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Class:	Student Number:	Name:

CAMBRIDGE A LEVEL PROGRAMME

SEMESTER ONE EXAMINATION DEC 2012

(1.5-year July 2012 Intake)

Monday **7 December 2010** **8.30 am – 9.30 am**

PHYSICS 9702/1

PAPER 1 Multiple Choice **1 hour**

Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil
Write your name, class and student number on the answer sheet in the spaces provided.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **forty** 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 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.

This document consists of **14** printed pages.

[Turn over

1 Which list of SI units contains only base units?

A newton, kelvin, second, volt, mole

B kilogram, metre, second, ohm, mole

C Kelvin, metre, mole, ampere, kilogram

D kilogram, newton, metre, ampere, ohm

2 Four physical quantities A, B, C & D are related by the equation A = B – CD.
Which of the statement must be correct for the equation to be homogeneous?

A A, B, C & D all have the same units.

B The product CD has the same units as A & B.

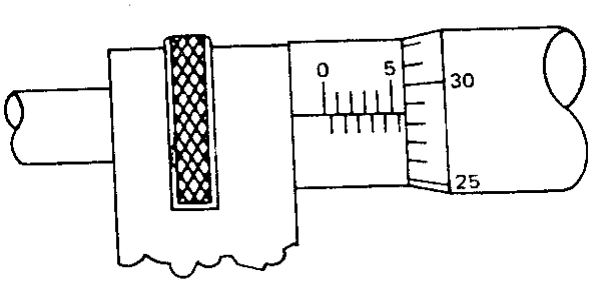
C A, B, C & D are all scalar quantities.

D The product CD is numerically equal to (B-A).

3 Which of the following equations is homogeneous?

A	$s = ut + \frac{1}{2} v t^2$	where s – displacement, u, v – velocity, t - time
B	$Pt = m (v^2 – u^2)$	P – power, m - mass
C	$R = V^2 I$	R – resistance, V – potential difference, I – current
D	$p + \frac{1}{2} v^2 = \rho$	p – pressure, ρ – density, v – velocity

4 A micrometer, without zero error, is used to measure the diameter of a cylinder as shown below. What is the diameter of the cylinder?



A 0.29 mm **B** 5.29 mm **C** 5.529 mm **D** 5.79 mm

5 The measurements of the cross-sectional area A and length L have an uncertainty of 4% and 3% respectively. The volume of a cylindrical wire, V is given by $V = A \times L$. What is the uncertainty in the calculated volume?

A 1% **B** 7 % **C** 8 % **D** 12%

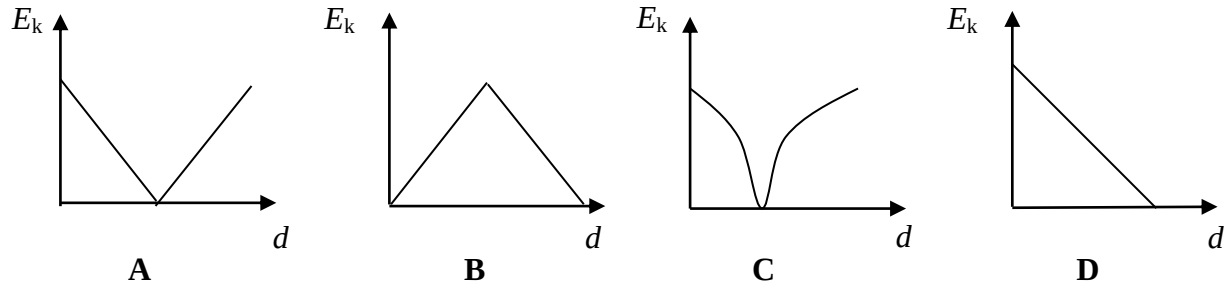
6 The density of the material of a rectangular block is determined by measuring the mass and linear dimensions of the block. The table shows the results obtained, together with their uncertainties.

mass = (25.0 ± 0.1) g
length = (5.00 ± 0.01) cm
breadth = (2.00 ± 0.01) cm
height = (1.00 ± 0.01) cm

The density is calculated to be 2.50 g cm^{-3}. What is the uncertainty in this result?

A ± 0.01 g cm^{-3} **B** ± 0.02 g cm^{-3} **C** ± 0.05 g cm^{-3} **D** ± 0.13 g cm^{-3}

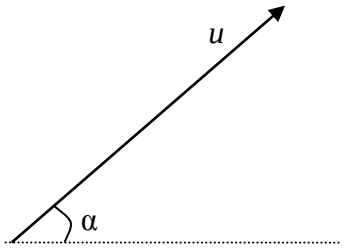
7 A spherical mass is projected vertically upwards with an initial speed and returns to its starting point. Which graph shows the variation of its kinetic energy, E_k with the distance d from the point of projection throughout the motion? (assume air resistance is negligible)



8 A stone is projected with an initial speed of 20 m s^{-1} into air at an angle 30^{o} to the horizontal. It hits the ground at the same level with its initial launching position. How far is the stone from the launching point?

A 35.3 m **B** 40.8 m **C** 70.6 m. **D** 81.6 m

9 A projectile is fired at an angle α to the horizontal at a speed *u* as shown below.



What will be the vertical and horizontal components of its velocity after a time *t*? Assume that air resistance is negligible. The acceleration of free fall is *g*.

	Vertical component	Horizontal component
A	$u \sin \alpha$	$u \cos \alpha$
B	$u \sin \alpha - gt$	$u \cos \alpha - gt$
C	$u \sin \alpha - gt$	$u \cos \alpha$
D	$u \cos \alpha$	$u \sin \alpha - gt$

10 Which is not one of Newton's laws of motion?

A The total momentum of a system of interacting bodies remains constant, providing no external force acts.

B The rate of change of momentum of a body is directly proportional to the external force acting on the body and takes place in the direction of the force.

C If body A exerts a force on body B, then body B exerts an equal and oppositely-directed force on body A.

D A body continues in a state of rest or of uniform motion in a straight line unless acted upon by some resultant external force.

11 Which of the following statements is correct with respect to an *elastic collision*?

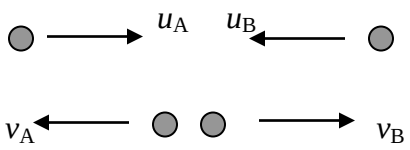
A Momentum, kinetic energy and total energy are conserved.

B Momentum and kinetic energy need not be conserved but total energy is.

C Kinetic energy is conserved but the total momentum might be reduced, not increased.

D Both kinetic energy and total energy are conserved but momentum is only conserved if the respective bodies are of equal mass.

12 Two objects of mass m_A and m_B are moving towards each other with speeds u_A and u_B as shown in the figure below. After collision, they move away from each other with speeds v_A and v_B.



If the collision is perfectly elastic, which of the followings is incorrect?

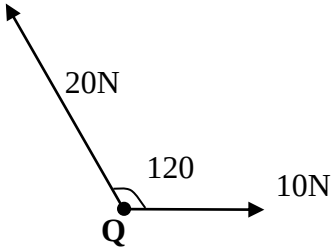
A $m_A u_A - m_B u_B = m_B v_B - m_A v_A$

B $\frac{1}{2} m_A u_A^2 + \frac{1}{2} m_B u_B^2 = \frac{1}{2} m_A v_A^2 + \frac{1}{2} m_B v_B^2$

C $u_A - u_B = v_B - v_A$

D $u_A + u_B = v_A + v_B$

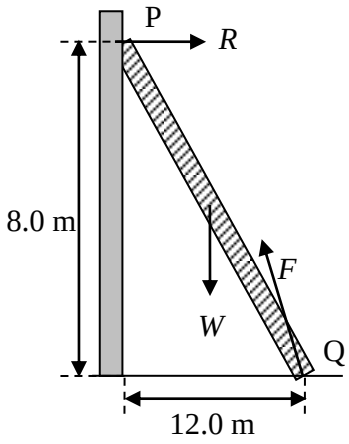
13 Two forces, 20 N and 10 N, act at a point **Q** as shown below. The angle between the directions of the forces is 120^o.



What is the magnitude of the resultant force?

A 10 N **B** 17 N **C** 22 N **D** 26 N

14 The figure shows a uniform ladder PQ leaning against a smooth, vertical wall. *R* is the normal reaction on the end P of the ladder and *W* the weight of the ladder. What is the force *F*, in terms of W, acting on the end Q of the ladder by the ground?



A 0.67W

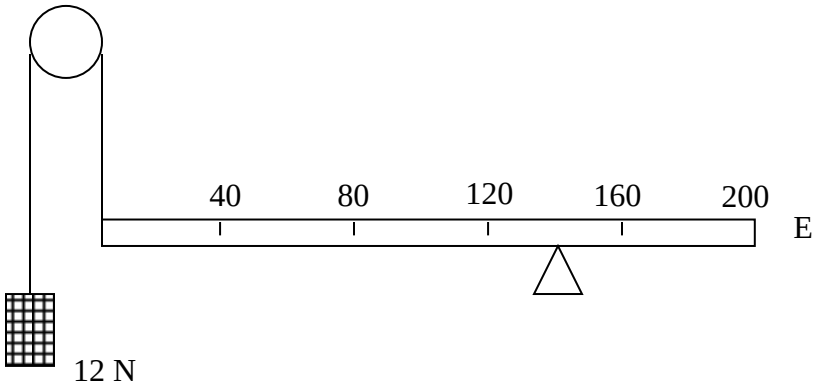
B 1.25W

C 1.50W

D 14.4W

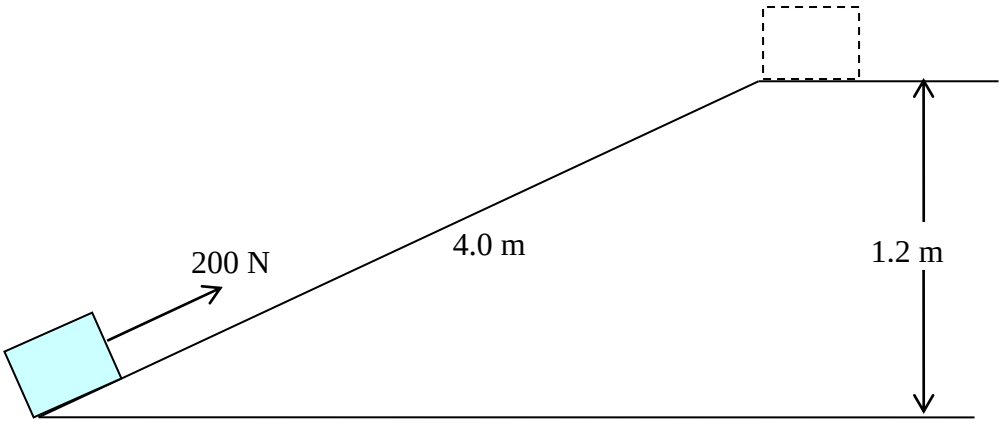
15 A uniform plank of weight 70 N is 200 cm long and rests on a support that is 60 cm from end E.
A load of 12 N is tied to another end of the plank with a rope that runs through a frictionless pulley.

At what distance from E must a 50 N weight be placed in order to balance the plank?



A 22.4 cm **B** 37.6 cm **C** 89.6 cm **D** 110.4 cm

16 The figure below shows a wooden block of mass 20 kg placed at the base of a rough inclined plane of vertical height 1.2 m. A 200 N force is used to push the block to the top of the inclined plane through a distance of 4.0 m. The wooden block stops at the top of the inclined plane.



What is the work done against friction along the inclined plane?

A 235 J **B** 240 J **C** 565 J **D** 800 J

17 A motor of power rating 50 W is used to lift up a 60 N load. If the load is rising at a constant speed of 0.40 m s^{-1}, what is the efficiency of the motor?

A 20 % **B** 24 % **C** 30 % **D** 48 %

18 Which statement applies to the boiling but not to the evaporation of a liquid?

A The separation of the molecules increases greatly

B At normal atmospheric pressure, the process occurs at one temperature only.

C Energy must be provided for the process to happen.

D All the bonds between molecules in the liquid are broken.

19 A child drinks a liquid of density 1.0×10^3 kg m^{-3} through a vertical straw. Atmospheric pressure is 1.0×10^5 Pa and the child is capable of lowering the pressure at the top of the straw by 5%. The acceleration of free fall is 9.8 ms^{-2}.

What is the maximum length of the straw that would enable the child to drink the liquid?

A 10.2m **B** 9.7m **C** 0.97m **D** 0.51m

20 In an experiment to demonstrate Brownian motion in a gas, a brightly illuminated cell containing smoke is viewed under a microscope. The observer sees a large number of bright specks undergoing random motion.

Which one of the following statements about this experiment is correct?

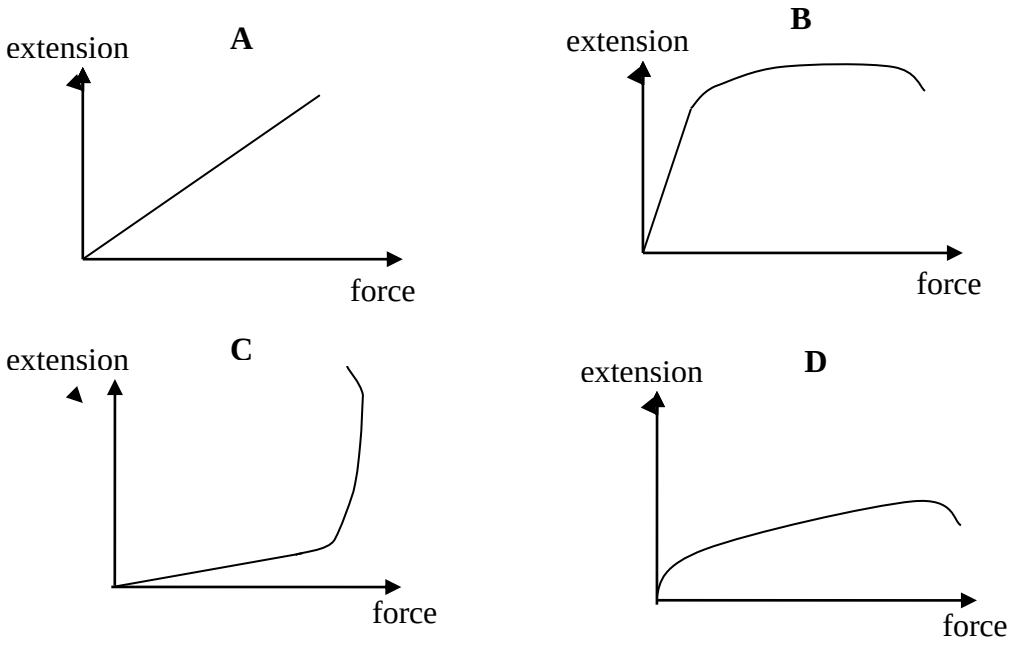
A Light is being scattered by gas molecules.

B The larger the smoke particle, the greater is the speed of the bright specks.

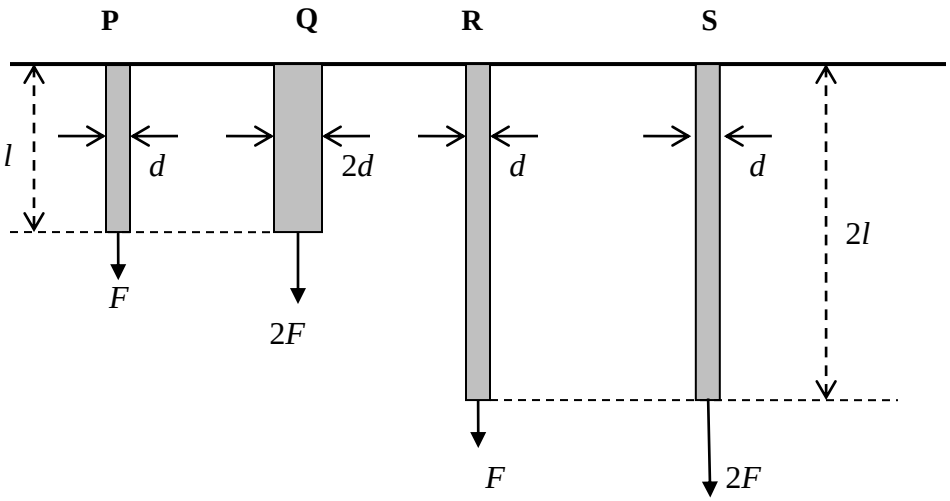
C The lower the smoke pressure of the gas, the more frequent are the direction changes of the bright specks

D The higher the temperature of the gas, the faster is the motion of the bright specks.

21 Which of the graphs would be the most suitable for a ductile material?



22 Four wires **P**, **Q**, **R** and **S** have diameters, lengths and are stretched by forces as shown. All the wires are made of the same material.



Arrange the extensions of these wires in ascending order.

A Q, P, R, S

B R, S, P, Q

C P, Q, R, S

D S, R, Q, P

23 An oscilloscope is connected to a microphone. Diagram P shows the trace displayed when a note of frequency *f* and amplitude *A* is played.

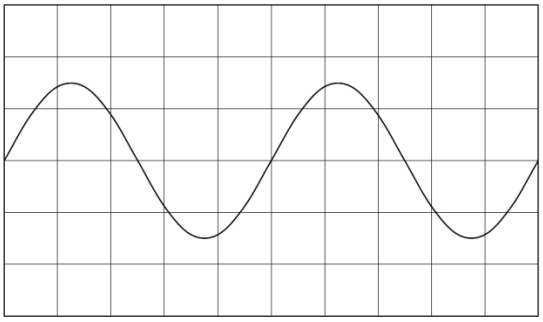


Diagram P

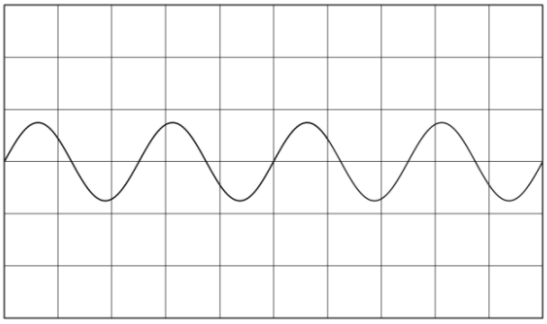


Diagram Q

A second note, as shown in diagram Q, is played. The settings of the oscilloscope remain unchanged. What are the frequency and the amplitude of second note?

	Frequency	Amplitude
A	$f/2$	$2A$
B	$2f$	$2A$
C	$f/2$	$A/2$
D	$2f$	$A/2$

24 Ultrasound waves differ from ultraviolet rays because ultrasound

A cannot be diffracted.

B cannot interfere.

C cannot be polarised.

D cannot produce stationary waves.

25 In a Young's double-slit experiment, what happens to the appearance of the fringe pattern if the width of both the slits is reduced by the same amount but their separation remains the same?

A The fringes become less bright and the fringe separation increases

B The fringe brightness is the same but the fringe separation increases

C The fringe separation is the same, the number of interference fringes increases

D The fringes become less bright, the number of interference fringes remains unchanged

26 The rulings on a diffraction grating are 6000 lines cm^{-1}.

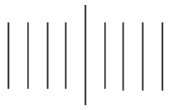
How many complete rainbow spectra, excluding the one at the middle, are formed when a coherent source of white light is directed to the grating?

A 2 **B** 4 **C** 6 **D** 8

27

The diagram above shows the first four diffraction orders on each side of the zero order when a beam of monochromatic light is incident normally on a diffraction grating of slit separation *d*. All the angles of diffraction are small. Which one of the patterns, drawn on the same scale, is likely to be obtained when the grating is exchanged for one with a slit separation *d*/2?

A



B

C

D

28 A vibrating tuning fork, held above a tube, sets up a standing wave in the air in the tube. Which of the following statements is correct?

A At the antinodes the particles vibrate back and forth, parallel to the length of the tube.

B At the antinodes the particles vibrate from side to side, perpendicular to the length of the tube.

C At the nodes the particles vibrate back and forth, parallel to the length of the tube.

D At the nodes the particles vibrate from side to side, perpendicular to the length of the tube.

29 A negatively charged oil droplet of mass 4×10^{-15} kg is stationary in a uniform electric field formed by two horizontal metal plates with a potential difference of about 124 V between them and a separation of 0.2 cm. What is the excess number of electrons in the droplet?

A 3 **B** 4 **C** 5 **D** 6

30 An electron is accelerating from rest in a uniform electric field produced by two parallel metal plates. The field is the only influence on the electron. Which one of the following pairs of quantities is needed to calculate the increase in kinetic energy of the electron between any two points in the field?

A the mass and the final speed of the electron

B the charge of electron and the potential difference across the plate

C electric field strength and the separation between the plates

D electric force acting on electron and the displacement moved

31 A heating coil is made from a metal wire for use with a fixed potential difference. The power developed in the coil will be decreased if

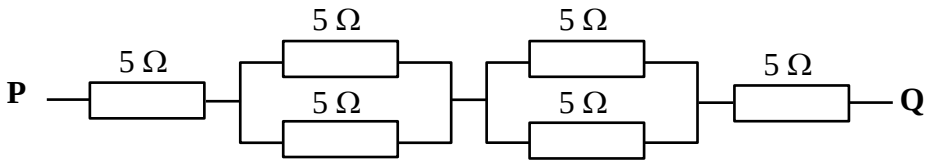
A the radius of the wire is decreased.

B the length of the wire is decreased.

C the temperature of the wire drops.

D metal of lower resistivity is used.

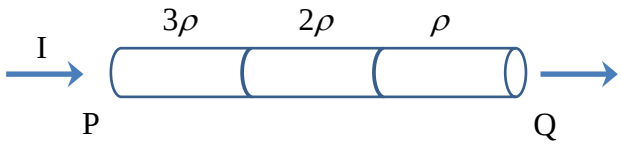
32 The diagram shows part of a circuit



What is the total resistance between the points **P** and **Q** due to the resistors?

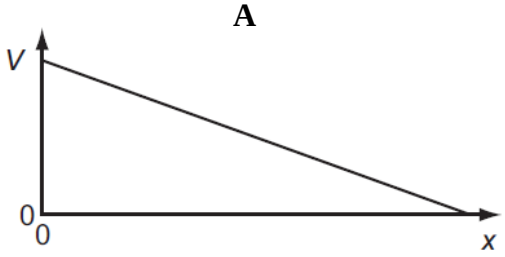
A 10.8 Ω **B** 15 Ω **C** 20 Ω **D** 30 Ω

33 A wire PQ is made of three different materials, with resistivities 3ρ, 2ρ and ρ. There is a current I in the composite wire as shown.

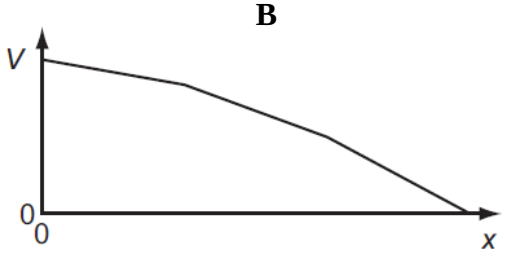


Which graph best shows how the pontential V along the wire varies with the distance x from P?

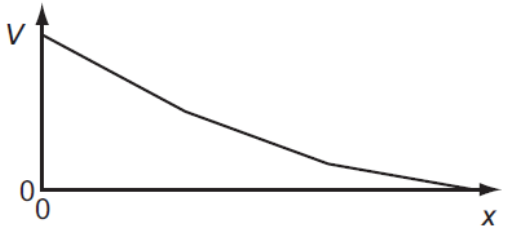
A



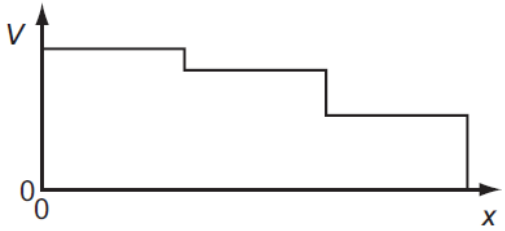
B



C



D

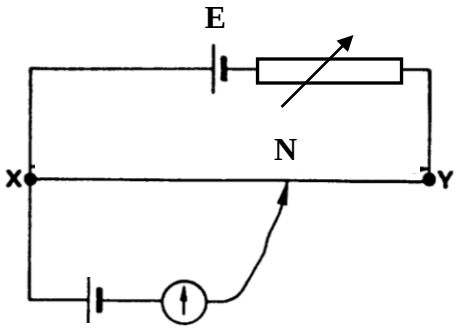


34 Two wires made of the same material and of the same length are connected in parallel to the same voltage supply. Wire **P** has a diameter of 2 mm. Wire **Q** has a diameter of 1 mm.

What is the ratio $\frac{\text{Current in } \mathbf{Q}}{\text{Current in } \mathbf{P}}$?

A 0.25 **B** 0.50 **C** 2.0 **D** 4.0

35 In the potentiometer circuit below, the moveable contact is placed at N on the bare wire XY, such that the galvanometer shows zero deflection.



The resistance of the variable resistor is now decreased.

What is the effect of this decrease on the potential difference across the wire XY and on the position of the moveable contact for zero deflection?

	Potential difference across XY	Position of moveable contact
A	increases	nearer to X
B	increases	nearer to Y
C	decreases	nearer to X
D	decreases	nearer to Y

36 A relay is required to operate 125 m from its power supply. The power supply has negligible internal resistance. The relay requires 12 V and a current of 0.90 A to operate. A cable connects the relay to the power supply and two of the wires in the cable are used to supply power to the relay.

The resistance of each of these wires is 0.007 Ω per metre.

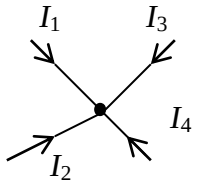
What is the minimum output e.m.f. of the power supply?

A 10.8 V **B** 12 V **C** 12.8 V **D** 13.6 V

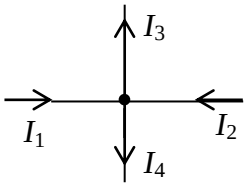
37 The diagrams show four different ways in which currents I_1, I_2, I_3 and I_4 can combine at a junction. For which of these junctions is the following equation correct?

$$I_1 + I_2 = I_3 + I_4$$

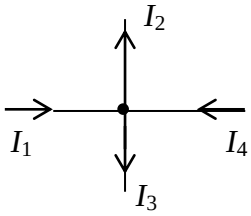
A



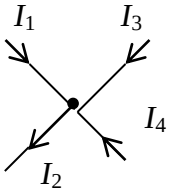
B



C



D



38 In an experiment to investigate the nature of the atom, a very thin gold film was bombarded with α - particles.

What pattern of deflection of the α - particles was observed?

A No α - particle was deflected through an angle greater than a right angle.

B All α - particles were deflected from their original path.

C Most α - particles were deflected through angles greater than a right angle.

D A few α - particles were deflected through angles greater than a right angle.

39 Which is the most incorrect statement concerning radiation from radioactive materials?

A Alpha-particles have positive charge.

B Gamma rays are slightly defected by a magnetic field.

C Beta- particles can penetrate a very thin piece of paper

D An electric field can deflect alpha- and beta- particles.

40 ${}^{238}_{92}U$ decays through a series of transformation to a stable nuclide. The particles emitted in the successive transformations are **α**, **β**, **β** and **α.**

Which nuclide is not produced during this series of transformations?

A ${}^{234}_{88}Ra$ **B** ${}^{230}_{90}Th$ **C** ${}^{234}_{91}Pa$ **D** ${}^{234}_{92}U$