NAME:	NO:	CLASS:

ADMIRALTY SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2024

SUBJECT	:	Physics
CODE/PAPER	:	6091/1
LEVEL/STREAM	:	Secondary 4 Express
DATE	:	23 Aug 2024
TIME	:	1130h – 1230h
DURATION	:	1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and register number on the Optical Answer Sheet provided unless this has been done for you.

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 Optical Answer Sheet.

Fill in the Optical 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 paper.
The use of an approved scientific calculator is expected, where appropriate.

40

DO NOT TURN OVER THIS PAPER UNTIL YOU ARE TOLD TO DO SO.

This question paper consists of **18** printed pages including this cover page.

1 A list of physical quantities is shown.

length
mass
speed
temperature
time
volume

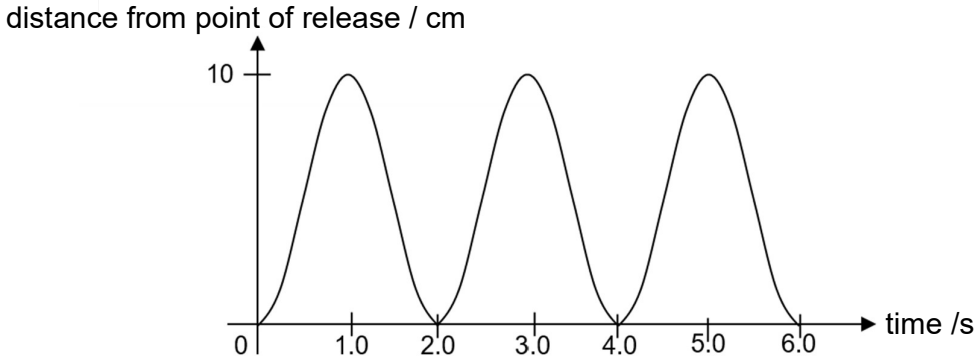
How many of these quantities are base quantities?

A 2
B 3
C 4
D 5

2 Which is the likely estimate of the radius of a hydrogen nucleus?

A 10^{-8} m **B** 10^{-10} m **C** 10^{-12} m **D** 10^{-15} m

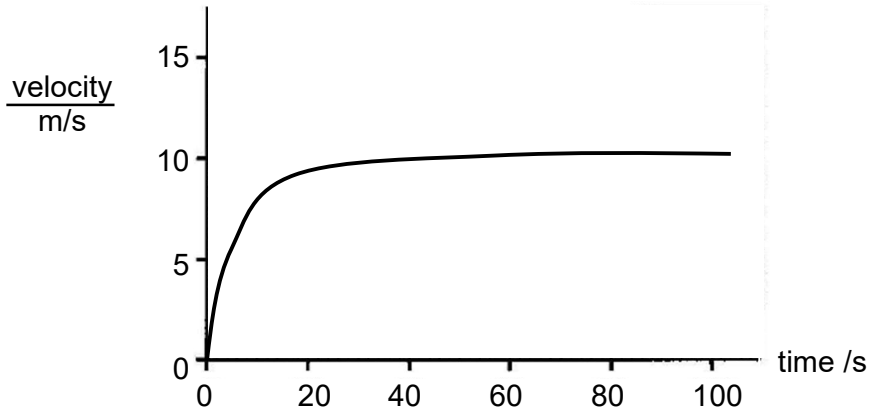
3 The bob of a simple pendulum is displaced slightly to one side and then released. The motion of the swinging bob is represented by the following graph.



What is the frequency of the swinging pendulum bob?

A 0.50 Hz
B 1.0 Hz
C 2.0 Hz
D 4.0 Hz

4 The diagram below shows the velocity-time graph of a falling object.



Which statement is true?

A Air resistance caused the object to decelerate.
B The acceleration due to gravity decreases with time.
C The acceleration of the object at t = 0 s is 10 m/s^2.
D The object stops moving after 40 s.

5 Four of the gravitational forces that act between planets in our Solar System are listed below.

W: the force on the Earth due to the Moon
X: the force on the Sun due to the Earth
Y: the force on the Moon due to the Earth
Z: the force on the Sun due to the Moon

Which two forces are an action-reaction pair?

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

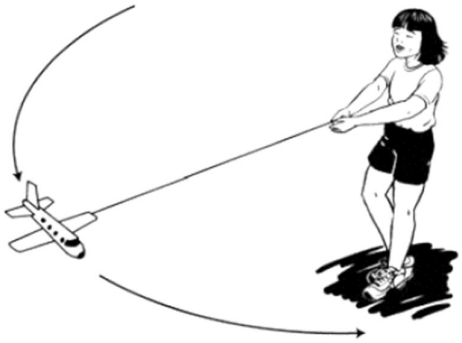
6 Experiments are carried out on the Moon and on Earth. There is no atmosphere on the Moon and the gravitational field strength on the Moon is less than that on Earth.

A coin and a feather are dropped at the same instant from the same height.

Which statement is correct for the experiment on the Moon?

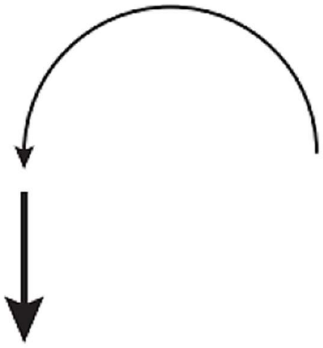
A The coin falls faster than the feather, taking a longer time than they take on Earth.
B The coin falls faster than the feather, taking a shorter time than they take on Earth.
C They fall together, taking a longer time than they take on Earth.
D They fall together, taking a shorter time than they take on Earth.

7 A student swings a toy plane in a circle on a string.



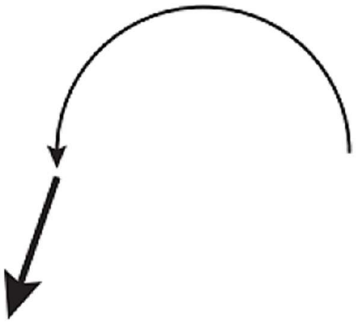
What path (top view) would the toy plane take if the string suddenly breaks?

A

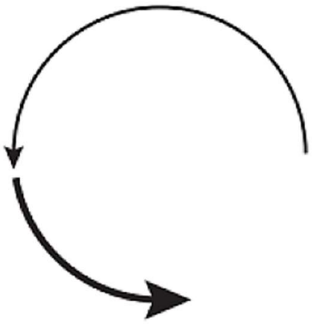


B

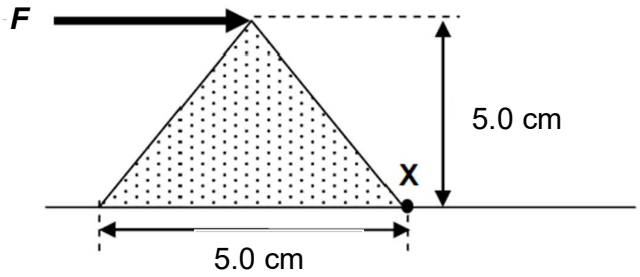
C



D



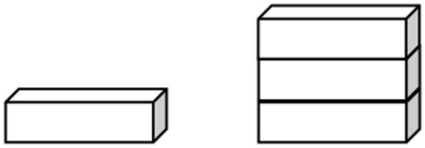
8 The diagram below shows the cross-section of a uniform pyramid of weight 10.0 N.



What is the minimum value of the force *F* that is required to just tilt the pyramid about X?

A 2.5 N **B** 5.0 N **C** 10.0 N **D** 20.0 N

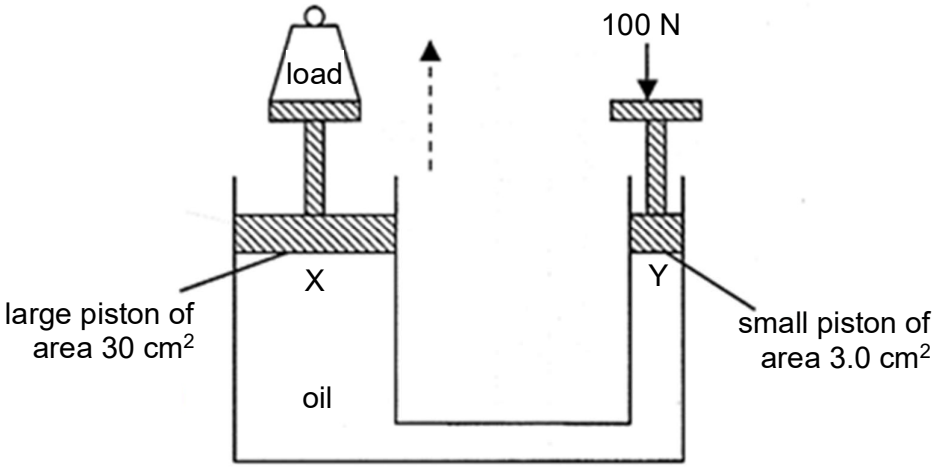
9 The diagram shows a single brick and a pile of three bricks. All the bricks are identical.



Which of the following best describes the three bricks, as compared to the single brick?

A three times the mass, volume and density
B three times the mass and density, but the same volume
C three times the density and volume, but the same mass
D three times the mass and volume, but the same density

10 In a hydraulic press as shown, the small piston of 100 N is pushed down and this is just sufficient to raise a heavy load in the large piston.



Neglecting the weight of the pistons, what is the maximum load that can be lifted?

A 10 N
B 100 N
C 1000 N
D 10 000 N

11 A battery-operated remote-control car is switched on.

What is the principal energy transfer taking place when it switches on?

A chemical potential store to internal store of energy
B kinetic store to internal store of energy
C chemical potential store to kinetic store of energy
D kinetic store to chemical potential store of energy

12 A machine is able to lift 150 000 g of bricks vertically up to a height of 30 m above the ground in 50 s.

What is the power of the machine?

A 0.9 kW **B** 900 kW **C** 45 kW **D** 2250 kW

13 Smoke particles in a sealed container are illuminated by a beam of light. Under a microscope, the smoke particles are observed to move at random speeds and change directions randomly.

What causes this motion?

A Collisions between smoke particles.
B Collisions with rapidly moving air molecules.
C Atomic vibrations within the smoke particles.
D Energy provided by the beam of light shining into the container.

14 Substances in gaseous state are less dense than when they are in liquid state or solid state because

A the molecules at gaseous state expand more than when they are in liquid or solid state
B the space between two molecules in gaseous state is wider than when it is in solid state and liquid state
C the molecules in gaseous state are in Brownian motion
D the molecules in gaseous state have smaller mass than when they are at liquid or solid state.

15 A metal cup with a shiny silver surface is filled with boiling water. A man touches the outer surface of the cup and finds it very hot.

Why is the surface hot?

A Boiling water gives off latent heat.
B The metal cup is a good thermal conductor.
C Convection takes place in the boiling water.
D The shiny silver surface is a good emitter of radiation.

16 A student, who is perspiring profusely, stands under a ceiling fan.

What is the main reason for her to feel cooler after some time?

A The fan sets up a convection current around her.
B The fan absorbs the radiation from her body at a faster rate.
C The fan increases the rate of evaporation of perspiration from her body.
D The fan increases the rate of radiation from her body to the surroundings.

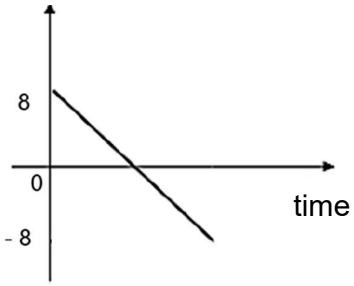
17 Which statement describes the process of boiling?

A Boiling occurs at any temperature and throughout a liquid.
B Boiling occurs at a fixed temperature and throughout a liquid.
C Boiling occurs at any temperature and only on the surface of a liquid.
D Boiling occurs at a fixed temperature and only on the surface of a liquid.

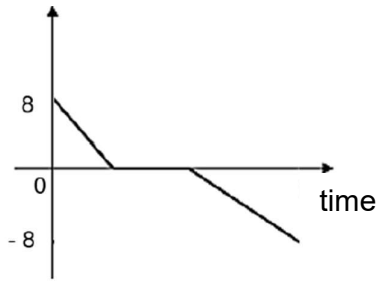
18 A cup of water at 8 °C was cooled to ice at – 8 °C.

Given that ice has a lower specific heat capacity than water, which of the following cooling curves shows how the temperature changes with time?

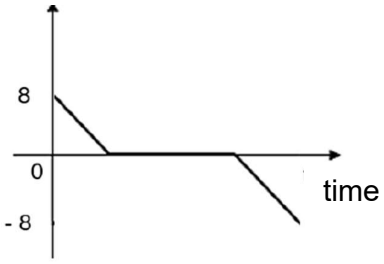
A



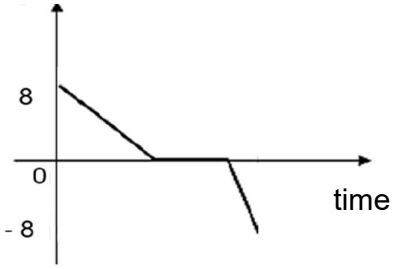
B



C



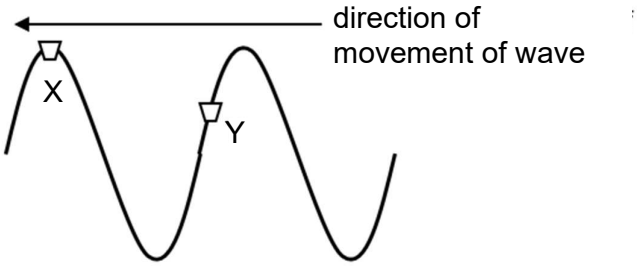
D



19 4000 J of energy is used to heat up a copper block from 50 °C to 70 °C.
What is the mass of the copper block, given that the specific heat capacity of copper is 400 J/(kg °C)?

A 0.5 kg **B** 1.0 kg **C** 10 kg **D** 200 kg

20 The diagram shows two corks, X and Y, floating on water.

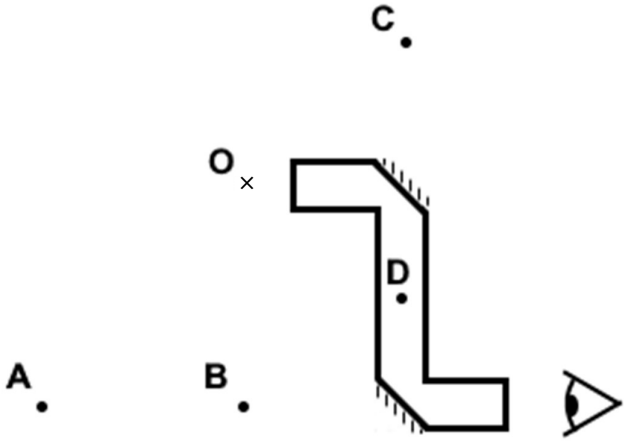


What will happen to both corks as the wave passes?

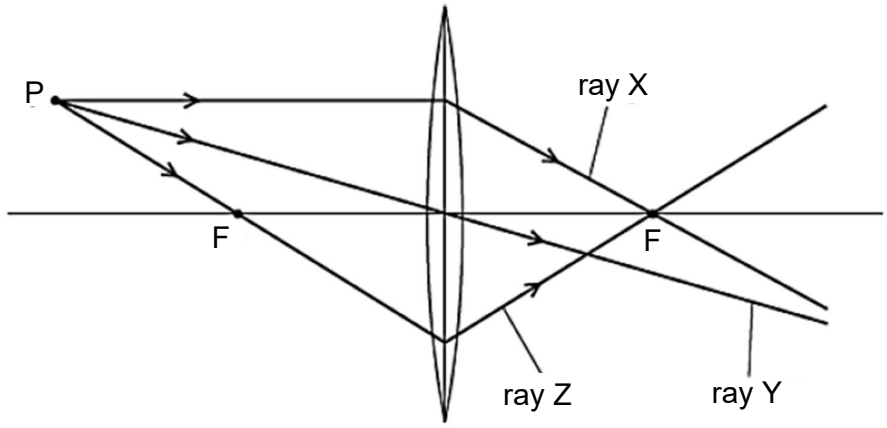
A Both X and Y will move downwards.
B Both X and Y will move upwards.
C X will move downwards and Y will move upwards.
D X will move upwards and Y will move downwards.

21 A periscope is constructed using two mirrors mounted on a bent pipe. An object is placed at Point **O**.

Where is the position of the image seen by the observer?



22 A student draws three rays of light from point P through a converging lens. Each point labelled F is a principal focus of the lens.



Which ray(s) is/are drawn correctly?

A ray Y only
B ray Z only
C ray X and Y only
D ray X and Z only

23 A converging lens has a focal length of 20 cm. An object is placed 50 cm from the optical centre of the lens. The lens equation is given by

$$\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$$

where u is the object distance, v is the image distance and f is the focal length.

How far will the image be from the optical centre of the lens?

A 10 cm
B 14 cm
C 20 cm
D 33 cm

24 Which of the following is an application of radio waves?

A detecting fake notes
B transmitting communication signals
C heating food
D killing cancerous cells

25 It is known that the energy E of an electromagnetic wave and its frequency f is related by the product:

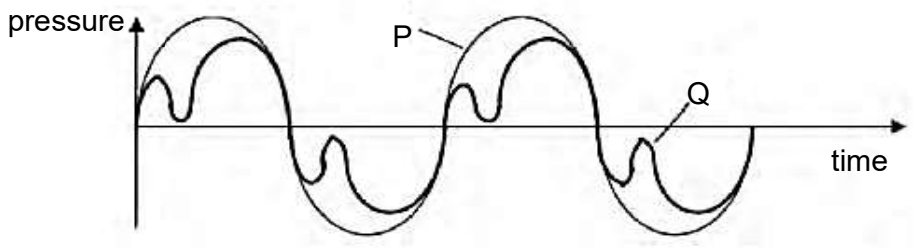
$$E = h \times f$$

where h is a constant.

Which type of electromagnetic waves has the highest energy?

A infrared radiation
B ultraviolet ray
C microwaves
D visible light

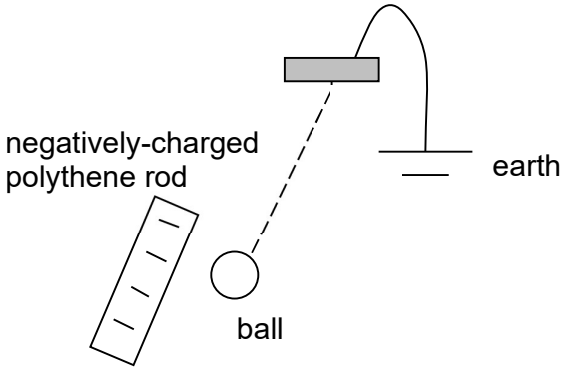
26 The diagram shows waveforms produced by a tuning fork P and a flute Q played by two students.



How does the sound of Q differ from sound of P?

A The loudness of Q is lower but has the same pitch as compared to P.
B The loudness of Q is higher and the pitch is lower as compared to P.
C The loudness of Q is the same and the pitch is higher as compared to P.
D The loudness of Q is the same and the pitch is lower as compared to P.

27 A small uncharged metal ball is suspended by a thin non-conducting thread. When a negatively charged polythene rod is brought close, the ball moves towards the rod.



Why did the ball move towards the rod?

A electrons transfer from one side of the ball to the other
B protons transfer to the side closer to the polythene rod
C electrons transfer from the ball to the earth
D protons transfer from the rod to the ball

28 A steady current of 0.50 A flows through a bulb when it is connected to a 1.5 V cell.

How much charge passes through the lamp in 1.0 min?

A 0.50 C **B** 1.5 C **C** 30 C **D** 45 C

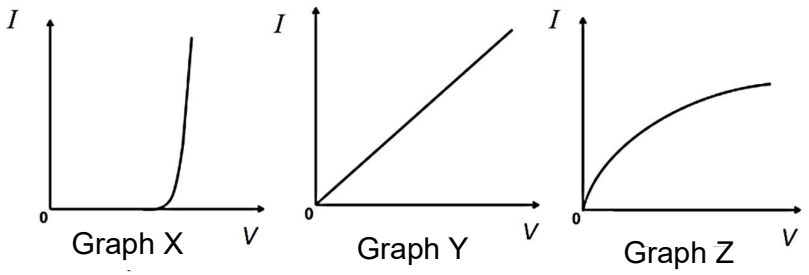
29 A wire has a resistance of 8 Ω. A second wire, made of the same material, half the length and twice the cross-sectional area.

What is the resistance of the second wire?

A 1 Ω
B 2 Ω
C 8 Ω
D 16 Ω

30 The graphs show the variation of current *I* with potential difference *V* for

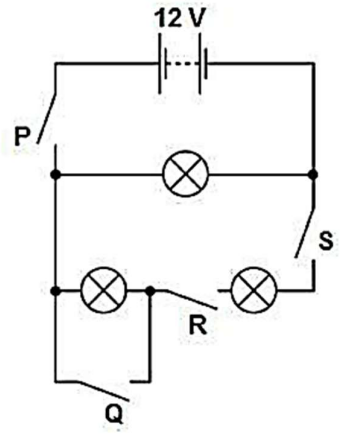
- a metal wire at constant temperature,
- a semiconductor diode and
- a filament lamp.



Which row correctly identifies these graphs?

	metal wire at constant temperature	semiconductor diode	filament lamp
A	graph X	graph Z	graph Y
B	graph Y	graph X	graph Z
C	graph Y	graph Z	graph X
D	graph Z	graph X	graph Y

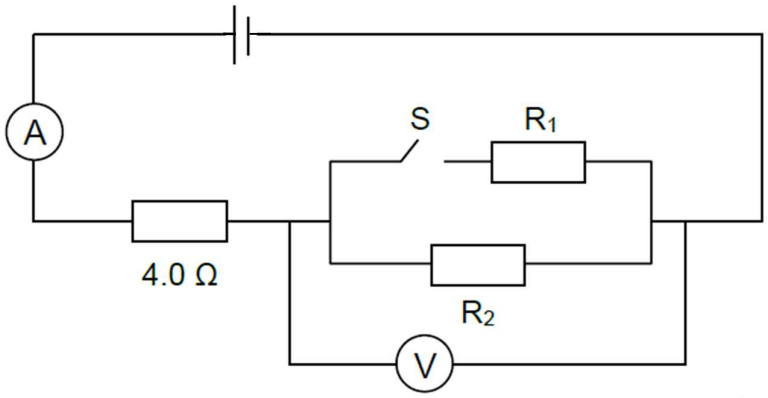
31 The circuit diagram shows three identical lamps. The lamps are rated at 5 W, 12 V.



Which switches need to be closed for two lamps to be operating?

A R and S
B P, R and S
C Q, R and S
D P, Q, R and S

32 Two resistors R_1 and R_2 are connected in a circuit as shown in the diagram below. When switch S is open, the ammeter reads 1.0 A and the voltmeter reads 8.0 V. When the switch S is closed, the ammeter reads 1.5 A and the voltmeter reads 6.0 V.



What are the resistances of R_1 and R_2?

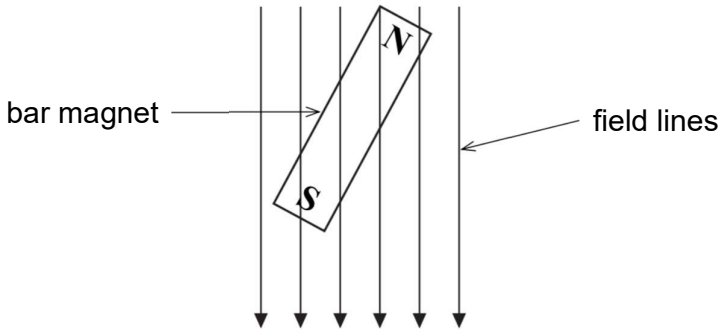
	R_1 / Ω	R_2 / Ω
A	4.0	4.0
B	4.0	8.0
C	8.0	4.0
D	8.0	8.0

33 The electric light switch for a bathroom is sometimes fitted on the wall outside the bathroom.

Why is this better than fitting the switch on the wall in the bathroom?

A The heat from the light in the bathroom affects the switch.
B The person in the bathroom may be electrocuted if water enters the switch.
C The switch is less likely to be damaged outside the bathroom.
D The warm air in the bathroom causes the switch to overheat.

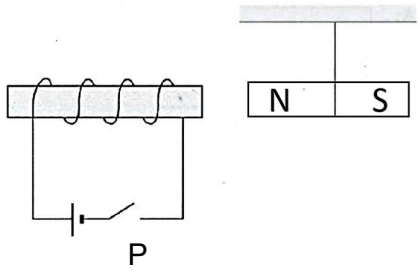
34 The diagram shows a bar magnet in a magnetic field.



When the magnet is released, how will it move?

A rotate clockwise
B remain stationary
C move to the top of the page
D move to the bottom of the page

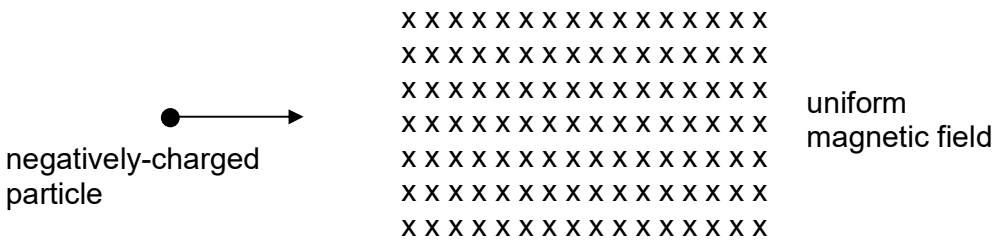
35 The diagram shows a fixed solenoid near a permanent magnet hung free to move.



What happens to the magnet when switch P is closed?

A attracted to the solenoid
B repelled by the solenoid
C remains at rest
D swings back and forth

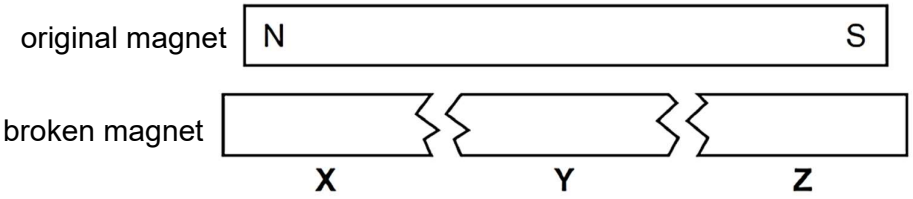
36 A negatively-charged particle is entering a uniform magnetic field perpendicularly.



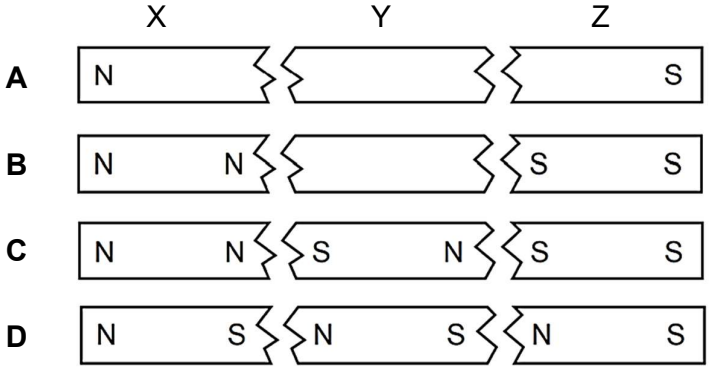
What will happen to the charged particle?

A experience a force into the paper
B experience a force out of the paper
C experience a force to the bottom of the paper
D experience a force to the top of the paper

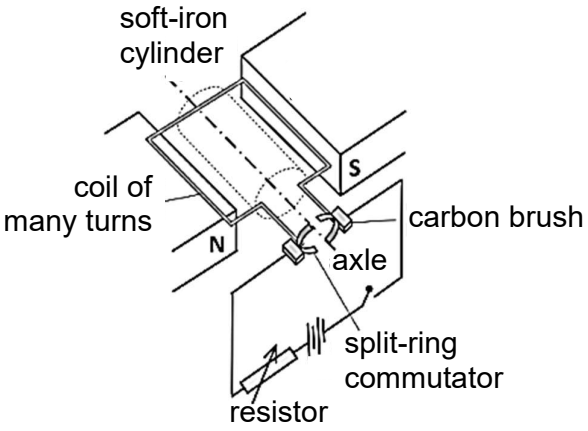
37 A bar magnet is broken into three parts X, Y and Z.



Which diagram shows the poles in X, Y and Z?



38 A d.c. motor is made as shown.



Which change does **not** increase the turning effect on the coil?

A increasing the diameter of the wire used to make the coil
B increasing the supply voltage
C removing the soft-iron cylinder
D using stronger magnets

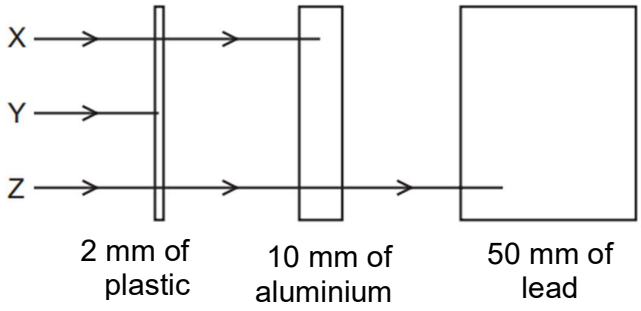
39 The following shows a nuclide equation for a nuclear reaction.

$$^{4}_{2}\text{He} + {}^{6}_{3}\text{Li} \rightarrow {}^{10}_{5}\text{B}$$

Which of the following is correct about this nuclear process?

	nuclear process	energy transfer
A	nuclear fusion	energy absorbed
B	nuclear fusion	energy released
C	nuclear fission	energy absorbed
D	nuclear fission	energy released

40 The diagram shows the paths of three different types of radiation, X, Y and Z.



Which row in the table correctly identifies X, Y and Z?

	X	Y	Z
A	α-particles	β-particles	γ-rays
B	β-particles	α-particles	γ-rays
C	β-particles	γ-rays	α-particles
D	γ-rays	α-particles	β-particles

END OF PAPER