



VICTORIA JUNIOR COLLEGE
2023 JC2 PRELIMINARY EXAMINATION
Higher 1

Name : _____

CT group : _____

PHYSICS

8867/01

Paper 1 Multiple Choice

25 September 2023

MONDAY

Additional Materials: Multiple Choice Answer Sheet

2.00 pm to 3.00 pm (1 hour)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name and Civics Group on the Answer Sheet in the spaces provided unless this has been done for you.

DO **NOT** WRITE ON ANY BARCODES.

There are **thirty** questions on 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.

The use of an approved scientific calculator is expected, where appropriate.

Data

speed of light in free space	$c = 3.00 \times 10^8 \text{ m s}^{-1}$
elementary charge	$e = 1.60 \times 10^{-19} \text{ C}$
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	$m_p = 1.67 \times 10^{-27} \text{ kg}$
the Avogadro's constant	$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$
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	$s = ut + \left(\frac{1}{2}\right) at^2$ $v^2 = u^2 + 2as$
resistors in series	$R = R_1 + R_2 + \dots$
resistors in parallel	$1/R = 1/R_1 + 1/R_2 + \dots$

H1 P1 - Phy Qty and Units MCQ

- 1 Which of the following equations **cannot** be correct?
(E = energy, p = momentum, c = speed of light, m = mass,)

A $E = pc$ B $E^2 = p^2c^2 + m^2c^4$ C $E = p^2c$ D $E = \frac{p^2}{2m}$

H1 P1 - Errors and Uncertainties MCQ

- 2 A certain experiment is carried out such that

$$A = 6 \frac{BC^2}{D}$$

If $A = (2.0 \pm 0.1)$, $C = (4.10 \pm 0.05)$, $D = (3.45 \pm 0.01)$, what is the percentage uncertainty of B ?

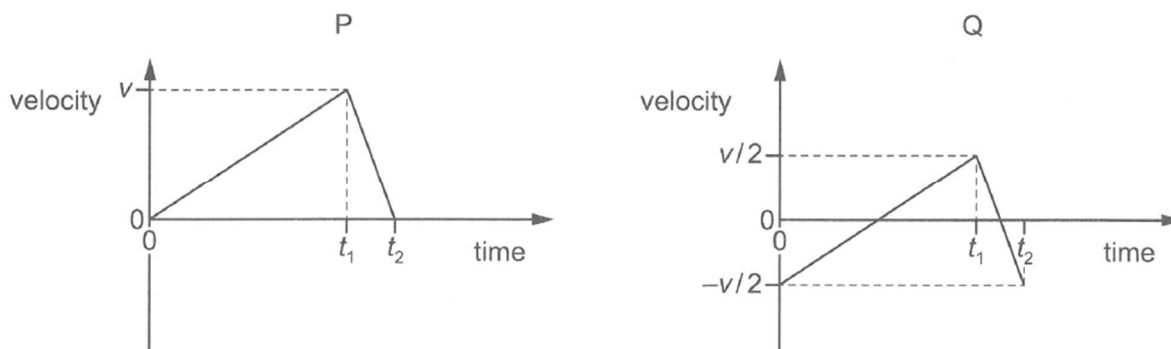
- A 2.9 % B 7.1 % C 7.7 % D 46 %

H1 P1 - Errors and Uncertainties

- 3 A student repeated a measurement three times and obtained measurements of masses 35.23 g, 37.21 g and 38.25 g. A second student did the same but obtained 37.23 g, 37.21 g and 37.25 g. What can be said of the second student's measurements compared to those of the first?

- A More accurate
B More precise
C Less accurate
D Less precise

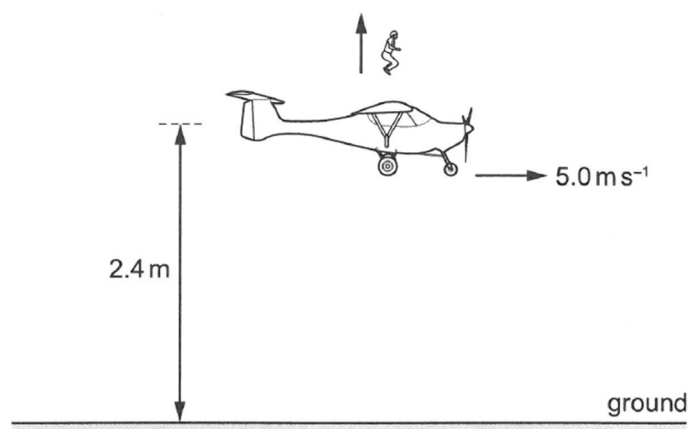
- 4 The motions of two objects P and Q along a straight line are shown in the following velocity-time graphs.



How do the magnitudes of the displacement and the total distance travelled compare for the two objects from time 0 to time t_2 ?

	displacement	distance
A	different	different
B	different	same
C	same	different
D	same	same

- 5 A toy aeroplane is flying above the ground at a constant horizontal velocity of 5.0 m s^{-1} when the toy pilot is ejected. The aeroplane propels the toy pilot upward from a height of 2.4 m above the ground so that the vertical component of his speed is initially 3.0 m s^{-1} .

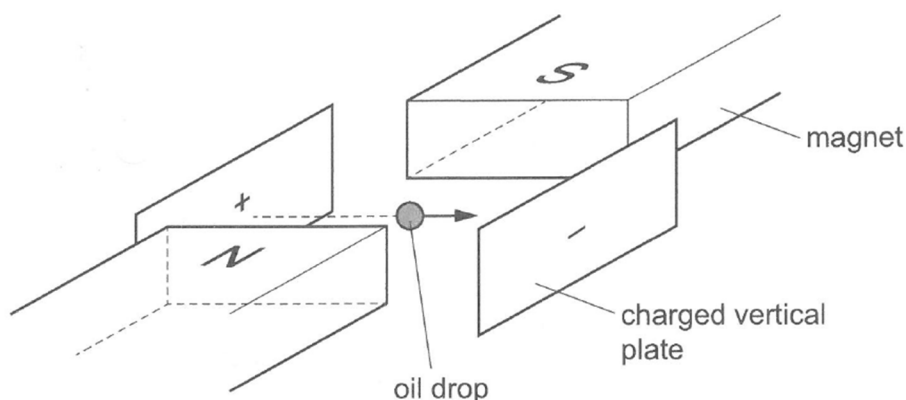


With what speed does the toy pilot hit the ground? Ignore the effects of air resistance.

- A 3.7 m s^{-1} B 5.8 m s^{-1} C 7.5 m s^{-1} D 9.0 m s^{-1}

H1 P1 Dynamics

- 6 A magnetic field is created using two bar magnets. Two charged vertical plates are placed near the magnets as shown.



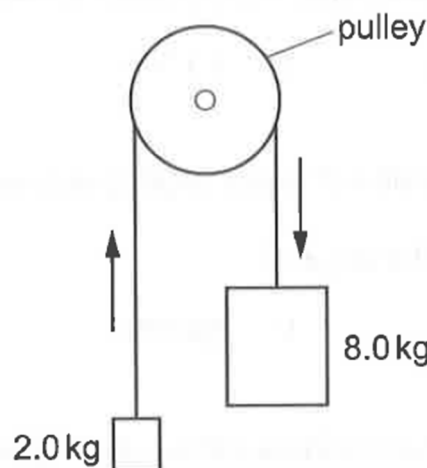
A charged oil drop moves in a horizontal straight line at constant speed in the air between the two plates.

Which equation about the magnitude of the forces acting on the charged oil drop must be correct?

- A air resistance = gravitational force
- B air resistance = magnetic force
- C electric force = magnetic force
- D gravitational force = magnetic force

H1 P1 Dynamics

- 7 Masses of 8.0 kg and 2.0 kg hang from a light inextensible cord passing over a pulley.



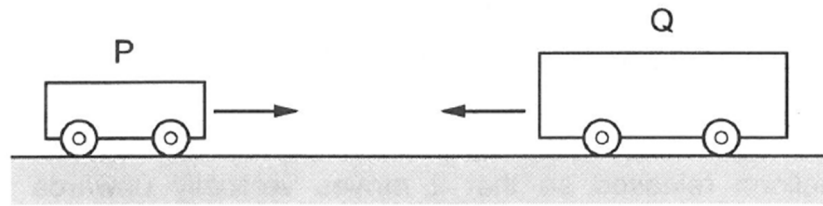
The pulley exerts friction on the cord that is equivalent to a force of 3.0 N at the circumference.

When the masses are released, they move in the direction of the arrows.

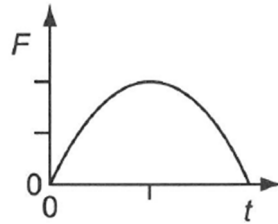
What is their acceleration?

- A 5.6 m s^{-2}
- B 5.9 m s^{-2}
- C 6.2 m s^{-2}
- D 9.3 m s^{-2}

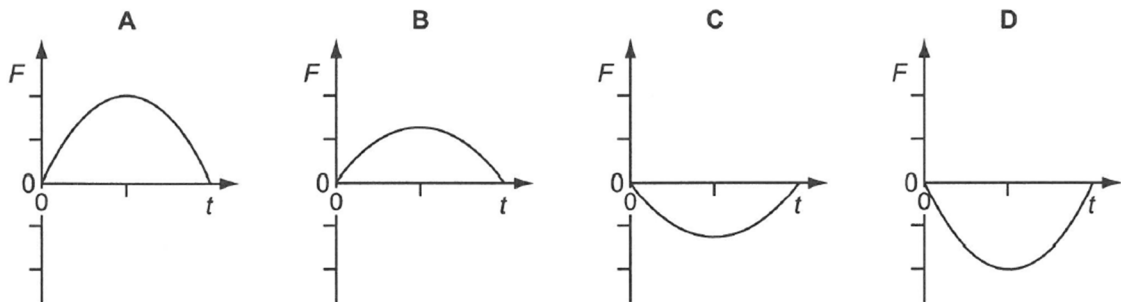
- 8 Two trolleys P and Q approach each other and collide.



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?



- 9 A 30 N and a 40 N force act concurrently on an object. If their resultant is 50 N, then the angle between the two forces is

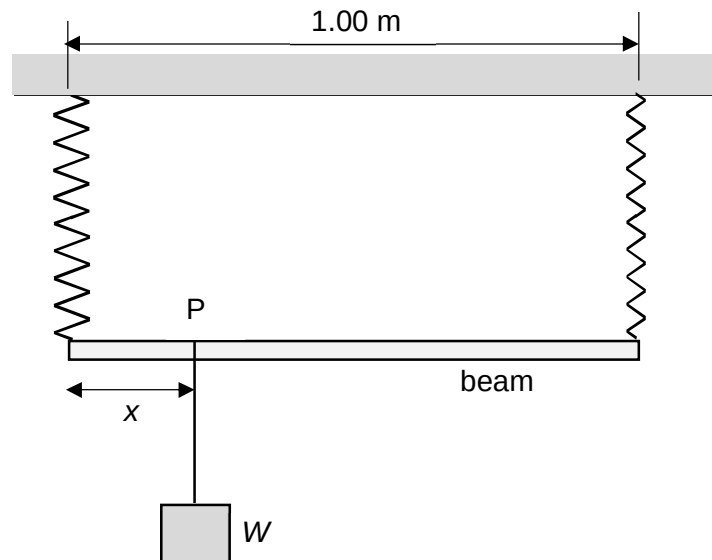
A 0° B 60° C 90° D 180°

Forces (H1 P1 MCQ 2)

- 10** A one-metre-long beam of negligible mass is suspended at its two ends from two springs attached to the ceiling.

The two springs are initially of the same length when no load is applied to them.

The force constant of the left spring is twice that of the right spring.



A mass is suspended using a string from the beam, and the position of its point of attachment is adjusted until the beam is horizontal.

What is the distance x of the point P of the mass from the left end of the beam when it is horizontal?

- A** 0.20 m **B** 0.25 m **C** 0.33 m **D** 0.50 m

Forces (H1 P1 MCQ 3)

- 11** A stone is suspended from the horizontal bar of a retort stand using a string.

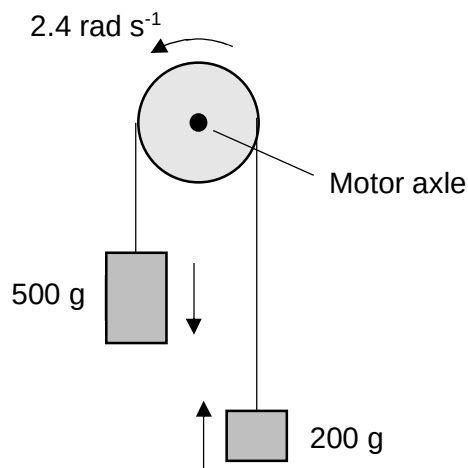
Which of the following pairs of forces **do not** form a Newton's third law pair?

	Force 1	Force 2
A	Weight of the stone	Force exerted by stone on Earth
B	Force exerted by stone on ceiling	Force exerted by ceiling on stone
C	Force exerted by stone on string	Force exerted by string on stone
D	Weight of the stone	Force exerted by string on stone

WEP (H1 P1 MCQ 1)

- 12** A 500 g mass and a 200 g mass are connected by an inextensible rope that passes over a pulley of radius 3.5 cm. The pulley is attached to the axle of a motor, which exerts a torque on the rope to lower the 500 g mass while raising the 200 g mass.

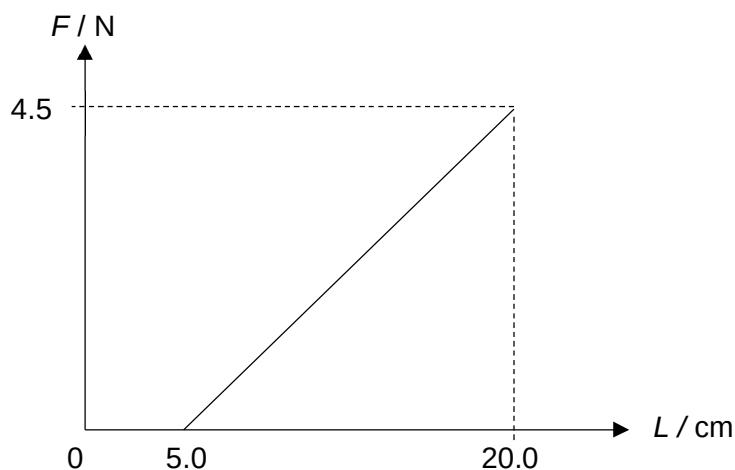
If the pulley rotates with a constant angular speed of 2.4 rad s^{-1} , what is rate of work done by the motor? Assume that there is no slipping between the rope and the pulley.



- A** -2.94 W **B** -0.25 W **C** 0.084 W **D** 7.1 W

WEP (H1 P1 MCQ 2)

- 13** The tension F in a spring varies with its length L according to the following graph.



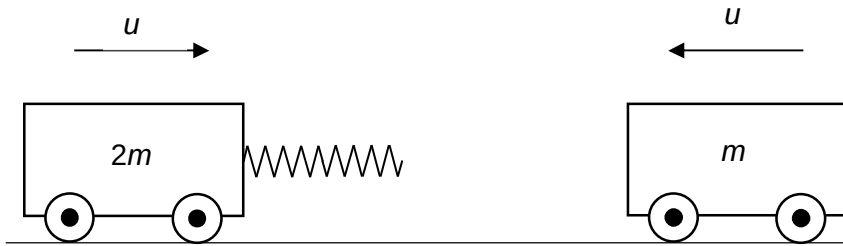
The unstretched spring is then suspended from the rod of a retort stand, and a 150 g mass is attached to its lower end, and then released.

What is the maximum length of the spring?

- A** 4.9 cm **B** 9.8 cm **C** 14.8 cm **D** 19.6 cm

WEP (H1 P1 MCQ 3)

- 14** Two carts of masses $2m$ and m move with identical initial speeds u toward each other. A spring attached to the front of the heavier cart is compressed when the carts collide. The spring is shortest when the carts are moving with the same velocity.



What is the elastic potential energy stored in the spring when it is at its minimum length due to the compression?

- A** $\frac{1}{4}mu^2$ **B** $\frac{1}{2}mu^2$ **C** $\frac{3}{4}mu^2$ **D** $\frac{4}{3}mu^2$

H1 P1 Circular motion

- 15** In a racetrack, a circular corner of radius r is banked at an angle of θ to the horizontal. The maximum friction between the track and a car of mass m is f . If the maximum speed with which it can negotiate the turn without any skidding is v , which of the following equations is correct?

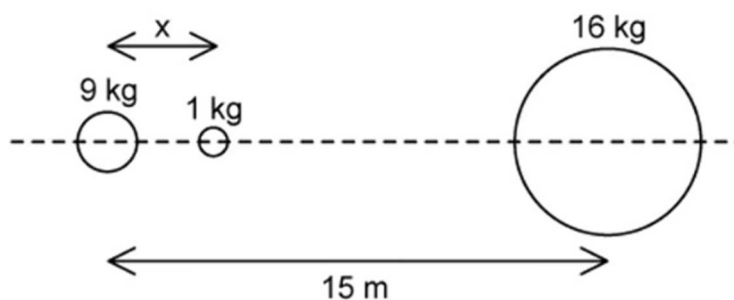
- A** $N \sin \theta - f \cos \theta = \frac{mv^2}{r}$ **B** $N \sin \theta + f \cos \theta = \frac{mv^2}{r}$
C $N \cos \theta - f \sin \theta = \frac{mv^2}{r}$ **D** $N \cos \theta + f \sin \theta = \frac{mv^2}{r}$

- 16** In the track and field event of the men's discus throw, a 2.0 kg discus is thrown at a speed of around 24.0 m s^{-1} by a competitor. If we assume that the path of the discus is approximately circular with a radius of 1.2 m when thrown, what is the angular velocity of the discus?

- A** 20 rad s^{-1} **B** 29 rad s^{-1} **C** 400 rad s^{-1} **D** 960 rad s^{-1}

H1 P1 Gravity

- 17** The diagram below shows three uniform masses in a straight line.



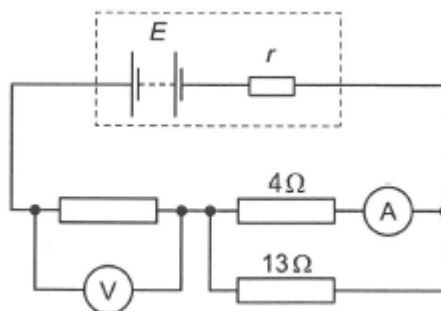
The resultant gravitational force on the 1 kg mass is zero if the distance x is

- A** 5.0 m **B** 5.4 m **C** 6.4 m **D** 8.6 m

- 18** Which of the following statements about uniform gravitational fields is **incorrect**?

- A** The field strength is equal at every point in a uniform gravitation field.
B The accelerations of free-falling bodies are dependent on their masses.
C The field lines in a uniform gravitational field are parallel to each other.
D There is a uniform gravitational field near the Earth's surface.

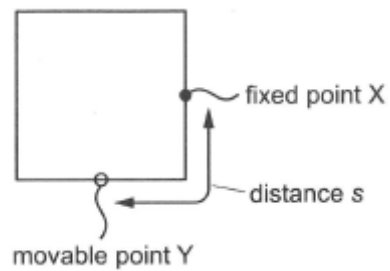
- 19** A battery of e.m.f. E and internal resistance r is connected to three resistors, a voltmeter and an ammeter, as shown.



The voltmeter reads 3.0 V, the ammeter reads 1.5 A, and the power loss in the internal resistance is 2.1 W. What is the e.m.f. of the battery?

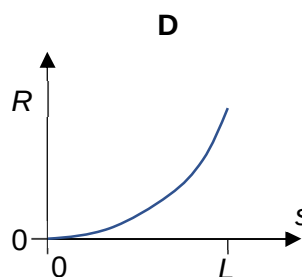
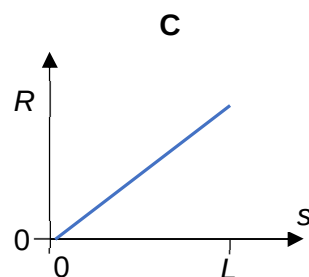
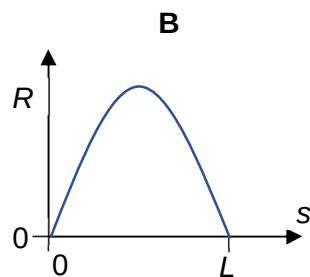
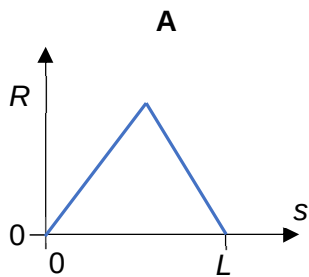
- A** 8.2 V **B** 9.0 V **C** 9.9 V **D** 10.1 V

- 20** A wire of length L forms a square loop with electrical contact points at X and at Y. X is at a fixed point and Y may be moved to make contacts at different points along the loop of wire.

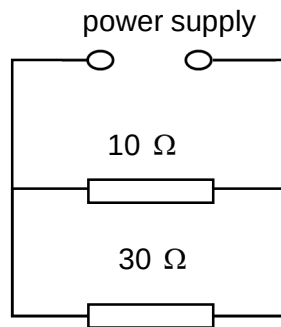


The resistance R between X and Y is measured as contact Y moves all the way round the loop, starting at X.

Which graph shows the variation of R with the distance s along the loop of wire?



- 21** A circuit consists of a power supply in series with a $10\ \Omega$ resistor and a $30\ \Omega$ resistor connected in parallel as shown.

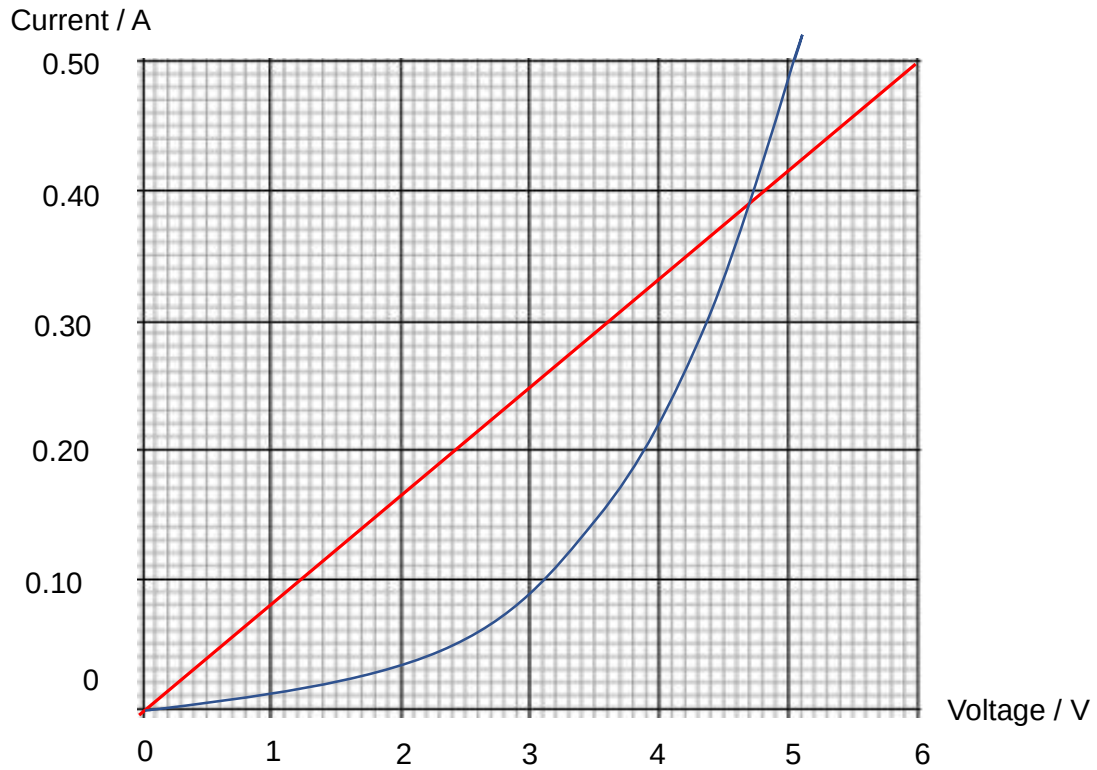


The total power dissipated in the resistors is P .

Which row correctly states the power dissipated in each resistor?

	Power dissipated in $10\ \Omega$ resistor	Power dissipated in $30\ \Omega$ resistor
A	$\frac{P}{4}$	$\frac{3P}{4}$
B	$\frac{3P}{4}$	$\frac{P}{4}$
C	$\frac{P}{10}$	$\frac{9P}{10}$
D	$\frac{9P}{10}$	$\frac{P}{10}$

- 22** The diagram below shows the I - V graphs of a thermistor and a resistor. When they were connected in series to a power supply of negligible internal resistance, a current of 0.10 A was drawn from the power supply. When they are connected in parallel with the power supply, what is the current drawn from the power supply?



A 0.20 A

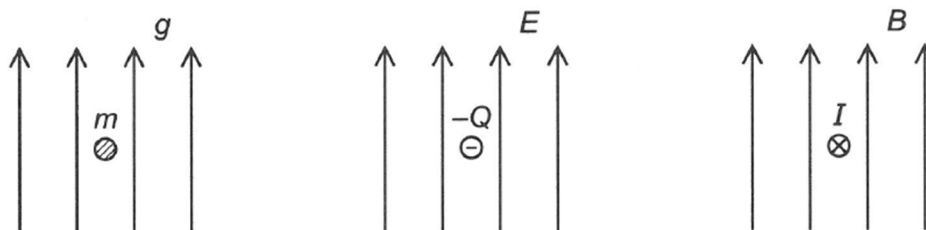
B 0.48 A

C 0.64 A

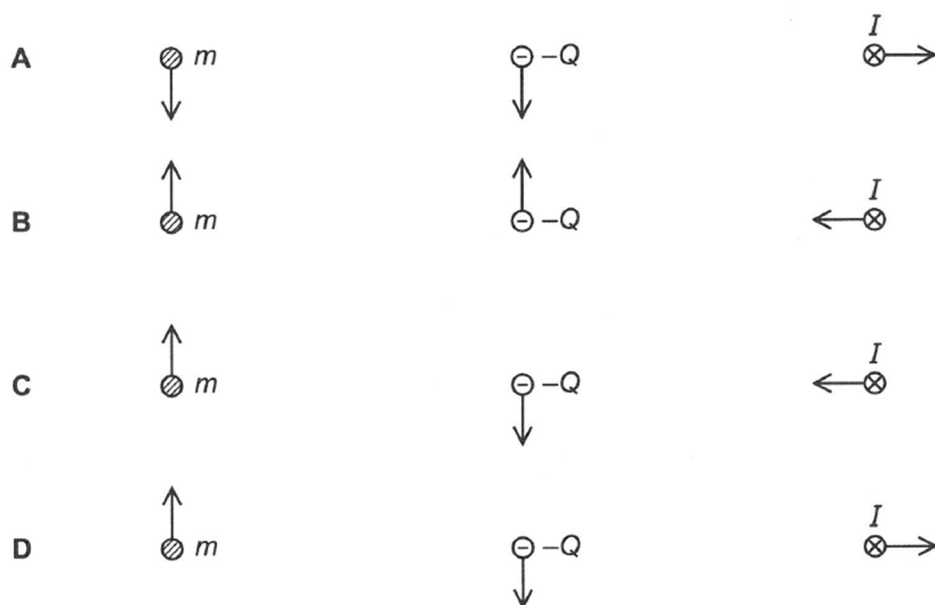
D 0.78 A

23 The diagrams show three uniform fields.

- a mass m in a gravitational field g
- a negative charge $-Q$ in an electric field E
- a conductor, carrying a current I into the diagram, in a magnetic field B .

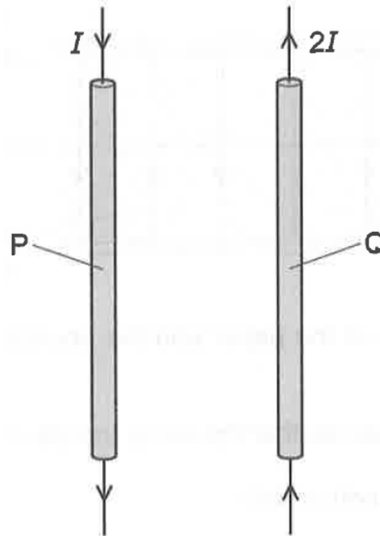


Which diagram shows the directions of the forces on m , $-Q$ and I ?



H1 P1 Electromagnetism

- 24** Two parallel wires, P and Q, carry electric currents in opposite directions. The current in Q is twice the current in P, as shown.

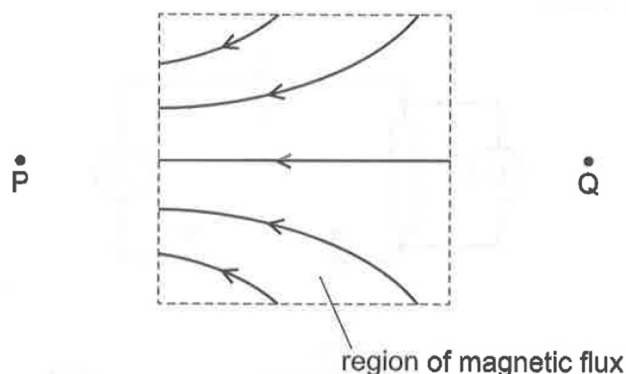


Which statement is correct?

- A** P and Q attract each other and the magnitude of the force exerted by Q on P is equal to that exerted by P on Q.
- B** P and Q attract each other and the magnitude of the force exerted by Q on P is twice that exerted by P on Q.
- C** P and Q repel each other and the magnitude of the force exerted by Q on P is equal to that exerted by P on Q.
- D** P and Q repel each other and the magnitude of the force exerted by Q on P is twice that exerted by P on Q.

H1 P1 Electromagnetism

- 25** The magnetic flux pattern formed horizontally in a region of space is shown below.



What could cause the magnetic flux pattern?

- A** a current-carrying, flat, circular coil with a diameter along the line PQ
- B** a current-carrying solenoid with one end at P
- C** a long, straight, current-carrying wire along the line PQ
- D** a south pole of a bar magnet at Q

- | | | | |
|----------|---------------------------------|----------|---------------------------------|
| A | $4.8 \times 10^{-12} \text{ N}$ | B | $9.6 \times 10^{-12} \text{ N}$ |
| C | $3.0 \times 10^7 \text{ N}$ | D | $6.0 \times 10^7 \text{ N}$ |

- A** 28.4 MeV **B** 2.84 MeV **C** 142 MeV **D** 14.2 MeV

- A** its atomic number will decrease by 1 unit
B its atomic number will increase by 1 unit
C its mass number will decrease by 1 unit
D its mass number will increase by 1 unit

- A** α -particles
B β -particles
C γ -rays
D uv-light

- A** $\frac{1}{16}$ **B** $\frac{1}{4}$ **C** $\frac{3}{4}$ **D** $\frac{15}{16}$

***** END *****