



HWA CHONG INSTITUTION
JC2 Preliminary Exam
Higher 1

**CANDIDATE
NAME**

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CT GROUP

14S

**CENTRE
NUMBER**

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**INDEX
NUMBER**

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PHYSICS

8866/01

Paper 1 Multiple Choice

17 September 2015

1 h

Additional Materials: Optical Mark Sheet

Write in soft pencil.

Write your name, CT, NRIC or FIN number on the optical mark sheet (OMS). Shade your NRIC or FIN in the spaces provided.

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 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

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 $p = \rho gh$

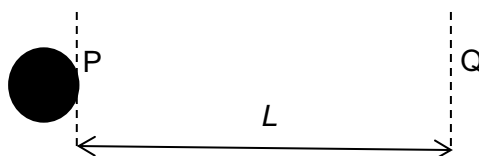
resistors in series, $R = R_1 + R_2 + \dots$

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

- 1 The power output of a solar panel is dependent on the *intensity* of sunlight on its surface. What is the unit of intensity, expressed in SI base units?

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

- 2 The momentum p of a rubber ball of mass m , as it rolls across a table surface at constant speed is given by the equation $p = \frac{mL}{t_2 - t_1}$, where
 t_1 is the time at which the front end of the ball passes point P,
 t_2 is the time at which the front end of the ball passes point Q.



Data from an experiment to determine p is recorded as follows:

$$m = (52.000 \pm 0.001) \text{ g}$$

$$L = (10.0 \pm 0.1) \text{ cm}$$

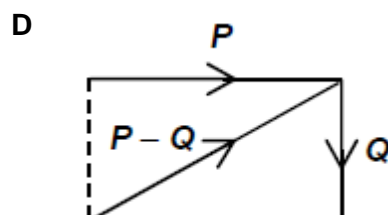
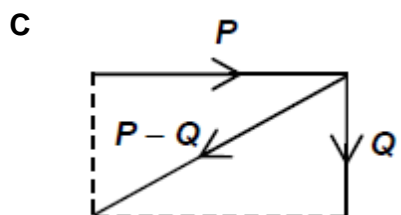
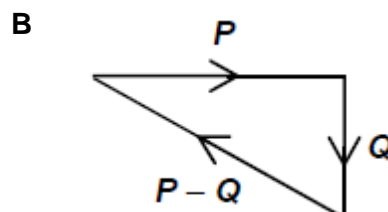
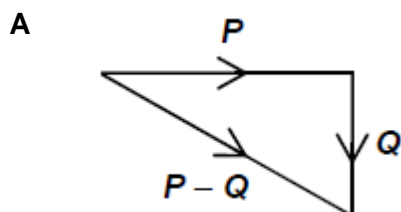
$$t_1 = (0.00 \pm 0.01) \text{ s}$$

$$t_2 = (0.63 \pm 0.01) \text{ s}$$

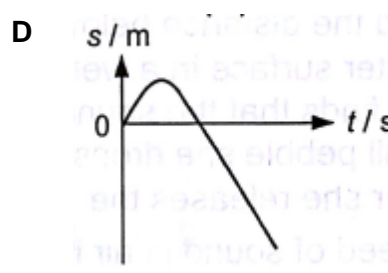
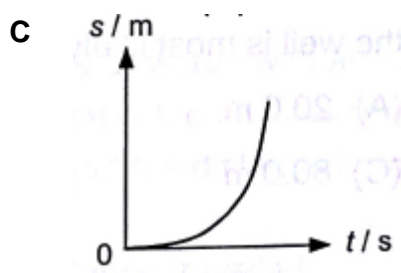
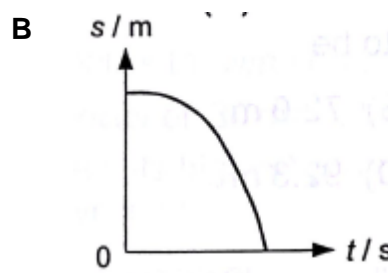
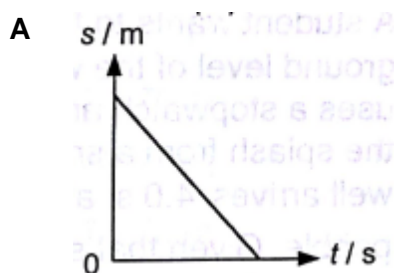
The momentum of the rubber ball should be recorded as

A $(830 \pm 20) \text{ g cm s}^{-1}$
 B $(830 \pm 30) \text{ g cm s}^{-1}$
 C $(830 \pm 28) \text{ g cm s}^{-1}$
 D $(830 \pm 35) \text{ g cm s}^{-1}$

3 Which vector triangle shows the resultant $P - Q$?



4 A sandbag is released from a hot air balloon when it is 10 m above the ground and ascending at a velocity of 4.0 m s^{-1} . Which of the following graphs best shows how its displacement will vary with time?



5 A projectile leaves the ground at an angle of 60° to the horizontal. Its initial kinetic energy is E . Neglecting air resistance, its kinetic energy at the highest point of the motion is

A $E/4$

B $E/2$

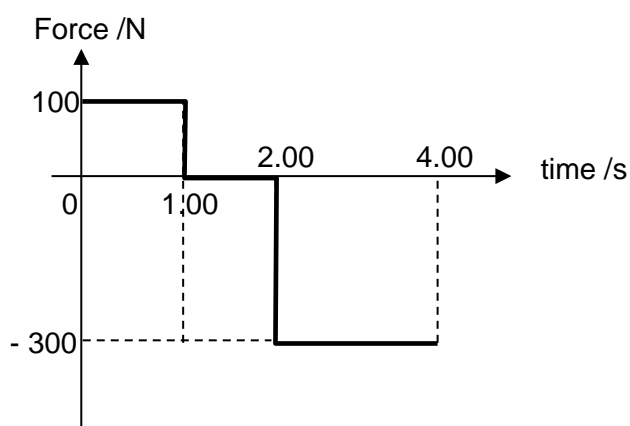
C E

D zero

- 6 An object is released from rest. Which of the following describes its velocity and acceleration before it reaches terminal velocity?

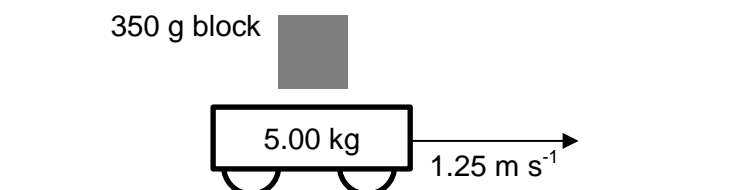
	velocity	acceleration
A	Increasing	constant
B	Increasing	decreasing
C	decreasing	constant
D	decreasing	decreasing

- 7 An object, initially moving with a velocity 92.0 m s^{-1} , experiences a force which varies with time as shown below.



If the object has a mass of 8.50 kg , what is the final velocity of the object after 4.00 s ?

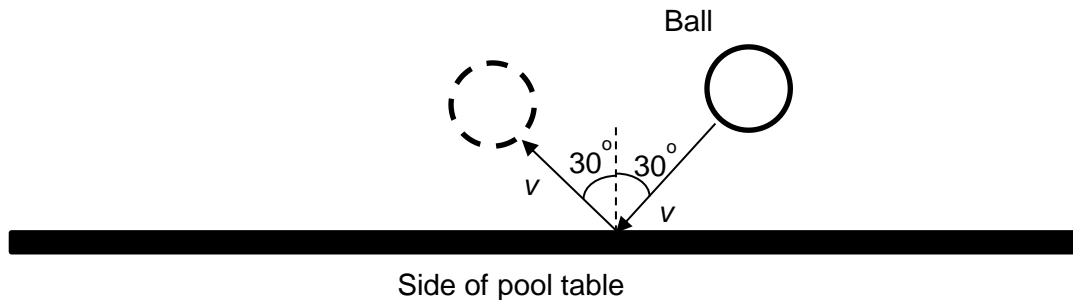
- A** 174 m s^{-1} **B** 163 m s^{-1} **C** 33.2 m s^{-1} **D** -151 m s^{-1}
- 8 The diagram shows a trolley moving on a smooth horizontal table at a speed of 1.25 m s^{-1} . A block with mass 350 g is then dropped vertically onto the trolley and remains on it.



After the block is dropped onto the trolley, what is the speed of the trolley?

- A** 1.25 m s^{-1} **B** 1.17 m s^{-1} **C** 0.856 m s^{-1} **D** 0.0875 m s^{-1}

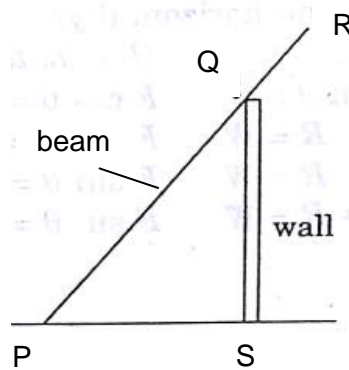
- 9 A snooker ball of mass m travels at a speed v towards the side of a snooker table as shown below. The ball strikes the side of the table at an angle of 30° to the normal and moves off with the same speed at an angle of 30° . The time of contact between the ball and the side is Δt . What is the expression for the average force acting on the ball?



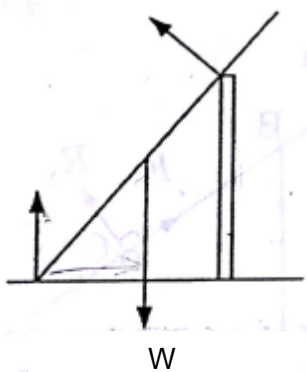
TOP VIEW

- A $\frac{mv}{\Delta t}$
- B $\frac{mv \cos 30^\circ}{\Delta t}$
- C $\frac{2mv \cos 30^\circ}{\Delta t}$
- D $\frac{2mv \sin 30^\circ}{\Delta t}$
- 10 A 2.0 kg cart moving due east at 6.0 m s^{-1} collides with a 3.0 kg cart moving due west. The cart stick together and come to rest after the collision. What was the initial speed of the 3.0 kg cart?
- A 6.0 m s^{-1} B 4.0 m s^{-1} C 2.4 m s^{-1} D 1.0 m s^{-1}

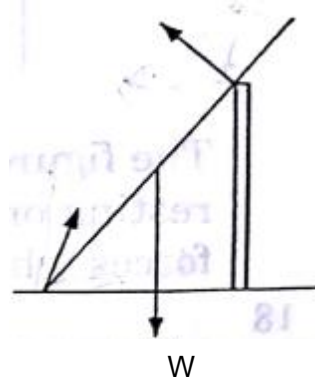
- 11 A uniform beam rests against a wall at a point Q. The end P of the beam is on rough ground. The contact at Q is smooth, and the beam is just about to slip. What are the possible forces acting on the beam?



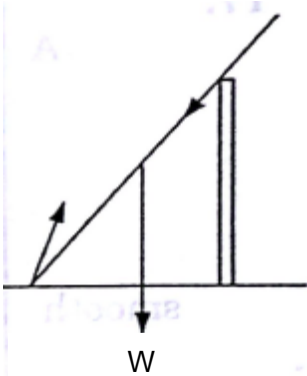
A



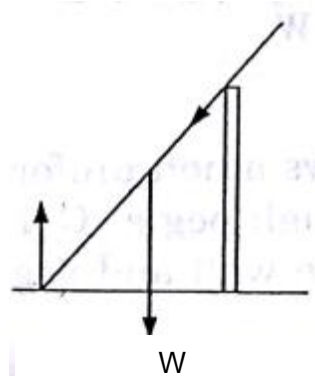
B



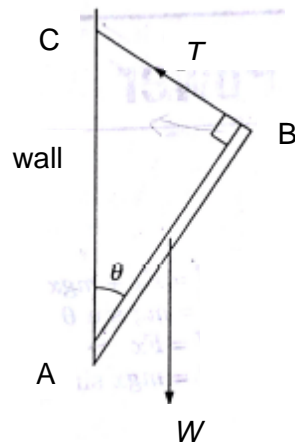
C



D

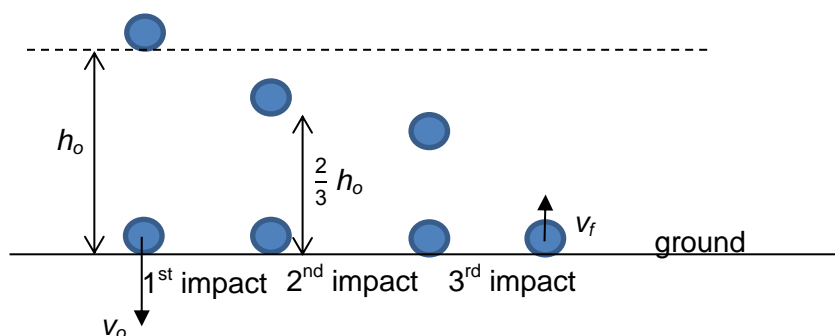


- 12 A uniform rod AB of length x is hinged at A and attached at B to a point on a wall such that angle ABC is 90° . The rod makes an angle θ with the wall. Which of the following equations is correct?

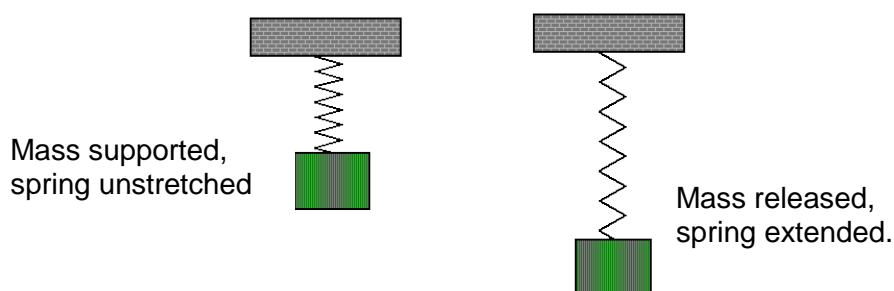


- A $T \cos \theta = W$
- B $T \sin \theta = W$
- C $2W \sin \theta = W$
- D $W \sin \theta = 2T$

- 13 A ball is dropped from a height h_o above the ground. After the first impact with the ground, the ball loses a fraction of its energy and rebounds to a maximum height of $\frac{2}{3} h_o$. Assuming that the fraction of energy lost during each impact is the same, determine the ratio of $\frac{v_f}{v_o}$ where v_f is the speed of the ball immediately after the 3rd impact and v_o is the speed of the ball just before the 1st impact.



- A $\left(\frac{2}{3}\right)^{\frac{1}{2}}$
- B $\left(\frac{2}{3}\right)^{\frac{2}{3}}$
- C $\left(\frac{2}{3}\right)^{\frac{3}{2}}$
- D $\left(\frac{2}{3}\right)^3$
- 14 A mass, m is attached to a spring of spring constant, k . The mass is supported so that the spring is unstretched.

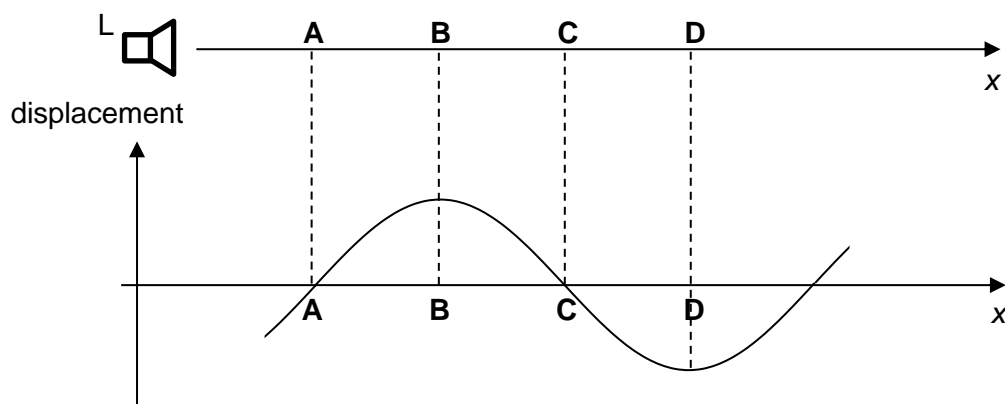


If the support is removed and the mass is released, the maximum extension of the spring will be given by

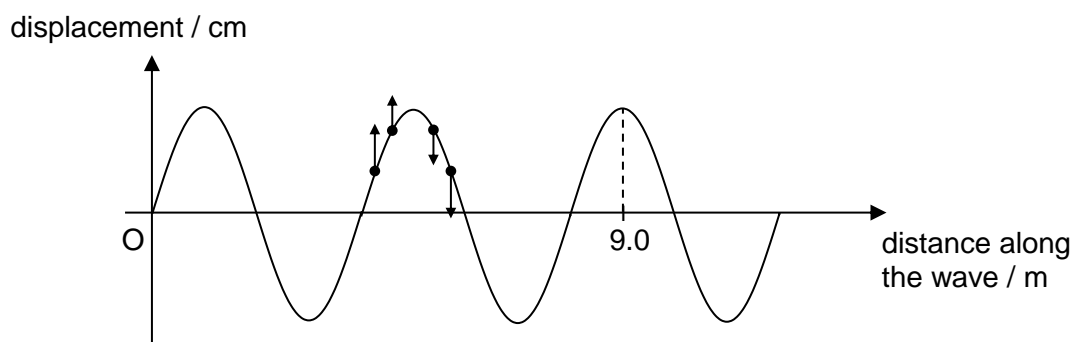
- A $\frac{mg}{k}$
- B $\frac{mg}{2k}$
- C $\frac{2mg}{k}$
- D $\frac{m}{k}$

- 15 The engine of a train travelling at 40 m s^{-1} , delivers a power of 2.0 MW. What is the tractive force exerted by the engine?
- A 5.0 kN B 8.0 kN C 50.0 kN D 80.0 kN
- 16 A lorry of mass 2000 kg has an engine which can deliver a maximum power of 50 kW. What is the minimum time in which the lorry can be accelerated from rest to a speed of 100 km h^{-1} on level ground?
- A 11.3 s
B 15.4 s
C 30.9 s
D 200 s
- 17 The least distance between two points of a progressive transverse wave with a phase difference of $\frac{\pi}{6}$ is 0.040 m. If the frequency of the wave is 500 Hz, what is the speed of the wave?
- A 6.6 m s^{-1} B 60 m s^{-1} C 120 m s^{-1} D 240 m s^{-1}

- 18 The figure shows a loudspeaker, L which emits a sound of constant frequency. The graph shows the displacements of the air particles from their undisturbed positions at one instant in time along x . Direction to the right is taken as positive. At which of the four points A, B, C, D is the instantaneous pressure at its minimum value?

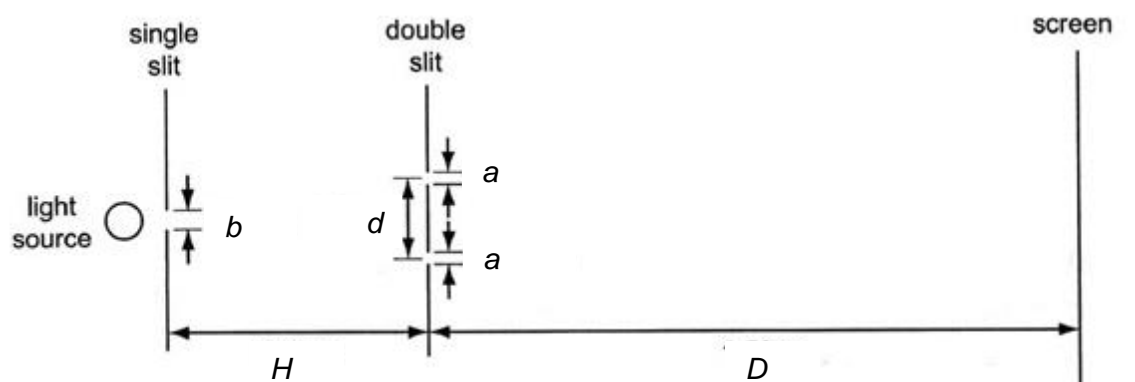


- 19 The diagram below shows the wave profile of a progressive wave at a particular time. The arrows show the directions in which some of the particles on the wave are moving at that instant. Which one of the following statements about the wave may not be correct?



- A Two particles exactly 8.0 m apart on the wave will be in phase.
- B Energy is being transported by the wave from the right to the left.
- C The frequency of the wave is 0.25 Hz.
- D All the particles on the wave have the same amplitude.

- 20 A student sets up an experiment to demonstrate double slit interference. The main features of the apparatus, and some of the dimensions, are shown below.



Which of the following changes will decrease the separation of the fringes on the screen?

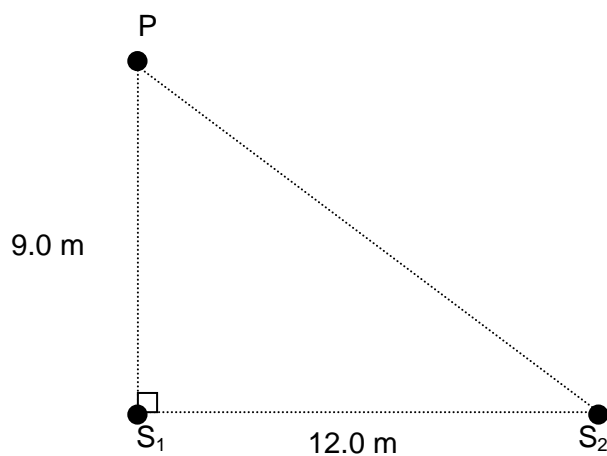
- A Increase the distance, D .
 - B Decrease the size, a of each slit.
 - C Decrease the distance, H between the single slit and double slit.
 - D Increase the slit separation, d .
- 21 Identical sound sources are placed near the open end of pipe P and one of the open ends of pipe Q. The sources produce sound with a wavelength of 32 cm.



Assuming there are no end corrections, stationary waves are formed in

- A P and Q
- B P only
- C Q only
- D Neither P nor Q

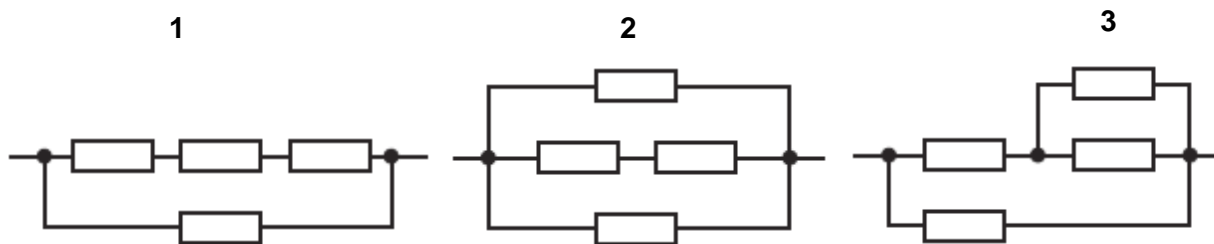
- 22 S_1 and S_2 are two generators which produce waves of wavelength 2.0 m. Operating alone, S_1 produces waves of intensity I at P while S_2 produces waves of intensity $4 I$.



When both of the generators are operating in phase, the resultant intensity of the waves at P is

- A 0
- B $3 I$
- C $5 I$
- D $9 I$

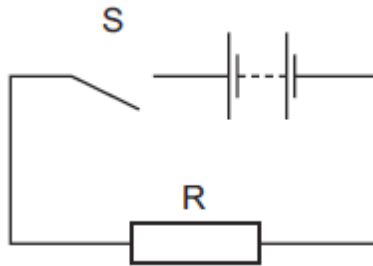
23 Four identical resistors are connected in the three networks below.



Which of the networks has the highest total resistance and which has the lowest?

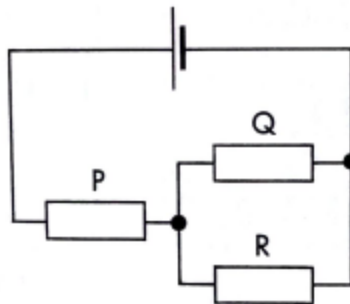
	highest	lowest
A	1	2
B	1	3
C	2	1
D	2	3

- 24 Consider the simple circuit below.



Which statement is correct?

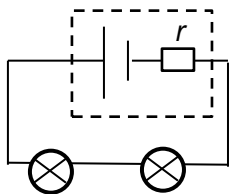
- A When switch S is closed, the potential difference across the battery falls because of work done per unit charge to move charges through the resistance R.
 - B When switch S is closed, the potential difference across the battery falls because of work done per unit charge to move charges through the internal resistance of the battery.
 - C When switch S is closed, the electromotive force (e.m.f.) of the battery falls because of work done per unit charge to move charges through the resistance R.
 - D When switch S is closed, the e.m.f. of the battery falls because of work done per unit charge to move charges through the internal resistance of the battery.
- 25 In the circuit shown below, P, Q and R are identical resistors.



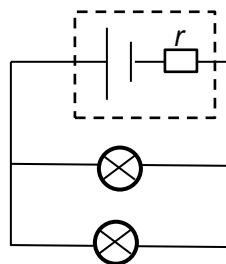
The ratio $\frac{\text{rate of production of heat in Q}}{\text{rate of production of heat in P}}$ is

- A 0.25
- B 0.5
- C 2
- D 4

- 26** A battery with internal resistance r is connected to two identical light bulbs each of resistance R . Which of the following expressions gives the efficiency η of each of the circuit?



Circuit 1



Circuit 2

Circuit 1

A $\eta = \frac{R}{R+2r} \times 100\%$

B $\eta = \frac{2R}{2R+r} \times 100\%$

C $\eta = \frac{2R}{2R+r} \times 100\%$

D $\eta = \frac{R}{R+2r} \times 100\%$

Circuit 2

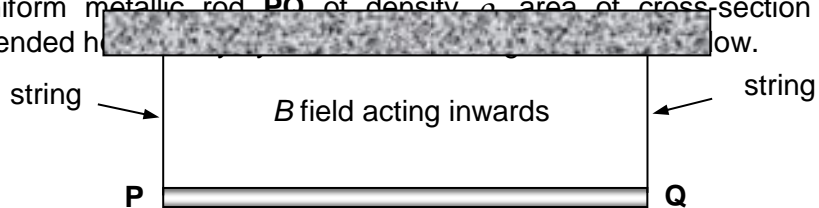
$\eta = \frac{R+2r}{R} \times 100\%$

$\eta = \frac{R}{2R+2r} \times 100\%$

$\eta = \frac{R}{R+2r} \times 100\%$

$\eta = \frac{2R}{2R+r} \times 100\%$

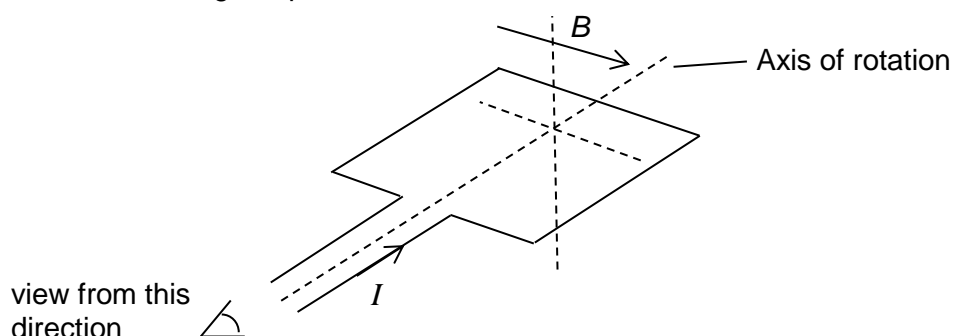
- 27 A uniform metallic rod **PQ** of density ρ , area of cross-section A and length l , is suspended horizontally by two strings as shown.



A uniform magnetic field B is directed into the plane of this page and perpendicular to the length of the rod. When a certain magnitude of current I is passed along the rod, the tensions of the supporting strings reduce to zero. What is the magnitude and direction of the current in **PQ** ?

	<i>Magnitude</i>	<i>Direction</i>
A	$\frac{B}{\rho Ag}$	Q to P
B	$\frac{B}{\rho Ag}$	P to Q
C	$\frac{\rho Ag}{B}$	Q to P
D	$\frac{\rho Ag}{B}$	P to Q

- 28** In an electric motor, current I passes through a rectangular coil of wire which is in a region of uniform magnetic field, B . Which of the following describes the rotation of the coil (viewed from the front along the axis of rotation as shown in the figure) from the position shown through a quarter-rotation?



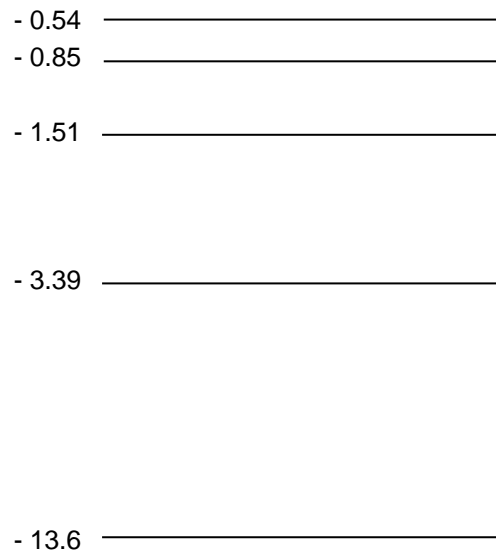
	Direction of rotation of coil	Torque on coil
A	The coil rotates clockwise	decreases
B	The coil rotates clockwise	constant
C	The coil rotates anticlockwise	decreases
D	The coil rotates anticlockwise	constant

- 29** When a metal is illuminated with light of frequency f , the maximum kinetic energy of the photoelectrons is 1.300 eV. When the frequency is increased by 50%, the stopping potential increases to 3.600 eV. What is the threshold frequency of this metal?

- A** 3.143×10^{14} Hz
- B** 7.964×10^{14} Hz
- C** 8.705×10^{14} Hz
- D** 1.112×10^{14} Hz

- 30 The figure below shows the energy levels of a hydrogen atom.

Energy / eV



What is the number of spectral emission lines that might be produced by transitions among these levels if photons of energy 12.6 eV are incident on the hydrogen atom in its ground state?

- A** 0 **B** 2 **C** 3 **D** 10

~~~ *End of Paper* ~~~