



Paya Lebar Methodist Girls' School (Secondary)

Preliminary Examination 2024 Secondary 4 Express / G3

CANDIDATE NAME		CLASS		CLASS INDEX NUMBER	
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CENTRE
NUMBER

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INDEX NUMBER

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PHYSICS

6091/01

Paper 1 Multiple Choice

27 August 2024

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Write your name, class, class index number on the separate Answer Sheet.

Do not use staples, paper clips, glue or correction fluid.

There are **forty** 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 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.

1 What is the typical size for a small atom?

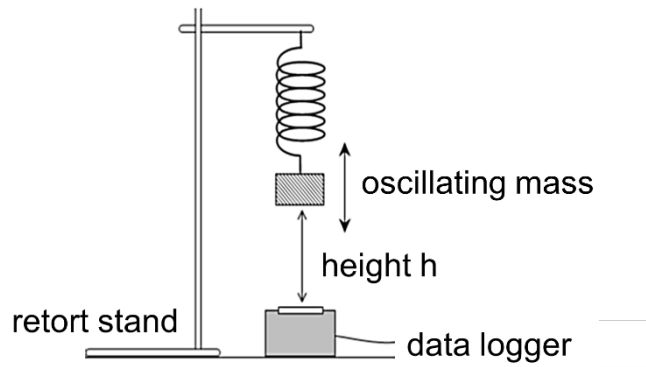
A 0.1 km

B 0.1 cm

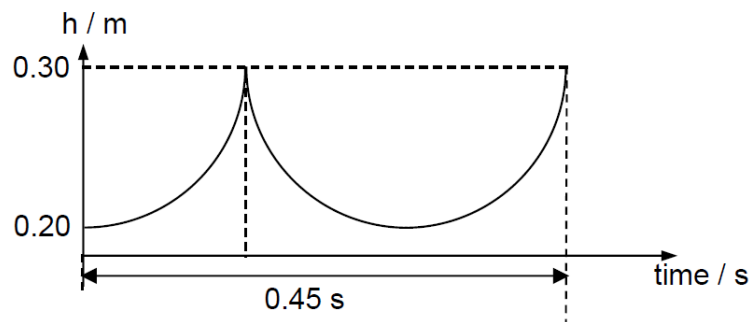
C 0.1 μm

D 0.1 nm

2 The height, h , of an oscillating mass is measured by a data logger.



A graph of height, h , against time is shown below.



What is the period of the oscillation?

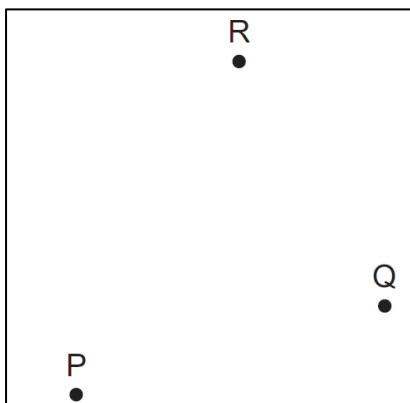
A 0.15 s

B 0.30 s

C 0.45 s

D 0.60 s

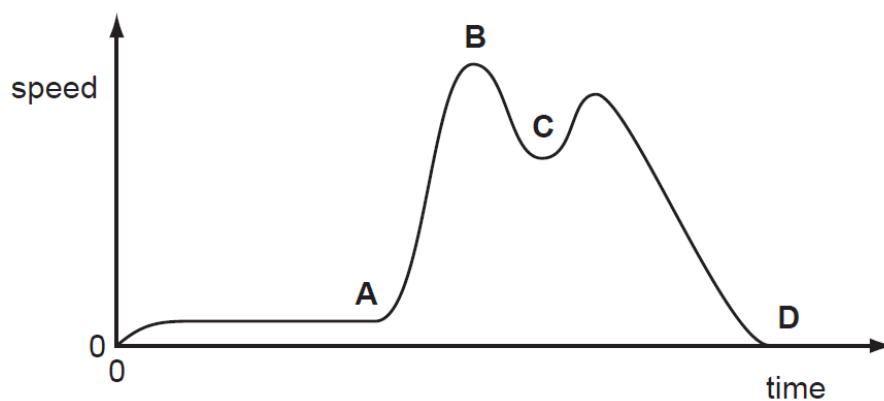
- 3 One object moves directly from P to R.



In a shorter time, a second object moves from P to Q to R.

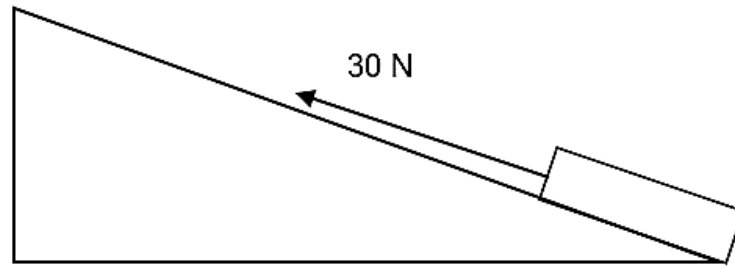
Which statement about the two objects must be correct for the journey from P to R?

- A They have the same average speed.
 - B They have the same average velocity.
 - C They have the same displacement.
 - D They travel the same distance.
- 4 A cyclist travels along a hilly road without using the pedals or brakes. Air resistance and friction are negligible. The speed-time graph of the cyclist is shown.



At which point did he reach the bottom of the first hill?

- 5 When a constant force of 30 N is applied on an object of mass 3.0 kg, the block moves up a rough slope at constant speed.



Which statement about the value of the frictional force on the object is true?

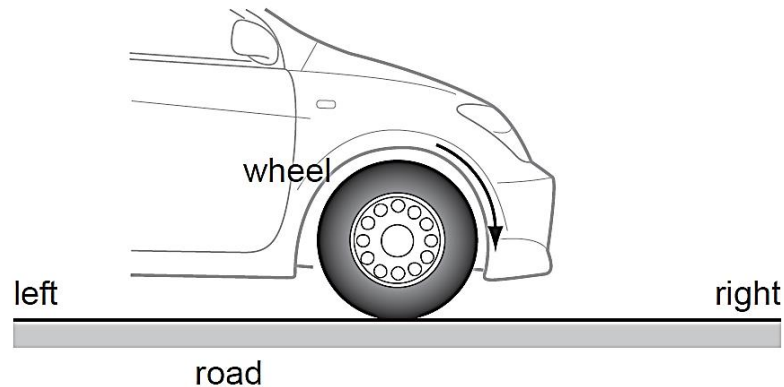
- A It is 0 N.
 - B It is less than 30 N.
 - C It is 30 N.
 - D It is more than 30 N.
- 6 The table below shows the volume and density of water and alcohol respectively.

liquid	volume / m ³	density / kg m ⁻³
water	1.5	1000
alcohol	0.5	800

Water is mixed with alcohol. The total volume of the mixture is 2.0 m³.
What is the density of the mixture?

- A 850 kg/m³
- B 900 kg/m³
- C 940 kg/m³
- D 950 kg/m³

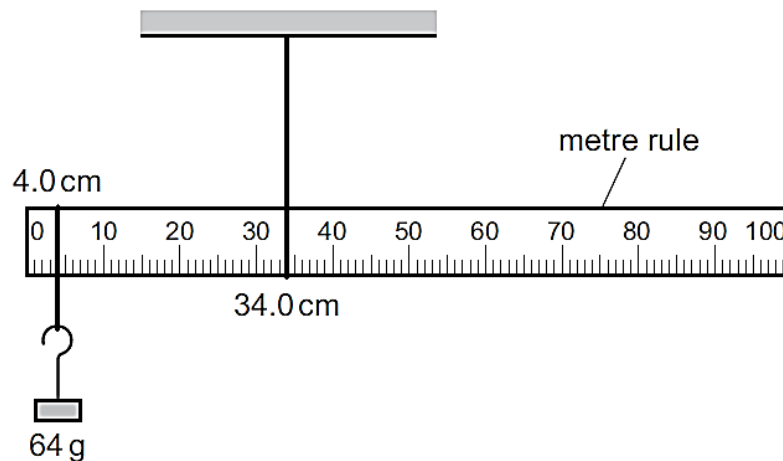
- 7 The front wheel of a car is turned in a clockwise direction by the engine as the car accelerates towards the right, as shown in the diagram.



There is a force of friction between the wheel and the road.
Which row shows the correct direction of frictional force?

	direction of frictional force on wheel	direction of frictional force on road
A	to the left	to the left
B	to the left	to the right
C	to the right	to the left
D	to the right	to the right

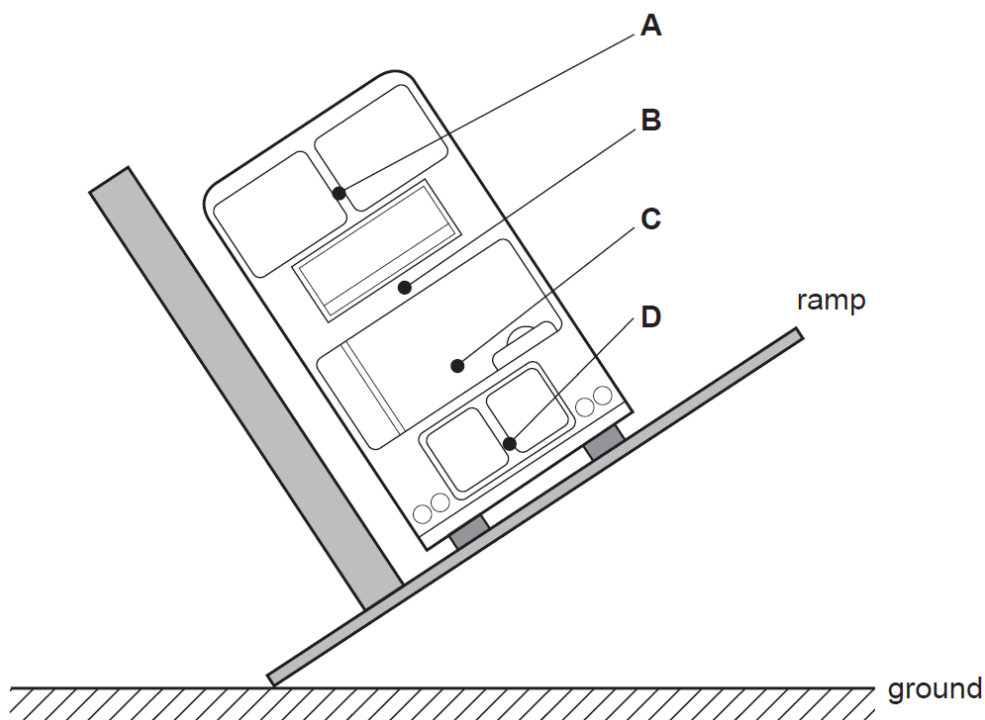
- 8 A uniform metre rule is pivoted at the 34.0 cm mark, as shown below.



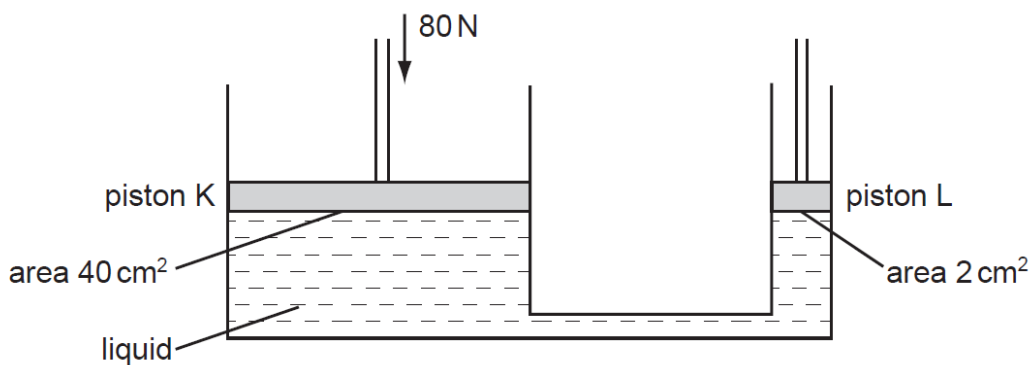
The rule balances when a 64 g mass is hung from the 4.0 cm mark.
What is the mass of the metre rule?

- A** 38 g **B** 44 g **C** 120 g **D** 136 g

- 9** The stability of a bus is tested by tilting it on a ramp. The diagram shows a bus that is just about to topple over. Where is the centre of gravity of the bus?



- 10** The system shown in the diagram contains a liquid.

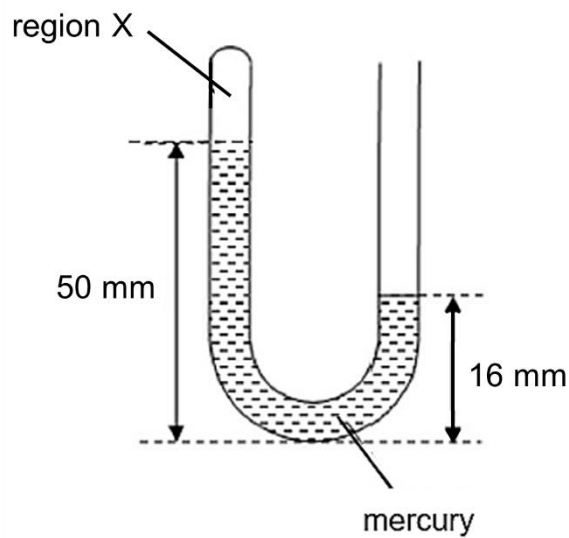


A downward force of 80 N is exerted on piston K.

What will be the upward force exerted by the liquid on piston L?

- A** 1 N **B** 4 N **C** 80 N **D** 1600 N

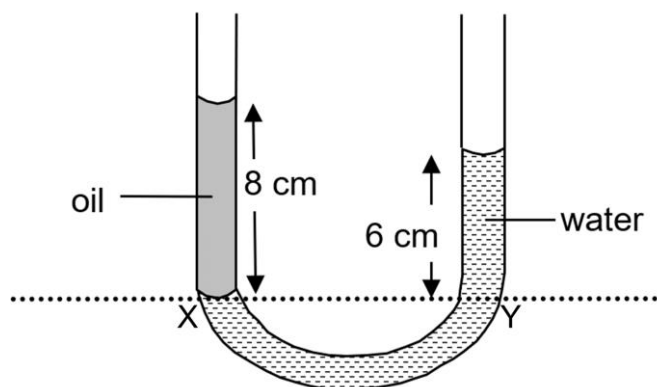
- 11** A gas in a sealed cylinder is heated.
Which quantity does not increase as the gas is heated?
- A** the average number of gas molecules hitting the cylinder walls per second
B the average kinetic energy of the gas molecules
C the average speed of the gas molecules
D the average distance between the gas molecules
- 12** The diagram shows a U-tube filled with mercury. The left arm is sealed, and the right arm is open. There is some trapped air in region X.



Given that the atmospheric pressure is 760 mmHg, what is the pressure of the trapped air in region X?

- A** 710 mmHg **B** 726 mmHg **C** 744 mmHg **D** 794 mmHg

- 13 The diagram shows a U-tube containing oil and water.



Pressure at X and Y are the same.

The density of water is 1.0 g/cm^3 . What is the density of the oil?

- A 0.25 g/cm^3 B 0.50 g/cm^3 C 0.75 g/cm^3 D 0.90 g/cm^3
- 14 A swimmer dives into a very deep pool at high speed. He slows down as he moves towards the bottom of the pool.
What is the **overall** energy transfer as the diver moves downwards through the water?
- A gravitational potential store $\rightarrow$ kinetic store + internal store
 B gravitational potential store $\rightarrow$ kinetic store $\rightarrow$ internal store
 C kinetic store + gravitational potential store $\rightarrow$ internal store
 D kinetic store $\rightarrow$ gravitational potential store + internal store
- 15 The input power to a lamp is 6.0 W . The lamp wastes 2.7 J of energy in 3.0 s .
What is the efficiency of the lamp?
- A 15 % B 45 % C 55 % D 85 %
- 16 When a liquid is cooled, its temperature changes while its volume shows negligible change. Which row shows the change in the kinetic and potential energies of the molecules?

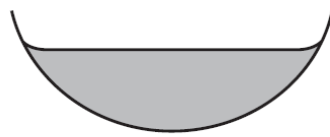
	kinetic energy	potential energy
A	decreases	remains the same
B	decreases	increases
C	increases	remains the same
D	increases	increases

- 17** A student adds 37 g of ice at 0 °C to 100 g of water at 30 °C.
The final temperature of the water and melted ice is 0 °C.
The specific heat capacity of water is 4.2 J / (g °C).

Assuming that there is no heat loss to or gain from the surroundings, what is the specific latent heat of ice?

- A** 47 J/g **B** 341 J/g **C** 4700 J/g **D** 12 600 J/g

- 18** Some of the liquid in a dish evaporates, as shown in the diagrams below.



before evaporation



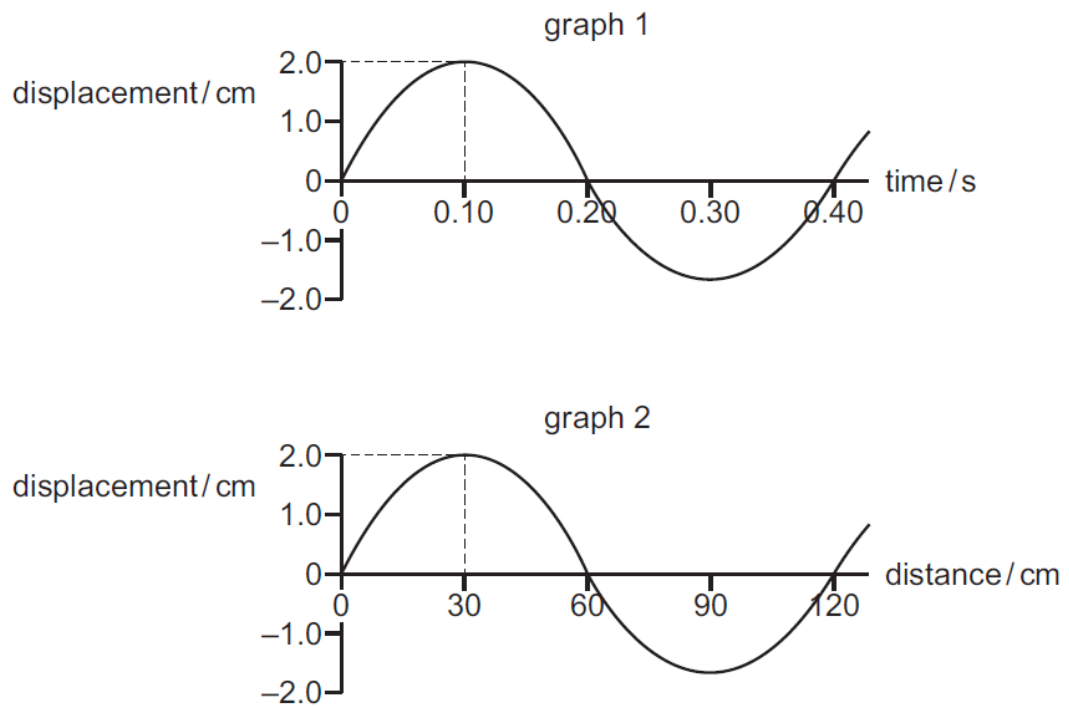
after evaporation

Which of the following statements are true?

- I. During evaporation, molecules that leave the liquid have higher energy.
- II. Molecules in the liquid have greater average kinetic energy before evaporation.
- III. During evaporation, molecules remaining in the liquid have higher energy.
- IV. Molecules remaining in the liquid have greater average kinetic energy after evaporation.

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

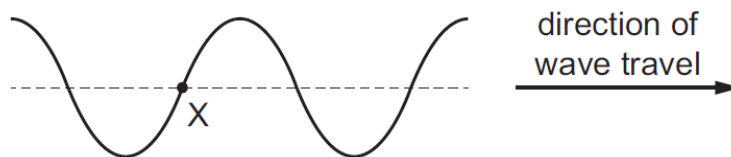
- 19** Graph 1 shows the variation with time of displacement at a fixed distance along a progressive wave. Graph 2 represents the same wave and shows the variation with distance of displacement at an instant in time.



What is the speed of the wave?

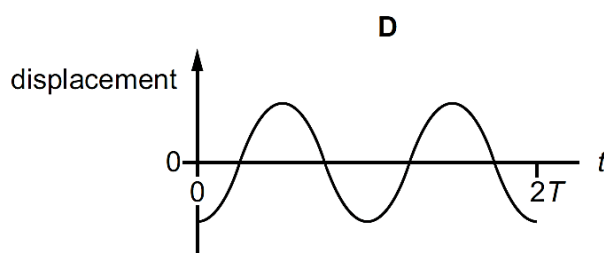
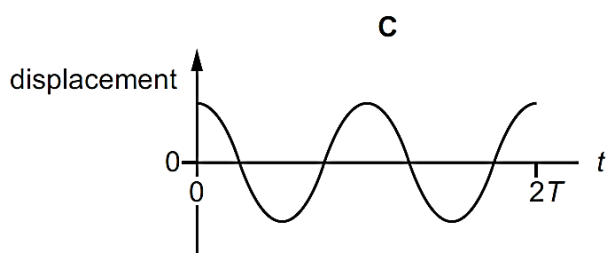
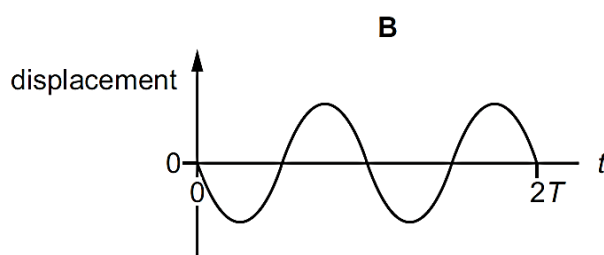
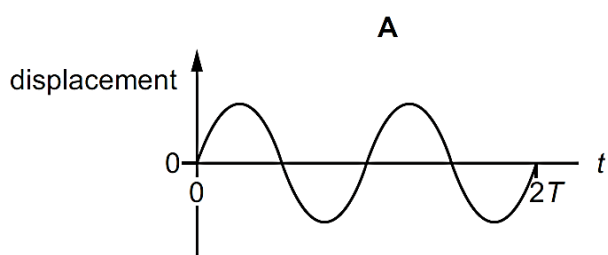
- A** 0.0033 m/s **B** 0.33 m/s **C** 3.0 m/s **D** 300 m/s

- 20** A transverse wave travels along a rope. The diagram shows the rope at time $t = 0$.



The wave is travelling from left to right. The period of the wave is T .
One particle of the rope is labelled X.

Which graph shows the variation with time of the displacement of particle X between $t = 0$ and $t = 2T$?



- 21** In an experiment to determine the speed of sound in air, a student stands 200 m away from a cliff and claps two pieces of wood together.
Her classmates standing next to her start stopwatches when the two pieces of wood meet and stop the stopwatches when they hear the echo.

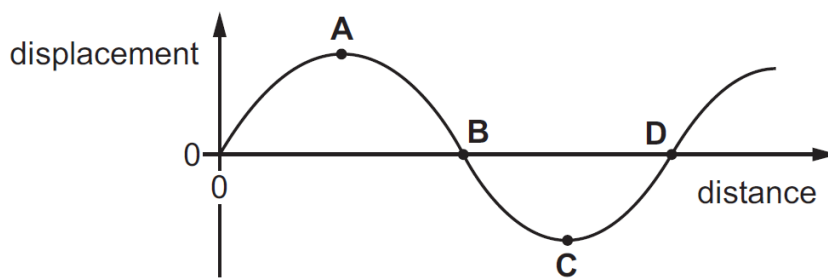
The measurements are repeated for a total of four times.
Their times are:

1.44 s 1.70 s 1.58 s 1.76 s

Which value for the speed of sound do they obtain?

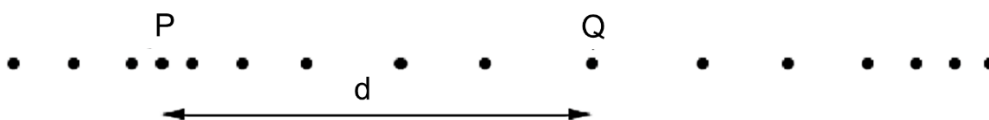
- A** 62 m/s **B** 123 m/s **C** 247 m/s **D** 340 m/s

- 22** A longitudinal wave is travelling from left to right. The graph shows the variation of the displacement of the particles with distance along the wave at one instant in time.



Displacements to the right are positive; displacements to the left are negative. Which labelled point represents a **compression**?

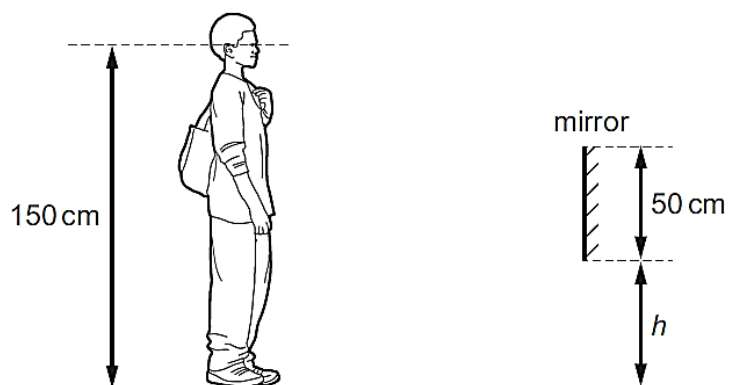
- 23** The diagram shows the position of particles of a sound wave at a particular instant in time.



The speed of the wave is v . P and Q are two points in the wave a distance d apart. What is the frequency of the wave?

- A** $\frac{v}{2d}$ **B** $\frac{v}{d}$ **C** $\frac{2v}{d}$ **D** $\frac{d}{v}$

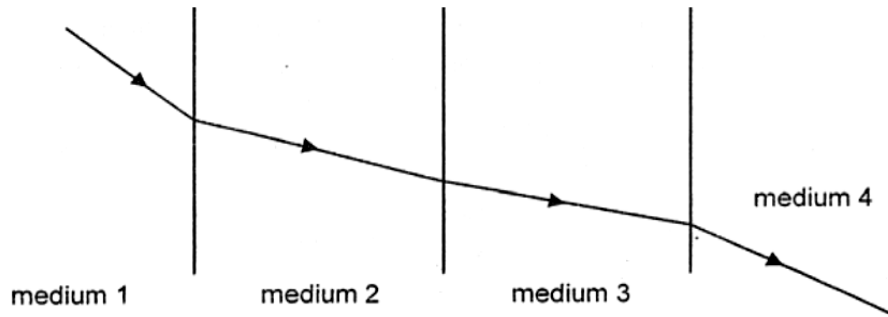
- 24** A shoe shop puts a mirror on the wall so that customers can look at their shoes. The length of the mirror is 50 cm. A customer has eyes 150 cm above ground level.



The bottom of the mirror is at height h above the ground.
What is the smallest value of h that allows the customer to see an image of his shoes in the mirror?

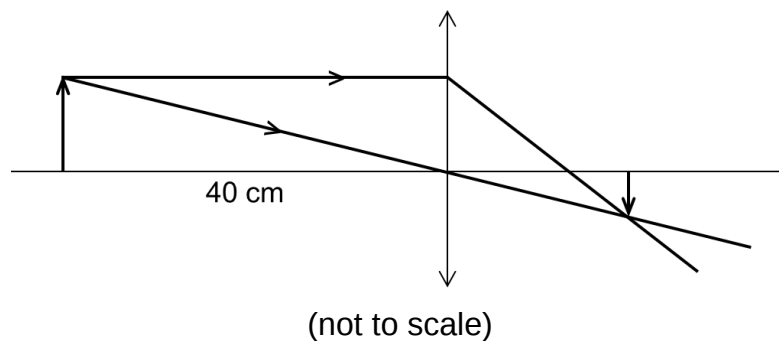
- A** 0 cm **B** 25 cm **C** 50 cm **D** 75 cm

- 25 The diagram below shows a ray of light traveling through four mediums of different refractive indices.



Which of the following is the possible refractive indices for each medium in **descending** order?

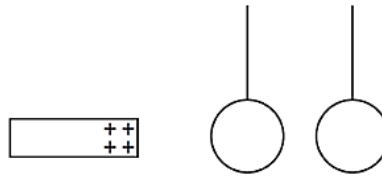
- A 3, 2, 1, 4
 - B 2, 3, 1, 4
 - C 3, 2, 4, 1
 - D 2, 3, 4, 1
- 26 The diagram shows an object placed 40 cm in front of a thin converging lens used to form a image.



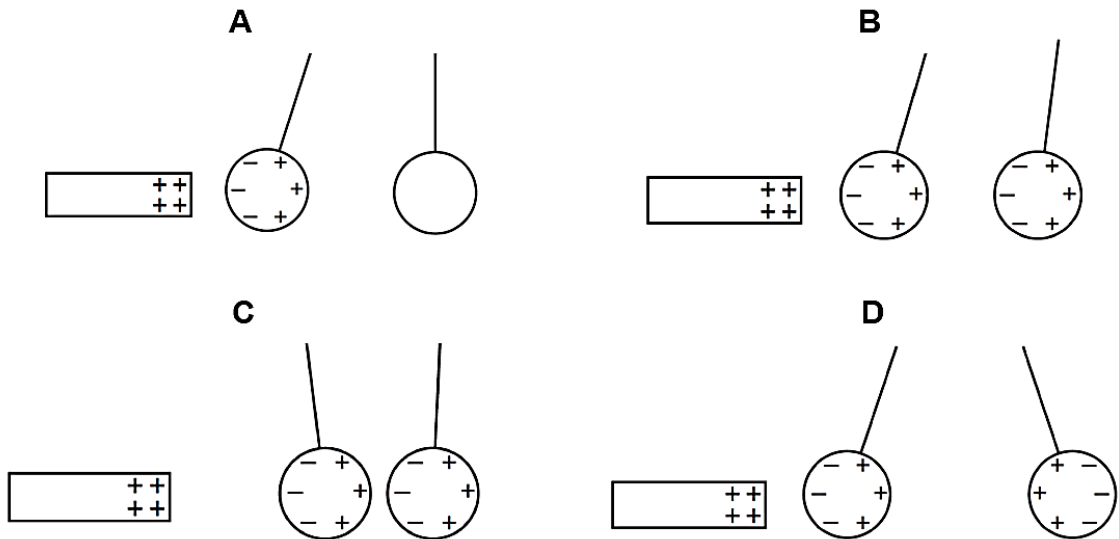
What is the focal length of the lens?

- A 10 cm
- B 20 cm
- C 30 cm
- D 50 cm

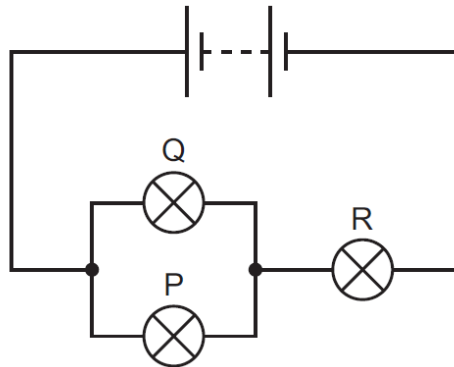
- 27 Two uncharged metal spheres, not touching one another, are suspended by means of a cotton thread.



A positively charged rod is brought near to the spheres. Which diagram shows what happens to the spheres?



- 28 Three identical filament lamps, P, Q and R, are connected to a battery of negligible internal resistance, as shown.



The filament wire in lamp Q breaks so that it no longer conducts. What are the changes in the brightness of lamps P and R?

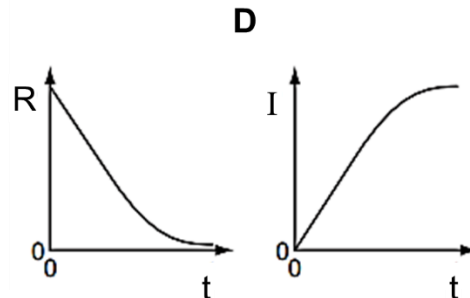
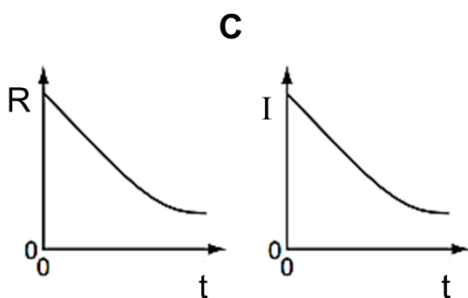
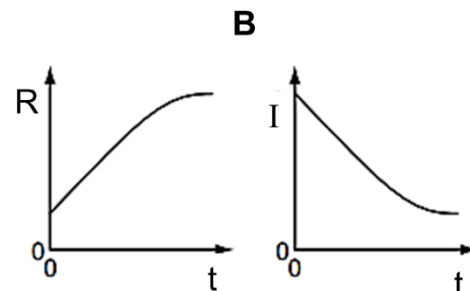
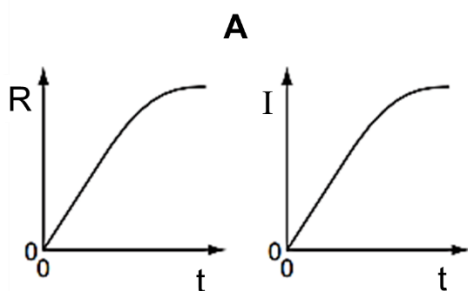
	lamp P	lamp R
A	brighter	brighter
B	brighter	dimmer
C	dimmer	brighter
D	dimmer	dimmer

- 29** When the flash on a camera is used, a charge of 1.5 C flows through the flash-tube in 0.0030 s. The average voltage across the flash-tube is 3.6 V.

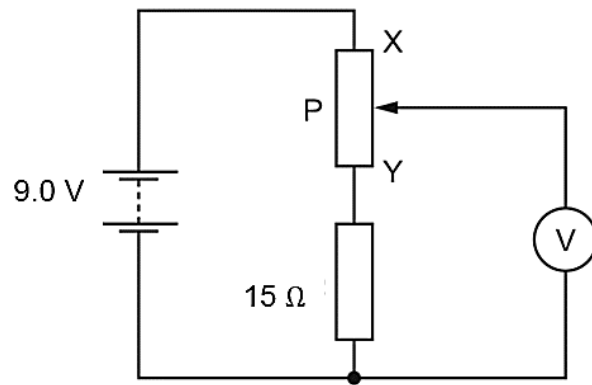
What is the electrical energy supplied to the flash-tube and what is the average power supplied?

	energy / J	power / W
A	2.4	0.0072
B	2.4	800
C	5.4	0.0162
D	5.4	1800

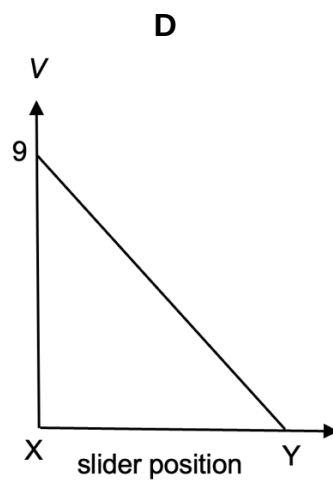
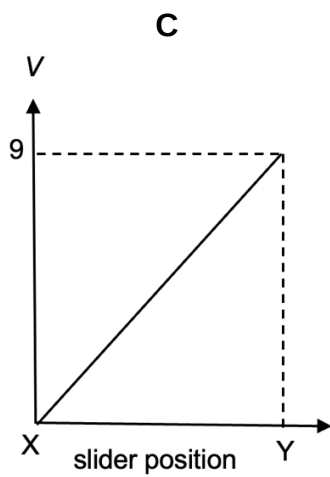
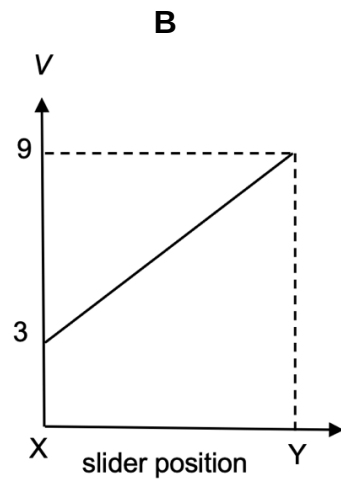
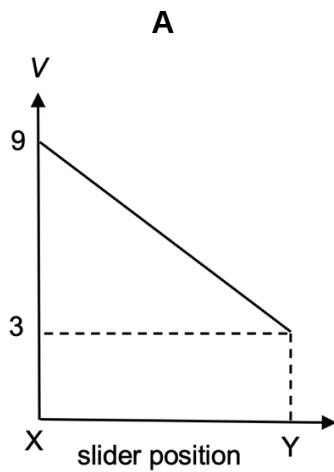
- 30** Which pair of graphs correctly shows how the resistance, R , of the filament and the current, I , vary with time after the filament lamp is switched on?



- 31** The diagram shows a 9.0 V battery connected in series with a $15\ \Omega$ fixed resistor, and a potentiometer P with a maximum resistance of $30\ \Omega$.



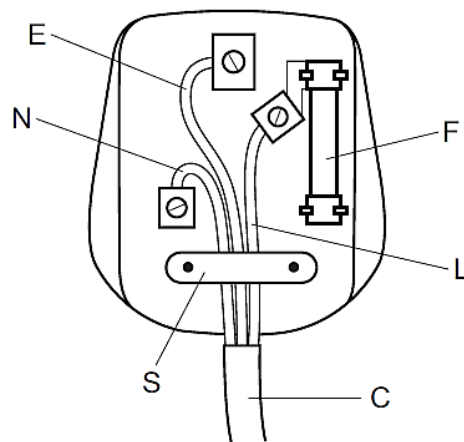
Which graph shows how the voltmeter reading varies as the slider is moved from X to Y?



- 32** The cost of one unit of electricity is \$0.24.
A 100 W lamp is switched on for five hours each day for three weeks.
How much does it cost to run the lamp for this period of time?

A \$0.36
B \$0.84
C \$2.52
D \$25.20

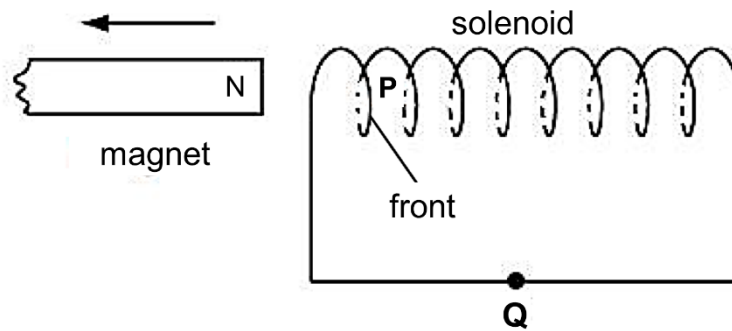
- 33** The diagram shows the wiring of a three-pin mains plug. There is an error in the diagram.



What is the error?

- A** The cable cover C is not under the clip S.
B The earth wire E is connected to the wrong terminal.
C The fuse F is connected to the live wire L.
D The live wire L is connected to the wrong end of the fuse F.

- 34** The north pole of a magnet is moving away from a solenoid.

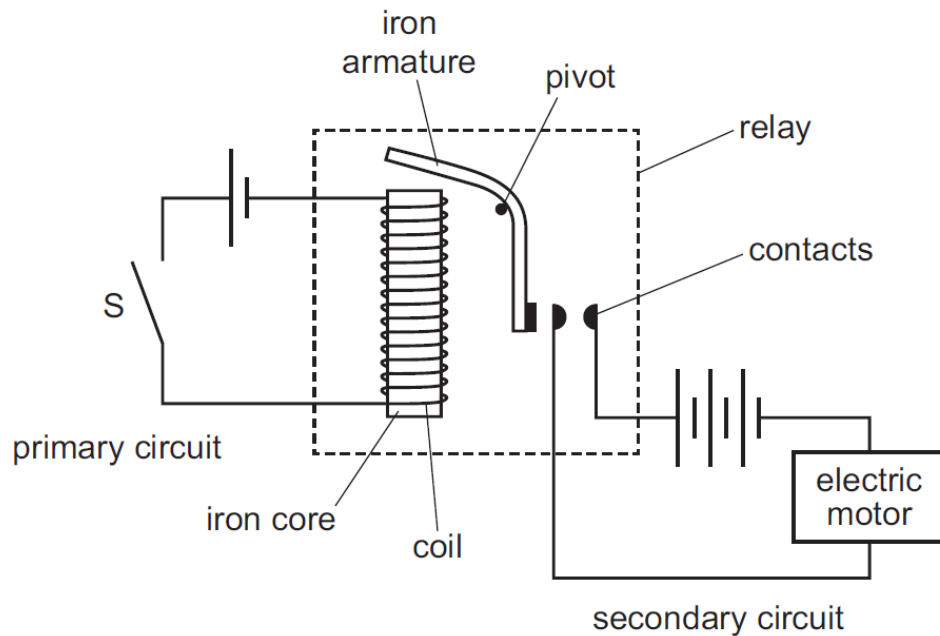


This movement induces a current in solenoid. The induced current produces a magnetic pole at **P**.

When the magnet is moving away, what is the magnetic pole produced at **P** and the direction of the induced current at point **Q**?

	magnetic pole at P	direction of induced current at Q
A	south	left
B	north	right
C	south	right
D	north	left

- 35** A student makes five statements to explain how the relay switches on the electric motor work.



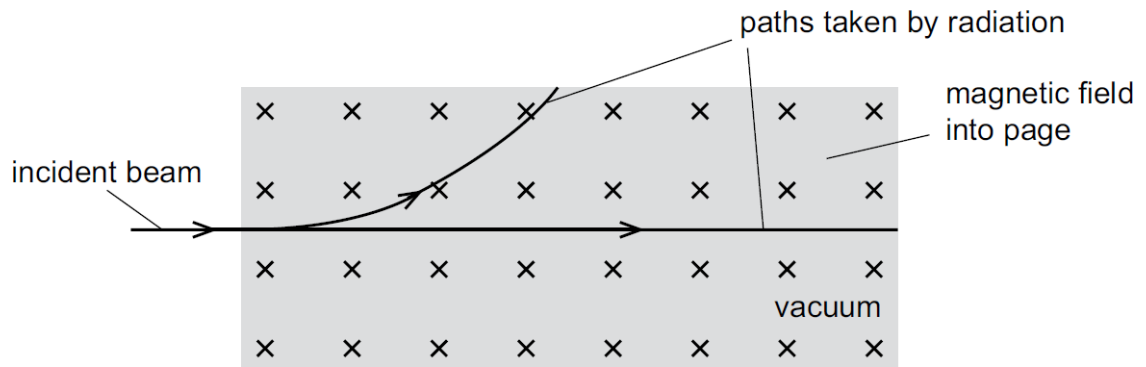
The statements are:

- 1 The current in the coil magnetises the electromagnet.
- 2 The armature closes the contacts.
- 3 The current in the secondary circuit makes the motor turn.
- 4 The electromagnet attracts the iron armature.
- 5 The switch S in the primary circuit is closed.

What is the correct order of the statements?

- A** 1 → 5 → 2 → 4 → 3
B 3 → 2 → 4 → 1 → 5
C 3 → 4 → 1 → 5 → 2
D 5 → 1 → 4 → 2 → 3

- 36** A beam of radiation enters a region in which there is a very strong, uniform magnetic field directed into the page. All the equipment is in a vacuum.

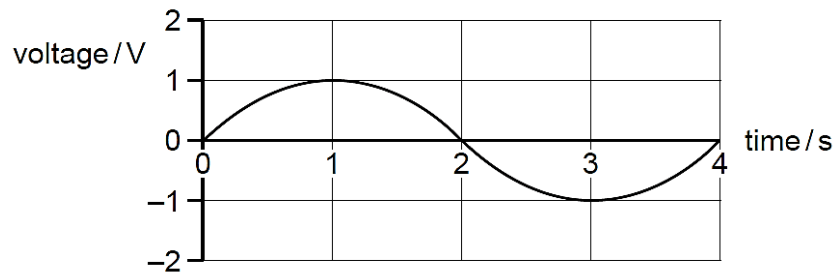


The beam splits and the curved path and the straight path taken by the radiation in the magnetic field are shown on the diagram.

What types of radiation are in the incident beam?

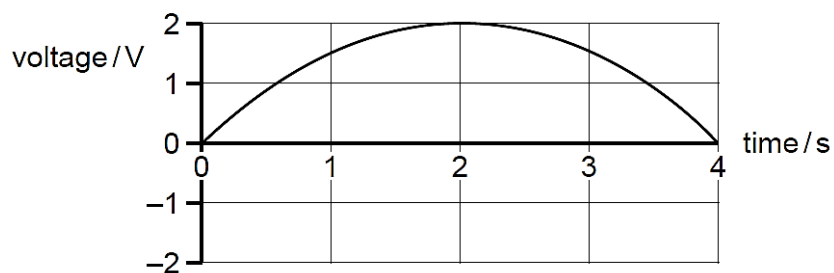
- A** α -particles and β -particles only
- B** α -particles and γ -rays only
- C** β -particles and γ -rays only
- D** α -particles, β -particles and γ -rays

- 37 A simple a.c. generator produces a voltage that varies with time as shown.

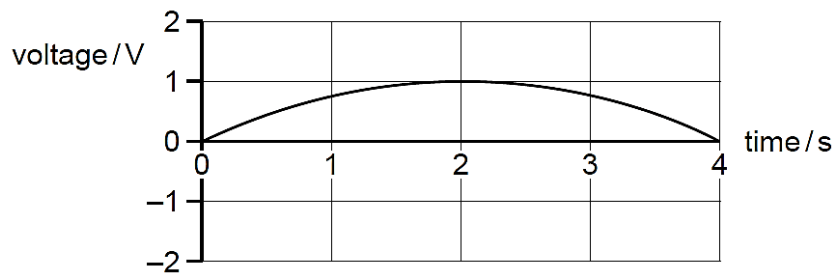


Which graph shows how the voltage varies with time when the generator rotates at twice the original speed?

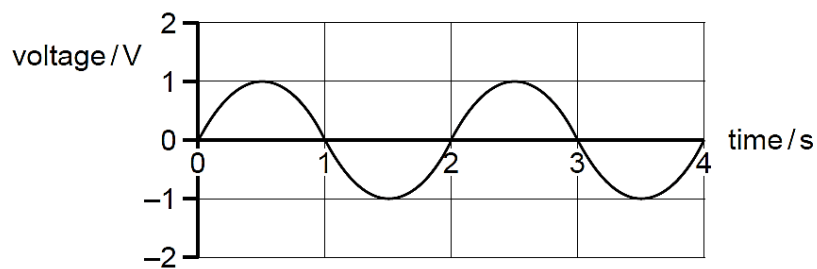
A



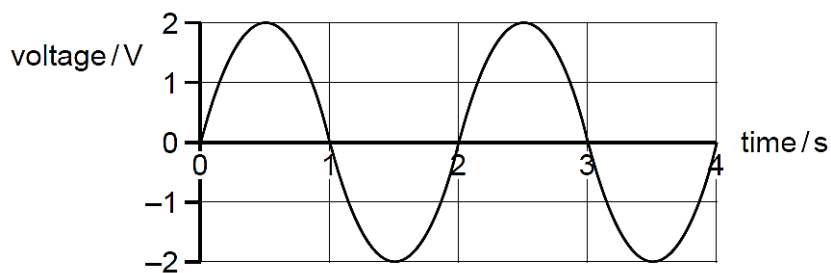
B



C



D



- 38** Electric power cables transmit electrical energy over large distances using high voltage, alternating current.

What are the advantages of using a high voltage and of using an alternating current?

	advantage of using a high voltage	advantage of using an alternating current
A	high current is produced in the cable	the resistance of the cable is reduced
B	high current is produced in the cable	the voltage can be changed using a transformer
C	less energy is wasted in the cable	the resistance of the cable is reduced
D	less energy is wasted in the cable	the voltage can be changed using a transformer

- 39** A nucleus of $^{238}_{92}\text{U}$ decays in stages by emitting α -particles and β -particles, eventually forming a nucleus of $^{206}_{82}\text{Pb}$.

How many α -particles and how many β -particles are emitted during the decay chain?

	α -particles	β -particles
A	8	6
B	8	10
C	16	6
D	16	22

- 40** When dealing with radioactive materials there are possible dangers. Which statement about radioactive materials is correct?

- A** Beta-particles can pass through skin and damage body cells.
- B** Materials that emit only alpha-particles must be kept in thick lead containers.
- C** Radioactive materials are safe to handle after two half-lives.
- D** Sources of gamma radiation are dangerous because they have long half-lives.

END OF PAPER

Answers for Prelim EOC Physics

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