NANYANG JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 1

PHYSICS 8866/01

Paper 1 Multiple Choice Questions **30 September 2015**

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name and class on the Cover of this Question Paper and on the Answer Sheet provided.

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 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.

This document consists of **13** printed pages.

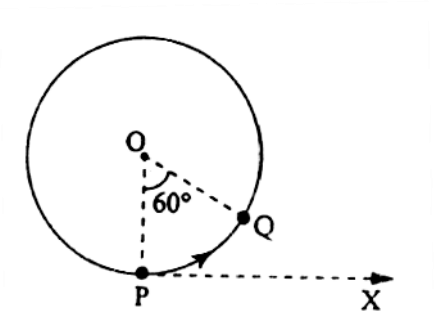
Data

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,	$R = R_1 + R_2 + ...$
resistors in parallel.	$1/R = 1/R_1 + 1/R_2 + ...$

1 The figure below shows a particle moving with constant speed 10 m s^{-1} in a horizontal circular path about a point O.



What is the change in velocity of the particle in its motion from the point P to the point Q?

A 5.0 m s^{-1} in the direction of PX.

B 7.3 m s^{-1} at an angle of 30 ° to the direction PX.

C 8.7 m s^{-1} at an angle of 90 ° to the direction PX.

D 10.0 m s^{-1} at an angle of 120 ° to the direction PX.

2 The density of a steel ball is determined by measuring its mass and diameter. The mass was measured within 1% and the diameter within 3%. The error in the calculated density of the steel ball is at most

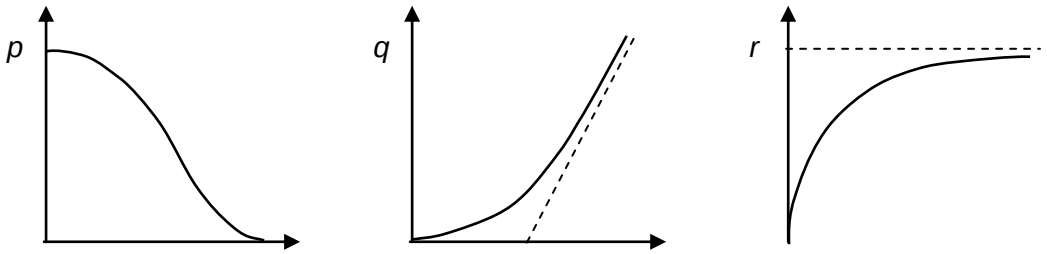
A 2%

B 4%

C 10%

D 28%

3 A stone is released from rest at a great height in air and falls owing to gravity. Each of the three graphs below represents the variation with time of one of three variables *p*, *q* and *r*.



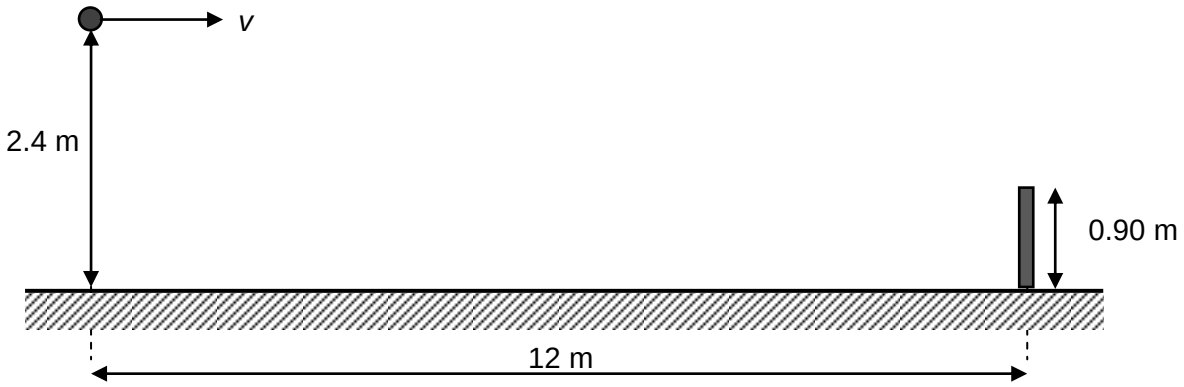
Which row correctly identifies the three variables *p*, *q* and *r*?

	p	*q*	*r*
A	acceleration	velocity	displacement
B	acceleration	displacement	velocity
C	displacement	acceleration	velocity
D	velocity	displacement	acceleration

4 The velocity of a car which is decelerating uniformly changes from 30 m s^{-1} to 20 m s^{-1} in 100 m. After what further distance will it come to rest?

A 80 m **B** 100 m **C** 150 m **D** 200 m

5 In a tennis match, a ball is hit horizontally with a speed *v* as shown in the diagram.



The bottom of the ball is initially 2.4 m above the ground and at a horizontal distance 12 m from the net.

The ball just clears the net, which is 0.90 m high.

What is the value of *v*? (Neglect the effect of air resistance.)

A 17 m s^{-1} **B** 22 m s^{-1} **C** 40 m s^{-1} **D** 43 m s^{-1}

6 When a man is standing in an ascending lift, the magnitude of the force exerted on the man's feet by the floor is always

A equal to the magnitude of his weight.

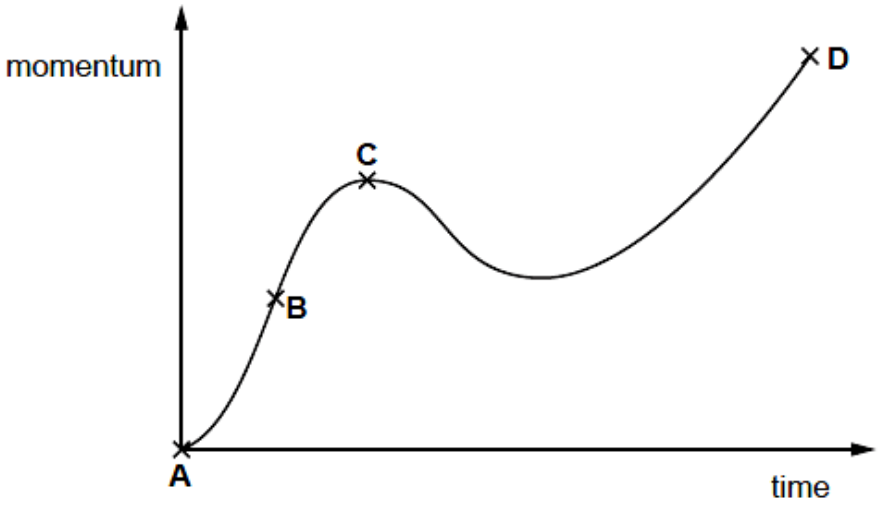
B greater than it would be in a stationary lift.

C equal to what it would be in stationary lift.

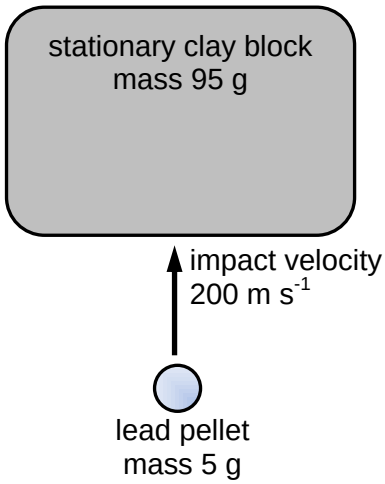
D equal to the magnitude of the force exerted on the lift floor by his feet.

7 A body experiences a varying resultant force that causes its momentum to vary, as shown in the graph.

At which point does the resultant force have the largest value?



8 A lead pellet of mass 5 g is shot vertically upwards into a clay block of mass 95 g that is initially stationary but is able to rise freely after impact.

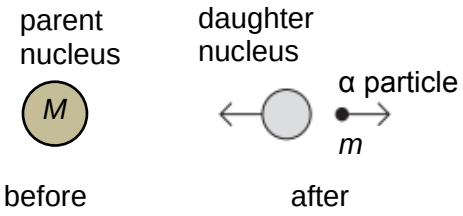


The pellet hits the block with an initial velocity of 200 m s^{-1}. It embeds itself in the block and does not emerge.

How long after the pellet impact will the block reach its highest point above its initial position?

A 0.50 s **B** 1.0 s **C** 2.0 s **D** 20 s

9 A stationary unstable nucleus of mass *M* emits an α particle of mass *m* with kinetic energy *E*. What is the speed of recoil of the daughter nucleus?



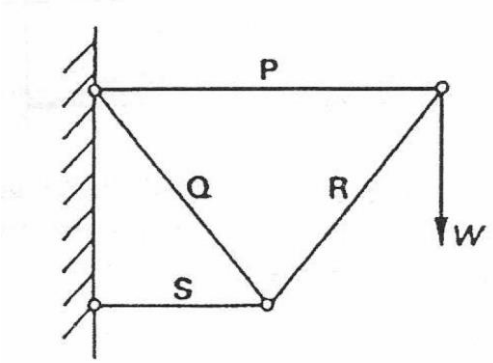
A $\frac{\sqrt{2mE}}{(M-m)}$

B $\frac{\sqrt{2mE}}{M}$

C $\frac{(M-m)}{\sqrt{2mE}}$

D $\frac{2mE}{(M-m)^2}$

10 In order to support a load W, four light hinged rods P, Q, R and S are connected as shown below and mounted in a vertical plane.



Which rods are in compression and which are in tension?

	In compression	In tension
A	P	Q, R, S
B	P, Q	R, S
C	Q, R	P, S
D	R, S	P, Q

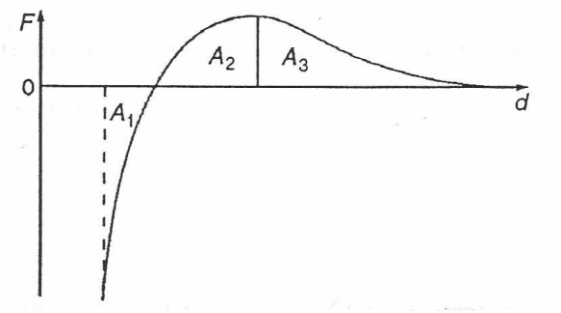
11 An astronaut of mass m in a spacecraft experiences a gravitational force $F = mg$ when stationary on the launch pad.
What is the gravitational force on the astronaut when the spacecraft is launched vertically upwards with an acceleration of 0.2 g?

A 1.2 mg **B** mg **C** 0.8 mg **D** 0

12 A car of mass 900 kg moves up a hill slope inclined at an angle of 10° to the horizontal. The dragging force experienced by the car is given by $F = 200 + 0.5\,v^2$, where v is the velocity of the car in m s^{-1} and F in N. If v is 30 m s^{-1}, the power required by the car is

A 20 kW
B 46 kW
C 65 kW
D 280 kW

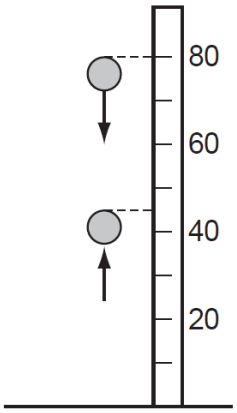
13 The graph shows how F, the attractive force, between two atoms, varies with d, their separation.



Which area represents the energy required to separate the atoms to infinity, assuming that they are originally at their equilibrium spacing?

A A_3
B $A_1 + A_2 + A_3$
C $A_2 + A_3 - A_1$
D $A_2 + A_3$

14 A solid rubber ball has a diameter of 8.0 cm. It is released from rest with the top of the ball 80 cm above a horizontal surface. It falls vertically and then bounces up so that the maximum height reached by the top of the ball is 45 cm, as shown.



If the kinetic energy of the ball is 0.75 J just before it strikes the surface, what is its kinetic energy just after it leaves the surface?

A 0.36 J **B** 0.39 J **C** 0.40 J **D** 0.42 J

15 A point source of sound emits energy equally in all directions at a constant rate. A person 8 m from the source listens to the sound. After a short while, the power of the source is halved.

How far should the person now be from the source if he wishes to hear the sound with the same loudness as before?

A $2\sqrt{2}$ m **B** 4 m **C** $4\sqrt{2}$ m **D** $8\sqrt{2}$ m

16 Which statement describes a situation when polarisation will not occur?

A Light waves pass through a pair of sunglasses.

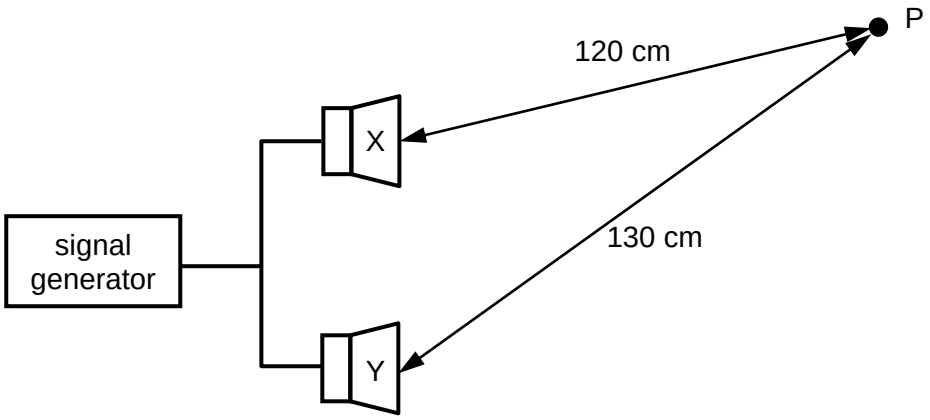
B Light waves pass through a liquid crystal display.

C Microwaves pass through a metal grid.

D Sound waves pass through a metal grid.

17 The output from a single signal generator is connected to two speakers, X and Y, so that the sound waves produced by each speaker are in phase.

The wavelength of the sound is 30 cm. P is a point near the speakers.

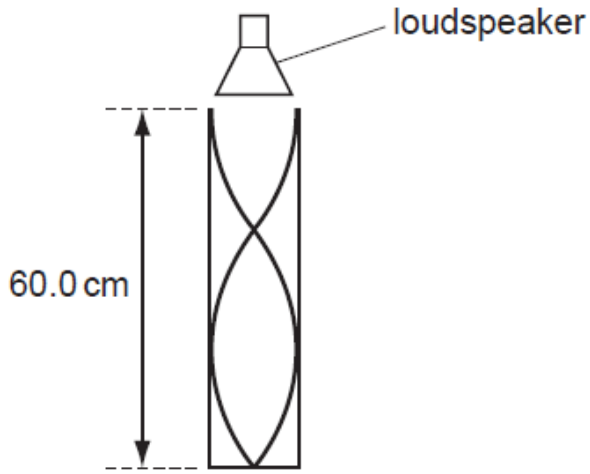


What is the phase difference between the waves arriving at P from X and Y?

A 0 radians **B** $\frac{\pi}{3}$ radians **C** $\frac{2\pi}{3}$ radians **D** π radians

18 The sound from a loudspeaker placed above a tube causes resonance of the air in the tube.

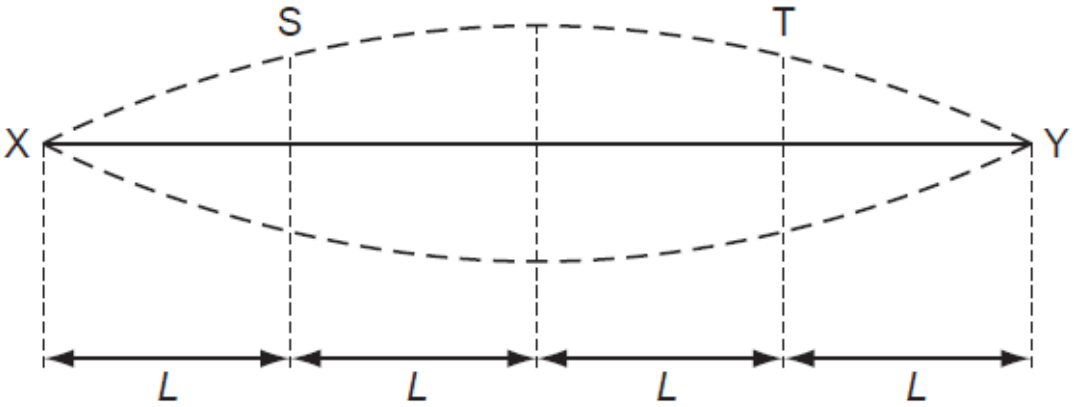
A stationary wave is formed with two nodes and two antinodes as shown.



The speed of sound in air is 330 m s^{-1}. What is the frequency of the sound?

A 413 Hz **B** 550 Hz **C** 830Hz **D** 1650 Hz

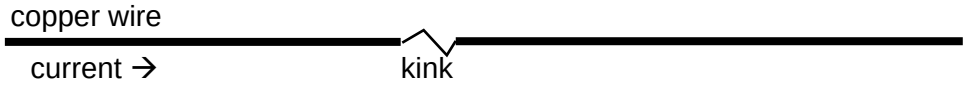
19 A uniform wire XY is fixed at its ends and vibrates transversely in its fundamental mode.



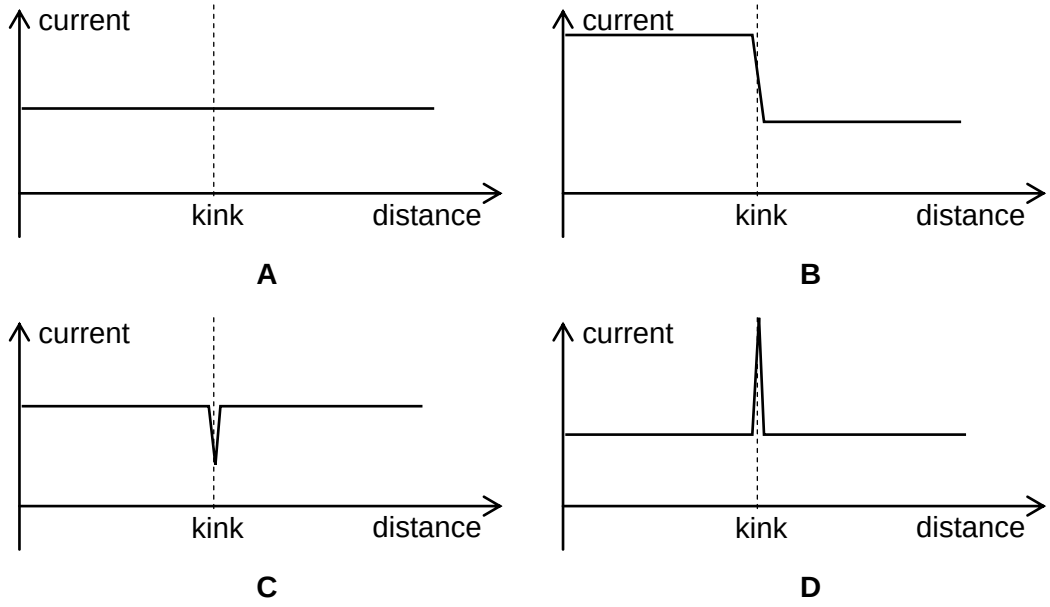
What is the phase difference between the displacement of a particle at S and that of a particle at T?

A 0^o **B** 45^o **C** 135^o **D** 180^o

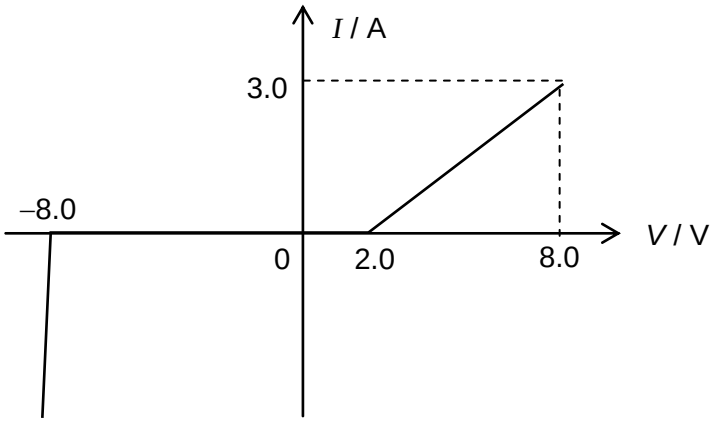
20 There is a kink in an otherwise uniform copper wire. The cross sectional area at the kink is much smaller than at the rest of the wire. The wire is carrying a current in the direction shown.



Which of the following graphs best describes the current along the length of the wire?



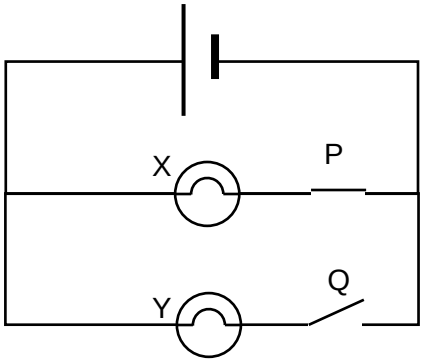
21 The graph below shows the *I*-*V* graph for a conductor X.



What are the values of resistance of X when a potential difference of 6.0 V is applied to it?

A zero, 2.0 Ω **B** zero, 3.0 Ω **C** ∞, 2.0 Ω **D** ∞, 3.0 Ω

22 The figure below shows a circuit containing a cell, an ideal voltmeter, two light bulbs X and Y, and two switches P and Q. Initially P is closed and Q is open.



When Q is closed, the brightness of X decreases. Which of the following is the reason for this observation?

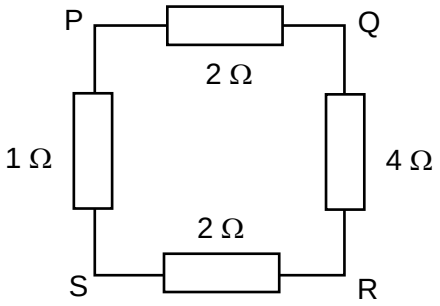
A Part of the current in X is diverted to Y.

B The cell has internal resistance.

C Resistance of X is greater than that of Y.

D Resistance of X is less than that of Y.

23 The figure below shows four resistors arranged in a loop.



How should a battery be connected to the resistors such that it delivers the greatest power?

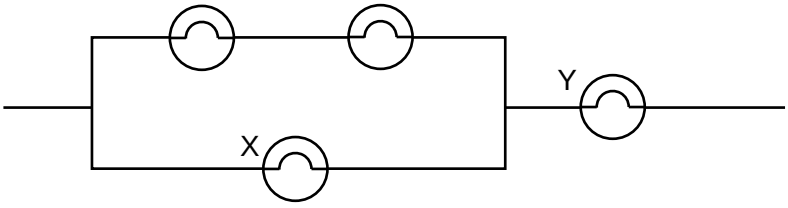
A Across P and S

B Across Q and R

C Across P and R

D Across S and R

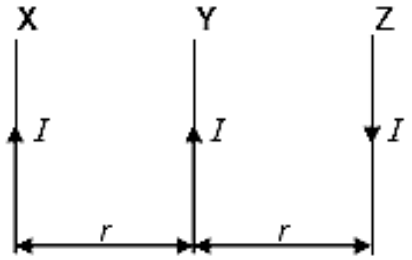
24 The figure below shows an arrangement of four identical lamps.



What is the ratio of $\frac{\text{Power dissipation by X}}{\text{Power dissipation by Y}}$?

A 1/9 **B** 4/9 **C** 1/2 **D** 2/3

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



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

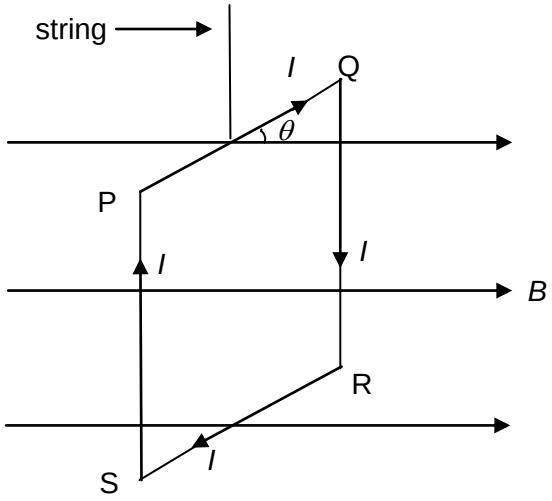
A zero

B along Y

C towards X

D towards Z

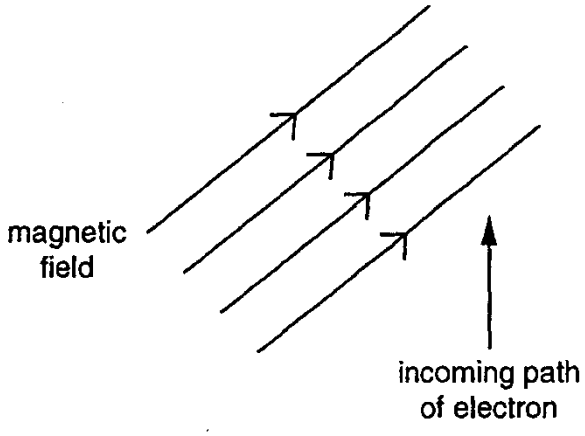
26 A rectangular coil PQRS is suspended from a string, with its plane vertical. The coil has *N* turns and carries a current I in a uniform horizontal magnetic field *B* which makes an angle θ with the plane of the coil as shown below.



If the area of the coil is A, the torque experienced by the coil is

A $NBAI\sin\theta$ **B** $NBAI\cos\theta$ **C** $\dfrac{NBAI}{\cos\theta}$ **D** $\dfrac{NBAI}{\sin\theta}$

27 The diagram shows an electron as it enters a magnetic field. The path of the electron and the magnetic field are in the plane of the paper.



In which direction is the electron initially deflected?

A into the plane of the paper
B out of the plane of the paper
C to the left of its incoming path
D to the right of its incoming path

28 Which two phenomena show appropriate experimental evidence for the wave nature, as well as for the particulate nature, of electromagnetic radiation?

	wave nature	particulate nature
A	photoelectric effect	diffraction
B	interference	photoelectric effect
C	interference	diffraction
D	diffraction	interference

29 Which of the following is a reasonable estimate of the energy of a photon of violet light?

A 4 eV **B** 6 eV **C** 3×10^{-19} J **D** 5×10^{-19} J

30 An electron has 1.7×10^{-17} J of kinetic energy. What is its de Broglie wavelength?

A 6.4×10^{-8} m **B** 1.2×10^{-10} m **C** 3.6×10^{9} m **D** 2.1×10^{13} m