



SERANGOON JUNIOR COLLEGE
General Certificate of Education Advanced Level
Higher 1

NAME

CG

INDEX NO.

PHYSICS

8866

Preliminary Examination
Multiple Choice Questions

27 August 2015
1 hr

Additional Materials: OMS.

READ THIS INSTRUCTIONS FIRST

Write your name, civics group and index number in the spaces at the top of this page.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs or rough working.

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

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

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.

DATA AND FORMULAE

Data

speed of light in free space,	$c = 3.00 \times 10^8 \text{ ms}^{-1}$
elementary charge,	$e = 1.60 \times 10^{-19} \text{ C}$
the Planck constant,	$h = 6.63 \times 10^{-34} \text{ Js}$
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,	$m_p = 1.67 \times 10^{-27} \text{ kg}$
acceleration of free fall,	$g = 9.81 \text{ ms}^{-2}$

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,	$p = \rho gh$
resistors in series,	$R = R_1 + R_2 + \dots$
resistors in parallel,	$1/R = 1/R_1 + 1/R_2 + \dots$

Answer all questions

1 Which of the following is a *random* error?

- A Error as a result of using $g = 10 \text{ m s}^{-2}$, instead of $g = 9.81 \text{ m s}^{-2}$
- B Error due to the recording of time using a stopwatch
- C Error due to a stopwatch running too fast
- D Zero error of a measuring instrument

2 The relation between the velocity v of waves in the sea with its wavelength λ , the surface tension γ and density ρ of sea water is given by:

$$v = k \sqrt{\frac{\gamma}{\lambda \rho}}$$

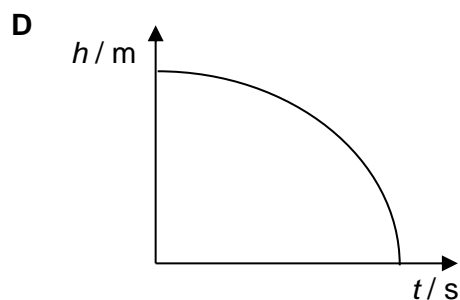
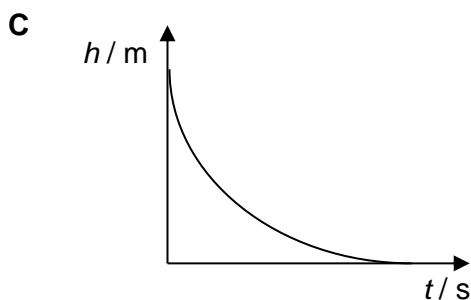
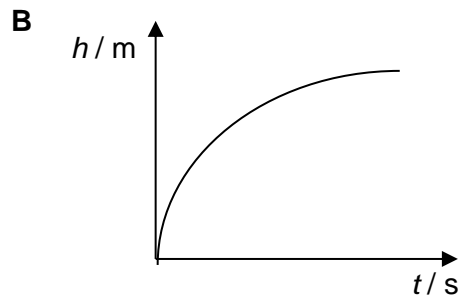
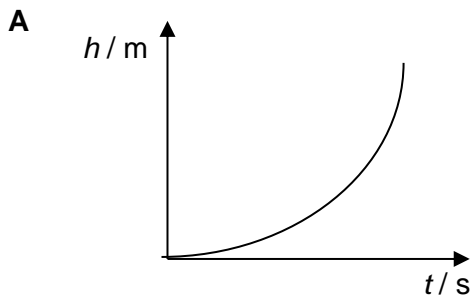
where k = constant of proportionality.

If $\gamma = (4.30 \pm 0.05) \text{ N m}^{-1}$, $\rho = (1450 \pm 20) \text{ kg m}^{-3}$ and the uncertainty in λ is 5 %, what is the percentage uncertainty in the velocity of the waves?

- A 2 %
- B 3 %
- C 4 %
- D 8 %

3 A heavy metal ball falls freely under gravity after being released from rest.

Which graph best represents the variation of height h of the ball from the ground with time t ?



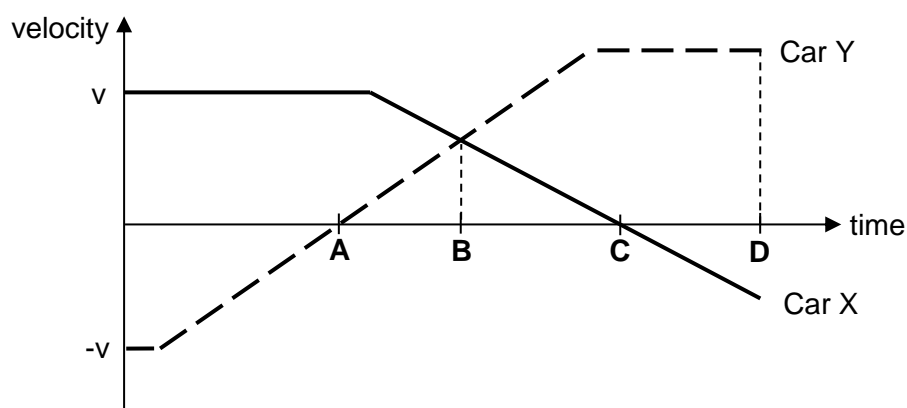
- 4 A ball is fired horizontally from the top of a cliff with a speed of 30 m s^{-1} . Air resistance is negligible. What will be its speed 3.0 s later?

A 29 m s^{-1} B 42 m s^{-1} C 54 m s^{-1} D 60 m s^{-1}

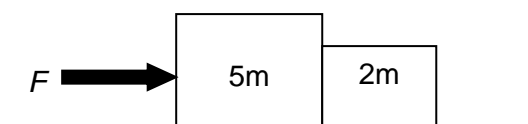
- 5 Car X and Car Y are at a distance apart and they move towards each other with the same initial speed v .



The graph shows the variation of velocity of the cars with time. At which time are the cars at their distance of closest approach?



- 6 Two blocks with masses $5m$ and $2m$ are pushed along a horizontal frictionless surface by a horizontal applied force F as shown. What is the magnitude of the force exerted by $2m$ on $5m$?

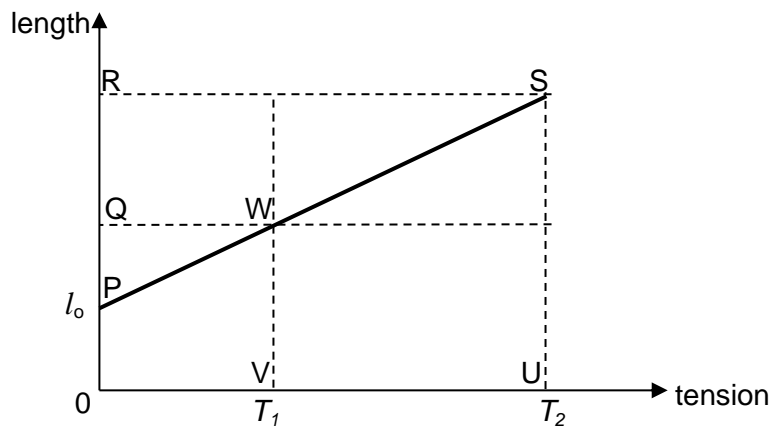


A $\frac{2}{7}F$ B $\frac{2}{5}F$ C $\frac{5}{7}F$ D $\frac{5}{2}F$

- 7 A 1.5 kg clay target is fired at 10 m s^{-1} into the air at an angle 30° to the horizontal. At its maximum height, it is hit by a 40 g pellet that was travelling at 50 m s^{-1} vertically upwards. If the pellet was embedded after it hits the clay target, what is the horizontal speed of the combined mass immediately after collision?

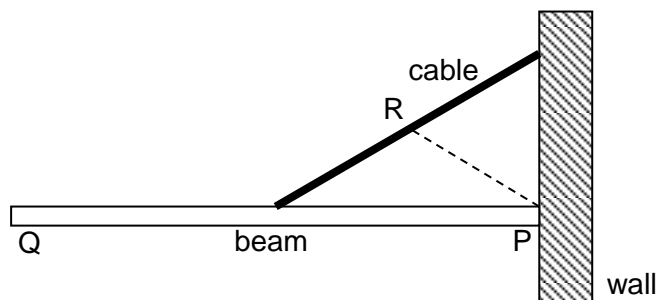
A 1.30 m s^{-1} B 6.17 m s^{-1} C 8.44 m s^{-1} D 8.53 m s^{-1}

- 8 The tension in a spring of natural length l_0 is first increased from zero to T_1 , and is then increased to T_2 .



Which area of the graph represents the work done by the spring during when the tension increases from T_1 to T_2 ?

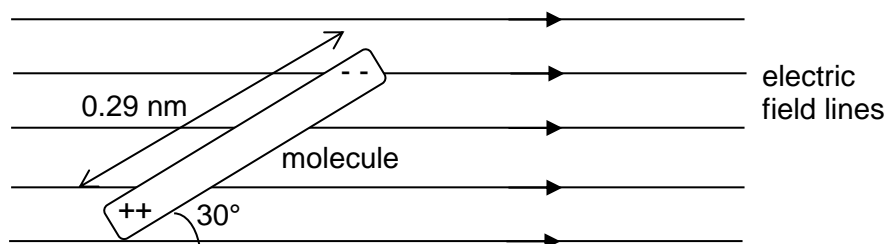
- A PQW
 B PRS
 C QRSW
 D SUVW
- 9 A uniform beam is hinged at P and is supported by a cable attached to the mid-point of the beam.



What is the direction of the force exerted by the wall on the beam?

- A PQ B QP C PR D RP

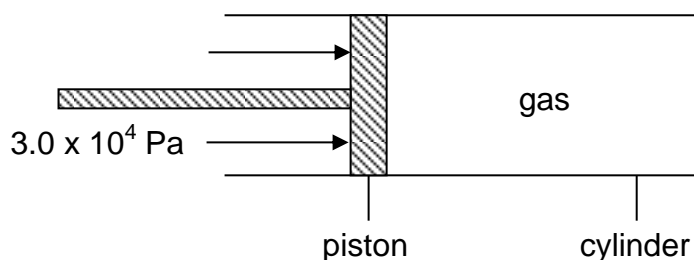
- 10** A dipolar molecule of length 0.29 nm is placed in a uniform electric field at an angle of 30° . The ends of the molecule have equal but opposite charges, and a force of 1.2×10^{-10} N is acted on each end.



What is the magnitude and direction of the torque acting on the molecule?

	<u>Magnitude of the torque / Nm</u>	<u>Direction of the torque</u>
A	1.74×10^{-20}	Clockwise
B	1.74×10^{-20}	Anti-clockwise
C	3.01×10^{-20}	Clockwise
D	3.01×10^{-20}	Anti-clockwise

- 11** 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 then heated and the piston moves 5.0 mm as a result. The work done on the gas is

- A** -380 J **B** -0.38 J **C** 0.38 J **D** 380 J
- 12** A body of mass 5.0 kg is initially travelling at a constant speed of 2.0 m s^{-1} on a horizontal frictionless surface. A force of 15 N acts on it and accelerates it to a final velocity of 12.0 m s^{-1} .

What is the work done by the force?

- A** 150 J **B** 180 J **C** 250 J **D** 350 J
- 13** A weight of 2.0 N is raised through a vertical height of 80 cm in 4.0 s using an electric motor.

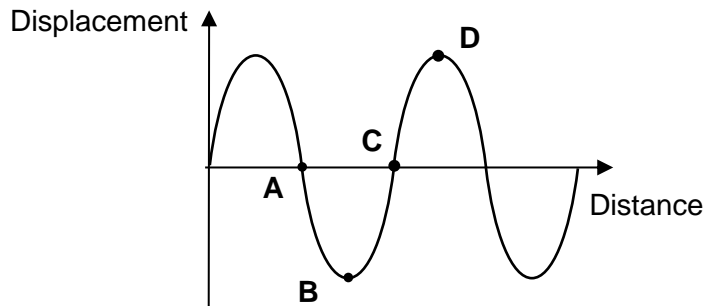
If the efficiency of the motor is 20% , what is the electrical power supplied to the motor?

- A** 0.080 W **B** 0.80 W **C** 2.0 W **D** 200 W

- 14 In a two-slit interference experiment, one slit transmits twice the amplitude of the other slit. If the maximum intensity of the interference pattern is I_o , what would be the minimum intensity in the pattern?

A $I_o/9$ B $I_o/4$ C $I_o/3$ D $I_o/2$

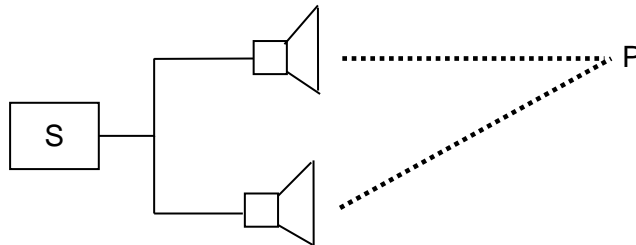
- 15 A sound wave travelling towards the right through air causes the air molecules to be displaced from their original positions. The graph below shows the variation with distance of the displacement of air molecules at a particular instant of time.



Taking the displacement towards the right as positive, at which point is the pressure maximum?

- 16 A signal from source S is emitted through two separate speakers as shown below. The sound waves from the speakers reach a point P by two paths which differ in length by 1.4 m. When the frequency of the sound is gradually increased, the result intensity at P goes through a series of maxima and minima. A maximum occurs when the frequency is 1000 Hz and the next maximum occurs at 1200 Hz.

What is the speed of the sound waves?

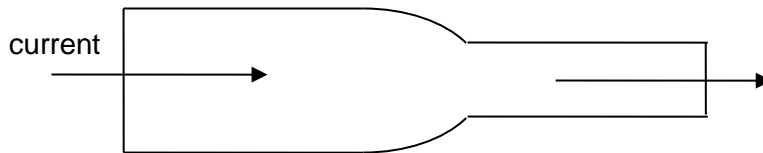


- A 200 m s^{-1}
 B 240 m s^{-1}
 C 280 m s^{-1}
 D 330 m s^{-1}

- 17 Interference maxima produced by a double source are observed at a distance of 1.0 m from the sources. In which one of the following cases are the maxima closest together?

- A sound waves of wavelength 20 mm from sources 50 mm apart
 B surface water waves of wavelength 10 mm from sources 200 mm apart
 C blue light from sources 2.0 mm apart
 D red light from sources 4.0 mm apart

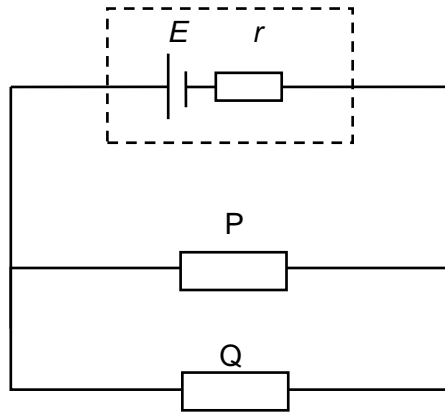
- 18 Sound waves can be detected behind an obstacle rather than light waves because
- A sound is a pressure wave whereas light is an electromagnetic wave.
 - B sound travels much more slowly than light.
 - C sound waves are longitudinal whereas light waves are transverse.
 - D sound waves have a much longer wavelength than light waves.
- 19 A $24\ \Omega$ resistor dissipates energy at the rate of 12 W.
What is the rate of dissipation of energy of a $16\ \Omega$ resistor connected in parallel with it?
- A 8 W
 - B 12 W
 - C 18 W
 - D 24 W
- 20 The figure below shows the top view of a metal strip of uniform thickness. The width of the narrow section is half the width of the wider section.



Which of the following statements is correct?

- A The potential difference per unit length of the narrower section is the same as the potential difference per unit length of the wider section.
- B The potential difference per unit length of the narrower section is smaller than the potential difference per unit length of the wider section.
- C The resistance of the narrower section will be smaller and hence more current will flow through as compared to the wider section.
- D The resistance per unit length of the narrow section is twice that of the wide section.

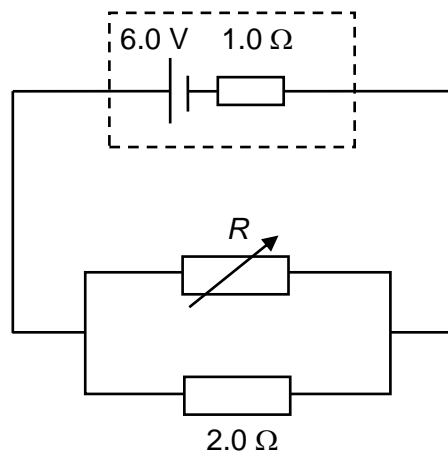
- 21** A battery of e.m.f E with internal resistance r , supplies a current of 0.025 A for 80 s . During this time, it produces 18 J of electrical energy while the resistor P receives 11 J and resistor Q receives 4 J .



What are the values for r and E ?

	r	E
A	$60\ \Omega$	360 V
B	$60\ \Omega$	9.0 V
C	$300\ \Omega$	9.0 V
D	$300\ \Omega$	360 V

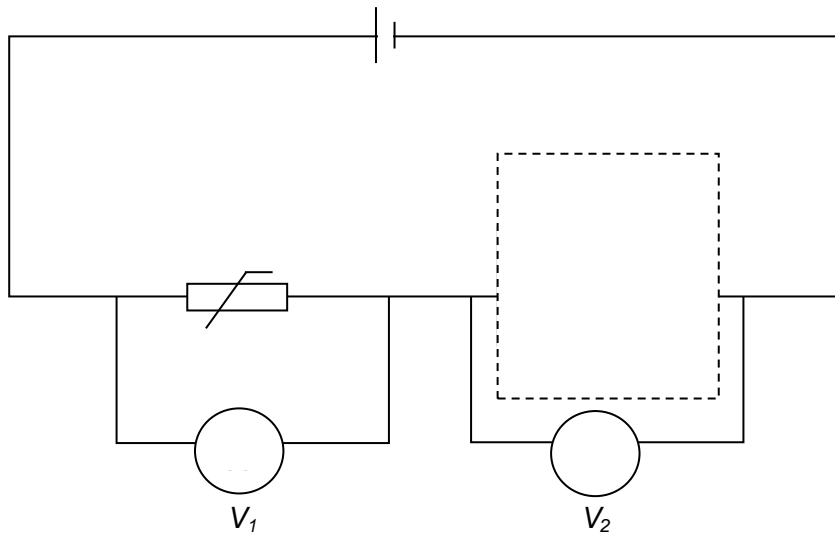
- 22** An e.m.f source of 6.0 V , with internal resistance $1.0\ \Omega$ is connected across a load which consists of two resistors in parallel. The resistance of the variable resistor R may be varied from $1.0\ \Omega$ to $6.0\ \Omega$.



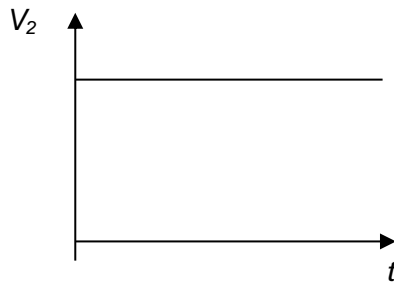
What is the resistance of R for maximum power to be delivered to the load?

- A** $1\ \Omega$ **B** $2\ \Omega$ **C** $3\ \Omega$ **D** $6\ \Omega$

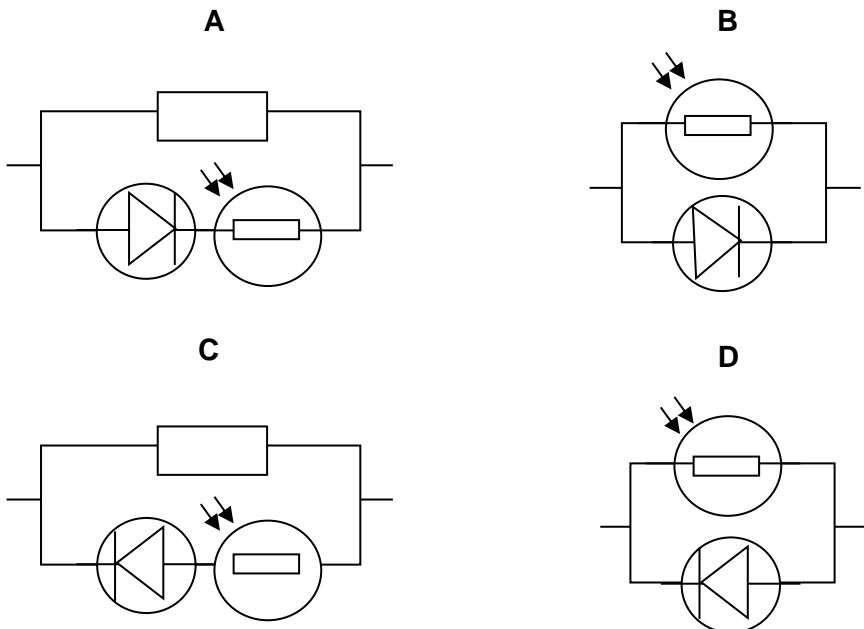
23 An electrical circuit as shown is set up as shown.



The temperature was decreased and the intensity of light increased. The variation of V_2 with time t is as shown.

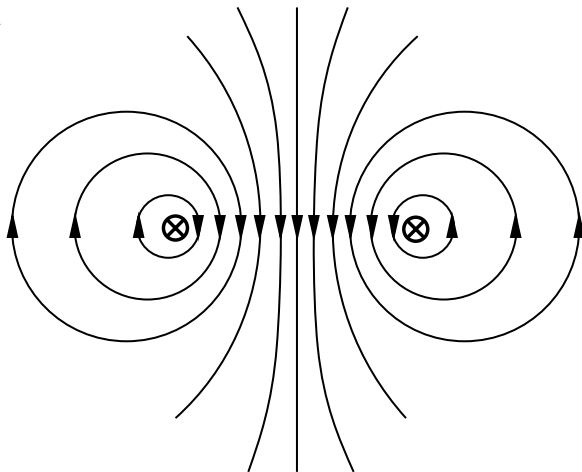


Which of the following could have been a possible set up in the dotted box?

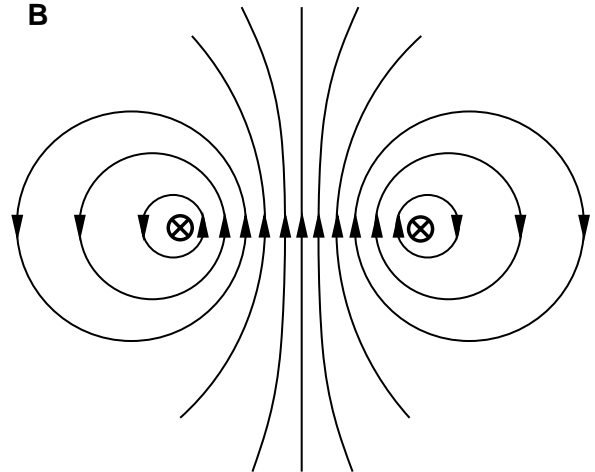


- 24 Two wires carry the same amount of current flowing into the page. Which of the following diagrams shows the resultant magnetic field pattern in the region?

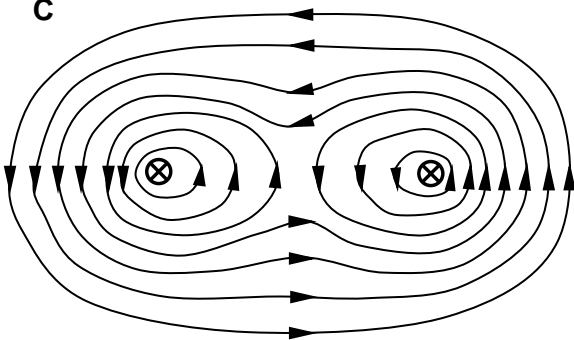
A



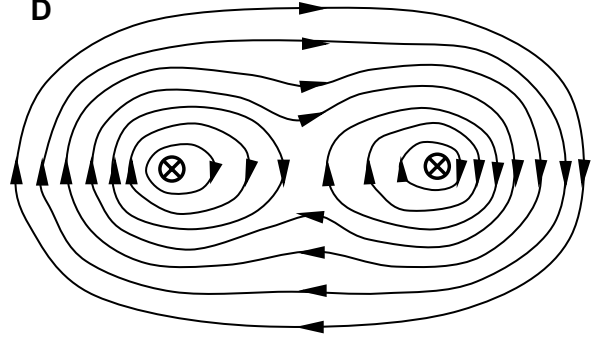
B



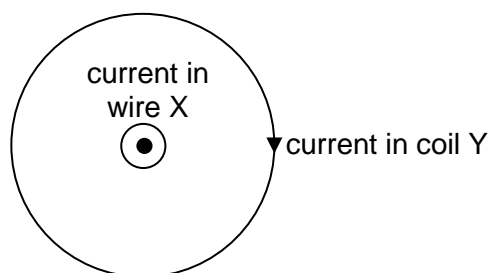
C



D



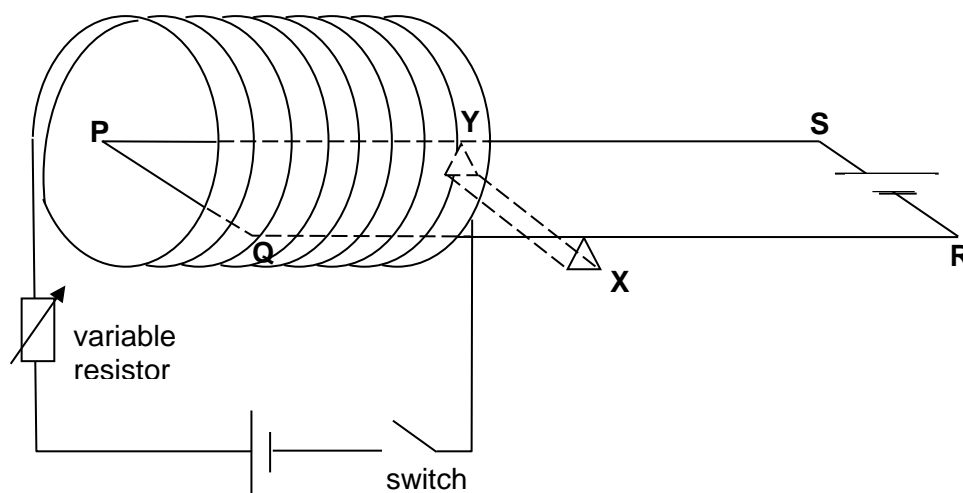
- 25 A long straight wire X is placed along the axis of a flat circular coil Y. The wire and the coil each carry a current as shown.



What can be deduced about the force acting on each part of Y due to the current in X?

- A The force is away from X.
- B The force is towards X.
- C The force is perpendicular to the plane of the diagram.
- D There is no force in any direction.

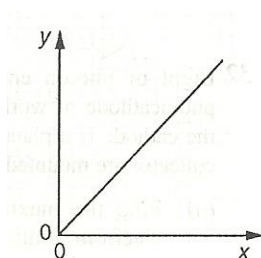
- 26 A light, uniform and insulated wire frame PQRS is partially placed inside a solenoid with magnetic field strength of 0.8 mT, and the current passes through it is 0.4 A. Side PQ of the frame is 7.0 cm and side QR is 18.0 cm. A pivot XY is placed at the midpoint along the length of the frame.



When the switch is closed, what is the direction of the electromagnetic force acting on side PQ and the magnitude of the moment about X due to this force?

	<u>Direction of the force</u>	<u>Moment about X / N m</u>
A	Upward	2.02×10^{-6}
B	Downward	2.02×10^{-6}
C	Upward	4.03×10^{-6}
D	Downward	4.03×10^{-6}

- 27 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?

	<u>x</u>	<u>y</u>
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

- 28** Light photons of energy 3.5×10^{-19} J fall on the cathode of a photocell. The current through the cell is just reduced to zero by applying a positive voltage of 0.25 V to the cathode with respect to the anode. What is the threshold wavelength of the photocell?
- A** 510 nm
B 570 nm
C 640 nm
D 690 nm
- 29** A proton and an electron are accelerated from rest through a potential difference of 2,000 V. What is the ratio of the proton's de Broglie wavelength to that of the electron?
- A** 0.023 **B** 0.23 **C** 1.02 **D** 42.8
- 30** Three spectra lines of wavelengths λ_1 , λ_2 , and λ_3 (in increasing magnitude) are produced by transitions between three energy levels in a certain atom. Which equation correctly relates λ_1 , λ_2 , and λ_3 ?
- A** $\frac{1}{\lambda_1} = \frac{1}{\lambda_2} + \frac{1}{\lambda_3}$
B $\frac{1}{\lambda_1} = \frac{1}{\lambda_3} - \frac{1}{\lambda_2}$
C $\frac{1}{\lambda_1} = \frac{1}{\lambda_2} - \frac{1}{\lambda_3}$
D $\lambda_1 = \lambda_2 + \lambda_3$

End of Paper

