NEW TOWN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
Secondary 4 Express

NAME			
CLASS		**INDEX NO.**	

PHYSICS 6091 [Revised]/01

Paper 1

23 Aug 2024

1 hour

0800 – 0900

Additional Materials: Multiple Choice Answer Sheet (OTAS)

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces at the top of the page.
Write in dark blue or black pen.
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 (OTAS).

Read the instructions on the Answer Sheet (OTAS) 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.
The use of an approved scientific calculator is expected, where appropriate.

Take the value of the gravitational field strength (g) on Earth to be 10 N/kg.

For Examiner's Use	
Total	**/ 40**

1 Which row shows the approximate diameter of an atom and the average diameter of the Earth?

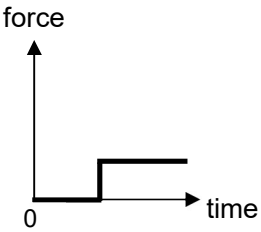
	diameter of an atom	diameter of the Earth
A	0.5 μm	10 Mm
B	0.5 μm	10 Gm
C	0.5 nm	10 Mm
D	0.5 nm	10 Gm

2 A student is given a wire of diameter less than 0.2 mm. Its length is approximately 18 cm. He is tasked to find the volume of the wire.

Which pair of instruments would be most suitable for finding the volume of the wire?

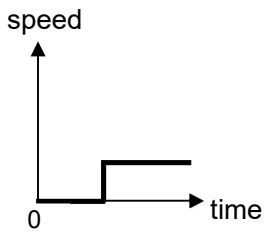
A electronic balance and micrometer
B metre rule and micrometer
C metre rule and vernier calipers
D micrometer and vernier calipers

3 A car driver presses the accelerator sharply when the traffic lights turn green.
The force applied on the car varies with time as shown in the graph below.



Which graph shows the variation with time of the car's speed?

A



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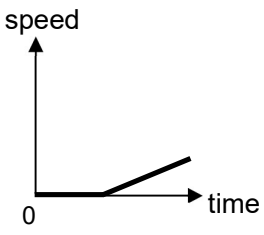

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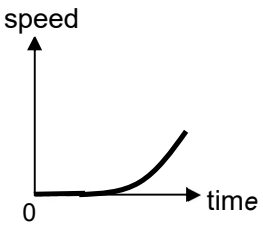
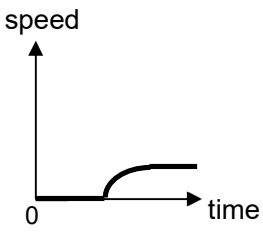


D



4 A bowling ball and a feather are dropped from the top of a high building. They are released at the same time. The bowling ball reaches the ground first.

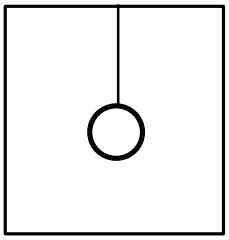
Which statement explains this?

A The acceleration of free-fall is greater for the bowling ball as compared to the feather.
B The bowling ball reaches a greater speed before the air resistance acting on it balances its weight.
C The gravitational field causes the feather to accelerate slower than the bowling ball.
D There is a smaller force of air resistance on the feather.

5 Which moving body has a resultant force acting on it?

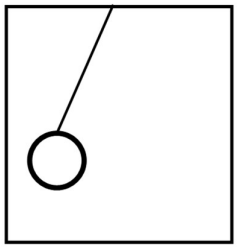
A a diver rising vertically through water at constant speed
B a parachutist descending vertically at terminal velocity
C a train going up a straight incline at constant speed
D an aircraft circling an airport at constant speed

6 Ahmad hung a ball to the ceiling of his car using a thin thread.
The figure shows the ball when the car is at rest.

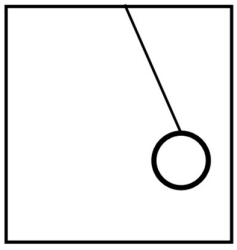


What is the position of the ball when his car starts moving to the right?

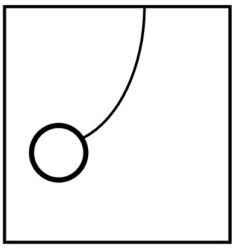
A



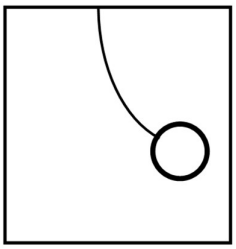
B



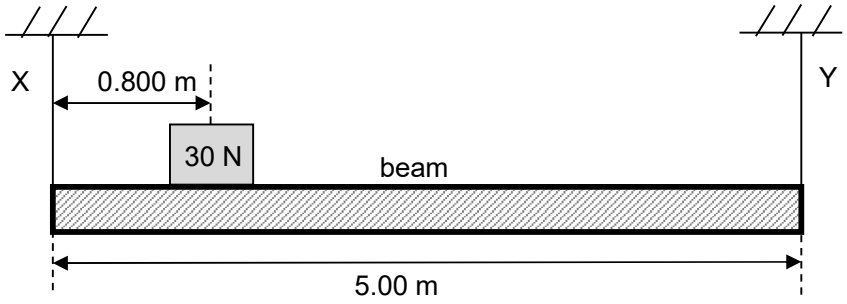
C



D



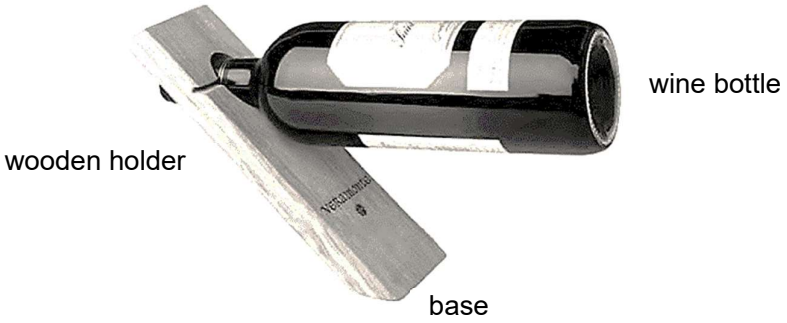
7 A uniform beam of 5.00 m has a weight of 140 N, is hung by two ropes at its ends. A wooden block of mass of 30.0 N is placed on the beam at 0.800 m from rope X.



What is the tension in each rope?

	tension in rope X/ N	tension in rope Y/ N
A	4.8	25.2
B	25.2	4.8
C	74.8	95.2
D	95.2	74.8

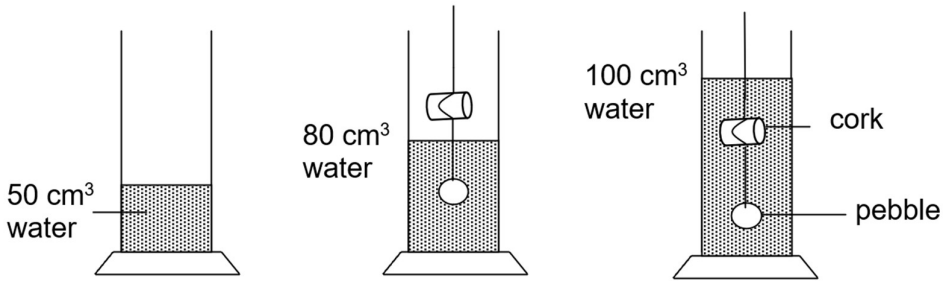
8 The diagram below shows a wine bottle placed in a wooden holder. The bottle and the holder are in equilibrium.



Which of the following statements is true about the set-up?

A The centre of gravity of the bottle is directly above the base of the wooden holder.
B The centre of gravity of the bottle and that of the wooden holder are at the same point.
C The centre of gravity of the wooden holder is directly above the base of the wooden holder.
D The centre of gravity of the bottle and the wooden holder is directly above the base of the wooden holder.

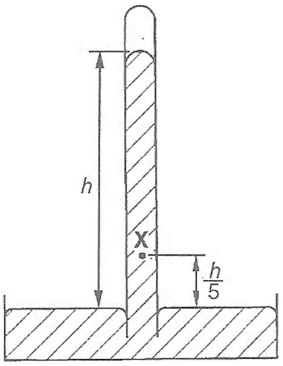
9 A student has to find the density of a cork by using a measuring cylinder.
The volume reading at each stage is shown in the figures below.
The mass of the pebble and the cork are 98.0 g and 4.00 g respectively.



What is the density of the cork?

A 0.0400 g/cm³ **B** 0.0800 g/cm³ **C** 0.100 g/cm³ **D** 0.200 g/cm³

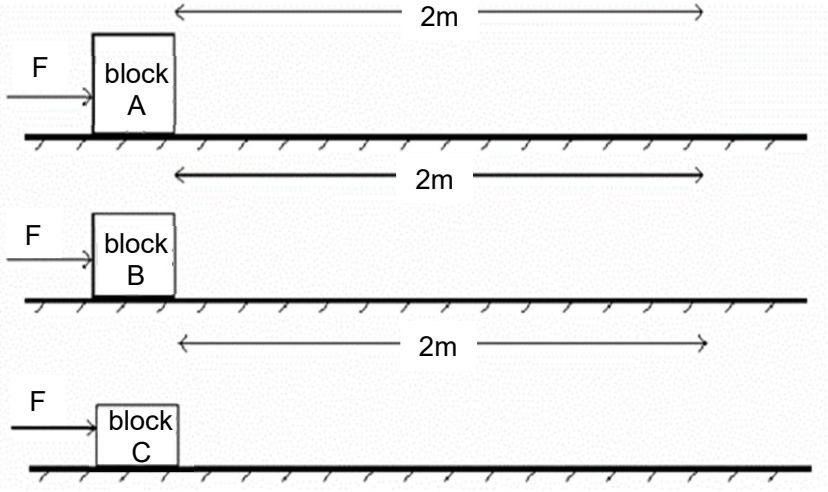
10 The height of a mercury barometer is *h* when the atmospheric pressure is 100 000 Pa.



What is the pressure at **X**?

A 20 000 Pa
B 80 000 Pa
C 120 000 Pa
D 180 000 Pa

11 Three blocks A, B, and C are each pushed by equal forces, F, across a smooth horizontal floor for a distance of 2 m.

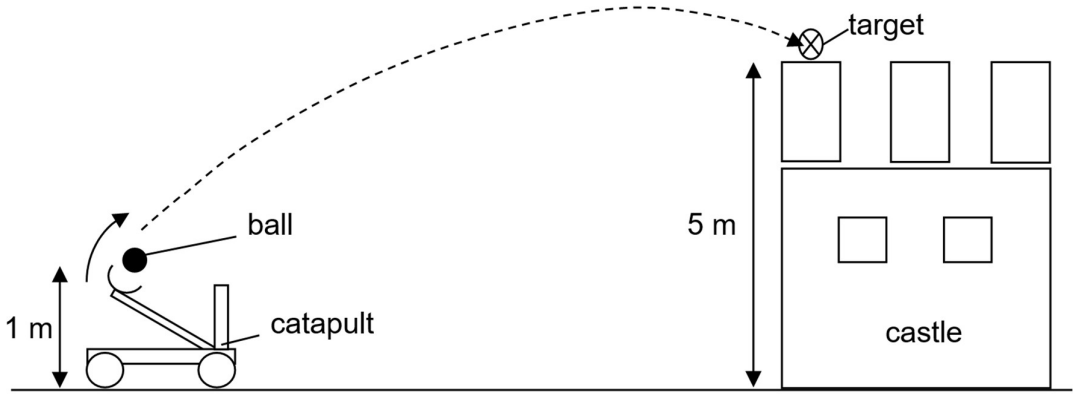


The mass of block A is greater than block B, and the mass of block B is greater than block C.

Which block would have the greatest amount of kinetic energy at the end of the 2 m push?

A Block A
B Block B
C Block C
D All blocks will have the same kinetic energy

12 A catapult launches a 3 kg ball into a castle. The ball leaves the catapult at a height of 1m and with a speed of 15 m/s. A target is placed 5 m at the top of the castle.



What is the speed of the ball when it hits the target? Assume there is no air resistance.

A 9.80 m/s
B 11.1 m/s
C 12.0 m/s
D 13.0 m/s

13 In a Brownian motion experiment, tiny smoke particles are observed to move in an uneven zig-zag manner.

What is the reason for this?

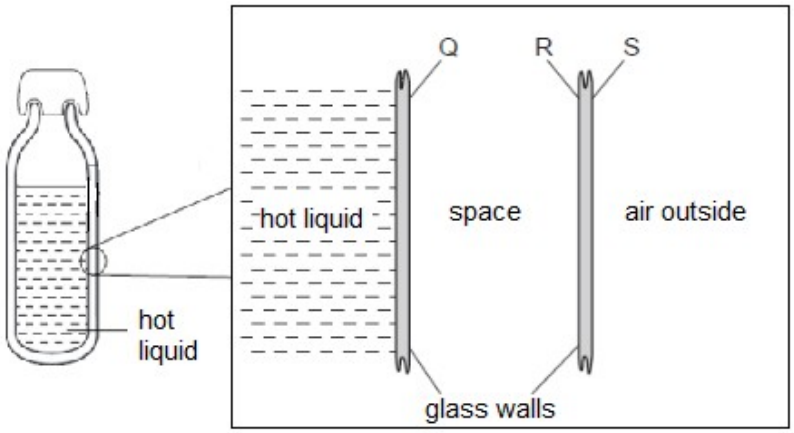
A Air molecules bombard the smoke particles randomly.
B The average internal energy of the air molecules is changing.
C The smoke particles are too light.
D There is convection current in the air.

14 A fixed shaped sealed container filled with gas is heated.

Which property of the gas must also increase?

A average force of particles acting on container walls
B density of gas
C distance between gas particles
D number of gas particles in container

15 A double-walled glass vessel is shown below.



How should surfaces Q, R and S be painted to minimize heat lost by hot liquid through radiation?

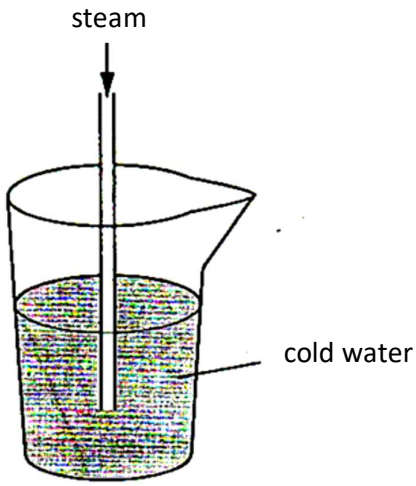
	Q	R	S
A	silver	black	black
B	black	black	black
C	silver	silver	silver
D	black	black	silver

16 Two liquids at the same temperature, alcohol and water, are spilt on the hand.
The hand with alcohol feels colder because alcohol

A evaporates more readily than water.
B has a higher boiling point than water.
C has a higher specific latent heat of vaporisation than water.
D is a worse conductor of heat than water.

17 The figure shows steam passing into a jug to warm up some cold water.
40.0 g of pure steam enters at 100 °C into the jug of water.
Eventually, the water in the jug reaches a temperature of 90.0 °C.

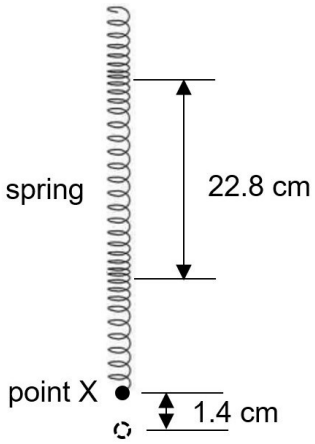
The specific heat capacity of water is 4.20 J/(g °C) and the specific latent heat of vaporization of water is 2250 J/g. You can ignore any heat loss to the atmosphere and the jug.



What is the total energy lost by steam in condensing to water at 100 °C and decreasing its temperature to 90.0 °C?

A 1680 J
B 91700 J
C 105000 J
D 107000 J

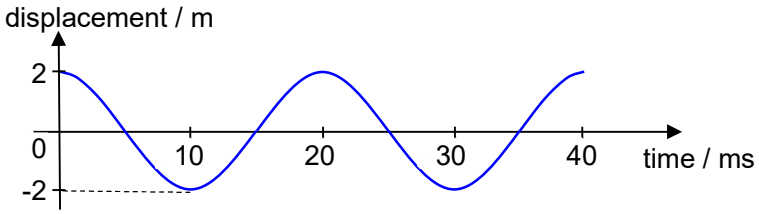
18 The diagram shows a spring oscillating vertically.
Point X at the end of the spring is oscillating between two vertical points 1.4 cm apart.



Which row describes the wave?

	amplitude / cm	wavelength / cm
A	0.7	11.4
B	0.7	22.8
C	1.4	11.4
D	1.4	22.8

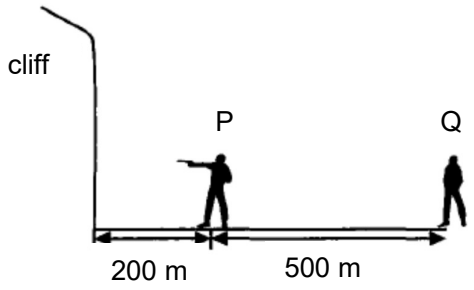
19 The diagram shows the displacement of a particle caused by a progressive wave traveling at a speed of 5.0 m/s.



What is the frequency of the vibration of the particle?

A 0.25 Hz
B 50 Hz
C 100 Hz
D 250 Hz

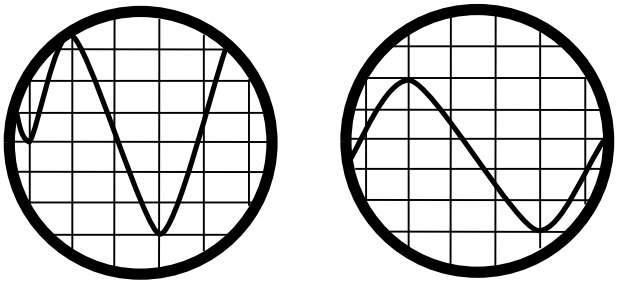
20 Two persons **P** and **Q** stood in front of a vertical cliff.
When **P** fired a pistol, **Q** heard two sounds.



What is the time interval between the two sounds if the speed of sound in air is 340 m/s?

A 0.59 s
B 1.18 s
C 1.47 s
D 2.05 s

21 The waveforms of two musical notes X and Y are shown on an electronic screen.
The y-axis denotes the amplitude of the note while the x-axis displays the time.



note X note Y

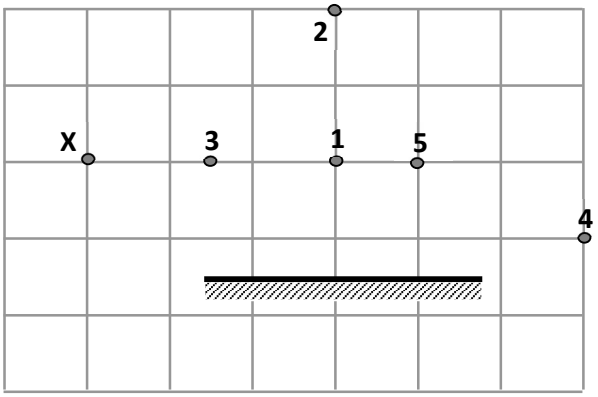
Which statement is correct?

A X has a higher pitch and is louder than Y.
B X has a higher pitch and is softer than Y.
C X has a lower pitch and is louder than Y.
D X has a lower pitch and is softer than Y.

22 Which of the following shows electromagnetic waves in order of increasing frequency?

A blue light, yellow light, X-rays, gamma rays
B microwaves, infra-red radiation, green light, red light
C radio waves, orange light, indigo light, ultra-violet waves
D X-rays, red light, infra-red radiation, microwaves

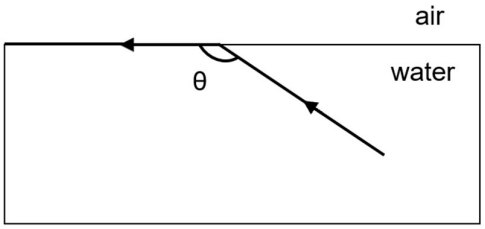
23 A person stands at a point **X** as shown.



Which images of the pins (**1**, **2**, **3**, **4**, **5**) will the person be able to see in the mirror?

A pins **1** and **2** only
B pins **3** and **4** only
C pins **1**, **4** and **5** only
D all the pins

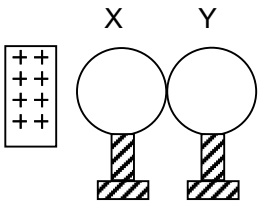
24 The diagram shows the path of a ray of light as it strikes the water-to-air boundary.



If the speed of the light in the water is 2.3×10^8 m/s and its speed in air is 3.0×10^8 m/s, determine the angle θ.

A 100 °
B 120 °
C 130 °
D 140 °

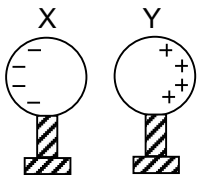
25 Two insulated brass spheres X and Y are placed together so that they touch one another.
A positively charged glass rod is brought near to the left side of X.



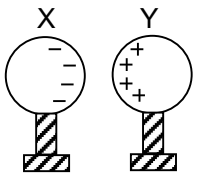
The two spheres are then separated slightly apart with the glass rod still in position.
The glass rod is then moved away from X.

Which of the diagram shows the spheres at the end of the experiment?

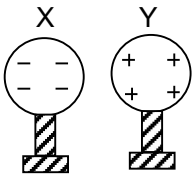
A



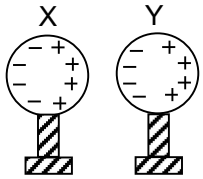
B



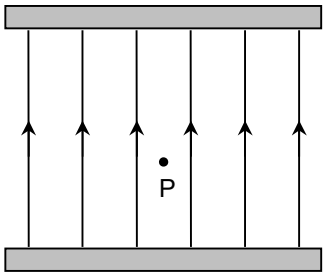
C



D



26 The figure shows a uniform electric field between two metal plates.
Describe the movement of the electron at P.



A downwards
B to the left
C to the right
D upwards

27 A 15.0 V cell is connected in series to a lamp labelled 15.0 V, 45.0 W.
The lamp shines at normal brightness for 20 hours.
What is the size of the charge that passes through the lamp at this time?

A 60 C **B** 3600 C **C** 216000 C **D** 1080000 C

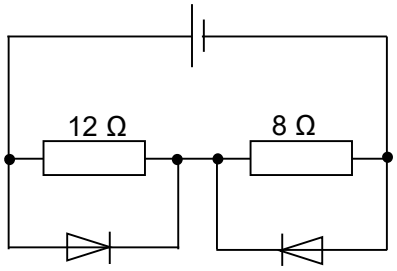
28 Wires X and Y, made of the same material, have dimensions as shown.

wire	diameter	length
X	*d*	*l*
Y	*2d*	*2l*

What is the ratio of the resistance of wire X to wire Y?

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

29 The diagram below shows an electrical circuit consisting of a battery connected in series with two resistors.
Each resistor has a diode, of negligible resistance, connected in parallel to it and acts as a current by-pass.

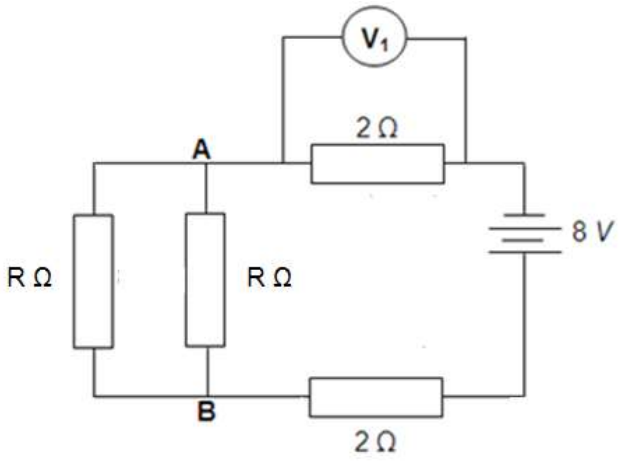


What is the effective resistance of the electrical circuit?

A 8 Ω
B 12 Ω
C 20 Ω
D infinite

30 The circuit below consists of a battery of e.m.f. of 8.0 V, four resistors and a voltmeter.

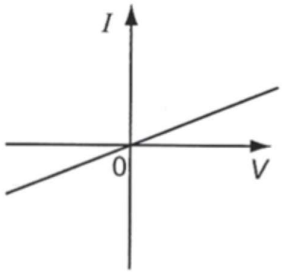
Voltmeter V_1 gives a reading of 2.0 V.



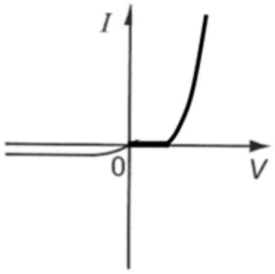
What is the potential difference across AB?

A 1.0 V **B** 1.5 V **C** 2.0 V **D** 4.0 V

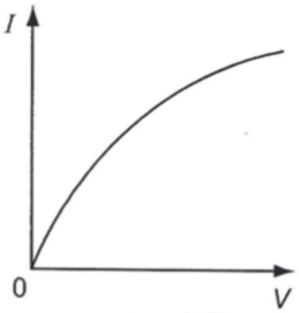
31 The three graphs X, Y and Z show the I-V characteristics for three different components.



graph X



graph Y

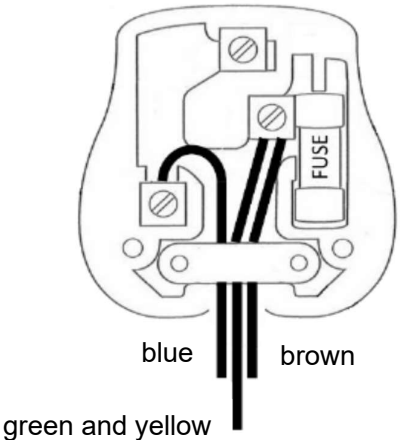


graph Z

Which components do the graphs represent?

	graph X	graph Y	graph Z
A	diode	filament lamp	metallic conductor
B	filament lamp	diode	metallic conductor
C	metallic conductor	diode	filament lamp
D	metallic conductor	filament lamp	diode

32 The plug of the toaster is wrongly wired as shown.



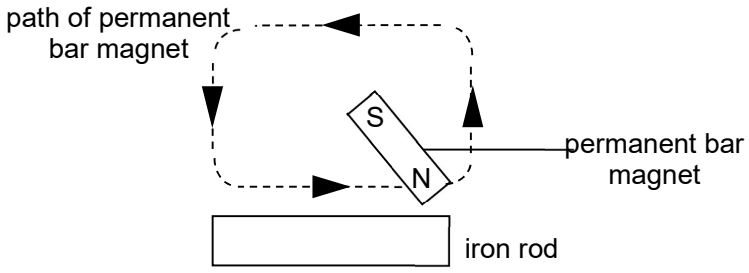
What will happen when the plug is used as shown?

A The fuse in the plug melts.
B The toaster continues to work.
C The toaster continues to work but the casing becomes live.
D The toaster does not work.

33 Many house-hold hair-dryers have no earth wire. Why is this so?

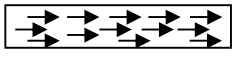
A The casing of the hair-dryer is made of plastic material.
B The current is small.
C The fan prevents the heating coil from becoming too hot.
D The plug is installed with a fuse.

34 The diagram below shows an iron rod being stroked by a permanent bar magnet.

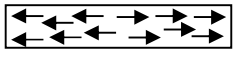


Which of the following shows the magnetic domains inside the iron rod after being stroked many times by the permanent bar magnet?

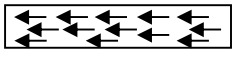
A



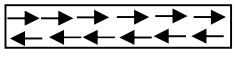
B



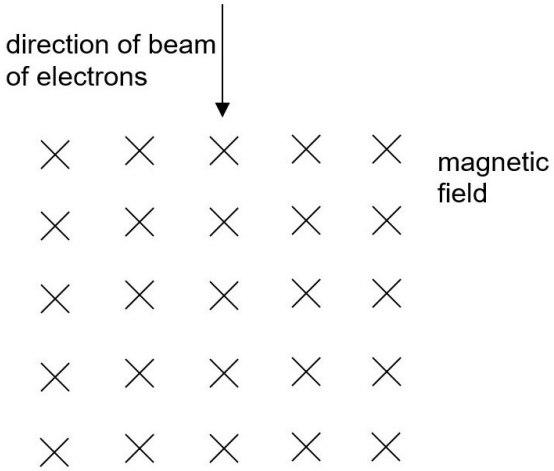
C



D



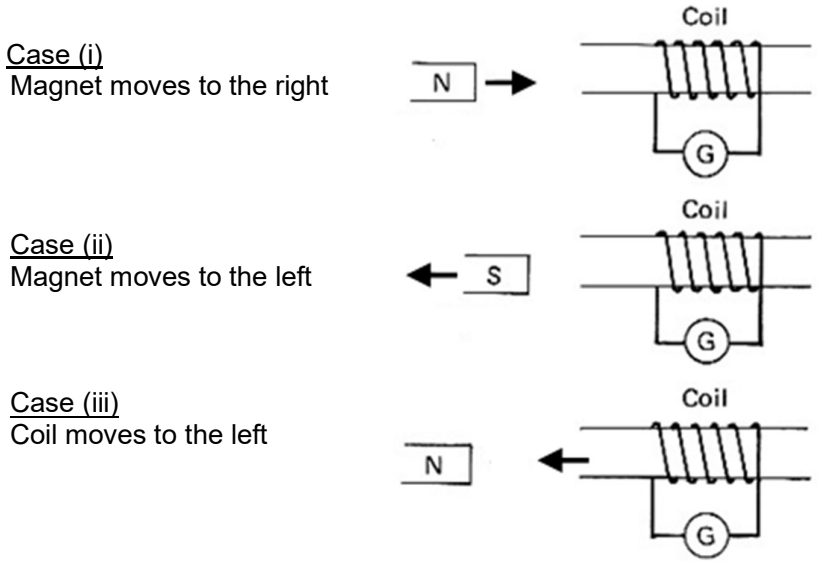
35 The diagram shows a beam of electrons entering a magnetic field.



Which of the following describes the movement of the electrons as it enters the magnetic field?

A The electrons are deflected into the paper.
B The electrons are deflected out of the paper.
C The electrons are deflected to the left.
D The electrons are deflected to the right.

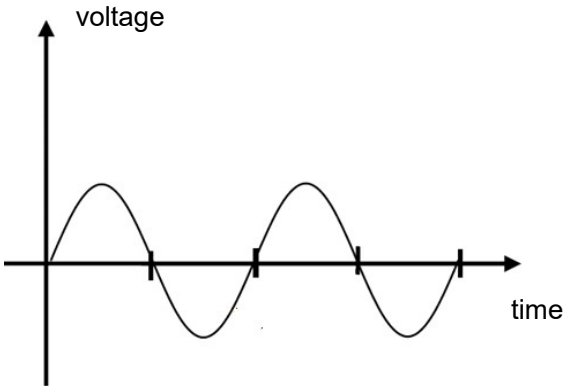
36 In the three set-ups below, arrow heads indicate direction of motion.



In which case does/do the induced current have the same direction?

A (i) and (ii) only
B (i) and (iii) only
C (ii) and (iii) only
D (i), (ii) and (iii)

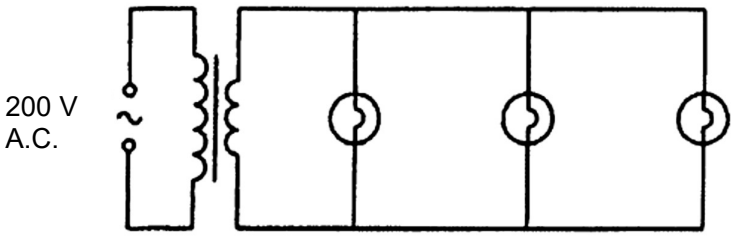
37 An a.c generator produces an output voltage as shown in the diagram.



Which of the following best describes the changes if the generator is turned twice as fast?

	output voltage	period
A	doubles	doubles
B	halves	doubles
C	unchanged	halves
D	doubles	halves

38 A transformer as shown below is 60% efficient.
Each light bulb is “12V 24W” and is working at the rated value.

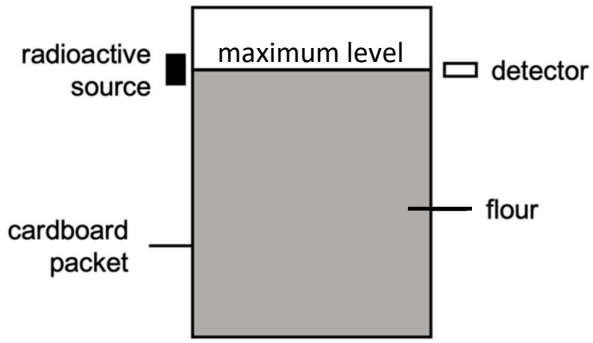


What is the primary current in the circuit?

A 0.36 A **B** 0.45 A **C** 0.60 A **D** 0.80 A

39 A factory produces packets of flour. The following shows an arrangement that is used to check that the flour inside a cardboard packet is not above the maximum level, else the flour will overflow.

If the flour is above this maximum level, the flour will absorb the radiation from the source so that the radiation does not reach the detector.



Which type of radiation is suitable for use?

A alpha-particles only
B beta-particles only
C gamma-rays only
D either alpha-particles or beta-particles

40 Astatine is a radioactive substance. It has a nucleon number of 218 and a proton number of 85. It forms a polonium nucleus when it decays, emitting an α-particle and a β-particle.

What are the nucleon number and the proton number of the polonium nucleus?

	nucleon Number	proton Number
A	214	84
B	214	83
C	216	83
D	215	82

END OF PAPER