



West Spring Secondary School

PRELIMINARY EXAMINATION 2021

Physics

6091/01

SECONDARY 4 EXPRESS

Name _____ () **Date** 17 Sept 2021

Class _____ **Duration** 1 hr

Additional Materials: 1 OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name and shade your index number on the Answer Sheet (OTAS) 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.

This document consists of **14** printed pages, including this cover page.

Setter : Mr Prakash s/o Radakrishna

[Turn over

- 1 Which expression has the same SI base units as pressure?

- A $\frac{\text{force}}{\text{length} \times \text{speed}}$
- B $\frac{\text{force}}{\text{length} \times \text{time}}$
- C $\frac{\text{mass}}{\text{length} \times (\text{time})^2}$
- D $\frac{\text{mass} \times (\text{time})^2}{\text{length}}$

- 2 Esther has to determine the diameter of a metal sphere using a pair of vernier calipers.

Diagram 1 shows the reading when the jaws of the vernier calipers are closed.

Diagram 2 shows the reading when measuring the diameter of the metal sphere.

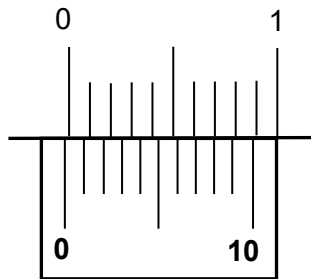


Diagram 1

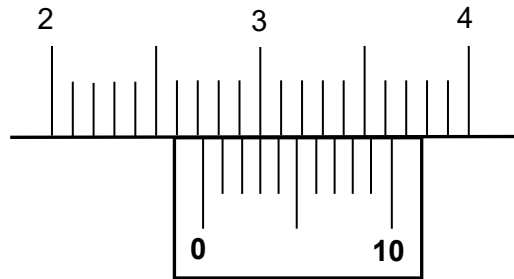
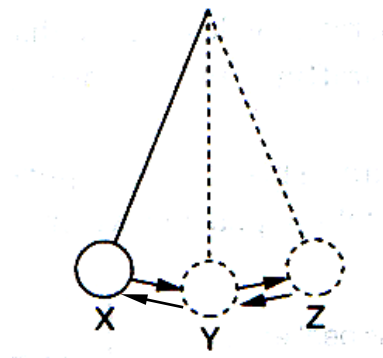


Diagram 2

What is the actual diameter of metal sphere?

- A 2.65 cm B 2.73 cm C 2.75 cm D 2.81 cm
- 3 The diagram shows a pendulum oscillating between positions **X** and **Z**. The middle point of the oscillation is **Y**.



The first time the pendulum passes through **Y**, a stopwatch is started. The thirty-first time the pendulum passes through **Y**, the stopwatch is stopped. The reading is 10 s.

What is the period of the pendulum?

- A $\frac{10}{15}$ s B $\frac{10}{30}$ s C $\frac{10}{31}$ s D $\frac{10}{60}$ s

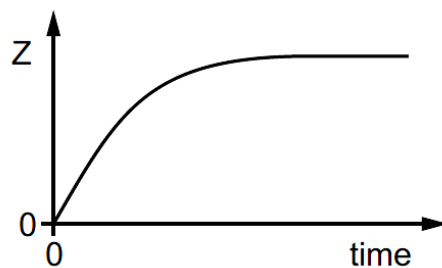
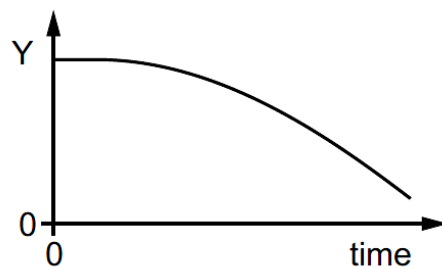
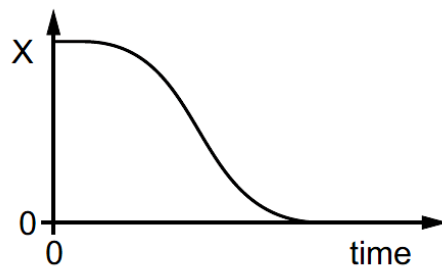
4 What must be changing when a body is accelerating uniformly?

- A** The speed of the body. **B** The velocity of the body.
C The mass of the body. **D** The force acting on the body.

5 An object is dropped at time $t = 0$ from a high building. Air resistance is significant.

Three graphs are plotted against time:

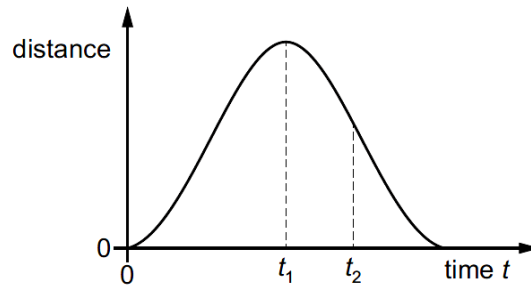
- the height of the object above the ground,
- the speed of the object,
- the magnitude of the resultant force on the object.



What are the quantities X, Y and Z?

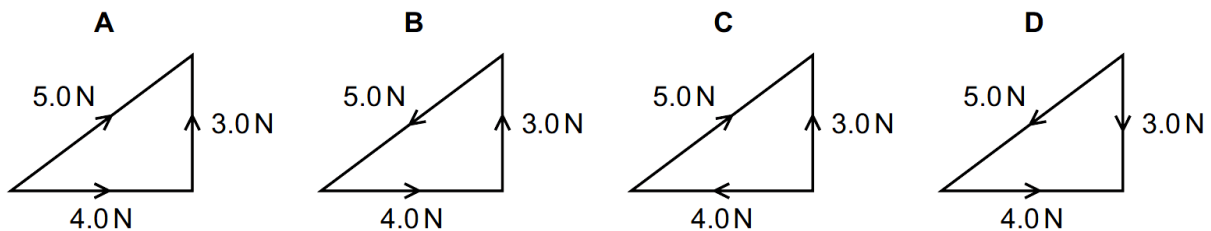
	height of the object above the ground	speed of the object	magnitude of the resultant force on the object
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	Y	X

- 6 A train sets off from a station at time $t = 0$. The graph shows how the distance between the train and the station varies with time.



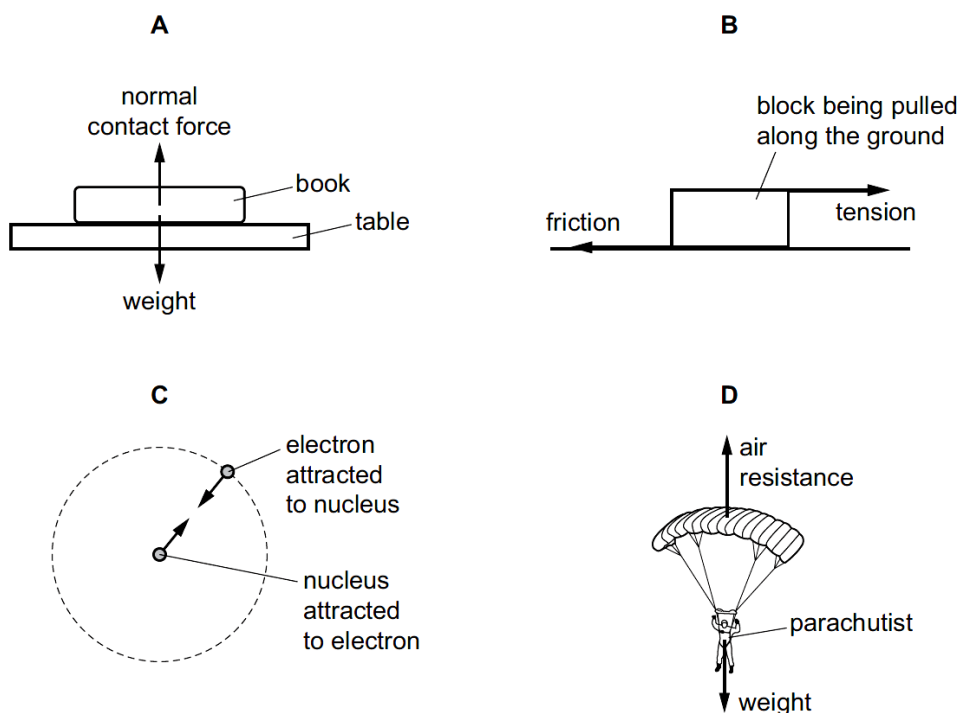
Which statement about the movement of the train between time t_1 and t_2 is correct?

- A Its speed is decreasing and it is moving away from the station.
 B Its speed is decreasing and it is moving towards the station.
 C Its speed is increasing and it is moving away from the station.
 D Its speed is increasing and it is moving towards the station.
- 7 Which diagram shows the addition of the 4.0 N and the 3.0 N forces?



- 8 Each diagram shows two forces that are equal in magnitude.

Which diagram shows two forces that are a Newton's third law pair of forces?



- 9 A metal block has a mass of 750 g. Magnesium makes up 60% of the mass and the remaining 40% is copper.

The density of magnesium is 1.7 g/cm^3 .

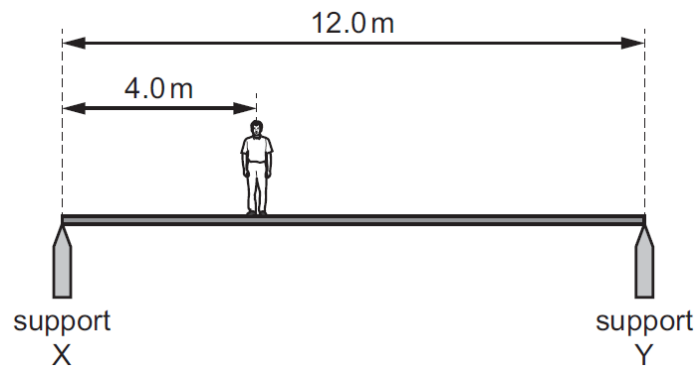
The density of copper is 9.0 g/cm^3 .

What is the density of the block?

- A** 2.5 g/cm^3 **B** 4.6 g/cm^3 **C** 5.4 g/cm^3 **D** 10.7 g/cm^3

- 10 A uniform horizontal footbridge is 12.0 m long and weighs 4000 N.

It rests on two supports X and Y, as shown.



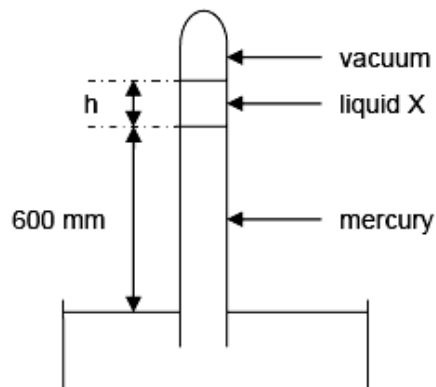
A man of weight 600 N stands a distance of 4.0 m from support X.

What is the upward force on the footbridge from support X?

- A** 2200 N **B** 2300 N **C** 2400 N **D** 2600 N

- 11 The diagram shows a barometer which contains mercury and liquid X.

The atmospheric pressure is 750 mm Hg and the density of liquid X is $\frac{3}{4}$ of the density of mercury.



What is h, the height of liquid X?

- A** 110 mm **B** 150 mm **C** 200 mm **D** 250 mm

- 12 A car accelerates up a hill.

Which of the following describes the changes in its kinetic energy and gravitational potential energy?

	kinetic energy	gravitational potential energy
A	unchanged	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 13 A car moves from rest with uniform acceleration along a horizontal road.

After travelling a distance of 100 metres, it has kinetic energy equal to 200 000 J.

What resultant force is acting on the car?

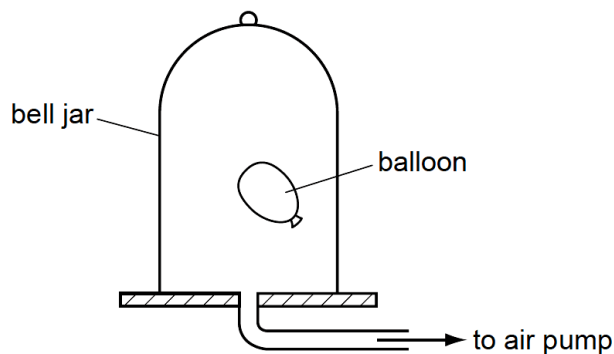
- A** 100 N **B** 1000 N **C** 2000 N **D** 20 000 N

- 14 The input power to a lamp is 6.0 W. The lamp wastes 2.7 J of energy in 3.0 s.

What is the efficiency of the lamp?

- A** 0.15 **B** 0.45 **C** 0.55 **D** 0.85

- 15 A partially-inflated balloon is placed inside a bell jar. The bell jar is connected to an air pump.



The air pump is switched on and air is removed from the bell jar.

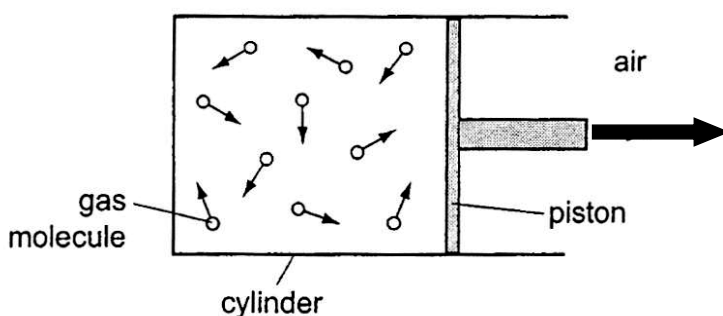
What happens to the pressure and to the volume of the gas inside the balloon?

	pressure	volume
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 16 Which row correctly describes the spacing, ordering and motion of the molecules in water and in ice when both are at a temperature of 0°C ?

	spacing	ordering	motion
A	molecules in ice are closer together than molecules in water	a regular pattern of molecules in both ice and water	molecules in both ice and water have the same average speed
B	molecules in ice are closer together than molecules in water	a regular pattern of molecules in ice but not in water	molecules in ice travel more slowly than those in water
C	molecules in ice are further apart than molecules in water	a regular pattern of molecules in both ice and water	molecules in ice travel more slowly than those in water
D	molecules in ice are further apart than molecules in water	a regular pattern of molecules in ice but not in water	molecules in both ice and water have the same average speed

- 17 Gas inside a cylinder is heated slowly to a higher temperature and the piston moves outwards.



As the volume increases, the pressure of the gas remains constant.

What happens to the speed of the gas molecules and their rate of collision with the piston?

	speed of molecules	rate of collision
A	increases	stays constant
B	increases	decreases
C	increases	increases
D	stays constant	increases

- 18 The following objects all lose heat.

Which object loses all of its heat by radiation?

- A** a concrete block with white surface at 100°C , in air.
- B** a shiny metal satellite at 30°C , in space.
- C** a metal block with black surface at 40°C , in air.
- D** the heating element of a kettle at 150°C , in water.

- 19 Physical properties of materials are used in the measurement of temperature.

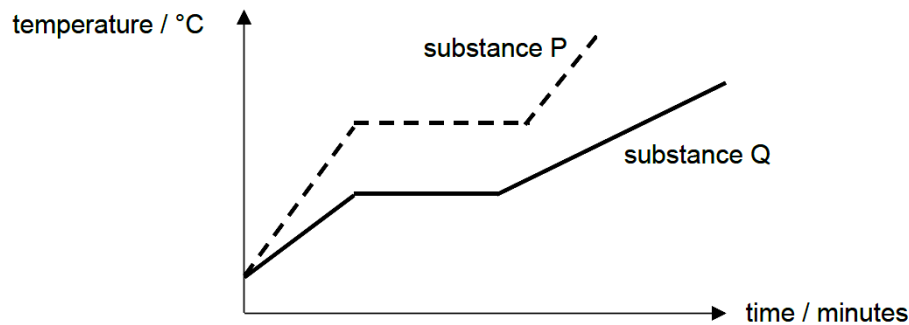
Which physical property is **not** suitable for this purpose?

- A** expansion of a metal **B** mass of a liquid
C resistance of a metal **D** volume of a liquid

- 20 Which statement about boiling and evaporation of a liquid is correct?

- A** Boiling only occurs at the surface of a liquid.
B Bubbles of air are produced throughout the liquid during boiling.
C Evaporation is not affected by the surface area of the liquid.
D Evaporation occurs at any temperature.

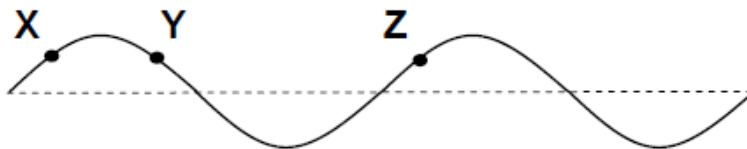
- 21 The diagram shows a temperature-time graph of two solid substances P and Q. Both substances are heated by the same heat source and results plotted on the same axes.



Which of the following about the two substances is correct?

	substance P	substance Q
A	higher melting point	higher specific heat capacity
B	higher melting point	lower specific heat capacity
C	lower melting point	higher specific heat capacity
D	lower melting point	lower specific heat capacity

- 22 The diagram shows an instantaneous position of a string as a transverse progressive wave travels along it from left to right.



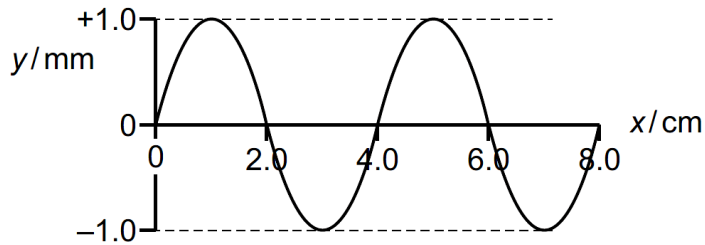
Which one of the following correctly shows the directions of the velocities of the points **X**, **Y** and **Z** on the string?

	X	Y	Z
A	→	→	→
B	→	←	→
C	↓	↓	↓
D	↓	↑	↓

- 23** A transverse wave in a medium has the waveform shown, where

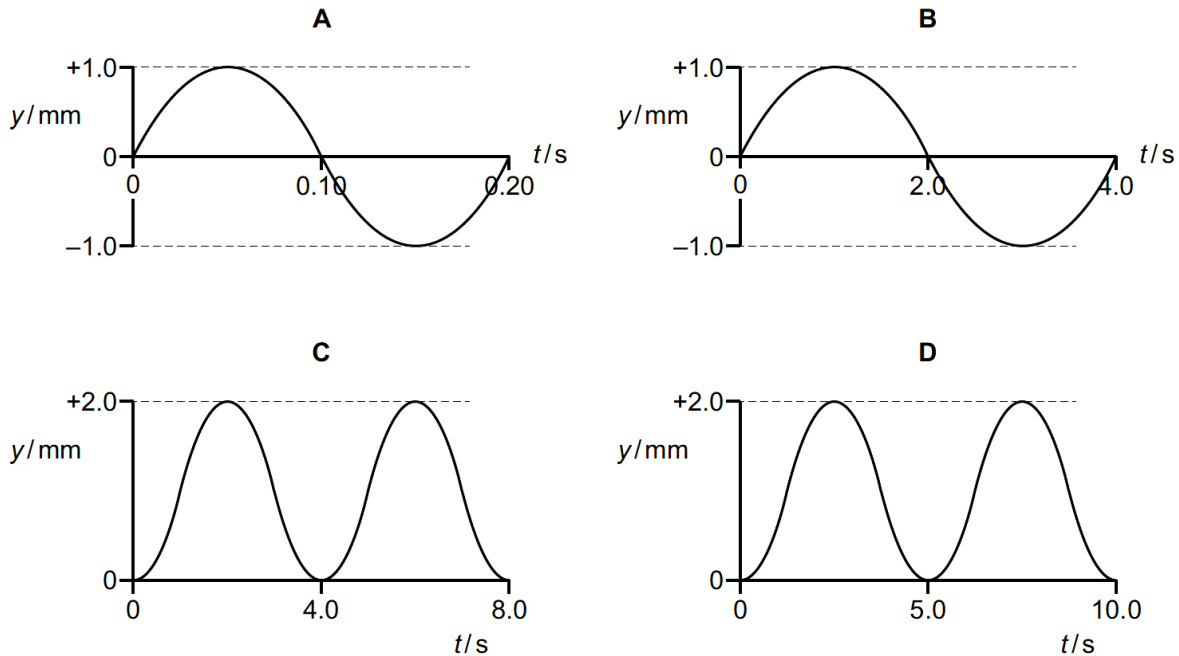
y = vertical displacement and x = horizontal distance.

The speed of the wave is 20.0 cm/s.

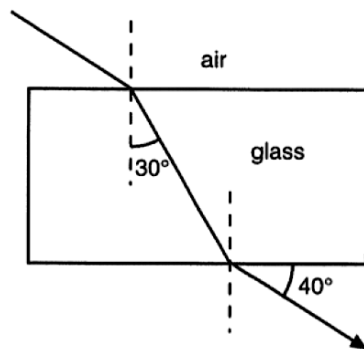


A particle of the medium oscillates vertically.

Which graph of vertical displacement y against time t best represents the motion of this particle?



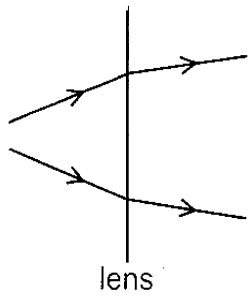
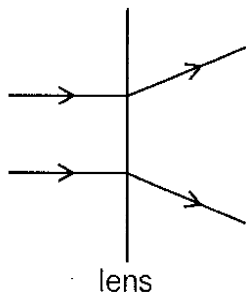
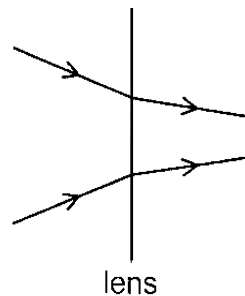
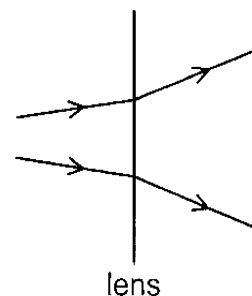
- 24** A ray of light is incident on a piece of glass block as shown in the diagram.



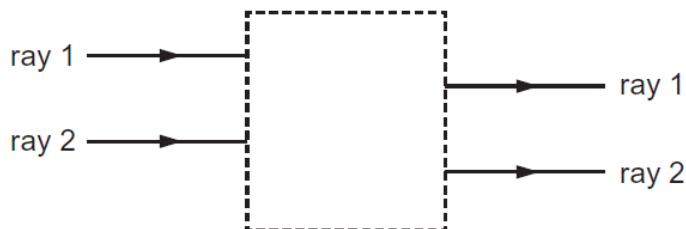
Which calculation gives the value of the refractive index of the glass block?

- | | | | |
|----------|------------------------------------|----------|------------------------------------|
| A | $\sin 30^\circ \div \sin 40^\circ$ | B | $\sin 30^\circ \div \sin 50^\circ$ |
| C | $\sin 40^\circ \div \sin 30^\circ$ | D | $\sin 50^\circ \div \sin 30^\circ$ |

- 25 Which diagram shows rays of light passing through a converging lens?

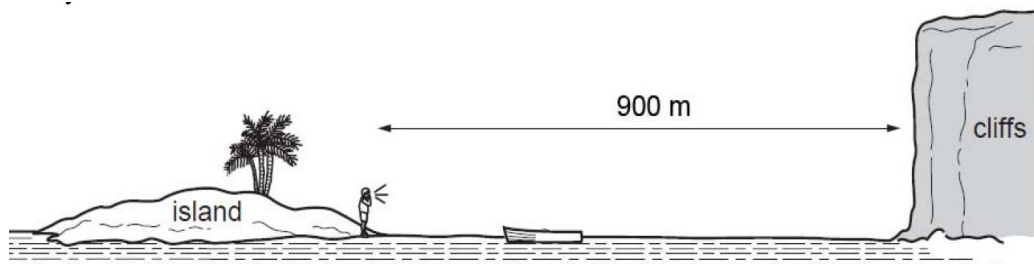
**A****B****C****D**

- 26 Two rays of light enter and leave a box.



What could be inside the box to make the rays behave as shown?

- A** a converging lens **B** a parallel-sided glass block
C a plane mirror **D** a triangular prism
- 27 Mr. Prakash is stranded on an island.



He shouts for help, but all he can hear in reply is the echo of his shout from some cliffs 900 m from where he is standing.

Sound travels at 340 m/s through the air.

What is the time interval between Mr Prakash shouting and hearing the echo?

- A** 0.38 s **B** 0.76 s **C** 2.6 s **D** 5.3 s

- 28 An ultrasound signal of frequency 2.0×10^6 Hz is used in a pre-natal scan.

The speed of the signal is 1.4 km/s.

What is its wavelength?

- A** 7.0×10^{-4} m **B** 2.8×10^{-3} m **C** 0.70 m **D** 2.8 m

- 29 Red and violet are the colours at the ends of the visible spectrum.

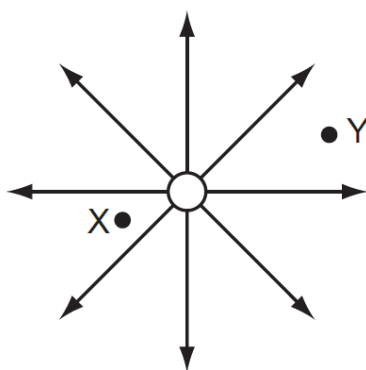
How do the frequencies and the wavelengths of these colours compare?

	higher frequency	longer wavelength
A	red	red
B	red	violet
C	violet	red
D	violet	violet

- 30 What happens when a plastic sphere that is rubbed with a piece of duster becomes negatively charged?

- A** The sphere loses protons to the duster.
B The sphere loses electrons to the duster
C The duster gains protons from the sphere.
D The duster loses electrons to the sphere.

- 31 The diagram shows the electric field near a point charge and two electrons X and Y.



Which row describes the forces acting on X and Y?

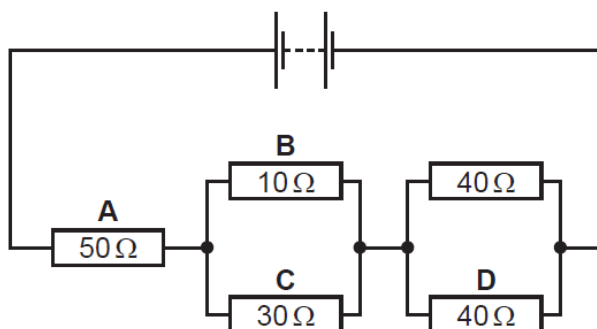
	direction of force	magnitude of force on X
A	radially inwards	less than force on Y
B	radially inwards	greater than force on Y
C	radially outwards	less than force on Y
D	radially outwards	greater than force on Y

- 32** During refueling, a petrol car receives 50 litres of fuel in 90 seconds. The petrol has 34 MJ of energy per litre.

For an electric car to receive the same amount of energy in the same time from a 230 V supply, what is the minimum current required?

- A** 2700 A **B** 8.2×10^4 A **C** 7.4×10^6 A **D** 6.6×10^8 A

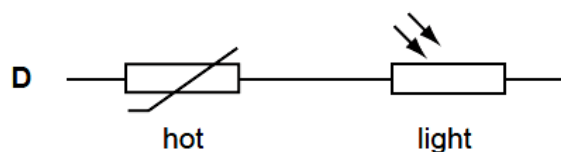
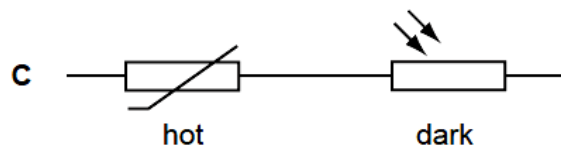
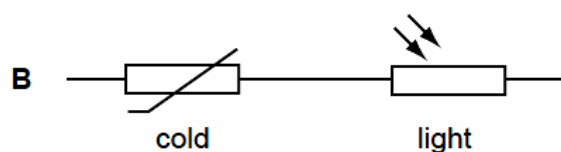
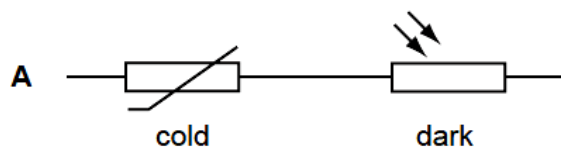
- 33** The diagram shows a circuit containing five resistors connected to a battery.



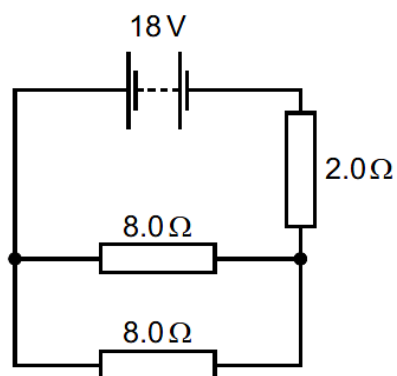
In which resistor, A, B, C or D is the current the smallest?

- 34** A thermistor and a light-dependent resistor are connected in series.

Under which conditions is the total resistance the smallest?

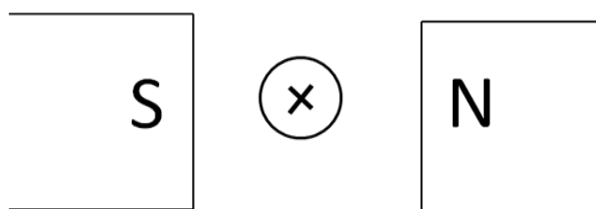


- 35 A power supply of 18 V is connected to three resistors, as shown.



What is the potential difference across the 2.0 Ω resistor?

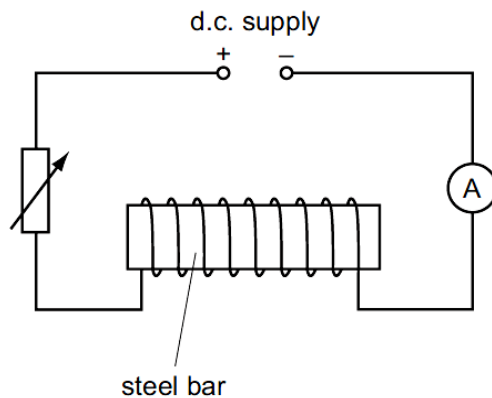
- A** 2.0 V **B** 3.6 V **C** 6.0 V **D** 12 V
- 36 An electric iron is marked 240 V, 2500 W.
- Four fuses are available with values of 5 A, 10 A, 13 A and 30 A.
- Which fuse should be used?
- A** 5 A **B** 10 A **C** 13 A **D** 30 A
- 37 An electrical appliance is plugged into a socket in the wall. The plug contains a fuse.
- What is the main purpose of the fuse?
- A** to protect the user from electric shock
B to protect the wiring from overheating
C to earth the appliance
D to earth the plug
- 38 The diagram shows a beam of electrons moving **into** the page in a magnetic field.



What will happen to the beam of electrons?

- A** deflect downwards **B** deflect upwards
C deflect to the left **D** deflect to the right

- 39 The diagram shows how a steel bar can be magnetised.



Which statement describes how the steel bar can be demagnetised?

- A Reverse the d.c. supply and gradually decrease the current in the circuit.
 B Reverse the d.c. supply and gradually increase the current in the circuit.
 C Use an a.c. supply and gradually decrease the current in the circuit.
 D Use an a.c. supply and gradually increase the current in the circuit.
- 40 Two parallel wires carry currents in the same direction.

Which diagram shows the magnetic field around each wire and the direction of the force on each wire?

