NAME		INDEX NO.		CLASS	

NORTHLAND SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary Four Express and Five Normal Academic

SCIENCE (PHYSICS/CHEMISTRY)   **5076/01**
Paper 1   **20 September 2019**

Additional materials provided: Answer Sheet (OTAS Sheet)   **1 hour**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, index number and class 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 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.
A copy of the Data Sheet is printed on page 18.
A copy of the Periodic Table is printed on page 19.

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

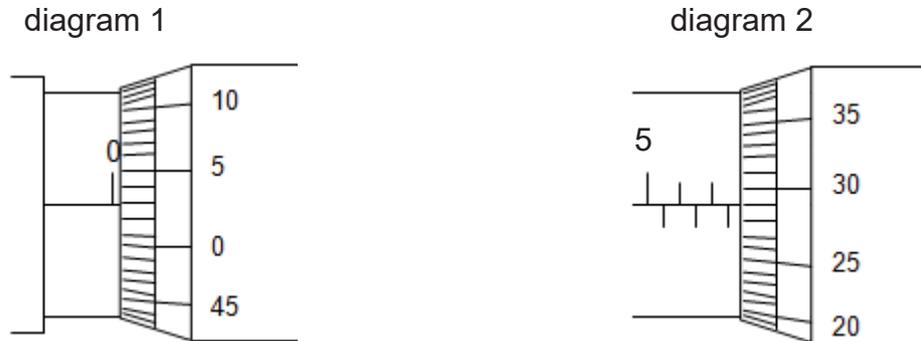At the end of the examination, submit the Answer Sheet (OTAS sheet) separately.

Setter: Mdm Nor Rasidah / Mdm Nilasari

Vetter: Ms Tan Lay Huay / Mr Koh Ee Beng

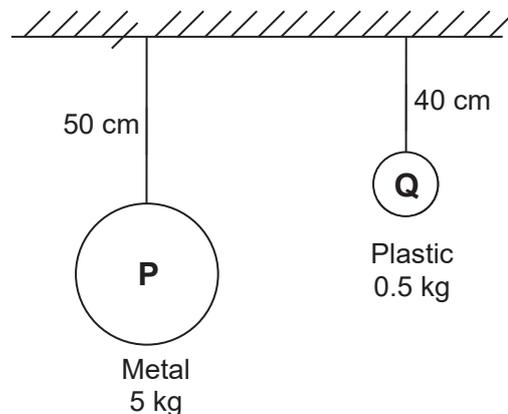**1**   A student uses a micrometer screw gauge to measure the thickness of a pipe.

Diagram 1 shows the reading when it is closed without the pipe.
Diagram 2 shows the reading when it is closed with the pipe.

diagram 1   diagram 2

What is the thickness of the pipe?

A   5.51 mm
B   5.57 mm
C   7.76 mm
D   7.82 mm

2   **P** and **Q** are two pendulums of different lengths, masses, sizes and materials.

Which statement is true?

A   **P** has a longer period as it is larger in size.
B   **Q** has a longer period as it is smaller in size.
C   **P** has a longer period as it is longer.
D   **Q** has a longer period as it is shorter.

3 The diagram below shows a speed time graph of a car.
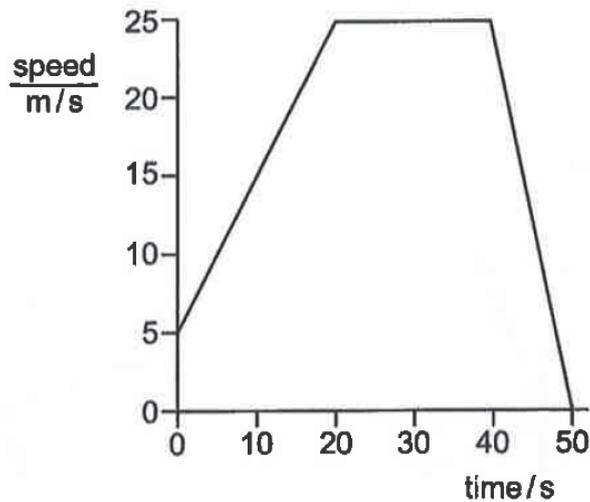
What is the average speed of the car for the first 20 s?

A 10.0 m/s
B 12.5 m/s
C 15.0 m/s
D 17.5 m/s

4 A ball is dropped in a vacuum tube. A series of photographs is taken at equal time intervals from the time of release.

Another ball of the same size but twice its mass is also dropped in the same tube and photographed.

Which diagram shows the motion of the heavier ball?

First Ball　　　**heavier ball which is double in mass**
　　　　　　　　　　　　A　　**B**　　**C**　　**D**

5 The diagram shows a pendulum bob, which is attached to one end of a string, suspended in mid-air. It is pulled to one side and held stationary.
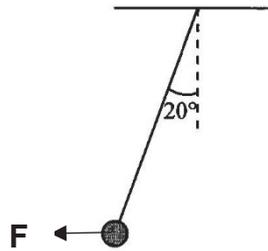
The forces acting on the bob are its weight W, the tension T in the string and pulling force F.

Which of the following diagrams correctly shows the forces acting on the bob?

A

B

C

D
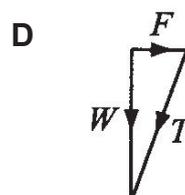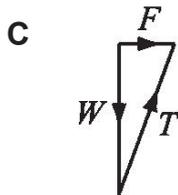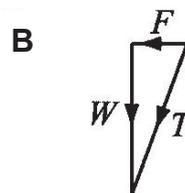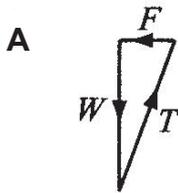
6 The friction between a body of mass 3 kg and the rough floor is 5.0 N.

What is the force required to push it across the rough floor with an acceleration of 3.0 m s^{-2}?

A   4.0 N
B   9.0 N
C   14.0 N
D   18.0 N

7 A weighing machine consists of a counterweight, **C**, an arm and a sliding pan **P**. The arm is free to rotate about the point **X**.

The sliding pan is moved along the arm until the arm balances as shown.

All moments are measured about **X**. The weight and moment of the arm can be ignored.
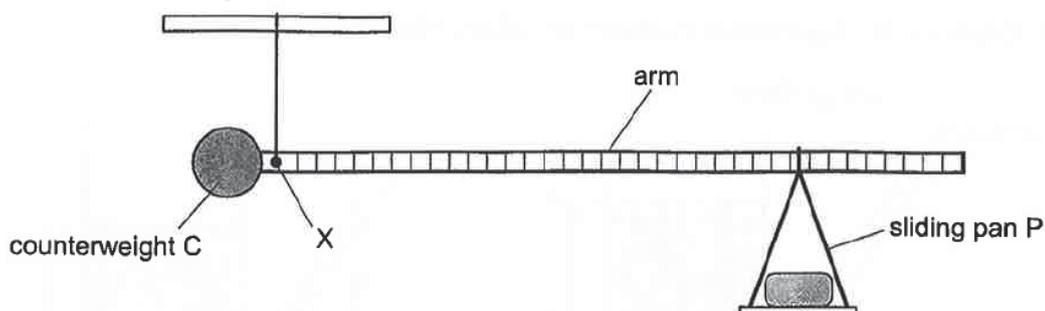
Why does the arm balances in the position?

A The moment of **C** equals the moment of **P**. The weight of **C** equals the weight of **P**.
B The moment of **C** equals the moment of **P**. The weight of **C** is greater than the weight of **P**.
C The moment of **C** greater than the moment of **P**. The weight of **C** equals the weight of **P**.
D The moment of **P** equals the weight of **C**.

8 A boy launches a remote control helicopter up to the sky at a constant acceleration.

What are the changes in the gravitational potential energy and the kinetic energy?

	Gravitational Potential Energy	Kinetic Energy
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

9 A substance consists of particles that are close together and moving past each other at random. The average speed of the particles is gradually decreasing.

What best describes the substance?

A a liquid being cooled
B a solid being cooled
C a gas being condensed to form a liquid
D a liquid being frozen to form a solid

10 A beaker of ice is heated until the beaker contains boiling water. The graph shows the temperature of the contents of the beaker during the experiment.
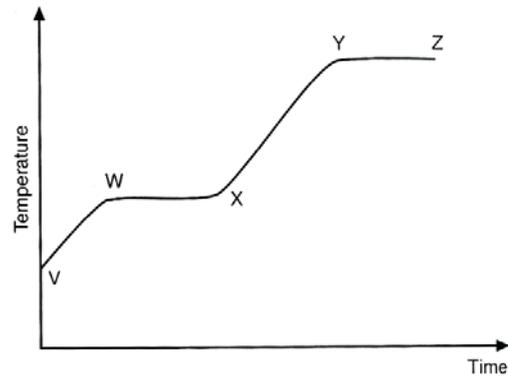
Between which two points are the contents in both liquid and solid states?

A V and W
B W and X
C X and Y
D Y and Z

11 A cup of tea is stirred with two spoons, one metal and one plastic.

Why does the metal spoon feel hotter than the plastic one?

A Convection occurs in metal faster than in plastic.
B Metal conducts heat faster than plastic.
C Metal needs more heat than plastic for the same rise in temperature.
D Metal radiates heat better than plastic.

12 An object **O** is placed close to a converging lens.

The diagram represents three rays from the top of **O** passing through the lens.
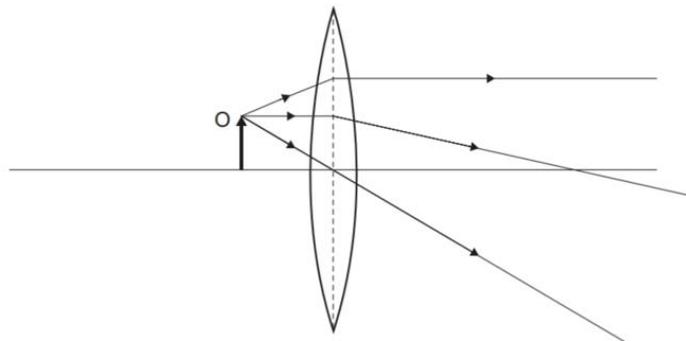
Which type of image is produced by the lens when the object is in this position?

A real and diminished
B real and enlarged
C virtual and inverted
D virtual and enlarged

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13 The diagram shows a ray of monochromatic light passing through a semi-circular glass block.
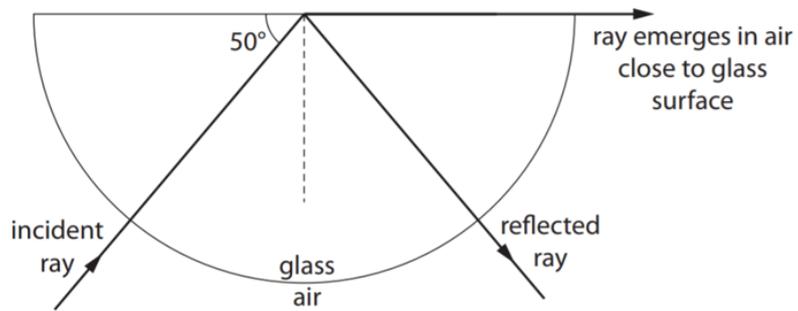
What is the critical angle of the glass?

A   0 °
B   40 °
C   50 °
D   55 °

14 The diagram represents a wave.

Which letter marks the amplitude of the wave?
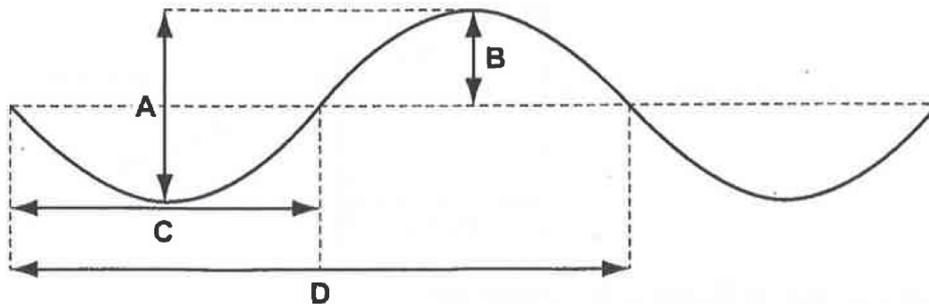
15 The diagram shows the relationship between energy and the wavelength of electromagnetic waves.
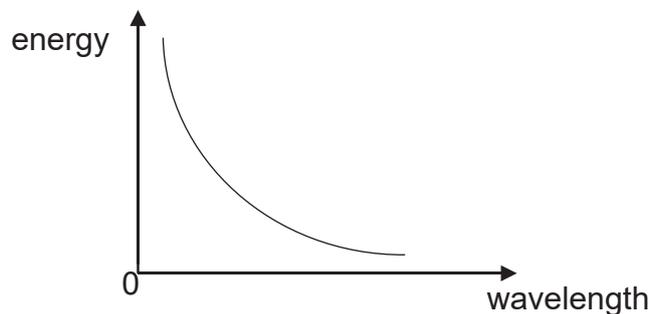
Which of the following has the lowest energy?

A   gamma ray
B   infra red
C   microwaves
D   x-rays

16 A sound wave passes through air. The diagram represents the arrangement of air molecules at one instance.

Which distance is the wavelength of the sound wave?
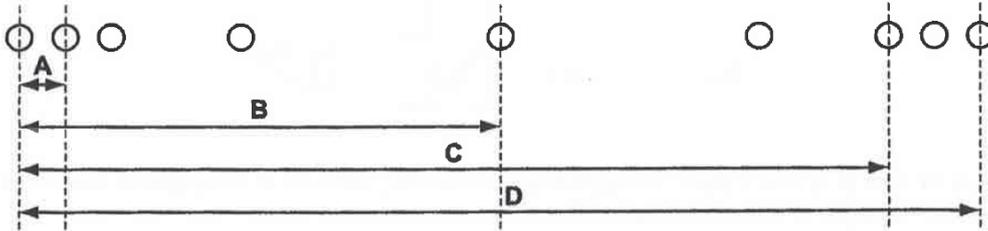
17 An electrical quantity is defined as 'the energy converted by a source in driving a unit charge round a complete circuit.'

What is this quantity called?

A electromotive force
B potential difference
C power
D voltage

18 Three resistors are connected together to form three different networks.
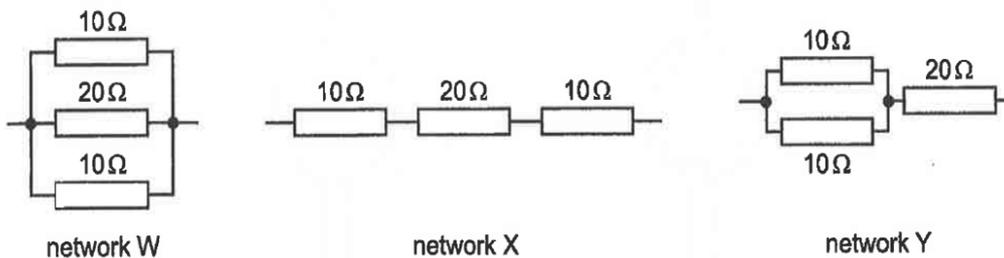
What is the correct order, going from the network with the smallest resistance to the network with the largest resistance?

A   W → X → Y
B   W → Y → X
C   X → W → Y
D   Y → X → W

19 The diagram shows an electrical circuit. The current flowing through the 4.0 Ω resistor is 3.0 A.
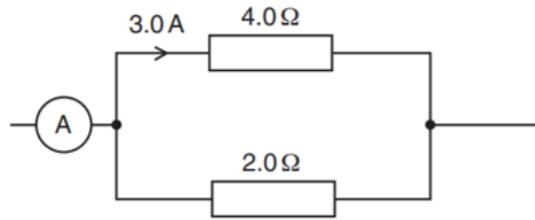
What is the current through the ammeter?

A 3.0 A
B 4.5 A
C 6.0 A
D 9.0 A

20 A main socket supply (240 V) is fitted with a 13 A fuse.

Heating coils, each rated at 240 V and 1 000 W, are connected to the socket.

What is the maximum number of such heating coils that can be connected to the socket?

A 1
B 2
C 3
D 4

21 Which piece of apparatus is used to measure exactly 28.3 cm^3 of a liquid?

A	B	C	D
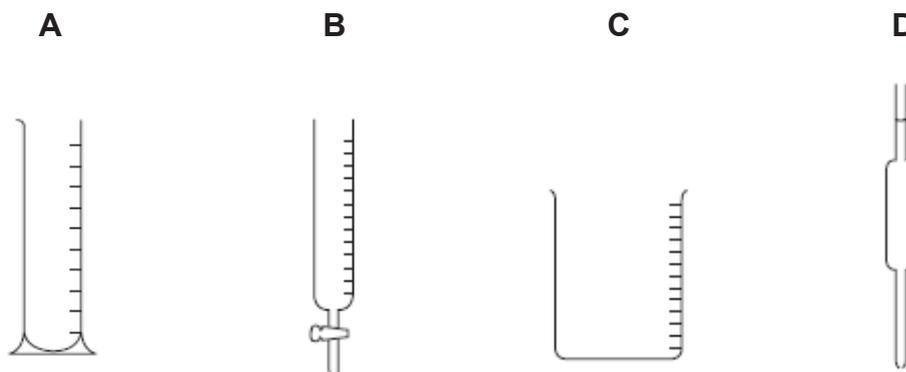
22 A label is missing from a bottle of a colourless solution **X**.

In order to identify the solution, two simple chemical tests are carried out.

test 1	A few drops of aqueous ammonia are added to a sample of **X**. A white precipitate is formed. This precipitate dissolves when more aqueous ammonia is added.
test 2	Aqueous sodium hydroxide and aluminium are added to another sample of **X** and warmed. A pungent gas, which turns moist red litmus paper blue, is produced.

What is **X**?

A ammonium carbonate   **B** copper(II) chloride

C zinc chloride   **D** zinc nitrate

23 The diagrams below show the change in the arrangement of atoms in a substance.

70 °C   110 °C
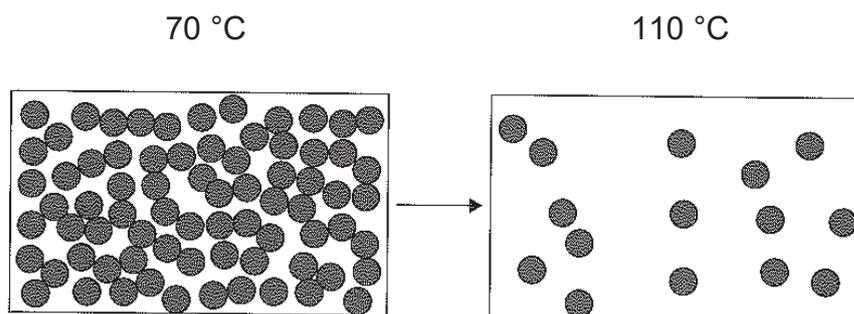
Which statement is correct?

A   There is a drop in the energy of the particles.

B   There is an increase in the orderliness of the particles.

C   The substance is a solid at 100 °C.

D   The substance is an element.

24 An element **X** of proton number 20 reacts with an element **Y** of proton number 17 to form a compound.

Which of the following is correct when this compound is formed?

		formula of compound
A	each atom of **X** gives away one electron	X_2Y
B	each atom of **Y** receives one electron	XY_2
C	each atom of **X** shares an electron with an atom of **Y**	X_2Y
D	each atom of **Y** shares an electron with an atom of **X**	XY_2

25 The symbol for an atom of boron is $^{11}_{5}B$.

What does the number 11 represent for an atom of boron?

A   the number of protons which determines its position in the Periodic Table

B   the number of nucleons

C   the number of protons

D   the total number of protons, neutrons, and electrons

26 Which substances will **not** react with each other?

    A   calcum oxide and silicon dioxide

    B   carbon monoxide and potassium oxide

    C   lead(II) oxide and sodium hydroxide

    D   magnesium oxide and hydrochloric acid

27 The colour of an indicator **X** in solutions of different pH is shown below.

pH	0	2	4	6	8	10	12	14

    red   orange   yellow

Indicator **X** can be used to distinguish between ………………………………..

    A   ethanoic acid and hydrochloric acid.

    B   sodium chloride solution and sodium hydroxide solution.

    C   sodium hydroxide solution and aqueous ammonia.

    D   sodium hydroxide solution and water.

28 What is the oxidation state of sulfur in zinc sulfate, $ZnSO_4$?

    A   -6   **B**   -2

    C   +6   **D**   +8

29 Which element has the **least** number of moles of atoms?

    A   1 g argon, ^{40}Ar

    B   1 g lithium, ^{7}Li

    C   1 g neon, ^{20}Ne

    D   1 g sodium, ^{23}Na

30 Ammonia gas, NH_3, decomposed according to the equation

$$2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$$
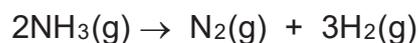
What volume of hydrogen (at room temperature and pressure) would be formed if 100 cm³ of ammonia were decomposed?

A 25 cm³

B 75 cm³

C 100 cm³

D 150 cm³

31 Which reaction does **not** involve either oxidation or reduction?

A $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$

B $Cu^{2+}(aq) + Zn(s) \rightarrow Cu(s) + Zn^{2+}(aq)$

C $CuO(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + H_2O(l)$

D $Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$

32 The table shows the initial and final temperatures in a series of experiments. Which experiment is most exothermic?

	initial temperature / °C	final temperature / °C
A	16.0	24.5
B	18.0	25.0
C	20.0	15.5
D	22.0	12.0

33 The diagram shows an experiment to investigate the rate of a reaction.
Readings of the total mass are taken every 30 seconds.
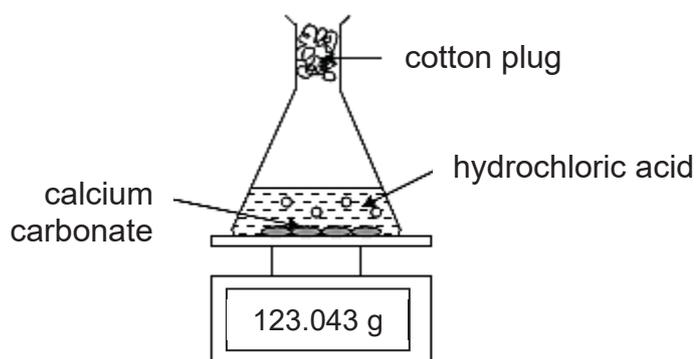
What is the correct graph for this experiment?
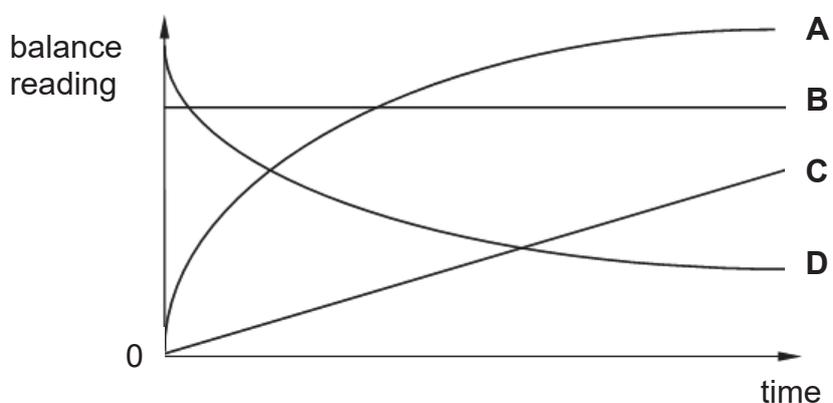
34 Carbon monoxide is formed when carbon is heated with the oxide of metal **X**.
No carbon monoxide is formed when carbon is heated with the oxide of metal **Y**.

Which row shows the order of reactivity of carbon, metal **X** and metal **Y**?

	least reactive	⟶	most reactive
A	carbon	**X**	**Y**
B	carbon	**Y**	**X**
C	**X**	carbon	**Y**
D	**Y**	carbon	**X**

35 Four elements have the following electronic configurations.

W	2, 1
X	2, 2
Y	2, 5
Z	2, 8

Which statement is correct?

A All four elements are in period 2.

B All four elements belong to Group II.

C **X** and **Y** are metals, **W** and **Z** are non-metals.

D **Z** is a halogen and **X** is an alkali metal.

36 When petrol is burnt in a car engine, a gas that is produced reacts with hemoglobin to reduce its ability to transport oxygen throughout the body.

What reaction has taken place and name the gas produced?

	reaction	name of gas
A	complete combustion	carbon dioxide
B	incomplete combustion	carbon monoxide
C	substitution	hydrogen chloride
D	cracking	hydrogen

37 Which pair of molecules satisfies the general formula of C_nH_{2n}?

A   H—C=C—O—H   H—C—O—H   **C**   H—C—C=C   C=C

B   H—C—C—H   H—C—H   **D**   H—C—H   H—C—C=C
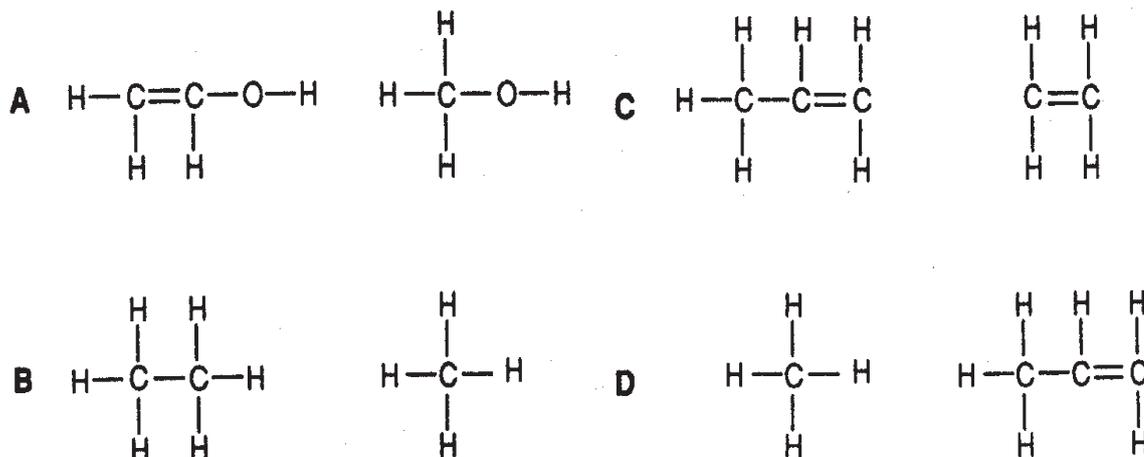
38 A compound **X** has the molecular structure as shown.
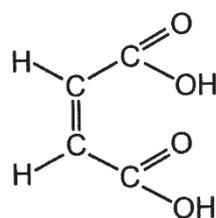
Which statement is **incorrect** about compound **X**?

A   **X** can be described both as an alkene and as a carboxylic acid.

B   **X** will react with sodium carbonate to give carbon dioxide gas.

C   **X** will decolorize reddish brown aqueous bromine.

D   **X** will react with sodium hydroxide to produce a white precipitate.

39 The diagram shows part of the structure of an addition polymer.

$$\left[\begin{array}{ccccc} CH_3 & H & CH_3 & H & CH_3 \\ | & | & | & | & | \\ C & C & C & C & C \\ | & | & | & | & | \\ Cl & CH_3 & Cl & CH_3 & Cl \end{array}\right]_n$$
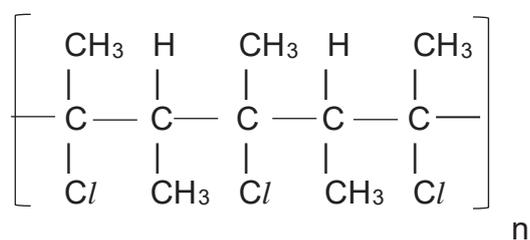
Which monomer is used to make this polymer?

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

A

$$\begin{array}{cc} CH_3 & H \\ | & | \\ C & = & C \\ | & | \\ CH_3 & Cl \end{array}$$

B

$$\begin{array}{cc} CH_3 & H \\ | & | \\ C & = & C \\ | & | \\ Cl & CH_3 \end{array}$$

C

$$\begin{array}{cc} H & CH_3 \\ | & | \\ C & = & C \\ | & | \\ Cl & Cl \end{array}$$

D

$$\begin{array}{cc} H & CH_3 \\ | & | \\ C & = & C \\ | & | \\ Cl & CH_3 \end{array}$$
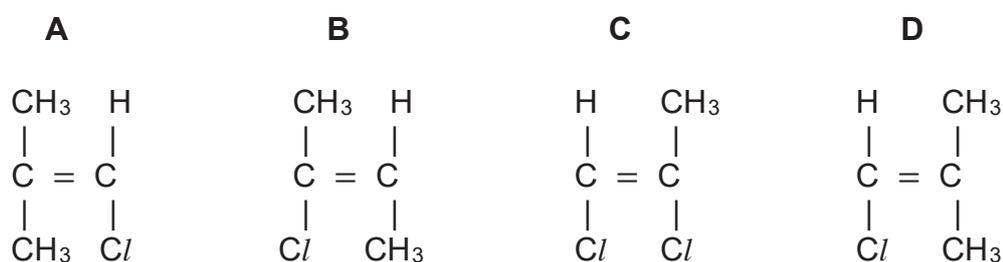
40 Which product(s) is formed when glucose undergoes fermentation?

A CH_3OH and CO_2

B CH_3COOH and O_2

C C_2H_4 and O_2

D C_2H_5OH and CO_2

End of Paper 1

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

The Periodic Table of Elements

Group

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

1						
1						
H						
hydrogen						
1						

I	II		III	IV	V	VI	VII	0
								2
								He
								helium
								4
3	4		5	6	7	8	9	10
Li	**Be**		**B**	**C**	**N**	**O**	**F**	**Ne**
lithium	beryllium		boron	carbon	nitrogen	oxygen	fluorine	neon
7	9		11	12	14	16	19	20
11	12		13	14	15	16	17	18
Na	**Mg**		**Al**	**Si**	**P**	**S**	**Cl**	**Ar**
sodium	magnesium		aluminium	silicon	phosphorus	sulfur	chlorine	argon
23	24		27	28	31	32	35.5	40

Transition elements:

19	20	21	22	23	24	25	26	27	28	29	30
K	**Ca**	**Sc**	**Ti**	**V**	**Cr**	**Mn**	**Fe**	**Co**	**Ni**	**Cu**	**Zn**
potassium	calcium	scandium	titanium	vanadium	chromium	manganese	iron	cobalt	nickel	copper	zinc
39	40	45	48	51	52	55	56	59	59	64	65
37	38	39	40	41	42	43	44	45	46	47	48
Rb	**Sr**	**Y**	**Zr**	**Nb**	**Mo**	**Tc**	**Ru**	**Rh**	**Pd**	**Ag**	**Cd**
rubidium	strontium	yttrium	zirconium	niobium	molybdenum	technetium	ruthenium	rhodium	palladium	silver	cadmium
85	88	89	91	93	96	–	101	103	106	108	112
55	56	57 – 71	72	73	74	75	76	77	78	79	80
Cs	**Ba**	lanthanoids	**Hf**	**Ta**	**W**	**Re**	**Os**	**Ir**	**Pt**	**Au**	**Hg**
caesium	barium		hafnium	tantalum	tungsten	rhenium	osmium	iridium	platinum	gold	mercury
133	137		178	181	184	186	190	192	195	197	201
87	88	89 – 103	104	105	106	107	108	109	110	111	112
Fr	**Ra**	actinoids	**Rf**	**Db**	**Sg**	**Bh**	**Hs**	**Mt**	**Ds**	**Rg**	**Cn**
francium	radium		Rutherfordium	dubnium	seaborgium	bohrium	hassium	meitnerium	darmstadtium	roentgenium	copernicium
–	–		–	–	–	–	–	–	–	–	–

Right side continued (Groups III–0 for periods 4–7):

III	IV	V	VI	VII	0
31	32	33	34	35	36
Ga	**Ge**	**As**	**Se**	**Br**	**Kr**
gallium	germanium	arsenic	selenium	bromine	krypton
70	73	75	79	80	84
49	50	51	52	53	54
In	**Sn**	**Sb**	**Te**	**I**	**Xe**
indium	tin	antimony	tellurium	iodine	xenon
115	119	122	128	127	131
81	82	83	84	85	86
Tl	**Pb**	**Bi**	**Po**	**At**	**Rn**
thallium	lead	bismuth	polonium	astatine	radon
204	207	209	–	–	–
	114		116		
	Fl		**Lv**		
	flerovium		livermorium		
	–		–		

lanthanoids

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La	**Ce**	**Pr**	**Nd**	**Pm**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**
lanthanum	cerium	praseodymium	neodymium	promethium	samarium	europium	gadolinium	terbium	dysprosium	holmium	erbium	thulium	ytterbium	lutetium
139	140	141	144	–	150	152	157	159	163	165	167	169	173	175

actinoids

89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	**Th**	**Pa**	**U**	**Np**	**Pu**	**Am**	**Cm**	**Bk**	**Cf**	**Es**	**Fm**	**Md**	**No**	**Lr**
actinium	thorium	protactinium	uranium	neptunium	plutonium	americium	curium	berkelium	californium	einsteinium	fermium	mendelevium	nobelium	lawrencium
–	232	231	238	–	–	–	–	–	–	–	–	–	–	–

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

NAME		INDEX NO.		CLASS	

NORTHLAND SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary Four Express and Five Normal Academic

SCIENCE (PHYSICS)
Paper 2 Physics
Candidates answer on the Question Paper.
No Additional Materials are required.

5076/02
17 September 2019
1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name and index number on the work you hand in.
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, and 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 [45 marks]
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B [20 marks]
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

At the end of the examination, fasten all your work securely together.
The number of marks is given in the brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
TOTAL	**65**

Setter: Mdm Nor Rasidah
Vetter: Ms Tan Lay Huay

This document consists of **17** printed pages.
[Turn over]

Section A
Answer **all** the questions in the spaces provide

1.   In a experiment, a student drops a small metal ball into a cylinder of oil. The ball
      falls alongside a vertical ruler and a camera records its position at time intervals of
      1.0 s, as shown in Fig. 1.1.
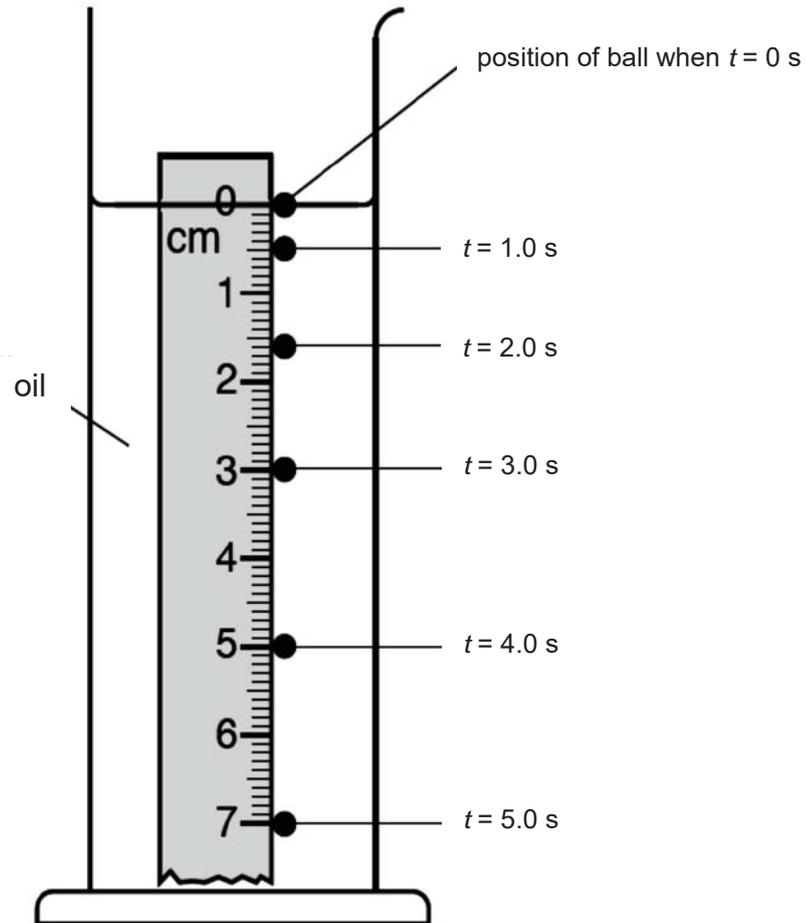
Fig. 1.1

(a) On the grid in Fig. 1.2, plot a distance-time graph for the ball. [2]

Fig. 1.2

distance / cm

time / s
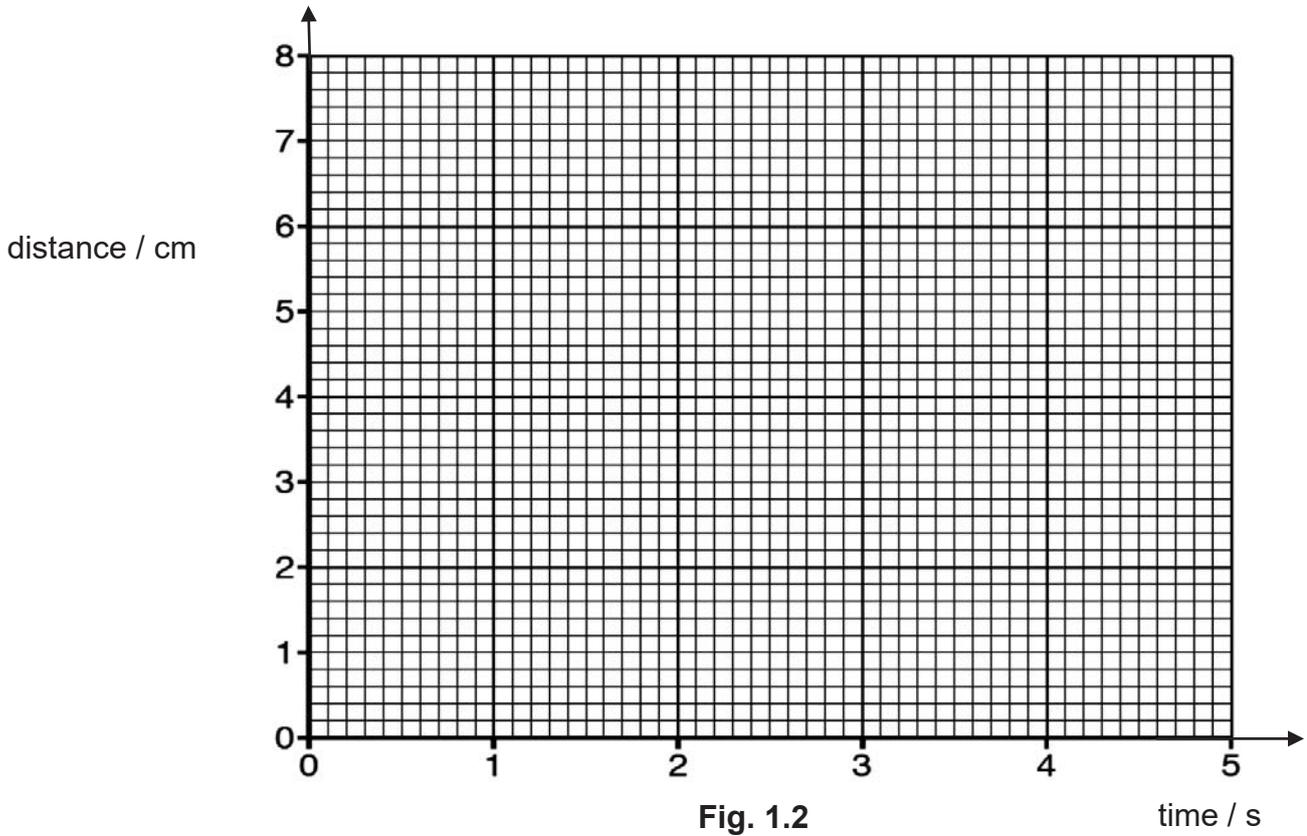
(b) Describe the motion of the ball for the whole 5 seconds.

....

....[2]

2.   Fig 2.1 shows a kitchen cupboard mounted securely to a vertical wall. The cupboard rests on a support at **A**.
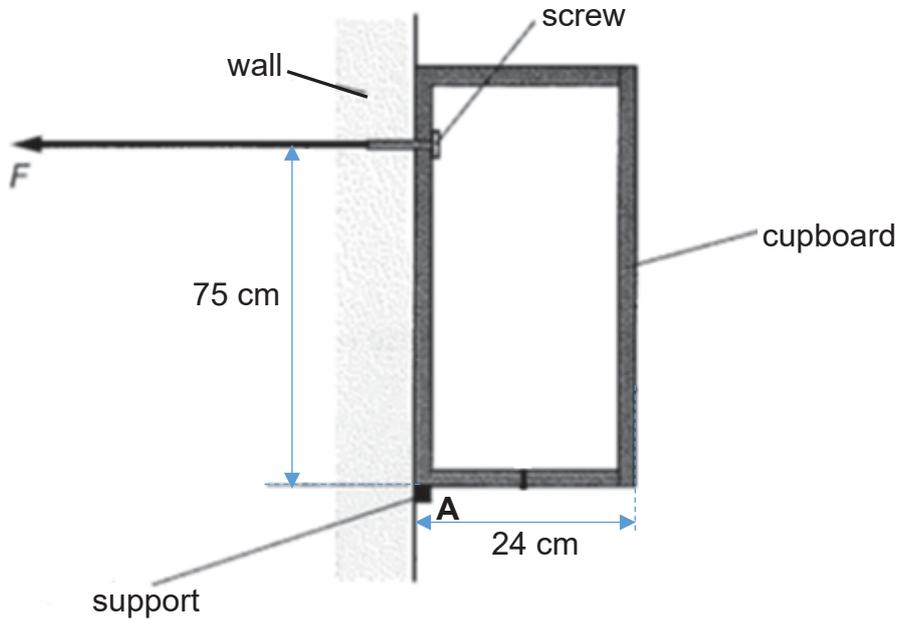
Fig 2.1

The total weight of the cupboard and its content is 200 N. The screw securing the cupboard to the wall is at a vertical distance of 75 cm from **A**.

(a)   Mark the center of gravity and draw an arrow to represent the weight of the cupboard on Fig. 2.1.   [1]

(b)   The direction of **F** provided by the screw on the cupboard is horizontal as shown in Fig. 2.1.

Calculate the magnitude of **F**.

force **F** = ……………. N [2]

(c)   State and explain how the magnitude of **F** would change, if at all, if the same screw is secured much closer to point **A**.

………………………………………………………………………………………………

………….……………………………………………………………………………….[2]

_____

3.   A 50 g golf ball is released from the top of a smooth track as shown in Fig. 3.1. The golf ball moves round the loop **BCD** and then along the track **DE**.

Fig. 3.1

(a)   Calculate the gravitational potential energy of the golf ball at **A**.
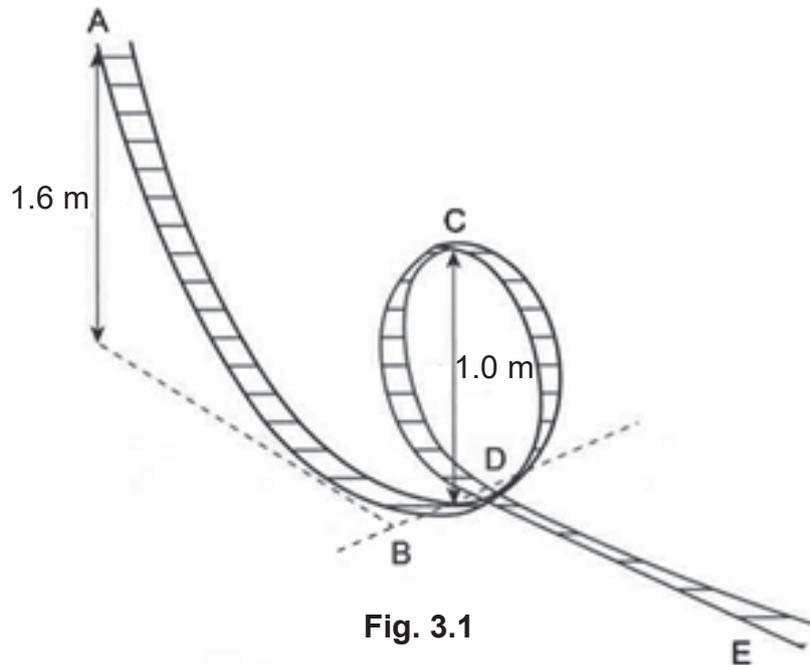
gravitational potential energy = ……………… J [2]

(b)   Calculate the speed of the golf ball at **B**.

speed = …………… m/s [2]

(c)   Calculate the kinetic energy of the golf ball at **C**.

kinetic energy at **C** = …………… J [2]

4.   Thermal flasks are used to store hot liquids such as soup to keep them warm for a period of time. Fig. 4.1 shows a thermal flask that uses foam as an insulating material and Fig. 4.2 shows one that uses vacuum.
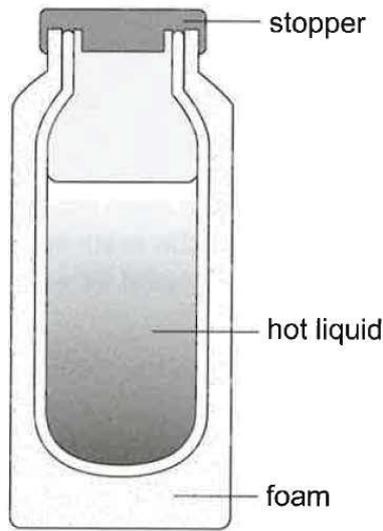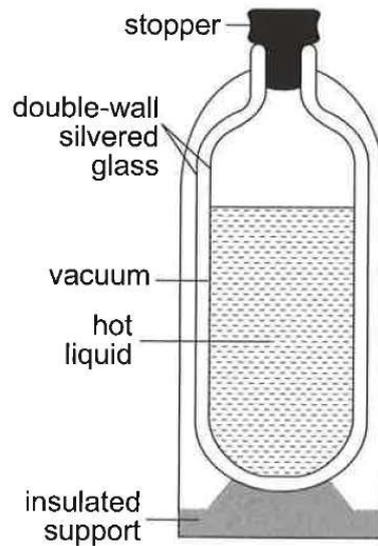

Fig. 4.1   **Fig. 4.2**

(a)   Explain why it is important for the stopper to be in place in order to keep the liquid hot.

....

....

....[2]

(b)   Why does the vacuum flask store hot liquid better than the flask with foam?

....

....

....[2]

(c)   State the purpose of the silvered glass.

....[1]

(d)   Explain why the vacuum flask can also be used to maintain cold drinks at a low temperature.

....

....[1]

5. A ray of light passes through the glass prism as shown in Fig. 5.1.
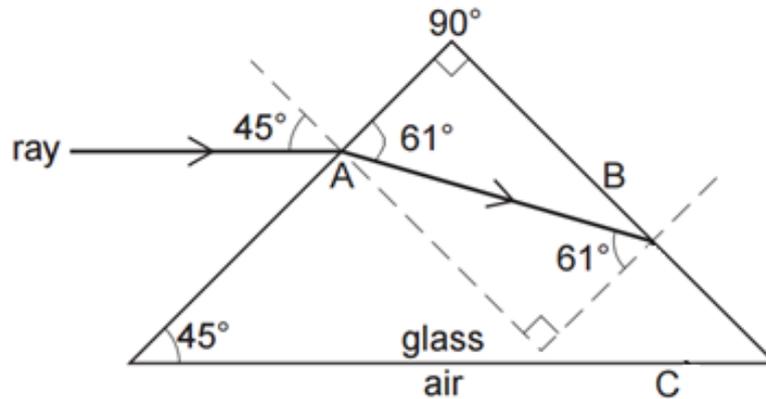

Fig. 5.1

(a) Calculate the refractive index of the glass.

refractive index = ... [2]

(b) Calculate the critical angle of glass.
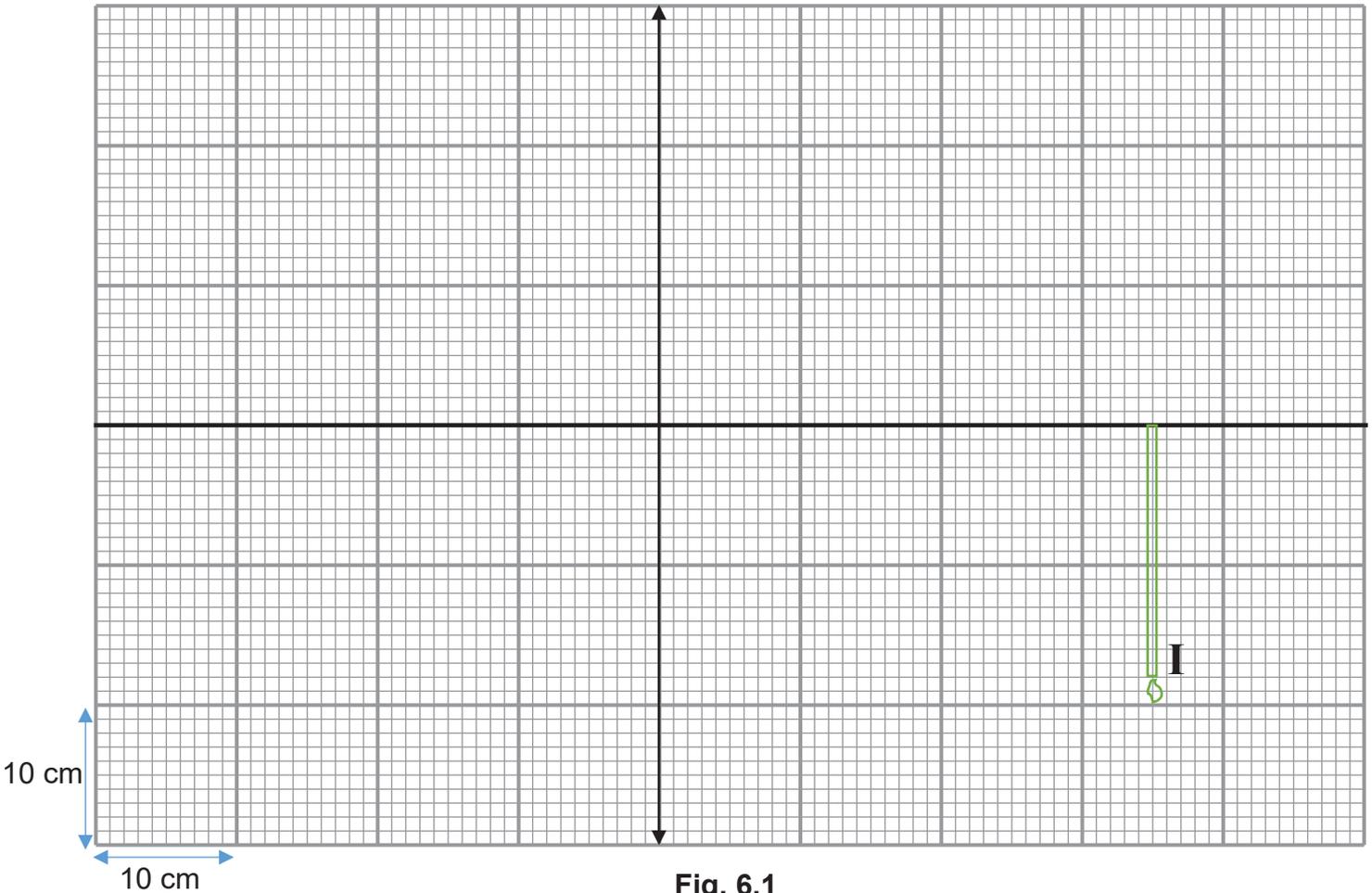
critical angle = ...° [1]

(c) **(i)** Draw what happens to the light ray when it incident on surface **B**.

(ii) Label the relevant angle clearly. [2]

6.	An image, **I**, of a candle is seen to be inverted in front of a convex lens. The image formed by the lens is 20 cm high and is 35 cm away from the lens.

The focal length of the lens is 15 cm.

10 cm

10 cm

Fig. 6.1

(a)	On Fig. 6.1, construct a ray diagram to show how the image is formed. [3]

(b)	State the object distance of the object from the lens.

distance = ………………. cm [1]

(c)	State **two** other characteristics of the image formed.

………..………………………………………………………………………….[1]

7. Two small positively charged metal spheres **A** and **B** are suspended using insulating thread, as shown in Fig. 7.1.
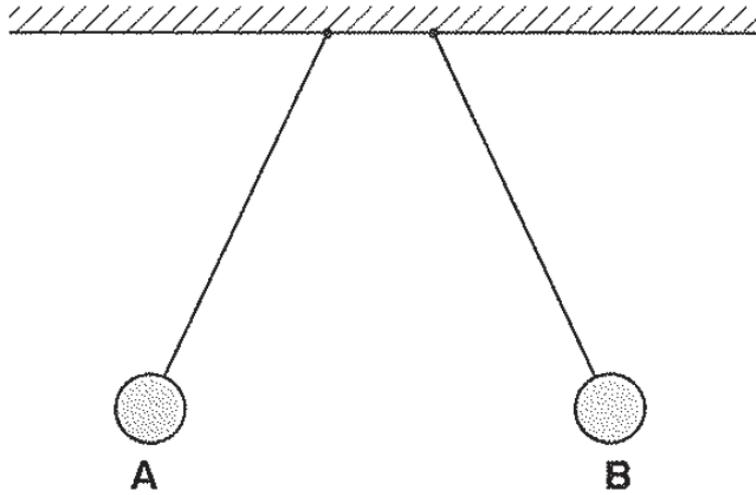

Fig. 7.1

(a) Draw the electric field between the spheres. [2]

(b) A conductor rod touch the metal sphere **B**. 0.02 C of charge flow in 0.05 s. Calculate the current flow.

current = ……………… A [1]

8.   Fig. 8.1 shows two lamps and a 4 Ω resistor connected in a circuit with a 6 V cell.
      The lamps have a resistance of 2 Ω each.
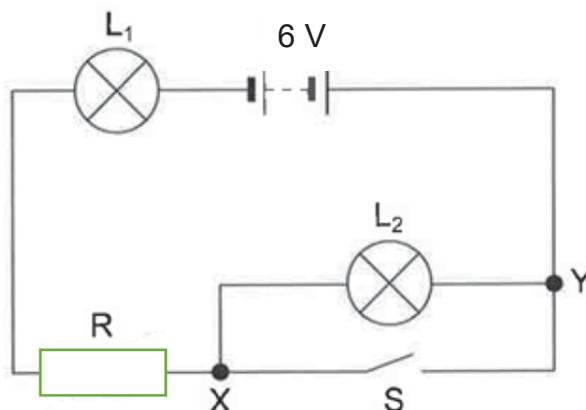

Fig. 8.1

(a)   Calculate the current through the resistor in the circuit as shown in Fig. 8.1.

current = ……………… A [2]

(b)   Compare the brightness of L_1 and L_2. Explain your answer.

………………………………………………………………………………………………

………………………………………………………………………………………………[2]

(c)   The switch is closed.
       Calculate the current flowing through the resistor.

current = ……………… A [2]

9. Fig. 9.1 shows a copper rod **XY** hung at rest in a uniform magnetic field pointing into the paper. The two contacts **X** and **Y** at the ends of the copper rod can move smoothly along the fixed vertical conducting rails **PQ** and **RS** which are connected to a power supply. As a result, current flows through the copper rod.
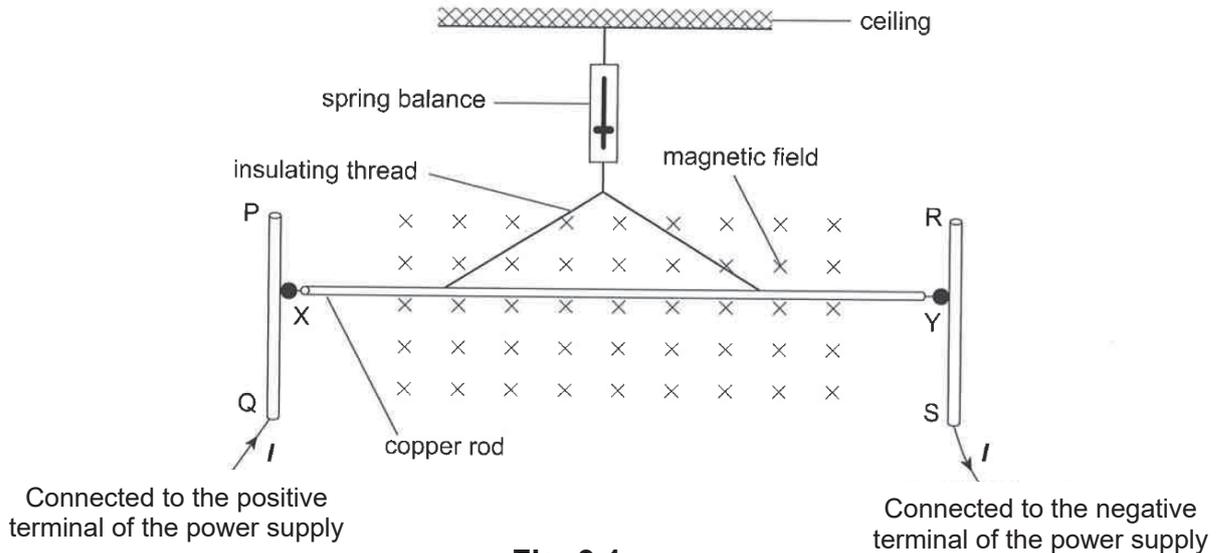
Fig. 9.1

(a) On Fig. 9.1, indicate the direction of force acting on the copper rod due to the current flowing from **X** to **Y**. [1]

(b) Suggest **one** way to increase the force acting on the copper rod.

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

(c) The current supply is switched off. Fig. 9.2 shows the tensions in the insulating thread drawn to scale. Complete the vector diagram and calculate the weight of the copper rod.
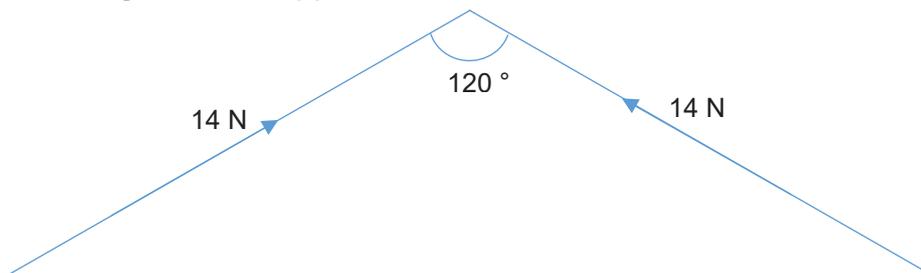
Fig. 9.2

weight of copper rod = ………………[3]

Section B

Answer any **two** questions in this section.
Write your answers in the spaces provided.

10. **(a)** Fig. 10.1 shows a wire passing through a hole in a horizontal, plastic board.

A

compass

wire

horizontal board

6.0 V

— ○

+ ○

Fig 10.1

A student moves a small compass around the board and plots the magnetic field lines due to the current.

Draw a diagram of the board as seen from above (point **A)** and mark on it the magnetic field lines due to the current.   [2]

(b) Ryan designed a simple doorbell as shown in Fig. 10.2. When the switch **S** is pressed and then released, two notes are produced.

Fig. 10.2

(i) Explain why the two notes are produced when the switch is pressed and then released.
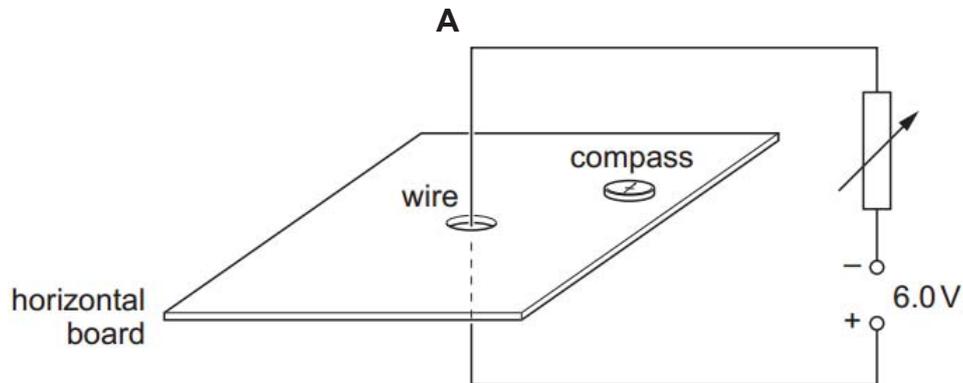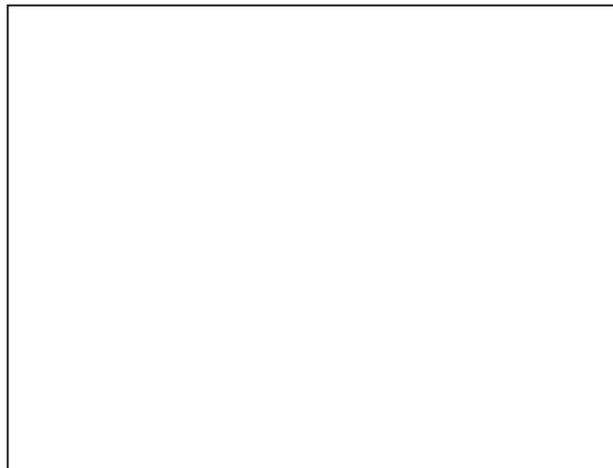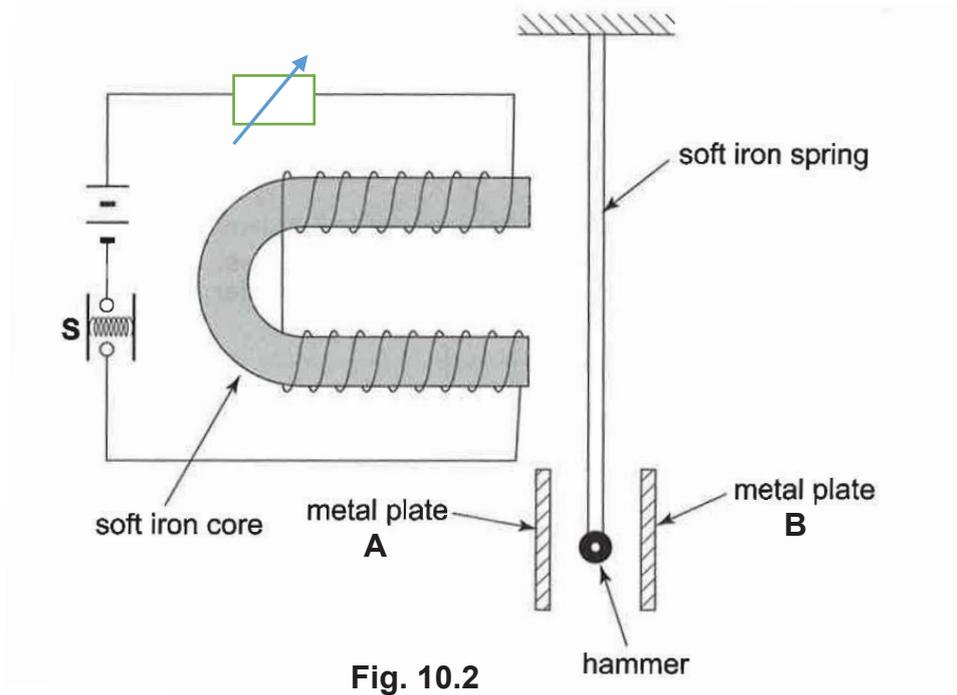
....

....

....

....

....[4]

(ii) The two metal plates are of different thickness. When the metal plate **A** is hit, it has more vibrations per second than metal **B**.

State and explain the difference in the sound heard when Plate **A** and Plate **B** are hit.

....

....[2]

(iii) When Ryan pressed the bell, Nigel who was in the house heard the sound 70 ms later. The speed of sound is 330 m/s.

Calculate Nigel's distance from the doorbell.

distance= ……………m [2]

11. Fig. 11.1 shows a rheostat. Terminal **Y** is connected to a moving contact, which rests on a circular carbon resistance track.

Terminals **X** and **Y** are connected to an external circuit.

The resistance between **X** and **Y** (R_{XY}) changes with the angle through which the shaft has been turned (θ). When the moving contact is at **Z**, it corresponds to an angle of 300˚.
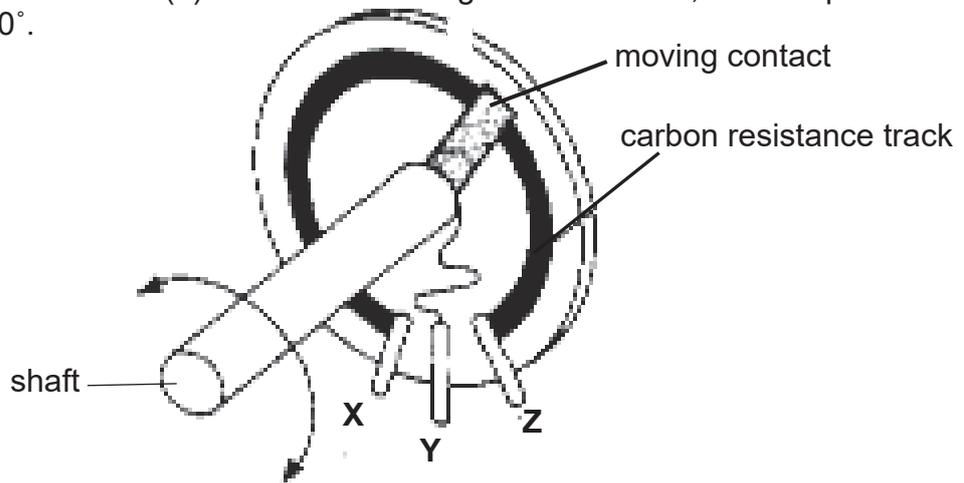

Fig. 11.1

Fig. 11.2 shows the graph of R_{XY}, against the entire range of θ (angle between **X** and **Y**).
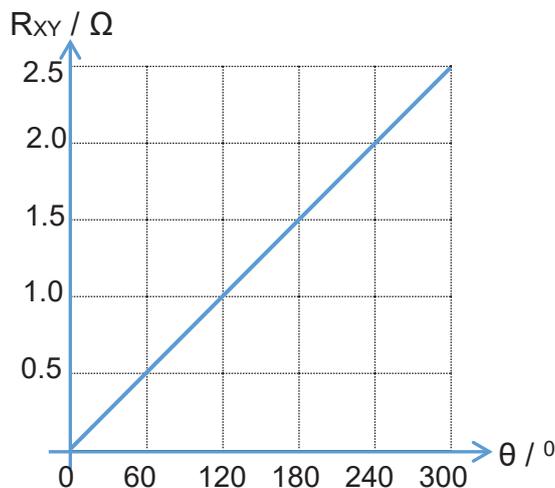

Fig. 11.2

(a) The angle of the shaft is placed at 180°. The current that flows through the rheostat is 0.3 A. Calculate the amount of thermal energy generated in the rheostat in 20 minutes.

energy = ……………J [3]

(b) The rheostat is used to control the volume of a radio. Explain how by turning the shaft, the volume of the radio can be changed.

………………………………………………………………………………………………

……………………………………………………………………………………………[2]

(c) The radio has a power rating of 4 W. It is used for 16 hours a day.
The cost of electricity is 28 cents per kilowatt hour.

Calculate the cost of using the radio for 30 days.

cost = ……………… cents [2]

(d) Some radios use two pins plugs while others use three pins plug. Explain the purpose of the additional pin.

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

……………………………………………………………………………………………[3]

12.   Fig. 12.1 shows a hollow iron cylinder containing air, floating in a pond.
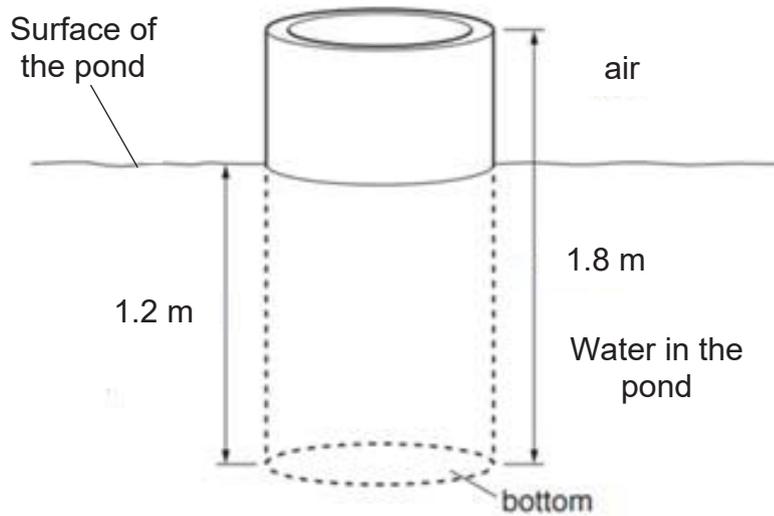

Fig. 12.1

The cylinder has a length of 1.8 m. It floats with 1.2 m submerged in water in the pond. The bottom of the cylinder has an area of 0.60 m². The pressure exerted on the bottom of the cylinder due to the depth of seawater is 12 240 Pa.

(a)   Calculate the force exerted on the bottom of the cylinder.

force = ……………… N [1]

(b)   Deduce the total weight of the cylinder and the air in it. Explain your answer.

…………………………………………………………………………………………………

…………………………………………………………………………………………………[2]

(c)   Calculate the average density of the cylinder.

density = ……….....…… kg/m³ [2]

(d)   Explain why the cylinder floats.

…………………………………………………………………………………………[1]

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(e) A wave passes through the water. Explain by the movement of the cylinder why the wave is a transverse wave.

....

....[1]

(f) The period of the wave produced is 20 ms. The distance between two crests as shown in Fig. 12.2 is 30 cm.
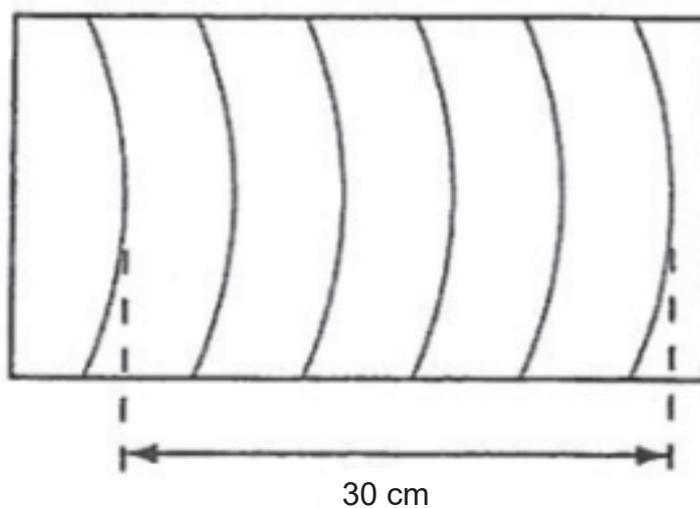

30 cm

Fig. 12.2

Calculate the speed of the wave in the pond.
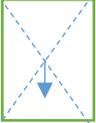
speed of the wave = ……………… m/s [3]

- End of paper -

NSS Prelim 2019
Science Physics O level

Paper 1

1	**C**	6	**C**	11	**B**	16	**C**
2	**C**	7	**B**	12	**D**	17	**A**
3	**C**	8	**D**	13	**B**	18	**B**
4	**B**	9	**A**	14	**B**	19	**D**
5	**A**	10	**B**	15	**C**	20	**C**

Paper 2

1a	Plotting [1] Line [1]	
b	0 – 3 s: Increasing speed [1] 3-5 s: Constant speed [1]	
a		
2b	12 x 200 = F x 75 [1] F = 32 N [1]	
c	The **perpendicular distance** to point A will be **smaller** [1], To obtain the **same value of moment**, the value of **F** will **increase**. [1]	
3a	50 g = 0.05 kg [1] GPE = mgh = 0.05 x 10 x 1.6 = 0.8 J [1]	
b	½ mv² = 0.8 ½ x 0.05 x v²= 0.8 [1] V = 5.66 m/s [1]	
c	Ke at C = lost in GPE from A to C = 0.05 x 10 x (1.6 – 1) [1] = 0.3 J [1]	
4a)	Stopper reduce heat lost by convection. [1] Hot air will rise out of the flask due to the low density. [1]	
b)	Foam is a poor conductor of heat but heat can still be transferred through conduction. [1] Conduction and convection cannot takes place through vacuum. [1]	
c)	Reduce heat lost by radiation	
d)	The features reduce heat transfer; either from the surrounding to the flask or from the flask to the surroundings.	
5a)	Sin 45 / sin 29 [1] = 1.458 = 1.46 [1]	

b)	1.458 = 1 / sin c C = 43.3 °	
c)	Total internal reflection [1] Angle of reflection 61 ° [1]	
6a	Focal point and arrows [1] Ray through optical centre [1] Ray through focal point [1]	
b)	26 cm	
c)	Real and magnified	
7a	Arrows pointing away from the spheres Correct shape of electric field.	
b	0.02 / 0.05 = 0.4 A [1]	
8	V = RI 6 = 8 I [1] I = 0.75 A [1]	
b)	Same brightness [1] They are connected in series, current through both the bulb is the same. Resistance of the bulbs are also the same. [1]	
c)	V = RI 6 = 6 I (Short circuit) [1] I = 1 A [1]	
9a	Up	
b	Increase the magnitude of the current Increase the strength of the magnetic field	
c	Draw the parallelogram Resultant force downwards Weight = 14 N (accept 13.8 N – 14.2 N)	
10a)	Anticlockwise directions Gaps gets bigger further away from wire	
b)	When the switch is on, the iron core becomes an electromagnet. [1] It will attract the soft iron spring and the hammer will hit the metal plate on the left.[1] When the switch is released, the iron core loses its magnetism [1] The spring is no longer attracted, therefore the force in the spring will cause it to move to the right and hit the other metal plate. [1]	
c)	Metal A will have a higher pitch As it has a higher frequency	
d	D = s x t = 70 / 1000 x 330 [1] = 23.1 m [1]	
11a	R = 1.5 [1]	

	t = 5 min = 300 s [1] P = I^2 Rt = 0.3 x 0.3 x1.5 x 300 = 162 W [1]	
b)	As θ increase, the length of the carbon resistance track in the circuit increase, resistance increase. [1] As θ increase, current decrease, volume decrease [1]	
c)	Energy = 4 x 16 x 30 = 1920 = 1.92 kWh [1] 1.92 x 0.28 = 53.76 cents [1]	
d)	Additional pin is Earth wire, which is connected to the metal casing. [1] If there is a fault, earth wire will cause a short circuit. [1] The fuse will melt and protect the user from electric shock [1]	
12a)	F = P x A = 12240 x 0.6 = 7 344 N	
b)	Total weight is equal to 7 344N . [1] Since the cylinder is not moving, resultant force is zero. [1]	

c)	Mass = 734.4kg or vol = 1.08 m^3 [1]
	
	Density = mass / vol
	        = 734.4 / 1.8x 0.6
	        = 680 kg/m^3 [1]	

d)	The average **density of the cylinder is lower than the density of water (1000 kg/m^3).**	
e)	**Cylin**der moves up and down while the energy is transferred horizontally.	
f)	F= 1/0.02 = 50 Hz [1] Wavelength = 30 / 5 = 6 cm = 0.06 m [1] Speed = 0.06 x 50 = 3 m/s [1]	