

Candidate's name

CTG

YISHUN JUNIOR COLLEGE JC 2 Preliminary Examinations 2014

PHYSICS HIGHER 1

8866/1

Wednesday 27th August 2014

2.00 pm – 3.00 pm

1 hour

Paper 1 Multiple Choice

Additional Materials: Multiple Choice Answer Sheet



READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write your name and CTG in the spaces provided on this cover page and on the Answer Sheet.

Shade your NRIC number in the space provided on the Answer Sheet.

There are **thirty** questions in 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 Multiple Choice 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.

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 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	=	$\rho g h$
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 Systematic and random errors have different properties.

P_1 : Has constant sign and magnitude

P_2 : Has varying sign and magnitude

Q_1 : Can possibly be eliminated

Q_2 : Cannot possibly be eliminated

R_1 : Will be reduced by taking average of repeated measurements

R_2 : Will not be reduced by taking average of repeated measurements

Which of the above properties are applicable to random errors?

A P_1, Q_1, R_2

B P_1, Q_2, R_1

D P_2, Q_1, R_2

C P_2, Q_2, R_1

- 2 Which of the following pairs describe a vector and a scalar respectively?

A Energy and power

B Force and speed

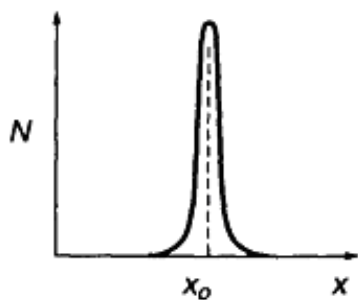
C Momentum and weight

D Mass and time

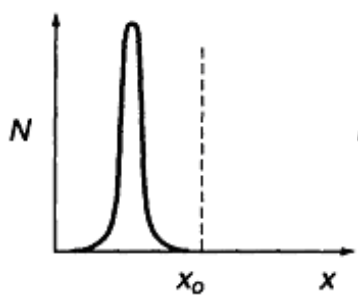
- 3 A quantity x is measured repeatedly and the number of measurements, N , giving a value x , is plotted against x . The true value of the quantity is x_0 .

Which of the following results could be described as accurate but not precise?

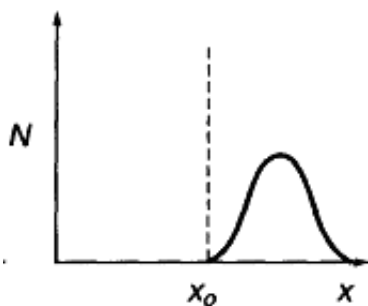
A



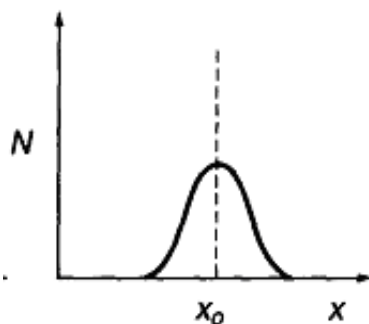
B



C



D

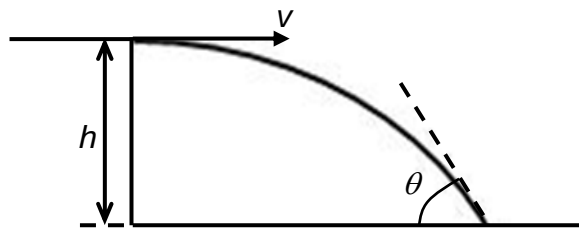


- 4 An object is projected with velocity 50 m s^{-1} at an angle of 60° to the horizontal. Air resistance is negligible.

What is the speed of the object after 1.0 s ?

- A 34 m s^{-1}
- B 42 m s^{-1}
- C 46 m s^{-1}
- D 59 m s^{-1}

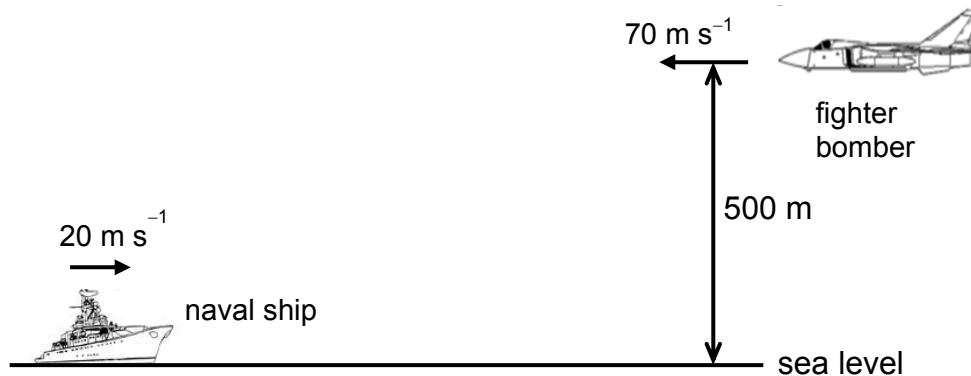
- 5 The diagram shows the path of a projectile fired with a horizontal velocity v from the top of a cliff of height h .



Which of the following values of v and h will give the greatest value of the angle θ ?

	$v / \text{m s}^{-1}$	h / m
A	10	20
B	10	80
C	30	10
D	50	10

- 6 A fighter bomber is travelling at 70 m s^{-1} horizontally at a height of 500 m above sea level. It is on a bombing run to its target, a naval ship which is moving at 20 m s^{-1} head on.



Assume negligible air resistance.

If the pilot wants to score a direct hit, he should release the bomb

- A when the plane is 200 m away from the naval ship.
 - B when the plane is 470 m away from the naval ship.
 - C when the plane is 710 m away from the naval ship.
 - D when the plane is 910 m away from the naval ship.
- 7 A man is parachuting at constant speed towards the surface of the Earth. The force which, according to Newton's third law, makes an action-reaction pair with the weight on the man is
- A the drag force acting on the man due to air resistance.
 - B the gravitational force on the Earth due to the man.
 - C the gravitational force on the man due to Earth.
 - D the tension in the harness of the parachute.
- 8 A trolley runs down a slope with a constant acceleration a . The mass of the trolley is now tripled and the trolley is allowed to run down the same slope. In both cases, effects of friction and air resistance are negligible.

Which statement is correct for the second experiment?

- A The accelerating force is the same.
- B The acceleration is $\frac{1}{3} a$.
- C The acceleration is a .
- D The acceleration is $3a$.

- 9 The diagrams below show two ways of hanging the same picture.

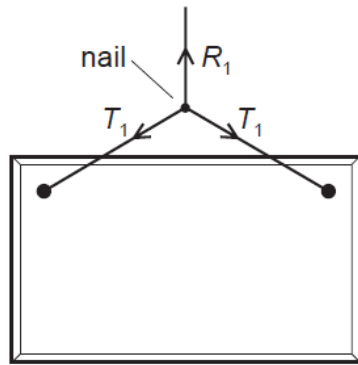


diagram 1

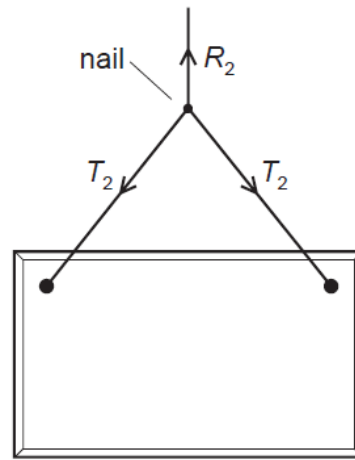


diagram 2

In both cases, a string is attached to the same points on the picture and looped symmetrically over a nail in a wall. The forces shown are those that act on the nail. In diagram 1, the string loop is shorter than in diagram 2.

Which information about the magnitude of the forces is correct?

- A $R_1 = R_2, T_1 = T_2$
- B $R_1 = R_2, T_1 > T_2$
- C $R_1 > R_2, T_1 > T_2$
- D $R_1 < R_2, T_1 = T_2$

For questions 10 and 11, please refer to Fig. 1

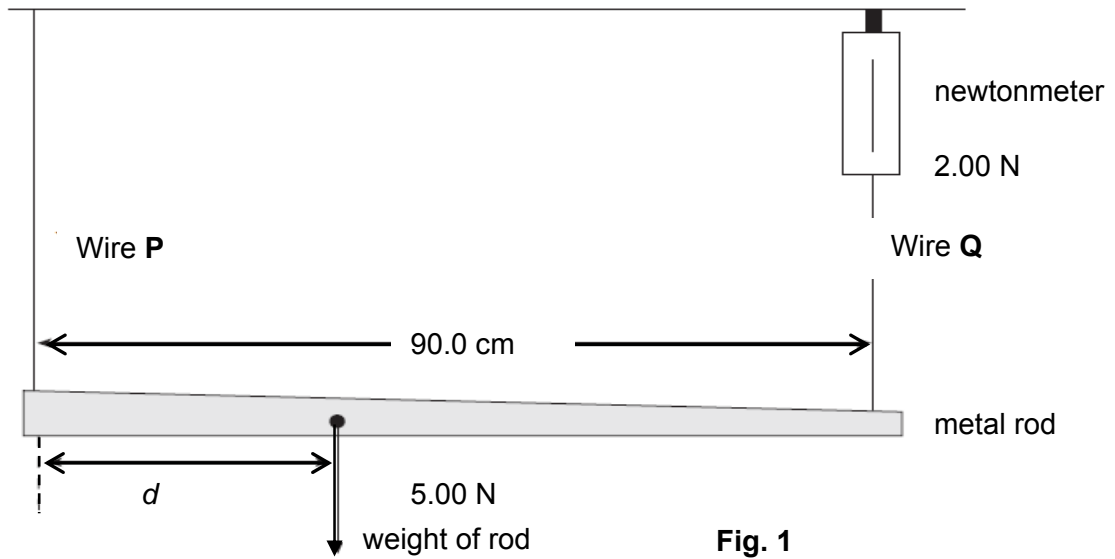


Fig. 1 shows an apparatus which is used to locate the centre of gravity of a non-uniform metal rod.

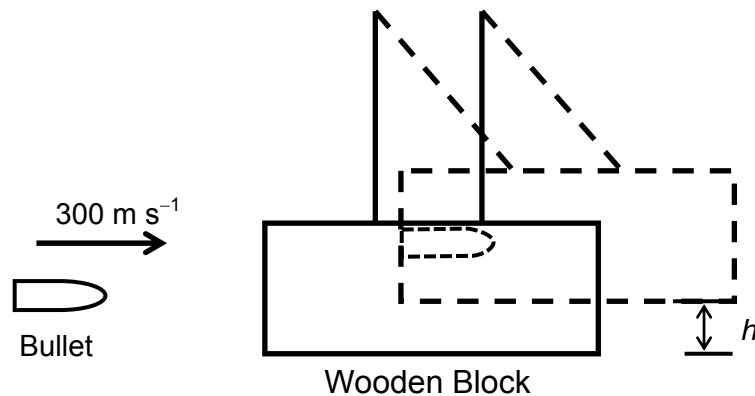
10 The moment of the weight of the rod about wire **P** is

- A** 0.45 N m anti clockwise
- B** 0.90 N m clockwise
- C** 1.8 N m anti clockwise
- D** 1.8 N m clockwise

11 The distance d is

- A** 36.0 cm
- B** 64.0 cm
- C** 40.0 cm
- D** 60.0 cm

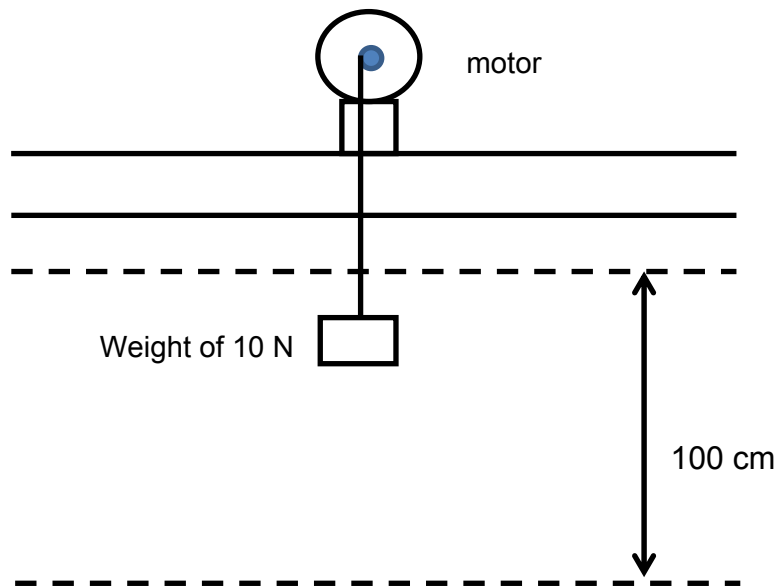
- 12** A bullet of mass 40.0 g is fired horizontally into a suspended wooden block of mass 2.00 kg with a velocity of 300 m s^{-1} . This is shown in the diagram below. The bullet gets embedded in the block and the bullet and block then move off as one.



What is the maximum height attained by the bullet and the block as it swing upwards?

- A** 1.76 m
- B** 23.3 m
- C** 40.1 m
- D** 89.9 m

- 13** A small electric motor is used to raise a weight of 10 N at constant speed through a vertical height of 100 cm in 5.0 s.

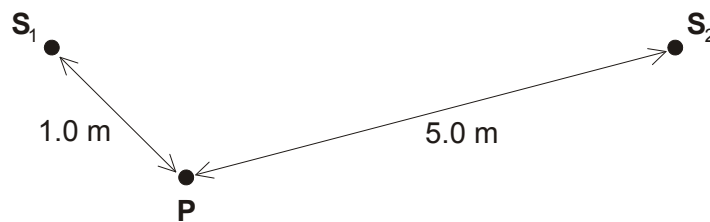


Given that the efficiency of the motor is 25 %, what is the electrical power supplied to the motor?

- A** 2.0 W
B 4.0 W
C 6.0 W
D 8.0 W
- 14** Two coherent waves, each of intensity $2 I$, meet in phase at a point. What is the resultant intensity at that point?
- A** $2 I$
B $4 I$
C $6 I$
D $8 I$
- 15** **P** and **Q** are points on a transverse wave of wavelength λ and sinusoidal in nature. The two points **P** and **Q** are $\frac{1}{2} \lambda$ apart and the waves are travelling from **P** to **Q**. Which one of the following correctly describes **Q** at an instant when **P** is displaced above equilibrium and moving upwards?

	<u>displacement of Q</u>	<u>movement of Q</u>
A	Below equilibrium	downwards
B	Below equilibrium	upwards
C	Above equilibrium	downwards
D	Above equilibrium	upwards

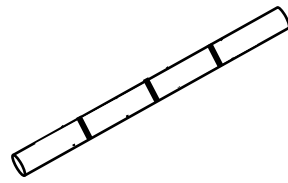
- 16 Stationary waves are set up on a length of rope fixed at both ends. Which of the following statements is true?
- A Between adjacent nodes, particles of the rope vibrate in phase with each other.
 - B The mid point of the rope is always stationary.
 - C Nodes need not necessarily be present at each end of the rope.
 - D Particles of the rope at adjacent antinodes always move in the same direction.
- 17 When a two-slit arrangement was set up to produce interference fringes on a screen using a monochromatic source of green light, the fringes were found to be too close together for convenient observation. Which of the following ways could help to increase the fringe separations?
- A Decrease the distance between the slits and the screen.
 - B Increase the separation between the slits.
 - C Increase the width of each slit.
 - D Replace the light source with a monochromatic red light.
- 18 Water waves of wavelength 0.5 m are produced by two sources S_1 and S_2 .



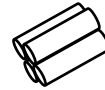
Point P is 1.0 m from S_1 and 5.0 m from S_2 . S_1 alone and S_2 alone each produces a wave of amplitude a and $3a$ at P respectively. Which of the following is the amplitude of the resultant wave at point P when S_1 and S_2 are operating together in anti-phase?

- A $4a$
 - B $2a$
 - C $1a$
 - D 0
- 19 A beam of beta particles constitutes a current of $10.0 \mu\text{A}$. Given that these beta particles travel at a speed of $2.5 \times 10^7 \text{ m s}^{-1}$, what is the average number of beta particles found in one centimetre length of this beam?
- A 2.5×10^4
 - B 4.0×10^4
 - C 2.5×10^6
 - D 4.0×10^6

- 20** A length of wire is cut into four parts and these parts are then wrapped together side by side to make a thicker wire.



original wire



new thicker wire

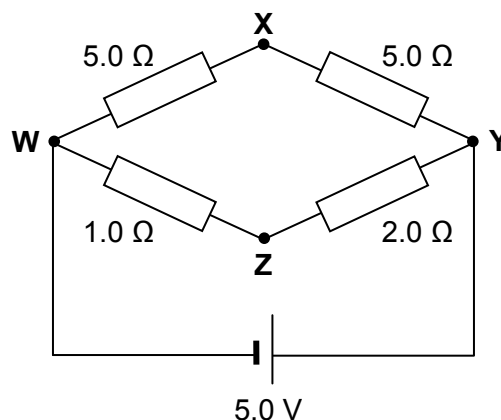
What is the ratio of the resistance of the original wire to this new thicker wire?

- A** 1:1
B 1:2
C 2:1
D 16:1
- 21** A mining machine has a maximum mechanical output power of 3.0 MW. A 20 kV voltage source supplies current to the machine through the transmission cables. The overall efficiency of the machine in converting electrical to mechanical power is 60 %.

What is the current in the transmission cables when the machine is operating at its maximum power?

- A** 90 A
B 100 A
C 250 A
D 270 A

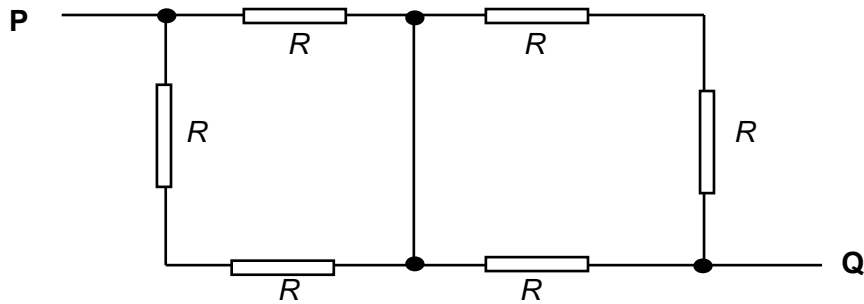
- 22** The circuit below represents a network of resistors.



The potential difference between **X** and **Z** is

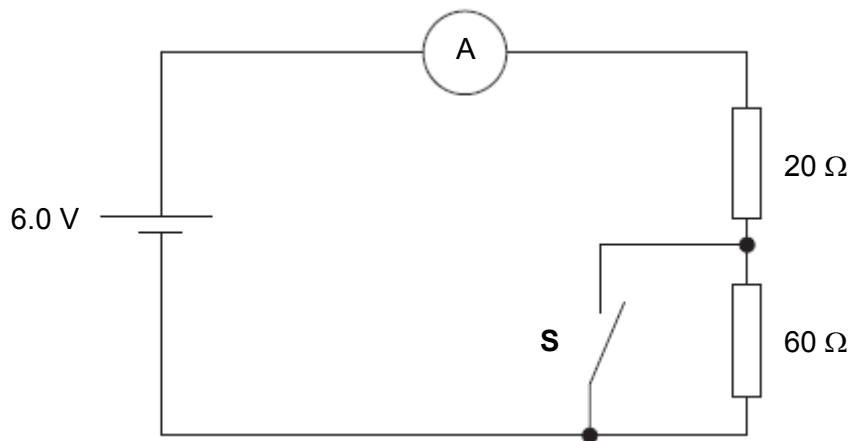
- A** 2.5 V **B** 2.0 V **C** 1.7 V **D** 0.83 V

- 23 In the circuit below, what is the effective resistance between **P** and **Q**?



- A $\frac{2}{3}R$
 B $1R$
 C $\frac{4}{3}R$
 D $\frac{1}{2}R$

- 24



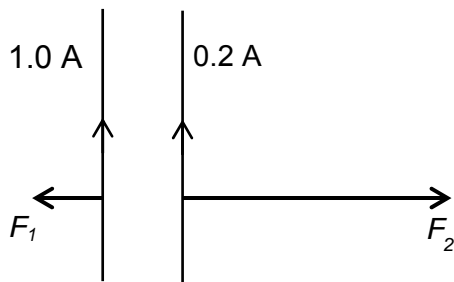
In the circuit shown above, the battery, of e.m.f. 6.0 V, has negligible internal resistance.

Which of the following shows the ammeter reading when the switch **S** is opened and closed?

	Switch is closed	Switch is opened
A	0.2 A	0.075 A
B	0.1 A	0.001 A
C	0.3 A	0.075 A
D	0.3 A	0.0010 A

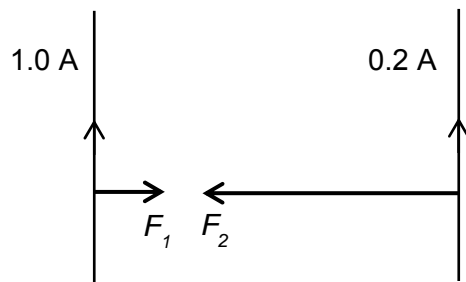
- 25 Two long straight parallel wires carry currents of 1.0 A and 0.2 A.

Which diagram shows the directions and relative magnitudes F_1 and F_2 of the forces on each of the wires?



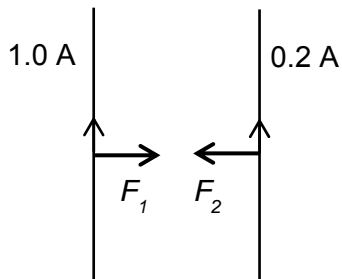
$$F_2 = 5 F_1$$

A



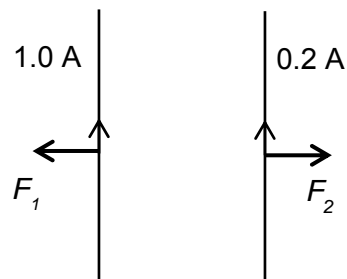
$$F_2 = 5 F_1$$

B



$$F_2 = F_1$$

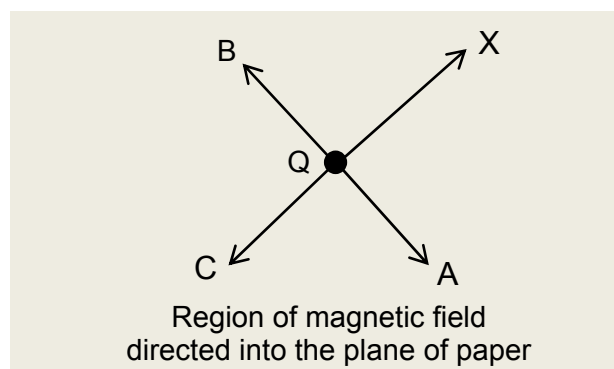
C



$$F_2 = F_1$$

D

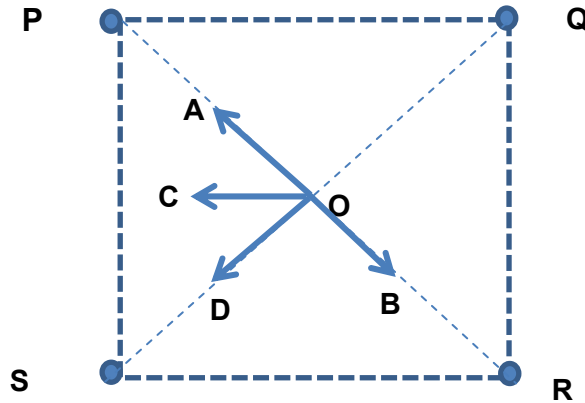
- 26 A negatively charged particle Q is moving in a magnetic field in the direction **X** as shown. In which direction is the force experienced by the particle?



- A** **A**
B **B**
C **C**
D no force exerted

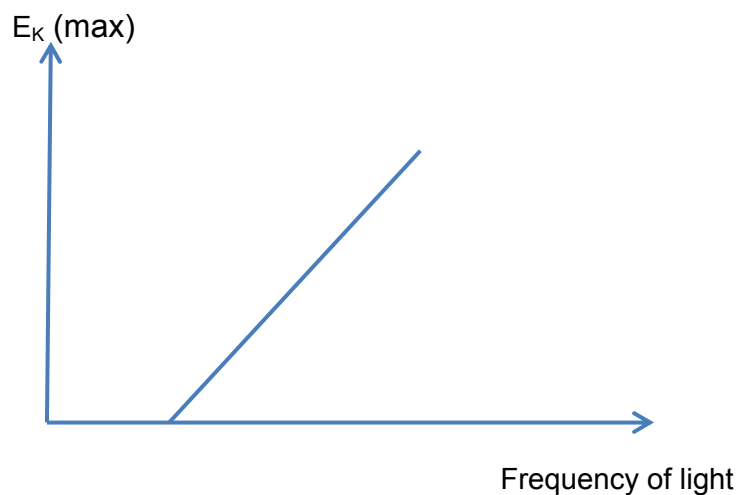
- 27 The figure below shows four long straight current carrying wires **P**, **Q**, **R** and **S** which are perpendicular to the plane of the paper placed at the four corners of a square. Point **O** is the point of intersection of the diagonals of the square. The currents in all the four wires have the same magnitude. The currents in wires **P**, **Q** and **R** flow out of the plane of the paper while that in **S** flows into the plane of the paper.

Which arrow shows the direction of the resultant magnetic field at **O**?



- 28 In an experiment on photoelectric effect, monochromatic light is directed onto the surface of a metal plate and the kinetic energy of the fastest moving photoelectrons, $E_K(\text{max})$ is measured against the frequency of incident light.

The graph describing this relationship is shown below.



Which of the following statements about the experiment is correct?

- A** The intercept on the frequency axis would change when a different metal is used.
- B** The larger the intercept on the frequency axis, the smaller is the workfunction of the metal used.
- C** The gradient of the graph would become steeper when the intensity of the light increases.
- D** The gradient of the graph would change when a different metal is used.

- 29** When a parallel beam of white light passes through a cool vapour, dark lines appear in the spectrum of the emergent light. This is because energy is absorbed and
- A** re-radiated subsequently in all random directions.
 - B** re-radiated as invisible infra-red.
 - C** re-radiated uniformly in all directions as white light.
 - D** re-radiated as high energy X-ray photons.
- 30** What is the estimate of the de Broglie wavelength of a bullet which is moving at a speed of 330 m s^{-1} ?
- A** $1.5 \times 10^{-29} \text{ m}$
 - B** $1.5 \times 10^{-32} \text{ m}$
 - C** $1.3 \times 10^{-34} \text{ m}$
 - D** $1.3 \times 10^{-37} \text{ m}$

– End of Paper –