Name:	Index Number:	Class:

YIO CHU KANG SECONDARY SCHOOL
O-LEVEL PRELIMINARY EXAMINATION 2024
SECONDARY FOUR EXPRESS

PHYSICS 6091/01
Paper 1 1 hour

Additional Materials: 10 September 2024 (Tuesday)
Optical Answer Sheet (OAS)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil on the OAS.
Do not use staples, paper clips, glue or correction fluid.
Write your name, index number and class on the OAS in the spaces provided.

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 OAS.

Read the instructions on the OAS 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.

Setter: Mr Brandon Chin

1 Which one of the following measurements would a digital micrometer screw gauge be most suitable?

A length of this page

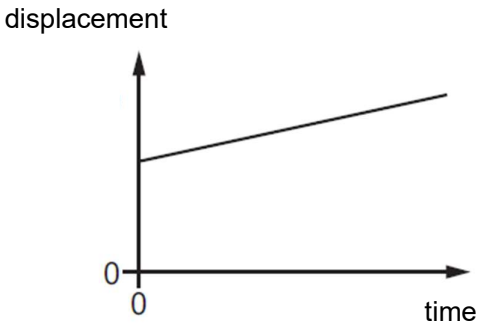
B diameter of a beaker

C diameter of a wire

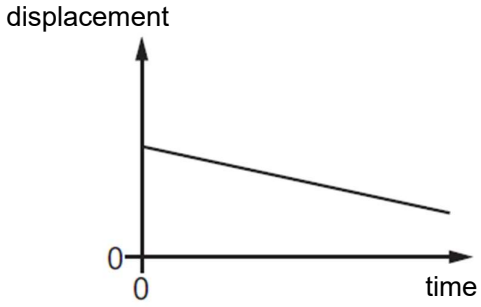
D radius of an atom

2 Which displacement-time graph represents a body whose velocity is decreasing?

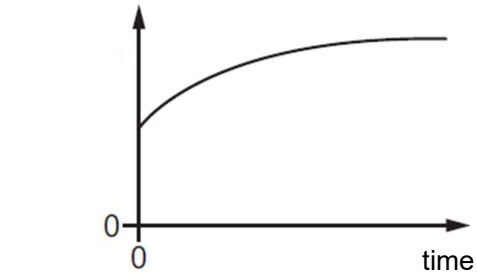
A



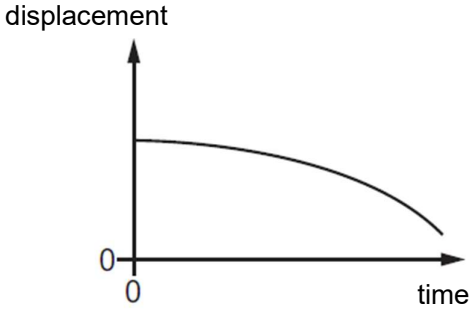
B



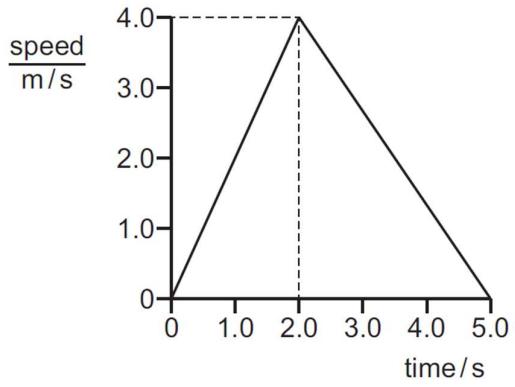
C



D



3 The diagram shows the speed-time graph for an object travelling in a straight line.



What is the acceleration of the object during the first two seconds and the total distance that it travels?

	acceleration / ms^{-2}	total distance / m
A	0.50	10
B	0.50	20
C	2.0	10
D	2.0	20

4 A sphere, **P**, made of steel, has a weight of 10 N on Earth.

Another sphere, **Q**, also made of steel, has a weight of 10 N on Mars.

The gravitational field strength on Earth is greater than the gravitational field strength on Mars.

Which of the following statements is correct?

A The mass of sphere **P** is the same as the mass of sphere **Q**.

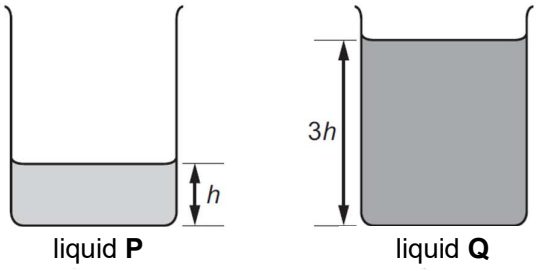
B The mass of sphere **P** is less than the mass of sphere **Q**.

C On Mars, the weight of sphere **P** is more than 10 N.

D On Earth, the weight of sphere **Q** is less than 10 N.

5 Two identical beakers contain the same mass of liquid.

Each beaker contains a different liquid.



Liquid **Q** has a density ρ.

What is the density of liquid **P**?

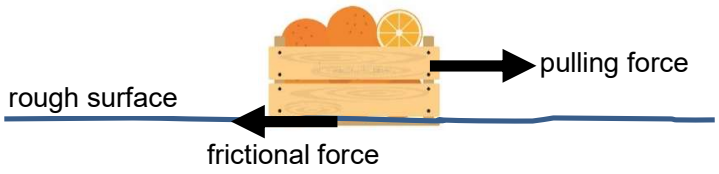
A $\rho \div 3$

B ρ

C 3ρ

D 9ρ

6 A crate of oranges is pulled across a rough surface by a force, causing the crate to accelerate at 1.5 m/s^2. The combined mass of the crate and oranges is 24 kg.



Which of the following shows the correct pair of the pulling force and frictional force?

	frictional force / N	pulling force / N
A	17	53
B	22	38
C	38	22
D	53	17

7 When a heavy coin falls a short distance towards the ground, it does not reach terminal velocity.

Which of the following statements best explains why this is so?

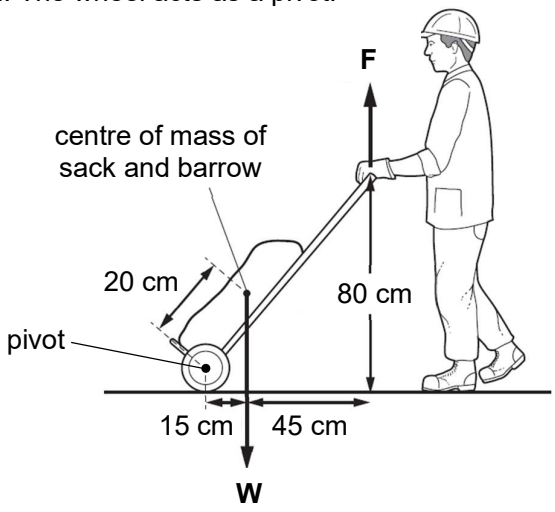
A The coin has not hit the ground.

B The weight of the coin equals the air resistance.

C The weight of the coin increases as air resistance increases.

D The weight of the coin is more than the air resistance.

8 The diagram shows a man holding a stationary sack and barrow. He applies a vertical force, **F**, to the handle of the barrow. The weight of the sack and barrow, **W**, and the centre of mass are shown. The wheel acts as a pivot.

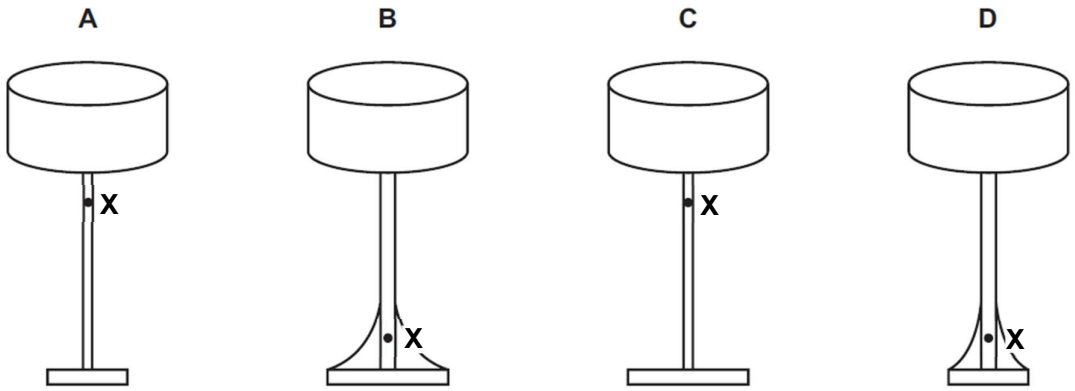


What are the moments produced about the pivot due to **F** and **W**?

	moments due to **F** / Ncm	moments due to **W** / Ncm
A	45 x **F**	15 x **W**
B	60 x **F**	15 x **W**
C	60 x **F**	20 x **W**
D	80 x **F**	20 x **W**

9 The diagrams show four table lamps resting on a table. The position of the centre of mass of each lamp is labelled **X**.

Which lamp is the least stable?



10 The pressure inside a gas cylinder is measured separately using two different mercury manometers as shown in Fig. **P** and **Q**. One of the manometers has an open end while the other has a sealed end.

A barometer, as shown in Fig. **R**, is used to measure the atmospheric pressure at the location of the experiment.

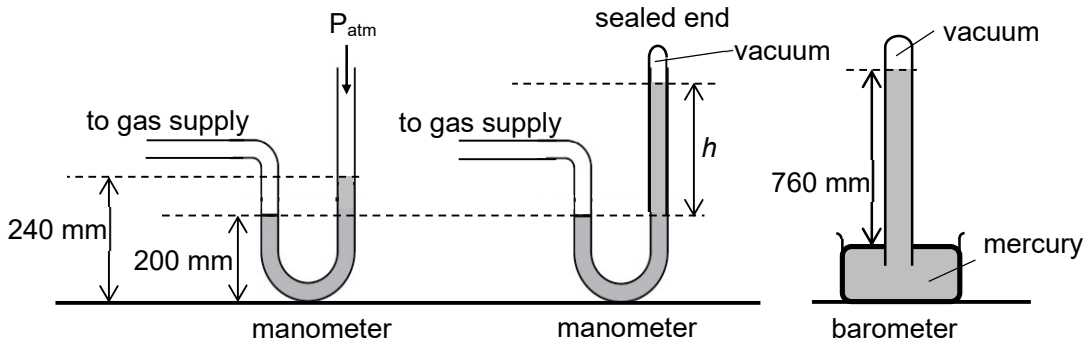


Fig. **P** Fig. **Q** Fig. **R**

The diagrams are not drawn to scale.

What is the height, *h*, of the mercury in Fig. **Q**?

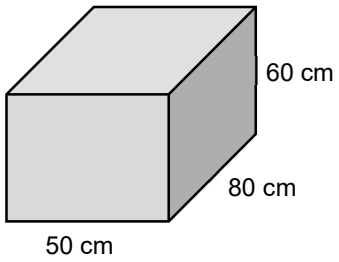
A 40 mm

B 720 mm

C 800 mm

D 1000 mm

11 The block below can be placed in any orientation on the ground.



Given that the minimum pressure exerted by the block on the ground is 100 Pa, what is the maximum pressure exerted by the block on the ground?

A 120 Pa

B 140 Pa

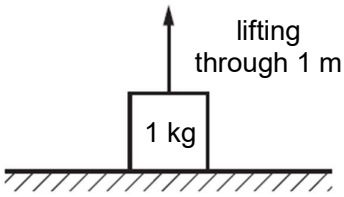
C 160 Pa

D 180 Pa

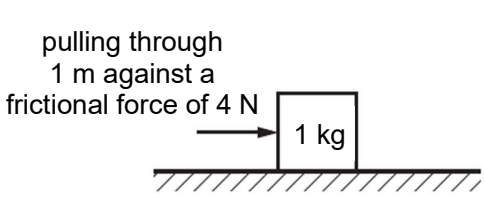
12 A student carries out some simple exercises. The gravitational field strength is 10 N/kg.

Which of the following exercises results in the most work done?

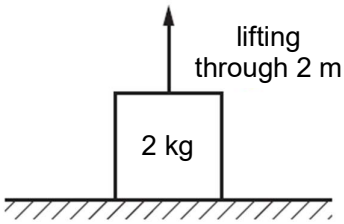
A



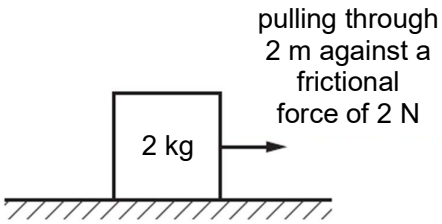
B



C



D



13 An object falls from a height of 5.0 m. As it hits the ground, the object has 750 J of energy in its kinetic store.

Air resistance can be ignored. The gravitational field strength is 10 N/kg.

What is the mass of the object?

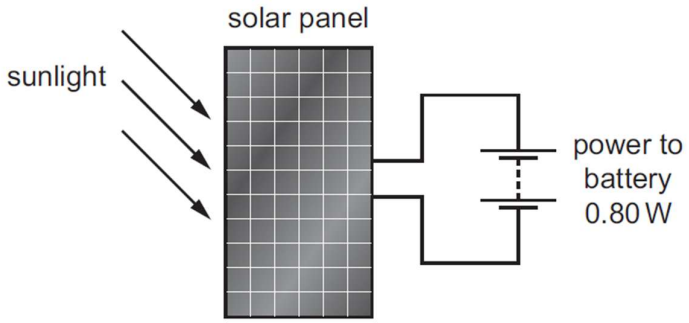
A 15 kg

B 50 kg

C 75 kg

D 150 kg

14 A solar panel is used to recharge a battery. The solar panel produces 0.80 W of electrical power. The panel is 20% efficient.



What is the power input of the sunlight onto the solar panel?

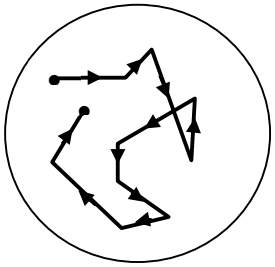
A 0.16 W

B 4.0 W

C 8.0 W

D 16 W

15 Smoke particles in a transparent box are observed using a microscope. A small point of light is seen to move around as shown.



What does this experiment demonstrate about air molecules?

A They are in continuous random motion.

B They can be seen through a microscope.

C They move because of collisions with smoke particles.

D They move more quickly when they are heated.

16 Four cups **A**, **B**, **C** and **D** contain hot coffee.

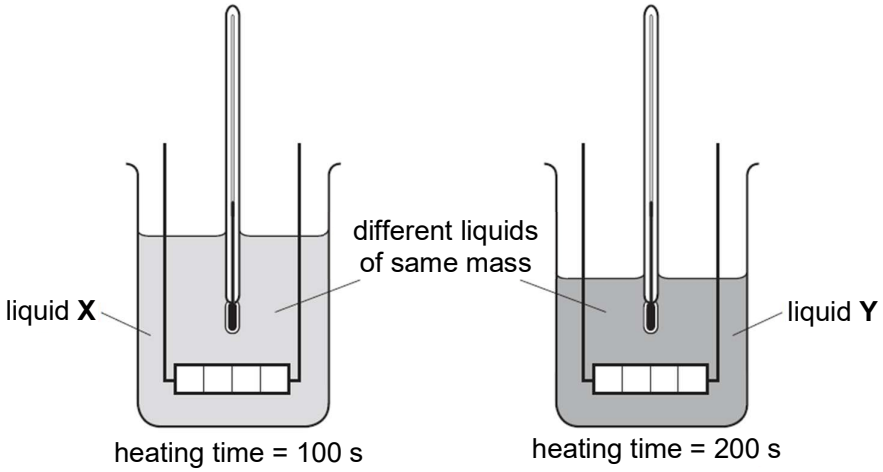
Which of the following cups will the coffee cool the fastest?

	the outer surface of the cup	the top of the cup
A	black	covered with a lid
B	black	no lid
C	white	covered with a lid
D	white	no lid

17 Equal masses of two different liquids are put into identical beakers.

Liquid **X** is heated for 100 s and liquid **Y** is heated for 200 s by heaters of the **same power**.

Each liquid has the same rise in temperature.



Which of the following statements is correct?

A Each beaker of liquid has the same heat capacity.
B Each beaker of liquid receives the same energy.
C Liquid **X** receives more energy than liquid **Y**.
D The heat capacity of liquid **X** is less than the heat capacity of liquid **Y**.

18 A student splashes water on her face.

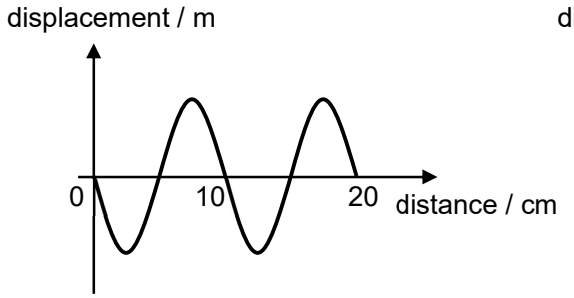
The following are three statements about the possible effects:

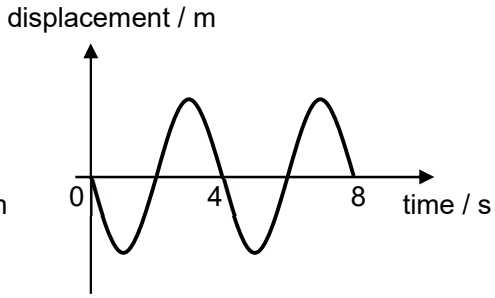
P The water uses energy to evaporate.
Q The water gains energy from the student.
R The face of the student cools down.

Which statements are correct?

A **P** and **Q** only
B **P** and **R** only
C **Q** and **R** only
D **P**, **Q** and **R**

19 The graphs below represent the variations in the displacement of a transverse wave with distance and time.

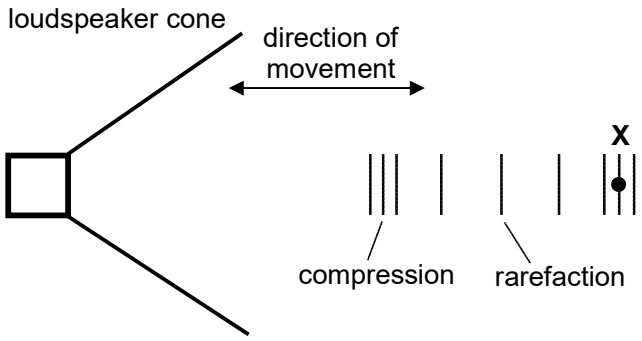




Which row correctly describes the wavelength and frequency of the wave?

	wavelength / cm	frequency / Hz
A	5.0	0.25
B	5.0	4.0
C	10	0.25
D	10	4.0

20 Compressions and rarefactions are sent out from a loudspeaker cone as it vibrates backwards and forward. The frequency of vibration is 50 Hz.



A compression is at point **X**.

How much time elapses before the next rarefaction arrives at **X**?

A 0.010 s

B 0.020 s

C 25 s

D 50 s

21 The frequencies of musical note **C** and note **E** are 262 Hz and 330 Hz respectively.

Which of the following statements are correct?

P Note **E** is louder than note **C**.

Q Note **E** travels faster than note **C**.

R Note **E** has a higher pitch than note **C**.

S Note **E** has a shorter wavelength than note **C**.

A **P** and **Q**

B **P** and **S**

C **Q** and **R**

D **R** and **S**

22 Visible light, X-ray and microwaves are all components of the electromagnetic spectrum.

Which of the following statements about the waves is correct?

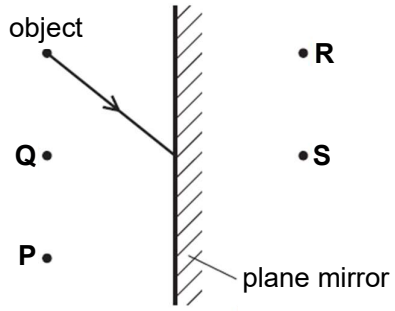
A In a vacuum, microwaves travel faster than visible light and have a shorter wavelength.

B In a vacuum, microwaves travel at the same speed as visible light and have a shorter wavelength.

C In a vacuum, X-rays travel faster than visible light and have a shorter wavelength.

D In a vacuum, X-rays travel at the same speed as visible light and have a shorter wavelength.

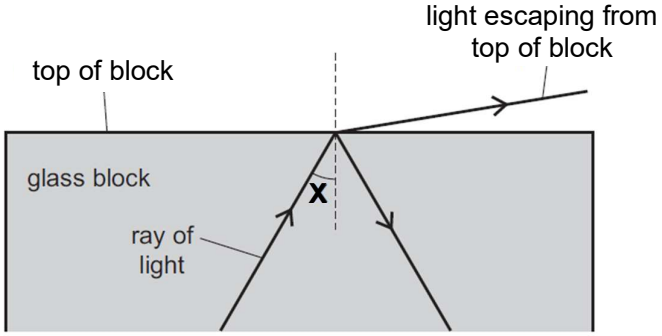
23 The diagram shows an object in front of a plane mirror. A ray of light from the object is incident on the mirror.



Through which point does the reflected ray pass, and at which point is the image of the object formed?

	point through which reflected ray passes	point at which image is formed
A	**P**	**R**
B	**P**	**S**
C	**Q**	**R**
D	**Q**	**S**

24 A scientist tries to direct a ray of light in a glass block so that no light escapes from the top of the block. However, some light escapes.



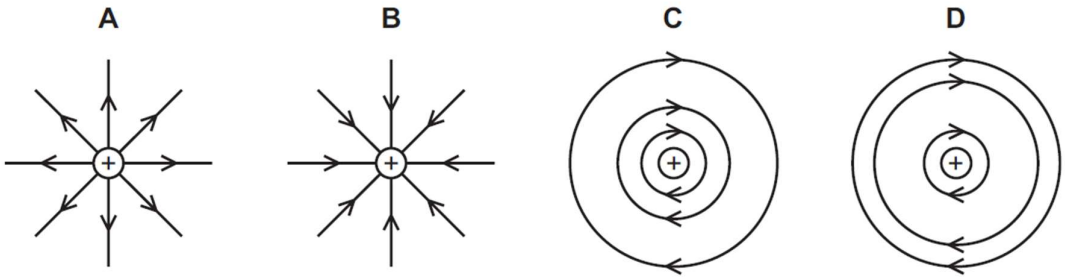
The scientist changes angle **X** and stops the light from escaping through the top of the block.

Which row in the table describes the change to angle **X** and the name of the effect produced?

	change to angle **X**	name of effect produced
A	decrease	refraction
B	decrease	total internal reflection
C	increase	refraction
D	increase	total internal reflection

25 The diagrams each show a positive point charge.

Which diagram represents the pattern and the direction of the electric field due to the charge?



26 A positively-charged rod is held near to, but not touching, an uncharged metal sphere.

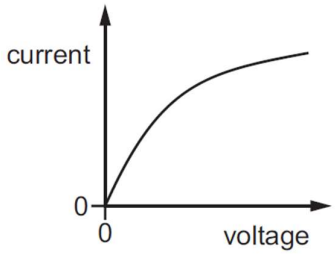
The sphere is briefly connected to the earth.

The rod is then removed.

Which of the following statements about the charge on the sphere is correct?

A It is charged negatively because negative charges have moved from earth to the sphere.
B It is charged negatively because positive charges have moved from the sphere to earth.
C It is charged positively because negative charges have moved from the sphere to earth.
D It is charged positively because positive charges have moved to earth from the sphere.

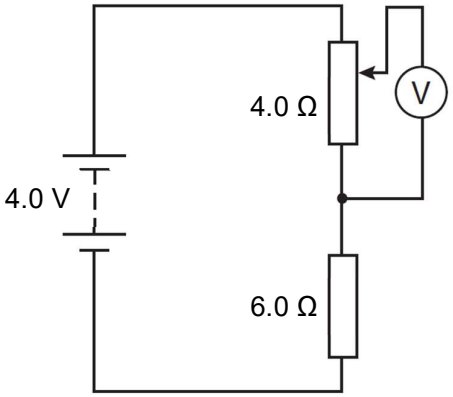
27 The graph shows the current–voltage characteristic for a filament lamp.



Which of the following statements describes how the resistance of the lamp changes as the voltage increases?

A The resistance decreases to zero.
B The resistance decreases, but not to zero.
C The resistance increases.
D The resistance remains constant.

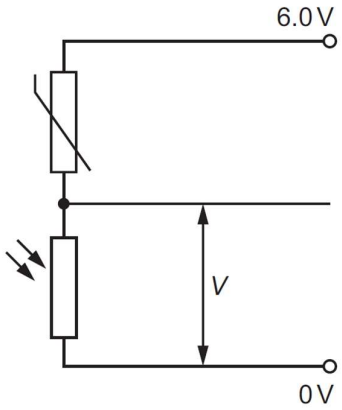
28 The diagram shows a circuit with a potential divider joined in series with a fixed resistor.



What are the minimum and maximum readings that can be obtained on the voltmeter when the potential divider is adjusted?

	minimum reading / V	maximum reading / V
A	0	1.6
B	0	2.0
C	1.0	4.0
D	4.0	10

29 A potential divider consists of a Negative Temperature Coefficient (NTC) thermistor and a light-dependent resistor (LDR).



Which of the following conditions will give the smallest voltage *V* across the LDR?

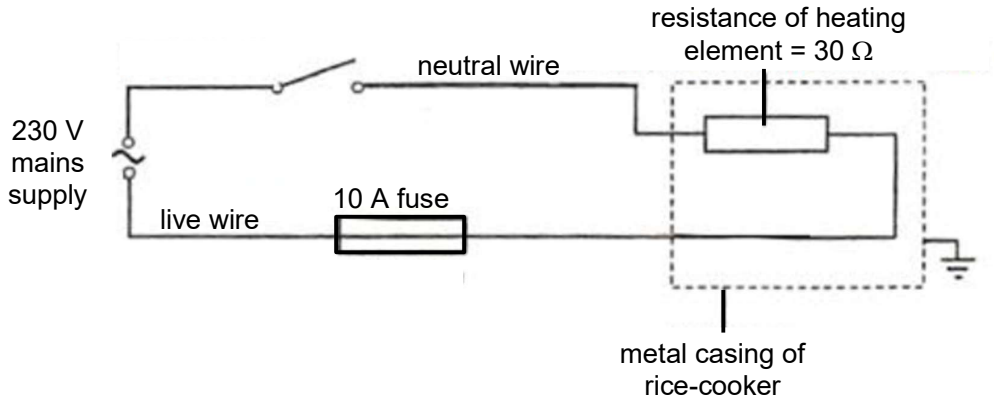
A cold and dark

B cold and bright

C hot and dark

D hot and bright

30 The diagram below shows the circuit formed when a rice-cooker is plugged into a mains socket.



What is the fault in this arrangement?

A The earth wire is missing.

B The fuse rating is too low.

C The resistance of the heating element is too high.

D The switch is connected wrongly.

31 What is the most effective method of de-magnetising a bar magnet?

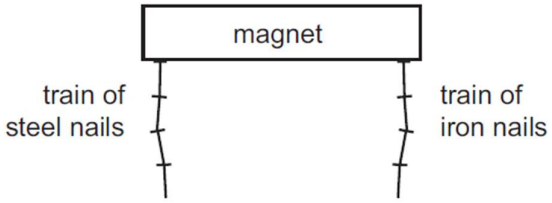
A placing the magnet in a solenoid carrying a large alternating current and gradually decreasing the current

B placing the magnet in a solenoid carrying a large direct current and gradually decreasing the current

C placing the magnet in a solenoid that produces a magnetic field in the opposite direction to the magnet

D placing the magnet next to an identical bar magnet with its poles in the opposite direction

32 A train of steel nails and a train of iron nails hang from two ends of a strong magnet.



The trains are then carefully removed from the magnet.

What happens to the trains of nails?

A Both trains of nails fall apart.
B Both trains of nails stay together.
C Only the train of iron nails falls apart.
D Only the train of steel nails falls apart.

33 A student sets up the experiment as shown in the diagram.

P and **Q** repel each other.

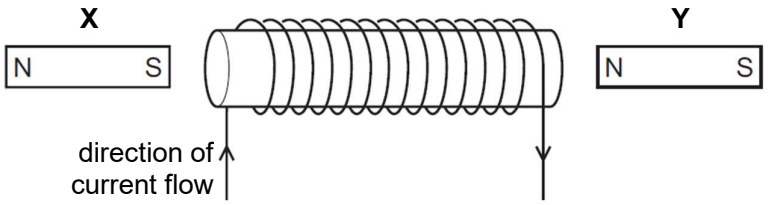
Which of the following row correctly states the poles at **P** and **Q**?

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

34 In which device is a split-ring commutator used, and what is its purpose?

	device	purpose
A	a.c. generator	to change the direction of the current in the coil as it turns
B	a.c. generator	to change the output current from d.c. into a.c.
C	d.c. motor	to change the direction of the current in the coil as it turns
D	d.c. motor	to change the input current from a.c. into d.c.

35 Two magnets are placed near a current-carrying coil. The diagram shows this experimental arrangement and the direction of the current in the coil.



Which of the following statements is correct?

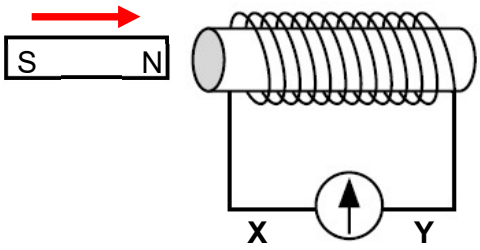
A Both **X** and **Y** are attracted to the coil.

B Both **X** and **Y** are repelled by the coil.

C **X** is attracted to the coil and **Y** is repelled.

D **X** is repelled by the coil and **Y** is attracted.

36 A small coil is connected to a galvanometer as shown below.



When the magnet is allowed to move towards the coil, which of the following statements shows the current flow?

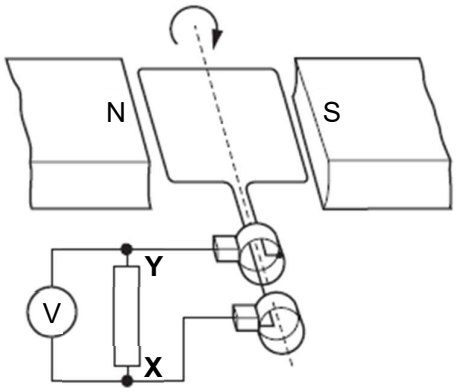
A continuously from **X** to **Y**

B continuously from **Y** to **X**

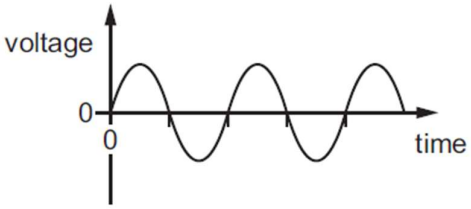
C momentarily from **X** to **Y**

D momentarily from **Y** to **X**

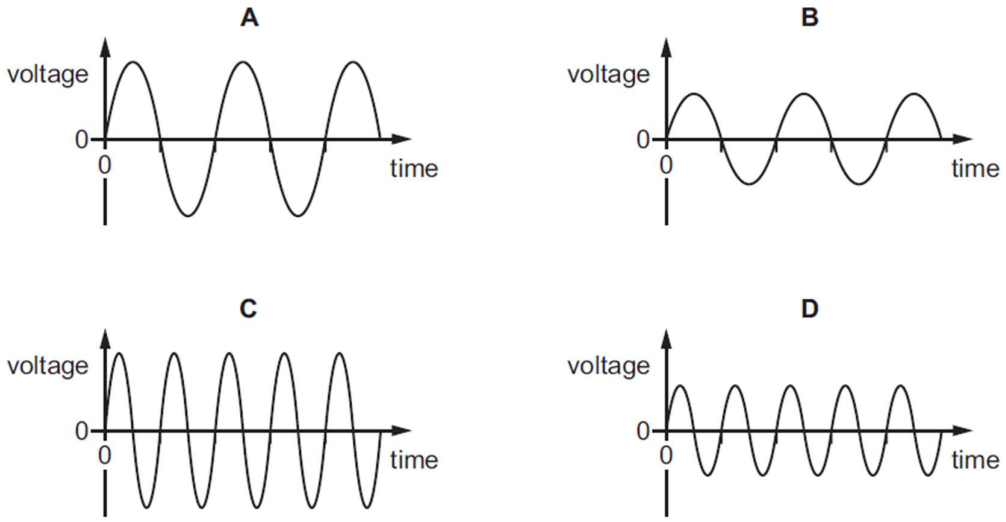
37 The diagram shows an a.c. generator.



The graph shows how the voltmeter reading across the resistor **YX** changes with time as the coil rotates.



Which graph shows what happens when the coil rotates at a faster rate?



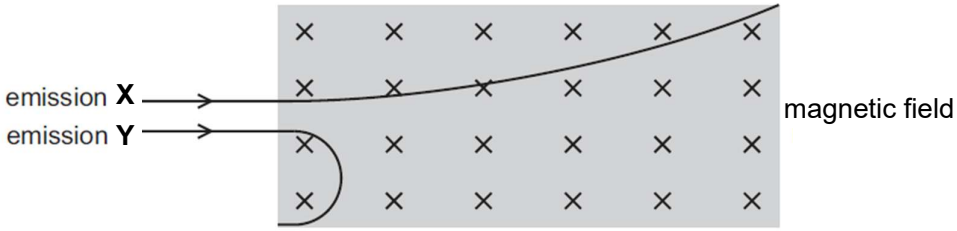
38 Nuclear fusion is a reaction that can take place in the sun.

Which row describes this reaction?

	action of atomic nuclei	energy
A	an atomic nucleus splits into two or more smaller nuclei	absorbed
B	an atomic nucleus splits into two or more smaller nuclei	released
C	atomic nuclei join together to form a larger nucleus	absorbed
D	atomic nuclei join together to form a larger nucleus	released

39 Emissions **X** and **Y** from a radioactive material are passed through a magnetic field.

The diagram shows the direction of the emissions, the direction of the magnetic field and the effect on the emissions.



Which type of emission is **X**, and which type of emission is **Y**?

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

40 A detector of ionising radiation gives a background reading of 20 counts/minute.

A radioactive isotope with a half-life of 2.0 days is brought near to the detector. The reading on the detector increases to 100 counts/minute.

How long does it take for the reading on the detector to decrease to 40 counts/minute?

A 2.0 days

B 4.0 days

C 5.0 days

D 10 days

END OF PAPER