltage,	$x = x_0 \sin \omega t$
magnetic flux density due to a long straight wire	$B = \frac{\mu_0 I}{2\pi d}$
magnetic flux density due to a flat circular coil	$B = \frac{\mu_0 NI}{2r}$
magnetic flux density due to a long solenoid	$B = \mu_0 nI$
radioactive decay,	$x = x_0 \exp(-\lambda t)$
decay constant	$\lambda = \frac{\ln 2}{t_{\frac{1}{2}}}$

Section A – Multiple Choice Questions

1 A copper pipe has a true diameter of 42.03 mm.

A builder measures the diameter of the pipe five times using digital calipers. The measurements are shown in the table.

diameter / mm
48.12
47.99
48.01
48.00
46.80

What describes the builder's measurements?

A accurate and precise

B accurate but not precise

C not precise and not accurate

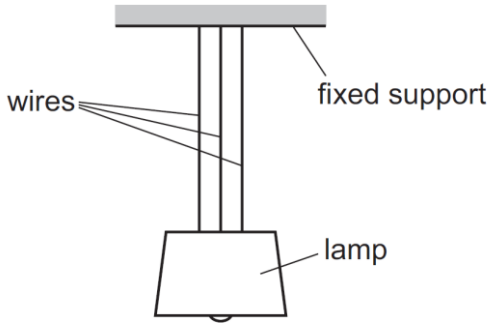
D precise but not accurate

2 A person, travelling on a motorway a total distance of 200 km, travels the first 90 km at an average speed of 80 km h^{-1}.

Which average speed must be obtained for the rest of the journey if the person is to reach the destination in a total time of 2 hours 0 minutes?

A 110 km h^{-1} **B** 120 km h^{-1} **C** 122 km h^{-1} **D** 126 km h^{-1}

3 A lamp is suspended in equilibrium from a fixed support by three long identical wires.



The weight of the lamp causes each wire to have an extension of 0.40 cm. The height *h* of the lamp above the floor is measured.

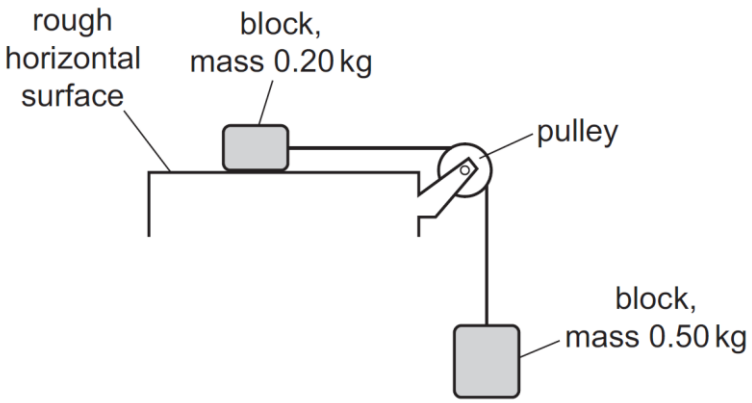
The middle wire suddenly breaks and the lamp falls a small distance as the extensions of the remaining two wires increase. The wires obey Hooke's law.

When the lamp is in equilibrium, the height *h* of the lamp above the floor is measured again.

What is the difference between the two values of *h*?

A 0.20 cm **B** 0.27 cm **C** 0.40 cm **D** 0.60 cm

4 Two blocks, of mass 0.20 kg and 0.50 kg, are connected by a light inextensible string that passes over a frictionless pulley.



The blocks are initially held stationary. The block of mass 0.20 kg rests on a rough horizontal surface.

The block of mass 0.50 kg is suspended in air. Air resistance is negligible.

When the blocks are released, the kinetic frictional force between the block of mass 0.20 kg and the rough surface is 3.5 N.

What is the magnitude of the acceleration of the masses?

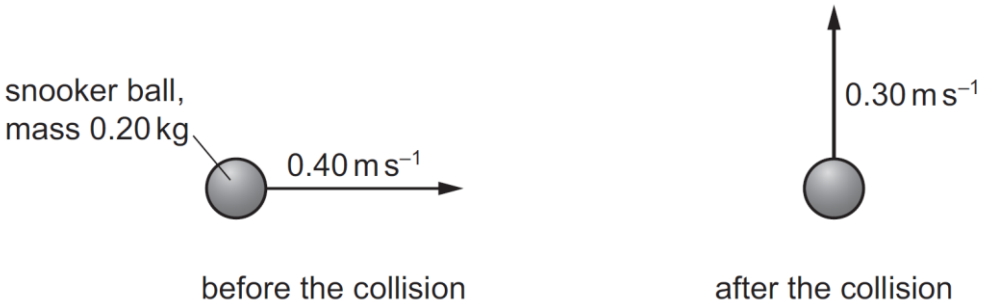
A 2.0 m s^{-2}

B 2.8 m s^{-2}

C 3.9 m s^{-2}

D 7.0 m s^{-2}

5 A snooker ball of mass 0.20 kg has a collision so that its direction of movement changes by an angle of 90°, as shown.



The ball has a speed of 0.40 m s^{-1} before the collision and a speed of 0.30 m s^{-1} after the collision.

What is the **magnitude** of the change in momentum of the snooker ball?

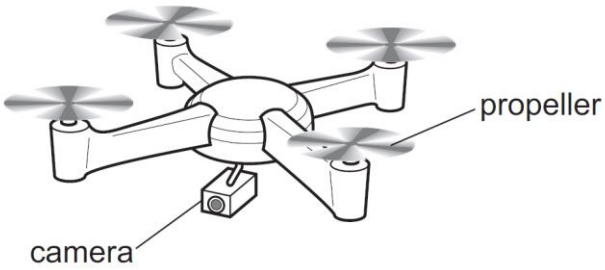
A 0.020 kg m s^{-1}

B 0.10 kg m s^{-1}

C 0.14 kg m s^{-1}

D 0.50 kg m s^{-1}

6 A camera drone of mass 1.20 kg hovers at a fixed point above the ground. The drone has four propellers.



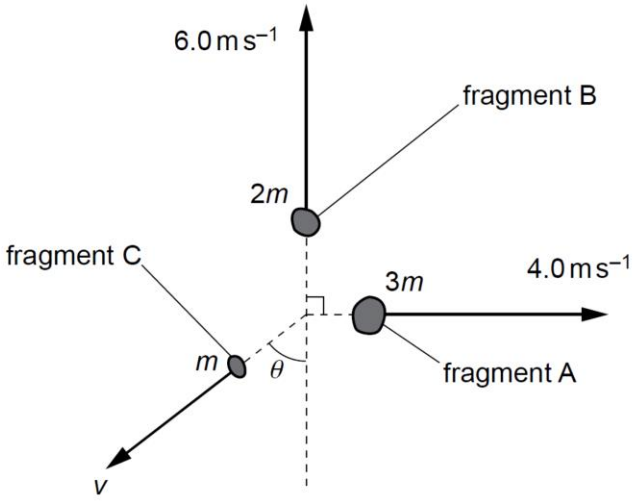
In a time of 1.00 s, each propeller pushes a mass of 0.400 kg of air vertically downwards.

Assume that the air above the propellers is stationary.

What is the speed of the air leaving each propeller?

A 0.750 m s^{-1} **B** 3.00 m s^{-1} **C** 7.36 m s^{-1} **D** 29.4 m s^{-1}

7 A firework is initially stationary. It explodes into three fragments A, B and C that move in a horizontal plane, as shown in the view from above.



Fragment A has a mass of 3*m* and moves away from the explosion at a speed of 4.0 m s^{-1}.

Fragment B has a mass of 2*m* and moves away from the explosion at a speed of 6.0 m s^{-1} at right angle to the direction of A.

Fragment C has a mass of *m* and moves away from the explosion at a speed *v* and at an angle θ as shown.

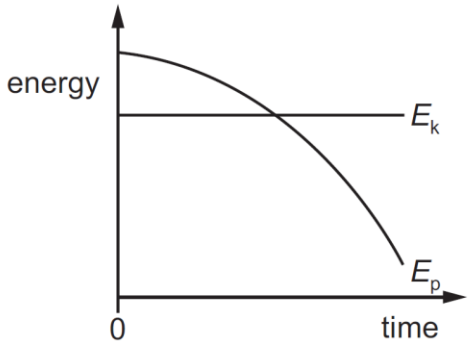
What is the angle θ ?

A 30° **B** 45° **C** 60° **D** 70°

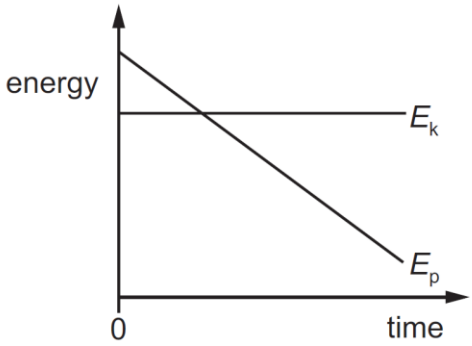
8 A steel ball is falling at constant speed in oil.

Which graph shows the variation with time of the gravitational potential energy E_p and the kinetic energy E_k of the ball?

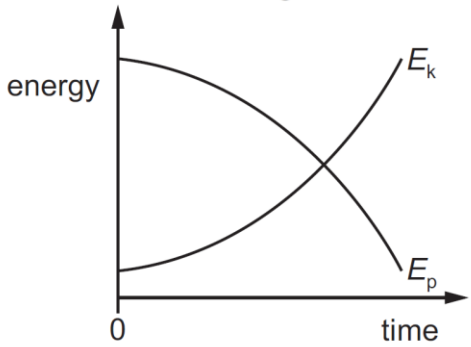
A



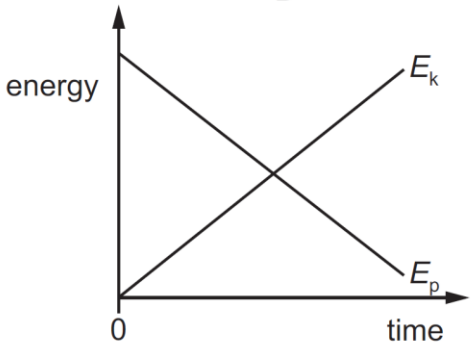
B



C



D

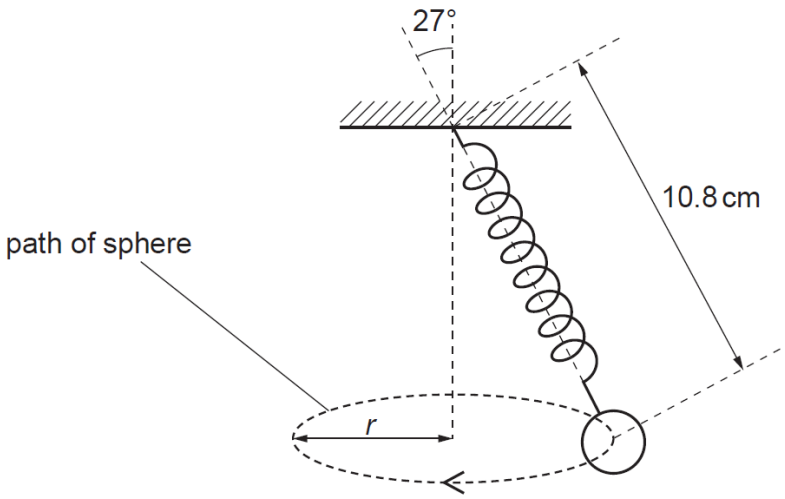


9 A vehicle of mass 1000 kg travels at a constant velocity of 6.5 m s^{-1} up a 45° incline. The input power to the engine of the car is 80 kW. The efficiency of the engine is 60%.

What is the resistive force on the car?

A 450 N **B** 5400 N **C** 7400 N **D** 14 kN

10 A steel sphere is set in motion so that it is moving in a horizontal circle at constant speed with a radius *r*, as shown below.



The distance from the centre of the sphere to the top of the spring is 10.8 cm and the spring is tilted at 27° from the vertical.

What is the period of the circular motion of the sphere?

A 0.62 s

B 7.9 s

C 6.2 s

D 79 s

11 Two satellites, A and B, orbiting around Earth have the same kinetic energy. Satellite A has a larger mass than satellite B. Which of the following statements is correct?

A Satellite A has the same total energy as satellite B.

B Satellite A has a smaller orbital radius than satellite B.

C Satellite A has a smaller period than satellite B.

D Satellite A has a larger angular velocity than satellite B.

12 For the construction of a thermometer, what is an essential requirement of a thermometric substance?

A It remains liquid over the entire range of temperatures to be measured.

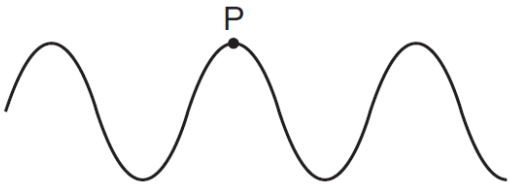
B It has a property that varies linearly with temperature.

C It has a property that varies with temperature.

D It obeys the equation of state.

13 A transverse water wave has a frequency of 1.50 Hz, a wavelength of 0.240 m and an amplitude of 0.120 m.

P is a water particle that is initially at the peak of the wave, as shown.



What is the total vertical distance travelled by P in a time of 0.75 s?

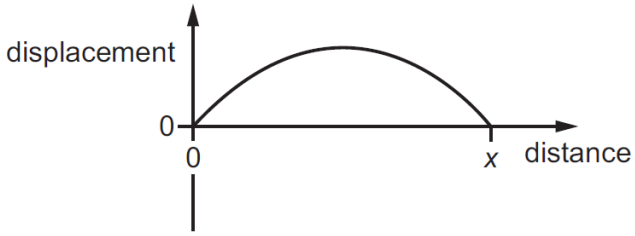
A 35.1 mm **B** 84.9 mm **C** 325 mm **D** 515 mm

14 A progressive longitudinal sound wave moves through air. The diagram shows the positions of the air particles along part of the wave at one instant.

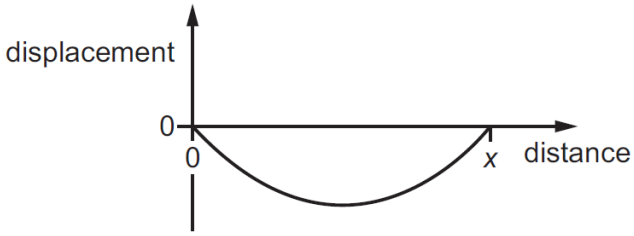
Point Q is a distance *x* from point P.

Which graph shows the variation of the displacement of the air particles with distance from P along the wave?

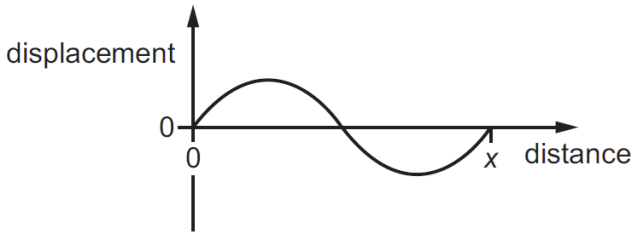
A



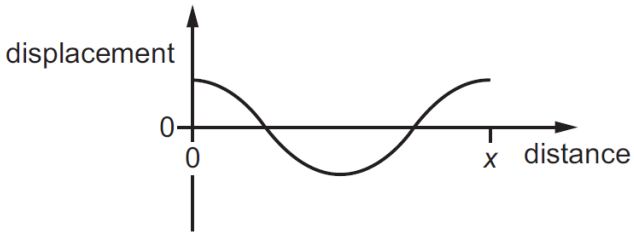
B



C

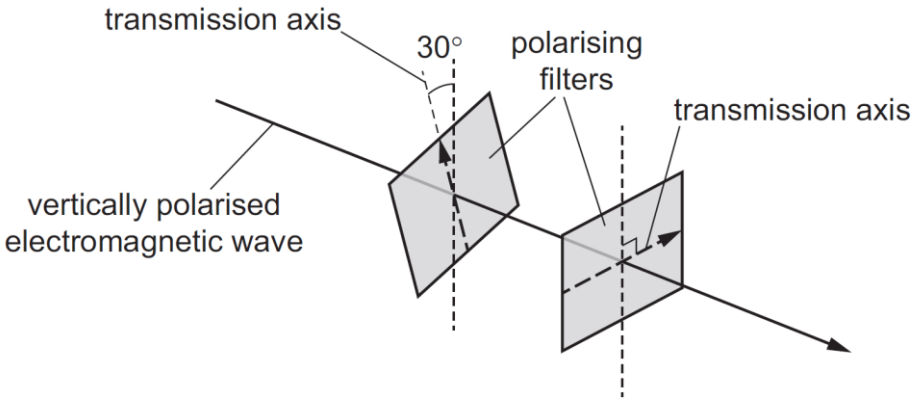


D



15 A vertically polarised electromagnetic wave of intensity I_0 is incident normally on a polarizing filter. The transmission axis of the filter is at an angle of 30° to the vertical.

The transmitted wave from the first filter is then incident normally on a second polarising filter. The transmission axis of this filter is at an angle of 90° to the vertical.



What is the intensity of the wave after passing through the second filter?

A 0 **B** 0.063 I_0 **C** 0.19 I_0 **D** 0.56 I_0

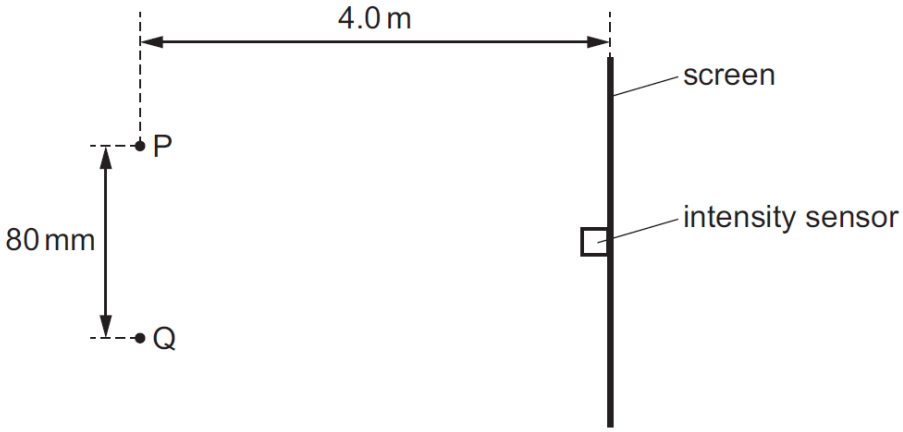
16 Waves P and Q have the same amplitude. The waves meet in phase at point X and interfere to give a resultant wave with intensity I.

The amplitude of wave P is doubled.

What is the new intensity of the resultant wave at X, in terms of I?

A 0.44I **B** 1.5I **C** 2.3I **D** 3.0I

17 A source of coherent light is incident on two slits, P and Q, which are placed 80 mm apart. The light has a single frequency of 1.5×10^{12} Hz. The light from the slits meets on a screen that is a distance of 4.0 m from the slits. The screen is parallel to a line joining the slits.



not to scale

An intensity sensor is placed on the screen at the midpoint of the interference pattern such that the intensity reading is a maximum. The intensity sensor is moved along the screen.

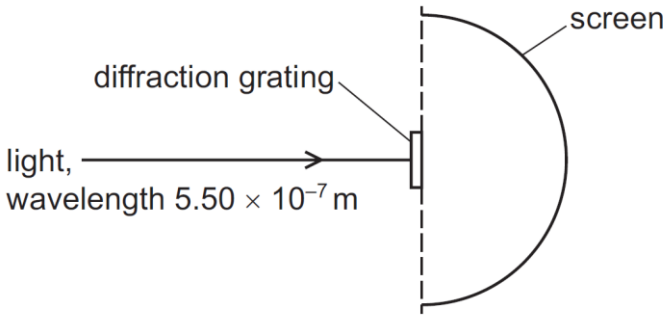
The sensor travels through two intensity minima, two intensity maxima and stops in the middle of the third intensity minimum.

Which distance does the sensor move through?

A 4.0 mm **B** 10 mm **C** 25 mm **D** 50 mm

18 Light of wavelength 5.50×10^{-7} m from a laser is incident normally on a diffraction grating.

The diffracted light is incident on a semicircular screen, as shown in the view from above.



view from above

A total of 9 bright dots are formed on the screen.

The grating is at the centre of the semicircle. The lines of the grating are vertical. The separation between adjacent lines in the grating is d.

What is a possible value of d?

A 2.25×10^{-6} m **B** 2.80×10^{-6} m **C** 4.40×10^{-6} m **D** 4.95×10^{-6} m

19 A double star is at a distance of 20 light years from the Earth. A telescope with a diameter of 3.0 m is used to view the star.

A light year is the distance light travels in a vacuum in one year.

What is the approximate minimum separation between the two stars of the double star that can be detected by the telescope?

A 5.0×10^{8} m **B** 1.0×10^{9} m **C** 3.5×10^{10} m **D** 3.5×10^{11} m

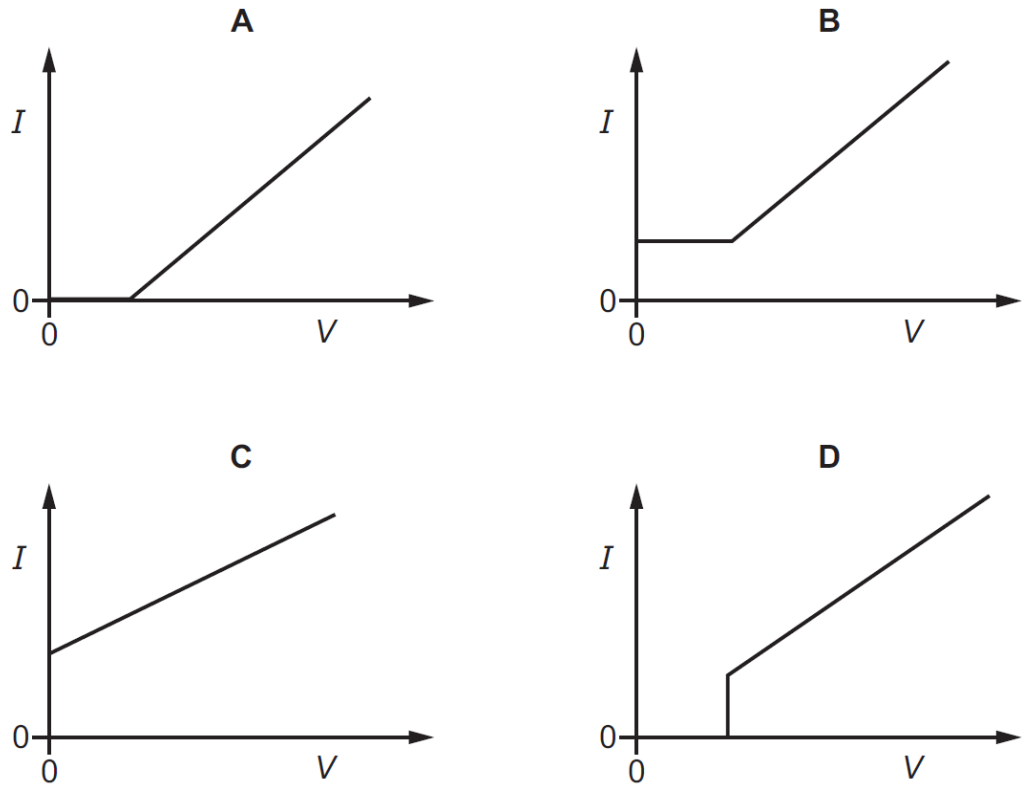
20 A long wire of radius 1.5 mm and length 2.0 m carries a steady current 5.0 A. There are approximately 1.5×10^{24} mobile electrons in the wire.

What is the drift velocity of the electrons in the wire?

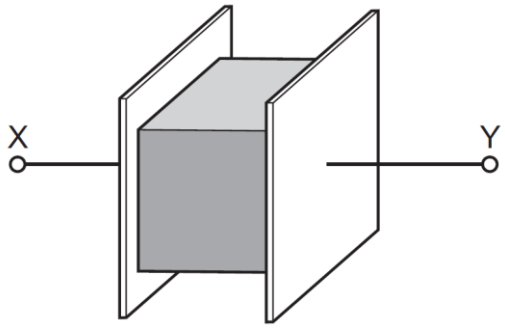
A 4.2×10^{-5} m s^{-1} **B** 7.2×10^{-5} m s^{-1} **C** 7.2×10^{-3} m s^{-1} **D** 2.9 m s^{-1}

21 A fixed resistor and a diode are combined by connecting them in series. The total potential difference V across the combination is varied and the corresponding current I is measured.

Which graph could represent the variation of I with V?



22 The resistance of a metal cube is measured by placing it between two parallel plates, as shown.

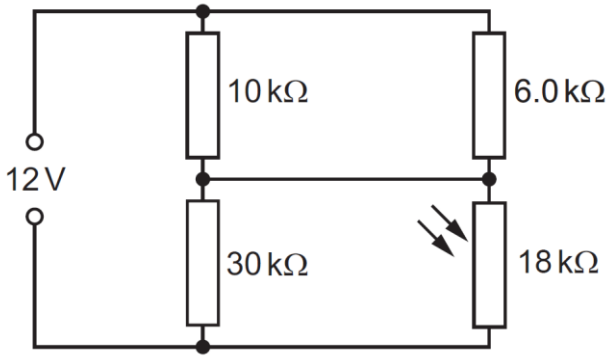


The cube has volume V and is made of a material with resistivity ρ. The connections to the cube have negligible resistance.

Which expression gives the electrical resistance of the metal cube between X and Y?

A $\rho V^{\frac{1}{3}}$ **B** $\rho V^{\frac{2}{3}}$ **C** $\dfrac{\rho}{V^{\frac{1}{3}}}$ **D** $\dfrac{\rho}{V^{\frac{2}{3}}}$

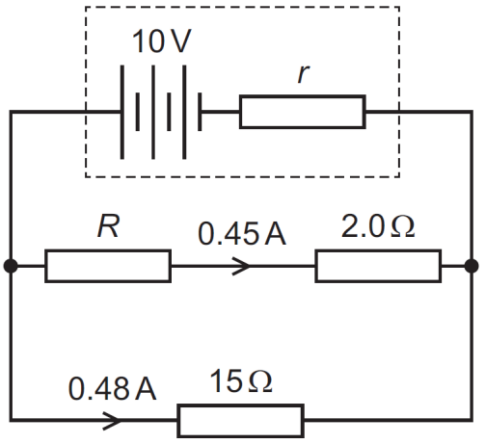
23 The diagram shows a circuit with a light-dependent resistor (LDR).



What is the effective resistance of the circuit?

A 15 kΩ **B** 24 kΩ **C** 40 kΩ **D** 64 kΩ

24 A battery of electromotive force (e.m.f.) 10 V and internal resistance r is connected to three resistors of resistances R, 2.0 Ω and 15 Ω, as shown. A current of 0.45 A is in the resistor of resistance 2.0 Ω and a current of 0.48 A is in the resistor of resistance 15 Ω.

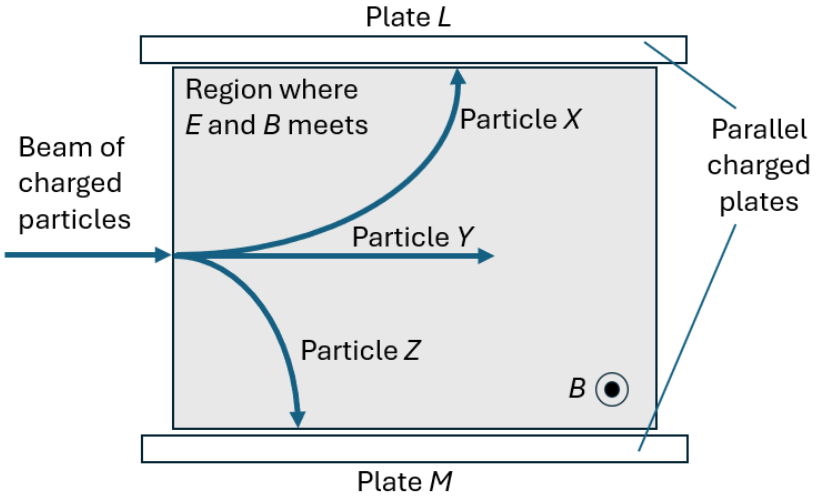


What are the values of r and R?

	r / Ω	R / Ω
A	3.0	14
B	3.0	20
C	5.8	14
D	5.8	20

25 A beam of charged particles enters a region where a uniform electric field E setup by Plate L and Plate M is perpendicular to a uniform magnetic field B. Magnetic field B is directed out of the paper. The particles enter this region horizontally from the left.

The path of particle X, Y and Z are illustrated in the diagram below.



Which of the statement can be concluded from the observation?

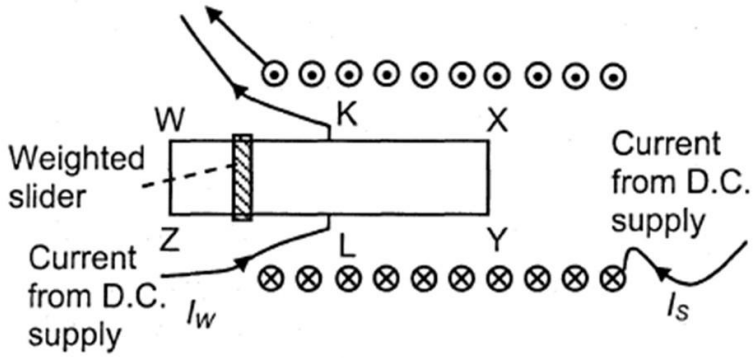
A The velocity of particle Y is larger than $\frac{E}{B}$.

B Plate L has a lower potential than plate M.

C Particle X, Y and Z have the same polarity.

D Particle Z has a larger mass than particle X and Y.

26 The figure below (not drawn to scale) shows the plan view of a weightless wire frame WXYZ being supported by two knife-edge at K and L. A current I_W flows through the frame. Section KXYL of the frame is placed inside a solenoid. A current of I_S flows through the coils of the soleniod. The wire frame is balanced in a horizontal position with a weighted slider.



Current I_S is increased.

Which of the following will enable the wire frame to be balanced in a horizontal position again.

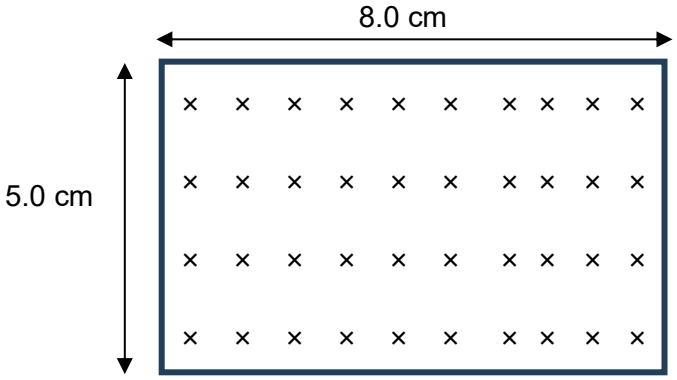
A Increase the current I_W.

B Reverse the direction of current I_W.

C Move the weighted slider closer to WZ.

D Increase the number of turns on the solenoid.

27 A rectangular coil of length 5.0 cm and breadth 8.0 cm consists of 50 turns. It is placed in a uniform magnetic field of flux density 0.40 T such that the plane of the coil is perpendicular to the magnetic field and is directed into the page. The magnetic field is then uniformly reduced to zero in 0.20 s.



Which statement correctly describes the magnitude of the induced electromotive force (e.m.f.) and the direction of the induced current in the coil?

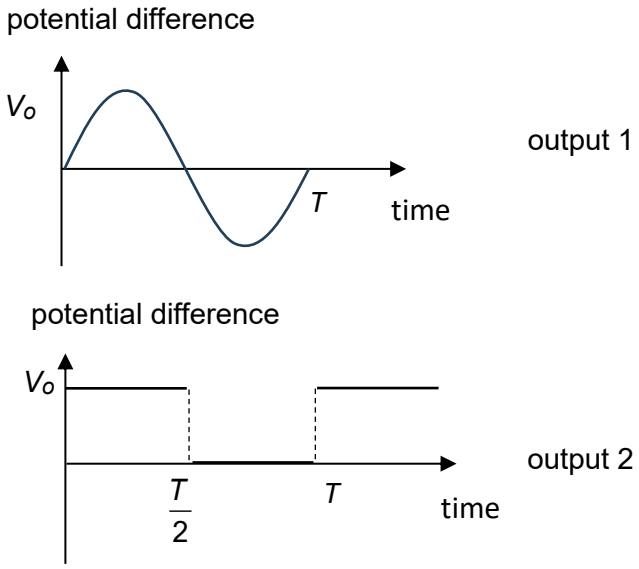
A Induced e.m.f. of 0.40 V and direction of current is clockwise

B Induced e.m.f. of 0.40 V and direction of current is anti-clockwise

C Induced e.m.f. of 0.80 V and direction of current is clockwise

D Induced e.m.f. of 0.80 V and direction of current is anti-clockwise

28 The outputs from the two sources are shown in the graphs below.



What is the ratio of $\frac{\text{root mean squared voltage from output 1}}{\text{root mean squared voltage from output 2}}$?

A 0.50 **B** 0.71 **C** 1 **D** 2

29 Which of the following explains why there are no X-ray frequencies in the line spectrum of hydrogen?

A Hydrogen nuclei do not contain neutrons.

B Hydrogen cannot be raised to a sufficiently high temperature.

C The cut-off frequency cannot be reached.

D The ionisation energy of a hydrogen atom is too low.

30 Which statement regarding alpha-particle scattering experiment can be concluded?

A Protons and electrons have equal but opposite charges.

B Protons have a much larger mass than electrons.

C The nucleus contains most of the mass of the atom.

D The nucleus of an atom contains protons and neutrons.

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