TAYLOR'S COLLEGE

Wisdom - Integrity - Excellence
since 1969

Class:	Student Number:	Name:

CAMBRIDGE A LEVEL PROGRAMME

TRIAL EXAMINATION AUGUST 2012

(January/March 2012 Intake)

Monday **27 August 2012** **8.30 pm – 9.30 pm**

PHYSICS 9702/13

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 **21** printed pages.

[Turn over

1 Which of the following expressions has the same unit as energy?

A pressure x volume

B frequency x wavelength

C mass x velocity

D force / area

2 Which of the following pair of physical quantities contains a scalar and a vector quantity?

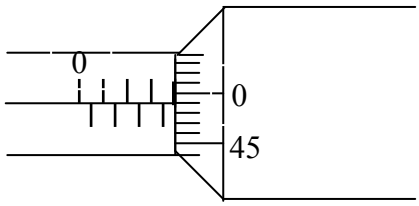
A work; energy

B displacement; momentum

C density; acceleration

D pressure; strain

3 A micrometer screw gauge is used to measure the diameter of a metal rod. The figure below shows the reading of the micrometer screw gauge.



If the zero error of the micrometer screw gauge is + 0.02mm, what is the diameter of the metal rod?

A 3.97 mm **B** 4.01 mm **C** 4.47 mm **D** 4.51 mm

4 Three quantities a, b and c are measured with their corresponding uncertainties estimated as δa, δb and δc respectively. The fractional uncertainty in $\frac{a}{b}c$ is at most

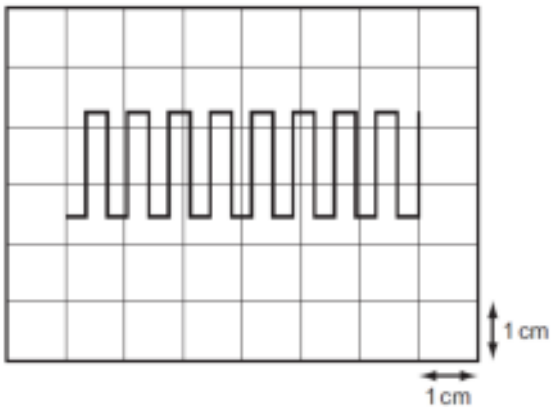
A $\delta a + \delta b + \delta c$

B $\delta a \times \delta b \times \delta c$

C $\frac{\delta a}{a} + \frac{\delta b}{b} + \frac{\delta c}{c}$

D $\frac{\delta a}{a} \times \frac{\delta b}{b} \times \frac{\delta c}{c}$

5 The diagram shows a square-wave trace on the screen of a cathode-ray oscilloscope. A grid of 1 cm squares covers the screen. The time-base setting is 5.0 ms cm^{-1}

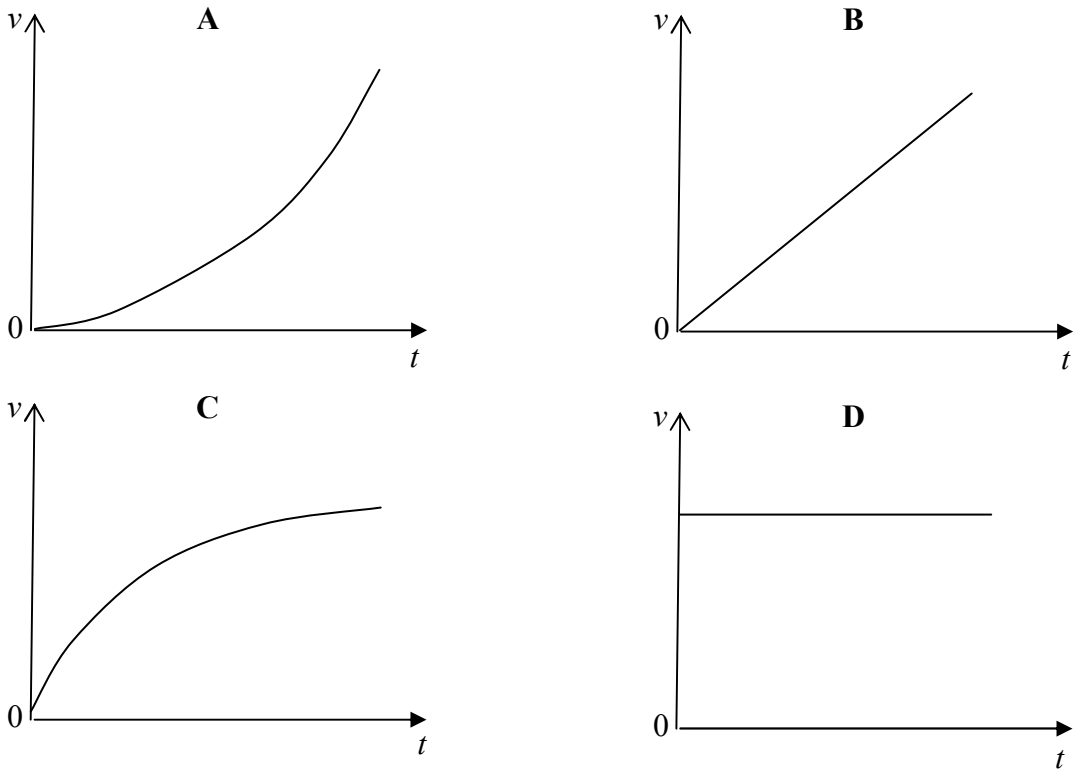


What is the approximate frequency of the square wave?

A 70 Hz **B** 140 Hz **C** 280 Hz **D** 1400 Hz

6 A ball is dropped from rest from the top of a tall building.

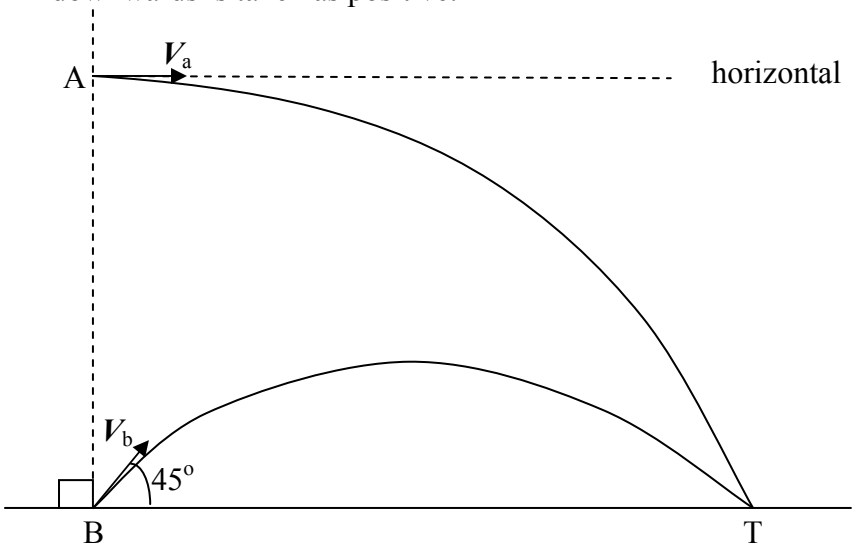
Which of the following graphs represents the variation of the velocity v with time t of the ball falling through air?



7 A freely falling object has a speed of 5.0 m s^{-1}. After falling a further 20 m, its speed is

A 15 ms^{-1} **B** 20 ms^{1} **C** 25 m s^{-1} **D** 45 ms^{-1}

8 A student is investigating projectile motions. He fires two small identical balls, A and B, simultaneously. Their trajectories are shown in the sketch below. The balls land at the same instant at the target, T. The V_a and V_b are the initial velocities of ball A and ball B respectively. Direction downwards is taken as positive.



Which of the followings is true?

A $V_a > V_b$; the final velocity of ball A at T = final velocity of ball B at T.

B $V_a < V_b$; the final velocity of ball A at T > final velocity of ball B at T.

C $V_a > V_b$; the final velocity of ball A at T > final velocity of ball B at T.

D $V_a < V_b$; the final velocity of ball A at T = final velocity of ball B at T.

9 A person weighing 100 N stands on some bathroom scales in a lift. If the scales show a reading of 110 N, which answer could describe the motion of the lift?

A Moving downwards and decelerating.

B Moving downwards with a constant velocity.

C Moving upwards and decelerating.

D Moving upwards with a constant velocity.

10 Newton's third law tells us that

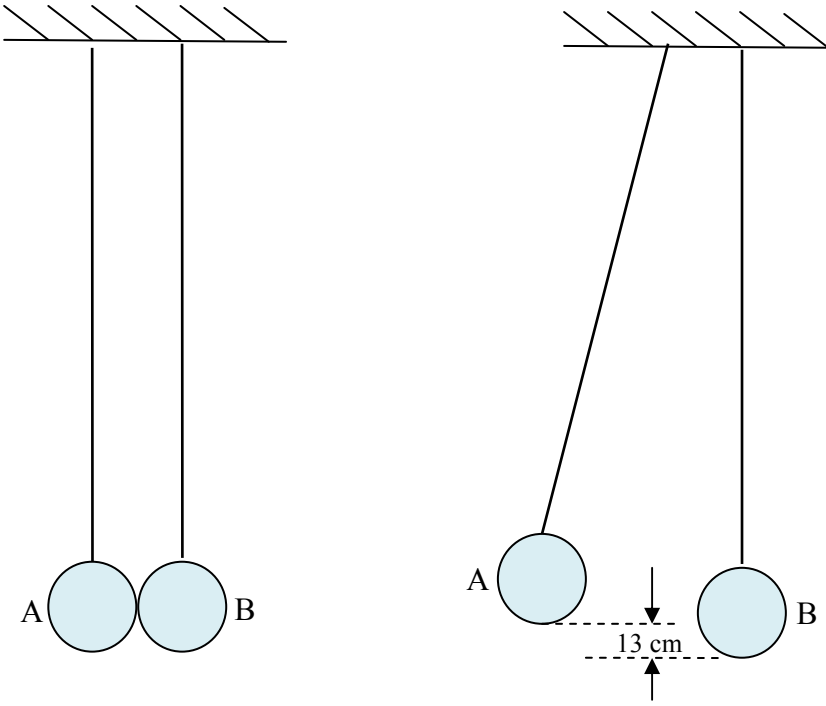
A actions usually have a reaction.

B weight and normal contact force are always equal and opposite.

C moving with constant velocity is the same as being at rest.

D forces always arise in pairs.

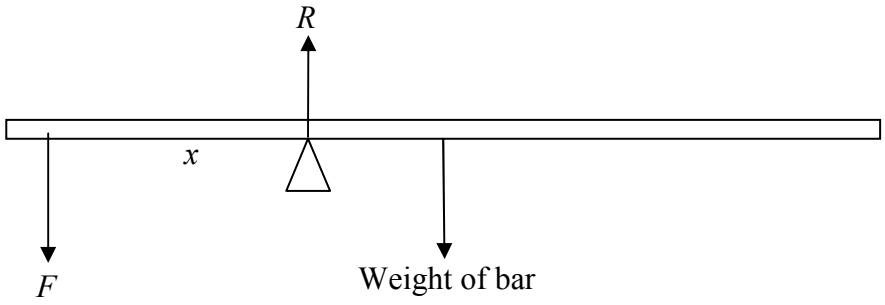
11 Two identical spheres A and B, each of mass 100 g, are suspended on inextensible threads so that, when they are hanging vertically, they just touch. Sphere A is pulled to one side so that it rises through a vertical height of 13 cm, as shown in the figure below.



Sphere A is released and it collides with sphere B. Both the spheres stick together and move together. The common speed of both spheres immediately after collision is

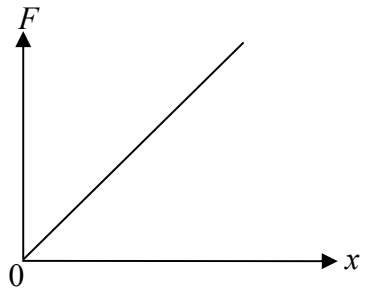
A 0.20 ms^{-1} **B** 0.40 ms^{-1} **C** 0.60 ms^{-1} **D** 0.80 ms^{-1}

12 A heavy metal rod is placed on a fixed pivot and kept in equilibrium by the forces shown.

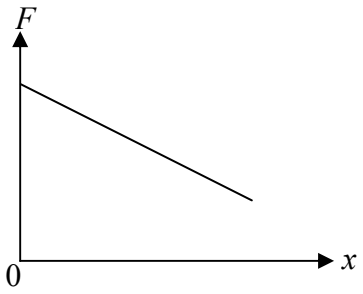


Which of the following graphs shows the variation of the force F with distance x from the pivot?

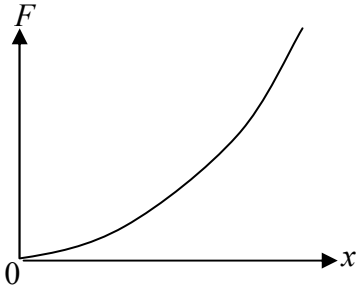
A



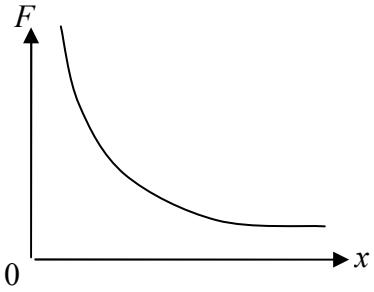
B



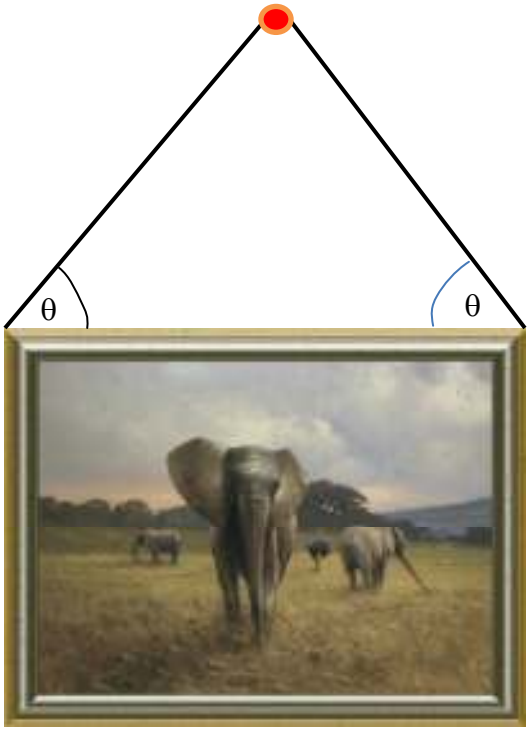
C



D



13 The diagram shows the forces acting on a picture frame, of weight W, suspended by two cords inclined at angle θ to the horizontal. The tension in the cords is T.



Which of the following expressions shows the correct relationship between W and T?

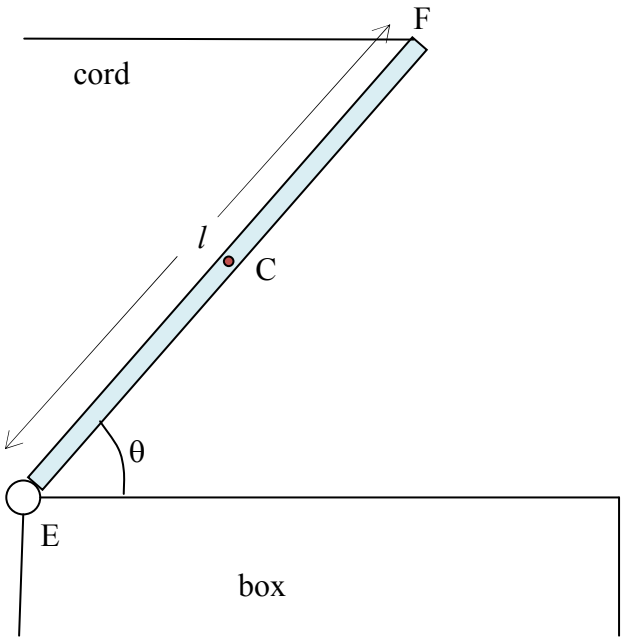
A $W = 2\ T \cos \theta$

B $W = T \cos \theta$

C $W = T \sin \theta$

D $W = 2T \sin \theta$

14 The lid of a box is hinged along one edge E, as shown in the figure below.



The lid is held open by means of a horizontal cord attached to the edge F of the lid. The lid, of length l and of uniform thickness and density, is inclined at an angle θ to the horizontal. The centre of gravity of the lid is at point C.

The weight of the lid is W, the tension in the cord is T and the force of the hinge on the lid is R.

Which of the following expressions is correct?

A $2T \sin\theta = W \cos\theta$

B $T \sin\theta = R \cos\theta$

C $2R \sin\theta = W \cos\theta$

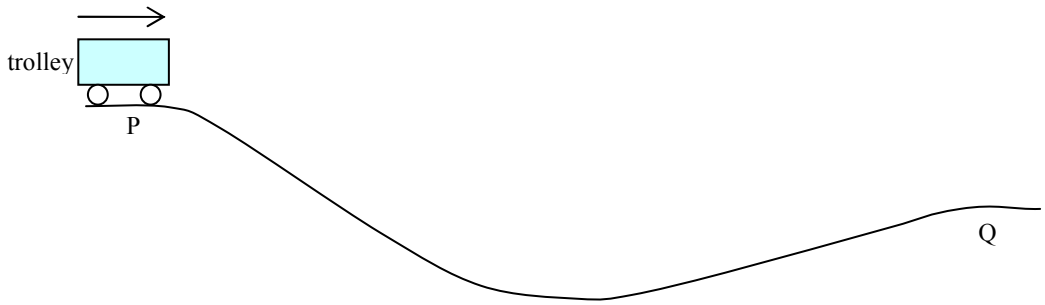
D $T \sin\theta = 2R \cos\theta$

15 To travel at a constant speed, a car engine provides 24 kW of useful power. The driving force on the car is 600 N.

At what speed does the car travel?

A 2.5 ms^{-1} **B** 4.0 ms^{-1} **C** 25 ms^{-1} **D** 40 ms^{-1}

16 A trolley runs from P to Q along a track. At Q its potential energy is 40 kJ less than at P.



At P, the kinetic energy of the trolley is 5 kJ. Between P and Q the work the trolley does against friction is 10 kJ.

What is the kinetic energy of the trolley at Q?

A 35 kJ **B** 45 kJ **C** 55 kJ **D** 65 kJ

17 A child drinks a liquid of density 1.0 x10^3 kg m^{-3} through a vertical straw. Atmospheric pressure is 1.0 x10^5 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 straw that would enable the child to drink the liquid?

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

18 The Young modulus of a given mataerial is

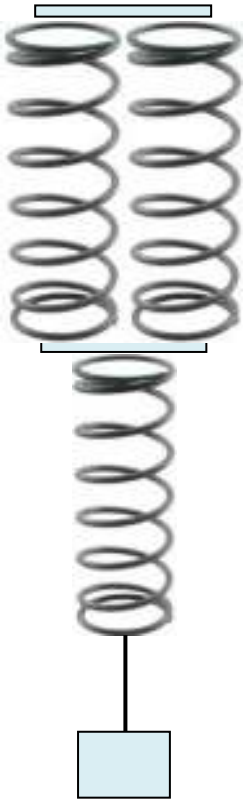
A dependent on the external force applied.

B dependent on the dimensions of the material.

C dependent on the extension or compression. produced.

D the characteristic of the material concerned.

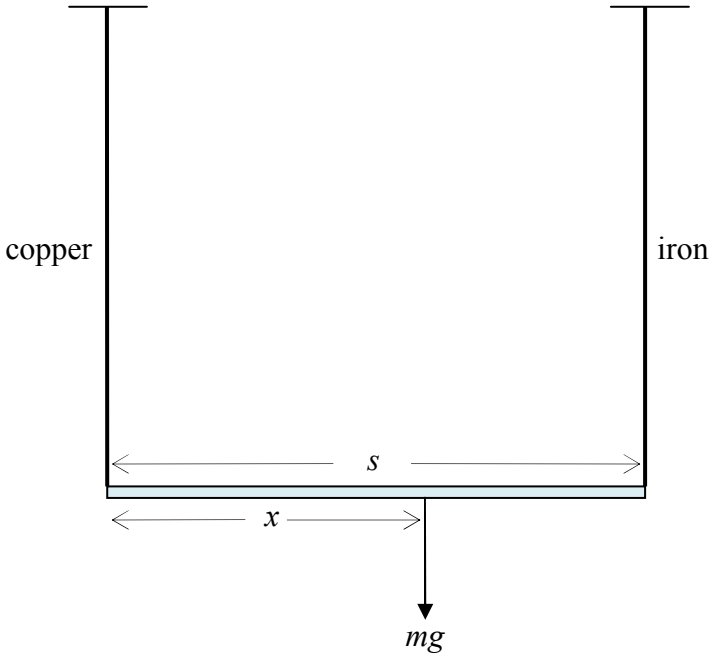
19 Three identical springs, each of spring constant k, are connected as shown in the figure below.



What is the spring constant of the system in terms of k if the same load W is hung at the bottom of the springs?

A k **B** $3k$ **C** $\frac{2}{3}k$ **D** $\frac{3}{2}k$

20 A light horizontal rod of length s is suspended from 2 vertical wires - a copper wire and an iron wire - both of the same length and cross-sectional area. A load of weight mg is suspended on the rod in such a way that the rod remains in a horizontal position as shown in the figure below.



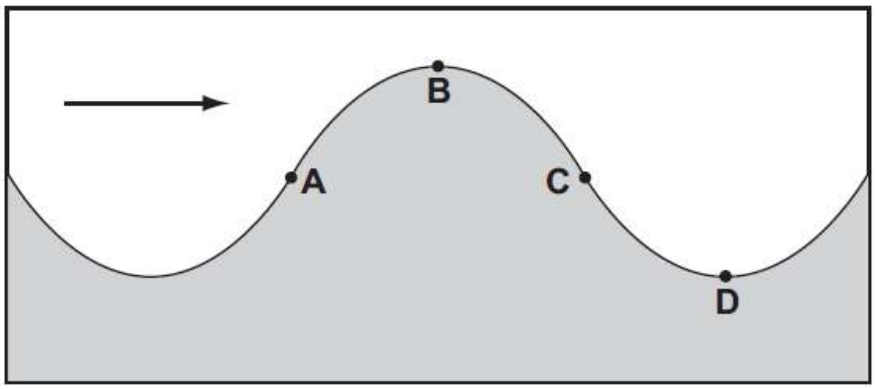
If the Young modulus of copper is E_1 and that of iron is E_2, what is the value of x for this to be possible?

A $\frac{E_2}{E_1 + E_2} s$ **B** $\frac{E_1}{E_1 + E_2} s$ **C** $\frac{E_1}{E_2} s$ **D** $\frac{E_2}{E_1} s$

21 Which of the following applies to a progressive transverse wave?

	Transfers energy	Can be polarized
A	No	No
B	No	Yes
C	Yes	No
D	Yes	Yes

22 The diagram shows a vertical cross-section through a water wave moving from left to right. At which point is the water moving upwards with maximum speed?



23 A wave of frequency 5 Hz travels at 80 km s^{-1} through a medium. What is the phase difference between two points 4 km apart?

A zero **B** $\frac{\pi}{2}\ rad$ **C** $\pi\ rad$ **D** $\frac{3}{2}\pi\ rad$

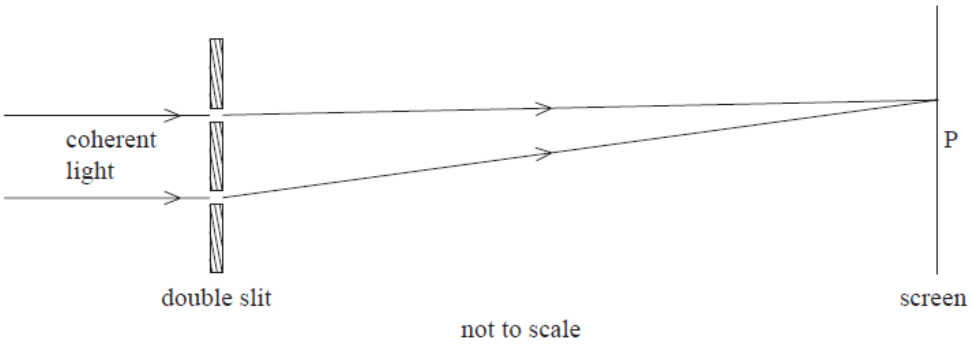
24 A point source of sound emits energy equally in all directions at a constant rate and a person 8 m from the source listens. After a while, the intensity of the source is halved. If the person wishes the sound to seem as load as before, how far should he be now from the source?

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

25 A parallel beam of white light is incident normally on a diffraction grating. It is noted that the second-order and third-order spectra partially overlap. What wavelength in the third-order spectrum will appear at the angle corresponding to a wavelength of 600 nm in the second-order spectrum?

A 300 nm **B** 400 nm **C** 600 nm **D** 900 nm

26 Light from a double slit arrangement produces bright and dark fringes on screen in the region near point P, as indicated below.

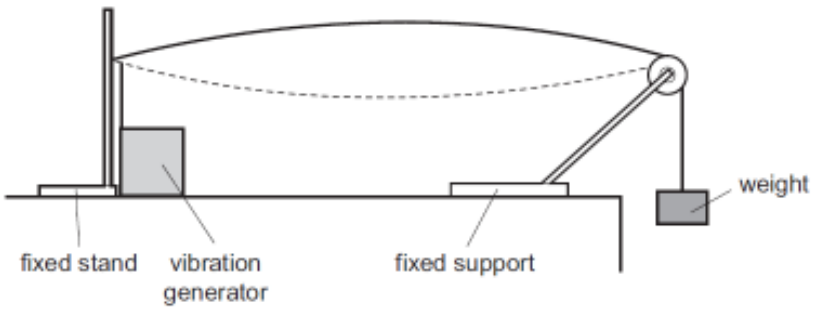


The light from the two slits has equal amplitudes on reaching point P.

Which one of the following gives the change, if any, in the appearance of the bright and the dark fringes when the amplitude of the light wave from one slit is reduced?

	Bright fringes	**Dark Fringes**
A	Remains the same.	Remains the same.
B	Becomes less bright.	Remains the same.
C	Becomes less bright.	Becomes more bright.
D	Remains the same.	Becomes more bright.

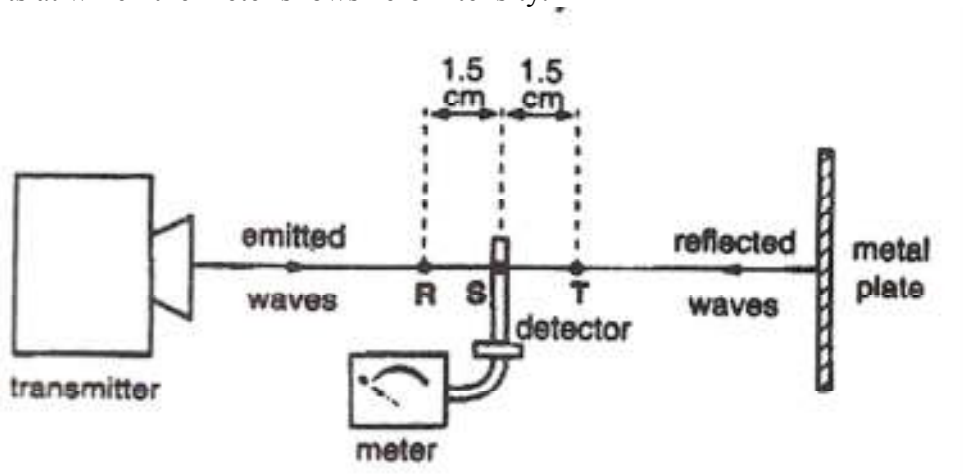
27 The diagram shows a steel wire clamped at one end and tensioned at the other by a weight hung over a pulley.



A vibration generator is attached to the wire near the clamped end. A stationary wave with one loop is produced. The frequency of the vibration generator is f.
Which frequency should be used to produce a stationary wave with two loops?

A $\frac{f}{4}$ **B** $\frac{f}{2}$ **C** $2f$ **D** $4f$

28 A microwave transmitter emits waves which are reflected from a metal plate, as shown in the diagram. A detector responds to the stationary waves produced R, S and T are three successive points at which the meter shows zero intensity.



What is the frequency of the waves?

A 9.0×10^6 Hz

B 1.0×10^8 Hz

C 1.0×10^{10} Hz

D 2.0×10^{10} Hz

29 A small charge q is placed in the electric field of a large charge Q. Both charges experience a force F. What is the electric fields strength of the charge Q at the position of the charge q.

A $\frac{F}{Qq}$ **B** $\frac{F}{Q}$ **C** FqQ **D** $\frac{F}{q}$

30 Drops X and Y, of the same oil, remained stationary in air in the same vertical electric field. After the field was switched off, X fell more quickly than Y.

Which deduction can be made?

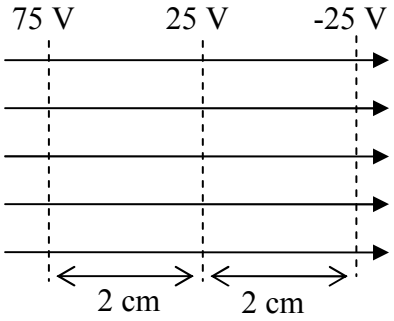
A X had a greater charge than Y.

B Y had a greater charge than X.

C Both X and Y were positively charged,

D The charges on X and Y were identical in sign and magnitude.

31 The diagram shows the direction of a uniform electric field in which the lines of equal potential are spaced 2.0 cm apart.



What is the value and direction of the electric force which is exerted on a charge of -10 μC when placed in the field?

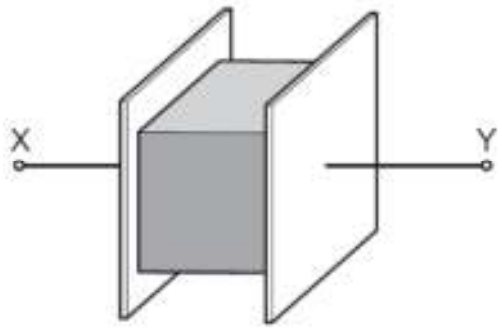
A 2.5 x 10^{-5} N to the right

B 2.5 x 10^{-5} N to the left

C 2.5 x 10^{-2} N to the right

D 2.5 x 10^{-2} N to the left

32 The resistance of a metal cube is measured by placing it between two parallel plates, as shown.



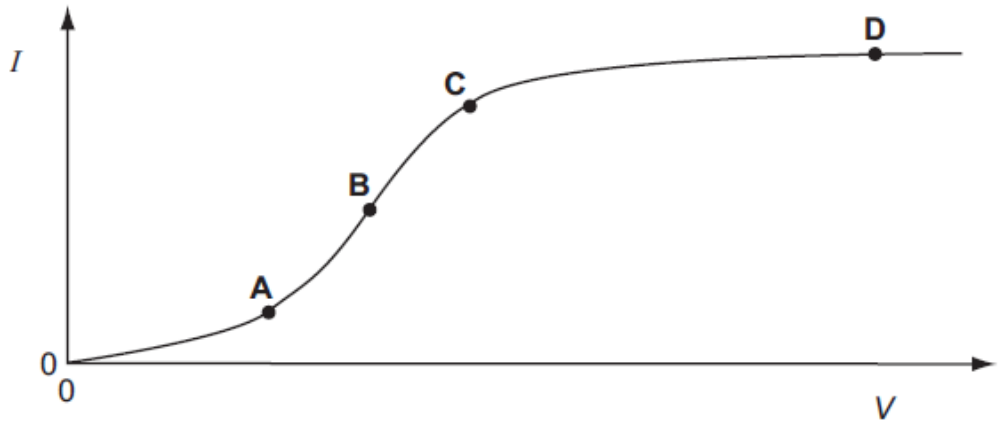
The cube has volume V and is made of a material with resistivity ρ. The connections to the cube have negligible resistance.

Which expression gives the electrical resistance of the metal cube between **X** and **Y**?

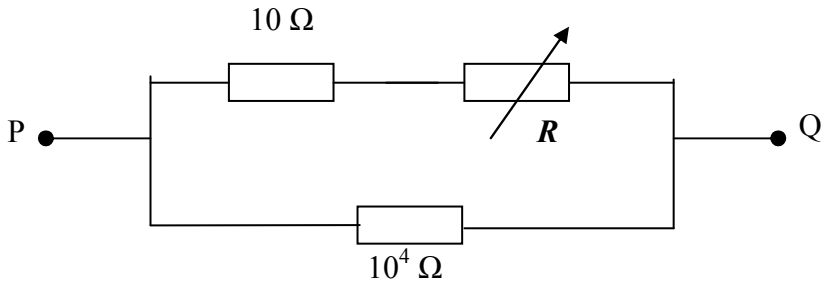
A $\rho V^{\frac{1}{3}}$ **B** $\rho V^{\frac{2}{3}}$ **C** $\frac{\rho}{V^{\frac{1}{3}}}$ **D** $\frac{\rho}{V^{\frac{2}{3}}}$

33 The graph shows how the electric current I through a conducting liquid varies with the potential difference V across it.

At which point on the graph does the liquid have the smallest resistance?



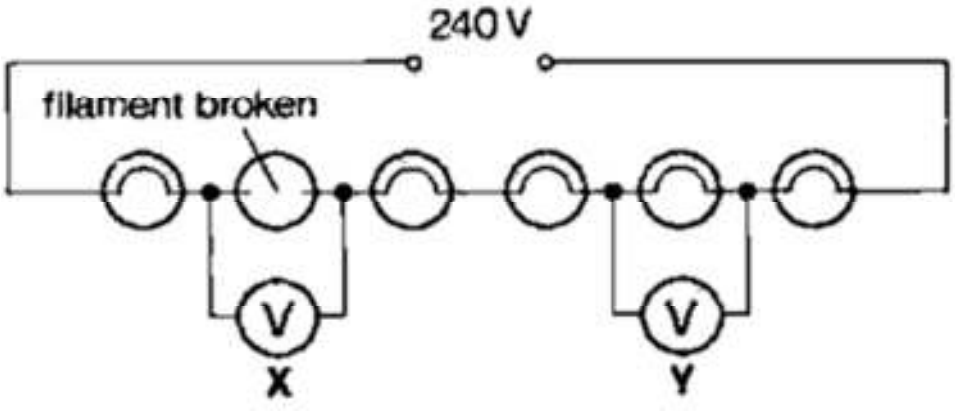
34 In the diagram below, the variable resistor R can be adjusted over its full range from 0 to 10^3 Ω.



What are the approximate limits for the resistance between P and Q?

A zero to 10^3 Ω
B zero to 10^4 Ω
C 10 to 10^3 Ω
D 10 to 10^4 Ω

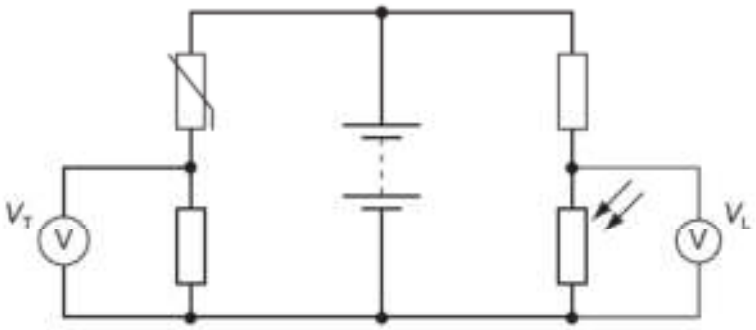
35 A main circuit contains six similar bulbs connected in series. One of the bulbs has a broken filament. Voltmeters X and Y of infinite resistance are placed in the circuit as shown.



What are the voltmeter readings?

	X reading / V	Y reading / V
A	0	0
B	0	240
C	40	40
D	240	0

36 In the circuit below, the reading V_T on the voltmeter changes from high to low as the temperature of the thermistor changes. The reading V_L on the voltmeter changes from high to low as the level of light on the light-dependent resistor (LDR) changes.

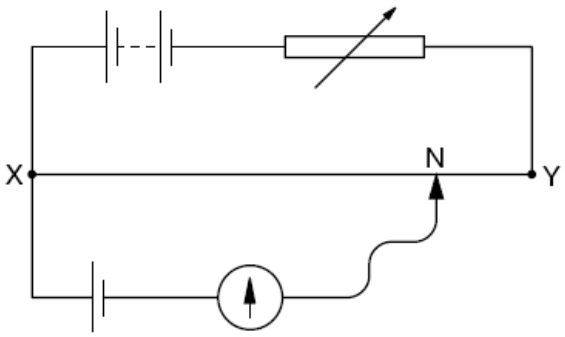


The readings on V_T and V_L are both high.

What are the conditions of temperature and light level?

	Temperature	Light level
A	Low	Low
B	Low	High
C	High	Low
D	High	High

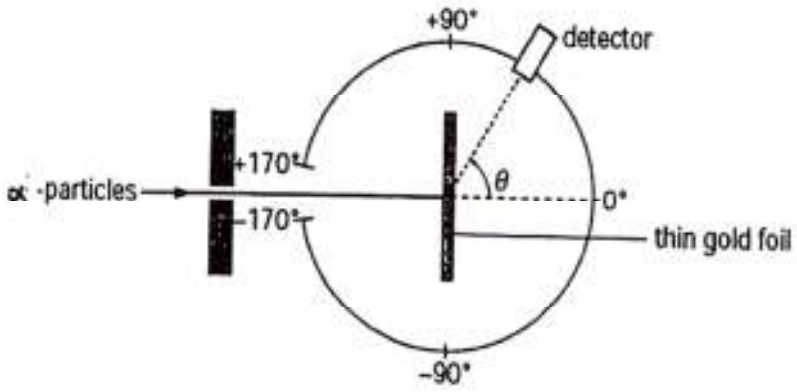
37 In the potentiometer circuit below, the moveable contact is placed at N on the bare wire XY, such that the galvanometer shows zero deflection.



The resistance of the variable resistor is now increased.
What is the effect of this increase 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

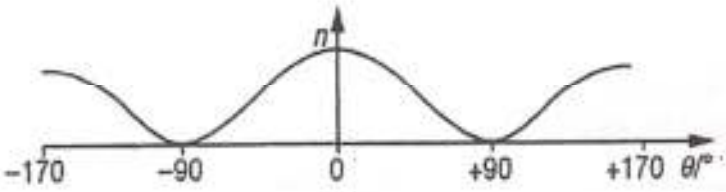
38 In repeating Rutherford's α-particles scattering experiment, a student used the apparatus shown, in a vacuum to determine n the number of α-particles incident per unit time, on a detector held at various angular positions θ.



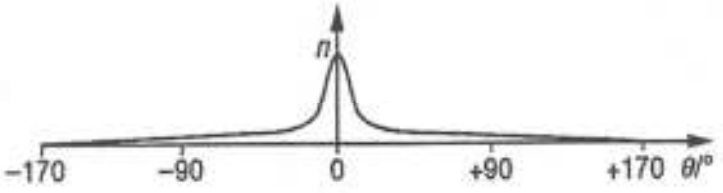
Which graph best represents the variation of n with θ?

A

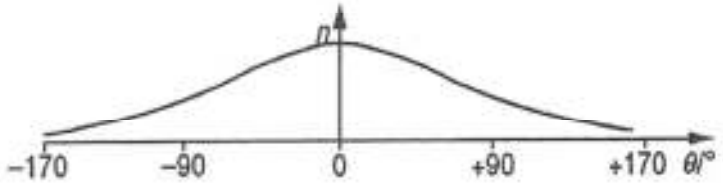
B



C



D



39 A detector is exposed to a radioactive source. Fluctuations in the count-rate are observed. What do these fluctuations indicate about radioactive decay?

A It is random.

B It is spontaneous.

C It is exponential.

D It is non-linear

40 When a nucleus of $^{238}_{92}U$ absorbs a slow neutron it subsequently emits two β-particles.

What is the resulting nucleus?

A $^{240}_{93}Np$ **B** $^{240}_{91}Pa$ **C** $^{239}_{94}Pu$ **D** $^{239}_{90}Th$

Answers

1 A	2 C	3 A	4 C	5 C	6 C	7 B	8 B	9 A	10 A
11 D	12 D	13 D	14 A	15 D	16 A	17 D	18 D	19 C	20 A
21 D	22 C	23 B	24 D	25 B	26 C	27 C	28 C	29 D	30 A
31 D	32 C	33 C	34 C	35 D	36C	37D	38 C	39 A	40 C