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Class/ Index Number	Centre Number/ 'O' Level Index Number	Name
/	/	



新加坡海星中学
MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

SCIENCE (PHYSICS, CHEMISTRY)

Paper 1

5076/01
28 August 2020
1 hour

Additional Materials:

Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class, index number and Centre number 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.

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.

A copy of the Data Sheet is printed on page 13.

A copy of the Periodic Table is printed on page 14.

The use of an approved scientific calculator is expected, where appropriate.

The total number of marks for this paper is 40.

At the end of the examination, hand in the following separately:

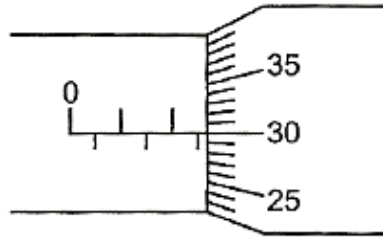
(1) Optical Test Answer Sheet (OTAS)

(2) Question Paper

For Examiner's Use

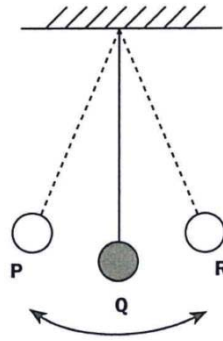
40

- 1 A micrometer is used to measure the thickness of a piece of glass and its reading is shown in the diagram below.



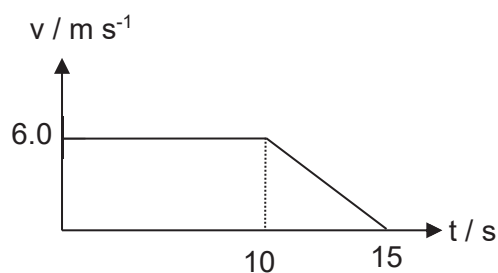
What is the thickness of the glass?

- A 2.30 mm B 2.80 mm
C 3.30 mm D 5.30 mm
- 2 The diagram shows a simple pendulum. The pendulum takes 0.30 s to move from P to Q.



What is the period of pendulum?

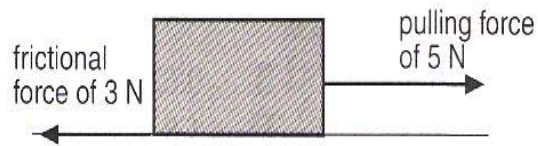
- A 2.4 s B 1.2 s
C 0.90 s D 0.60 s
- 3 The graph below shows the variation of velocity of a car with time.



Which of the following statements is true?

- A The acceleration is constant.
B The velocity is constant in the last 5 seconds.
C The car is not moving in the first 10 seconds.
D Average speed of the car for 15 seconds is 5.0 m/s.

- 4 The diagram shows a box of 4 kg pulled by a 5 N force. A frictional force of 3 N acts in the opposite direction.



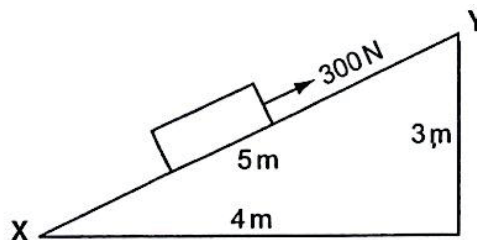
What is the acceleration of the box?

- A 2.0 m/s² B 1.25 m/s² C 0.75 m/s² D 0.50 m/s²
- 5 Four objects landed on three different planets.

Object	Mass / kg	Weight / N
P	40	80
Q	20	200
R	10	200
S	20	40

From the table above, which two objects landed on the same planet?

- A P and S B Q and S
C Q and R D R and S
- 6 A 300 N force is applied to a box in the direction XY in order to move it up a ramp in 20 s.



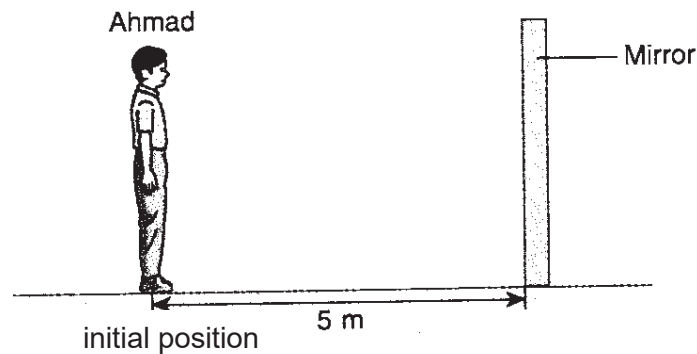
What is the average power to move the box from X to Y?

- A 60 W B 75 W C 600 W D 750 W
- 7 Which of the following does not describe the characteristics of gas molecules?
- A All molecules move with the same speed.
B The kinetic energy each molecule possesses is not constant.
C The average speed of the molecules remains constant if temperature of the gas is constant.
D When a gas is cooled, molecules lose energy and distance between molecules becomes closer in liquid state.

- 8 Boiling and evaporation are different processes. Which statement is **not** correct?

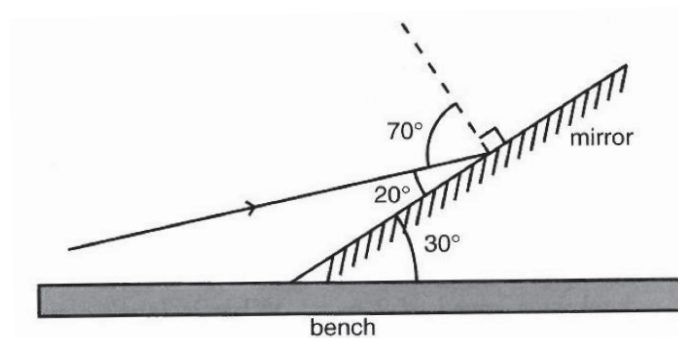
A Evaporation causes the temperature of a liquid to fall.
B When a boiling liquid is heated its temperature remains constant.
C Evaporation can only occur when the temperature of the liquid is high enough.
D Boiling occurs throughout the entire liquid but evaporation only occurs at the surface.

- 9 The diagram shows Ahmad standing in front of a plane mirror at a distance of 5 m.



What is the distance between Ahmad's initial position and his final image if Ahmad moves backwards by another 5 m?

- A** 5 m **B** 10 m **C** 15 m **D** 20 m
- 10 A mirror is tilted at angle of 30° to the bench. A ray of light is directed so that it hits the mirror at an angle of 20° to the surface of the mirror.



What is the angle of reflection?

A 20° **B** 30° **C** 50° **D** 70°

11 Which of the following statements is/are true about the transverse wave?

- I** It carries energy.
- II** It has compression and rarefaction.
- III** The vibration of its particles is perpendicular to the direction in which the wave travels.

- A** I only
- B** I and II
- C** I and III
- D** II and III

12 Which of the following is a property of all electromagnetic waves?

- A** they travel with the same speed in vacuum
- B** they travel at the speed of sound
- C** they do not obey the laws of reflection and refraction
- D** they are longitudinal waves

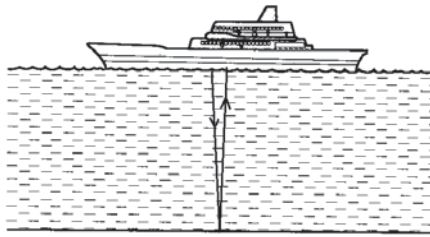
13 Which of the following is the correct order of increasing wavelength?

	shortest wavelength → longest wavelength		
A	infrared radiation	x-rays	microwaves
B	microwaves	Infrared radiation	x-rays
C	x-rays	microwaves	infrared radiation
D	x-rays	infrared radiation	microwaves

14 The main components of the electromagnetic spectrum have many well-known uses. What is a common use of ultraviolet radiation?

- A** sterilisation of medical equipment
- B** check metal castings for cracks
- C** alarms to detect intruder
- D** for cancer treatments

- 15** The diagram shows a ship using ultrasonic detector to measure the depth of the sea. The detector sends a pulse and receives the pulse from the sea bed 0.6 s later.



What is the depth of the sea if the speed of sound in water is 1400 m/s?

- | | | | |
|----------|--------|----------|-------|
| A | 1680 m | B | 840 m |
| C | 420 m | D | 210 m |

- 16** When a polythene rod is rubbed with wool, the polythene becomes negatively charged. What has happened to the polythene rod and the wool to cause this?

	polythene	wool
A	gained electrons	gained protons
B	gained electrons	lost electrons
C	lost protons	gained protons
D	lost protons	lost electrons

- 17** Which of the following about electric field are correct?

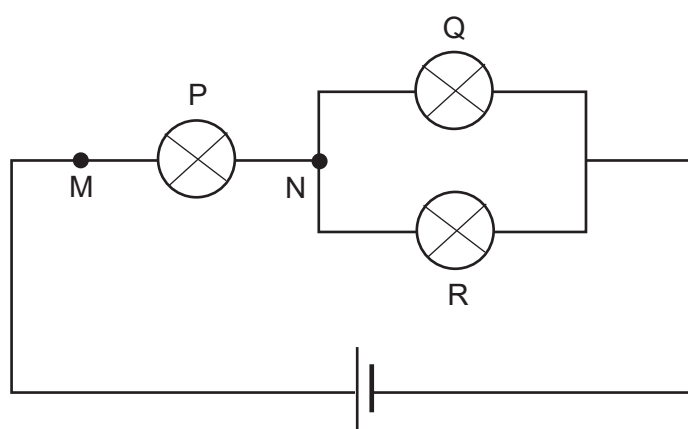
- I Electric field lines cannot cross each other.
- II A charge experiences a force when it is placed in an electric field.
- III The direction of field lines shows the direction of electrostatic force acting on a small electron.

- A** I and II **B** I and III
C II and III **D** all of the above

- 18 A piece of wire 0.4 m long has a cross-section of 2.0 mm^2 .
Which of the following wires of the same material has half its resistance?

	length / m	cross-sectional area / mm^2
A	0.2	1.0
B	0.2	4.0
C	0.8	4.0
D	0.8	8.0

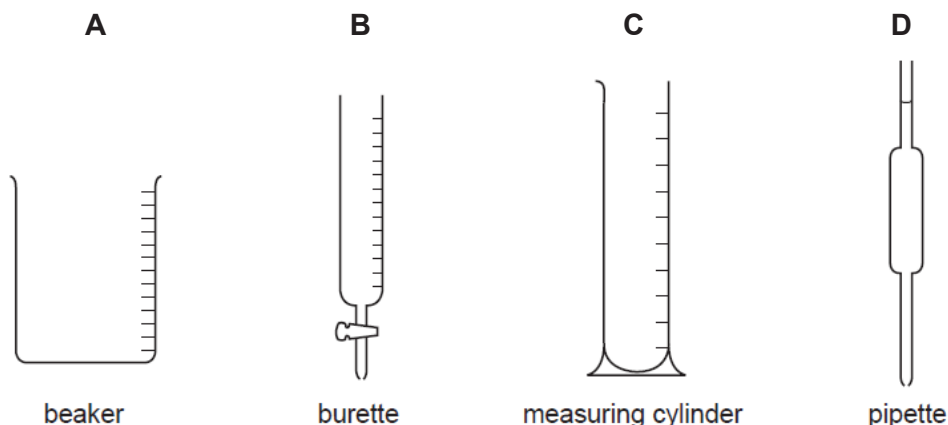
- 19 The diagram shows three identical bulbs connected to a cell.



Another copper wire is now connected from M to N, across bulb P.
Which statement is correct?

- A** Q and R do not light up and P gets brighter.
 - B** Q and R do not light up with no change in the brightness of P.
 - C** P does not light up and Q and R get brighter.
 - D** P does not light up with no change in the brightness of Q and R.
- 20 What happens when a 250 V, 2500 W water heater is connected to a mains supply using a plug fitted with a 13 A fuse?
- A** the heater burns out
 - B** the heater works normally
 - C** the fuse in the plug melts
 - D** the heater runs at half power

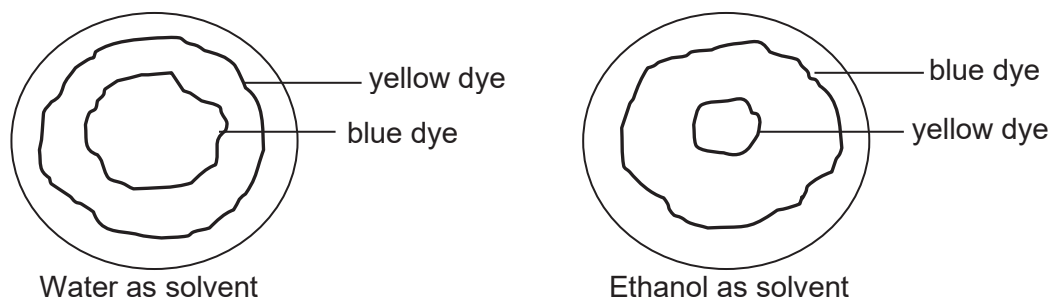
- 21 Which piece of apparatus is used to measure exactly 22.50 cm³ of a liquid?



- 22 Potassium nitrate crystals can be separated from sand by using the processes shown. What is the correct order for the processes?

	first → last			
A	filter	dissolve	evaporate	crystallise
B	dissolve	evaporate	crystallise	filter
C	dissolve	evaporate	filter	crystallise
D	dissolve	filter	evaporate	crystallise

- 23 The components of an unknown food colouring, **P**, are separated using paper chromatography with two different solvents, water and ethanol. The results are shown below:



Which of the following statements is true?

- A Food colouring **P** contains a total of 4 dyes.
 B The yellow dye is more soluble than the blue dye in ethanol.
 C The blue dye is more soluble than the yellow dye in water.
 D The blue dye is more soluble in ethanol than in water.
- 24 An atom of fluorine is represented by $^{19}_{9}\text{F}$.
 What is the electron arrangement of the fluoride ion?

- A 2,6 B 2,7 C 2,8 D 2,8,1

- 25 An element, R, has p protons and n neutrons in its nucleus.

Which row gives a possible correct number of protons, neutrons and electrons in an isotope of R?

	protons	neutrons	electrons
A	p	n	p
B	p	$n+1$	p
C	$p+1$	$n+1$	$p+1$
D	$p-1$	n	$p-1$

- 26 Element X has an electronic structure 2.8.8.1.

Element Y has an electronic structure 2.8.6.

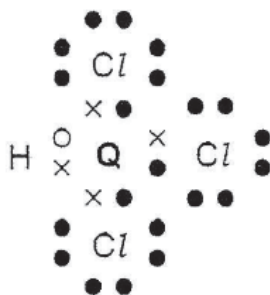
What is made when X and Y react?

	type of compound	formula
A	covalent compound	X_2Y
B	covalent compound	XY_2
C	ionic compound	X_2Y
D	ionic compound	XY_2

- 27 Element Q has four electrons in its outermost shell.

Element Q can combine with hydrogen and chlorine to form a compound $QHC\ell_3$.

The diagram shows the electronic structure of $QHC\ell_3$ (outer shell electrons only).



Which of these properties will this compound have?

- A It will be a solid at room temperature.
 - B It will be readily soluble in water.
 - C It will be a good conductor of electricity.
 - D It will have a low boiling point.
- 28 There is one component of air which exists as molecules with triple bonds. What is its composition in clean air?

- A 0.03% B 1% C 21% D 78%

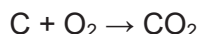
- 29 Elements A and B can combine to form a compound X.

element	proton number	nucleon number
A	9	19
B	8	16

The mass of one mole of X will be

- A** 17g **B** 25g **C** 51g **D** 54g

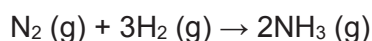
- 30 A 6g sample of pure carbon is completely burned in oxygen.



Which mass of carbon dioxide is produced?

- A** 12g **B** 22g **C** 38g **D** 44g

- 31 Ammonia gas can be produced by reacting nitrogen and hydrogen as shown in the equation below.



What volume of ammonia is produced when 50 cm³ of nitrogen is reacted with 90 cm³ of hydrogen?

- A** 60 cm³
B 100 cm³
C 140 cm³
D 150 cm³

- 32 The colour of Universal Indicator at different pH values is given below.

pH	2	6	11
Colour	red	yellow	blue

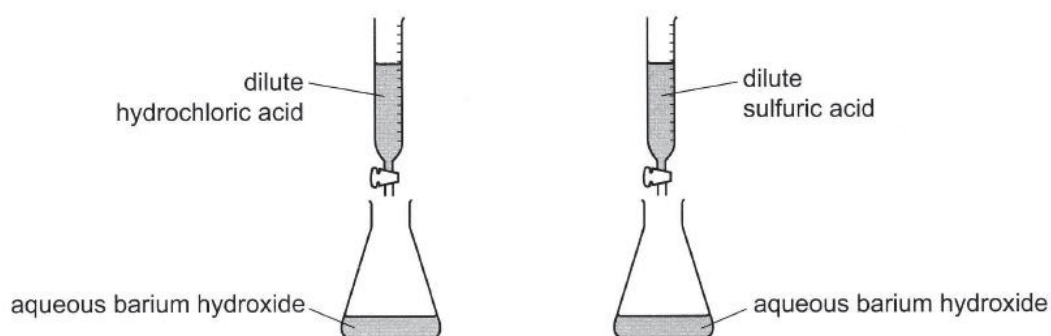
What are the colours formed when a few drops of Universal Indicator are added separately to dilute sulfuric acid and aqueous ammonia?

	dilute sulfuric acid	aqueous ammonia solution
A	red	blue
B	red	yellow
C	blue	red
D	yellow	red

- 33 Which of the following is not a redox reaction?

- A** reacting magnesium with sulfuric acid
B formation of silver chloride through precipitation
C combustion of carbon in air
D adding sodium metal to cold water

- 34 The diagrams show two experiments, one to make barium chloride and the other to make barium sulfate.



In each experiment, the acid is run into the conical flask until the pH is 7.

Which are the steps needed to obtain the solid salts?

	barium chloride	barium sulfate
A	crystallisation	crystallisation
B	crystallisation	filtration
C	filtration	crystallisation
D	filtration	filtration

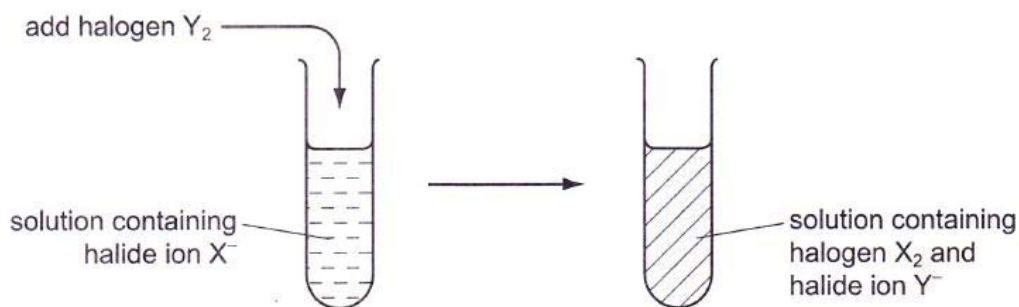
- 35 Tests were conducted on unknown substance X and the following results were obtained.

	Test	Observations
1	To an aqueous solution of X, add aqueous sodium hydroxide in excess.	No precipitate formed.
2	To an aqueous solution of X, add dilute hydrochloric acid.	A gas is evolved, giving a white precipitate with limewater.

Which of the following could solid X be?

- A** calcium nitrate
- B** zinc nitrate
- C** lead(II) carbonate
- D** potassium carbonate

- 36 The diagram shows an experiment involving halogens and aqueous halide ions.



Which choices of Y_2 and X^- give the result shown?

	$I_2 + Br^-$	$Cl_2 + Br^-$	$Cl_2 + I^-$
A	✓	✓	✓
B	✓	✓	x
C	✓	x	✓
D	x	✓	✓

key

✓ = gives result shown

x = does not give result shown

- 37 The table lists three ways of extracting metals.

method	description of extraction
1	refining as metal occur uncombined naturally
2	heating metal ore with carbon
3	electrolysis of molten metal chloride

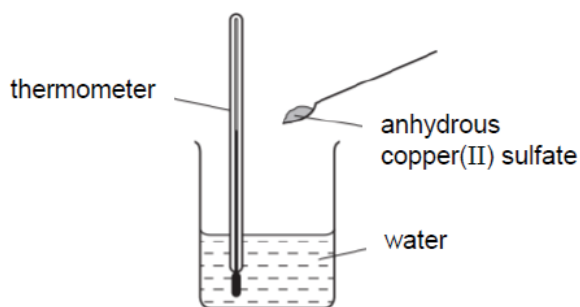
Which of the following shows the metals that can be best extracted using the above methods?

	method 1	method 2	method 3
A	gold	potassium	magnesium
B	gold	calcium	zinc
C	gold	zinc	potassium
D	magnesium	calcium	zinc

- 38 What will happen when a piece of copper is added to aqueous zinc sulfate?

- A** A coating of zinc will appear on the surface of the copper.
- B** Bubbles of hydrogen will appear on the surface of copper.
- C** The copper will dissolve.
- D** There will be no reaction.

- 39 When anhydrous copper(II) sulfate is added to water and is dissolved, there is an increase in the reading recorded by the thermometer as shown below.



Which of the following correctly describes the change that has occurred and the reason for the change?

- A endothermic change, heat is taken in to dissolve the anhydrous copper(II) sulfate
 - B endothermic change, heat is given out to dissolve the anhydrous copper(II) sulfate
 - C exothermic change, heat is given out as anhydrous copper(II) sulfate dissolves
 - D exothermic change, heat is taken in as anhydrous copper(II) sulfate dissolves
- 40 Dilute sulfuric acid reacts with copper(II) oxide to form copper(II) sulfate and water.

What would **not** alter the speed of this reaction?

- A The concentration of the sulfuric acid.
- B The pressure at which the reaction takes place.
- C The size of the particles of copper(II) oxide.
- D The temperature of the reacting mixture.

END OF PAPER

Data Sheet

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

57	La	lanthanum	139	58	Ce	cerium	140	59	Pr	praseodymium	141	60	Nd	neodymium	144	61	Pm	promethium	—	62	Sm	samarium	150	63	Eu	euporium	152	64	Gd	gadolinium	157	65	Tb	terbium	159	66	Dy	dysprosium	163	67	Ho	holmium	165	68	Er	erbium	167	69	Tm	thulium	169	70	Yb	ytterbium	173	71	Lu	lutetium	175
89	Ac	actinium	—	90	Th	thorium	232	91	Pa	protactinium	231	92	U	uranium	238	93	Np	neptunium	—	94	Pu	plutonium	—	95	Am	americium	—	96	Cm	curium	—	97	Bk	berkelium	—	98	Cf	californium	—	99	Es	einsteinium	—	100	Fm	fermium	—	101	Md	mendelevium	—	102	No	nobelium	—	103	Lr	lawrencium	—

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Class/ Index Number /	Centre Number/ 'O' Level Index Number /	Name
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新加坡海星中学

MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

SCIENCE (PHYSICS, CHEMISTRY)

Paper 2 Physics

5076/02

26 August 2020
1 hour 15 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your class, index number, Centre number, O level index number and name in the spaces at the top of this page.

You may use an HB pencil for any diagrams, graphs, tables or rough working.

Write in dark blue or black pen.

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

The use of an approved scientific calculator is expected, where appropriate.

You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions.

Write your answers in the spaces provided on the question paper.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper (sections A and B) is 65.

For Examiner's Use	
Section A	45
Section B	20
Total	65

This document consists of **17** printed pages inclusive of this cover page.

Section A

Answer **all** questions. Write your answer in the spaces provided.

- 1 Fig.1.1 shows the speed - time graphs of two falling balls. One of them is a rubber ball and the other is a plastic ball with a small parachute attached to it.

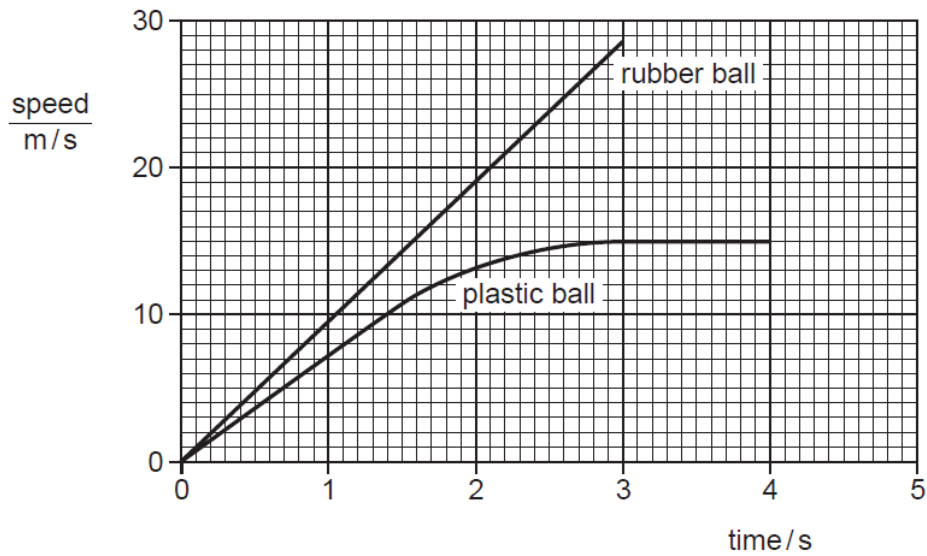


Fig. 1.1

- (a) Describe the motion of the plastic ball during the first 3.0 s.

.....

 [1]

- (b) Calculate

- (i) the acceleration of the falling rubber ball during the first 3.0 s,

acceleration = [2]

- (ii) the distance fallen by the rubber ball during the first 3.0 s.

distance = [2]

- (c) The weight of the plastic ball with the small parachute is 0.80 N. State the value of the air resistance acting on it 3.0 s after release. Explain your answer.

.....

.....

.....

..... [2]

- 2 At a sports event, a television camera is supported above the playing area by two wires A and B, as shown in Fig. 2.1.

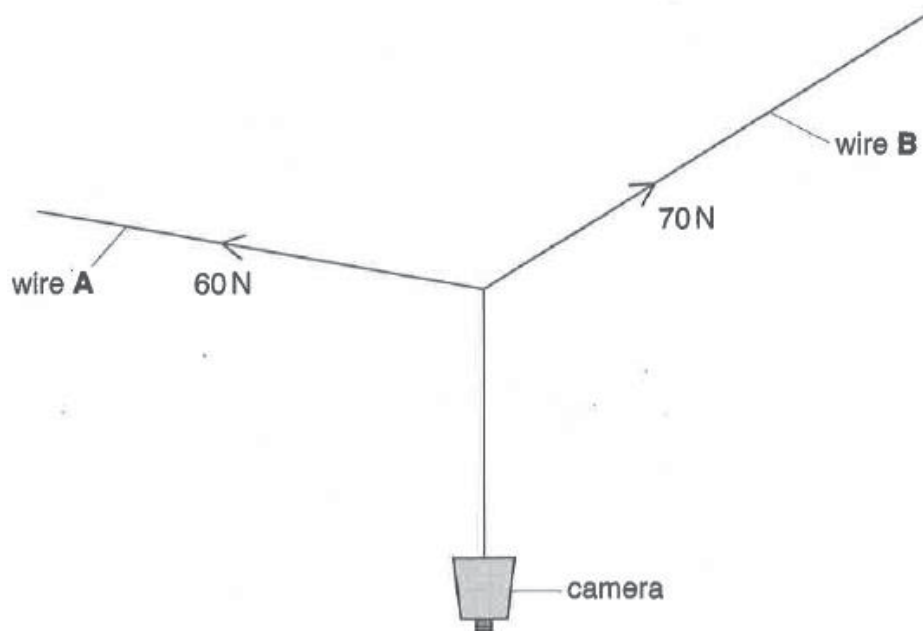


Fig. 2.1

There is a force of 60 N in wire A and a force of 70 N in wire B.

Fig. 2.1 is drawn to scale.

On Fig. 2.1, draw a vector diagram, using a scale of 1.0 cm representing 10 N, to determine the weight of the camera.

weight = [3]

- 3 A falling metal hammer is used to drive a hollow steel post into the ground, as shown in Fig. 3.1. The hammer is lifted by an electric motor and then falls freely to hit the baseplate.

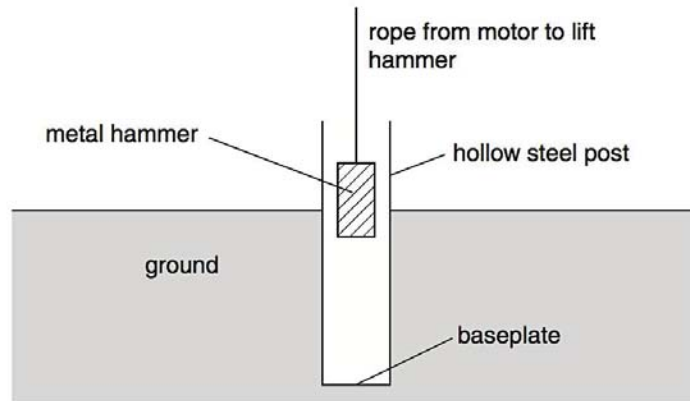


Fig. 3.1

- (a) The metal hammer has a mass of 1500 kg and it hits the baseplate with a speed of 8.0 m/s.
 (i) Calculate the kinetic energy of the hammer as it hits the baseplate.

kinetic energy = [2]

- (ii) Calculate the height above the baseplate from which the hammer is dropped. Assume air resistance is negligible. Take $g = 10 \text{ N/kg}$.

height = [2]

- (b) State and explain one change to the equipment in Fig. 3.1 that would cause the baseplate to move further into the ground each time the hammer falls.

.....

 [2]

- 4 (a) A large amount of thermal energy loss from a house takes place through the walls. This thermal energy loss can be reduced by filling the space between the walls with polystyrene foam as shown in Fig. 4.1.

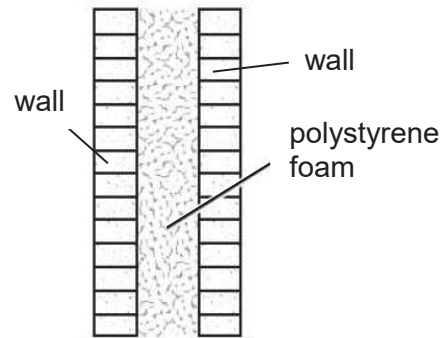


Fig. 4.1

Explain how this reduces thermal energy loss.

.....

.....

.....

..... [2]

- (b) Fig. 4.2 shows the inside of a conventional oven.

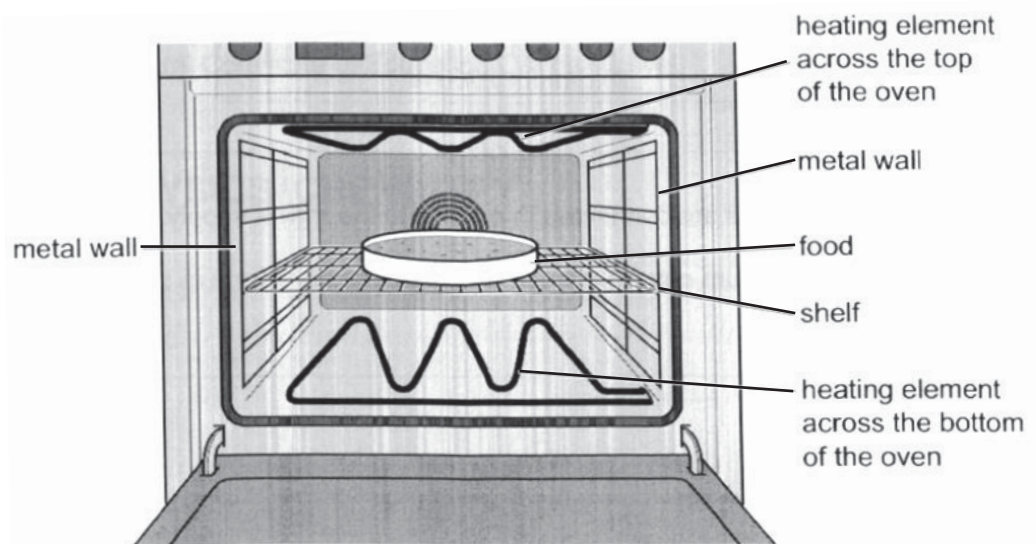


Fig. 4.2

- (i) Explain how thermal energy is transferred from the heating element to the food by convection.

.....

.....

.....

.....

.....

..... [2]

- (ii) State and explain how the design of the oven can be changed to reduce heat loss by radiation from the inside of the oven.

.....

.....

..... [2]

- (iii) State the type of electromagnetic wave that is used to cook the food in the conventional oven.

..... [1]

- 5 Some ice is placed in a beaker and is heated until the beaker contains boiling water only. Fig. 5.1 shows the temperature - time graph.

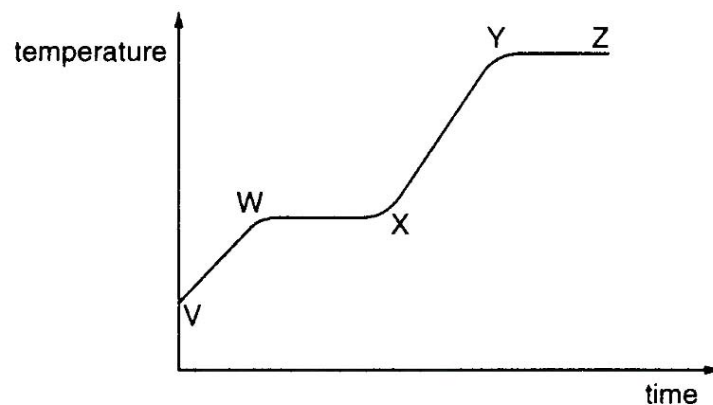


Fig. 5.1

- (a) Identify the process taking place during WX.

..... [1]

- (b) Describe the changes, if any, that occur to the arrangement and to the motion of the molecules during WX.

arrangement of molecules:

.....

motion of molecules:

.....

[2]

- (c) State what happens to the internal kinetic energy and internal potential energy of the molecules during YZ.

.....

..... [1]

- 6 Fig. 6.1 shows the magnified view of the path that a light ray takes when it strikes the lens.

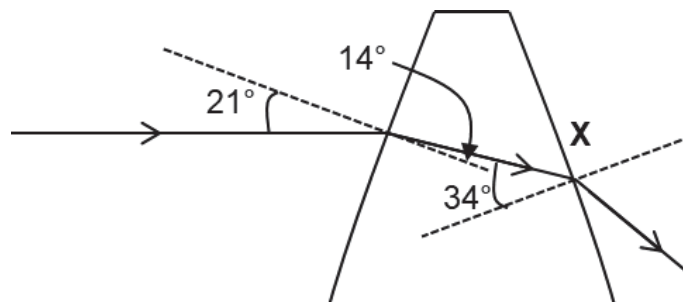


Fig. 6.1

- (a) Calculate the refractive index of the lens.

refractive index = [3]

- (b) Calculate the critical angle of the lens.

critical angle = [2]

- (c) Explain why the light ray does not undergo total internal reflection when it strikes the surface of the lens at point X.

.....
 [1]

- 7 An object is placed 18 cm in front of a thin converging lens, as shown in Fig. 7.1.

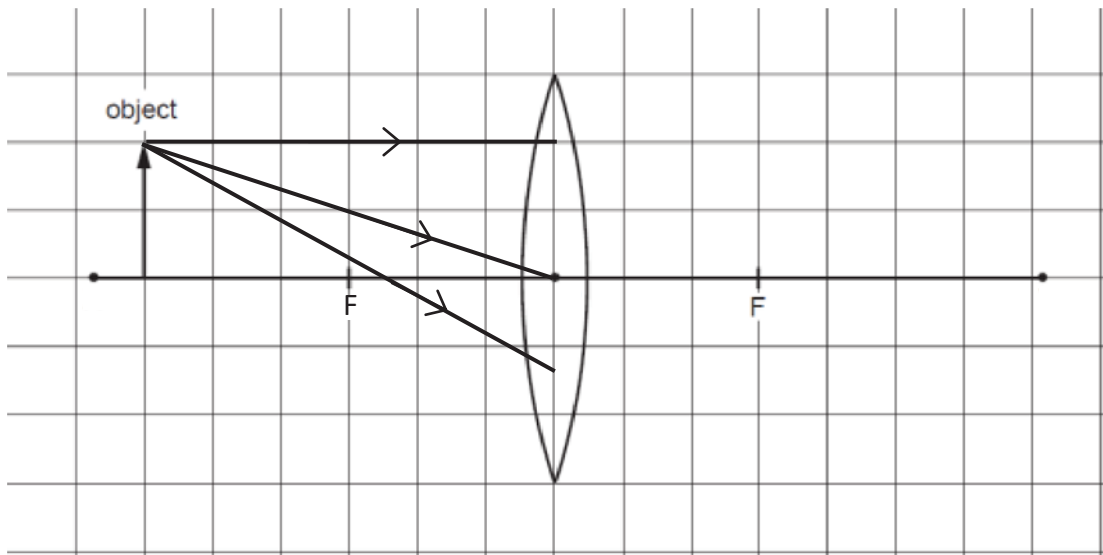


Fig. 7.1

F is the principal focus of the lens.

Three rays have been drawn from the top of the object to the lens.

- (a) On Fig. 7.1, complete the three rays from the top of the object to locate the image. [3]
- (b) The object is now moved so that it is 5.0 cm from the lens.

Describe two characteristics of the new image formed.

.....

 [2]

- 8 Two small uncharged metal spheres **A** and **B** are suspended side by side using insulating thread, as shown in Fig. 8.1.

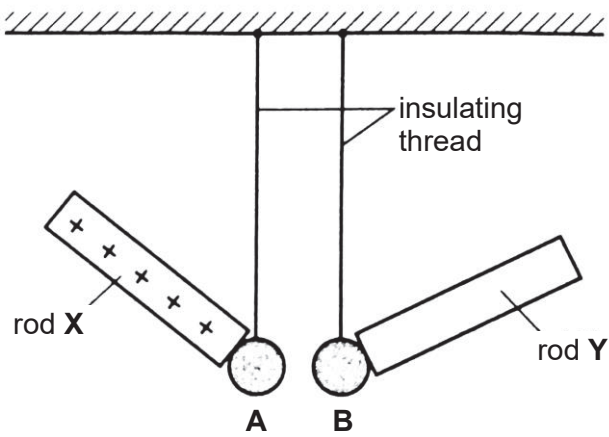


Fig. 8.1

Rods **X** and **Y** are both charged conductors that are held using insulators.

Rod **X** is positively charged and touches sphere **A**. Rod **Y** touches sphere **B**.

The rods are removed and sphere A becomes positively charged. The spheres move towards each other as shown in Fig. 8.2.

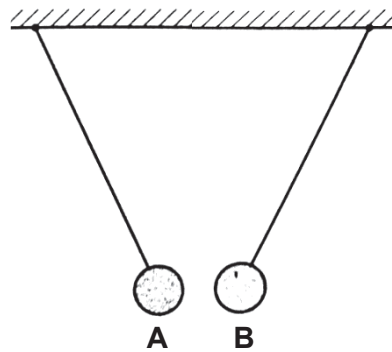


Fig. 8.2

State and explain what can be deduced about rod Y.

.....

.....

..... [2]

- 9 Fig. 9.1 shows a circuit which consists of three resistors connected to a battery of e.m.f. 12 V.

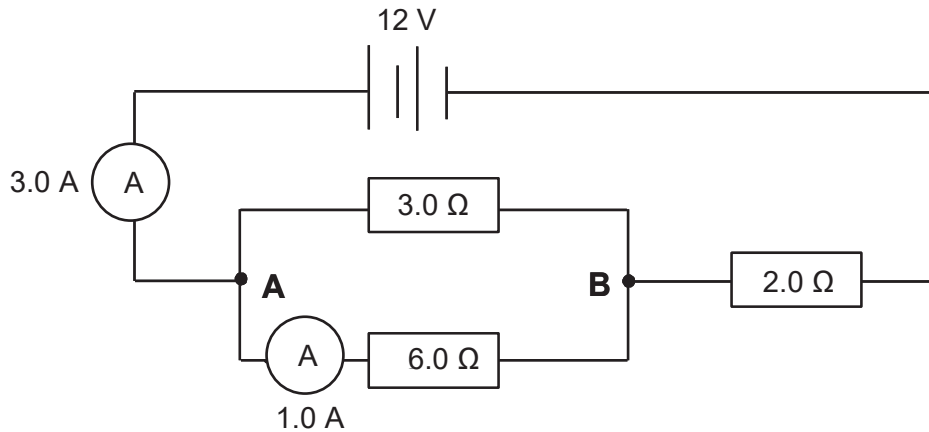


Fig. 9.1

(a) Calculate

- (i) the current flowing through the $3.0\ \Omega$ resistor,

current = [1]

- (ii) the potential difference across the $3.0\ \Omega$ resistor.

potential difference = [2]

(b) (i) Calculate the potential difference across the $2.0\ \Omega$ resistor.

potential difference = [1]

- (ii) Hence, calculate the energy transferred in 40 s in the $2.0\ \Omega$ resistor.

energy = [1]

Section B

Answer any **two** questions in this section.

Write your answer in the spaces provided.

- 10** A mechanical digger is used to remove soil from the ground, as shown in Fig. 10.1.

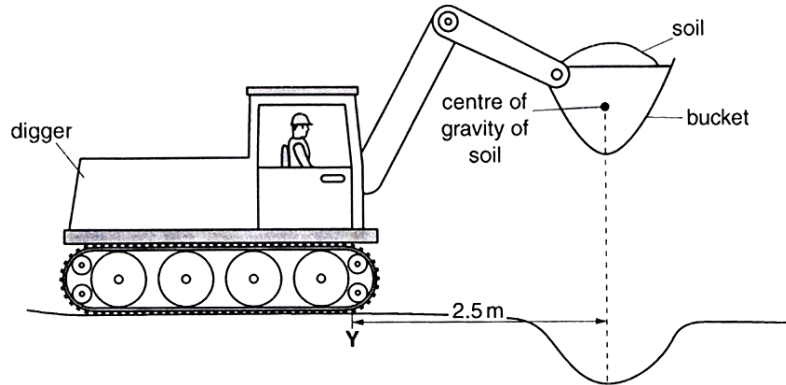


Fig. 10.1

The bucket of the digger contains 1.4 m^3 of soil. The density of the soil is 2500 kg/m^3 .

(a) Calculate, for the soil in the bucket,

(i) its mass,

mass = [1]

(ii) its weight ($g = 10 \text{ N/kg}$).

weight = [2]

- (b) Fig. 10.1 shows the centre of gravity of the soil is a horizontal distance 2.5 m from the front edge Y of the tracks in contact with the ground.
- (i) Calculate the moment about Y of the weight of the soil.

moment = [2]

- (ii) The digger does not tip over. Use your knowledge of moments to explain why the digger does not tip.

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.....

..... [2]

- (c) Fig. 10.2 shows a figurine of a martial artist adopting a basic stance.



Fig. 10.2

- (i) State the advantage(s) of this stance.

.....

..... [1]

- (ii) Fig. 10.3 shows the figurine being tilted by a force applied to the side.



Fig. 10.3

Explain why the figurine will not topple over when the force is removed.

.....

.....

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.....

..... [2]

- 11 (a) The displacement-distance and displacement-time graphs of a wave are shown in Fig. 11.1 and Fig. 11.2 respectively.

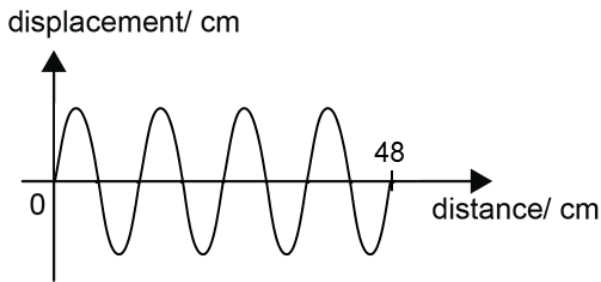


Fig. 11.1

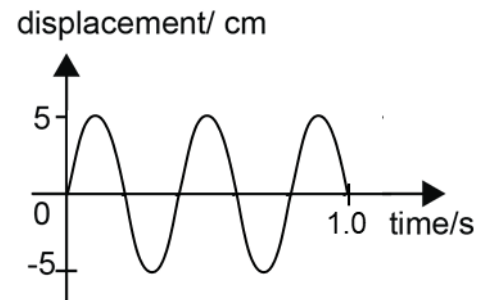


Fig. 11.2

Determine the

- (i) period of the wave,

period = [1]

- (ii) wavelength of the wave,

wavelength = [1]

- (iii) speed of the wave.

speed = [2]

- (b) Sabrina goes to the concert hall where she sits at the back of the hall to listen to musical instruments performance.

- (i) Explain how sound waves from the instruments travel through air and enable Sabrina hear the sound through her ears.

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..... [2]

- (ii) Fig. 11.3 shows a digital displacement-time display of sound waves of a particular note Sabrina hears.

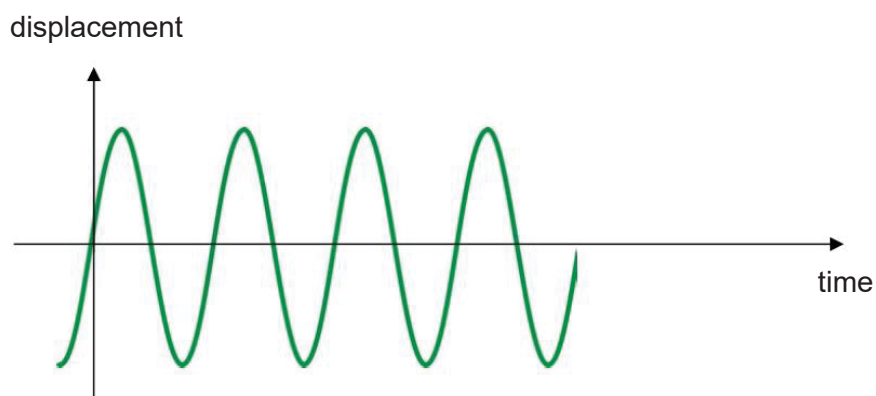


Fig. 11.3

On Fig. 11.3, draw another sound wave which is softer but lower in pitch. [2]

- (iii) While listening to the music at the back of the hall, Sabrina realised that the frequency of the sound does not affect the speed at which it travels.

Explain why the speed of the sound is not affected.

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..... [2]

12

Fig. 12.1 shows the electrical wiring in a table lamp.

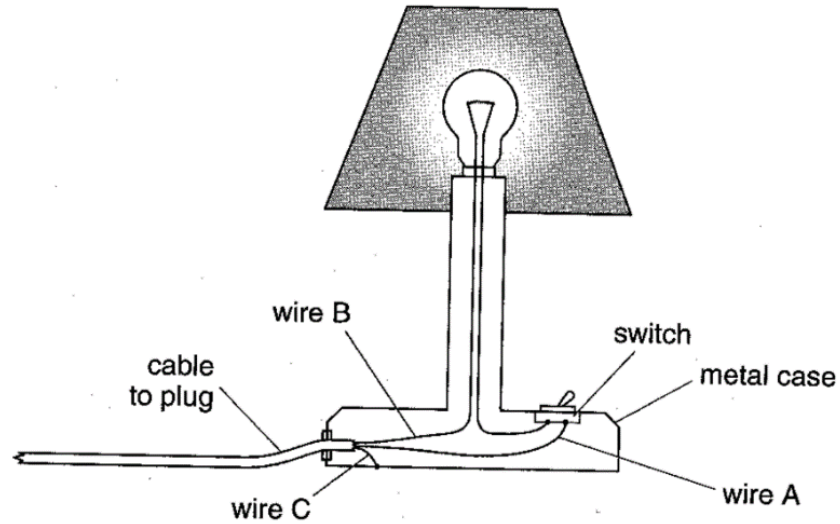


Fig. 12.1

(a) The lamp is marked “240 V, 90 W”. The lamp is switched on for 10 minutes.

(i) Calculate the current drawn by the lamp.

current = [2]

(ii) Calculate the amount of charge passing through the lamp.

charge = [2]

(b) Explain why wire A rather than wire B is connected to the live terminal in the plug.

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..... [2]

- (c) State which wire carries no current when the table lamp is working normally.

..... [1]

- (d) Wire **A** becomes loose and touches the metal case. Explain why a person who touches the casing does not get electric shock.

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.....
..... [1]

- (e) A second lamp is double insulated. Explain whether an earth wire is required for the second lamp.

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..... [2]

