CHRIST CHURCH SECONDARY SCHOOL
2024 PRELIMINARY EXAMINATION
FOUR EXPRESS

CANDIDATE NAME		CLASS	
CENTRE NUMBER	S	INDEX NUMBER	

PHYSICS **6091/01**
Paper 1 **27 Aug 2024**
1 hour

Additional Material: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST
Write in soft pencil on the Multiple Choice Answer Sheet.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, Class and Index number on the Answer Sheet in the spaces provided.

There are **forty** questions in this section. 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 provided.

Read very carefully the instructions on the answer sheet.

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 calculator is expected, where appropriate.

This Question Paper consists of 18 printed pages including this cover page.

[Turn over

1 Which of the following shows the most suitable instruments used for the measurements of these given objects?

	internal diameter of a test-tube	thickness of a copper wire
A	digital calipers	digital micrometer screw gauge
B	metre rule	digital calipers
C	digital micrometer screw gauge	digital calipers
D	measuring tape	digital micrometer screw gauge

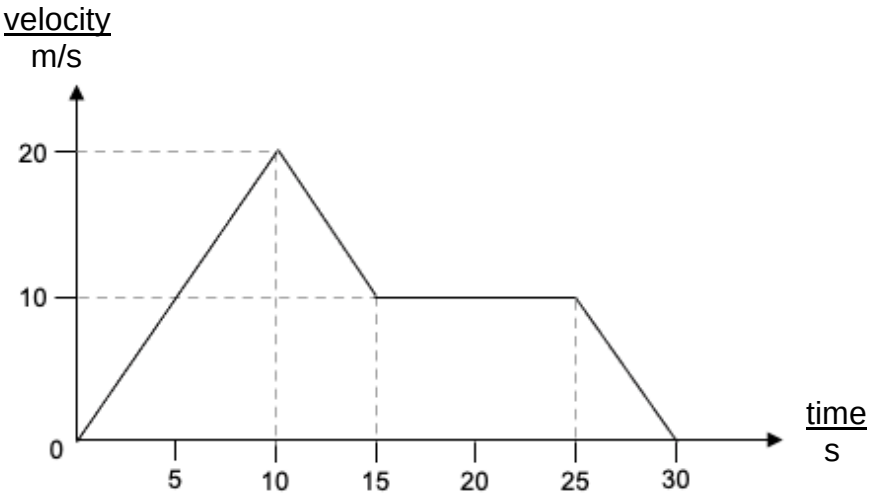
2 A student studies some equations:

density = mass / volume
work done = force x displacement
acceleration = change of velocity / time taken

How many different vector quantities can be found in these equations?

A 2 **B** 3 **C** 4 **D** 5

3 The velocity-time graph shows the motion of an object during a period of 30 s.



What is the average velocity of the object during this first 25 s?

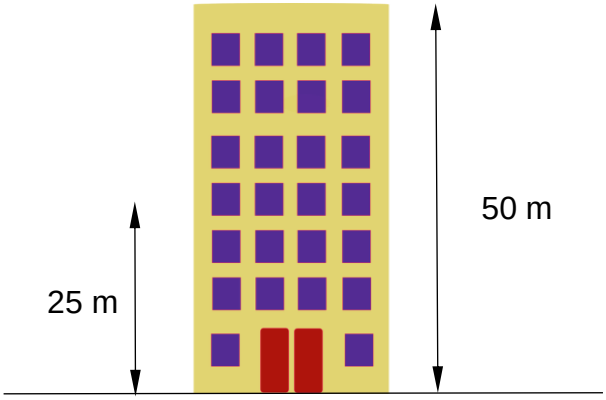
A 10 m/s **B** 11 m/s **C** 17 m/s **D** 18 m/s

4 A cyclist has an initial speed of 5.0 m/s. She is travelling at a uniform deceleration for 3.0 m before she came to a stop.

How long did she take to stop?

A 0.60 s
B 1.2 s
C 1.3 s
D 3.0 s

5 Two similar balls are released from a 50 m tall building at the same time.

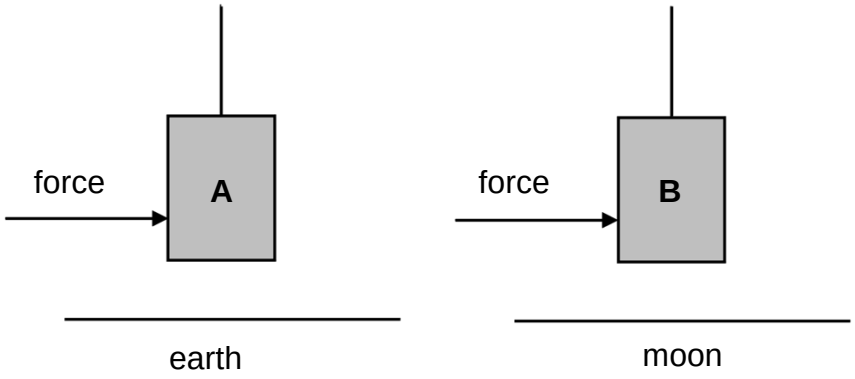


One drops from the top while the other from mid-level. Air resistance is negligible.

Which quantity is the same for both balls?

A acceleration **B** average speed **C** final velocity **D** time of travel

6 Two identical blocks of concrete, A and B are hung on a rope close to the surface of Earth and the surface of the moon as shown.

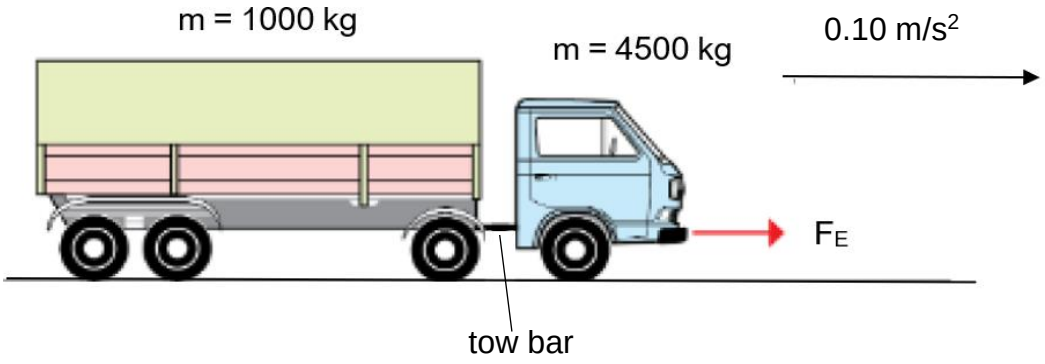


A sideway force of same magnitude is applied to both blocks of concrete.

What statement is correct?

A It is easier to move B as it has less weight.
B It is more difficult to move A as it has less weight.
C Both A and B move with the same ease as they have the same mass.
D Both A and B move with the same ease as they have the same weight.

7 A truck engine of mass 4500 kg pulls a trailer of mass 1000 kg along a level track is accelerating at 0.10 m/s^2. The truck engine is connected to the trailer via a tow bar.

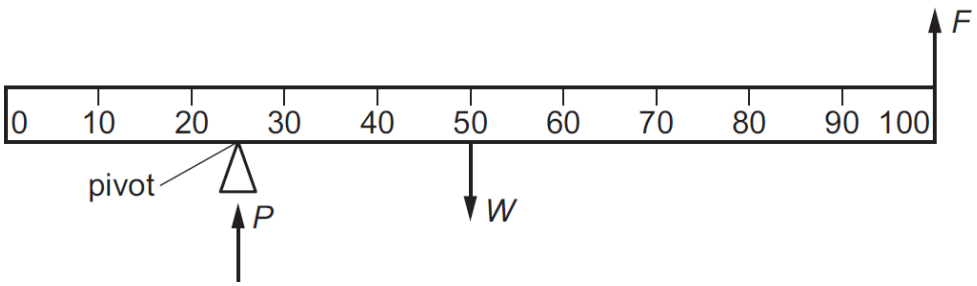


Given that the resistive force acting on the truck engine is 10 N per 1000 kg and the resistive force acting on the trailer is 5 N per 1000 kg.

What are the forward thrust F_E exerted by the engine and the tension in the tow bar?

	forward thrust F_E	tension in tow bar
A	550 N	0 N
B	550 N	105 N
C	600 N	0 N
D	600 N	105 N

8 A uniform metre rule of weight *W* is pivoted at the 25 cm mark and held horizontal by a force F applied upwards at the 100 cm mark.



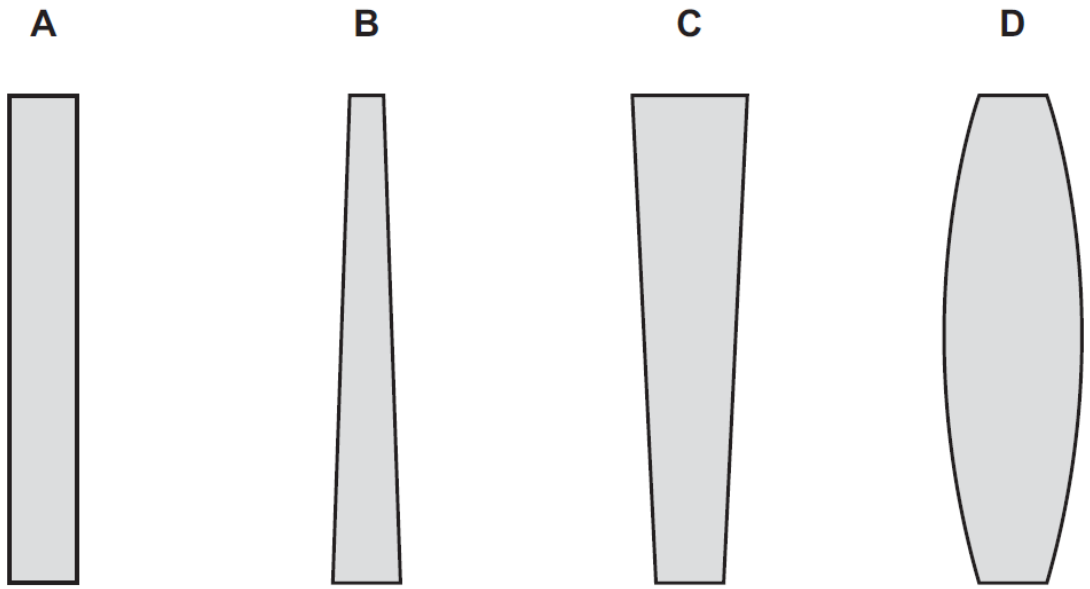
The rule is supported by a vertical force *P* acting at the pivot.

What is the magnitude of *P*?

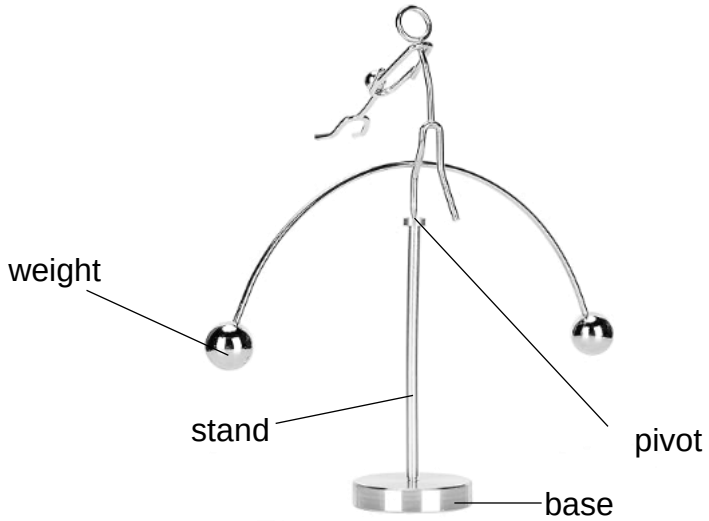
A $\frac{1}{3}W$ **B** $\frac{1}{2}W$ **C** $\frac{2}{3}W$ **D** $\frac{4}{3}W$

9 Four glass objects have square bases of equal area.

Which object is the most stable?



10 A balancing toy comprises two weights on each side as shown.
It is pivoted at the top of a stand with a base.

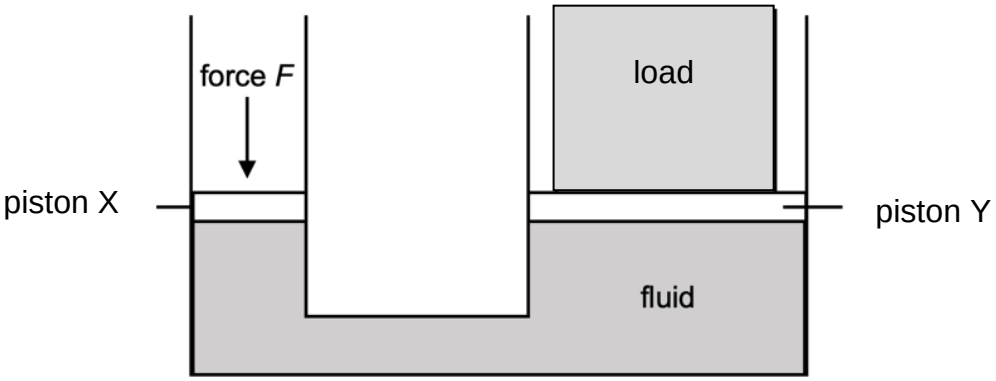


Which statement concerning the centre of gravity (CG) of balancing toy is correct?

A If titled and released, the CG of the toy would not oscillate sideways.
B The base raises the CG of the toy to provide stability.
C The thin stand raises the CG of this toy to provide stability.
D The two weights lower the CG of this toy to below the pivot to provide stability.

[Turn over

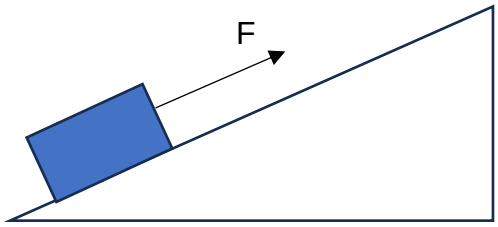
11 A simple hydraulic jack is used to lift a load by applying a force F as shown.



Which changes to the diameters of the pistons X and Y would allow a greater load to be lifted by the same force, *F*?

	diameter of piston X	diameter of piston Y
A	doubled	doubled
B	doubled	halved
C	remained the same	halved
D	halved	doubled

12 A box is pulled up with a force F up a rough slope at a uniform speed.



Which statement regarding the energy stores of the box is **not** correct?

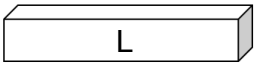
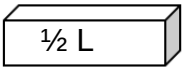
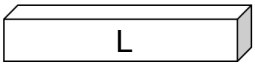
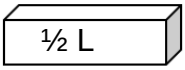
A Mechanical work is done by the force F on the object as it moves up the slope.
B No energy is transferred out to the surrounding due to heating.
C The gravitational potential store of the box increases as it moves up the slope.
D The kinetic store of the box remains the same as it moves up the slope.

13 Which statement correctly describes the kinetic particle model in liquid during boiling?

A The average speed of the particles increases.
B The intermolecular forces of attraction between the particles become weaker.
C The internal kinetic energy of the particles increases.
D The internal potential energy of the particles decreases.

14 Four bars of different made of different materials and different sizes are placed at one end of each bar in water at 80 °C.

The time taken for the temperature to rise by 2 °C on the other end of the bars are recorded.

material	size	time for temperature to rise by 2 °C / s
aluminium		12
copper		3
fibreglass		77
polystyrene		15

The materials are being considered to make a metal tank to keep its contents warm. The metal tank will be insulated.

Which materials should be used to make the tank and its insulation?

	tank	insulation
A	aluminium	fibreglass
B	aluminium	polystyrene
C	copper	fibreglass
D	copper	polystyrene

15 A block of brass is heated and its rise in temperature is measured.

The amount of energy gained by the block is E. The mass of the block is m.
The rise in temperature of the block is ΔT.

Which expression gives the specific heat capacity of brass?

A $\frac{m}{E\Delta T}$

B $\frac{m\Delta T}{E}$

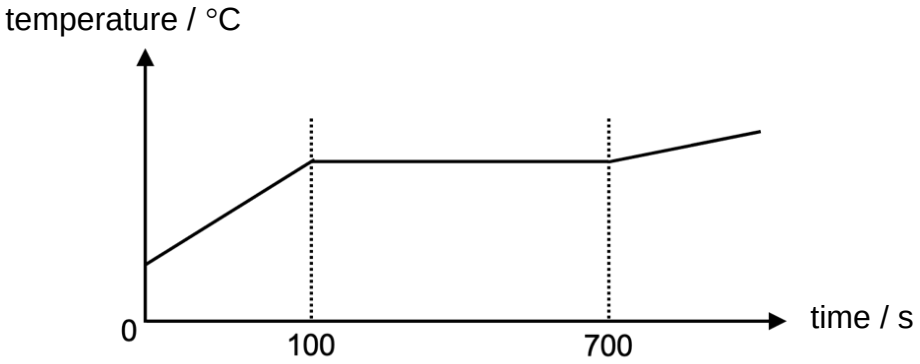
C $\frac{E}{m\Delta T}$

D $\frac{E\Delta T}{m}$

[Turn over

16 A 550 g of unknown liquid is heated using a 1.5 kW electric heater.

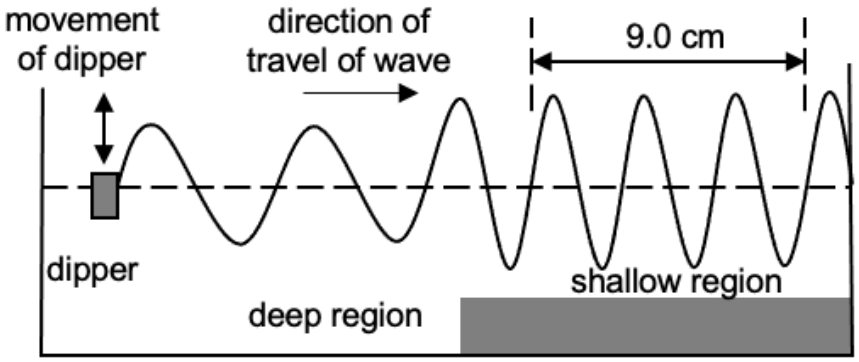
The temperature of this liquid over a period time is plotted on a graph shown below.



What is the specific latent heat of vaporisation of the substance?

A 1.6 J/kg
B 270 J/kg
C 1600 J/kg
D 1900 kJ/kg

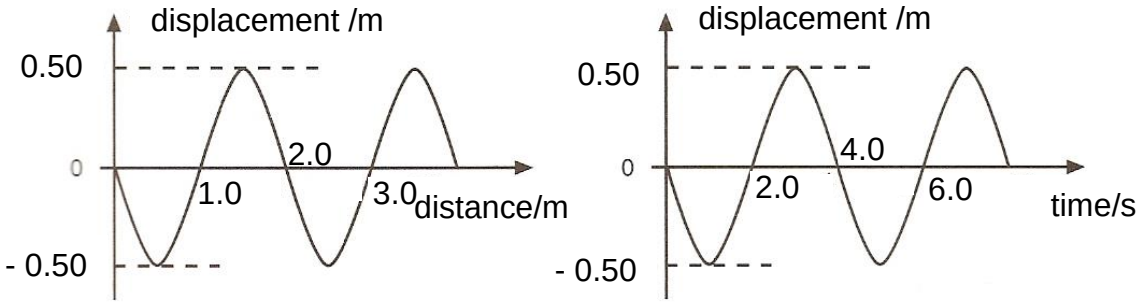
17 A dipper vibrates at a frequency of 2.5 Hz in a ripple tank to produce water waves. The wave travels from the deep region to the shallow region as shown.



Which statement is correct?

A The frequency of the waves increases as it moves from deep to shallow regions.
B The speed of the waves in the shallow region is approximately 23 cm/s.
C This wave is longitudinal as vibration is perpendicular to direction of wave travel.
D Wavefronts are close together in the shallow region as compared to the deep region.

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



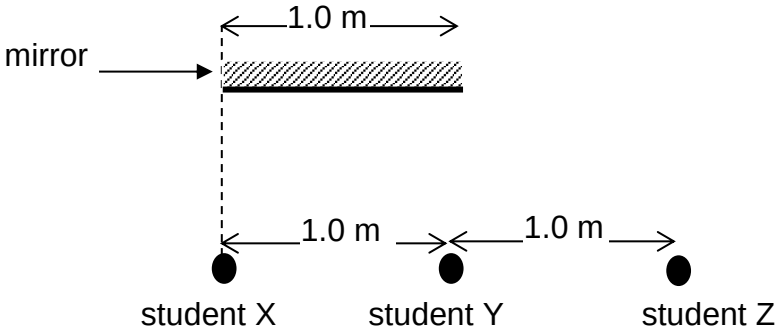
Which row correctly gives the value of the wavelength, amplitude, frequency and speed of this wave?

	wavelength/m	amplitude/m	frequency/Hz	speed/(m/s)
A	1.0	- 0.50	4.0	4.0
B	1.0	0.50	2.0	4.0
C	2.0	0.50	0.25	0.50
D	2.0	1.00	0.25	0.50

19 Which statement best describes the hazardous effects due to over-exposure to electromagnetic waves?

A The exposure to X-rays can cause heating effects which is harmful to the skin.
B The infrared waves can result in ionising radiation that penetrate human body.
C The over-exposure to radio waves can potentially cause skin cancer.
D The radioactive materials can potentially emit gamma rays to ionise living cells.

20 Three students, X, Y and Z, stand 1.0 m apart in front of a plane mirror that is 1.0 m long.



Student X stands in line with one edge.

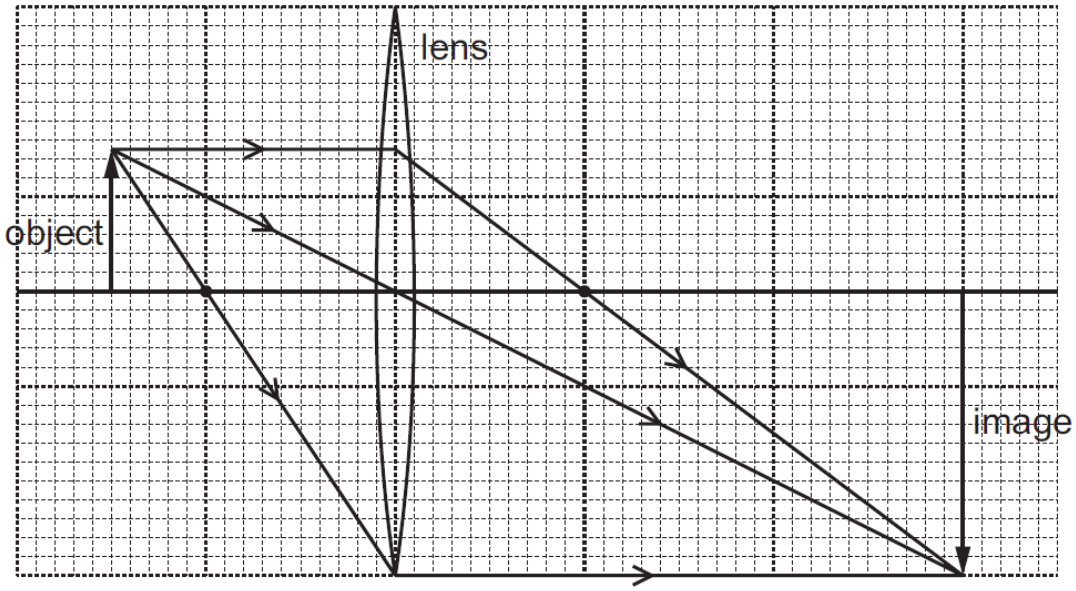
How many students can see the images of the other two?

A 0 **B** 1 **C** 2 **D** 3

[Turn over

21 An object is placed in front of a converging lens of focal length 4.0 cm.
The height of the image is 6.0 cm.

The arrangement is shown on the scale diagram.

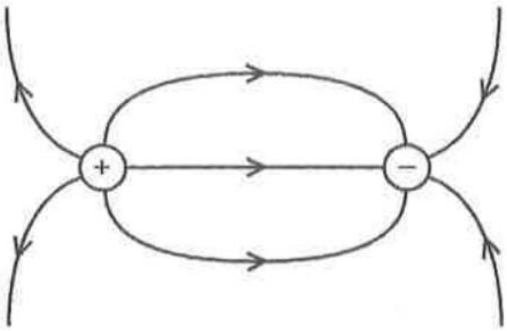


Which statement is **not** correct?

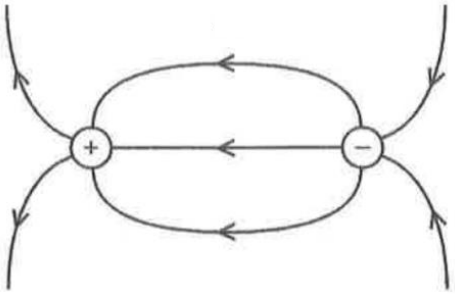
A The image shown can be described as real and inverted.
B The linear magnification of produced by the lens is 0.50.
C When object is placed 3.0 cm from lens, image formed is upright and magnified.
D When object is placed 8.0 cm from lens, the image is same size as object.

22 Which diagram shows the electric field between a positive point charge and a negative point charge?

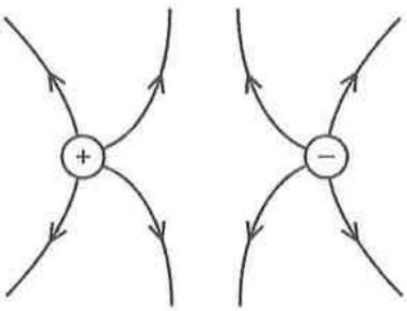
A



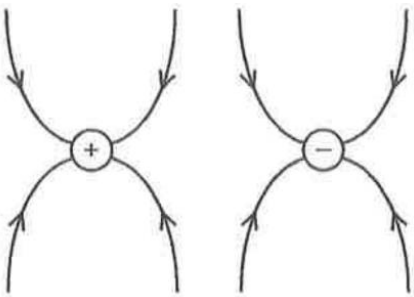
B



C



D



23 Which example does **not** describe how electrostatic charging may be a potential hazard?

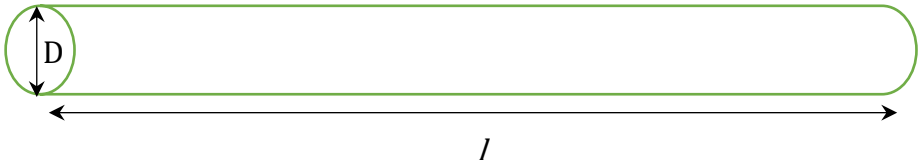
A Accumulation of charges on the walls of ungrounded truck carrying petrol.
B Bulk transfer of combustible fuel in pipes can generate charges through friction.
C Built-up static charges on surface of airplanes during mid-air refuelling.
D Use of charged paint droplets to create a uniform coat on metallic surface of car.

24 During a thunderstorm, 35 C of charge passes between the thunderclouds and the ground. On average, a lightning can strike the ground for 1.0 ms.

What is the average current generated between the thunderclouds and the ground when the lightning strikes?

A 35mA
B 35 A
C 35 kA
D 35 MA

25 A resistance wire of length l and diameter D has a resistance R.



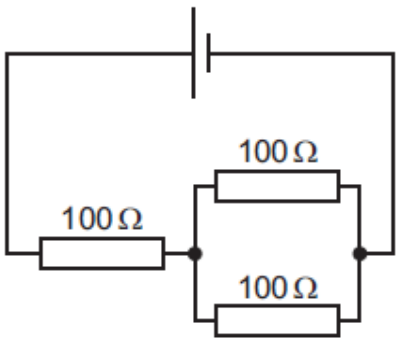
Which change will cause the resistance of another wire of the same material to increase four times?

A Decrease the diameter to $\frac{\mathrm{D}}{2}$ and keep the length unchanged
B Decrease the diameter to $\frac{\mathrm{D}}{2}$ and decrease the length to $\frac{l}{2}$
C Increase the diameter to $2\mathrm{D}$ and decrease the length to $\frac{l}{2}$
D Increase the diameter to $2\mathrm{D}$ and decrease the length to $4l$

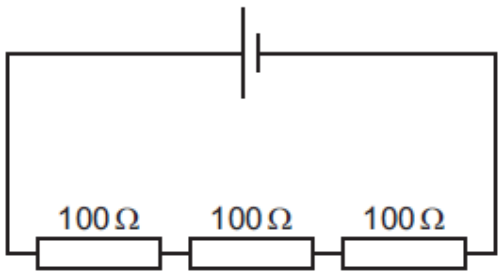
[Turn over

26 The diagrams show four circuits. Each circuit contains three 100 Ω resistors.

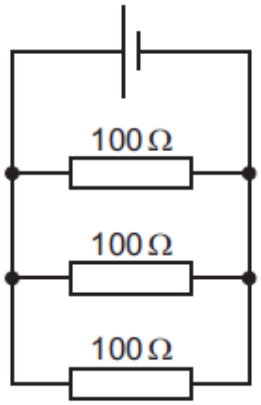
P



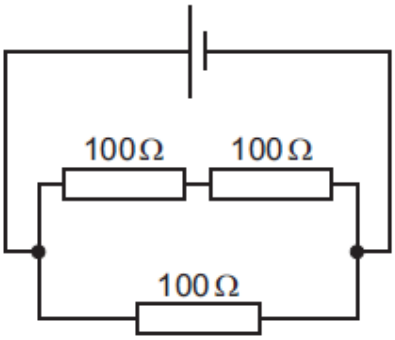
Q



R



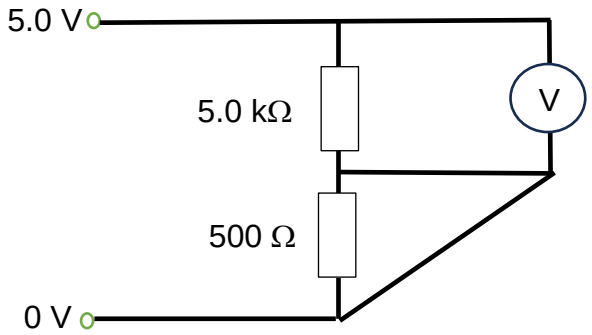
S



Which row correctly arranges the total resistance of the circuit from smallest to largest?

	smallest total resistance → largest total resistance
A	P, Q, R, S
B	R, P, S, Q
C	R, S, P, Q
D	Q, R, P, S

27 A voltmeter is connected across a potential divider circuit as shown.



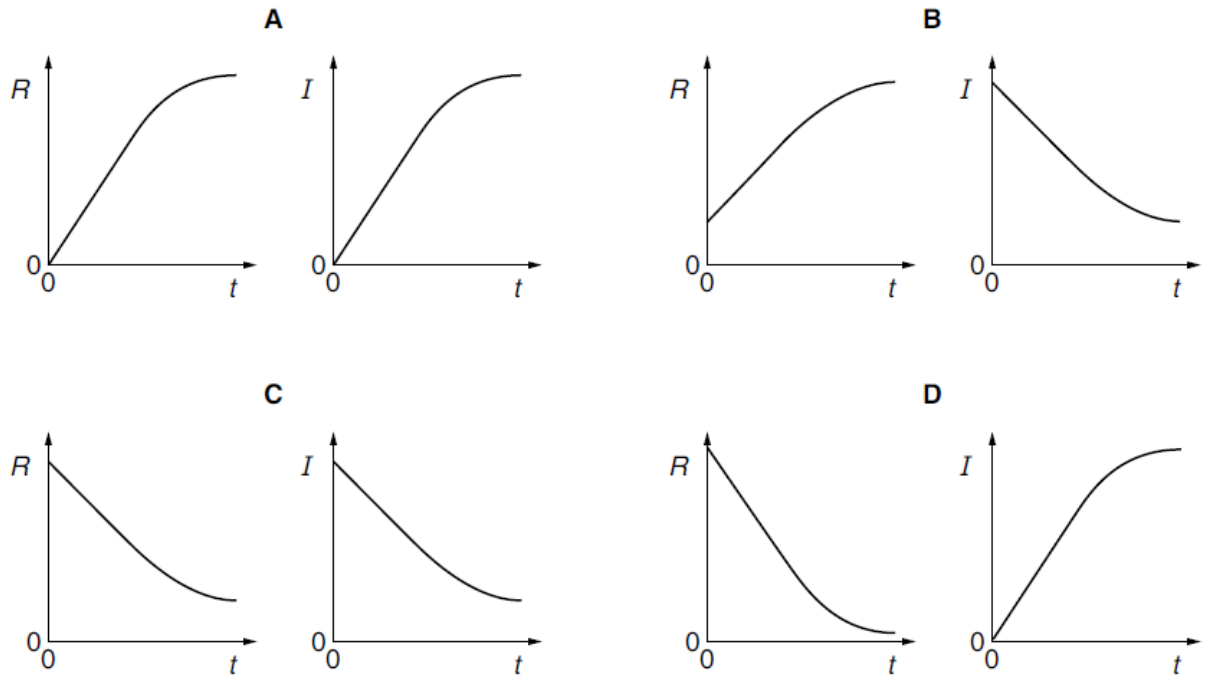
What is the reading on the voltmeter?

A 0.00 V **B** 0.45 V **C** 4.55 V **D** 5.00 V

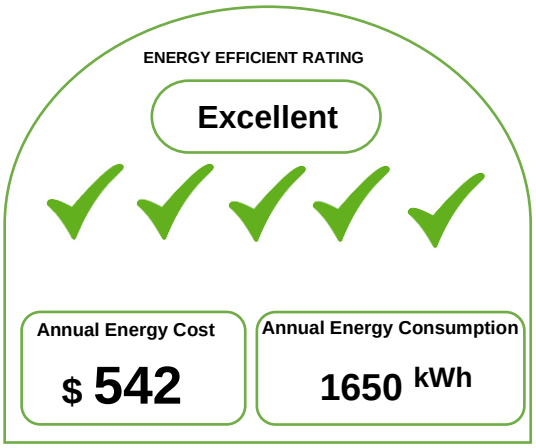
28 When a filament lamp is switched on, there is a current in filament.

As the temperature of the filament increases, its resistance changes.

Which pair of graphs shows how the resistance R of the filament and the current I in the lamp vary with time t after the lamp is switched on?



29 Two labels are found on an electrical appliance.



ABC Brand
Operating Voltage 230 V
Power 2.8 kW
Fuse Rating 13 A

Which of the statement is **not** correct?

A The annual unit cost of electricity is about $0.328.
B The operating current is 13 A.
C The total energy consumption per year is 5.94 GJ.
D When operating for 4.0 minutes, the amount of electrical energy used is 672 kJ.

[Turn over

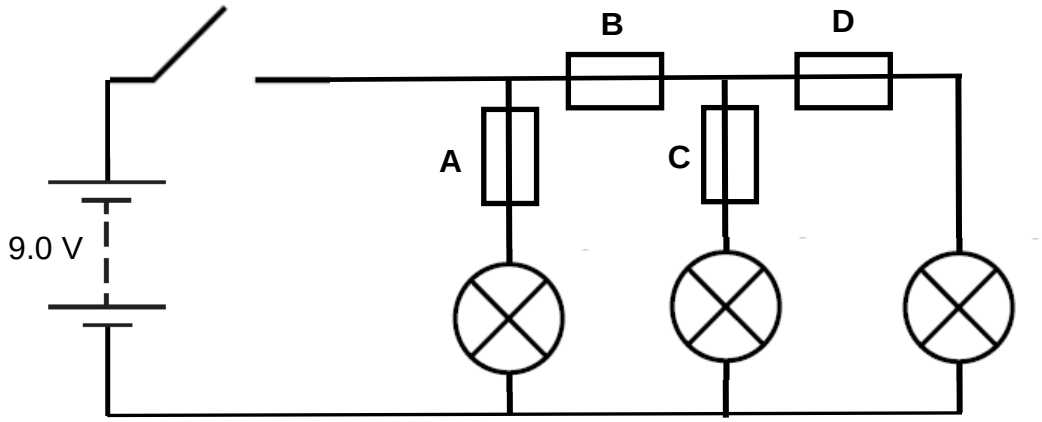
30 Which row shows the correct colour code for wiring in a three-pin plug.

	earth wire	live wire	neutral wire
A	brown	blue	green/yellow
B	blue	green/yellow	brown
C	blue	brown	green/yellow
D	green/yellow	brown	blue

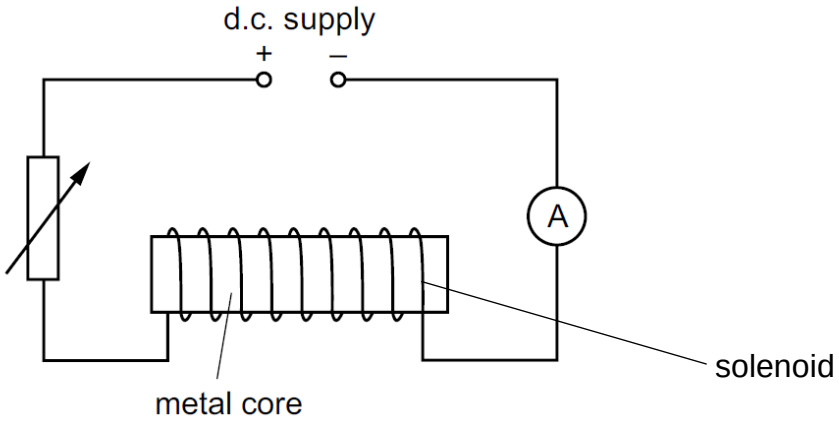
31 Three light bulbs each rated 9 V, 40 W are connected to a 9.0 V battery.

Four fuses, A, B, C and D are also connected as shown. Each fuse is rated 5A.

Which fuse will melt when the switch is closed?



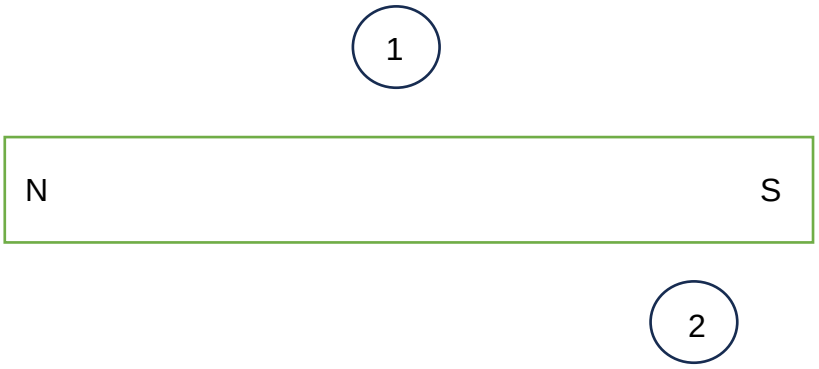
32 The diagram shows an electromagnet.



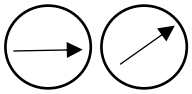
Which row correctly shows the materials used for the different parts of the electromagnet?

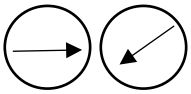
	metal core	solenoid
A	copper	soft iron
B	soft iron	copper
C	soft iron	soft iron
D	steel	steel

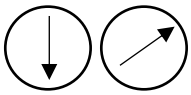
33 Two plotting compasses are placed besides a permanent bar magnet.

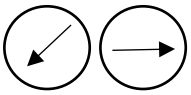


In which directions do the two compasses point?

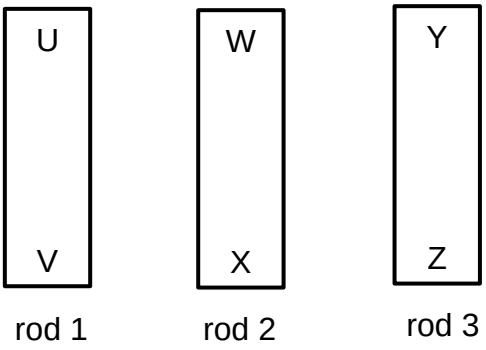
A 

B 

C 

D 

34 The ends of three metal rods are tested by holding close to one another.



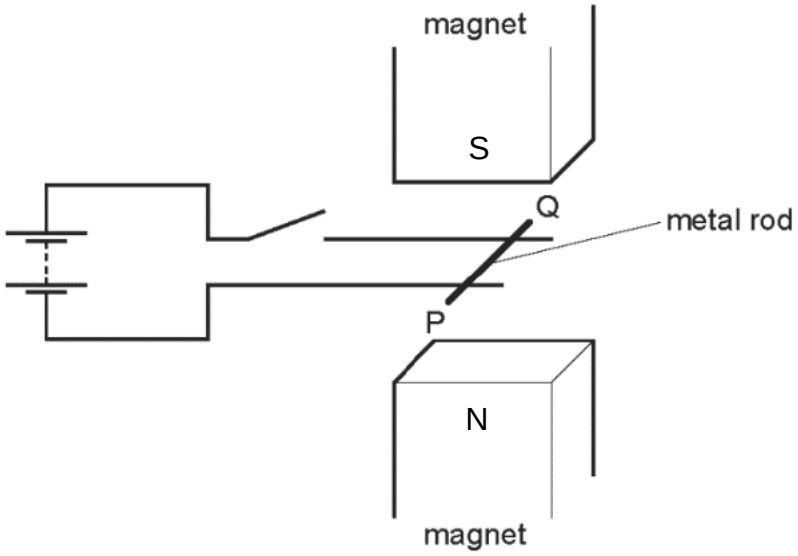
The results are recorded:

end U attracts end W
end V attracts end X
end X repels end Y
end Z attracts end U

Which statement is not correct?

A Ends U and Y have the same polarity.
B Ends V and Z have same polarity.
C Rods 1, 2 and 3 are all magnets.
D Rods 1 and 2 are not magnets as there is no repulsion recorded between them.

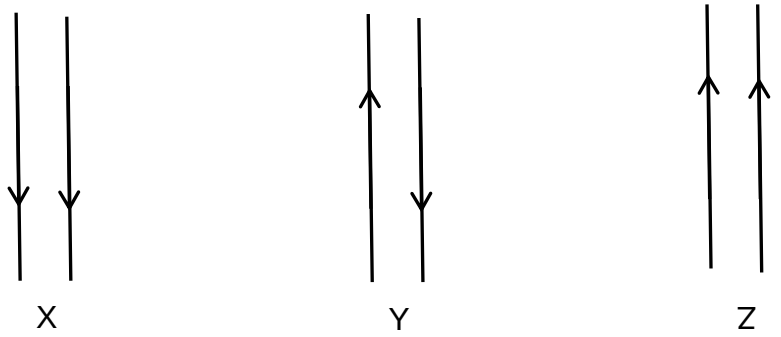
35 A metal rod PQ rests on two horizontal metal wires connected to a battery. The rod lies between the poles of a magnet.



Which of the change(s) can be made to move the rod to the right when the switch is closed?

A Repeatedly open and close the switch.
B Reverse the battery terminals only. (Positive and negative positions)
C Reverse the battery terminals and positions of the north and south poles.
D Reverse the direction of the metal rod. (P and Q change positions)

36 Three pairs of parallel wires have currents flowing through them as shown.



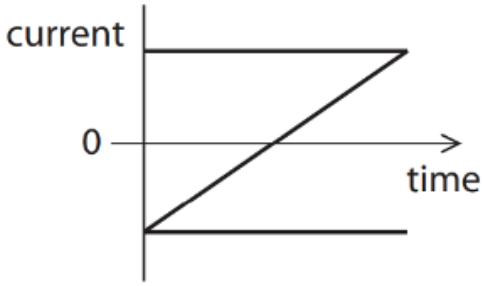
What type of force does each pair of wires experience?

	X	Y	Z
A	attraction	repulsion	attraction
B	attraction	repulsion	none
C	repulsion	none	attraction
D	repulsion	attraction	repulsion

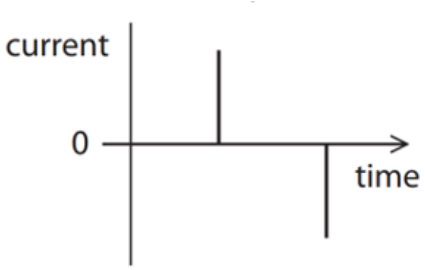
37 A student connects a switch, a fixed resistor and a battery to the primary coil of a step-up transformer. The student also connects a fixed resistor across the secondary coil. The student switches on the circuit and then later switches it off.

Which of the following graphs represent the current in the secondary coil?

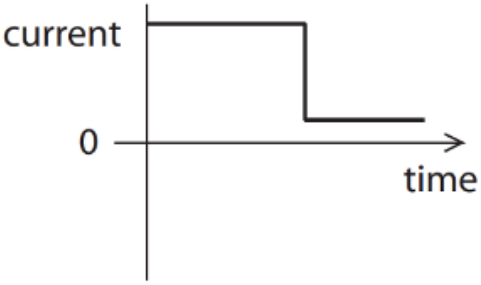
A



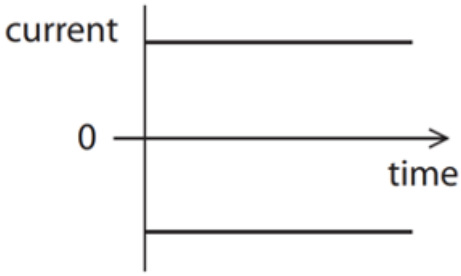
B



C



D



38 A charger for a mobile phone uses a transformer which steps the voltage down from 230 V to 5.0 V.

The secondary coil in the transformer has 100 turns.

How many turns are on the primary coil?

A 2 **B** 12 **C** 4600 **D** 530 000

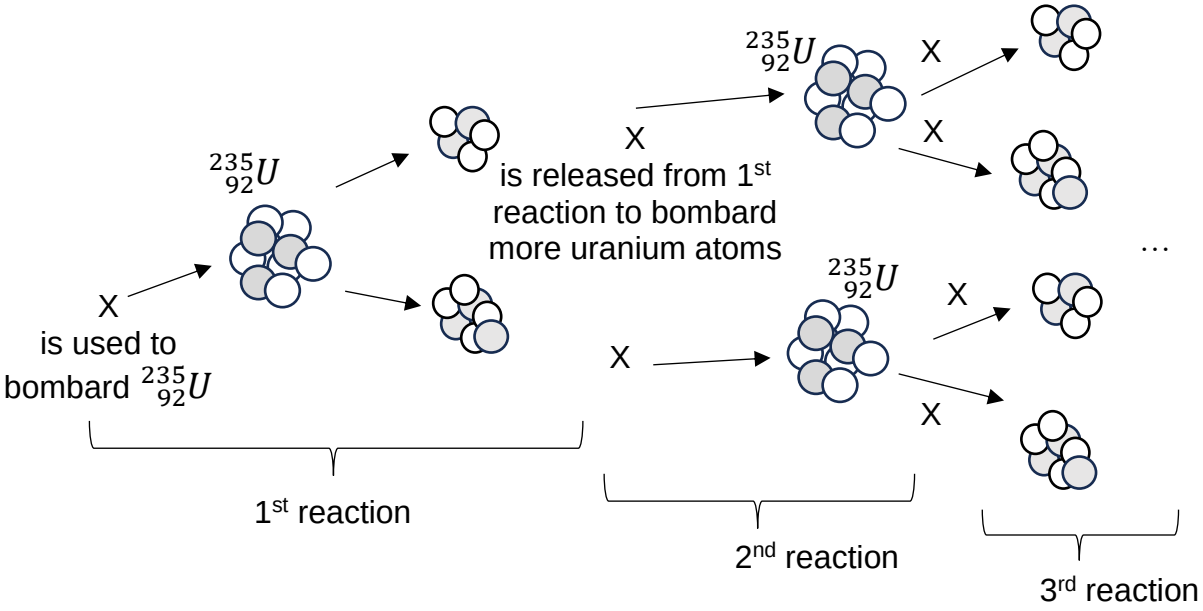
39 Electric power cables transmit electrical energy over large distances using high-voltage alternating current.

What are the advantages of using high voltage and of using an alternating current?

	advantage of using a high voltage	advantage of using an alternating current
A	high current is produced in the cables	resistance of the cable is reduced
B	high current is produced in the cables	voltage can be varied using a transformer
C	less energy is wasted in the cables	resistance of the cable is reduced
D	less energy is wasted in the cables	voltage can be varied using a transformer

[Turn over

40 A chain reaction of a nuclear fuel of Uranium, $^{235}_{92}U$ is shown below.



Which nuclear reaction is taking place and what is the particle marked X?

	nuclear reaction	particle X
A	alpha decay	alpha particle
B	fission	beta particle
C	fission	neutron
D	fusion	gamma rays