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CRESCENT GIRLS' SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION

5058/01
PHYSICS

PAPER 1

28 August 2013

1 hour

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces provided at the top of this page and on the optical answer sheet.

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 optical answer sheet.

Read the instructions in 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.

Unless specified in the question, you may assume the following constants:

Gravitational acceleration = 10 m/s^2

Speed of light in vacuum = $3.0 \times 10^8 \text{ m/s}$

- 1 A student has been asked to determine, as accurately as possible, the dimensions of a strand of optic fibre. The optic fibre is about 90 cm long and about 0.5 mm in diameter.

Which measuring instruments should the student use?

	<u>Length</u>	<u>Diameter</u>
A	Metre rule	vernier calipers
B	Metre rule	micrometer
C	Vernier calipers	vernier calipers
D	Vernier calipers	micrometer

- 2 A pair of vernier calipers is used to measure the thickness of a coin.

With the jaws closed and no coin, the reading on the vernier calipers is shown in diagram 1. With the jaws closed around coin, the reading on the vernier calipers is shown in diagram 2.

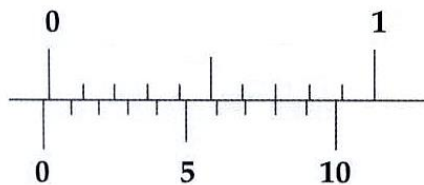


Diagram 1

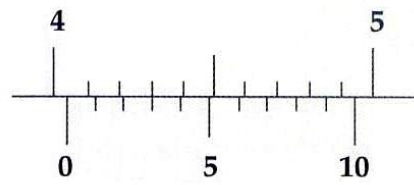


Diagram 2

What are the zero error and the actual thickness of the coin?

	<u>Zero error / cm</u>	<u>Corrected reading / cm</u>
A	- 0.02	4.05
B	- 0.08	4.11
C	0.02	4.01
D	0.08	3.95

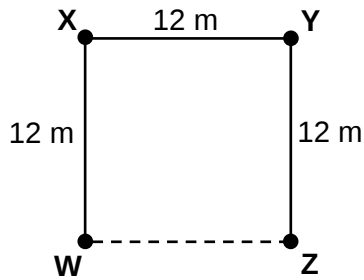
- 3 A strip of paper tape is pulled by a toy car under a vibrating arm. The arm vibrates regularly, making 50 dots per second.



The average speed of the toy car is _____.

- A 0.011 m/s
B 1.1 m/s
C 3.0 m/s
D 300 m/s

- 4 A girl takes 6.0 s to walk from point **W** to point **X**, and takes 6.0 s to walk from point **X** to point **Y**, and finally takes another 6.0 s to walk from point **Y** to point **Z** as illustrated below.



The points **WXYZ** forms a square with side 12 m. What is the magnitude of her average speed and velocity?

	<u>Average speed (m/s)</u>	<u>Average velocity (m/s)</u>
A	2.0	0.50
B	2.0	0.67
C	2.0	2.0
D	6.0	0.67

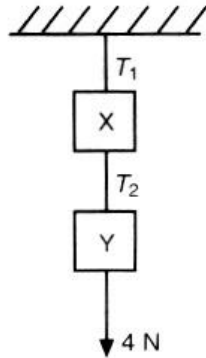
- 5 A boy who is standing at the bottom of a building throws a stone upwards to a man standing 2.0 m above the boy. If the stone is thrown up with a speed of 7.0 m/s, what is the speed of the stone at the instant when it is caught by the man? Assume that the air resistance and the height of the boy and man are negligible.

- A 3.0 m/s
- B 6.2 m/s
- C 9.0 m/s
- D 9.4 m/s

- 6 Three forces of magnitude 2.0 N, 3.0 N and 5.0 N respectively act on an object of mass 4.0 kg. Which of the following cannot be the magnitude of the acceleration of the object?

- A 0 m/s^2
- B 1.0 m/s^2
- C 2.0 m/s^2
- D 3.0 m/s^2

- 7 Two blocks **X** and **Y** of weights 10 N and 6.0 N respectively are suspended by two strings. A downward force of 4.0 N is applied to **Y**.



What are the tensions T_1 and T_2 in the two strings?

	T_1	T_2
A	8.0 N	10 N
B	10 N	4.0 N
C	14 N	6.0 N
D	20 N	10 N

- 8 Which person in the following cases has the greatest inertia?

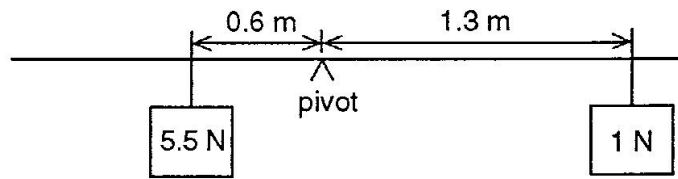
- A** A 50 kg girl sprinting at 10 m/s
- B** A 70 kg long-distance runner running at 5 m/s
- C** A 90 kg man walking at 2 m/s
- D** A 110 kg wrestler resting on a mat

- 9 The densities of metals **X** and **Y** are 7.6 g/cm^3 and 3.0 g/cm^3 respectively. Equal masses of **X** and **Y** are melted and mixed to form an alloy.

What is the density of the alloy?

- A** 1.25 g/cm^3
- B** 2.15 g/cm^3
- C** 4.30 g/cm^3
- D** 5.30 g/cm^3

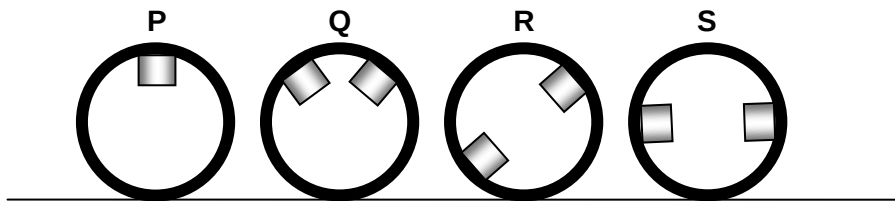
- 10 The diagram shows a light rod with two weights hanging from it.



A third weight is to be added to bring the system into equilibrium so that the rod is balanced. What weight is required and where should it be placed?

	<u>Weight</u>	<u>Position</u>
A	1.0 N	2.0 m to the left of the pivot
B	1.0 N	3.0 m to the right of the pivot
C	2.0 N	1.0 m to the left of the pivot
D	2.0 N	1.0 m to the right of the pivot

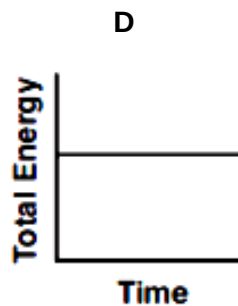
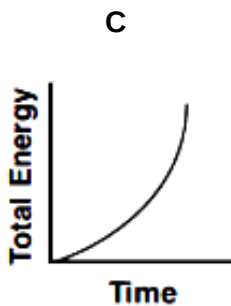
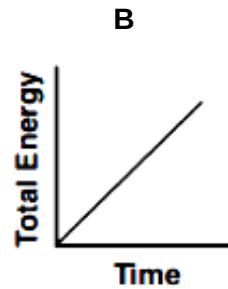
- 11 The diagram shows four hollow pipes **P**, **Q**, **R** and **S** have one or two weights attached to their inner surfaces.



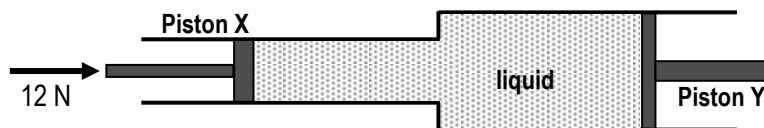
Which hollow pipes are in the state of unstable equilibrium?

- | | |
|---|-----------------|
| A | P and Q only |
| B | Q and R only |
| C | P, Q and R only |
| D | P, Q, R and S |
- 12 The engine of a car of mass 500 kg generates power of 10000 W to move the car. Find the time taken for the car to accelerate from a speed of 10 m/s to 20 m/s.
- | | |
|---|-------|
| A | 2.5 s |
| B | 5.0 s |
| C | 7.5 s |
| D | 10 s |

- 13 A ball is dropped from the top of a building. Which graph best represents the relationship between the ball's total energy and elapsed time as the ball falls to the ground? Assume air resistance is negligible.



- 14 The diagram shows a cylinder fitted with two pistons X and Y of diameters 5.0 cm and 10.0 cm respectively. The piston X is pushed by a force of 12 N.



What is the force exerted on piston Y?

- A 3.0 N
- B 6.0 N
- C 24 N
- D 48 N

- 15** Diagram 1 shows an open-ended capillary tube in horizontal position with air trapped by a small, stationary mercury plug of 12 cm in length. Diagram 2 shows the same capillary tube in an upright position. The atmospheric pressure is 75 cmHg.

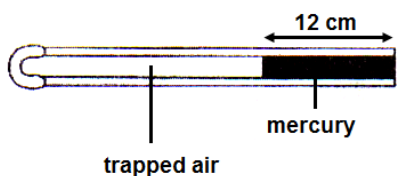


Diagram 1

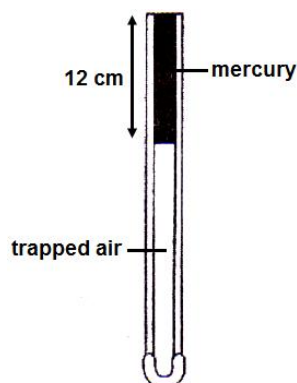
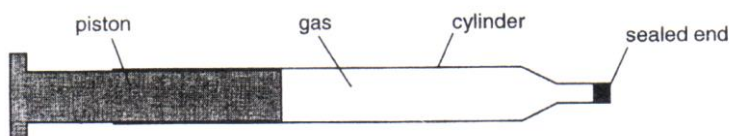


Diagram 2

What is the pressure of the trapped column of air in diagram 1 and 2?

	<u>Diagram 1</u>	<u>Diagram 2</u>
A	12 cmHg	75 cmHg
B	12 cmHg	87 cmHg
C	75 cmHg	63 cmHg
D	75 cmHg	87 cmHg

- 16** The syringe in the diagram contains air at atmospheric pressure. The piston moves freely along the cylinder without any friction. When the syringe is heated from 40 °C to 100 °C, the piston moves outwards. When the temperature becomes steady, the piston stops moving.



State how the value of each of quantities below compares at 100 °C, after the piston stops, with its value at 40 °C.

	<u>Average speed of gas molecules</u>	<u>Frequency of collisions between the gas molecules and the piston</u>
A	Increases	Increases
B	Increases	Decreases
C	Increase	No change
D	No change	No change

17 When an object is being heated, which of the following statements is/are **correct**?

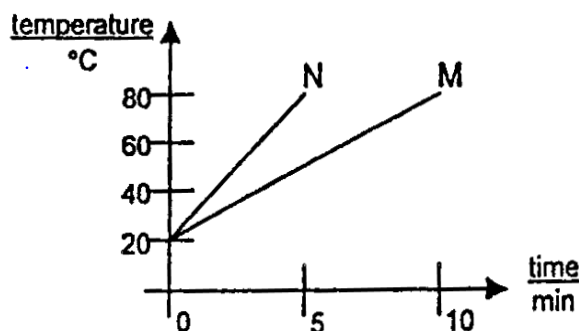
- I. Its temperature always increases.
- II. Its internal energy always increases.
- III. Its kinetic energy and potential energy cannot rise at the same time.

- A II only
- B I and II only
- C II and III only
- D All of the above

18 A faulty thermometer reads 10°C and 90°C when placed in melting ice and steam respectively. If this thermometer is uniformly graduated, find the true temperature if the thermometer reads 40°C .

- A 27.5°C
- B 32.0°C
- C 37.5°C
- D 42.0°C

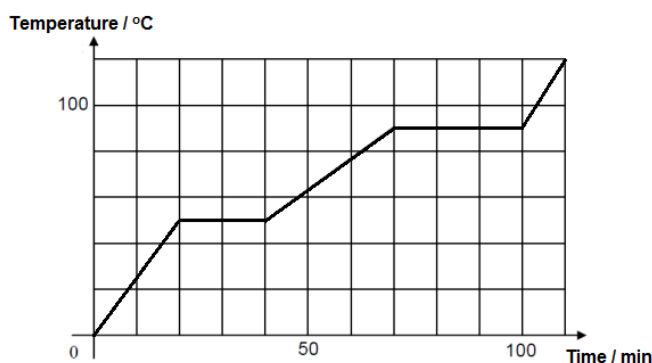
19 The ratio of the masses of two metal blocks **M** and **N** are $2 : 1$. They are both heated uniformly using identical heaters. The temperature-time graphs of the blocks are shown below.



What is the ratio of the specific heat capacities of **M** to **N**?

- A $1 : 1$
- B $1 : 4$
- C $2 : 1$
- D $4 : 1$

20 The graph shows the change in temperature when heat is supplied at 200 W to 1 kg of the substance.



The specific latent heat of vaporisation of the substance is _____ J/kg .

- A 4000
- B 6000
- C 240000
- D 360000

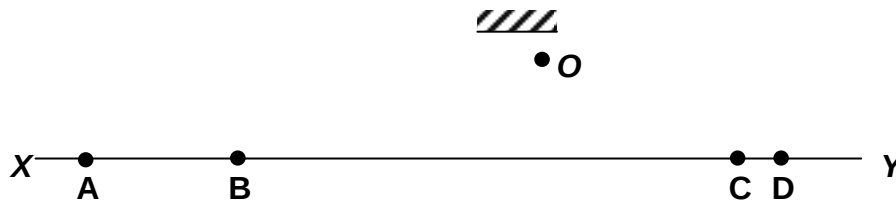
21 Which statement about the process of evaporation is not correct?

- A A moist atmosphere decreases the rate of evaporation from a water surface.
- B Evaporation can cause cooling.
- C Liquids with lower boiling points evaporate more easily.
- D The rate of evaporation increases with increased pressure.

22 In the process of convection, energy is transferred _____.

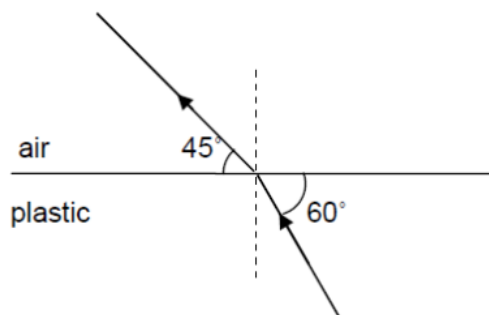
- A because of density differences in a fluid
- B because of temperature differences in a solid
- C by the diffusion of molecules through a fluid
- D by the vibration of molecules about a mean position

23 An object **O** is placed in front of the mirror as shown in the diagram. Mary moves along the line **XY** to observe the image of **O**.



At which point **A**, **B**, **C** or **D** on line **XY** can the image of **O** be seen?

24 The diagram shows a ray of light travelling from plastic to air.

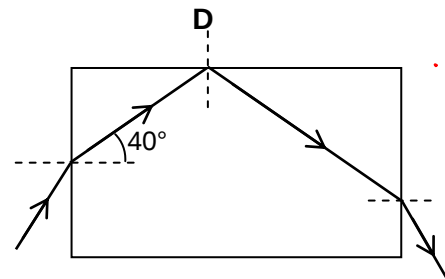
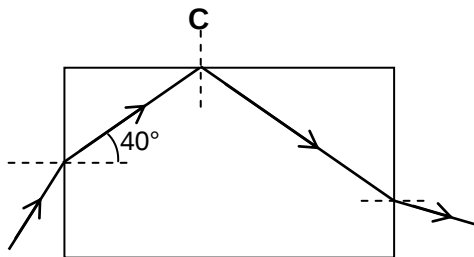
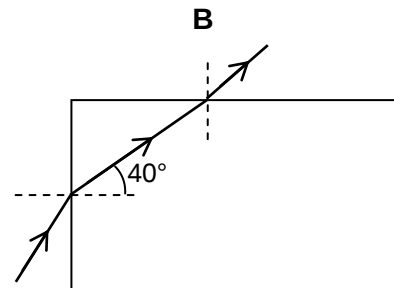
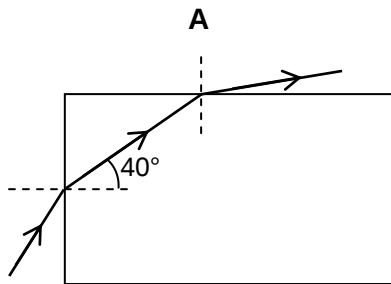


What is the refractive index of the plastic?

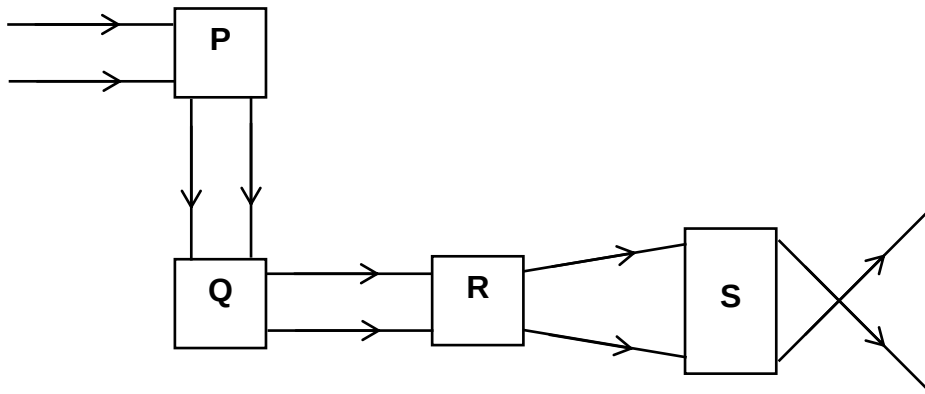
- A 0.707
- B 0.816
- C 1.22
- D 1.41

- 25** A ray of light is incident on one side of a rectangular glass block. The angle of refraction is 40° in the glass. The critical angle for glass is 42° .

Which diagram correctly shows the path of this ray?



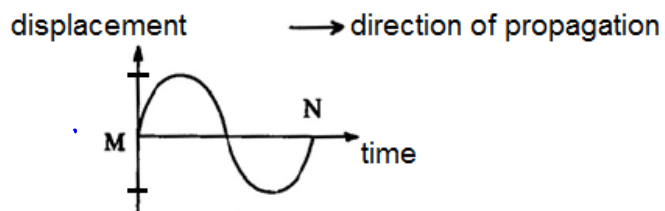
- 26** A beam of light passes through four optical devices **P**, **Q**, **R** and **S** as shown in the diagram.



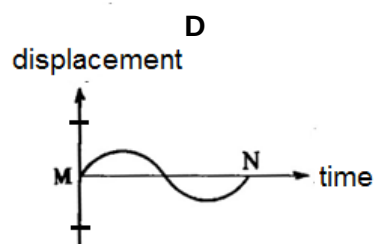
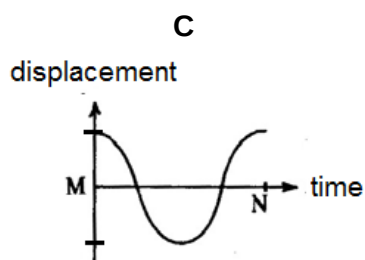
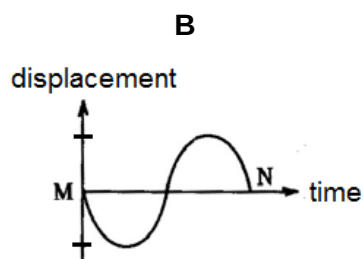
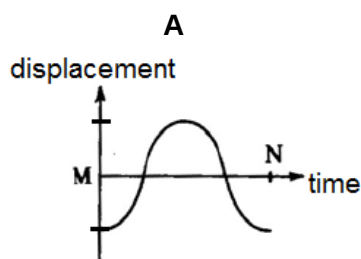
Which combination of mirrors and lenses is **correct**?

	P	Q	R	S
A	Plane mirror	Plane mirror	Converging lens	Diverging lens
B	Converging lens	Diverging lens	Plane mirror	Plane mirror
C	Diverging lens	Converging lens	Plane mirror	Plane mirror
D	Plane mirror	Plane mirror	Diverging lens	Converging lens

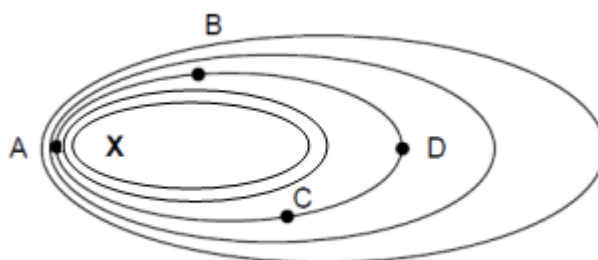
- 27 A wave is travelling along the positive x -axis. The displacement–time graph shows the waveform at a certain instant.



Which diagram correctly shows the displacement–time graph of the wave between **MN** after one quarter of the period?



- 28 Waves travel more slowly on the surface of water when the water is shallow. A girl makes an oscillatory motion by dipping her finger up and down into a pool at **X**. The diagram shows the wavefronts on the surface of the pool.



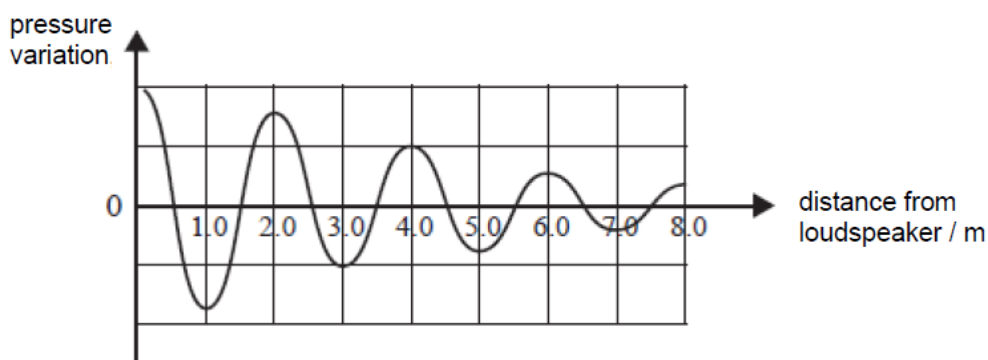
Which region of the pool is likely to be most shallow?

29 Which of the following electromagnetic radiation are able to ionise the gases?

(I) X-rays (II) Microwaves (III) γ -rays

- A (I) and (II) only
 B (I) and (III) only
 C (II) and (III) only
 D (I), (II) and (III)

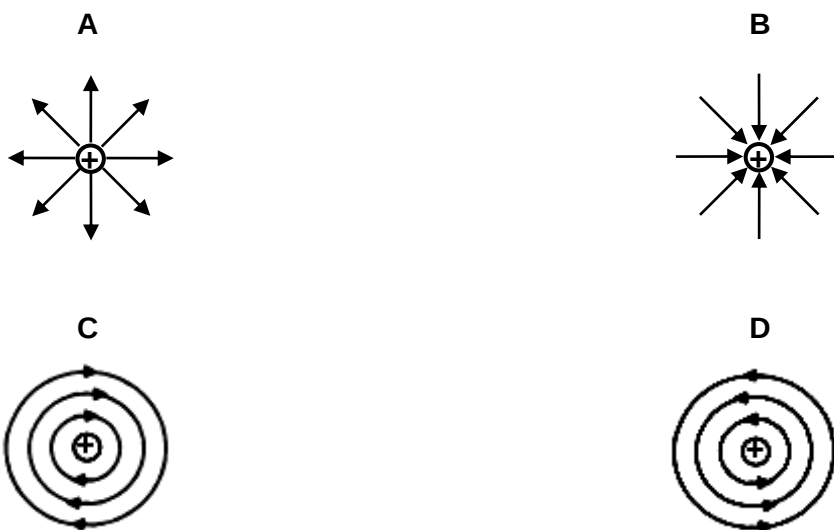
30 A loudspeaker is emitting sound of a fixed intensity which travels equally in all directions. The graph shows the pressure variation plotted against distance from the loudspeaker, at a particular instant of time. Take the speed of sound to be 333 m/s.



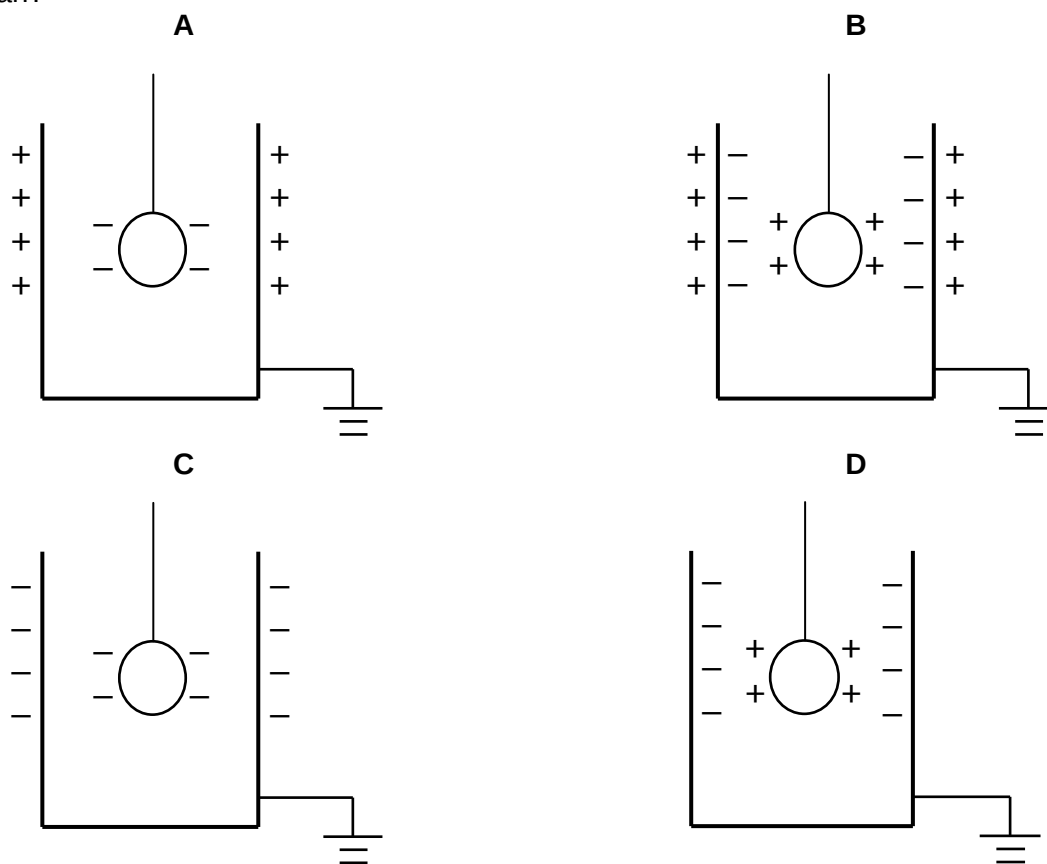
The frequency of the sound emitted is _____.

- A 111 Hz
 B 133 Hz
 C 167 Hz
 D 333 Hz

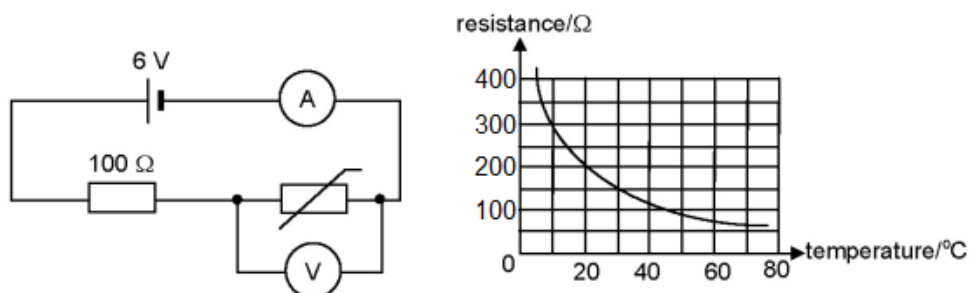
31 Which diagram correctly illustrates the electric field around a positive point charge?



- 32** A charged sphere is suspended by an insulating thread inside a metal can. The outside of the can is earthed. Which diagram shows the resulting charges on the sphere and on the can?



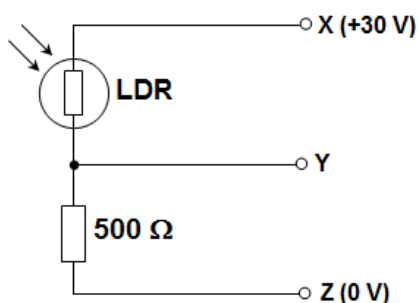
- 33** The thermistor in the circuit below has the resistance–temperature graph as shown.



What are the readings on the ammeter and voltmeter when the temperature of the thermistor is 30 $^{\circ}\text{C}$?

	Ammeter reading / A	Voltmeter reading / V
A	0.020	4.0
B	0.024	3.6
C	0.040	4.0
D	0.040	6.0

- 34** A potential divider which consists of a light dependent resistor (LDR) and a $500\ \Omega$ resistor are connected across the **X** and **Z** terminals with a potential difference of 30 V as shown in the diagram.

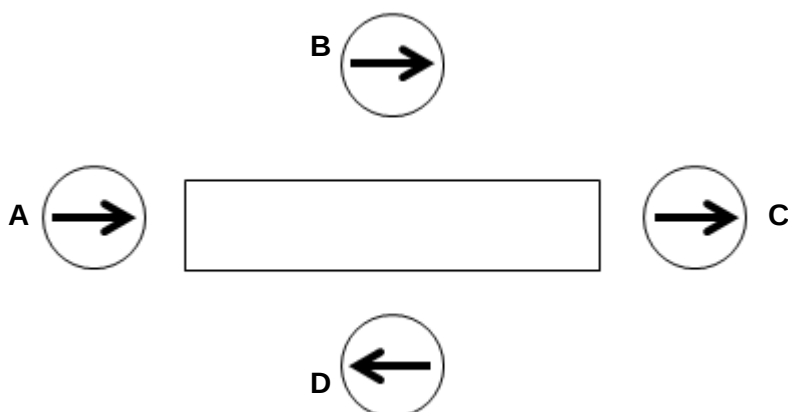


The resistance of the LDR is $1000\ \Omega$ in the dark but drops to $100\ \Omega$ in bright light. What is the corresponding change in electrical potential at **Y**?

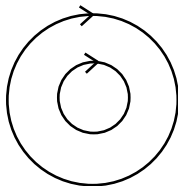
- A** It rises from 5 V to 20 V.
 - B** It rises from 10 V to 25 V.
 - C** It drops from 20 V to 5 V.
 - D** It drops from 25 V to 10 V.
- 35** If the cost of 1 kWh of electricity is 30 cents, what is the total cost of operating the following electrical appliances for 3 hours?

Electrical appliance	Rating
Television	235 W
Air-conditioner	2.75 kW
Lamps	100 W

- A** \$2.78
 - B** \$5.49
 - C** \$30.85
 - D** \$303.98
- 36** Four magnetic compasses are placed around a permanent bar magnet. Which compass needle is pointing in the wrong direction?

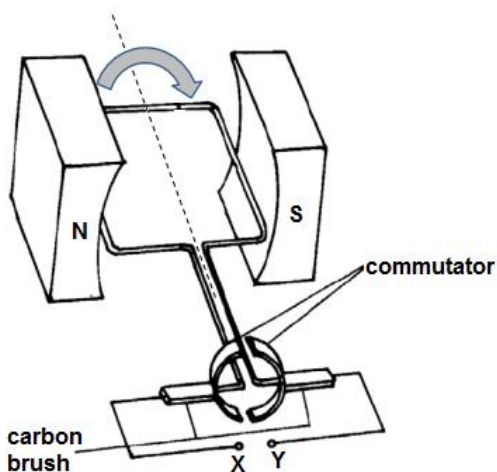


- 37 A small coil of wire lies inside a larger coil of wire on the same plane. Both coils carry the same amount of current flowing in a clockwise direction as shown below.



Which statement about the larger coil is true?

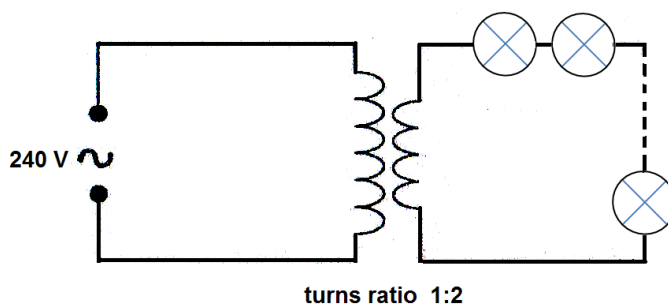
- A It will be stretched outwards
 - B It will be compressed inwards
 - C It experiences a torque about the horizontal axis
 - D It experiences a downward force along the plane of the coil
- 38 The diagram shows a simple generator.



If the coil is made to rotate in a clockwise direction, which of the following statements are true?

- I. The e.m.f. across **XY** will reach its maximum value when the plane of the coil is horizontal.
 - II. **Y** will be the negative terminal of the output.
 - III. It will be harder to turn the coil if a lamp is connected to the X and Y terminals.
- A I and II only
 - B II and III only
 - C I and III only
 - D I, II and III

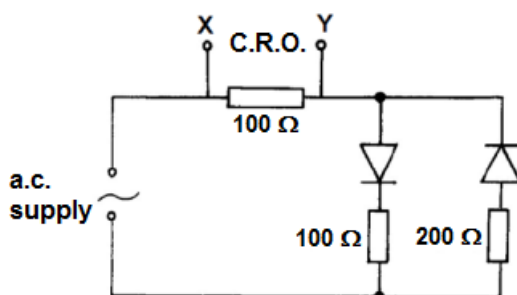
- 39 The diagram shows many small identical light bulbs connected to an ideal transformer of turns ratio 1:2. The bulbs are rated at 2 V, 2 W.



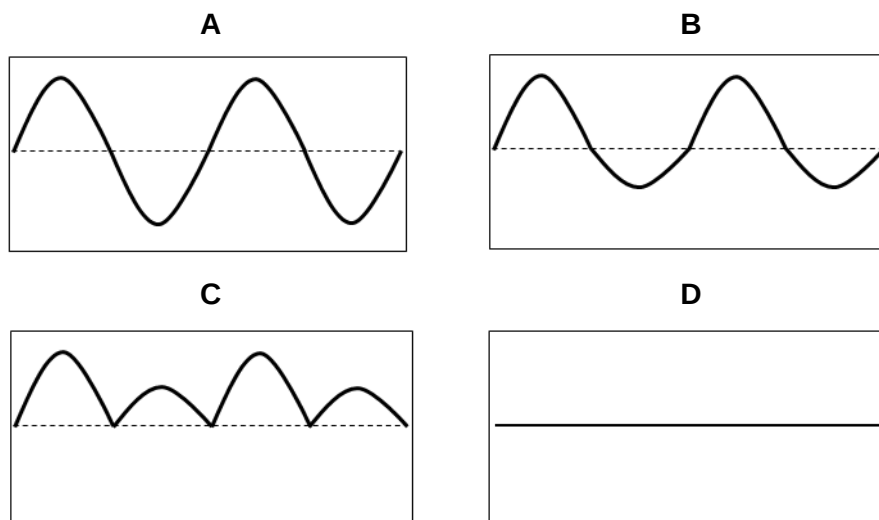
To operate the bulbs at normal brightness, how many bulbs can be connected to the secondary side of the transformer and what is primary current?

	<u>No. of bulbs</u>	<u>Primary current</u>
A	60	0.50 A
B	60	2.0 A
C	240	0.50 A
D	240	2.0 A

- 40 In the circuit below, X and Y are connected to a cathode ray oscilloscope.



Which voltage–time graph correctly shows the trace obtained on the screen of the C.R.O.?



– End of Paper –