

Name:		Index Number:		Class:	
-------	--	---------------	--	--------	--



CATHOLIC HIGH SCHOOL

Preliminary Examination

Secondary 4 (O-Level Programme)

PHYSICS

Paper 1 Multiple Choice

6091/01

29 Aug 2023

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use paper clips, glue or correction fluid.

Write your name, index number and class on this paper and on the Answer Sheet 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 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.

For examiner's use only:

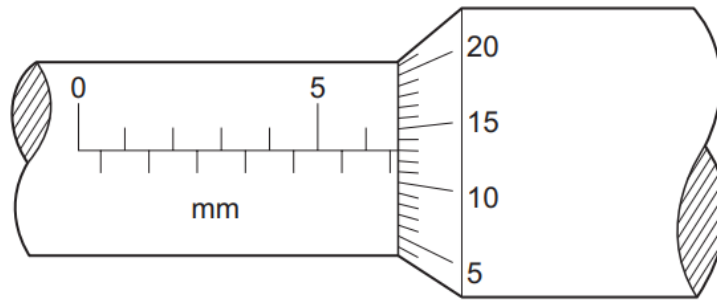
Total	/ 40
--------------	-------------

Overall	Marks	%
Paper 1	40	30%
Paper 2A	50	50%
Paper 2B	30	
Paper 3	40	20%

1 Which pair of units are both SI base units?

- A ampere, degree Celsius
- B ampere, kelvin
- C coulomb, degree Celsius
- D coulomb, kelvin

2 A micrometer screw gauge is used to measure the diameter of an object. It has a zero error of -0.02 mm.



What is the estimated diameter of the object?

- A 6.63 mm B 6.65 mm C 8.13 mm D 8.15 mm

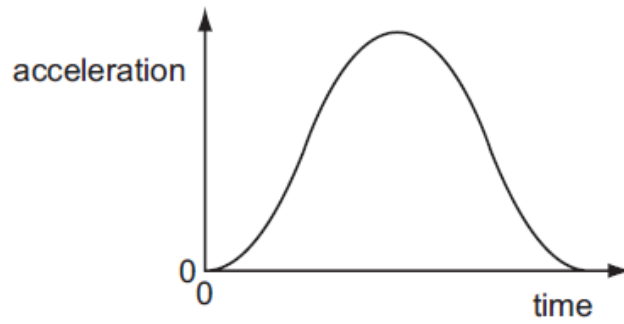
3 An object accelerates uniformly from rest. The effects of friction and air resistance are negligible.

The object travels a distance of 40 m in 4.0 s.

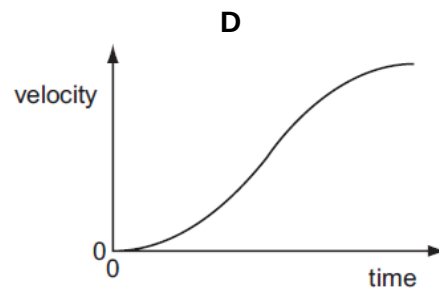
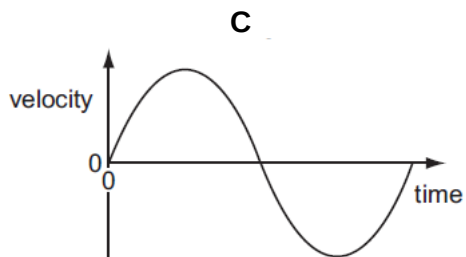
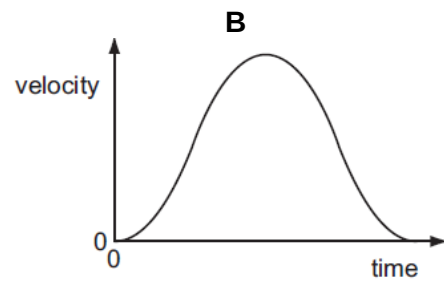
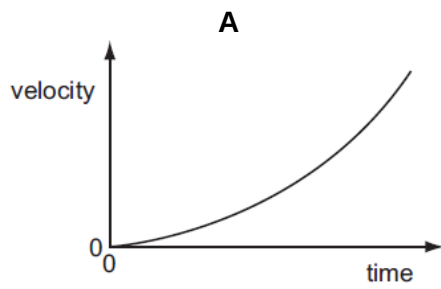
What is the acceleration of the object?

- A 0.40 m/s^2 B 2.5 m/s^2 C 5.0 m/s^2 D 20 m/s^2

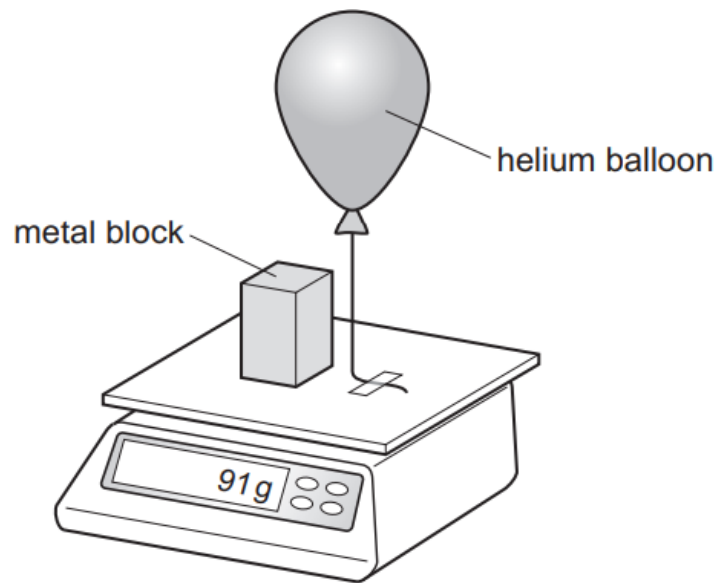
- 4 The graph shows how the acceleration of an object moving in a straight line varies with time.



Which graph shows the variation with time of the velocity of the object?



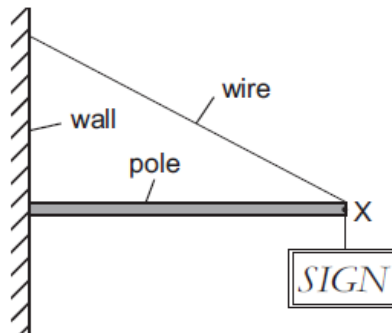
- 5 A helium balloon is tied to a top-pan balance. A metal block of mass 100 g is placed on the balance. The reading on the balance is 91 g.



Which statement can be deduced from the experiment?

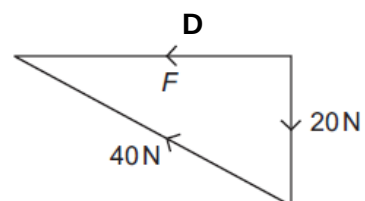
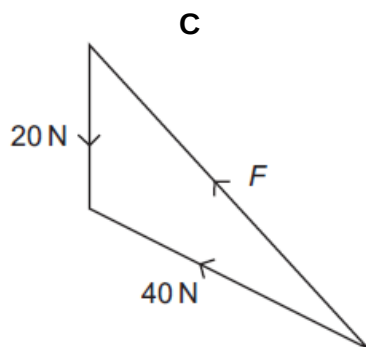
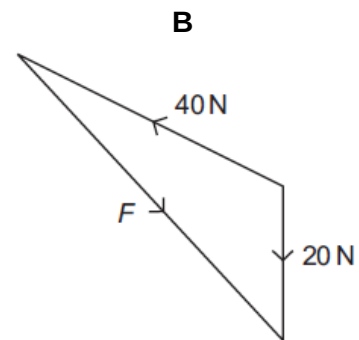
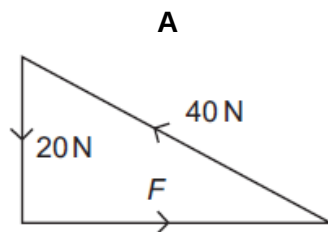
- A The balloon has a weight of 0.91 N.
- B The balloon exerts a downward force of 0.09 N on the top-pan balance.
- C The resultant downward force on the top-pan balance is 0.91 N.
- D The top-pan balance measures the weight of the objects placed on it.

- 6 The diagram shows a sign of weight 20 N suspended from a pole, attached to a wall. The pole is kept in equilibrium by a wire attached at point X of the pole.



The force exerted by the pole at point X is F , and the tension in the wire is 40 N.

Which diagram represents the three forces acting at point X?



- 7 A 120 kg rock is vertically suspended from a support on the Moon.

When an astronaut applies a horizontal force on the rock, which of the following is true about the rock?

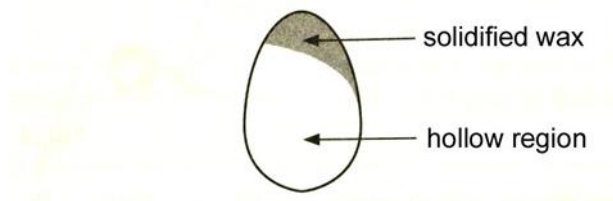
- A** It is easier to push than on Earth.
- B** It is more difficult to push than on Earth.
- C** It requires minimum effort of 1200N to push.
- D** It requires the same effort to push as on Earth.

- 8 1.5 m³ of water is mixed with 0.50 m³ of alcohol. The density of water is 1000 kg / m³ and the density of alcohol is 800 kg / m³.

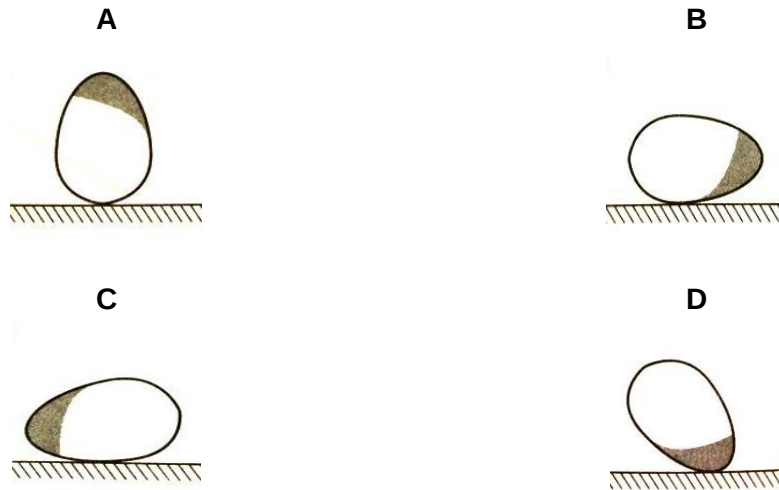
What is the density of the mixture with volume 2.0 m³?

- A 850 kg / m³ B 900 kg / m³ C 940 kg / m³ D 950 kg / m³

- 9 An empty egg shell contains solidified wax as shown.



In which position is the egg shell most stable when placed on a flat, horizontal surface?



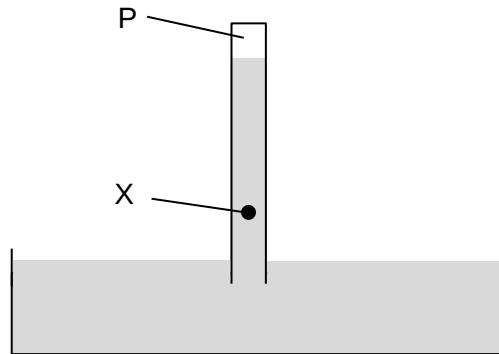
- 10 A child drinks a liquid of density ρ through a vertical straw.

Atmospheric pressure is p_0 and the child is capable of lowering the pressure at the top of the straw by 10%. The gravitational field strength is g .

What is the maximum length of straw that would enable the child to drink the liquid?

- A $\frac{p_0}{10\rho g}$ B $\frac{9p_0}{10\rho g}$ C $\frac{p_0}{\rho g}$ D $\frac{10p_0}{\rho g}$

- 11 A mercury barometer is used to measure the atmospheric pressure at sea level as shown.



The barometer is brought up to a mountain which has a lower atmospheric pressure compared to sea level.

How will the pressure at point X and region P change after the barometer is brought up to the mountain?

	pressure at point X	pressure at region P
A	decreases	decreases
B	decreases	remains unchanged
C	increases	decreases
D	remains unchanged	remains unchanged

- 12 The data below are taken from a test of a petrol engine for a motor car.

power output	150 kW
fuel consumption	20 litres per hour
energy content of fuel	40 MJ per litre

Which expression shows the calculation for the efficiency of the engine?

- A $\frac{150 \times 10^3 \times 60 \times 60}{20 \times 40 \times 10^6}$
- B $\frac{150 \times 10^3}{40 \times 10^6 \times 20 \times 60 \times 60}$
- C $\frac{150 \times 10^3 \times 40 \times 10^6 \times 20}{60 \times 60}$
- D $\frac{150 \times 10^3 \times 20}{40 \times 10^6 \times 60 \times 60}$

- 13 Which statement about solids, liquids and gases is **not** correct?

- A Gases are less dense than liquids because the molecules in a gas are very far apart.
- B Liquids flow because the molecules in a liquid slide over each other.
- C Solids are rigid because the molecules in a solid vibrate.
- D Solids cannot be compressed because the molecules are close to each other in fixed positions.

- 14** In a Brownian motion experiment, bright specks of smoke particles are observed to move in constant, random zigzag motion.

What is the reason for the motion of the bright specks of smoke particles?

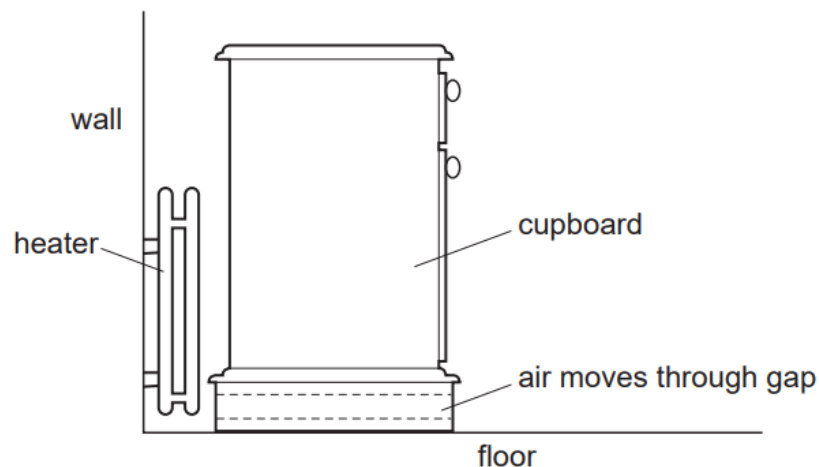
- A** The air particles collide unevenly against the smoke particles.
- B** The convection currents of air caused the smoke particles to move.
- C** The smoke particles are light.
- D** The smoke particles gain energy from the light source.

- 15** The average kinetic energy of gas molecules in a closed, rigid container is increased.

What happens to the pressure of the gas?

- A** The pressure decreases as the force and frequency of collision between the gas molecules and the container walls decrease.
- B** The pressure decreases as the force and frequency of collision between the gas molecules and the container walls increase.
- C** The pressure increases as the force and frequency of collision between the gas molecules and the container walls decrease.
- D** The pressure increases as the force and frequency of collision between the gas molecules and the container walls increase.

- 16** A cupboard is placed in front of a heater. Air can move through a gap under the cupboard.



Which line in the table describes the temperature and the direction of the air that moves through the gap?

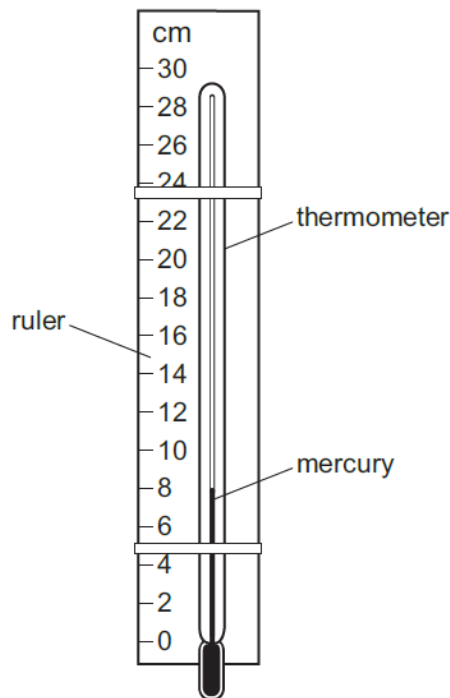
	air temperature	air direction
A	cool	away from the heater
B	cool	towards the heater
C	warm	away from the heater
D	warm	towards the heater

- 17 Cooling fins are used in many devices such as refrigerators and car radiators.

Which statement about their design is correct?

- A Their large surface area increases the rate of heat loss by conduction.
- B Their high specific heat capacity increases the rate of heat loss by conduction.
- C They are made of metal to increase the rate of heat loss by infra-red radiation.
- D They are painted white to increase the rate of heat loss by infra-red radiation.

- 18 A mercury thermometer with no scale is taped to a ruler as shown.



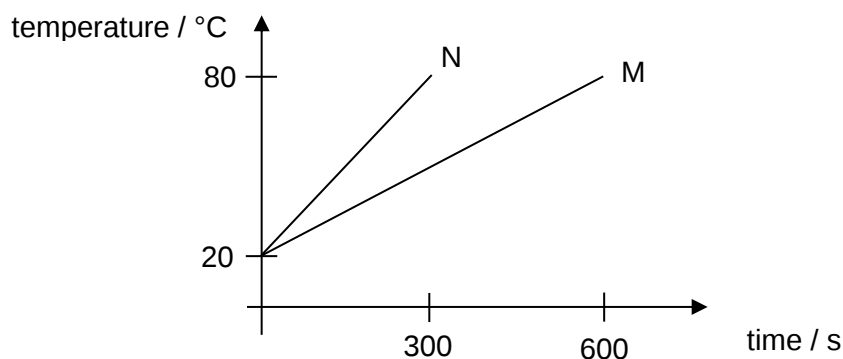
When the thermometer is placed in steam, the mercury level rises to 22.0 cm. When the thermometer is placed in a liquid of temperature 30°C , the mercury level falls to 8.0 cm.

Which is the length of the mercury level when it is placed in another liquid of temperature 10°C ?

- A 2.2 cm
 - B 2.7 cm
 - C 4.0 cm
 - D 18 cm
- 19 Which process does **not** require energy to be supplied?

- A boiling
- B evaporation
- C freezing
- D melting

- 20** Two metal blocks M and N are both heated uniformly using identical heaters. The temperature-time graphs of two metal blocks M and N are as shown.



The mass of M is twice of N.

What is the ratio of the specific heat capacities of M to N?

- A** 1:1 **B** 1:4 **C** 2:1 **D** 4:1

- 21** Two thermometers, P and Q, give the same reading at room temperature.

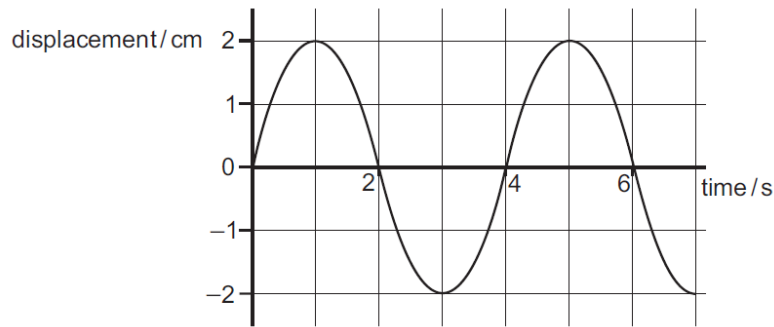
The bulb of thermometer Q is wrapped in gauze and dipped in a beaker of water at room temperature.

Air at room temperature is blown over the two thermometer bulbs.

Which statement correctly describes and explains what happens?

- A** P has a higher reading than Q because bulb P absorbs energy from the air.
B P has a higher reading than Q because water evaporates from the gauze and cools bulb Q.
C P has a lower reading than Q because the wet gauze insulates bulb Q.
D P has a lower reading than Q because water evaporates from the gauze and warms bulb Q.

- 22 The graph shows how the displacement of a particle in a wave varies with time.



Which statement is correct?

- A The wave has an amplitude of 2 cm and could be either transverse or longitudinal.
 - B The wave has an amplitude of 2 cm and must be transverse.
 - C The wave has an amplitude of 4 cm and could be either transverse or longitudinal.
 - D The wave has an amplitude of 4 cm and must be transverse.
- 23 An object is placed 30 cm in front of a plane mirror.

Which statement describes the image of the object?

- A The image is the same size as the object and 30 cm from the mirror.
 - B The image is the same size as the object and 60 cm from the mirror.
 - C The image is smaller than the object and 30 cm from the object.
 - D The image is smaller than the object and 60 cm from the object.
- 24 A small underwater pool light is 1.0 m below the surface. The light emerging from the water forms a circle on the water surface.

The water has a refractive index of 1.33 and the critical angle for light passing from water to air is 49° .

What is the radius of the circle?

- A 0.75 m B 0.87 m C 1.0 m D 1.2 m
- 25 Which statement on gamma rays is **not** correct?

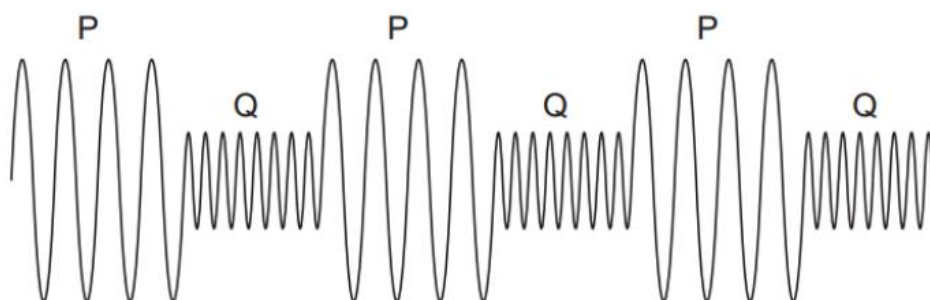
- A It has a larger frequency than infra-red radiation.
- B It is an ionising radiation.
- C It is used to sterilise food.
- D It travels at the same speed as ultrasound.

- 26 When a guitar is played, the string of the guitar vibrates and music is heard.

Which row correctly describes the type of waves produced along the string and in air?

	string	air
A	longitudinal	longitudinal
B	longitudinal	transverse
C	transverse	longitudinal
D	transverse	transverse

- 27 A siren produces two different sounds P and Q, which are emitted alternately at regular time intervals as shown.



Which sound is louder and which sound has a higher pitch?

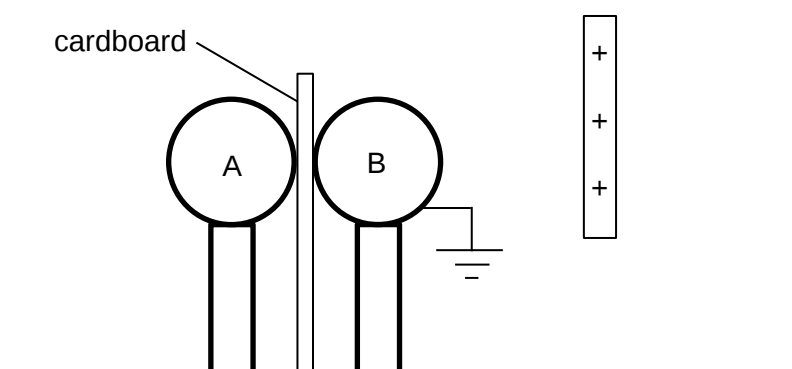
	louder	higher pitch
A	P	P
B	P	Q
C	Q	P
D	Q	Q

- 28 A girl hears an echo when she claps her hand near a high wall.

What happens to the echo if she moves nearer to the wall?

- A It has the same loudness and takes less time to reach her.
- B It is louder and takes less time to reach her.
- C It is louder and takes more time to reach her.
- D It is softer and takes less time to reach her.

- 29** Two uncharged metal spheres A and B are placed together with a cardboard inserted between them as shown. Both spheres are supported by insulating stands and sphere B is earthed by a wire.



A positively charged rod is brought near the spheres.

What is the charge on spheres A and B respectively when the wire is removed first followed by the charged rod?

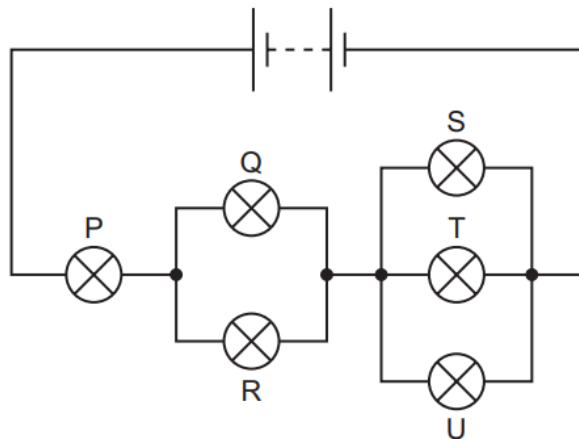
	sphere A	sphere B
A	negative	negative
B	neutral	negative
C	neutral	positive
D	positive	positive

- 30** Two wires made of the same material and of the same thickness are connected in parallel to the same voltage supply. Wire P has a length of 1.0 m. Wire Q has a length of 2.0 m.

What is the ratio $\frac{\text{current in P}}{\text{current in Q}}$?

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

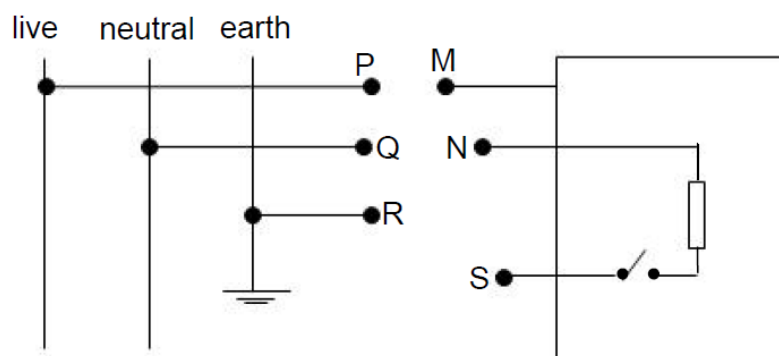
- 31 The diagram shows a circuit of six identical lamps connected to a battery.



Which lamps are the dimmest?

- A P only
 - B Q and R only
 - C S, T and U only
 - D P, Q, R, S, T and U are equally bright
- 32 What is the unit of electrical power?
- A ampere
 - B kilowatt-hour
 - C volt
 - D watt
- 33 Which energy resource is **not** renewable?
- A nuclear
 - B sunlight
 - C tides
 - D wind

- 34** An electrical appliance with a metal case is to be connected to the mains supply as shown.



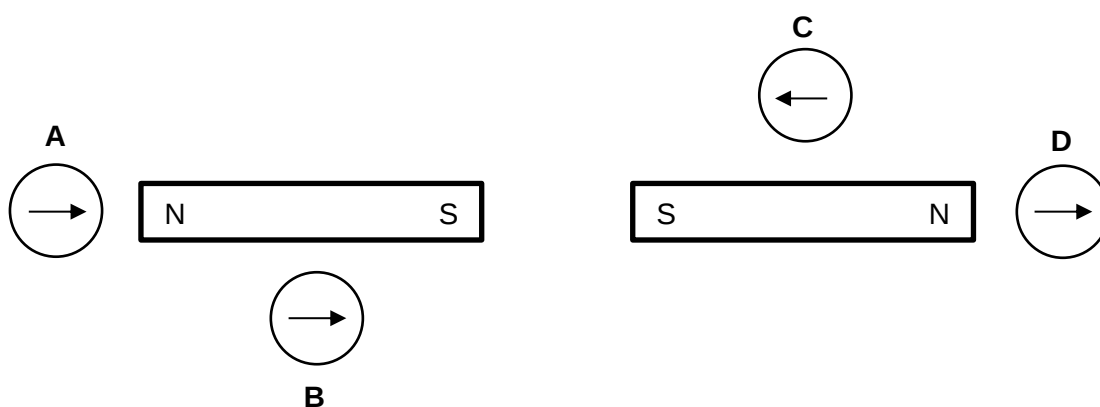
Wires P, Q and R are the live, neutral and earth wires respectively. They are to be connected to wires M, N and S.

Which combination shows how wires P, Q and R should be connected to wires M, N and S?

	P connected to	Q connected to	R connected to
A	N	M	S
B	N	S	M
C	S	M	N
D	S	N	M

- 35** Four plotting compasses are placed in the magnetic field of two identical bar magnets as shown in the diagram.

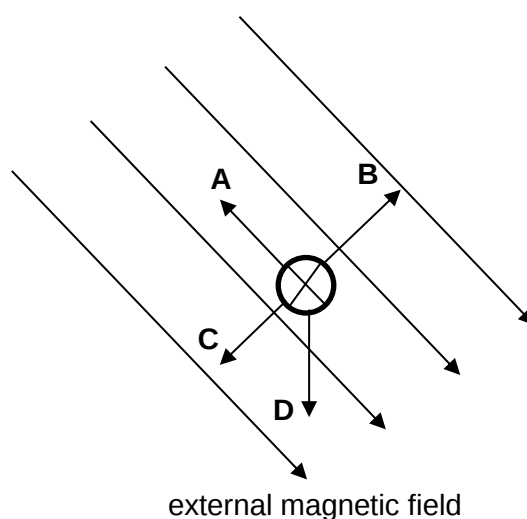
Which compass is pointing in the wrong direction?



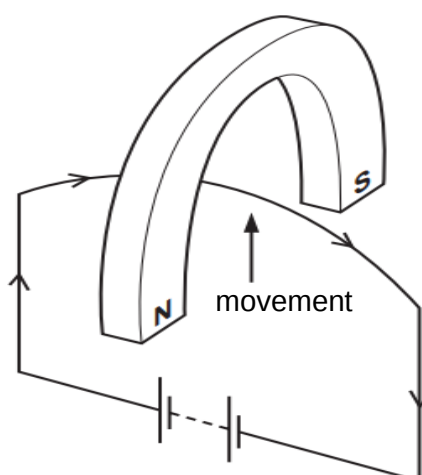
- 36** A horizontal power cable that carries a steady current is in a region of an external magnetic field as shown.

The current in the cable is flowing into the plane of the diagram.

Which arrow shows the direction of the force on the cable caused by the external magnetic field?



- 37** A wire is placed in a strong magnetic field. When a current is passed through the wire, a force is exerted upwards on the wire as shown.

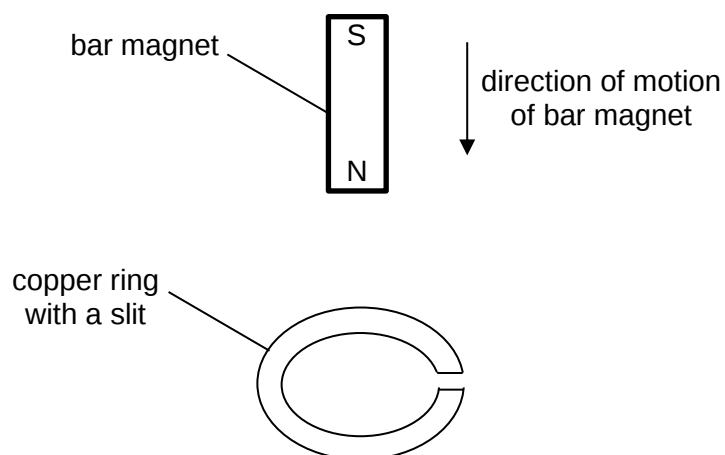


The current is reversed.

What is the direction of the force acting on the wire?

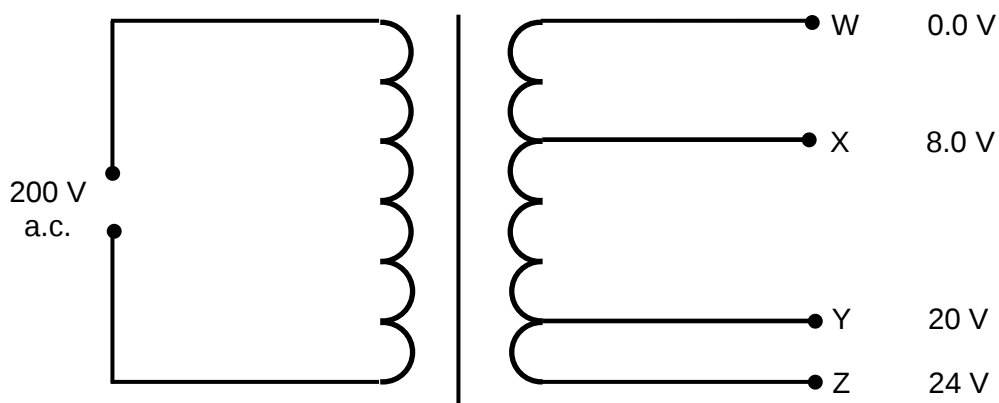
- A** downwards
- B** towards the north pole
- C** towards the south pole
- D** upwards

- 38** A bar magnet is falling towards a copper ring which has a slit as shown.



Which statement is correct?

- A** An anti-clockwise current is induced in the copper ring when viewed from above.
 - B** The bar magnet is observed to slow down as it falls through the copper ring.
 - C** The bar magnet will fall through the ring under the influence of gravity.
 - D** The copper ring will be magnetised by the bar magnet.
- 39** A transformer can step down an input alternating voltage to various output voltages as shown.

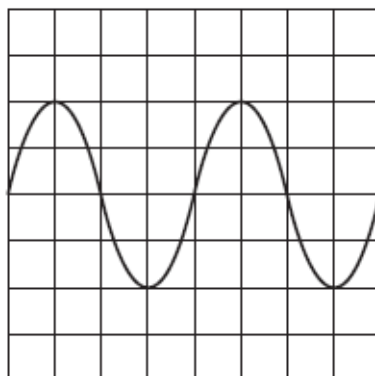


The primary coil has 5000 turns.

What is the number of turns in the secondary coil between X and Y?

- A** 300
- B** 600
- C** 42000
- D** 83000

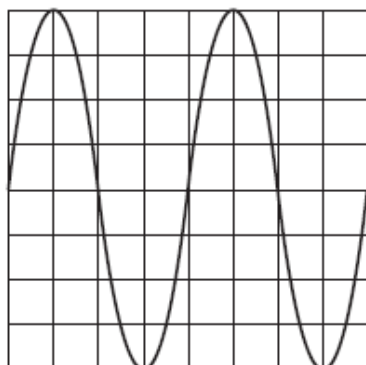
- 40 The following trace is seen on the screen of a cathode-ray oscilloscope (CRO).



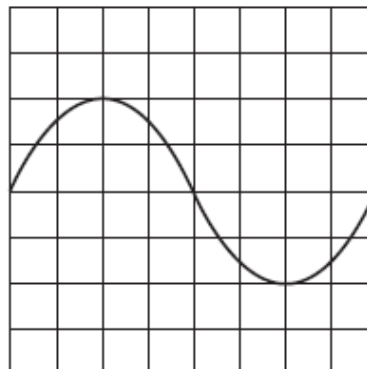
The setting of the time base is then changed from 10 ms / cm to 20 ms / cm. The Y-gain is unchanged.

Which trace is now seen on the screen?

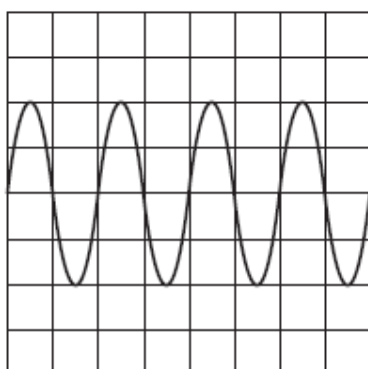
A



B



C



D

