DUNMAN HIGH SCHOOL
Preliminary Examinations
Year 6
Higher 1

CANDIDATE NAME

CLASS

INDEX NUMBER

PHYSICS

8866/01

Paper 1 Multiple Choice

September 2016

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

DO **NOT** WRITE IN 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 ducted 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 **15** printed pages and **1** blank page.

[Turn over

Data

speed of light in free space,	c	=	3.00×10^{8} m s^{-1}
elementary charge,	e	=	1.60×10^{-19} C
the Planck constant,	h	=	6.63×10^{-34} J s
unified atomic mass constant,	u	=	1.66×10^{-27} kg
rest mass of electron,	m_e	=	9.11×10^{-31} kg
rest mass of proton,	m_p	=	1.67×10^{-27} kg
acceleration of free fall,	g	=	9.81 m s^{-2}

Formulae

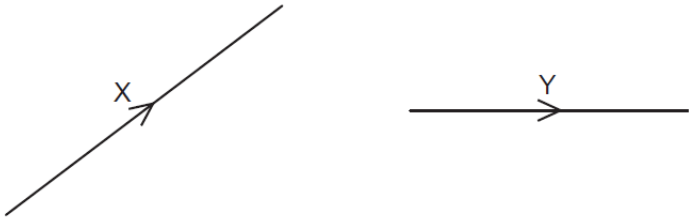
uniformly accelerated motion,	$s = ut + \frac{1}{2}at^2$
	$v^2 = u^2 + 2as$
work done on/by a gas,	$W = p\,\Delta V$
hydrostatic pressure,	$p = \rho gh$
resistors in series,	$R = R_1 + R_2 + \ldots$
resistors in parallel,	$1/R = 1/R_1 + 1/R_2 + \ldots$

1 In thermal physics, the rate of flow of thermal energy, $\frac{d\theta}{dt}$ can be found using the equation $\frac{d\theta}{dt} = kA\frac{(T_2 - T_1)}{L}$. k is defined as the thermal conductivity of material, A is the total cross sectional area of conducting surface of material and T_2 and T_1 are the temperatures across the conducting surface of thickness L.

Deduce the SI base unit for thermal conductivity.

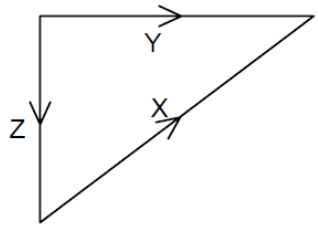
A kg m s^{-3} K^{-1} **B** kg m^{-2} K^{-1} **C** W m^{-1} K^{-1} **D** J m^{-2} K^{-1}

2 The diagram shows two vectors X and Y.

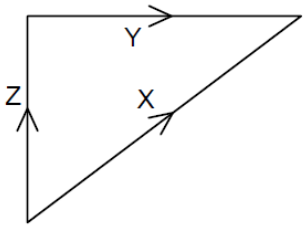


In which vector triangle does the vector Z show the magnitude and direction of vector X – Y?

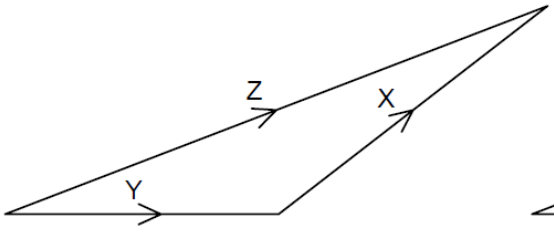
A



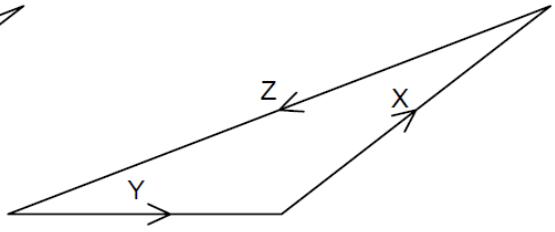
B



C



D

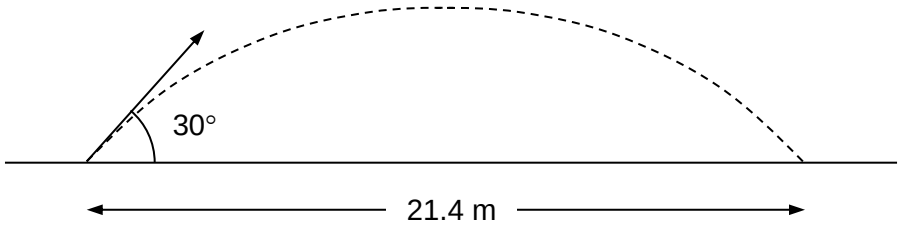


3 The period of oscillation of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$. Given that the length of the pendulum, l is (20.0 ± 0.1) cm, Mark measured the period, T to be (0.89 ± 0.02) s.

What is the best way Mark should express the calculated value of acceleration due to gravity, g in m s^{-2}?

A 9.97 ± 0.50 **B** 9.9 ± 0.5 **C** 10.0 ± 0.5 **D** 10 ± 1

4 A ball is projected at an angle of 30° above the horizontal and travels a horizontal distance of 21.4 m.



Determine the new horizontal distance travelled by the ball if it is now projected at the same initial speed but at an angle of 45° above the horizontal. Assume that air resistance is negligible.

A 24.7 m **B** 26.2 m **C** 30.3 m **D** 37.1 m

5 An object is projected vertically upwards in an evacuated column. It takes time t to reach the highest point of its motion, and it takes a further time t to fall back to its initial position.

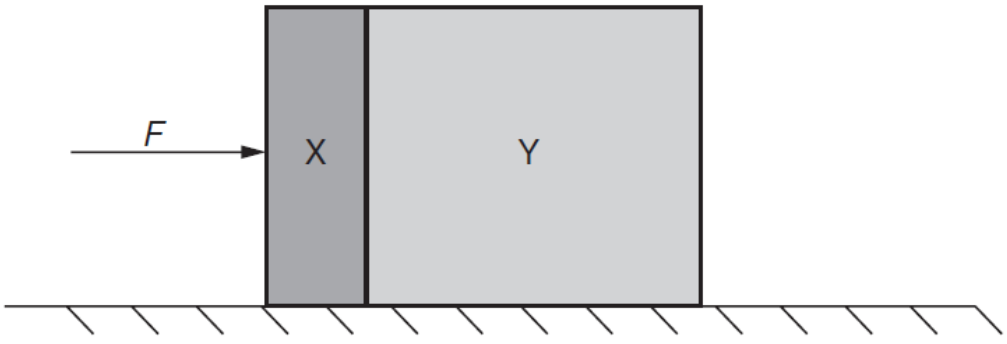
The column is then filled with a dense gas so that air resistance acting on the object cannot be ignored. The object is again projected vertically upwards with the same initial speed. It now takes time t_1 to reach the highest point of its motion, and a further time t_2 to fall back to its initial position.

Which of the following options is correct?

A $t_1 = t_2$ and $t_1 < t$ **B** $t_1 < t_2$ and $t_1 = t$

C $t_1 < t_2$ and $t_1 < t$ **D** $t_1 = t_2$ and $t_1 = t$

6 Two blocks X and Y, of masses m and $3m$ respectively, are accelerated along a smooth horizontal surface by a force F applied to block X as shown.



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

A $F/4$ **B** $F/3$ **C** $F/2$ **D** $3F/4$

7 A lift is moving upwards and slowing down. A man of weight W is in the lift and he experiences a normal force N from the lift.

Which of the following relationships is correct?

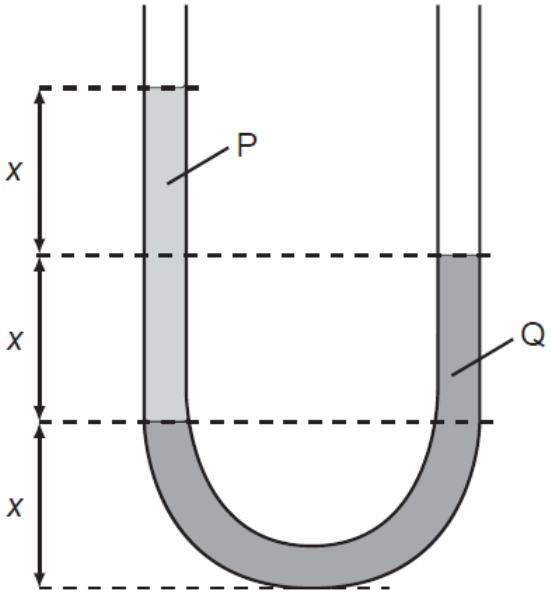
A $N = 2W$ **B** $2W > N > W$ **C** $N = W$ **D** $N < W$

8 A ball A of mass M is moving towards the right with speed $\frac{1}{2}V$. A ball B of mass $2M$ is moving towards the left with speed $\frac{1}{3}V$. Both balls are involved in a head-on elastic collision.

Calculate the final velocities of the two balls.

	Velocity of ball A	Velocity of ball B
A	$\frac{5}{6}V$ towards the left	$\frac{1}{3}V$ towards the right
B	$\frac{5}{18}V$ towards the right	$\frac{4}{9}V$ towards the left
C	$\frac{5}{18}V$ towards the left	$\frac{1}{9}V$ towards the right
D	$\frac{11}{18}V$ towards the left	$\frac{2}{9}V$ towards the right

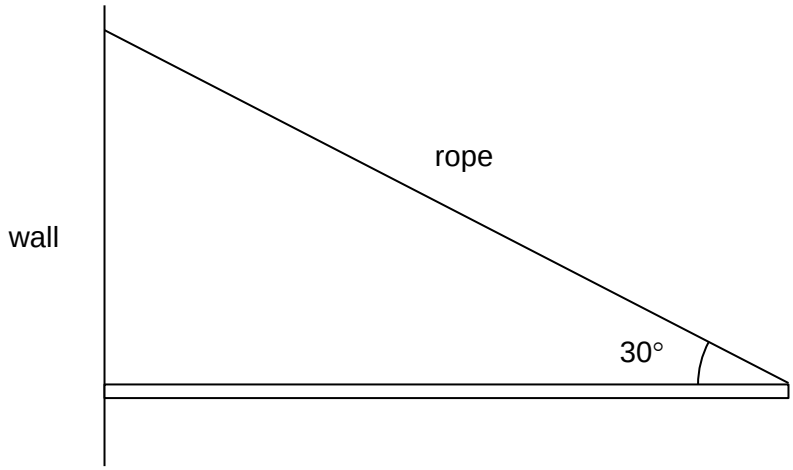
9 The diagram shows two liquids, labelled P and Q, which do **not** mix. The liquids are in equilibrium in an open U-tube.



What is the ratio $\frac{\text{density of P}}{\text{density of Q}}$?

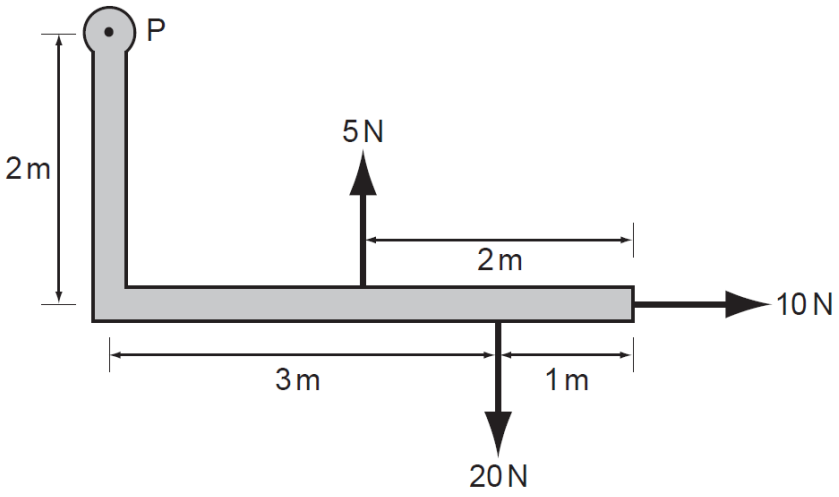
A 1/2 **B** 2/3 **C** 3/2 **D** 2

10 One end of a uniform pole is attached to a hinge on a wall. The other end of the pole is attached to a rope. Given that the pole has a mass of 12.5 kg, determine the magnitude of the force that the hinge exerts on the pole.



A 70.8 N **B** 123 N **C** 142 N **D** 173 N

11 An L-shaped rigid lever arm is pivoted at point P.

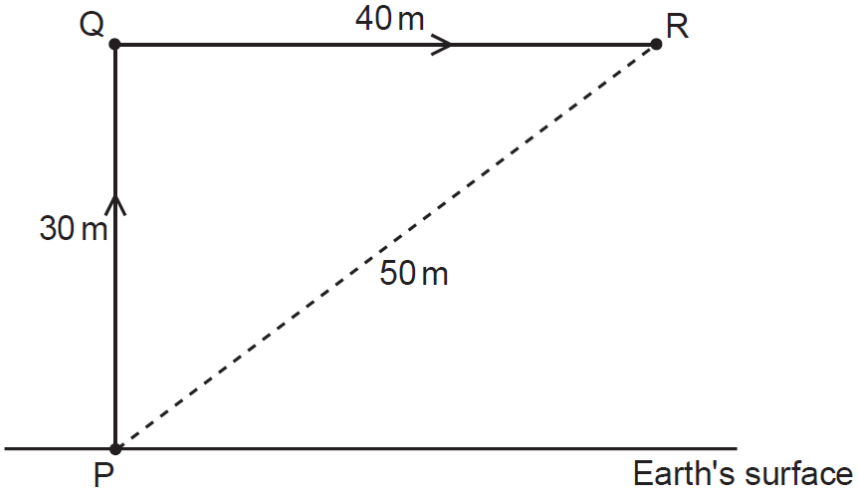


Three forces act on the level arm, as shown in the diagram.

What is the magnitude of the resultant moment of these forces about point P?

A 30 N m **B** 35 N m **C** 50 N m **D** 90 N m

12 A stone of weight 4.0 N in the Earth's gravitational field is moved from P to Q and then to R along the path shown.

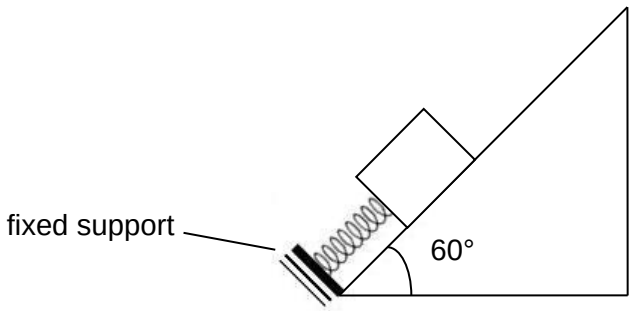


How much potential energy does the stone gain?

A 120 J **B** 200 J **C** 240 J **D** 1200 J

13 A 200 g block is pressed against a spring of force constant 1.4 kN m^{-1} until the block compresses the spring by 10 cm. The spring rests at the bottom of a ramp inclined at 60° to the horizontal.

If there is a friction of 1.2 N between the block and the ramp, how far up the incline will the block move before it comes to stop for the first time when the block is released?



A 2.4 m **B** 3.2 m **C** 4.1 m **D** 7.1 m

14 The engine of a boat supplies a constant power of 110 kW to propel the boat forward. The boat attains a maximum speed of 21.0 m s^{-1}. Given that the magnitude of the resistive force acting on the boat is proportional to the square of the boat's speed, calculate the resultant force acting on the boat when it is moving with a speed of 15.0 m s^{-1}.

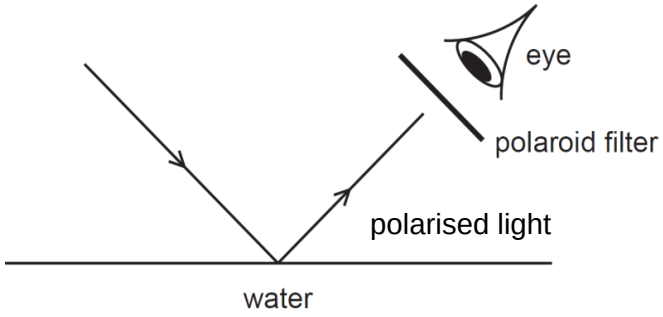
A 2.67 kN **B** 3.59 kN **C** 4.66 kN **D** 7.33 kN

15 A wave has frequency of 5.0 Hz. It travels through a medium at a speed of 8.0 km s^{-1}.

What is the phase difference, in radians, between two points 2.0 km apart?

A 0 **B** $\pi/4$ **C** $\pi/2$ **D** π

16 Light reflected from the surface of water is polarised. A polaroid filter is used to view a water surface.



The polaroid filter is rotated through 180° in the plane perpendicular to the reflected light.

Which statement could describe the observations?

A The brightness changes from a maximum to a minimum.

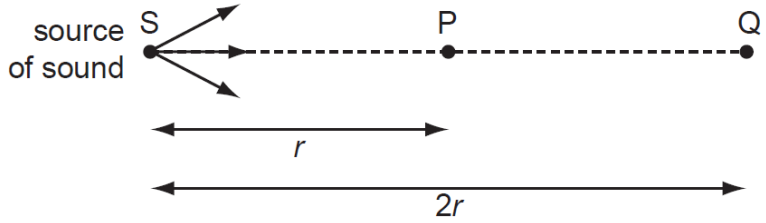
B The brightness changes from a minimum to a maximum.

C The brightness changes from a maximum to a minimum to a maximum.

D The brightness changes from a minimum to a maximum to a minimum to a maximum.

17 The intensity I of a sound at a point P is inversely proportional to the square of the distance x of P from the source of the sound. That is

$$I \propto \frac{1}{x^2}.$$



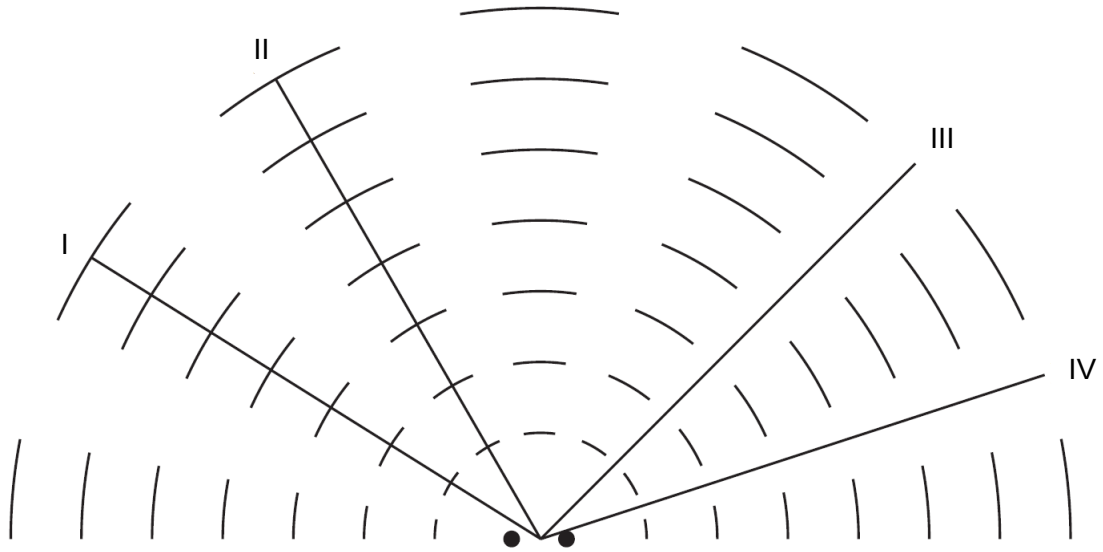
Air molecules at P, a distance r from S, oscillate with amplitude 8.0 μm.

Point Q is situated at a distance 2r from S.

What is the amplitude of oscillation of air molecules at Q?

A 1.4 μm **B** 2.0 μm **C** 2.8 μm **D** 4.0 μm

18 Two identical sources in a ripple tank generate waves of wavelength λ. The interfering waves produce the wave pattern shown below.



Along which of the labelled lines is the path difference between the waves from the sources equal to 1.5λ?

A I **B** II **C** III **D** IV

19 Which of the following statements is true about the characteristics of a stationary wave?

A Particles at the antinodes have minimum potential energy.

B Particles at the nodal positions have maximum kinetic energy.

C Separation between a node and the adjacent antinode is half a wavelength.

D Amplitude of vibrations varies from a minimum at the node to a maximum at the antinode.

20 Diagram 1 shows a ripple tank experiment in which plane waves are diffracted through a narrow slit in a metal sheet.

Diagram 2 shows the same tank with a slit of greater width.

In each case, the pattern of the waves incident on the slit and the emergent pattern are shown.

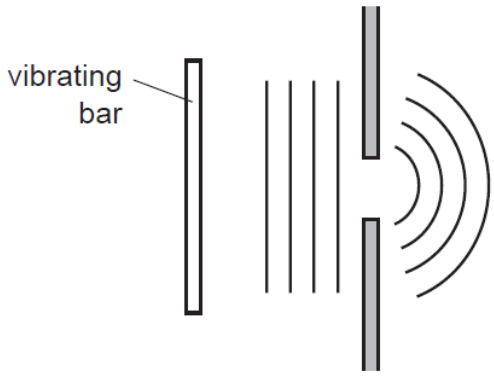


diagram 1

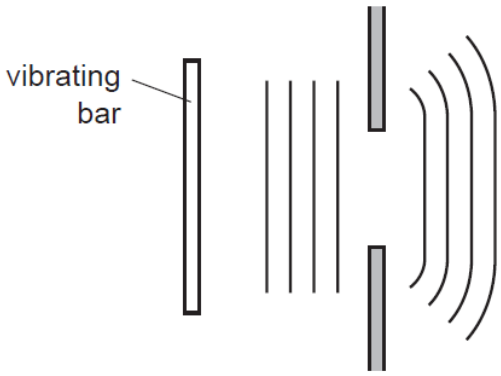


diagram 2

Which action would cause the waves in diagram 1 to be diffracted less and so produce an emergent pattern closer to that shown in diagram 2?

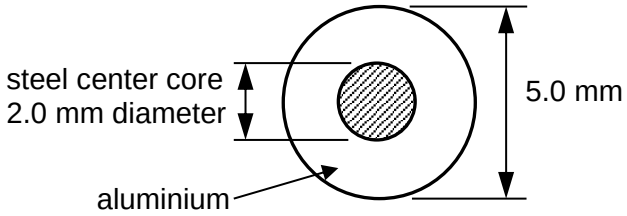
A increasing the frequency of vibration of the bar

B increasing the speed of the waves by making the water in the tank deeper

C reducing the amplitude of vibration of the bar

D reducing the length of the vibrating bar

21 A 5.0 mm thick wire comprises a steel center core of diameter 2.0 mm surrounded by a coating of aluminium.

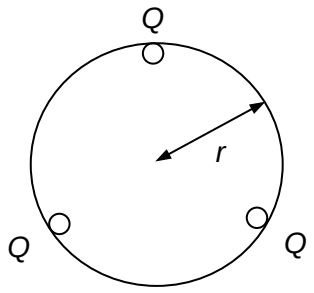


The resistivity of steel and aluminium are 1.0×10^{-7} Ω m and 2.8×10^{-8} Ω m respectively.

What is the resistance for a length of 1.0 m of such a wire?

A 0.88 mΩ **B** 1.6 mΩ **C** 3.5 mΩ **D** 34 mΩ

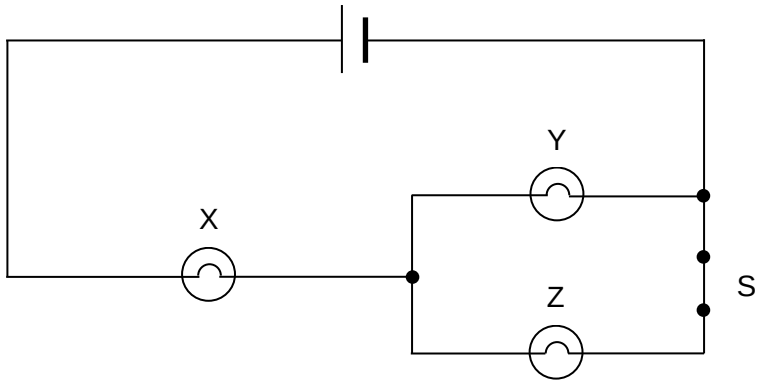
22 Three small conductors, on the edge of an insulating disc of radius r, are each given a charge Q as shown. The frequency of rotation of the disk is f.



What is the equivalent electric current at the edge of the disc?

A $3Qf$ **B** $\frac{3Q}{f}$ **C** $6\pi Qf$ **D** $\frac{2Qf}{\pi r}$

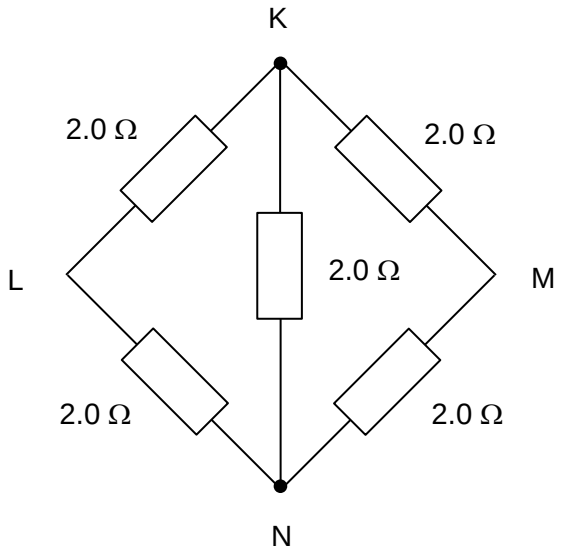
23 In the circuit, X, Y and Z are three identical bulbs. Initially, switch S is closed.



When switch S is open, what will happen to the brightness of bulb X and Y?

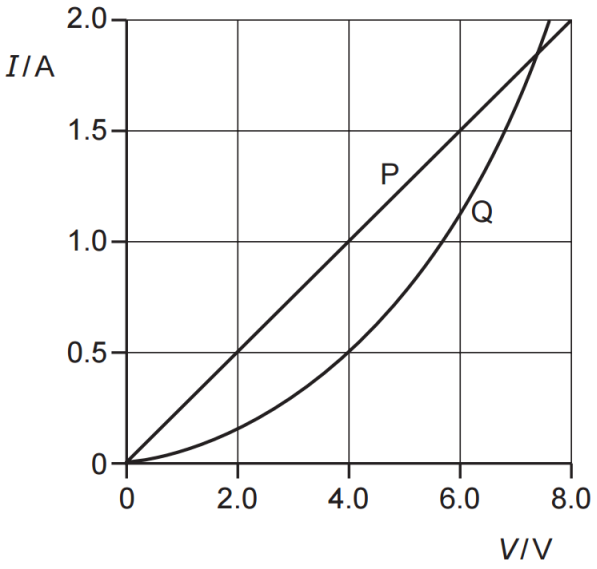
	Bulb X	Bulb Y
A	Decreases	Increases
B	Increases	Decreases
C	Decreases	Decreases
D	Increases	Increases

24 In the circuit shown, determine the equivalent resistance between L and M.



A 1.0 Ω **B** 2.0 Ω **C** 3.0 Ω **D** 4.0 Ω

25 The I-V characteristics of two electrical components P and Q are shown below.



Which statement is correct?

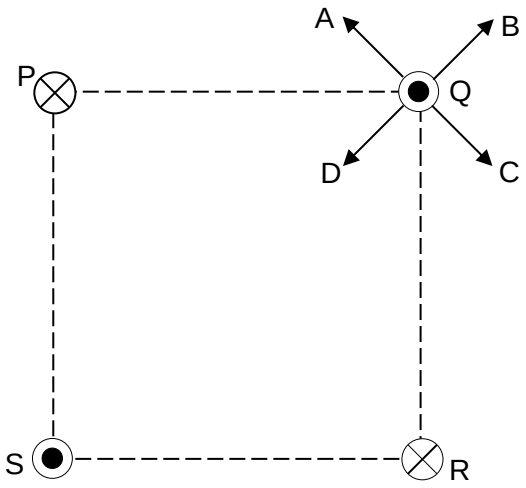
A P is a resistor and Q is a filament lamp.

B The resistance of Q increases as the current in it increases.

C For a current of 1.9 A, the resistance of Q is approximately half that of P.

D For a current of 0.5 A, the power dissipated in Q is double that in P.

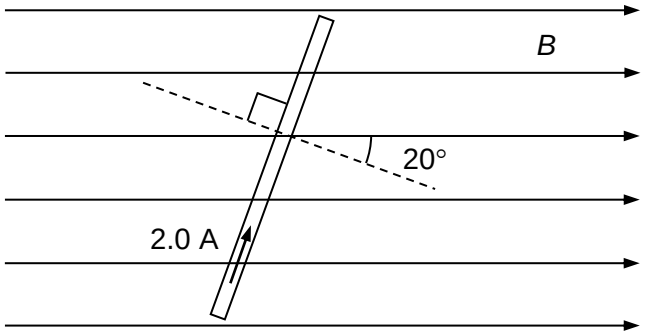
26 In the diagram below, four long wires are placed at each corner of a square and carrying equal currents. The direction of the current in wires P and R is into the plane and that in wires Q and S is out of the plane of the paper.



Which labelled arrow correctly shows the direction of the resultant force acting on wire Q?

27 A straight conductor is in the plane of a uniform magnetic field as shown. The current in the conductor is 2.0 A and the normal of the conductor is at an angle 20° to the magnetic field of flux density of *B*. The force per unit length on the conductor due to the current in the magnetic field is 5.5 N m^{-1}.

Top view



Calculate the value of *B*.

A 0.9 T **B** 1.8 T **C** 2.9 T **D** 8.0 T

28 Transitions between three energy levels in a particular atom give rise to three spectral lines. The shortest and the longest wavelengths of these spectral lines are λ_1 and λ_2 respectively.

The wavelength of the other spectral line is

A $\lambda_2 - \lambda_1$ **B** $\frac{\lambda_2 - \lambda_1}{2}$ **C** $\frac{\lambda_1\lambda_2}{\lambda_1 + \lambda_2}$ **D** $\frac{\lambda_1\lambda_2}{\lambda_2 - \lambda_1}$

29 Light quanta of energy 3.5×10^{-19} J fall on the cathode of a photocell. The current through the cell is just reduced to zero by applying a stopping potential of 0.25 V.

What is the work function energy of the cathode?

A 2.9×10^{-19} J

B 3.1×10^{-19} J

C 3.9×10^{-19} J

D 6.4×10^{-19} J

30 The intensity of a beam of monochromatic light is doubled.

Which one of the following represents the corresponding change, if any, in the momentum of each photon of the radiation?

A increased fourfold **B** doubled

C halved **D** the same

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