



EUNOIA JUNIOR COLLEGE
JC2 PRELIM EXAMINATIONS 2026
General Certificate of Education Advanced Level
Higher 2

CANDIDATE
NAME

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CIVICS
GROUP

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REGISTRATION
NUMBER

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PHYSICS

Paper 1 Multiple Choice

9478/01

21st September 2026

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 **14** printed pages and **2** blank pages.

Data

speed of light in free space

$$c = 3.00 \times 10^8 \text{ m s}^{-1}$$

permeability of free space

$$\mu_0 = 4\pi \times 10^{-7} \text{ H m}^{-1}$$

permittivity of free space

$$\varepsilon_0 = 8.85 \times 10^{-12} \text{ F m}^{-1}$$

$$\left(\frac{1}{4\pi\varepsilon_0} = 8.99 \times 10^9 \text{ m F}^{-1} \right)$$

elementary charge,

$$e = 1.60 \times 10^{-19} \text{ C}$$

the Planck constant,

$$h = 6.63 \times 10^{-34} \text{ J s}$$

unified atomic mass constant,

$$u = 1.66 \times 10^{-27} \text{ kg}$$

rest mass of electron,

$$m_e = 9.11 \times 10^{-31} \text{ kg}$$

rest mass of proton,

$$m_p = 1.67 \times 10^{-27} \text{ kg}$$

molar gas constant,

$$R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$$

the Avogadro constant,

$$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$$

the Boltzmann constant,

$$k = 1.38 \times 10^{-23} \text{ J K}^{-1}$$

gravitational constant,

$$G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$$

acceleration of free fall,

$$g = 9.81 \text{ m s}^{-2}$$

Formulae

uniformly accelerated motion

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

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

work done on / by a gas

$$W = p\Delta V$$

pressure

$$p = \frac{F}{A}$$

gravitational potential

$$\phi = -\frac{Gm}{r}$$

temperature

$$T / \text{K} = T / ^\circ\text{C} + 273.15$$

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.

$$v = v_0 \cos \omega t = \pm \omega \sqrt{(x_0^2 - x^2)}$$

electric current

$$I = nAvq$$

resistors in series

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

resistors in parallel

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

capacitors in series

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \dots$$

capacitors in parallel

$$C = C_1 + C_2 + \dots$$

energy in a capacitor

$$U = \frac{1}{2} QV = \frac{1}{2} \frac{Q^2}{C} = \frac{1}{2} CV^2$$

charging a capacitor

$$Q = Q_0 \left[1 - e^{-\frac{t}{\tau}} \right]$$

discharging a capacitor

$$Q = Q_0 e^{-\frac{t}{\tau}}$$

RC time constant

$$\tau = RC$$

electric potential

$$V = \frac{Q}{4\pi\epsilon_0 r}$$

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

$$B = \mu_0 nI$$

energy states for quantum particle in a box

$$E_n = \frac{h^2}{8mL^2} n^2$$

radioactive decay

$$x = x_0 e^{-\lambda t}$$

radioactive decay constant

$$\lambda = \frac{\ln 2}{t_{\frac{1}{2}}}$$

- 1 Dynamic viscosity, μ , measures a fluid's internal resistance to gradual deformation by shear or tensile stress. The SI unit for dynamic viscosity is newton second per square meter (N s m^{-2}).

Given that

$$\mu = \frac{vL\rho}{R}$$

where v is the velocity of the fluid, L the characteristic length and ρ is the density of the fluid.

What is the unit of R , expressed in SI units?

- A** $\text{kg N}^{-1} \text{m}^{-1}$ **B** $\text{kg N}^{-1} \text{m}^{-3} \text{s}^{-2}$ **C** $\text{m}^{-2} \text{s}^{-2}$ **D** dimensionless
- 2 Quantity a is related to b , c and d by the equation shown:

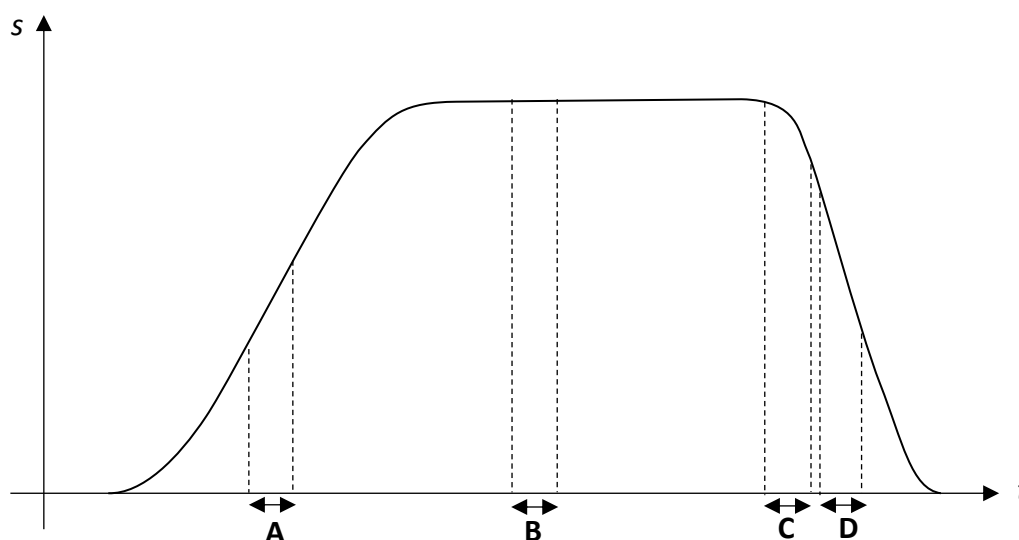
$$a = \frac{b - c}{d^2}$$

The numerical values of b , c and d in their SI units are:

$b = 25 \pm 3$, $c = 4 \pm 1$ and $d = 100 \pm 1$.

What is the percentage uncertainty in a ?

- A** 12% **B** 20% **C** 21% **D** 39%
- 3 The graph shows the variation with time t of the displacement s of a vehicle moving along a straight line.



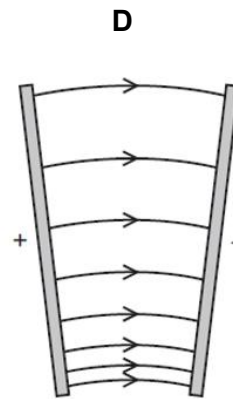
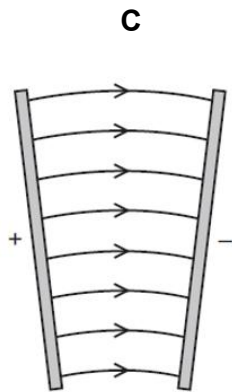
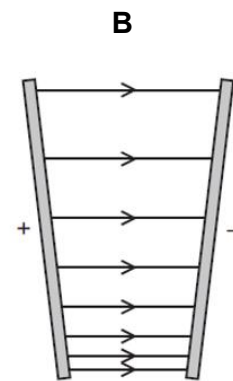
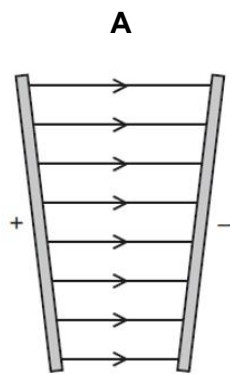
During which time interval does the acceleration of the vehicle have its greatest magnitude?

4 Which of the following lists contains only energy stores?

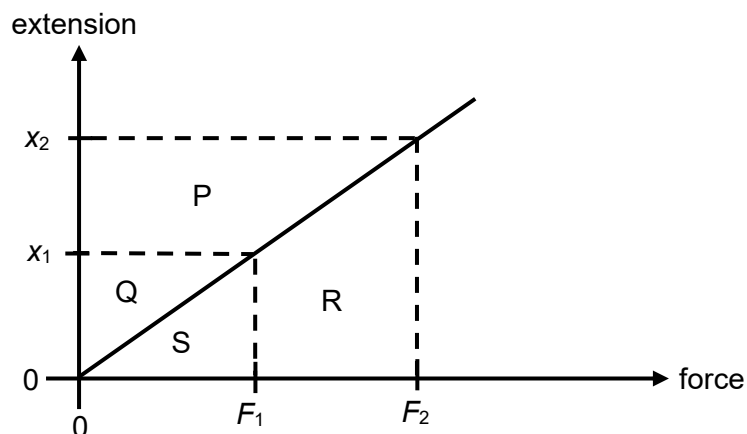
- A kinetic, internal, sound, chemical potential
- B internal, light, electrical, chemical potential
- C kinetic, gravitational potential, work done, elastic potential
- D gravitational potential, internal, kinetic, chemical potential

5 A potential difference is applied between two metal plates that are **not** parallel.

Which diagram shows the electric field between the plates?



- 6 The graph shows how the extension of a spring varies with the force used to stretch it.



Which area represents the change in elastic potential energy of the spring when the extension changes from x_1 to x_2 ?

- A** P **B** Q **C** P+Q **D** R+S

- 7 A proton (1u) traveling with velocity $+0.100c$ collides elastically head-on with a helium nucleus (4u) traveling with velocity $-0.050c$.

What are the velocities of each particle after the collision?

	Proton	Helium nucleus
A	$-0.140c$	$+0.010c$
B	$+0.140c$	$+0.010c$
C	$+0.233c$	$-0.083c$
D	$-0.233c$	$+0.083c$

- 8 A particle moves with a constant angular velocity ω in a circle of radius r centered at point O.

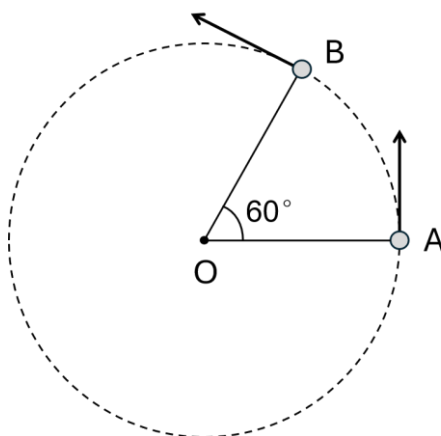
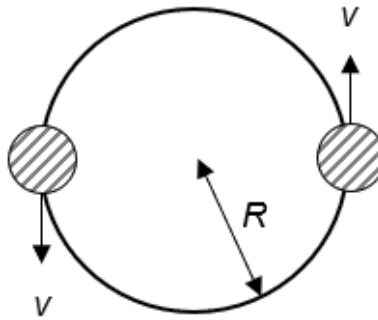


Diagram not drawn to scale

What is the magnitude of the change in velocity between points A and B?

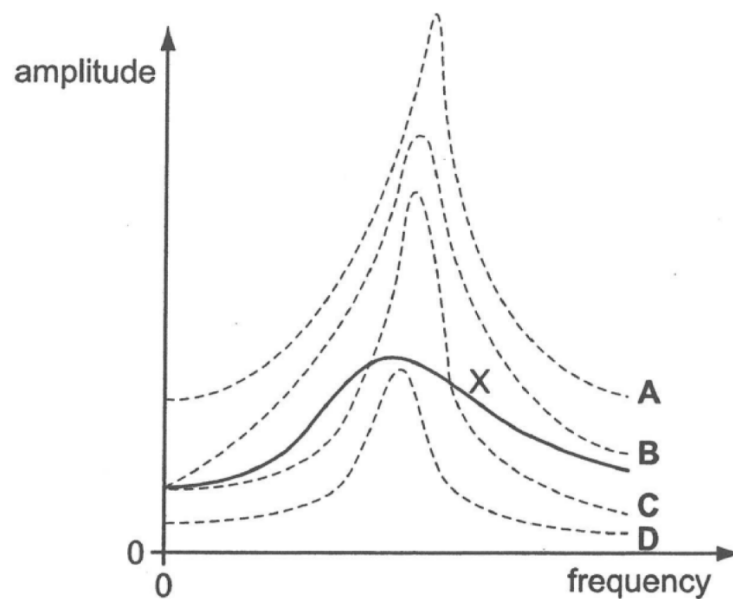
- A** zero **B** $\frac{1}{2}r\omega$ **C** $r\omega$ **D** $2r\omega$

- 9 Two binary stars of equal mass M move with constant speed v in a circular orbit of radius R about their common centre of mass.

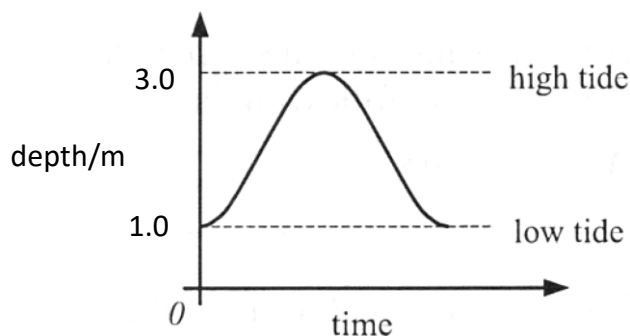


What is the speed v of each star?

- A $\sqrt{\frac{GM}{4R}}$ B $\sqrt{\frac{GM}{2R}}$ C $\sqrt{\frac{GM}{R}}$ D $\sqrt{\frac{2GM}{R}}$
- 10 An object is in a geostationary orbit around the Earth.
Which statement about the object is incorrect?
- A It must be orbiting in the plane of the Equator.
B It must be orbiting at the same speed as an object on the Equator.
C It must be orbiting in the same direction as the direction of rotation of the Earth.
D It must be orbiting with the same angular velocity as that of the rotation of the Earth.
- 11 The solid line X on the graph shows how the amplitude of an oscillating system varies with the frequency at which it is driven. The amplitude of the driving force is constant at all frequencies.
Which dashed line shows the response of the system under conditions where there is less damping?



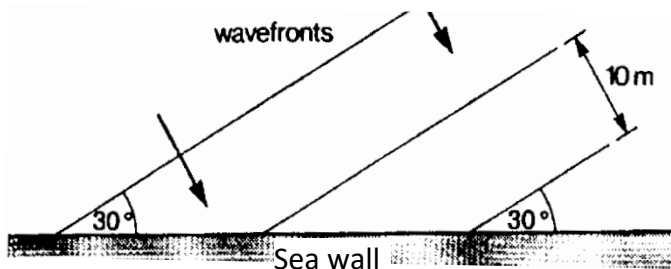
- 12 The water depth in a harbour varies in a simple harmonic manner between 1.0 m at low tide and 3.0 m at high tide, as shown in the figure below. The duration between successive low tides is 12 hours.



A certain boat requires a minimum depth of 1.5 m to enter and to exit the harbour.

If the boat enters the harbour at a depth of 1.5 m as the tide was rising, what is the maximum duration that it can stay in the harbour if it wants to exit the harbour within this tide cycle?

- A 1.0 h B 2.0 h C 8.0 h D 10 h
- 13 Parallel water waves of wavelength 10 m strike a straight sea wall. The wave fronts make an angle of 30° with the wall as shown in the figure below.



What is the phase difference at any instant between the waves at two points 5.0 m apart along the wall?

- A 0 rad B 1.6 rad C 2.7 rad D 3.1 rad

- 14** A beam of light of wavelength λ is incident normally on a diffraction grating. The angular separation between the two third order maxima is θ , and the number of lines per metre of the grating is d .

Which row shows possible values of λ , θ and d ?

	λ	θ	d
A	450 nm	25°	3.2×10^5 lines per metre
B	450 nm	30°	1.9×10^5 lines per metre
C	650 nm	38°	3.2×10^5 lines per metre
D	650 nm	46°	1.9×10^5 lines per metre

- 15** A telescope with an aperture of 20 cm receives light of wavelength 580 nm from a binary star system which can just be resolved by the telescope.

The two stars are 7.3×10^{17} m from the telescope.

How far apart are the two stars?

- A** 2.1×10^{12} m **B** 2.5×10^{16} m **C** 2.1×10^{19} m **D** 2.5×10^{23} m

- 16** An ideal gas has a volume of 40 cm^3 at pressure 100 kPa and temperature 50°C .

It is compressed to 20 cm^3 and heated to 100°C .

What is its final pressure?

- A** 58 kPa
B 100 kPa
C 230 kPa
D 400 kPa

- 17** The temperature of an ideal gas can be changed by either changing its volume or placing it in an environment with a different surrounding temperature compared to the temperature of the ideal gas.

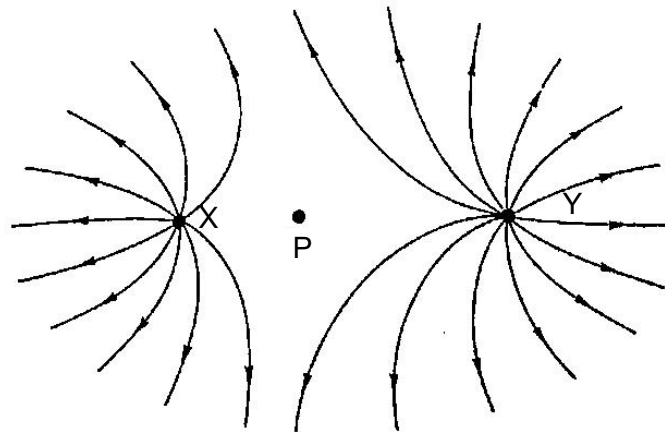
Which scenario must result in an increase in the temperature of the ideal gas?

	volume of gas	surrounding temperature
A	increase	higher
B	increase	lower
C	decrease	higher
D	decrease	lower

- 18 Objects A and B are in thermal equilibrium with each other.

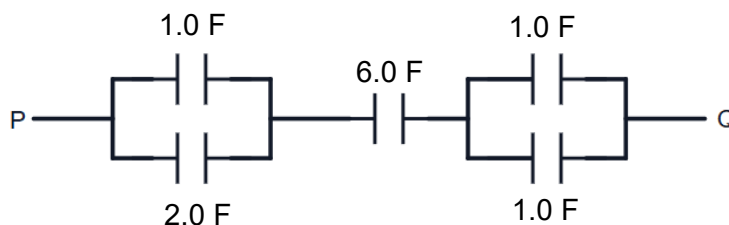
Which statement may not be correct?

- A The two objects are at the same temperature.
 - B The two objects have the same internal energy.
 - C There is no net heat transfer between the two objects when in contact.
 - D Particles within the two objects have the same mean random kinetic energy.
- 19 The diagram shows the electric field lines between two isolated point charges X and Y. The electric field at point P is zero.



Which of the following statements is true?

- A The electric potential at point P is a maximum.
 - B The electric potential at point P is negative.
 - C A negative charge placed between point P and Y will start to move towards Y.
 - D The resultant electric field strength is always inversely proportional to the square of the distance from Y.
- 20 The figure below shows some capacitors arranged between P and Q.



What is the total capacitance between points P and Q?

- A 1.0 F
- B 7.0 F
- C 10 F
- D 11 F

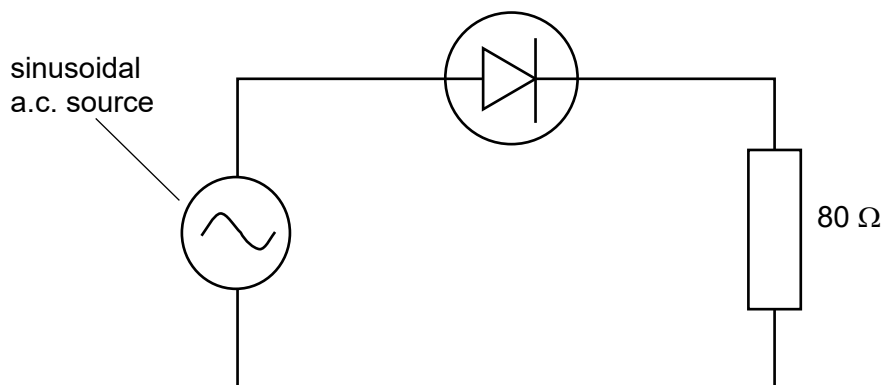
- 21** Two cylindrical conductors, X and Y, are made from the same material. The conductors have equal lengths, but Y has a smaller diameter than X.

X and Y are connected in series to a cell.

Which row compares the number of charge carriers per unit time passing through X and through Y and compares the average drift speed of the charge carriers in X and in Y?

	number of charge carriers per unit time	average drift speed of charge carriers
A	Y greater than X	Y greater than X
B	Y same as X	Y same as X
C	Y greater than X	Y same as X
D	Y same as X	Y greater than X

- 22** The sinusoidal a.c. source shown in the circuit diagram below has a peak-to-peak voltage of 18 V.



What is the r.m.s. current through the 80 Ω resistor?

- A** 0.056 A **B** 0.080 A **C** 0.11 A **D** 0.16 A

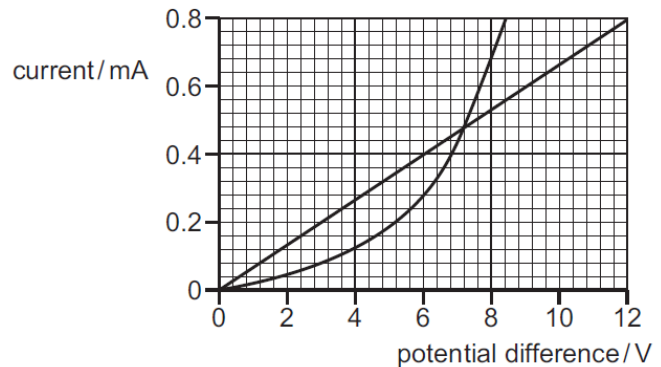
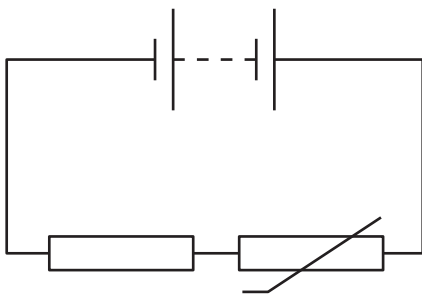
- 23** A piece of wire X has resistivity ρ , length L and cross-sectional area A . Wire X has a resistance R .

A second piece of wire Y is made of a different metal. It has the same resistance as X but has twice the length of X.

Which row gives possible values for the resistivity and the cross-sectional area of Y?

	resistivity	cross-sectional area
A	$\frac{1}{2}\rho$	$\frac{1}{2}A$
B	$\frac{1}{2}\rho$	A
C	ρ	$\frac{1}{2}A$
D	2ρ	A

- 24** The diagram shows a circuit containing a thermistor, a fixed resistor and a battery. The graph shows the I - V characteristics of both components.



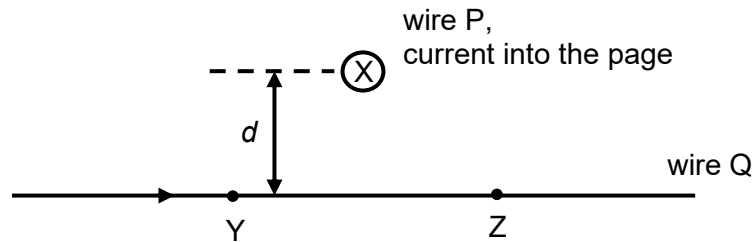
The battery has an e.m.f. of 12 V and negligible internal resistance.

What is the current in the fixed resistor?

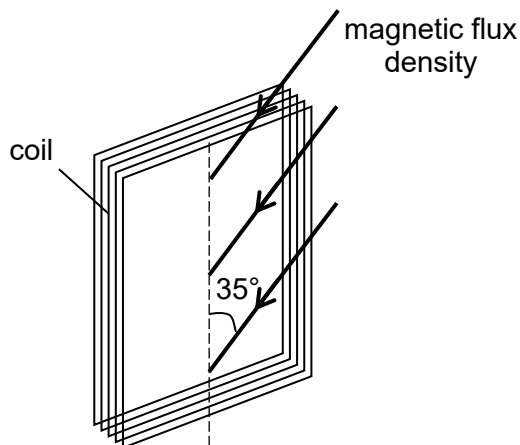
- A** 0.36 mA **B** 0.40 mA **C** 0.48 mA **D** 0.80 mA

- 25** Two long straight wires P and Q are placed perpendicular to each other at a distance d apart. A current flows into the page in wire P while a current flows from left to right in wire Q.

What are the directions of the forces acting on wire Q at points Y and Z due to the magnetic field produced by wire P?



- | | | |
|----------|-------------|-------------|
| | force at Y | force at Z |
| A | out of page | into page |
| B | into page | out of page |
| C | towards P | away from P |
| D | towards P | towards P |
- 26** A flat circular coil of 720 turns, each of area 0.060 m^2 , is placed with its plane aligned at 35° to a uniform magnetic field as shown below. The magnetic flux density of the field is changed steadily from 70 mT to 40 mT over a duration of 5.0 s.



What is the average e.m.f. induced in the coil during this duration?

- | | | | | | | | |
|----------|--------|----------|--------|----------|--------|----------|--------|
| A | 0.15 V | B | 0.21 V | C | 0.26 V | D | 0.74 V |
|----------|--------|----------|--------|----------|--------|----------|--------|

- 27 Photon X carries energy E_X and momentum p_X , and Photon Y carries energy E_Y and momentum p_Y . Photon X has a longer wavelength than Photon Y.

Which relationships are true?

- | | | |
|----------|-------------|-------------|
| A | $E_X > E_Y$ | $p_X > p_Y$ |
| B | $E_X > E_Y$ | $p_X < p_Y$ |
| C | $E_X < E_Y$ | $p_X > p_Y$ |
| D | $E_X < E_Y$ | $p_X < p_Y$ |

- 28 An electron is trapped in an infinite potential well, the size of which decreases by a factor of 4.

What is the effect on the uncertainty of the momentum of the particle?

- A** It increases at most by a factor of 4.
- B** It increases at least by a factor of 4.
- C** It decreases at most by a factor of 4.
- D** It decreases at least by a factor of 4.

- 29 In the Rutherford α -scattering experiments, α -particles are directed at a thin gold foil.

What is a direct deduction from the results of the experiment?

- A** α -particles are nuclei of helium atoms
- B** α -particles are positively charged.
- C** The nucleus of the atom is much smaller in size than the size of the whole atom.
- D** The nucleus of the atom is oppositely charged to the electrons.

- 30 A Geiger-Müller counter is placed near a fresh radioactive sample with a known half-life. It reads an initial total count rate of $200 \text{ counts min}^{-1}$. After four half-lives have elapsed, the total count rate decreases to one-quarter of its initial value.

What is the background count rate?

- A** $0 \text{ counts min}^{-1}$ **B** $13 \text{ counts min}^{-1}$ **C** $40 \text{ counts min}^{-1}$ **D** $50 \text{ counts min}^{-1}$

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