Cambridge Assessment International Education

Cambridge O Level

PHYSICS **5054/12**

Paper 1 Multiple Choice **October/November 2023**

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m / s^2).

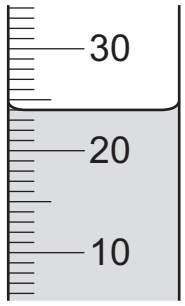
INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

This document has **20** pages. Any blank pages are indicated.

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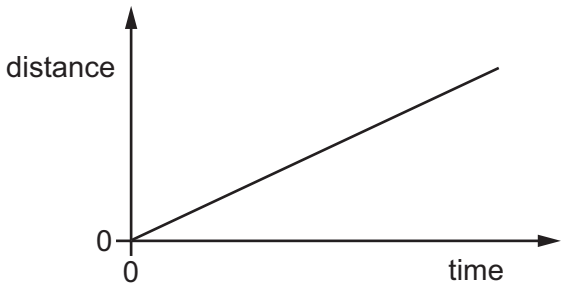
1 The diagram shows the level of liquid in a measuring cylinder. The scale is marked in cm^3.



What is the volume of the liquid?

A $20.4\,cm^3$ **B** $24.0\,cm^3$ **C** $24.5\,cm^3$ **D** $25.0\,cm^3$

2 The diagram shows the distance–time graph of a car.



The car is travelling along a straight road up a hill.

Which quantity for the car is constant and greater than zero?

A acceleration

B displacement

C gravitational potential energy

D kinetic energy

3 A distance–time graph and a speed–time graph show the motion of an object.

How are the speed and the acceleration of the object determined from these graphs?

	speed	acceleration
A	area under the distance–time graph	area under the speed–time graph
B	area under the distance–time graph	gradient of the speed–time graph
C	gradient of the distance–time graph	area under the speed–time graph
D	gradient of the distance–time graph	gradient of the speed–time graph

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4 A student finds that the mass of a rock is 65 g.

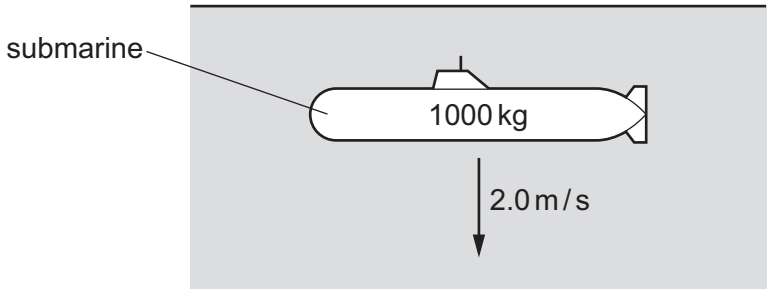
She pours 30 cm^3 of water into a measuring cylinder.

She places the rock in the water so that the water covers the rock completely. The water level rises to 55 cm^3.

What is the density of the rock?

A 0.38 g/cm^3 **B** 1.2 g/cm^3 **C** 2.2 g/cm^3 **D** 2.6 g/cm^3

5 A small submarine of mass 1000 kg sinks in water with a constant speed of 2.0 m/s.



What is the resultant force exerted on the submarine as it sinks?

A 0

B 500 N downwards

C 2000 N downwards

D 9800 N downwards

6 A student drops, from rest, a light ball in air. The ball experiences some air resistance as it falls.

What happens to the velocity and to the acceleration of the ball during the first few seconds after release?

	velocity	acceleration
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

7 The stopping distance of a car travelling at a certain speed is measured in four different situations.

- on a dry road with new tyres
- on a dry road with old, worn tyres
- on a wet road with new tyres
- on a wet road with old, worn tyres

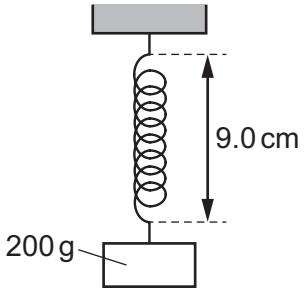
The results are shown.

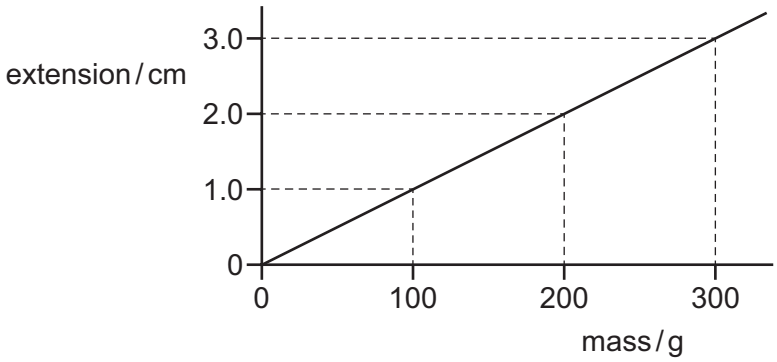
	W	X	Y	Z
stopping distance / m	12	16	17	40

Which two results are possible measurements on the dry road with old, worn tyres?

A W and X **B** X and Y **C** X and Z **D** Y and Z

8 A spring has a length of 9.0 cm when loaded with a 200 g mass. The extension–mass graph for the spring is shown.





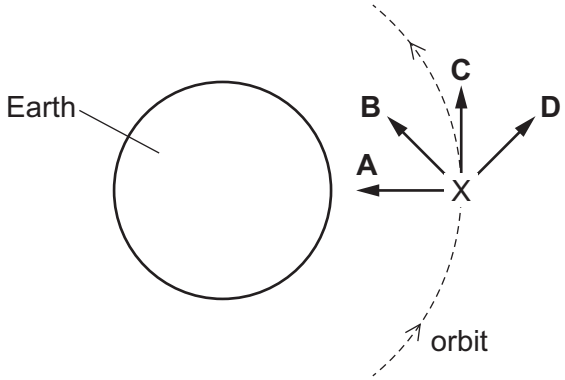
The 200 g mass is replaced with a 100 g mass.

What is the new length of the spring?

A 7.0 cm **B** 8.0 cm **C** 9.0 cm **D** 10 cm

9 The International Space Station orbits the Earth.

Which arrow shows the direction of the force on the International Space Station when it is at point X?



10 Which expression is equal to impulse?

A change in momentum ÷ time

B change in momentum

C force × distance moved in the direction of the force

D force ÷ area

11 A box with mass 4.0 kg is pulled from rest along a horizontal floor by a constant force *F*.

A constant frictional force of 1.0 N acts on the box.

When the box has travelled 1.0 m its velocity is 1.5 m / s.

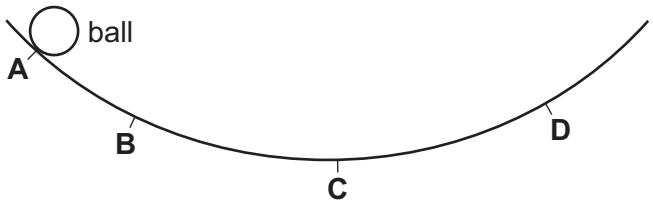
The kinetic energy of the box is equal to the work done on the box.

What is force *F*?

A 2.0 N **B** 3.5 N **C** 4.0 N **D** 5.5 N

12 The diagram shows a curved track. A ball is released from the position shown.

At which point is the gravitational potential energy stored in the ball the maximum?



13 How does an oil-fired power station differ from a nuclear power station?

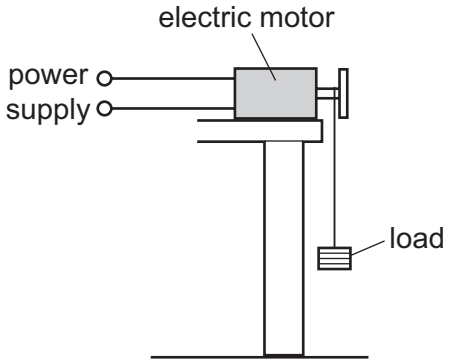
A Gases emitted by hot fuel are emitted into the atmosphere.

B Steam is produced in a boiler using hot fuel.

C The hot steam is used to turn a turbine.

D Turbines are used to drive an electric generator.

14 An electric motor is used to lift a load at a constant speed.



The gravitational potential energy (GPE) stored in the load increases.

The moving load also has stored kinetic energy (KE).

Which expression is used to calculate the efficiency of the motor when the load is being lifted at a constant rate?

A $\text{efficiency} = \dfrac{\text{GPE gained per second}}{\text{KE gained per second}}$

B $\text{efficiency} = \dfrac{\text{GPE gained per second}}{\text{power supplied}}$

C $\text{efficiency} = \dfrac{\text{power supplied}}{\text{GPE gained per second}}$

D $\text{efficiency} = \dfrac{\text{power supplied}}{\text{KE gained per second}}$

15 A battery delivers 3000 J of energy to a small 2.0 W electric motor before the battery stops working.

For how long is the motor switched on?

A 1500 minutes

B 100 minutes

C 50 minutes

D 25 minutes

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16 A man finds it difficult to hammer a wooden post into the ground.

How could he make the post go in more easily?

A Make the bottom of the post pointed.

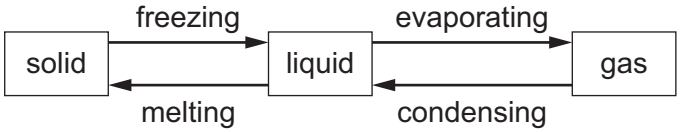
B Make the top of the post pointed.

C Use a longer post.

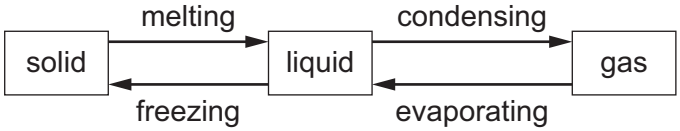
D Use a wider post.

17 Which diagram shows the names of the changes of state that correspond to the directions of the arrows?

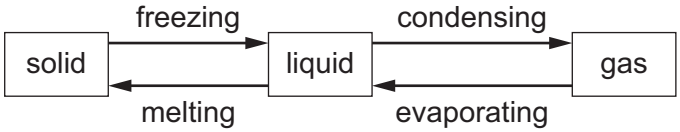
A



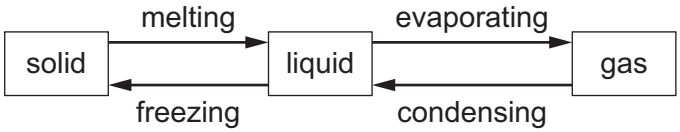
B



C



D



18 A sealed cylinder containing gas is left in direct sunlight.

Eventually the cylinder explodes.

How is this explained in terms of the behaviour of the gas particles?

A Each particle gets bigger and they collide with each other more often.

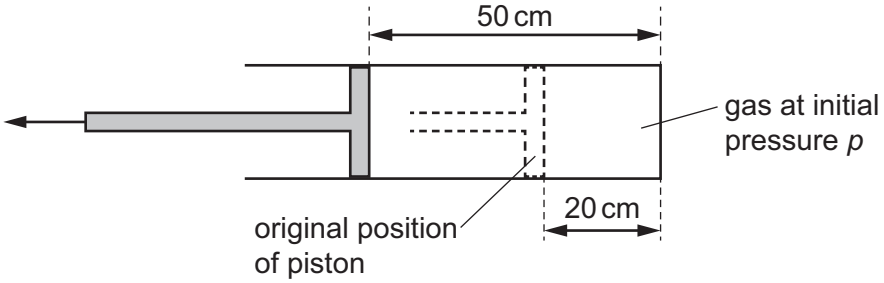
B Each particle gets bigger and they collide harder with the cylinder.

C The particles gain kinetic energy and hit the cylinder harder and more often.

D The particles lose kinetic energy and they hit the cylinder harder and more often.

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19 A gas is trapped inside a cylinder by a movable piston. The length of the gas column is 20 cm and the pressure inside the cylinder is p.



The piston is pulled out a distance of 30 cm, so that the length of the gas column is now 50 cm. The temperature of the gas does not change.

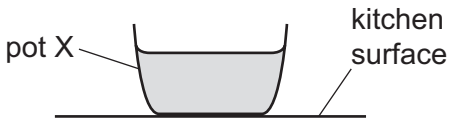
What is the new pressure of the gas?

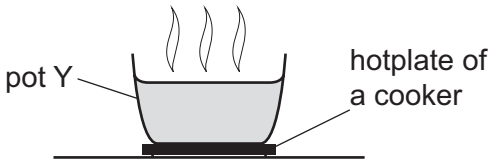
A $0.40p$ **B** $0.60p$ **C** $1.5p$ **D** $2.5p$

20 Pot X and pot Y are both in a cool room.

Pot X contains hot water below its boiling point.

Pot Y is identical to pot X but contains water that is kept boiling by a hotplate underneath it.





What happens to the average kinetic energy of the particles in the liquid water in pot X and to the average kinetic energy of the particles in the liquid water in pot Y?

	kinetic energy of liquid particles in X	kinetic energy of liquid particles in Y
A	decreases	increases
B	decreases	does not change
C	stays the same	increases
D	stays the same	does not change

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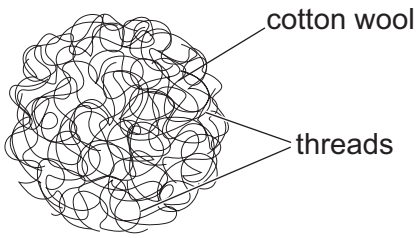
21 Solid metals are good thermal conductors.

How closely packed are their particles and do the metals contain free electrons?

	packing of particles	contains free electrons
A	close together	no
B	close together	yes
C	far apart	no
D	far apart	yes

22 Cotton wool is a good thermal insulator.

It consists of many threads of cotton which are tangled together to make a material which can easily be pulled apart or compressed. The diagram shows the structure of cotton wool.



Why is cotton wool a good thermal insulator?

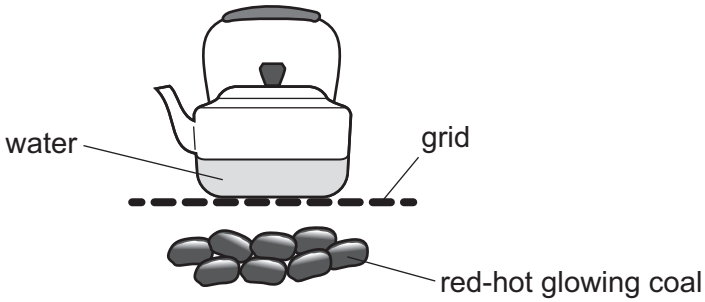
A Each thread is very thin.

B It has a large surface area because it is made of many threads.

C It has a low density because of the trapped air.

D It traps air and prevents convection.

23 A metal kettle is heated on a grid above red-hot glowing coal.

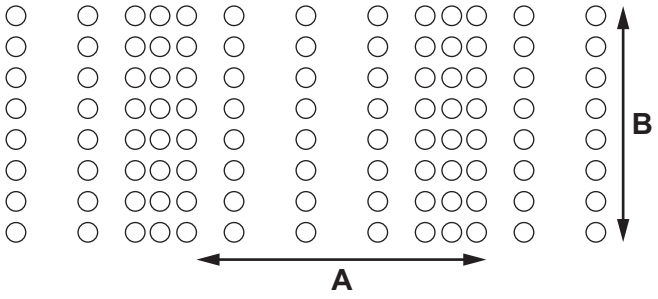


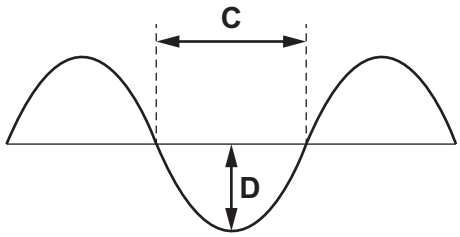
What are the main thermal energy transfers through the bottom of the kettle and within the water?

	through kettle	within water
A	conduction	conduction
B	radiation	convection
C	conduction	convection
D	radiation	conduction

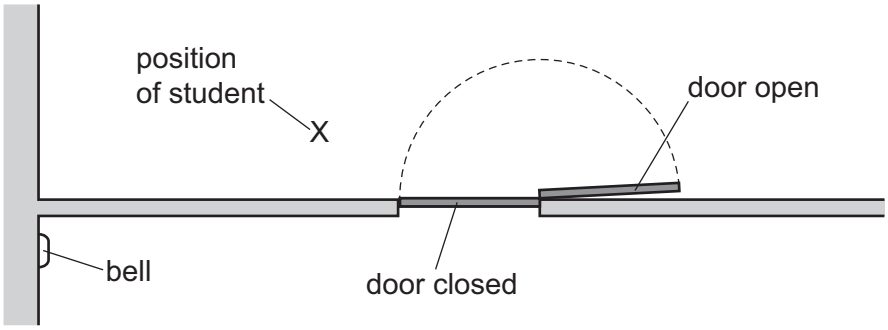
24 The diagram shows two waveforms.

Which arrow shows the wavelength of a longitudinal wave?





25 A bell, on a wall outside a classroom, rings. A student is standing at point X shown on the view from above.



The door of the classroom is closed and the student in the room at X hears the bell ring.

The door is opened, and the sound heard by the student from the bell is louder.

What causes the sound reaching the student to be louder?

A diffraction

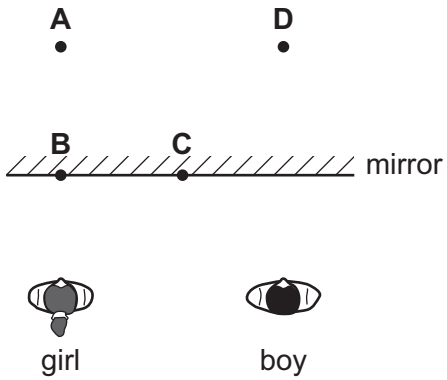
B dispersion

C reflection

D refraction

26 A boy stands beside a girl in front of a large vertical plane mirror. They are equal distances from the mirror, as shown. The boy sees an image of the girl.

Where is the girl's image?



27 Light travelling in air is incident on a water surface.

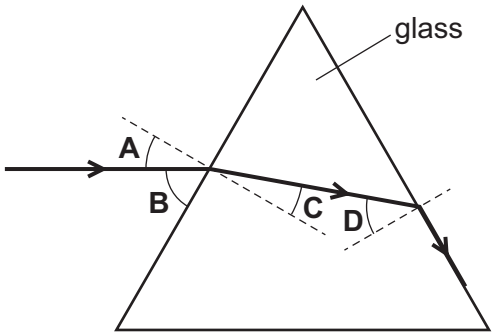
The refractive index of water is 1.3 and the angle of refraction in the water is 40°.

What is the angle of incidence in the air?

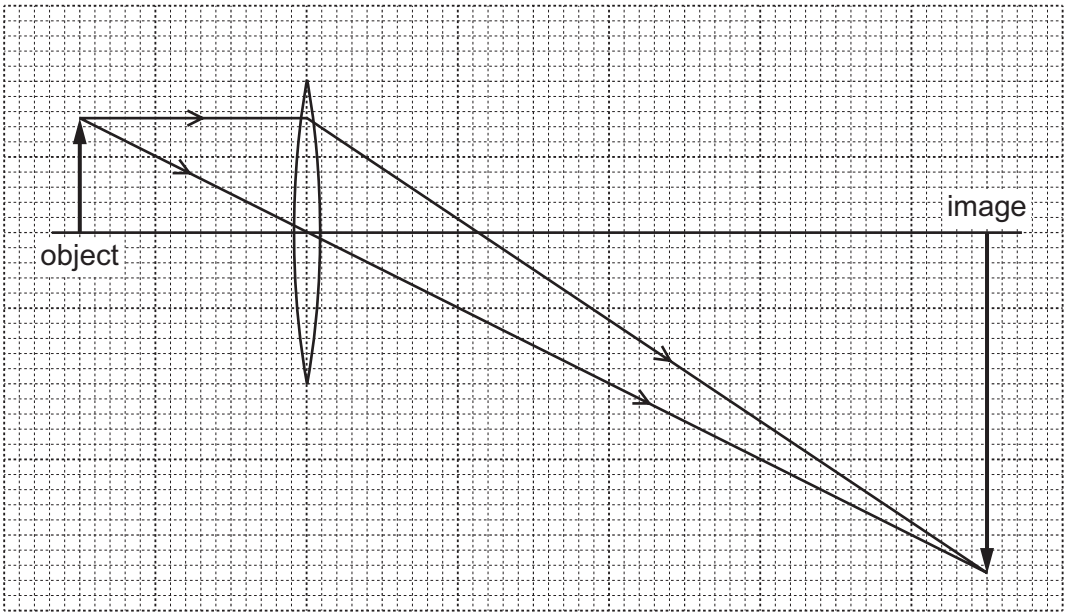
A 30° **B** 50° **C** 52° **D** 57°

28 The diagram shows a ray of light passing through a triangular glass block.

Which angle is the critical angle of light in glass?



29 A lens is used to produce a magnified image, as shown in the scale diagram.



What is the linear magnification produced by the lens?

A 0.33 **B** 3.0 **C** 4.0 **D** 6.0

30 Ultraviolet radiation is a component of the electromagnetic spectrum.

Which application uses ultraviolet radiation?

A Bluetooth technology

B prenatal scanning

C sterilising water

D thermal imaging

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31 A student rubs different rods held in his hand.

Which rod gains a large electrostatic charge?

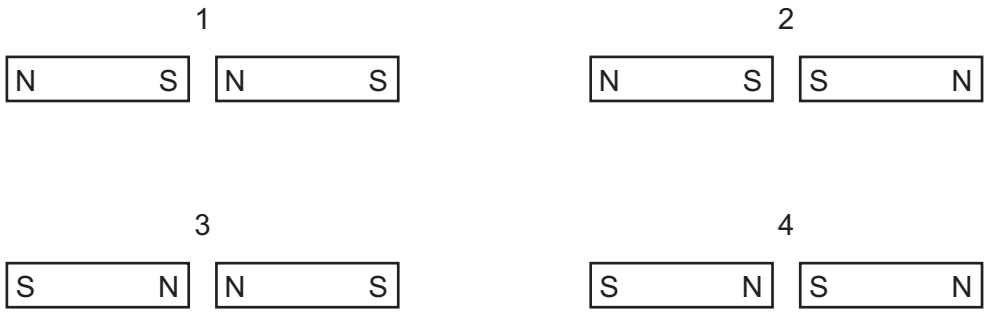
A a polythene rod rubbed with a steel magnet

B a polythene rod rubbed with a woollen duster

C an iron rod rubbed with a steel magnet

D an iron rod rubbed with a woollen duster

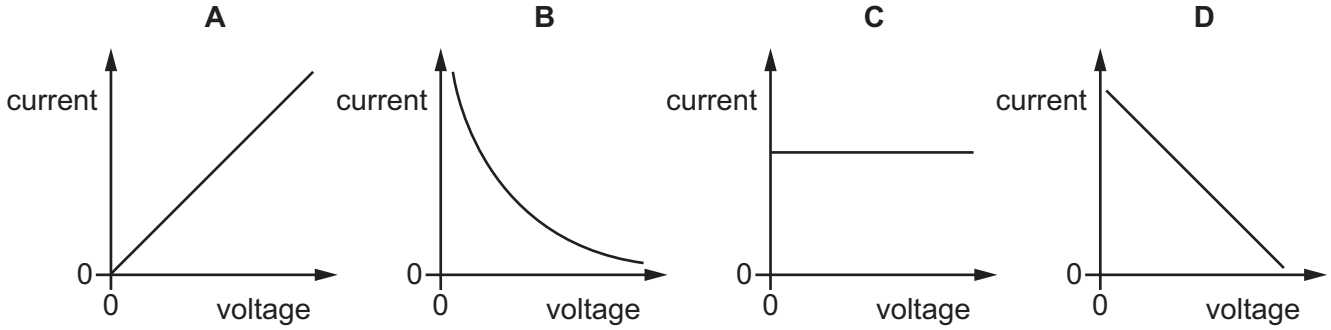
32 Two permanent magnets are placed side by side in four different arrangements.



In which arrangements do the magnets repel each other?

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

33 Which graph shows how the current changes when the voltage across a resistor of constant resistance is varied?



34 Two identical resistors are connected first in series and then in parallel.

The two resistors in series are connected to a power supply and the current is I_s. The parallel combination is connected to the same power supply and the current supplied is I_p.

What is the ratio $\frac{I_s}{I_p}$?

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

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35 The output of an a.c. generator is connected to a lamp.

The coil of the generator is rotated at a constant rate which makes the lamp flash twice every second.

The coil is then rotated at half the rate of rotation.

What happens to the maximum brightness of the lamp and how many times does the lamp flash every second?

	brightness	number of flashes every second
A	decreases	1
B	decreases	4
C	does not change	1
D	does not change	4

36 Which device uses the magnetic effect of an electric current?

A compass

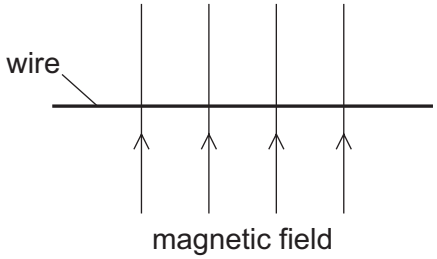
B fuse

C loudspeaker

D magnifying glass

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37 A wire is placed at right angles to a uniform magnetic field.



There is a current in the wire and it experiences a force.

Beams of alpha-particles, beta-particles and neutrons are fired into the magnetic field in the same direction as the conventional current in the wire.

Which beams experience a force that is initially in the same direction as the force experienced by the current-carrying wire?

	alpha-particles	beta-particles	neutrons
A	✓	✗	✓
B	✓	✗	✗
C	✗	✓	✓
D	✗	✓	✗

key

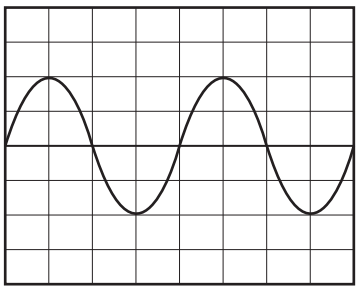
✓ = beam experiences a force in the same direction

✗ = beam does not experience a force in the same direction

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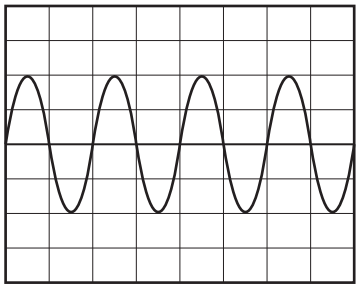
38 The diagram shows the trace produced on the screen of an oscilloscope due to an alternating voltage input.



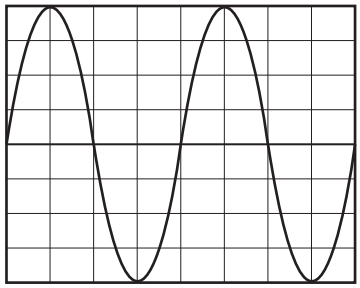
The time–base on the oscilloscope is set to 4 ms / cm.

What does the trace look like when the time base is set to 2 ms / cm?

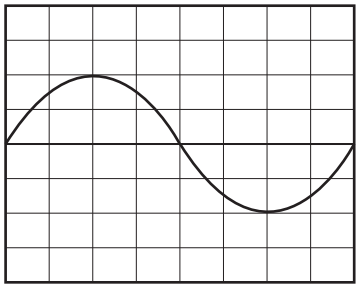
A



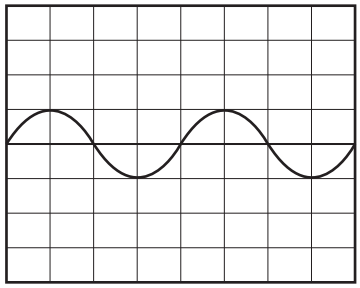
B



C



D



39 The half-life of a radioactive isotope is 2.5 minutes.

This isotope is the only radioactive isotope in a radioactive sample.

Between time t = 0 and t = 7.5 minutes, the mass of this isotope in the sample decreases by 70 μg.

What is the mass of this isotope at t = 0?

A 75 μg **B** 80 μg **C** 210 μg **D** 560 μg

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40 When observed on the Earth, the redshift of the light from galaxy X is smaller than the redshift of the light from galaxy Y.

Which galaxy is closer to the Earth and which galaxy is receding from the Earth faster?

	closer to the Earth	faster recession
A	X	X
B	X	Y
C	Y	X
D	Y	Y

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