

Class/ Index Number /	Centre Number/ 'O' Level Index Number /	Name
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新加坡海星中学
 MARIS STELLA HIGH SCHOOL
 PRELIMINARY EXAMINATION
 SECONDARY FOUR

PHYSICS

Paper 1 Multiple Choice

6091/01

3 September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your class, index number, Centre number, O level index number and name in the spaces at the top of this page.

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 question booklet.

The use of an approved scientific calculator is expected, where appropriate.

The total marks for this paper is 40.

At the end of the examination, hand in the following separately:

(1) Multiple Choice Answer Sheet

(2) Question Paper

- 1 Max Planck's equation of radiation states that the energy, E , of electromagnetic waves is equal to the product of Planck's constant, h and the frequency, f of the electromagnetic wave. The equation is $E=hf$.

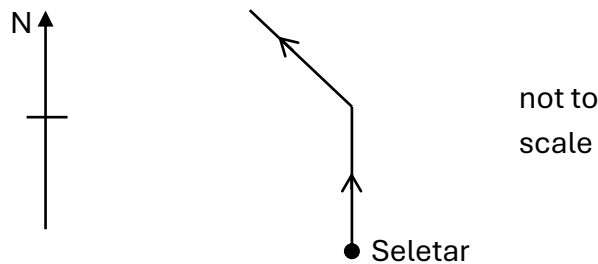
What is the unit of Planck's constant, h , expressed as SI **base** units?

- A J / Hz
- B $\text{m s}^2 / \text{kg}^3$
- C $\text{kg m}^2 / \text{s}$
- D $\text{kg m}^3 / \text{s}^2$

- 2 An air-traffic control centre at Seletar looks after aircraft within a 400 km radius of Singapore.

A small aircraft, flying due north at 300 km/h, passes over Seletar at 12:00pm. It carries enough fuel for another 550 km of flying.

At 12:30pm, air traffic control instructs the pilot to turn through 45° onto a north-westerly bearing. The aircraft continues at 300 km/h until 1:30pm.

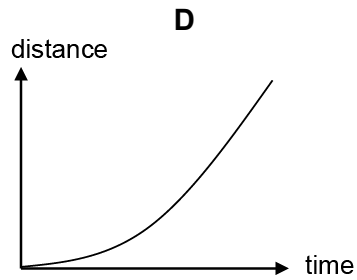
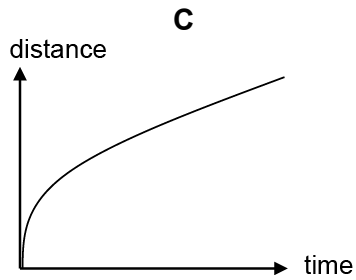
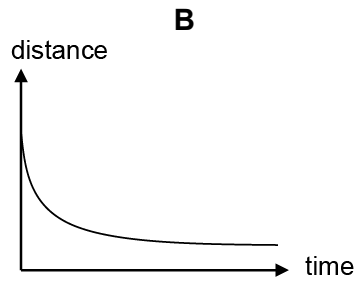
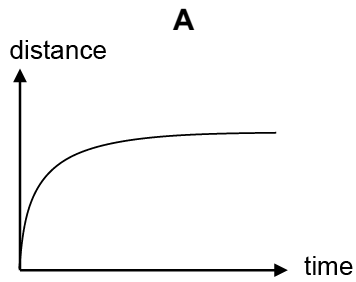


At 1:30pm the aircraft is still 150 km from its destination.

What is the location of the aircraft and which action is required?

	location of aircraft	action required
A	outside Seletar's air-traffic control space	carry on to destination
B	outside Seletar's air-traffic control space	make an emergency landing before getting to destination due to insufficient fuel
C	within Seletar's air-traffic control space	carry on to destination
D	within Seletar's air-traffic control space	make an emergency landing before getting to destination due to insufficient fuel

- 3 Which of the following distance-time graphs best describes a skydiver jumping off a plane till reaching terminal velocity?



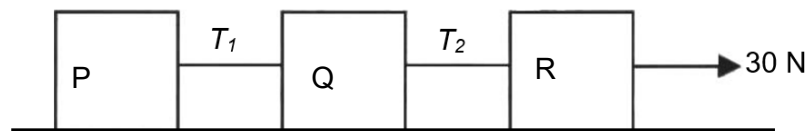
- 4 At the top of a cliff of height 100 m, a girl throws a rock upwards with a velocity of 15 m/s.

How much time later will the rock hit the bottom of the cliff? Ignore the effects of air resistance and take acceleration due to gravity as $g = 10 \text{ m/s}^2$.

- A** 6.2 s **B** 6.8 s
C 7.5 s **D** 8.2 s

- 5 P, Q and R are three identical blocks resting on a smooth surface as shown below.

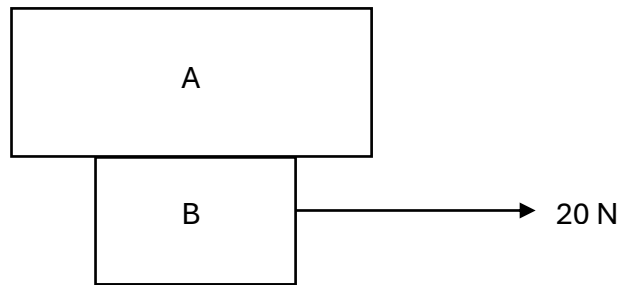
The blocks are joined by strings with tensions T_1 and T_2 when a force of 30 N is applied at one end as shown in the diagram below.



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

	T_1	T_2
A	15 N	15 N
B	30 N	30 N
C	10 N	20 N
D	10 N	15 N

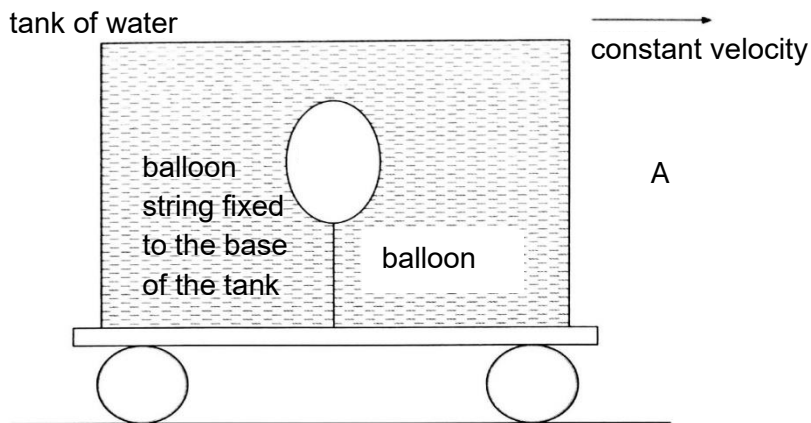
- 6 Two objects, A (mass 6.0 kg) and B (mass 4.0 kg), are stacked one on top of the other as shown.



B is pulled by a horizontal force of 20 N and all surfaces are frictionless.

What is the acceleration of A?

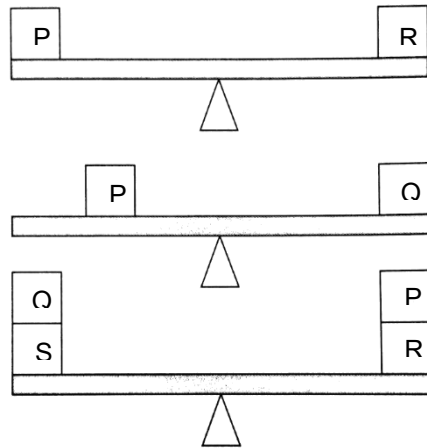
- A 0 m/s²
 - B 2.0 m/s²
 - C 3.3 m/s²
 - D 5.0 m/s²
- 7 A sealed tank filled to the brim with water is mounted on wheels. A balloon is fixed at the base of the tank. The tank is initially moving at a constant velocity.



Which statement correctly describes the motion of the balloon when the tank starts to slow down?

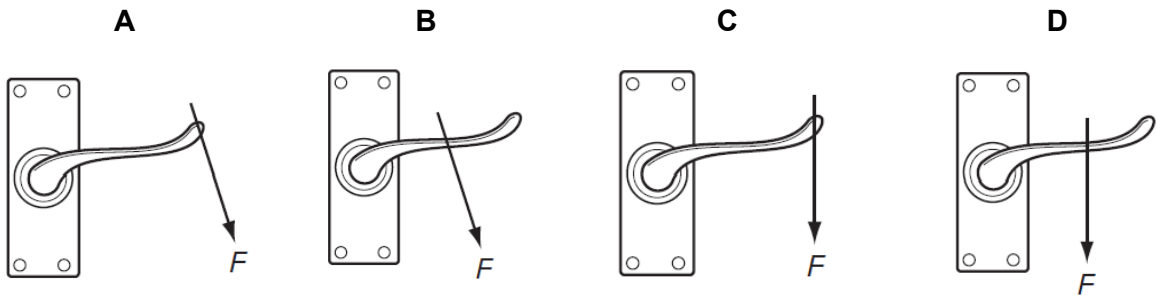
- A The balloon will move backward.
- B The balloon will move forward.
- C The balloon will remain in its original position.
- D The balloon will start to oscillate back and forth.

- 8 Four cubes P, Q, R and S are used to balance a uniform beam pivoted about its mid-point. They have the same volume but different masses.

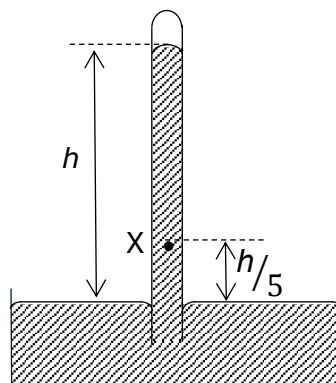


Which cube is the heaviest?

- A P B Q C R D S
- 9 The diagrams show a force of magnitude F being applied to the same door handle.
- Which diagram shows the greatest moment?



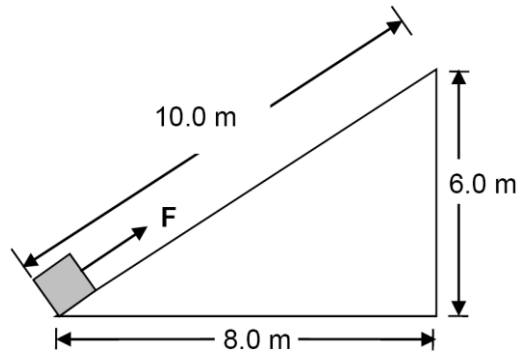
- 10 The diagram shows a mercury barometer.



Given that the height of the mercury barometer is h when the atmospheric pressure is 100 000 Pa, what is the pressure at point X?

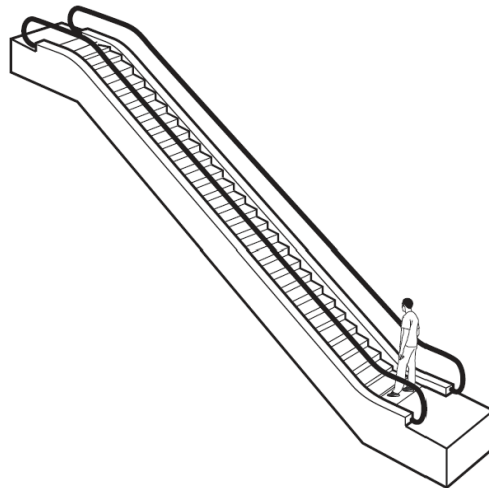
- A 20 000 Pa B 80 000 Pa
C 120 000 Pa D 180 000 Pa

- 11 The figure below shows a box of mass 6.0 kg being dragged to the top of a slope at a constant speed by a constant force F .

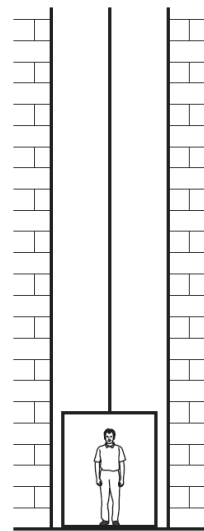


Given that the total work done against friction is 160 J and the gravitational field strength is 10 N/kg , what is the value of force F ?

- A 16 N B 20 N C 52 N D 60 N
- 12 A man can either take an escalator or a lift to travel up between two floors in a hotel.



escalator



lift

The escalator takes 20 seconds to carry the man between the two floors. The useful work done against gravity is W . The useful power developed is P . The lift takes 30 seconds to carry the same man between the same two floors.

How much useful work against gravity is done by the lift, and how much useful power is developed by the lift?

	useful work done against gravity by lift	useful power developed by lift
A	more than W	less than P
B	more than W	P
C	W	less than P
D	W	P

- 13** When a hot gas is left to cool, its internal energy decreases.

What causes this?

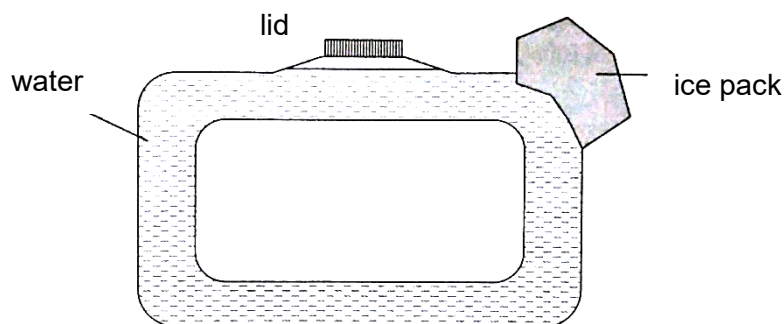
- A** a decrease in the kinetic energy of the gas particles
- B** a decrease in the gravitational potential energy of the gas particles
- C** an increase in the average speed of the gas particles
- D** an increase in the average distance of separation of the gas particles

- 14** An experiment is carried out to investigate the rate of transfer of internal energy by conduction and radiation through different mediums – mercury, vacuum and wood.

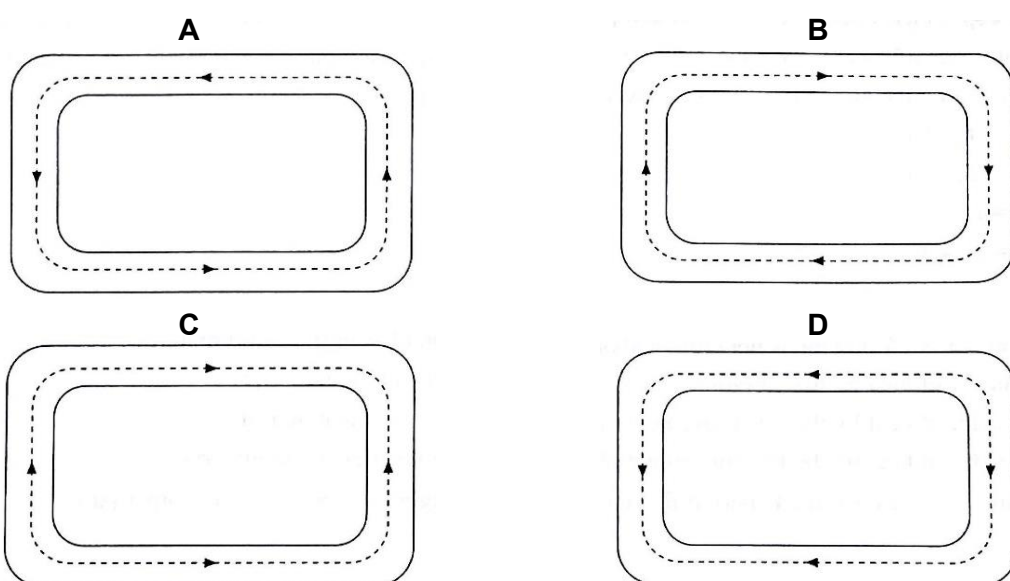
Which mediums show the greatest rate of transfer of internal energy by conduction and radiation?

	conduction	radiation
A	mercury	vacuum
B	vacuum	mercury
C	vacuum	wood
D	wood	vacuum

- 15 A student filled an upright ring-shaped container completely with warm water. He then placed a pack of ice at a corner of the container.



Which is a correct illustration of the convection current that was set up?



- 16 Two different liquids, P and Q with the same mass and initial temperature, are heated by the same heat source. Liquid P reaches a temperature of 80°C faster than liquid Q.

This shows that

- A liquid P has a higher specific heat capacity than liquid Q.
 - B liquid P has a lower specific heat capacity than liquid Q.
 - C liquid P has a higher specific heat of vapourisation than liquid Q.
 - D liquid P has a lower specific heat of vapourisation than liquid Q.
- 17 A wave in the sea collides with a cliff.

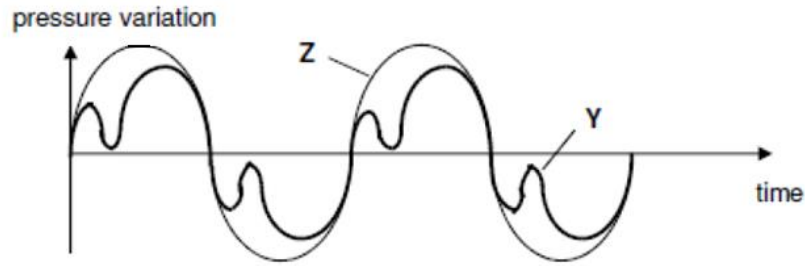
A crest of the wave hits the cliff once every 6.0 s.

The horizontal distance between a crest and the adjacent trough of the wave is 4.5 m.

What is the speed of the wave?

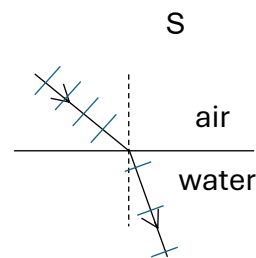
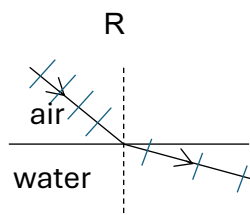
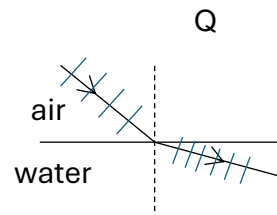
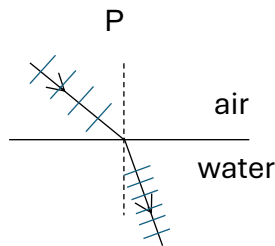
- A 0.67 m / s
- B 0.75 m / s
- C 1.3 m / s
- D 1.5 m / s

- 18 The figure below shows two waveforms produced by a flute (Y) and tuning fork (Z) played by two students.



How do the loudness and pitch of the sound from the tuning fork Z compare to that of the flute Y?

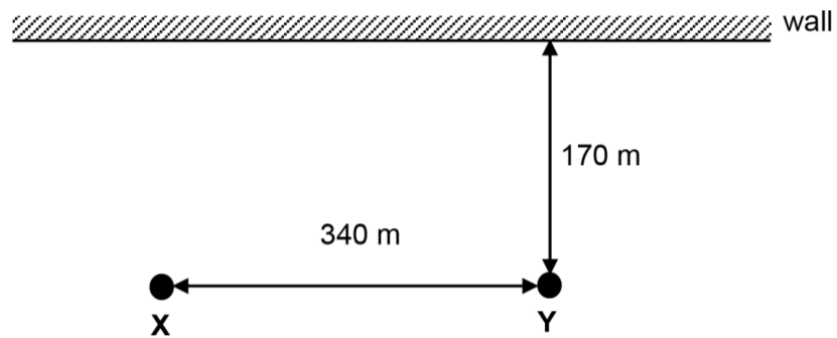
- A** The loudness of Y is lower but its pitch is the same as Z.
B Both Y and Z have the same loudness and pitch.
C The loudness of Y is higher but its pitch is lower than Z.
D The loudness of Y is the lower but its pitch is higher than Z.
- 19 The diagrams below show the waves travelling from air to water. The wave direction and wavefronts along the wave are also shown in each diagram.



Which of the diagrams above correctly represent light and sound waves as it travels from air to water?

	light wave	sound wave
A	P	Q
B	S	Q
C	P	R
D	S	R

- 20 The diagram shows two persons (X and Y) standing 340 m apart and 170 m away from the wall.



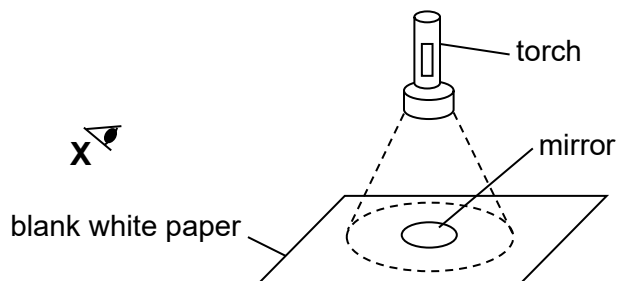
When person X fires a gun, person Y hears the gunshot twice.

Given that the speed of sound in air is 340 m/s, what is the time interval between the two gunshot sounds heard by person Y?

- A** 0.41 s **B** 0.50 s **C** 0.62 s **D** 1.24 s
- 21 What is one of the uses of ultrasound?
- A** cleaning jewellery
B fluorescent tubes
C optical fibres
D sunbeds

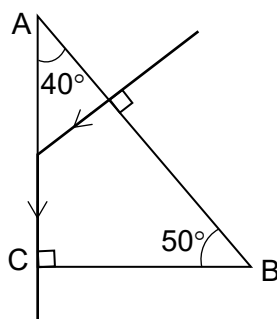
- 22** One night, Chester switched off all the lights in his room and placed a large piece of blank white paper onto his table.

He placed a small mirror, with its reflecting surface facing upwards, at the centre of the paper. Chester then shined a torch directly above the mirror as shown in the diagram below.



What would Chester see if he looks at the setup at position **X**?

- A** The mirror appears brighter than the paper as most of the light rays undergo regular reflection into his eyes.
 - B** The mirror appears brighter than the paper as most of the light rays undergo diffused reflection into his eyes.
 - C** The paper appears brighter than the mirror as most of the light rays undergo regular reflection into his eyes.
 - D** The paper appears brighter than the mirror as most of the light rays undergo diffused reflection into his eyes.
- 23** The diagram shows a ray of light entering a glass prism at the surface AB and travelling along the surface AC.



What is the refractive index of the glass prism?

- A** 1.31
- B** 1.42
- C** 1.50
- D** 1.56

24 Applications use different components of the electromagnetic spectrum.

Which shows correct applications for X-rays, ultraviolet light and microwaves?

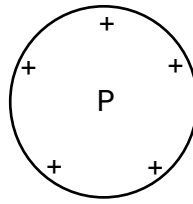
	X-rays	ultraviolet light	microwaves
A	mobile phone	fluorescent tube	intruder alarm
B	killing cancerous cells	sterilising surgical instruments	satellite television
C	medical imaging	television controller	sunbed
D	sterilising surgical instruments	television controller	detecting cracks in metal

25 An electrically charged plastic ball is dropped from rest.

Which types of fields are caused by the ball?

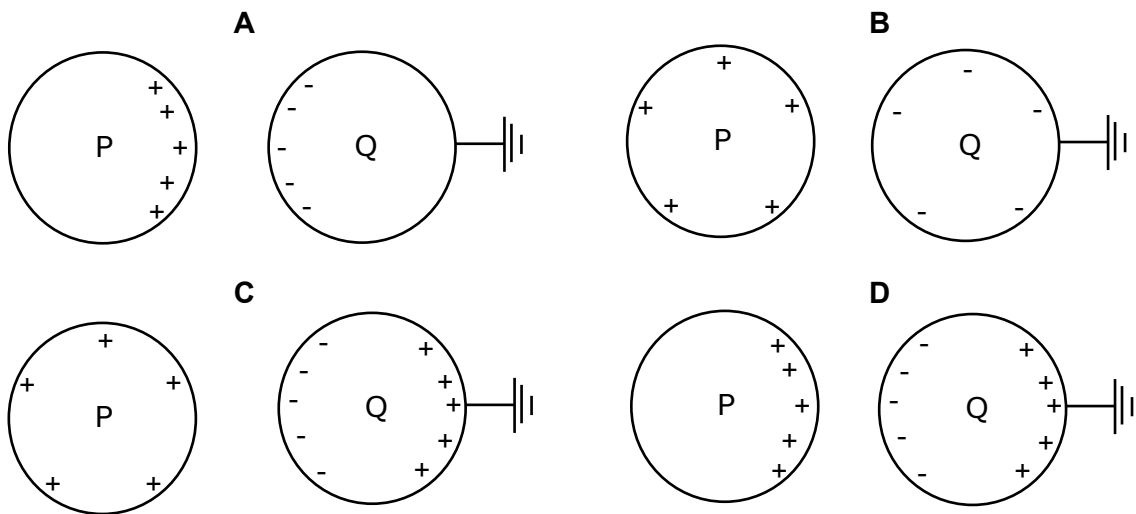
- A** gravitational and magnetic only
- B** electric and gravitational only
- C** electric and magnetic only
- D** electric, gravitational and magnetic

- 26** A metal sphere P has a positive charge distribution as shown.



A similar sphere Q, connected to an earthing wire, is brought close to P.

Which diagram best shows the final distribution of charge between the two spheres?



- 27** A student touches the body of a car that has become charged during its journey.

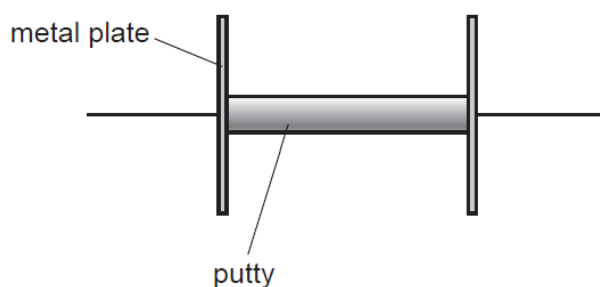
A current of 10 mA passes through him for 20 ms.

How much charge flows through him?

- A** $2.0 \times 10^{-4} \text{ C}$ **B** 0.50 C **C** 2.0 C **D** 200 C

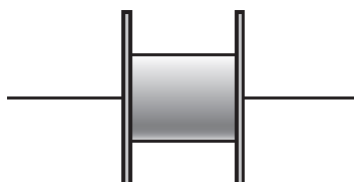
- 28** Conducting putty is a soft material which can easily be made into different shapes. It conducts electricity.

50 g of conducting putty is placed between two metal plates as shown.



With the putty arranged like this, it has a resistance of $8\ \Omega$.

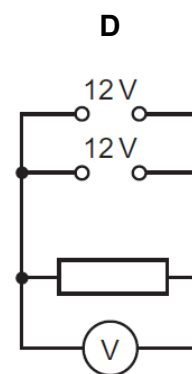
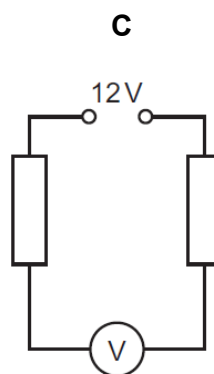
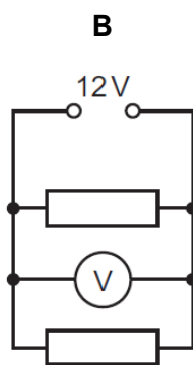
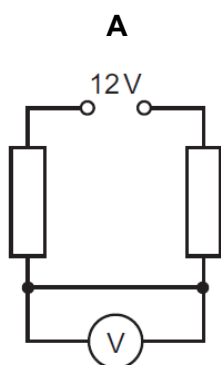
The plates are now squeezed together so that the distance between them is halved.



What is the resistance of the putty now?

- A** $2\ \Omega$ **B** $4\ \Omega$ **C** $8\ \Omega$ **D** $16\ \Omega$

- 29** In which circuit does the voltmeter not read 12 V?



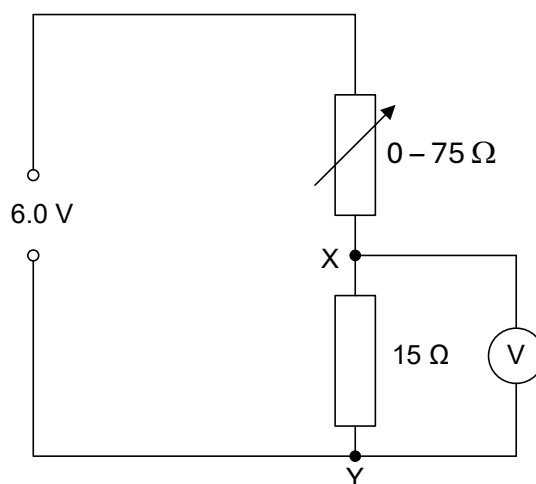
- 30** When the flash on a camera is used, a charge of 1.5 C flows for 0.0030 s through the flash lamp.

The average voltage across the flash lamp is 3600 V.

What is the energy supplied electrically to the flash lamp and what is the average power supplied?

	energy / J	power / W
A	2400	7.2
B	2400	800 000
C	5400	16.2
D	5400	1.8×10^6

- 31** The diagram shows two resistors in a circuit with a power supply and a voltmeter.



What is the range of voltages that can be obtained between points X and Y?

- A** 0.0 V to 1.0 V
- B** 0.0 V to 6.0 V
- C** 1.0 V to 3.0 V
- D** 1.0 V to 6.0 V

- 32** At a construction site, a metal scaffolding is firmly embedded in the damp ground. A builder holds a mains-operated electric drill in one hand, and the metal scaffolding with the other hand.

The power cable of the drill is damaged such that parts of the exposed cable enters the metal casing of the drill, where an earth wire is connected.

Which of the following could happen?

- A** A current could pass through the builder and electrocute him.
- B** A current in the scaffolding could heat him up and burn him.
- C** The large current could blow the fuse.
- D** The large current could make the motor spin too quickly.

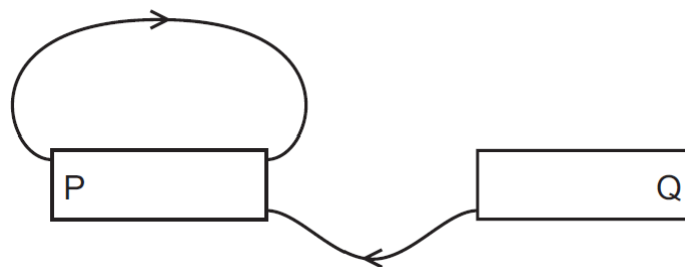
- 33** A 240 V mains circuit contains eight 60 W lamps in parallel.

At the time when the lamps are switched on, the filaments are cold and the current is four times as large as the final steady current in the circuit.

What is the initial current supplied by the mains?

- A** 0.25 A **B** 1.0 A **C** 2.0 A **D** 8.0 A

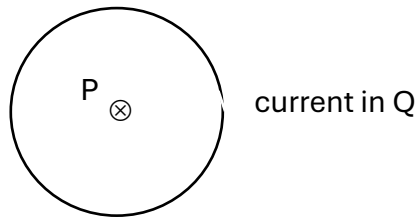
- 34** The diagram shows two magnetic field lines of the magnetic field around two bar magnets.



Which row shows the magnetic poles at end P and end Q of the two magnets?

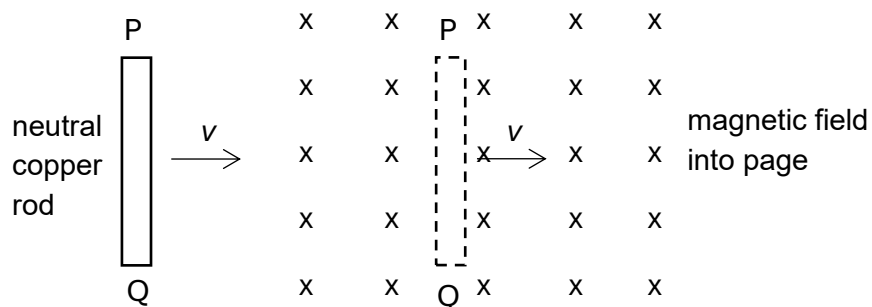
	P	Q
A	N	N
B	N	S
C	S	N
D	S	S

- 35** A long straight wire P is placed along the axis of a flat circular coil Q.
The wire and the coil each carry a current as shown.



What can be deduced about the force acting on each part of Q due to the current in P?

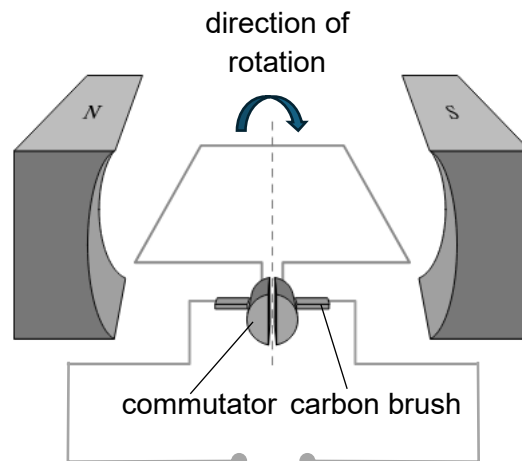
- A** The force is away from P.
B The force is towards P.
C The force is perpendicular to the plane in the diagram.
D There is no force in any direction.
- 36** The diagram below shows an electrically neutral copper rod moving at speed v into a magnetic field. The direction of the field is into the page. P and Q are the ends of the copper rod.



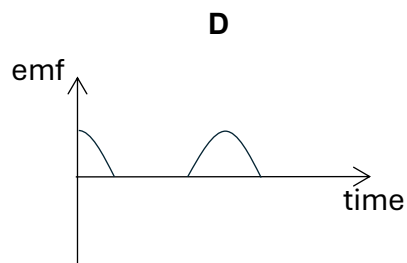
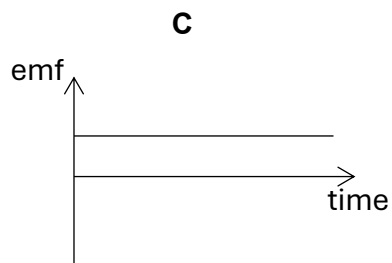
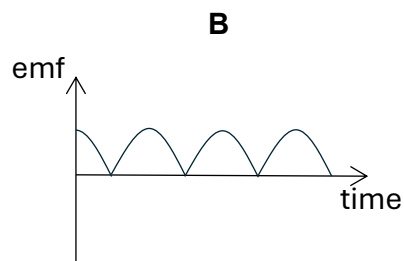
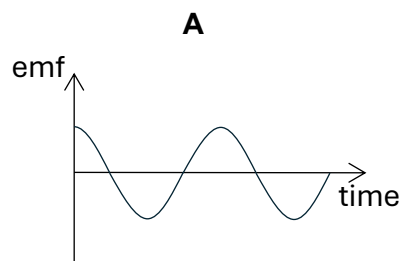
Which of the following options best describes the net charge found at P and Q when the rod is moving and is completely inside the magnetic field?

	P	Q
A	positive	positive
B	negative	positive
C	neutral	neutral
D	positive	negative

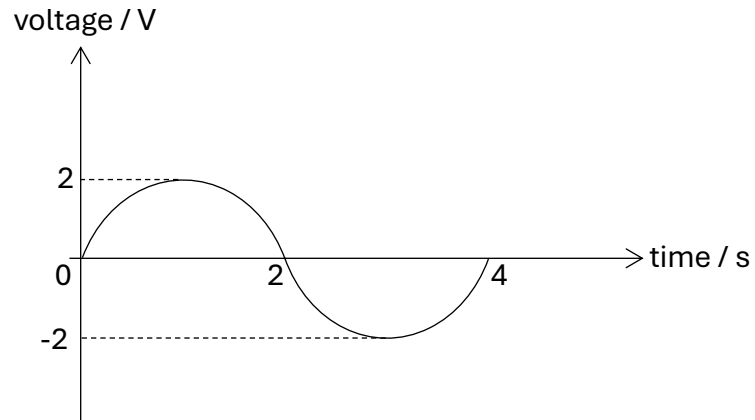
- 37 The figure shows an electrical generator, which consists of a rotating coil between a pair of permanent magnets.



Which of the following graphs shows the variation of e.m.f. produced by the generator?



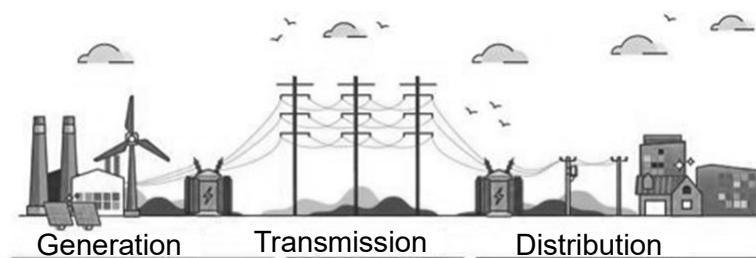
- 38 A simple a.c. generator produces a voltage which varies with time as shown in the graph below.



Which of the following reflects how the correct voltage varies with time when the generator rotates at half the original speed?

	maximum voltage / V	frequency / Hz
A	1	0.13
B	1	0.50
C	4	0.13
D	4	0.50

- 39 Long-distance power transmission occurs at high alternating voltages.



The following are reasons suggested to explain why high alternating voltages are used.

reason	
1	Alternating voltages can be stepped up or down efficiently by transformers.
2	For a given transmission power, the current will be reduced if a high voltage is adopted.
3	The power loss in the transmission cables will be reduced if a high voltage is adopted.

Which of the above reasons are correct?

- A both reasons 1 & 2
 - B both reasons 1 & 3
 - C both reasons 2 & 3
 - D all the given reasons
- 40 A radioisotope has a half-life of 18 hours.
- At 9:00 am on 1 May, a sample was prepared which contained 4.00 mg of the radioisotope.
- At what time will the mass of the radioisotope remaining be 0.50 mg?
- A 3:00 am on 2 May
 - B 3:00 pm on 3 May
 - C 9:00 am on 4 May
 - D 9:00 pm on 7 May