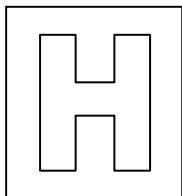


Candidate Name: _____

Class AdmNo

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2014 Preliminary Exam 2

Pre-university 2

H1 PHYSICS

8866 / 01

Monday

22 September 2014

1 hour

Additional Materials: OMR Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your full name, class and admission number in the spaces at the top of this page and on the separate Answer Sheet.

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.

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

| | |
|-------------------------------|---|
| speed of light in free space, | $c = 3.00 \times 10^8 \text{ m s}^{-1}$ |
| elementary charge, | $e = 1.60 \times 10^{-19} \text{ C}$ |
| 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, | $m_p = 1.67 \times 10^{-27} \text{ kg}$ |
| 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, | $W = p\Delta V$ |
| hydrostatic pressure, | $p = \rho gh$ |
| resistors in series, | $R = R_1 + R_2 + \dots$ |
| resistors in parallel, | $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$ |

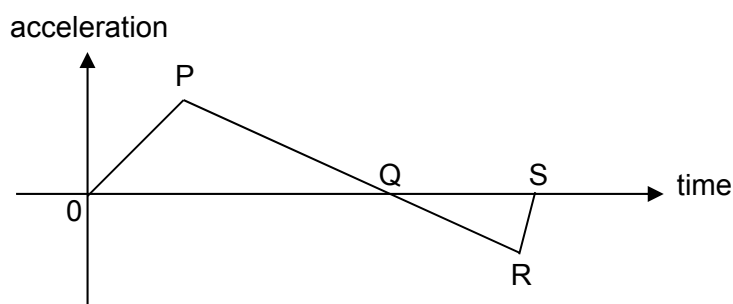
- 1 What is the estimated number of ping pong balls that can completely fill a classroom with dimensions 20.0 m by 10.0 m by 3.50 m, without being crushed?

A 10^3 **B** 10^6 **C** 10^7 **D** 10^8

- 2 Express the pascal in SI base units.

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

- 3 The acceleration-time graph of an object moving in a straight line is as shown.



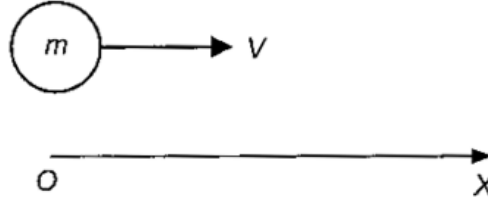
If the object starts its motion from rest, at which point is the object moving with the largest speed?

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

- 4 A cannon at the top of a 30 m high hill fires a shell at an angle of 30.0° upwards from the horizontal with a speed of 50.0 m s^{-1} . Taking air resistance to be negligible, what is the angle to the vertical at which the shell lands on level ground?

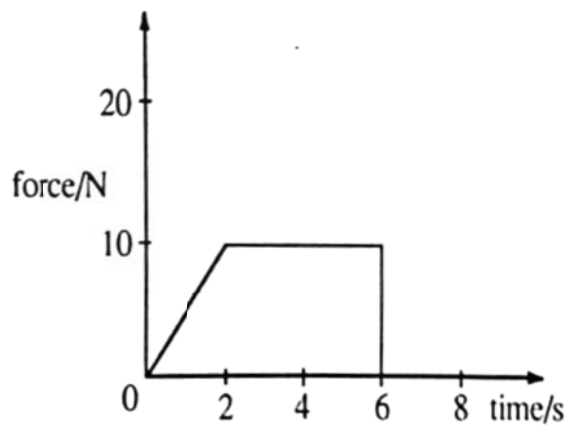
A 7.93°
B 38.9°
C 51.2°
D 82.1°

- 5 A particle of mass m is traveling with a velocity v in the direction OX as shown below. At a later time, its velocity is of the same magnitude in the opposite direction XO.



What is the change of momentum that has taken place in this time interval?

- A mv in the direction OX.
B mv in the direction XO.
C $2mv$ in the direction of OX.
D $2mv$ in the direction of XO.
- 6 A body of mass 3 kg is acted on by a force which varies with time t as shown in the figure below.



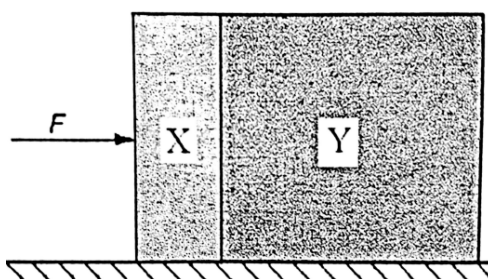
What is the momentum acquired by the mass?

- A 5 N s
B 30 N s
C 50 N s
D 60 N s

- 7 When a man is standing in an ascending lift, a force F is exerted on the man's feet by the lift.

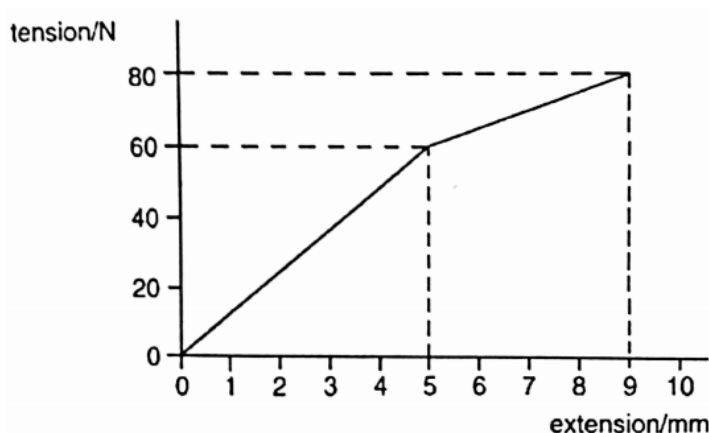
Which of the following statement is true about force F ?

- A F is equal to the magnitude of his weight
 - B F is less than the magnitude of his weight
 - C F is greater than it would be if the lift is stationary.
 - D F is equal to the magnitude of the force exerted on the lift by his feet
- 8 Two blocks, X and Y, of masses m and $2m$ respectively are accelerated along a smooth horizontal surface by a force F applied to block X, as shown in the diagram.



What is the magnitude of the force exerted by block Y on block X during the acceleration?

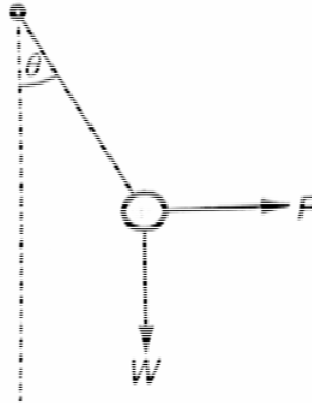
- A $F/3$
 - B $F/2$
 - C $2F/3$
 - D F
- 9 A sample is placed in a tensile testing machine. It is extended by known amounts and the tension is measured.



What is the work done on the sample when it is given a total extension of 9 mm?

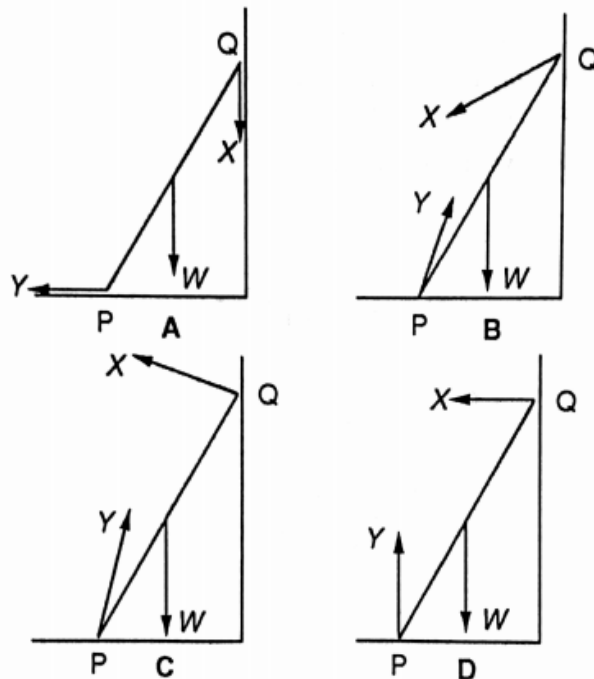
- A 0.31 J
- B 0.36 J
- C 0.43 J
- D 0.72 J

- 10 A small ball of weight W is suspended by a light thread. When a strong wind blows horizontally, exerting a constant force F on the ball, the thread makes an angle θ to the vertical as shown in the diagram below.

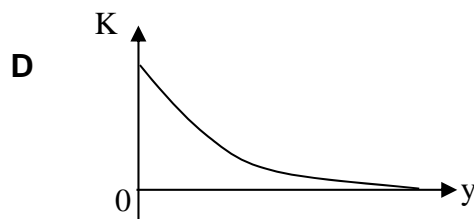
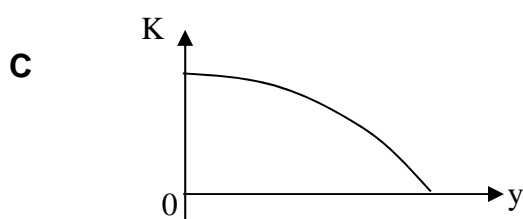
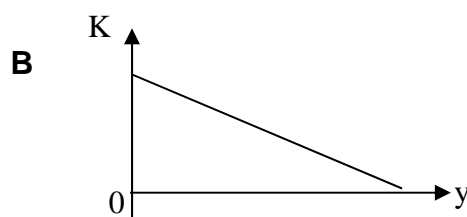
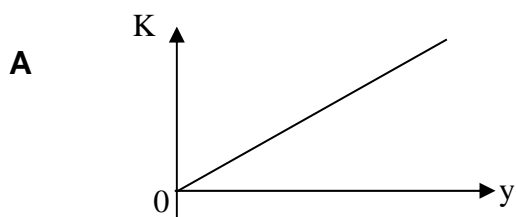


Which equation correctly relates θ , F , and W ?

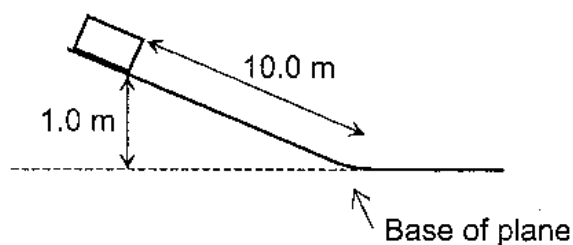
- A $\cos \theta = F/W$
 B $\sin \theta = F/W$
 C $\tan \theta = F/W$
 D $\tan \theta = W/F$
- 11 A ladder PQ, resting on a rough floor and leaning against a rough wall, is on the point of slipping. It is of weight W and the contact forces exerted on the ladder by the wall and the floor are X and Y respectively. Which one of the following diagrams correctly shows the directions of these forces?



- 12 An object is projected vertically upwards. Ignoring air resistance, which of the following graphs shows the variation of its kinetic energy, K with the vertical distance travelled, y during the upwards motion?



- 13 A body of mass 1.0 kg initially at rest slides down an inclined plane that is 1.0 m high and 10.0 m long as shown in the diagram below.



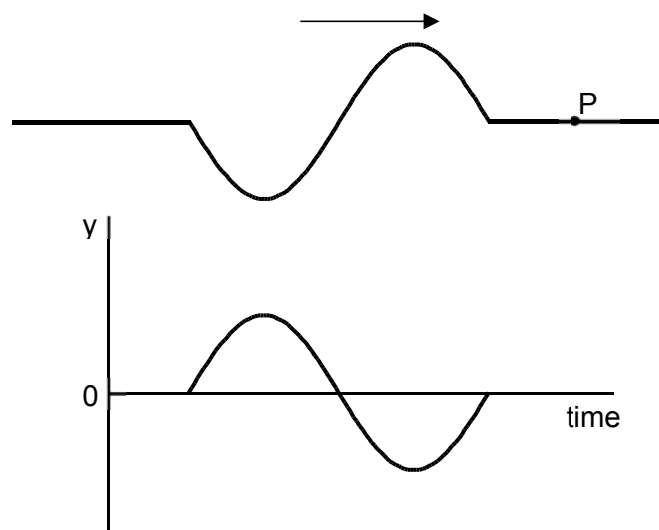
If the body experiences a constant resistive force of 0.5 N over the slope, what is the kinetic energy of the body at the base of the plane?

- A** 4.81 J
B 9.31 J
C 10.3 J
D 14.8 J
- 14 A car of mass 1500 kg is accelerated from rest to a speed of 100 km h^{-1} on level ground. Given that the time taken is 12.1 s, what is the average power delivered by the engine?

A 1.72 kW **B** 47.8 kW **C** 95.7 kW **D** 620 kW

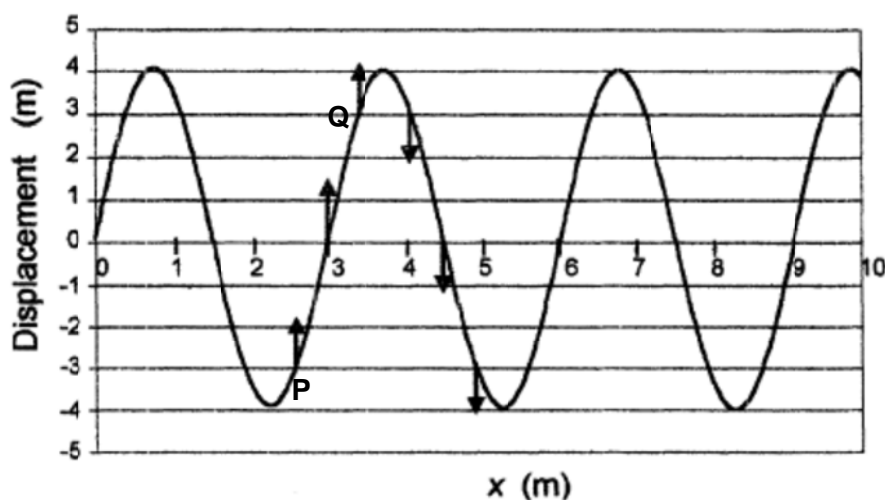
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- 15 The diagram shows the profile of a pulse on a string travelling towards a point P. The graph shows the variation with time of a physical quantity measured at P while the pulse is passing.



Which one of the following quantities does the y-axis represent?

- A** displacement **B** velocity **C** acceleration **D** potential energy
- 16 The figure below shows a displacement - distance graph of a progressive transverse wave at a particular time. The arrows show the directions in which some of the particles on the wave are moving at that instant.



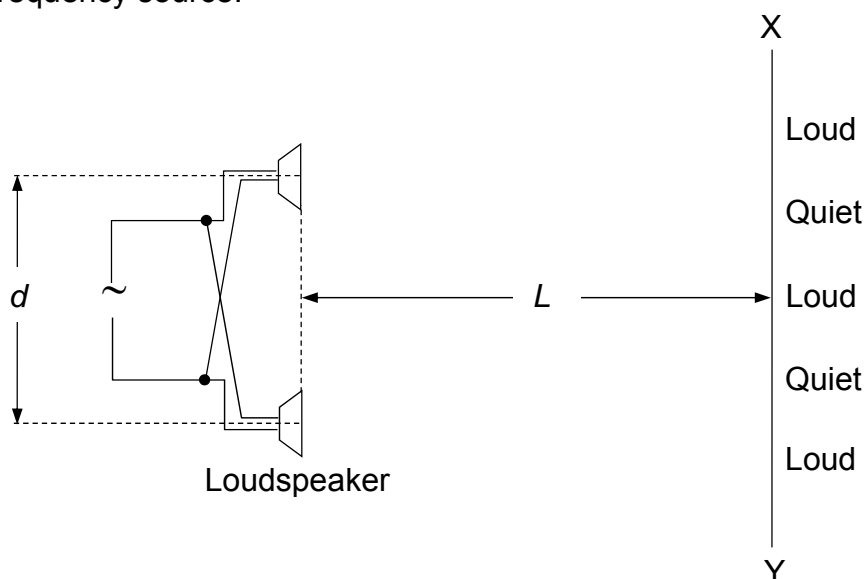
Which of the following statements about the wave is correct?

- A** The wave has amplitude 8 m and the phase of the particles on the wave is constantly changing.
B Energy is being transferred by the wave from the right to the left.
C The wave is moving to the right and its wavelength is 3 m.
D Particles P and Q have a phase difference of π radians at the instant shown.

- 17 A small source of sound radiates energy equally in all directions. The intensity of the sound 3.0 m away from the source is 0.18 W m^{-2} . If the power of the source is tripled, what is the intensity at a distance 4.5 m away from the source?

A 0.090 W m^{-2} B 0.24 W m^{-2} C 0.18 W m^{-2} D 0.28 W m^{-2}

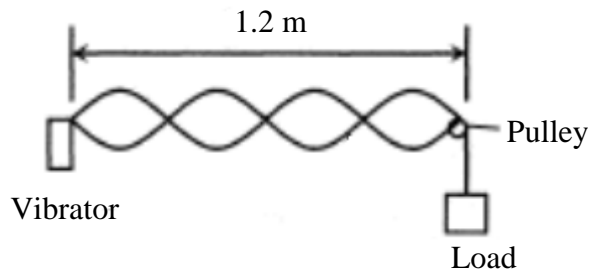
- 18 The diagram shows two identical loudspeakers driven in phase from a common audio-frequency source.



When a student moves along a line such as XY , he notices that there are regions in which the sound heard is alternately loud and quiet. Which of the following will make the regions in which the sound is loud to move closer together?

- A Decreasing distance d
 B Increasing L
 C Increasing the frequency of the audio-frequency source
 D Increasing the power output from the audio-frequency source

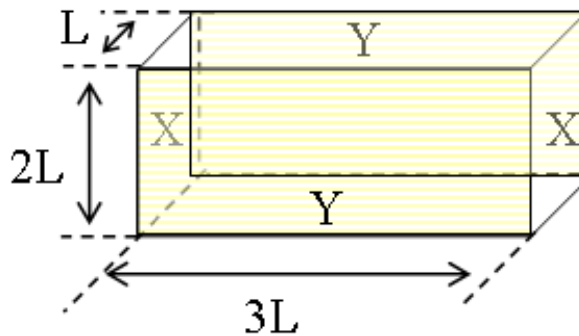
- 19 The diagram shows an experiment in which nodes are observed in a vibrating wire. The frequency of the vibrator is 290 Hz.



What is the speed of propagation, in m s^{-1} , of the waves along the wire?

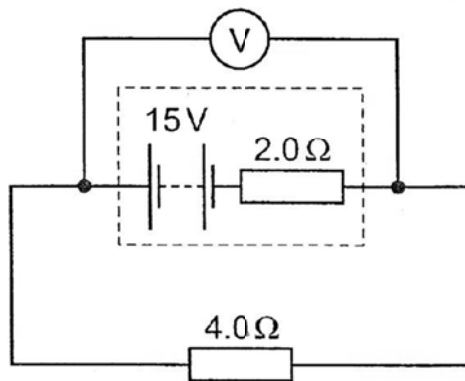
- A 42
 - B 84
 - C 168
 - D 174
- 20 Which effect provides direct experimental evidence that light is a transverse, rather than a longitudinal, wave motion?
- A Light can be diffracted.
 - B Two coherent light waves can be made to interfere.
 - C The intensity of light from a point source falls off inversely as the square of the distance from the source.
 - D Light can be polarised.

- 21 A conductor has the dimensions given by the figure below.



What is the ratio R_X / R_Y of the resistance between the opposite faces marked X (left and right faces) and Y (front and rear faces) respectively?

- A $2/3$ B $9/4$ C $3/2$ D $9/1$
- 22 A battery has an e.m.f. of 15 V and an internal resistance of $2.0\ \Omega$. It supplies current to a $4.0\ \Omega$ resistor.



What is the reading on the high resistance voltmeter?

- A 5.0 V
 B 7.5 V
 C 10 V
 D 15 V

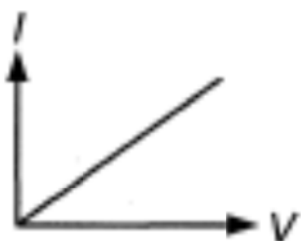
- 23 A high potential is applied between the electrodes of a gas discharge tube so that the gas is ionised. The gas carries a current of 8.16 mA and the number of electrons passing any point in the gas per unit time is $2.58 \times 10^{16} \text{ s}^{-1}$.

If the charge on each positive particle is $3.2 \times 10^{-19} \text{ C}$, what is the number of positively charge particles passing any point in the gas per unit time?

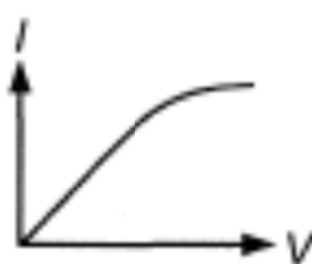
- A $1.26 \times 10^{16} \text{ s}^{-1}$
- B $2.58 \times 10^{16} \text{ s}^{-1}$
- C $3.84 \times 10^{16} \text{ s}^{-1}$
- D $10.3 \times 10^{16} \text{ s}^{-1}$

- 24 Which graph best represents the way in which the current I through a thermistor depends upon the potential difference V across it?

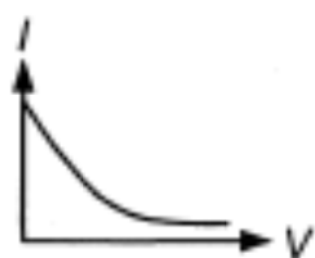
A



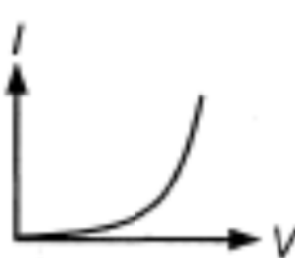
C



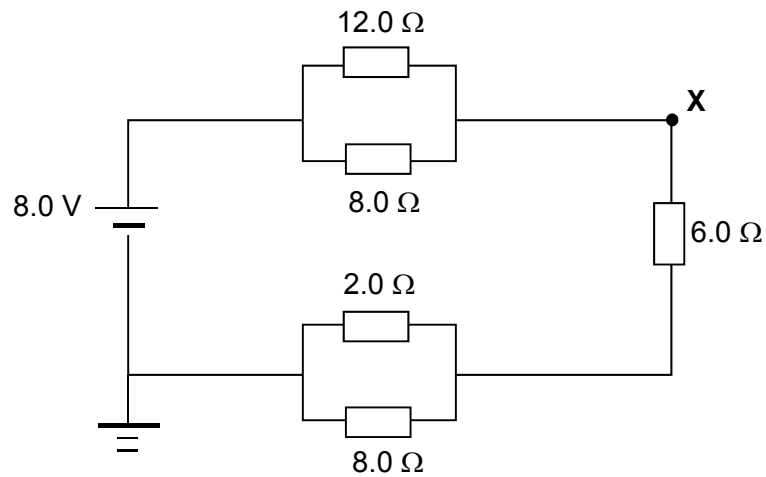
B



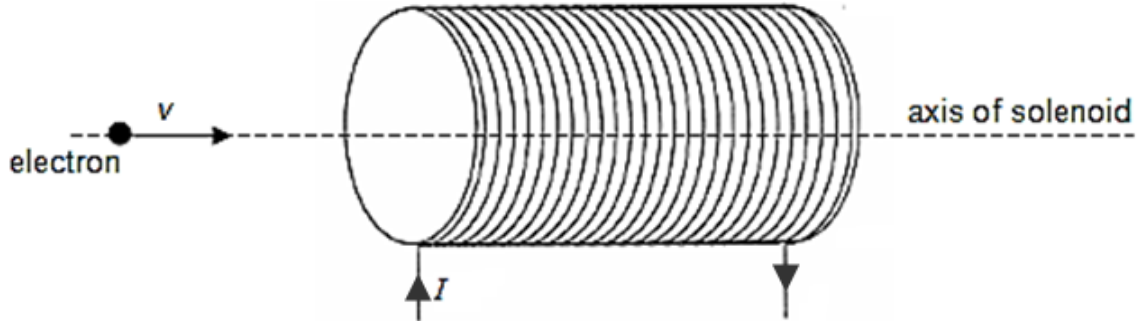
D



- 25 What is the value of the potential at point **X** in the circuit below?



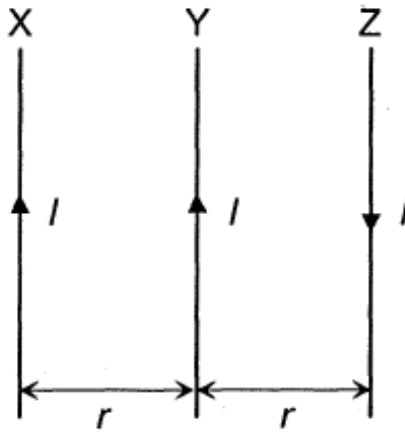
- A 3.09 V B - 3.87 V C 4.90 V D - 6.96 V
- 26 An electron of velocity v is moving along the axis of a solenoid carrying current, I .



Which of the following is a correct statement about the magnetic force acting on the electron?

- A The force acts perpendicularly to the direction of motion.
 B The force acts in the same direction of motion.
 C The force acts in the opposite direction of motion.
 D No force acts.

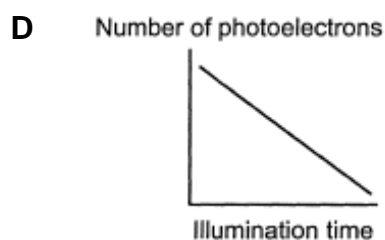
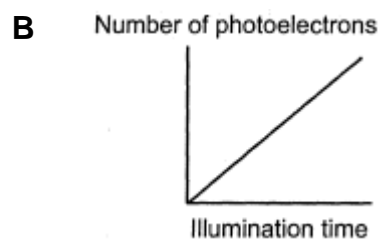
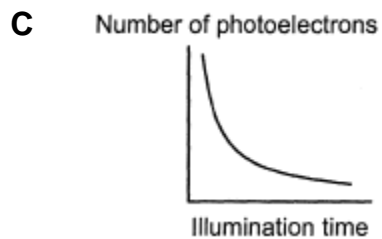
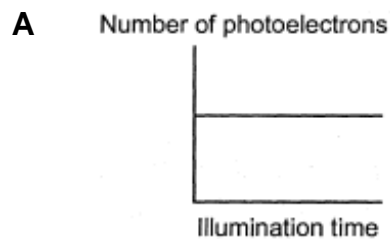
- 27 The figure below shows three parallel wires X, Y and Z which carry currents I of equal magnitude in the direction shown.



What is the resultant force experienced by Y due to currents in X and Z?

- A 0
 B Towards X
 C Towards Y
 D Along Y
- 28 A beam of monochromatic light incident on a metal surface causes the emission of photoelectrons. The length of time that the surface is illuminated by this beam is varied, but the intensity of the beam is kept constant.

Which graph best represents the relationship between the total number of photoelectrons emitted and the length of time of illumination?



29 Which of the following set-up will **not** emit any photoelectrons?

| | Intensity / W ms^{-2} | Work function of metal / eV | Wavelength of incoming radiation /m |
|----------|--------------------------------|-----------------------------|-------------------------------------|
| A | 1.0 | 2.0 | 3.0×10^{-7} |
| B | 0.5 | 3.0 | 3.0×10^{-7} |
| C | 0.5 | 2.0 | 6.0×10^{-7} |
| D | 1.0 | 3.0 | 6.0×10^{-7} |

30 A metal surface in an evacuated tube is illuminated with monochromatic light causing the emission of photoelectrons which are collected at an adjacent electrode.

If the experiment were to be repeated with light of double the intensity but the same wavelength, how would the photocurrent I and stopping potential V be affected?

- A** I doubled, V halved
- B** I halved, V unchanged
- C** I doubled, V unchanged
- D** I doubled, V doubled

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