



**HILLGROVE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2026
SECONDARY 4 G3 (EXPRESS)**

CANDIDATE
NAME

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CLASS

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PHYSICS

6091/01

Paper 1 Multiple Choice

31 August 2026

1 hour

Additional Materials: Multiple Choice Answer Sheet

8.10 AM to 9.10 AM

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class and index number on the Answer Sheet in the spaces provided.

DO NOT WRITE ON ANY BARCODES.

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.

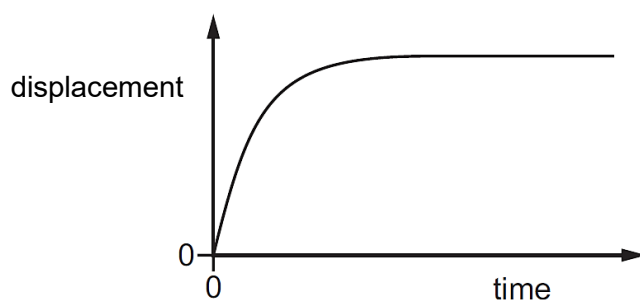
1 Which row shows scalar quantities and vector quantities?

	scalar quantities	vector quantities
A	displacement, force, temperature	distance, weight, mass
B	displacement, mass, force	distance, weight, temperature
C	distance, force, weight	displacement, mass, temperature
D	distance, mass, temperature	displacement, force, weight

2 Which statement is correct?

- A** There are a million milliwatts in a megawatt.
- B** There are a million nanograms in a microgram.
- C** There are a thousand microamperes in an ampere.
- D** There are a thousand micrometres in a millimetre.

3 The diagram shows the displacement–time graph for a moving object.



What is a description of the moving object?

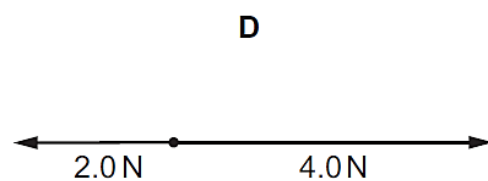
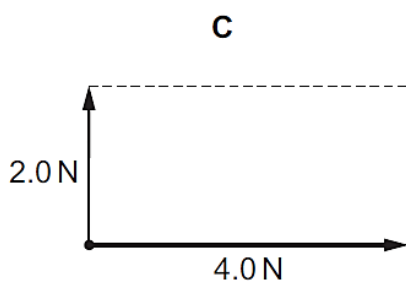
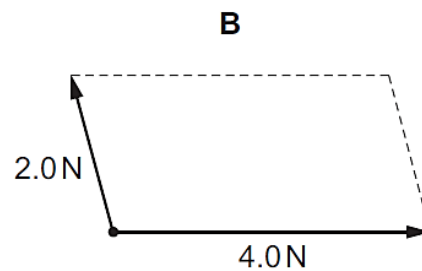
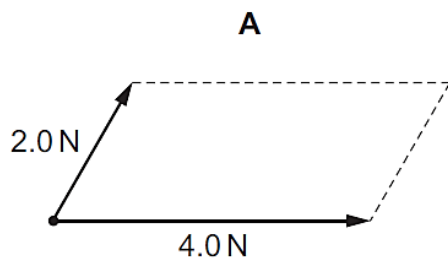
- A** a ball thrown vertically upwards and falling back to the thrower
- B** a car starting from rest and speeding up as it moves away from a traffic signal
- C** a rock dropped from a high cliff and falling into the sea below
- D** a train braking to a halt as it stops at a station

- 4 Two objects have the same size and shape but one has a smaller mass than the other. They are each dropped from rest.

Comparing the two objects, what can be said of the lighter object?

- A It has a lower initial acceleration and a lower terminal velocity.
 B It has a lower initial acceleration and the same terminal velocity.
 C It has the same initial acceleration and a lower terminal velocity.
 D It has the same initial acceleration and the same terminal velocity.
- 5 Forces of 4.0 N and 2.0 N act at a point.

Which combination of forces will have the largest resultant force?

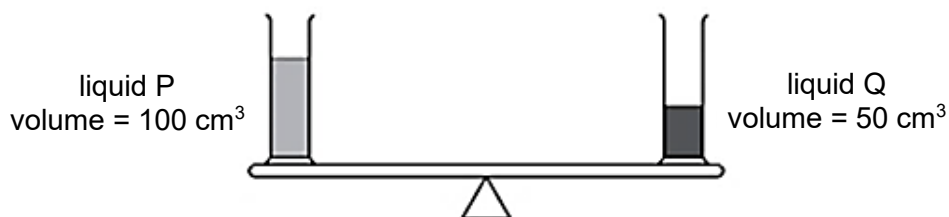


- 6 A force of 2400 N accelerates a car, of mass 800 kg, from an initial speed of 2.0 m/s.

What is the acceleration of the car, and its velocity after 2.0 s?

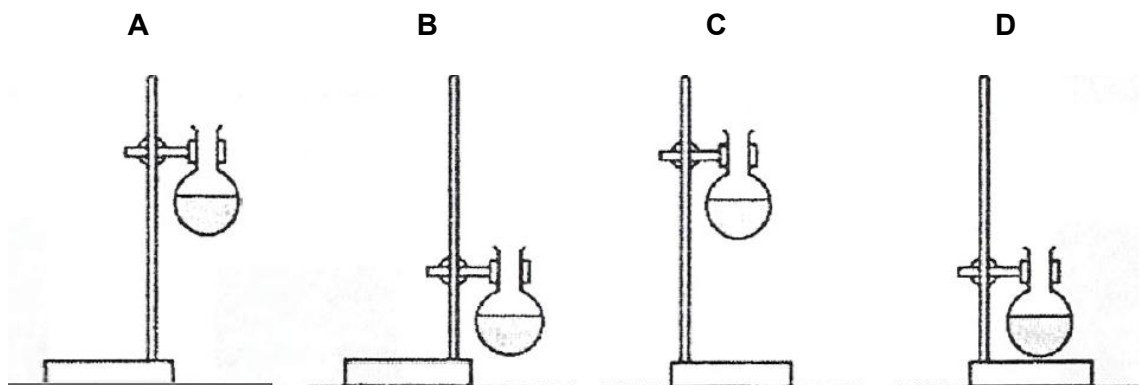
	<u>acceleration</u> m/s ²	<u>velocity</u> m/s
A	0.33	0.67
B	0.33	2.7
C	3.0	6.0
D	3.0	8.0

- 7 Two identical measuring cylinders containing liquid P and liquid Q are placed on a balance. The balance is pivoted at its centre and remains horizontal, as shown.

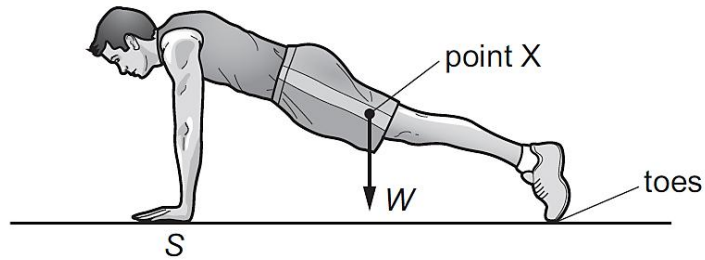


How does the density of liquid P compare with the density of liquid Q?

- A The density of liquid P is half the density of liquid Q.
- B The density of liquid P is equal to the density of liquid Q.
- C The density of liquid P is twice the density of liquid Q.
- D The density of liquid P is four times the density of liquid Q.
- 8 A student uses a stand and clamp to hold a flask of liquid in four different arrangements. Which arrangement is the **least** stable?



- 9 The diagram shows an athlete doing press-ups on the floor. The athlete is using both hands. The area of contact of each hand with the floor is S . The athlete's toes act as a pivot during each press-up.

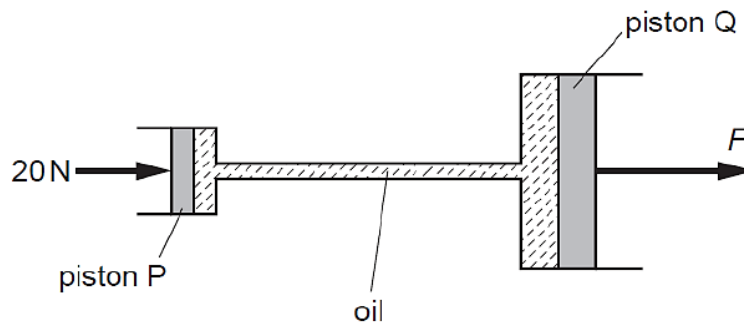


The athlete's weight W acts through point X. The distance between his toes and point X is half of the distance between his toes and his shoulders.

What is the pressure exerted on the palm of each of the athlete's hands?

- A $\frac{W}{8S}$ B $\frac{W}{4S}$ C $\frac{W}{2S}$ D $\frac{W}{S}$
- 10 The diagram shows a simple model of the braking system of a car. Piston P has an area of 5.0 cm^2 and piston Q has an area of 25 cm^2 .

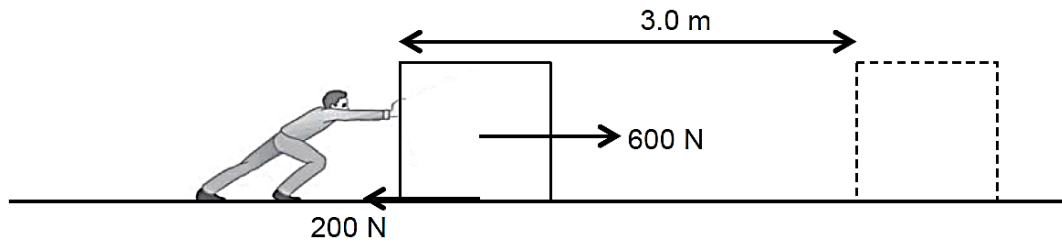
A force of 20 N is applied to piston P. As a result, there is a force F on piston Q.



Which statement is correct?

- A The distance moved by piston Q is five times the distance moved by piston P.
 B The force F acting on piston Q is 20 N .
 C The pressure acting on piston Q is 4.0 N/cm^2 .
 D The pressure acting on piston Q is higher than the pressure acting on piston P.

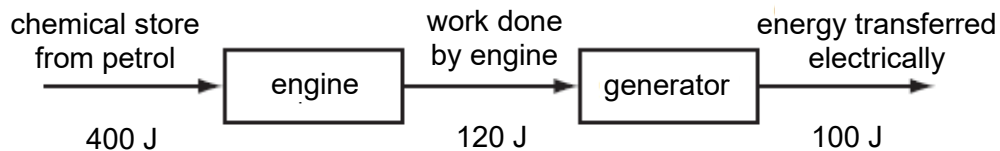
- 11 A man exerts a horizontal force of 600 N on an object as shown in the diagram.



A frictional force of 200 N acts on the object. The object moves 3.0 m in 4.0 s.

What is the useful power transferred to the object?

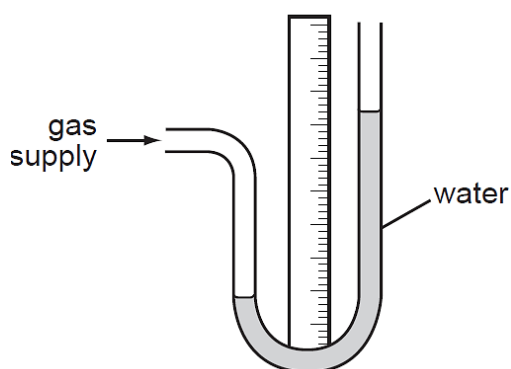
- A 150 W
 - B 300 W
 - C 450 W
 - D 600 W
- 12 Energy from petrol is used to operate an engine. The engine drives a generator, which produces energy electrically.



What is the overall efficiency of the process?

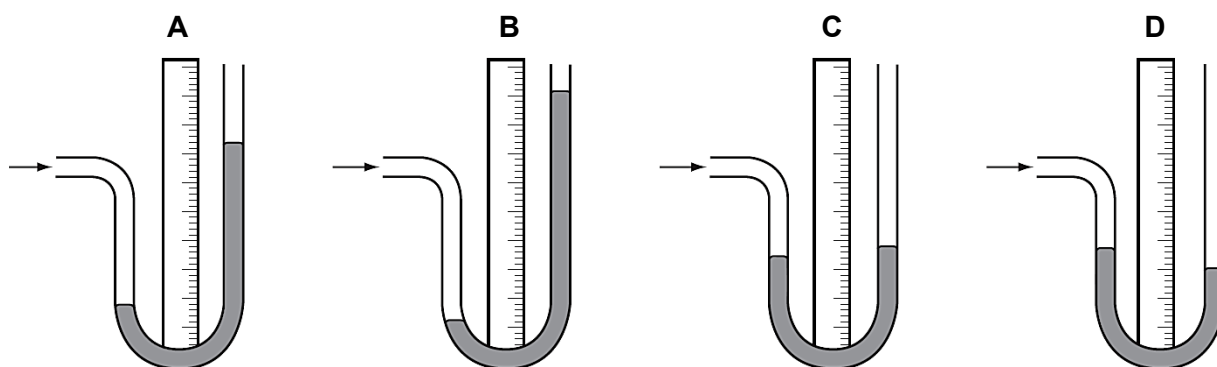
- A 25 %
- B 30 %
- C 75 %
- D 83 %

13 A water manometer is connected to a gas supply. The diagram shows the water levels.



The water is replaced by mercury, which is denser than water.

Which diagram shows the mercury levels when the manometer is connected to the same gas supply?



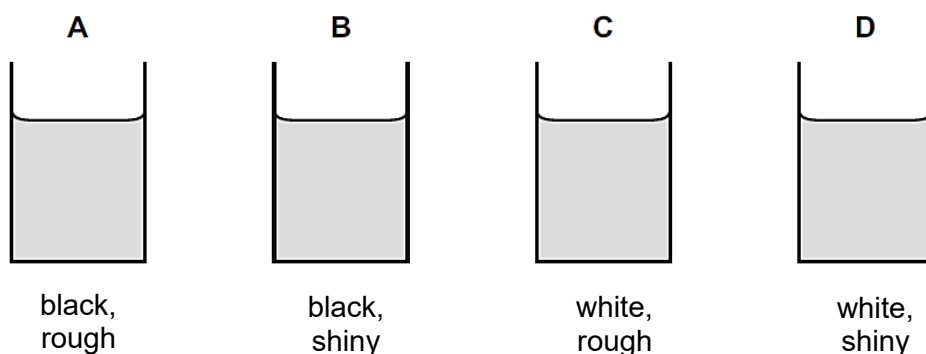
14 A gas condenses into a liquid.

What happens to the molecules of the gas?

- A** They move apart and gain energy.
- B** They move apart and lose energy.
- C** They move closer and gain energy.
- D** They move closer and lose energy.

- 15** Four metal cans are identical except for the colour and the texture of their outer surfaces. 100 cm³ of water at 70 °C is poured into each can.

Which can cools the fastest?



- 16** A rod of metal is heated at one end.

Which statement best describes the conduction of heat through the metal?

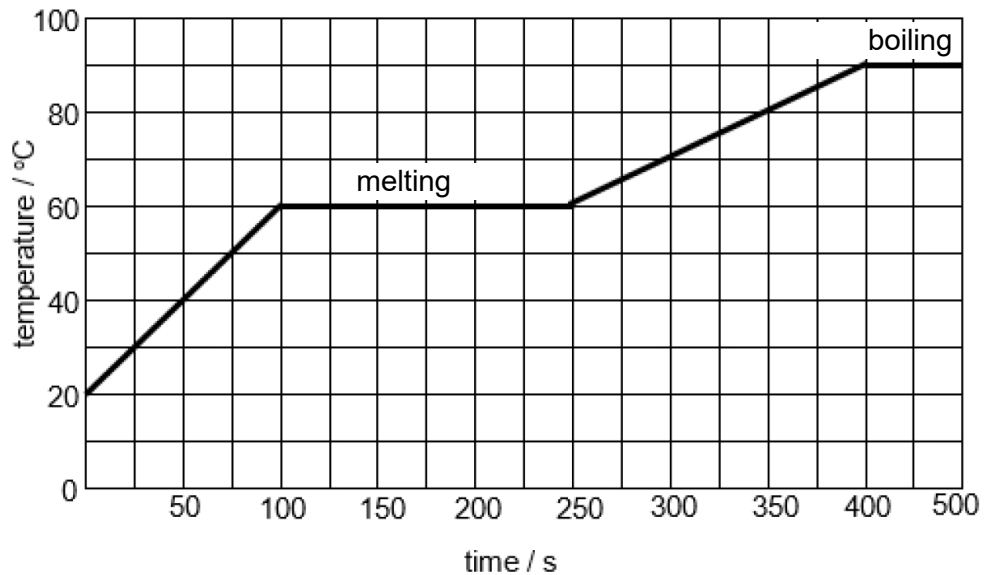
- A** Atoms move from the hot end and hit electrons at the cold end.
B Atoms vibrate and hit atoms at the cold end.
C Free electrons move from the hot end and hit atoms further along the rod.
D Free electrons vibrate and pass energy to free electrons further along the rod.

- 17** A beaker of water is left to evaporate.

Which molecules escape from the surface of the water and what happens to the average speed of the water molecules that remain?

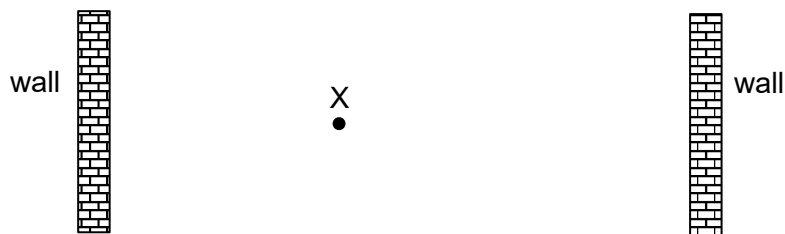
	escaping molecules	average speed of remaining molecules
A	less energetic ones	decreases
B	less energetic ones	increases
C	more energetic ones	decreases
D	more energetic ones	increases

- 18 A substance of mass 2.0 kg is heated by a 2000 W heater. The graph of temperature against time for the substance is shown in the diagram.



What is the specific heat capacity of the substance in its solid state?

- A 1700 J/ kg°C
 - B 2500 J/ kg°C
 - C 5000 J/ kg°C
 - D 150 000 J/ kg°C
- 19 A man who is standing at point X between two parallel walls fires a starting pistol.

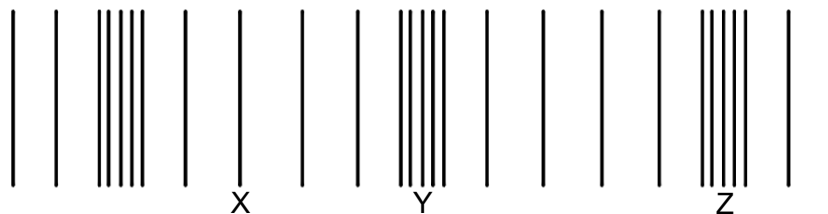


He hears the first echo after 0.60 s and another one after 0.80 s.

How long after firing the pistol will he hear the next echo?

- A 1.2 s
- B 1.4 s
- C 1.6 s
- D 2.4 s

- 20** A longitudinal wave travels along a spring. The diagram represents the position of the coils of the spring at a particular instant as it vibrates from side to side.



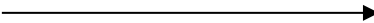
Each coil completes six oscillations in 3.0 s.

Which distance represents the wavelength and what is the period of the wave?

	wavelength	period / s
A	X to Y	0.50
B	X to Y	2.0
C	Y to Z	0.50
D	Y to Z	2.0

- 21** The diagram shows part of the electromagnetic spectrum. Some sections are labelled.

Radio waves		R	visible light			gamma-rays
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 increasing frequency

Which application uses section R?

- A** cancer treatment
- B** satellite television
- C** detection of counterfeit notes
- D** television remote controller

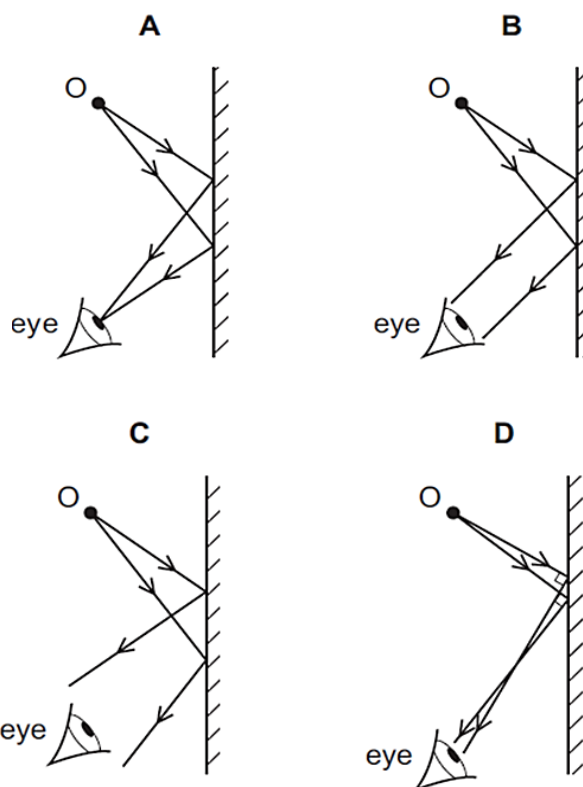
22 Blue light has a shorter wavelength than red light.

How do the speed and the frequency of blue light in air compare with the speed and the frequency of red light in air?

	speed of blue light	frequency of blue light
A	greater	greater
B	greater	less
C	same	greater
D	same	less

23 An eye views an object O by reflection in a plane mirror.

Which ray diagram is drawn correctly?



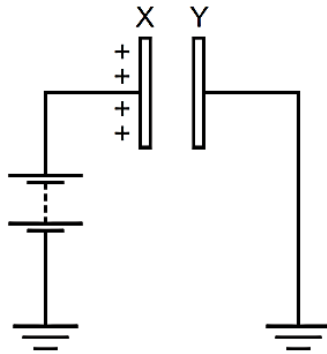
- 24** When an object is placed at a distance of 20 cm from a lens, the image formed is the same size as the object.

If the object is placed 15 cm from the lens, what are the characteristics of the image formed?

- A** real, inverted, diminished
- B** real, inverted, magnified
- C** virtual, upright, diminished
- D** virtual, upright, magnified

- 25** A metal plate X is connected to earth by a battery. The plate has a positive charge.

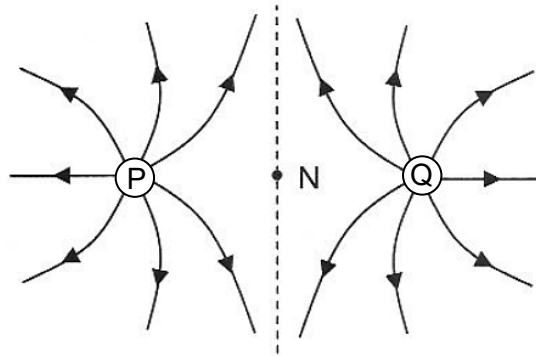
A second metal plate Y is initially uncharged and connected to earth. It is then positioned parallel to X.



What happens as Y is brought close to X?

- A** Electrons flow from earth to Y only.
- B** Electrons flow from Y to earth only.
- C** Protons flow from Y to earth and electrons flow from earth to Y.
- D** Protons flow from earth to Y and electrons flow from Y to earth.

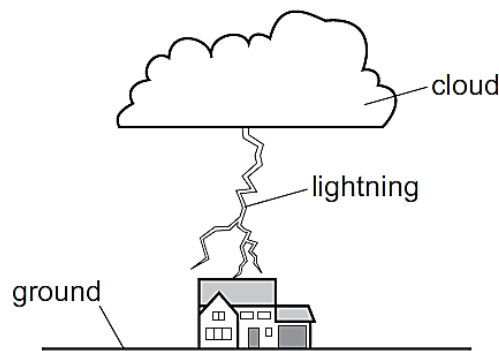
- 26 The diagram shows the electric field due to two charges P and Q. The charges are equal in magnitude. An electron is placed at point N in the electric field where point N is the centre of the two charges.



Which row correctly shows the charges of P and Q and the motion of the electron?

	charge of P	charge of Q	motion of electron
A	negative	negative	at rest
B	negative	positive	move towards P
C	positive	negative	move towards Q
D	positive	positive	at rest

- 27 The diagram shows a lightning strike.

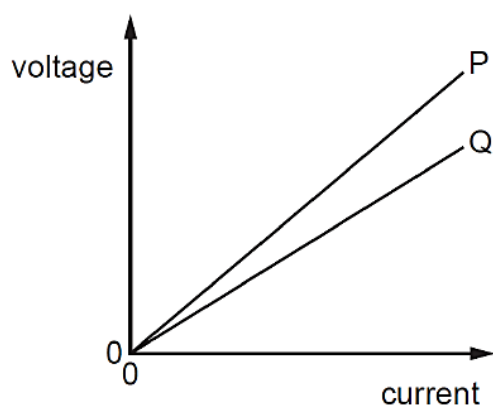


During the lightning strike, there is a current of 2.8×10^4 A between the cloud and the house for 52 ms.

How much charge flows during the lightning strike?

- A** 1500 C **B** 15 000 C **C** 540 000 C **D** 1 500 000 C

28 The diagram shows how voltage varies with current for two resistance wires P and Q.

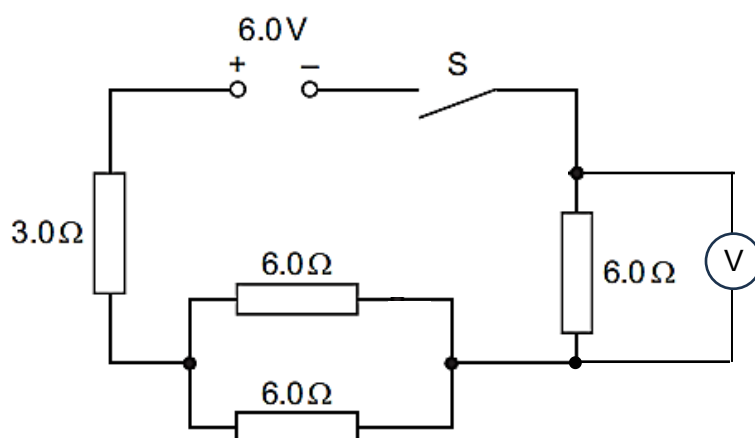


The wires are made from the same material and have equal lengths. The resistance of the wires and their cross-sectional areas are different.

Which wire has the greater resistance and which wire has the larger cross-sectional area?

	greater resistance	larger cross-sectional area
A	P	P
B	P	Q
C	Q	P
D	Q	Q

29 A student connects the circuit shown.



The switch S is closed.

What is the reading on the voltmeter?

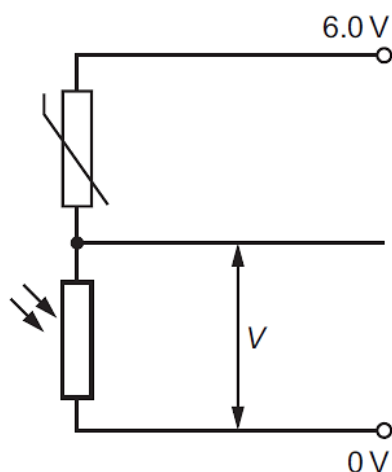
A 1.0 V

B 3.0 V

C 4.5 V

D 6.0 V

30 A potential divider consists of a thermistor and a light-dependent resistor (LDR).

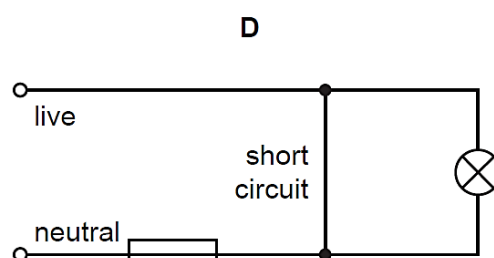
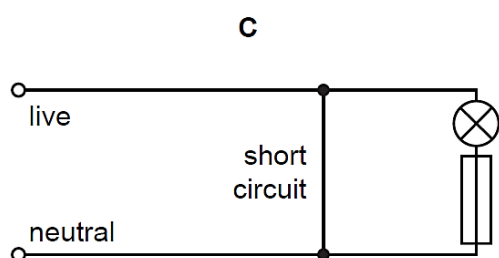
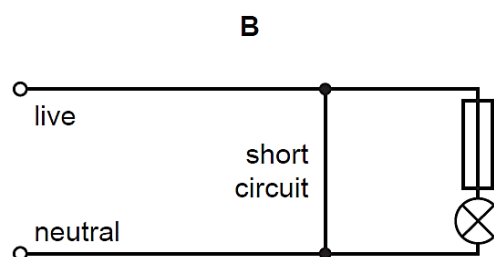
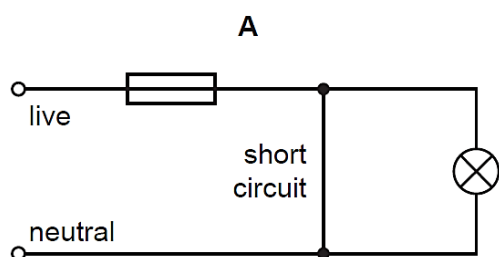


Which conditions give rise to the **smallest** voltage V ?

- A cold and bright
- B cold and dark
- C hot and bright
- D hot and dark

31 In each of the circuits below, a short circuit occurs.

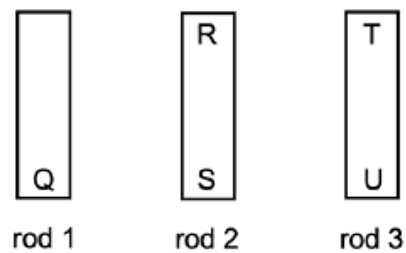
In which circuit would the fuse blow and make the circuit safe to repair?



32 Why are the metal casings of electrical appliances earthed?

- A** to complete the circuit
- B** to ensure the casing is not at a dangerous voltage
- C** to ensure the fuse blows when the current is too large
- D** to protect the appliance from overheating

33 An experiment is carried out to determine which of three metal rods are permanent magnets. End Q of rod 1 is brought close to the ends of rod 2 and rod 3.



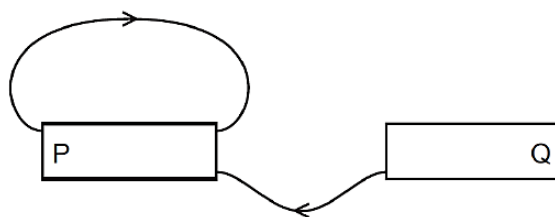
The observations are recorded in the table below.

end Q brought near to	observation
R	attraction
S	attraction
T	attraction
U	repulsion

Which metal rod(s) is / are magnet(s)?

- A** rod 1 only
- B** rods 1 and 2 only
- C** rods 1 and 3 only
- D** rods 1, 2 and 3

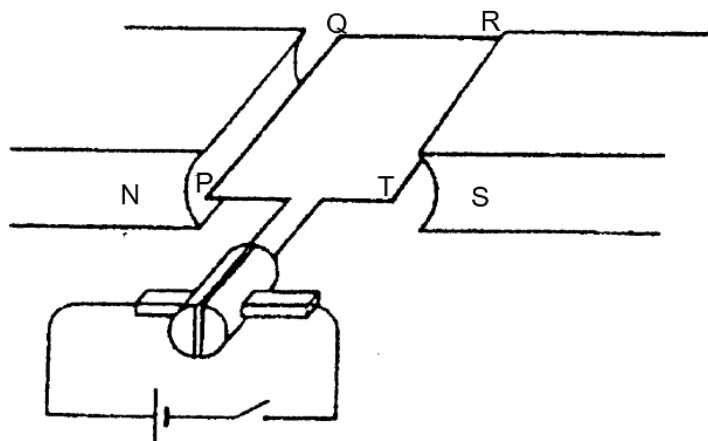
34 The diagram shows two magnetic field lines of the magnetic field around two bar magnets.



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

	P	Q
A	north	north
B	north	south
C	south	north
D	south	south

35 The diagram below shows a simple d.c. motor.

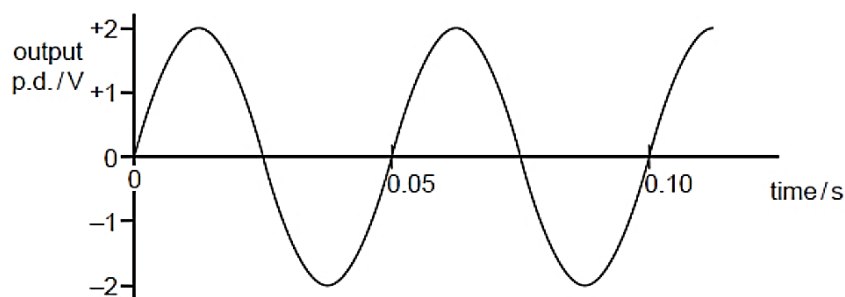


When the switch is closed, which statement(s) is/are correct?

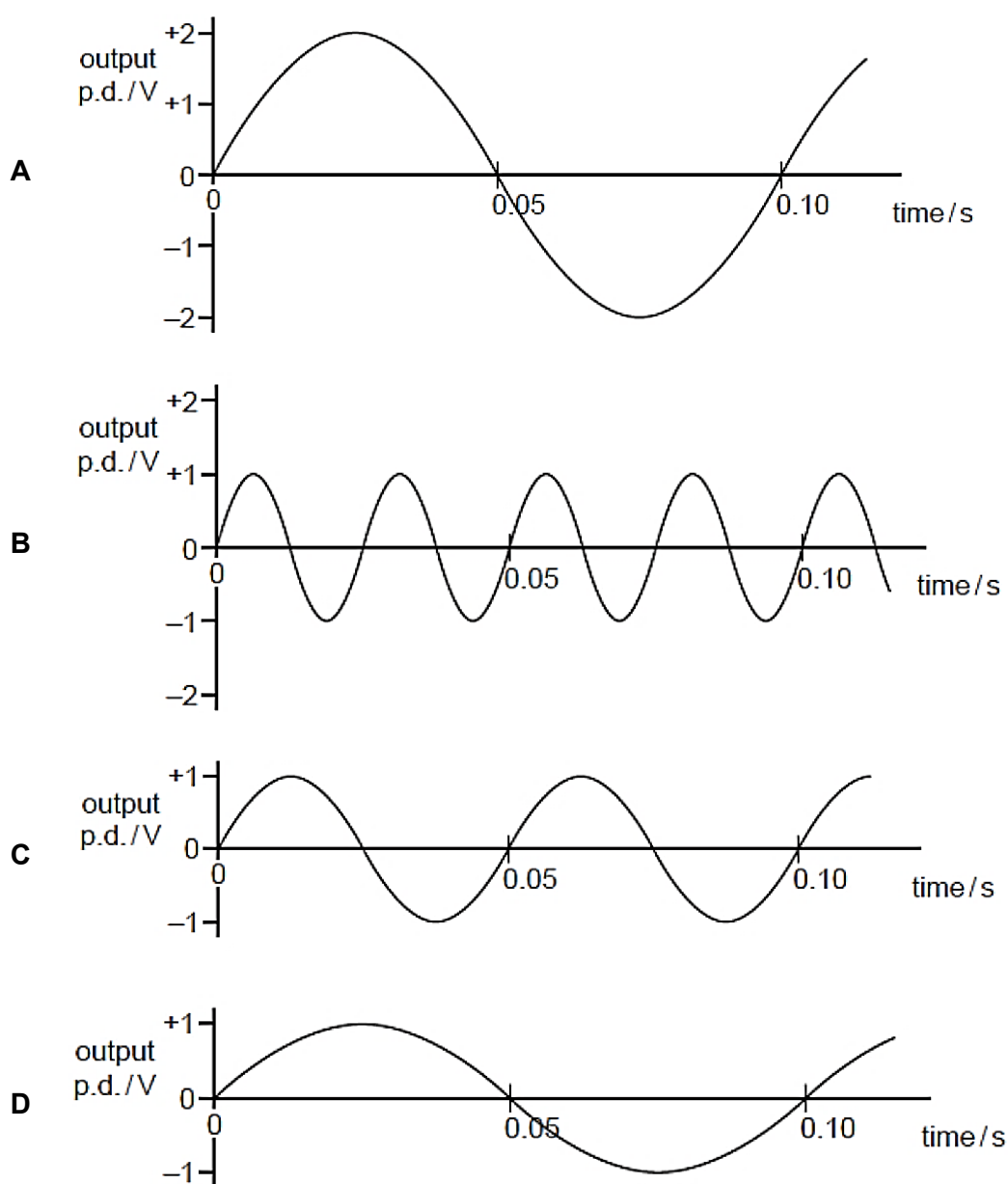
- 1 A current will flow around the coil in the direction PQRT.
- 2 The coil will rotate in a clockwise direction.
- 3 The purpose of the commutator is to reverse the current in the coil after every half turn.

- A** 1 only
- B** 1 and 2 only
- C** 1 and 3 only
- D** 1, 2 and 3

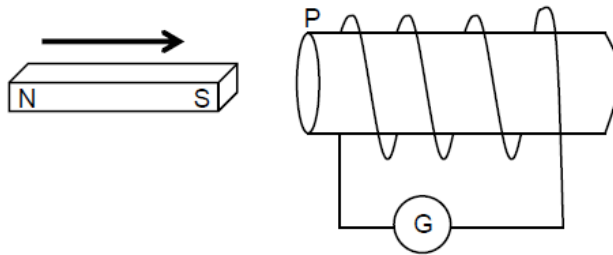
- 36 The graph shows the output of an a.c. generator. The coil in the generator rotates 20 times in one second.



Which graph shows the output when the coil rotates 10 times in one second?



37 The diagram shows a permanent magnet approaching a solenoid at a constant speed.



What is the polarity of the solenoid at P and the direction of the deflection in the galvanometer?

	polarity of solenoid at P	direction of deflection in the galvanometer
A	north	to the left
B	north	to the right
C	south	to the left
D	south	to the right

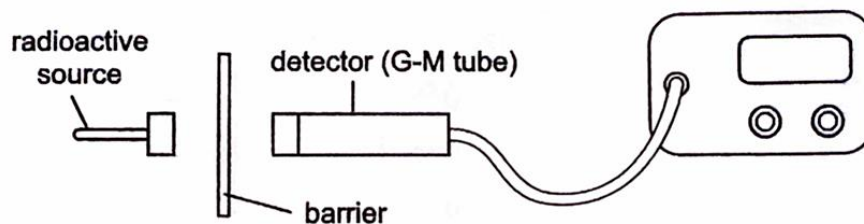
38 A step-down transformer has a primary coil and a secondary coil wound on a soft-iron core.

The primary coil is connected to a 6.0 V direct current (d.c.) supply.

Which statement about the transformer is correct?

- A** The output voltage is equal to 6.0 V.
- B** The output voltage is greater than 6.0 V.
- C** The output voltage is less than 6.0 V but more than zero.
- D** There is no output voltage.

- 39** The diagram shows the apparatus used in an experiment in which barriers of various materials are placed in turn between different radioactive sources and a detector.



The table shows the count rates recorded by the detector for four sources.

Which source contains a mixture of radioactive materials?

source	count rate/ counts per minute			
	no barrier	paper	thin aluminum	thick lead
A	200	200	200	30
B	200	30	30	30
C	1200	600	200	30
D	1200	1200	30	30

- 40** During fission, a nucleus of uranium-235 (U-235) absorbs one neutron to produce two daughter nuclei and three neutrons.

Krypton-92 (Kr-92) is one of the daughter nuclei and it contains 92 nucleons.

How many nucleons does the other daughter nucleus contain?

- A** 92 **B** 141 **C** 144 **D** 327

END OF PAPER