YUHUA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

4E/5N	CANDIDATE NAME			
	CLASS		INDEX NUMBER	

SCIENCE (PHYSICS, CHEMISTRY) 5076/01

Paper 1 Multiple Choice **3 Sept 2019**
1 hour

Additional Materials : Multiple Choice Answer Sheet

Setter: Mr Yeh Bao Yaw
Ms Cheong Ai Hwa

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Use soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your *Class*, *Name* and *Class Index Number* in the spaces at the top of this page and on the Multiple Choice Answer Sheet.

Read the instructions on the Multiple Choice Answer Sheet carefully

There are **forty** questions in 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 Multiple Choice 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 **18**.
A copy of the Periodic Table is included on page **19**.

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

This document consists of **19** printed pages, inclusive of this page.

[Turn over

1 A micrometer screw gauge is used to measure the diameter of a copper wire.

Fig. 1.1 shows the reading when the anvil and the spindle are tightly closed.
Fig. 1.2 shows the observed reading when the wire is placed between the anvil and the spindle.

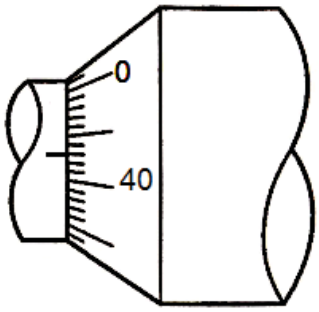


Fig. 1.1

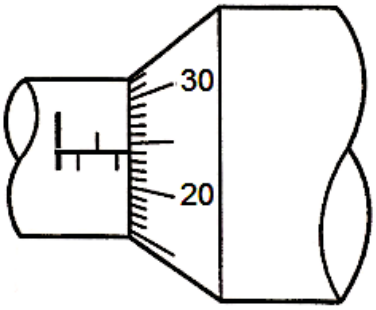
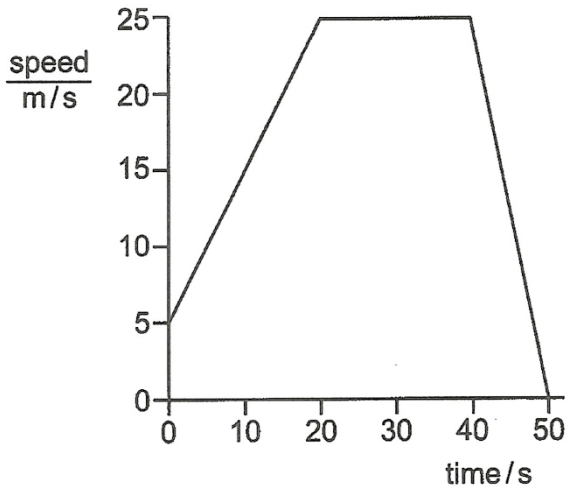


Fig. 1.2

What is the thickness of the copper wire?

A 1.67 mm
B 1.74 mm
C 1.81 mm
D 2.17 mm

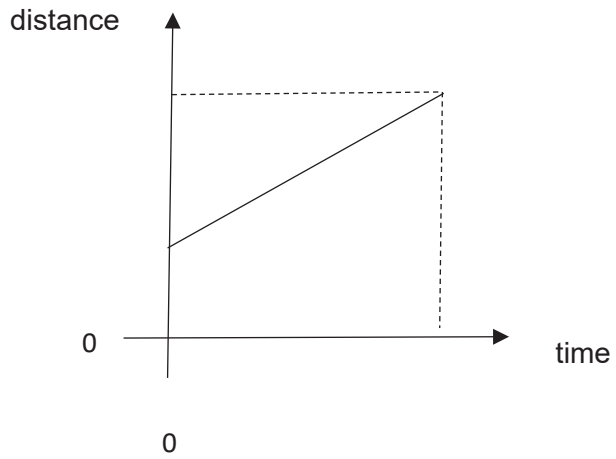
2 The diagram below is a speed-time graph for a car.



Which two quantities are needed to find the average speed of the car for this 50 s period?

A the area under the graph and the total time taken
B the gradient at 50 s and the total time taken
C the initial speed and final speed
D the maximum speed and the time taken to reach it

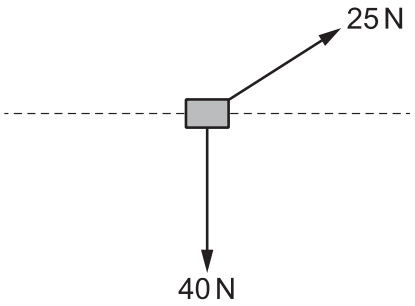
3 The following distance-time graph shows the distance travelled by a moving car.



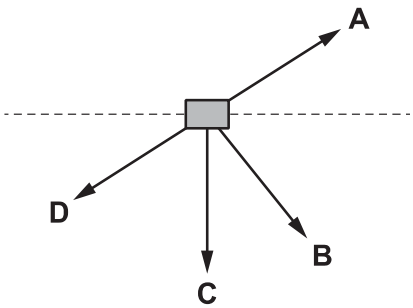
Which feature of the graph gives the speed of the car?

A the area between the line and the distance axis
B the area between the line and the time axis
C the difference between the starting and finishing distances
D the gradient of the line

4 Forces of 25 N and 40 N act on an object in the directions shown.



Which arrow shows the direction of the resultant force on the object?



5 A boat of 3000 kg moves with a constant velocity of 7 ms^{-1} through a lake over a time period of 5 s.

What is the resultant force acting on the boat?

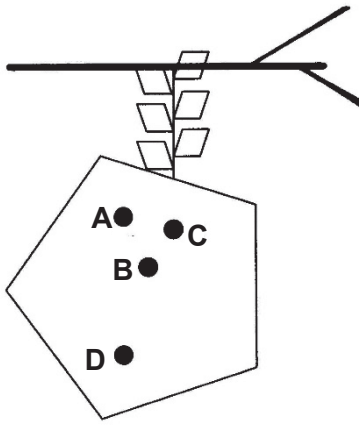
A 0 N
B 1400 N
C 4200 N
D 21000 N

6 An Eskimo stands on snow wearing snow-shoes. The mass of the Eskimo is 40 kg and the snow-shoes have a total area of 0.5 m^2 in contact with the snow. A 1 kg mass has a gravitational force of 10 N acting on it.

What pressure does the Eskimo exert on the snow?

A 20 N / m^2
B 80 N / m^2
C 200 N / m^2
D 800 N / m^2

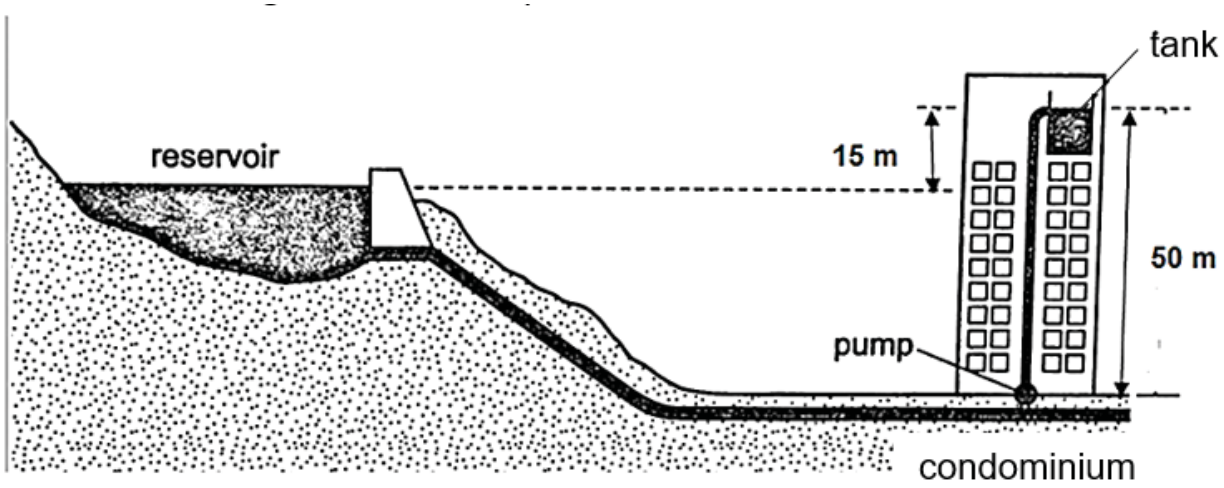
7 A kite hangs freely on the branch of a tree and comes to rest in the position as shown in the diagram below. Which labelled point is most likely to be the centre of gravity of the kite?



8 Which of the following statements correctly describes a stable equilibrium?

A the centre of gravity rises before returning to its original height
B the centre of gravity drops
C the centre of gravity remains at the same height
D the centre of gravity drops before returning to its original height

9 Water flows freely from a nearby reservoir into the condominium without any loss of energy. A pump is required to provide additional energy to lift the water into a storage tank at the top of the condominium. The gravitational field strength is 10 N/kg.



How much additional energy does the pump need to supply to lift each kilogram of water into the tank?

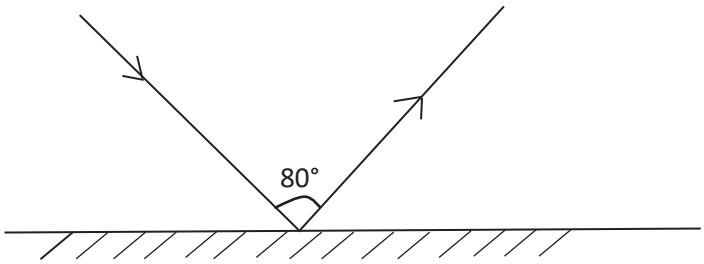
A 50 J
B 150 J
C 350 J
D 500 J

10 The hot water for a house can be produced by absorbing solar energy, using copper panels through which the water circulates.

What is the best finish for the top surface of the copper panels?

A clear plastic
B dull black paint
C highly polished
D white paint

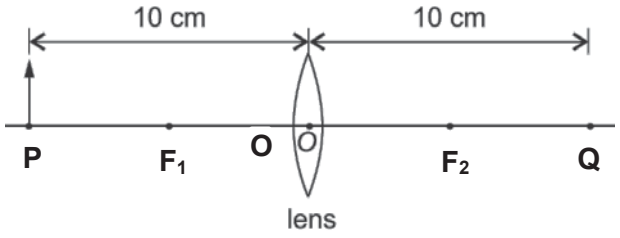
11 The diagram shows a ray of light striking a plane mirror.



What must the angle of incidence be if the total angle between the incident and reflected rays is 80°?

A 40°
B 50°
C 80°
D 100°

12 The diagram shows an object placed 10 cm away from a converging lens which has a focal length of 5 cm.



At which point will the image be formed?

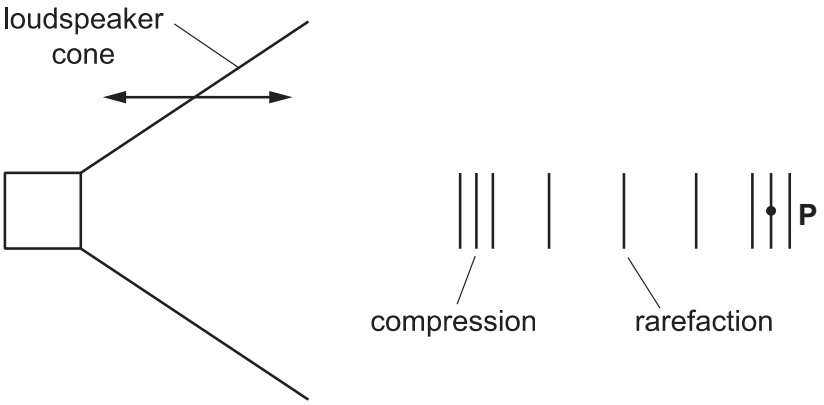
A F_2
B **Q**
C Between **O** and F_2
D Between F_2 and **Q**

13 Radio waves, visible light and X-rays are all part of the electromagnetic spectrum.

What is the correct order of these components in increasing wavelength?

	shortest wavelength ⟶		longest wavelength
A	Visible light	Radio waves	X-rays
B	Visible light	X-rays	Radio waves
C	X-rays	Radio waves	Visible light
D	X-rays	Visible light	Radio waves

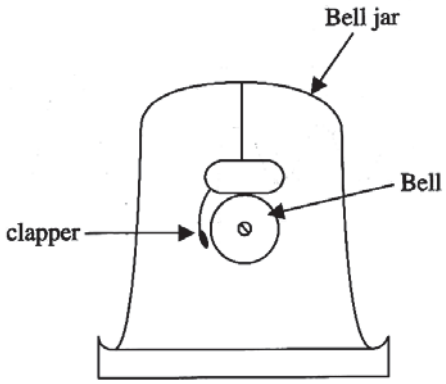
14 A series of compressions and rarefactions are sent out from a loudspeaker cone as it vibrates backwards and forwards. The frequency of the vibration is 40 Hz.



A compression is found to be at point **P**. How much time would have passed before the next rarefaction arrives at **P**?

A 0.0125 s
B 0.025 s
C 20 s
D 40 s

15 An electric bell is suspended in a bell jar as shown. An observer outside the bell jar can see the clapper striking the bell but cannot hear any sound produced by the striking. What is a possible reason?



A The bell jar contains a vacuum.
B The bell jar is filled with inert gas.
C The bell jar is filled with water.
D The bell jar has very thick glass walls.

16 The amplitude and frequency of a sound wave are both increased. How are the loudness and pitch of the sound affected?

	loudness	pitch
A	increased	raised
B	increased	lowered
C	decreased	raised
D	decreased	lowered

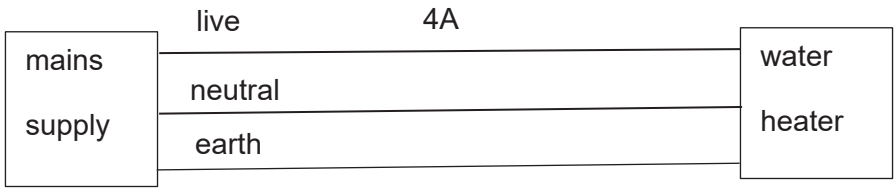
17 A piece of wire 0.5 m long has an area of cross-section of 1 mm^2. Which wire of the same material **A, B**, **C** or **D** has twice the resistance?

	length / m	area / mm^2
A	0.25	1.0
B	0.25	2.0
C	0.50	0.5
D	0.50	2.0

18 An electric oven rated at 3500 W operates from a 240 V mains.
What is the correct fuse rating for its plug to be connected to the mains socket?

A 13 A
B 16 A
C 20 A
D 30 A

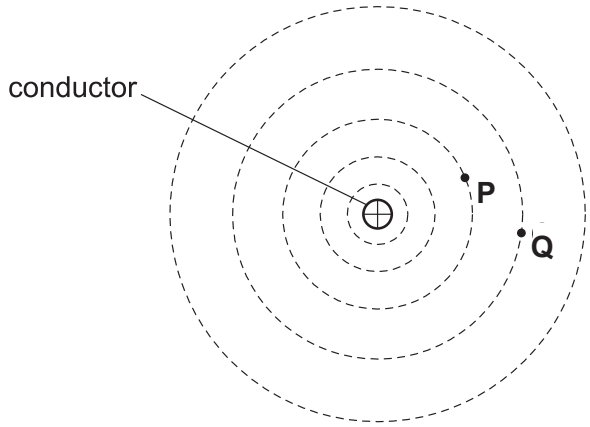
19 The diagram shows the three wires of an electrical mains supply connected to an electric water heater.



What are the currents in the neutral and earth wire corresponding to a current of 4 A in the “live” wire?

	neutral	earth
A	4 A	4 A
B	4 A	0 A
C	2 A	2 A
D	0 A	4 A

20 The diagram shows the shape of the magnetic field lines near a current-carrying conductor.



The current in the conductor is flowing into of the plane of the diagram.
Which row correctly states the direction of the field lines and compares the strength of the field at points **P** and **Q**?

	direction of field lines	stronger field at
A	clockwise	**P**
B	clockwise	**Q**
C	anti-clockwise	**P**
D	anti-clockwise	**Q**

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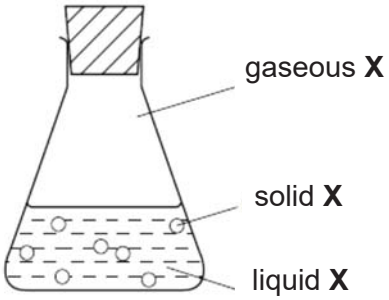
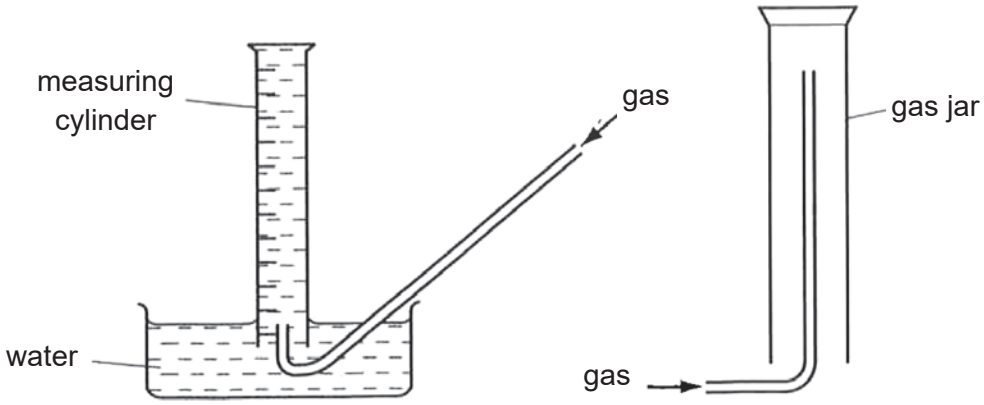
21 The conical flask contains compound **X** which is present in solid, liquid and gaseous states.



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

A A gaseous **X** molecule has a lower mass than a liquid **X** molecule.
B Energy is released when **X** changes from gas to liquid.
C Gas **X** molecules occupy a larger space than same number of liquid **X** molecules.
D Solid **X** molecules vibrate about fixed positions.

22 The following diagrams show two methods of gas collection.



Which row gives the properties of a gas which could be collected by both methods?

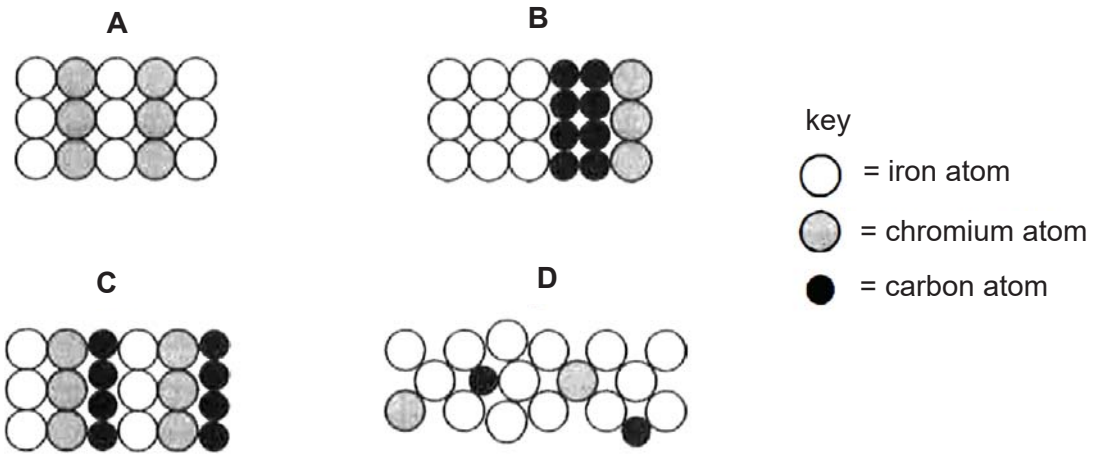
	property 1	property 2
A	insoluble in water	denser than air
B	insoluble in water	less dense than air
C	soluble in water	denser than air
D	soluble in water	less dense than air

23 Substance **E** melts at -114 °C and boils at 78 °C. It is soluble in water.

Which method can be used to obtain a significant amount of a pure sample of **E** from a mixture of **E** and water?

A crystallisation
B filtration
C fractional distillation
D paper chromatography

24 Which of the following diagrams shows the arrangement of the atoms in stainless steel?



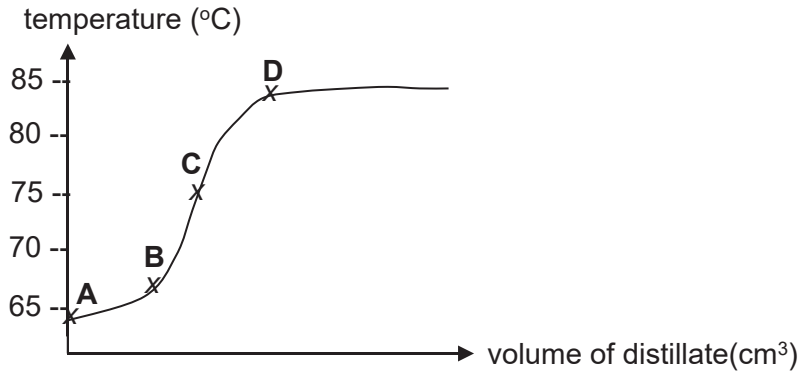
25 The following apparatus can be used in the measurement of volumes of liquids:

I 25 ml beaker
II 50 ml burette
III 25 ml graduated measuring cylinder
IV 25 ml pipette

Which of the following shows the correct order of increasing accuracy of these apparatus?

A **I**, **III**, **IV**, **II**
B **II**, **III**, **IV**, **I**
C **II**, **IV**, **III**, **I**
D **I**, **IV**, **III**, **II**

26 The following graph shows the temperature changes when a 1:1 mixture of methanol (melting point: −97 ºC, boiling point 65 ºC) and propanol (melting point: −89 ºC, boiling point: 82 ºC) was distilled.



If a 3 cm^3 fraction of the distillate was collected at each of the points **A**, **B**, **C** and **D** indicated on the graph, which fraction would contain the highest proportion of propanol?

27 Nitric acid can be decomposed into nitrogen dioxide, water and oxygen as shown in the equation given below.

$$4HNO_3(aq) \rightarrow 4NO_2(g) + 2H_2O(l) + O_2(g)$$

What volume of gas would be produced if 12.6 g of nitric acid was used?

A 1.2 dm^3
B 4.8 dm^3
C 6.0 dm^3
D 8.4 dm^3

28 An element **X** has two isotopes, ^{238}**X** and ^{235}**X**.

How does ^{238}**X** differ from ^{235}**X**?

A It has 3 more neutrons.
B It has 3 more neutrons and 3 more electrons.
C It has 3 more protons.
D It has 3 more protons and 3 more electrons.

29 Which of the following pairs of ions **cannot** be distinguished using aqueous sodium hydroxide?

A Ca^{2+} and Fe^{2+}
B Cu^{2+} and Fe^{3+}
C NH_4^+ and H^+
D Pb^{2+} and Zn^{2+}

30 What are the two reagents that **cannot** be used to prepare a soluble salt of magnesium ethanoate?

A magnesium and ethanoic acid
B magnesium carbonate and ethanoic acid
C magnesium hydroxide and ethanoic acid
D magnesium nitrate solution and potassium ethanoate solution

31 The electrical properties of four substances **W**, **X**, **Y** and **Z** are shown below:

substance	electrical property
W	conducts electricity only in aqueous solution
X	conducts electricity when molten and in solid state
Y	conducts electricity when molten and in aqueous state
Z	does not conduct electricity under any conditions

What could these four substances be?

	W	**X**	**Y**	**Z**
A	$CaCl_2$	HCl	P	Pb
B	HCl	Pb	$CaCl_2$	P
C	P	$CaCl_2$	HCl	Pb
D	Pb	P	$CaCl_2$	HCl

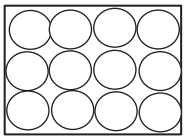
32 Metals **W**, **X**, **Y** and **Z** are placed in salt solutions as shown in the table

	result of placing metal in solution of			
	salt of **W**	salt of **X**	salt of **Y**	salt of **Z**
W	no reaction	**X** displaced	**Y** displaced	no reaction
X	no reaction	no reaction	no reaction	no reaction
Y	no reaction	**X** displaced	no reaction	no reaction
Z	**W** displaced	**X** displaced	**Y** displaced	no reaction

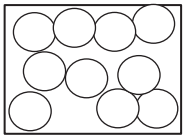
What is the order of reactivity of the metals from most reactive to least reactive?

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

33 The figures below show the particles in a substance at two different temperatures but at the same pressure.



-90 ºC



-5 ºC

Which of the following most likely indicates the melting point and boiling point of the substance?

	melting point / ºC	boiling point / ºC
A	180	200
B	23	80
C	-78	13
D	-123	-10

34 Which of the following shows the correct trends down the group for the melting point, density and atomic radius of alkali metals?

	melting point	density	atomic radius
A	increasing	decreasing	increasing
B	decreasing	increasing	increasing
C	increasing	increasing	decreasing
D	decreasing	decreasing	decreasing

35 In which of the reaction is the underlined substance acting as an oxidising agent?

A $Cl_2 + 2\underline{FeCl_2} \rightarrow 2FeCl_3$

B $2HCl + \underline{MgO} \rightarrow MgCl_2 + H_2O$

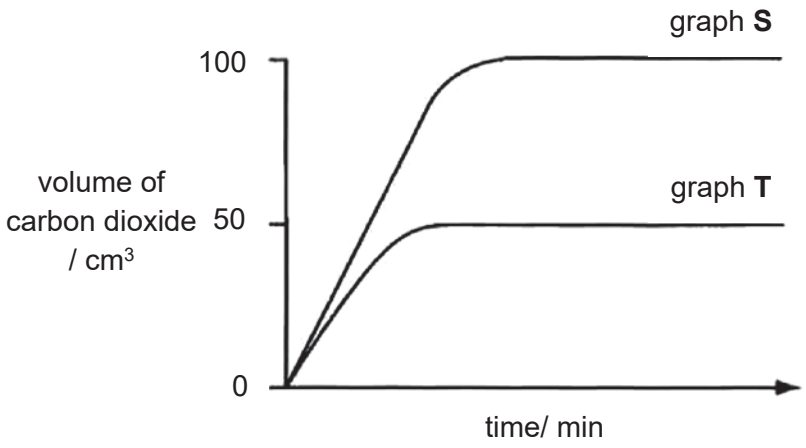
C $\underline{CuO} + H_2 \rightarrow Cu + H_2O$

D $ZnO + \underline{CO} \rightarrow Zn + CO_2$

36 Some crystals of magnesium carbonate were added to an excess of sulfuric acid at room temperature.

The volume of carbon dioxide produced was measured over a period of time. The results are shown in graph **S**.

The experiment was repeated and graph **T** was obtained.



Which change was used to obtain the results shown in graph **T**?

A Acid of the same volume and half the original concertation was used.
B Half the mass of magnesium carbonate was used.
C Larger crystals of magnesium carbonate were used.
D Using a lower temperature.

37 Rice mills face a greater threat of explosion from production of rice flour compared to rice silos which store rice grains.

Below are four statements which can explain why rice mills have a higher possibility of explosion occurring.

I The combustion of rice flour is exothermic.
II Rice flour is less combustible than rice grains.
III Rice flour dust has a larger surface area than rice grains.
IV Rice flour catalyses the combustion of gaseous fuel in the mills.

Which of the above are true?

A **I** and **III** only
B **II** and **IV** only
C **I** and **IV** only
D **I**, **III** and **IV** only

38 A student investigated the reaction of vegetable oils with hydrogen. 100 cm^3 of hydrogen was bubbled through 1 g samples of four vegetable oils containing a suitable catalyst. The volume of hydrogen gas remaining after each experiment was recorded in the table below.

vegetable oil	volume of hydrogen gas remaining/ cm^3
P	**100**
Q	**87**
R	**63**
S	**0**

Which vegetable oils are unsaturated?

A **P**, **Q** and **R**
B **Q** and **R**
C **Q**, **R** and **S**
D **S** only

39 When ethanol is left standing in the air for some time, it becomes acidic.

Which chemical equation represents this change?

A $CH_3CH_2OH + CO \rightarrow CH_3CH_2CO_2H$
B $CH_3CH_2OH + O_2 \rightarrow CH_3CO_2H + H_2O$
C $CH_3CH_2OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$
D $2CH_3CH_2OH + O_2 \rightarrow 2CH_3CO_2H + 2H_2$

40 The table shows the observations made when an organic compound **X** reacts with aqueous bromine and acidified potassium manganate(VII)

reagent	observation
aqueous bromine	no visible reaction
acidified potassium manganate(VII)	purple solution turns colourless

What is compound **X**?

A ethane
B ethanoic acid
C methanol
D propene

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

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key proton (atomic) number atomic symbol name relative atomic mass									5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	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 europium 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
actinoids	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.).

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PRELIMINARY EXAMINATION 2019
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

4E/5N	CANDIDATE NAME			
	CLASS		INDEX NUMBER	

SCIENCE (PHYSICS) 5076/02

Paper 2 **30 Aug 2019**
1 hour 15 minutes

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

Setter: Mr Yeh Bao Yaw

READ THESE INSTRUCTIONS FIRST
Write your name, class and index number on all the work you hand in.
Write in dark blue and black pen.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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.

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

For Examiner's Use	
Section A	
Section B	
……..	
……..	
Total	

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

[Turn over

Section A

Answer **all** the questions in the spaces provided.

1 **Fig. 1.1** shows a catapult used to project an object. Force **F** pulls back the object, creating a tension in the rubber cords.

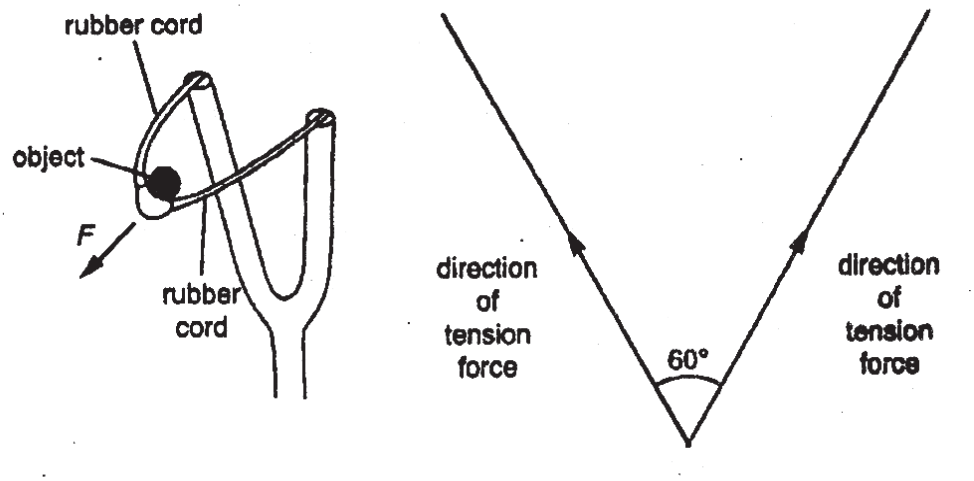


Fig. 1.1

The tension force in each rubber cord is 20 N and the two cords are 60° to each other as shown in **Fig. 1.1**. By making a scale drawing of 1 cm : 4 N, find the resultant of these two tension forces acting on the object.

resultant force = …….. N [3]

2 **Fig. 2** shows a claw hammer being used to pull a nail out of a piece of wood.

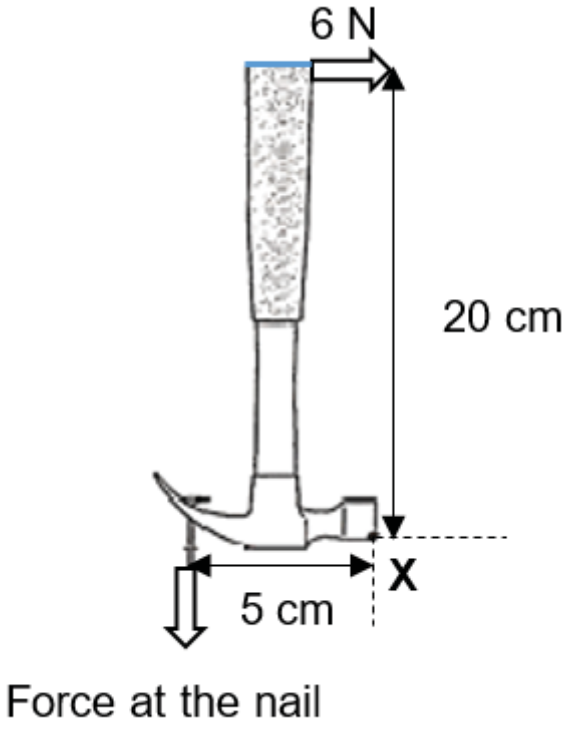


Fig. 2.1

(a) Explain why the force at the nail is greater than the force exerted at the handle of the hammer.

……

……

……

…… [2]

(b) The hammer rotates about the pivot, **X**, when the nail is being pulled out. A force of 6 N is applied at the end of the hammer's handle as shown in **Fig. 2.1**. Calculate the force on the nail.

force at the nail = …….. N [2]

3 **Fig. 3.1** shows a small ball bearing rolling down a hemispherical bowl of radius 14.0 cm. The ball bearing has a mass of 1 kg. The inner surface of the bowl is slightly rough. (g = 10 N/kg)

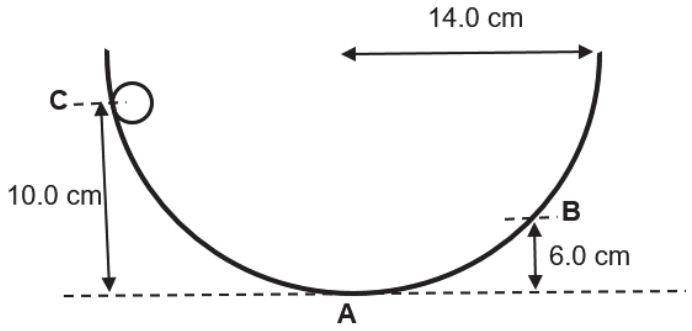


Fig. 3.1

(a) Calculate the gravitational potential energy of the ball bearing when it is released at a vertical distance of 10.0 cm above **A**, which is the bottom of the bowl.

gravitational potential energy = …….. J [2]

(b) Hence or otherwise, find the maximum possible speed of the ball bearing at **A**.

maximum speed = …….. m/s [2]

(c) When the ball is released at **C**, explain why the ball bearing is only able to reach **B** using the principle of conservation of energy.

……

……

……

…… [2]

4 **Fig. 4.1** shows a vending machine that can serve a hot cooked ready-to-eat meal. It has a storage space for frozen food at the bottom of the machine. The cooking compartment is separated from the storage space.

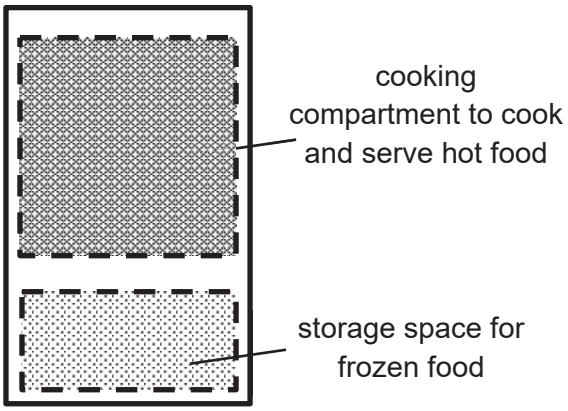


Fig. 4.1

(a) In terms of thermal energy transfer, explain why the cooking compartment is at the top while the storage space for frozen food is located at the bottom of the vending machine.

……

……

……

…… [2]

(b) Suggest one way to reduce thermal energy transfer between the cooking compartment and the storage space for frozen food.

……

…… [1]

(c) What colour should the vending machine be in order to reduce heat gain to the storage space for frozen food? Explain your answer.

……

……

……

…… [2]

5 **Fig. 5.1** shows the wave crests viewed on the surface of a ripple tank (not drawn to scale).

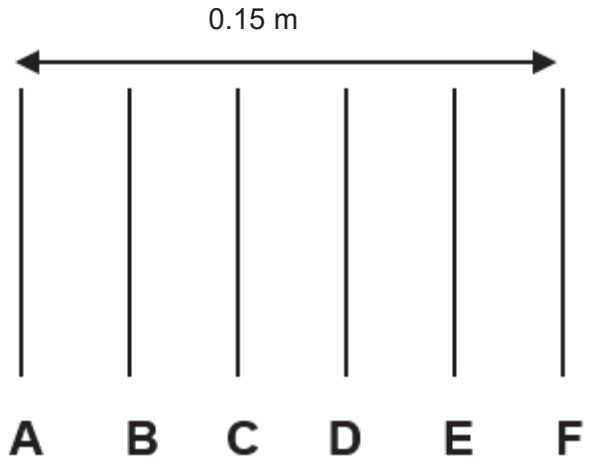


Fig. 5.1

(a) State what is meant by a wavefront.

……

…… [1]

(b) The wavefront shown at position **A** in **Fig. 5.1** takes 5.0 s to travel to position **F**. Determine

(i) the wavelength of the wave,

wavelength = …… m [1]

(ii) the speed of the wave,

speed = …… m/s [1]

(iii) the frequency of the wave.

frequency = …… Hz [1]

6 **Fig. 6.1** shows the position of an object **O** and a thin converging lens with its focal points, **F**.

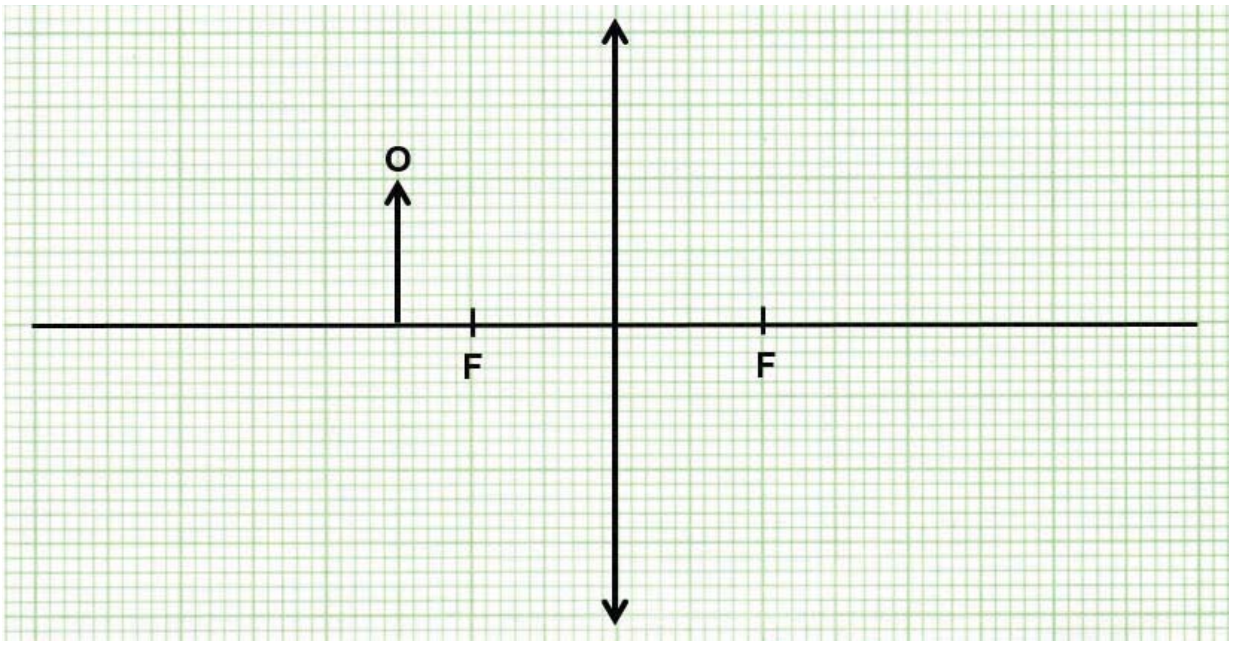


Fig. 6.1

(a) On **Fig. 6.1**, draw two rays from the top of **O** to locate the top of the image. Draw in the whole of the image. [2]

(b) State the characteristics of the image produced.

…… [1]

(c) State an application for this arrangement of object and lens.

…… [1]

7 **Fig. 7.1** shows the base of a large thundercloud which is negatively charged above a tall building. A lightning flash occurs as the thundercloud loses some of its charge to the ground.

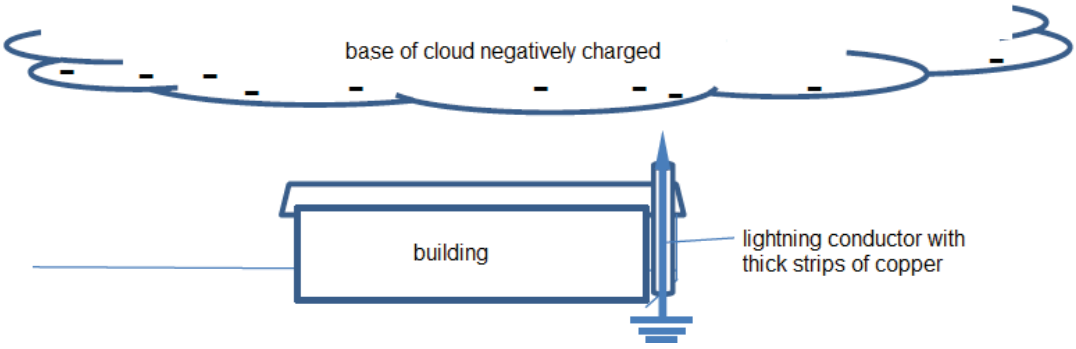


Fig. 7.1

(a) **(i)** State if the tip of the lightning conductor is positively or negatively charged.

…… [1]

(ii) Explain how the tip of the lightning conductor becomes charged, as stated in **(a)(i)**.

……

…… [2]

(b) **(i)** One lightning flash delivers an average current of 10 000 A to the ground for a duration of 0.0002 s.
Calculate the amount of charge that is transferred during this flash.

charge = …… C [1]

(ii) Assuming that there is a potential difference of 4 MV between the cloud and the ground, calculate the energy dissipated during the flash.

energy = …… J [2]

8 **Fig. 8.1** below shows a circuit containing two lamps connected in parallel to a 12 V battery. Each lamp is rated 12 V, 2.0 A.

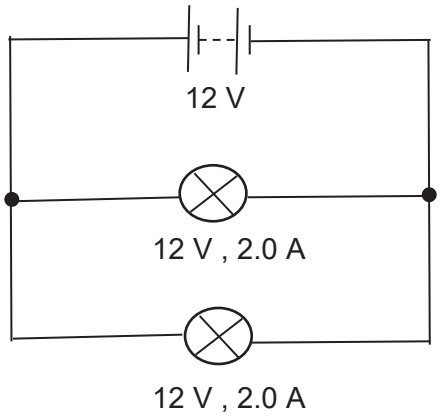


Fig. 8.1

(a) State the current passing through the battery.

current = ... A [1]

(b) Calculate the resistance of each lamp.

resistance of each lamp = ... Ω [2]

(c) Hence, calculate the total resistance in the circuit.

total resistance = ... Ω [2]

9 **Fig. 9.1** below shows the wiring inside an electric iron.

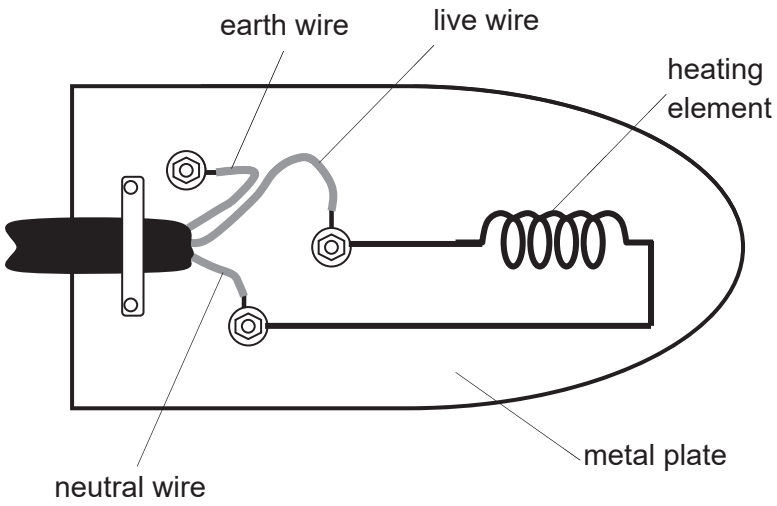


Fig. 9.1

(a) Describe the fault that occurs that causes current to flow in the earth wire.

……..

……. [1]

(b) The iron has a power rating of 1500 W and is connected to a 240 V mains supply.

(i) Calculate the current passing through the iron when in use.

current = ……. A [1]

(ii) If electricity costs 15 ¢ per kWh, what is the cost of using the iron for 10 hrs?

cost = …… ¢ [2]

10 A coil is wound on an iron core. It is placed near a permanent magnet, as shown in **Fig. 10.1**.

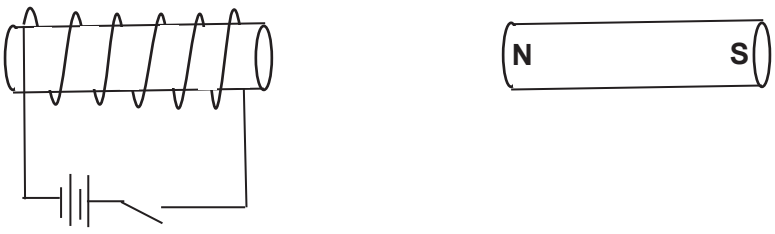


Fig. 10.1

(a) The current is switched on. Explain why the permanent magnet moves away from the iron core.

……

……

…… [2]

(b) The current is switched off and the permanent magnet is replaced by an iron rod. State and explain what will happen to the iron rod when the current is now switched on.

……

……

…… [2]

Section B

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

Write your answers in the spaces provided.

11 A train as shown in **Fig. 11.1** travels from one station to the next. It starts from rest at time t = 0 and accelerates uniformly for the first 20 s. It accelerates uniformly for the first 20 s. At t = 20 s it reaches its top speed of 30 m/s. It then travels at this speed for a further 30 s before decelerating uniformly to rest. The total time for the journey is 60 s.

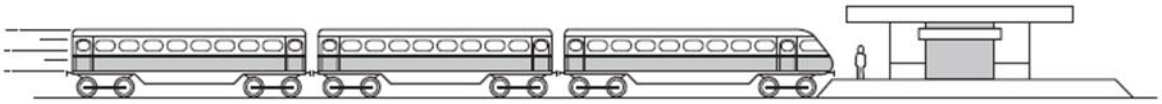


Fig. 11.1

(a) On **Fig 11.2** below, plot a speed-time graph for the motion of the train.

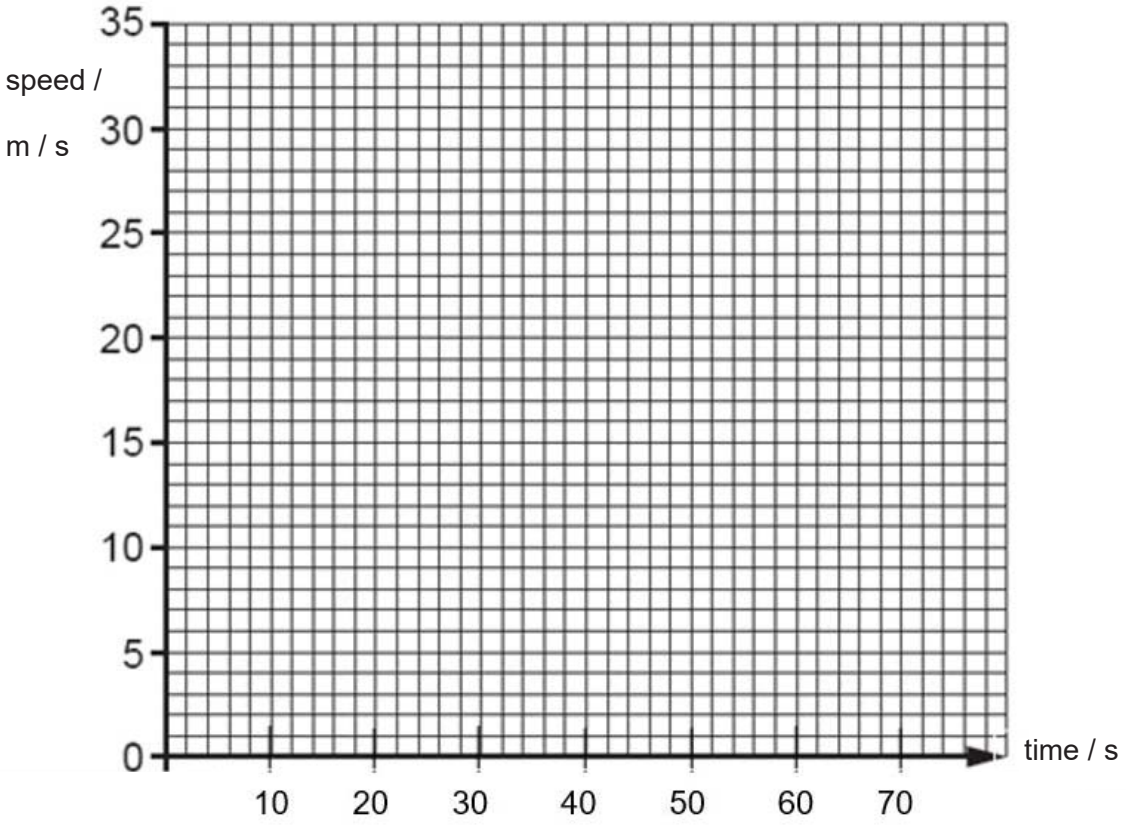


Fig. 11.2 [3]

(b) Explain what is meant by *uniform acceleration*.

……..

…… [1]

(c) By using your graph in **Fig. 11.2**, calculate

(i) the acceleration of the train.

acceleration = …… m / s^2 [2]

(ii) the total distance between the two stations.

total distance = …… m [2]

(d) The train is stopped by applying the brakes. Various factors can affect the braking distance of the train. State and explain how the braking distance of the train is affected by carrying more passengers.

……..

……..

……..

…… [2]

12 **(a)** **Fig. 12.1** shows what happens to three rays of light as they enter an optical fibre glass of uniform refractive index

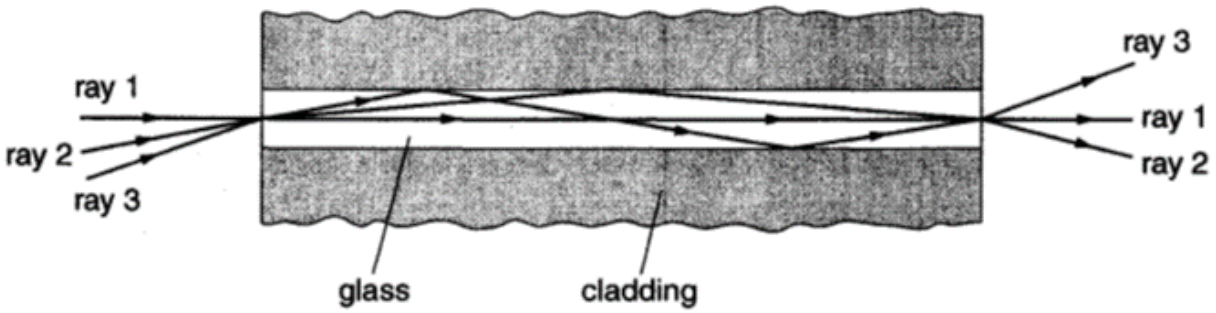


Fig. 12.1

Fig. 12.2 gives information about the three rays as it passes through the fibre.

	angle of incidence on entry / ˚	angle of refraction on entry / ˚
ray 1	0	0
ray 2	20	13
ray 3	35	**X**

Fig. 12.2

(i) Using data for ray 2 from **Fig. 12.2**, calculate the refractive index of the glass.

refractive index = …….. [2]

(ii) Calculate the angle of refraction **X** for ray 3.

angle of refraction **X** = ……..° [2]

(iii) Using information calculated from **(i)**, calculate the critical angle of the light in the fibre glass.

critical angle = ……..° [2]

(iv) Explain why the light does not escape from the sides of the optical fibre.

……

……

……

…… [2]

(b) Explain why ray 1 does not bend when entering the optical fibre glass from air, but rays 2 and 3 bends.

……..

……..

……..

……. [2]

13 Some melted crystals are allowed to cool. A student records the temperature of the melted crystals at regular intervals in **Table 13.1**, until there was no further change in temperature. The temperature of the room was at 25 °C.

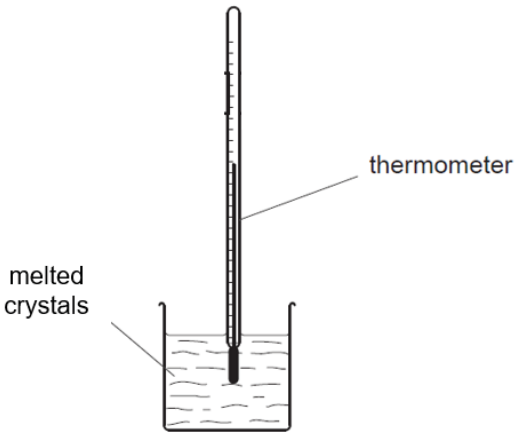


Fig 13.1

time **t** /mins	0	2	4	6	8	10	12	14
temperature /°C	78	59	52	52	52	40	38	25

Table 13.1

(a) (i) Plot the cooling curve for the substance on **Fig. 13.2** from t = 0 s to t = 16 s.

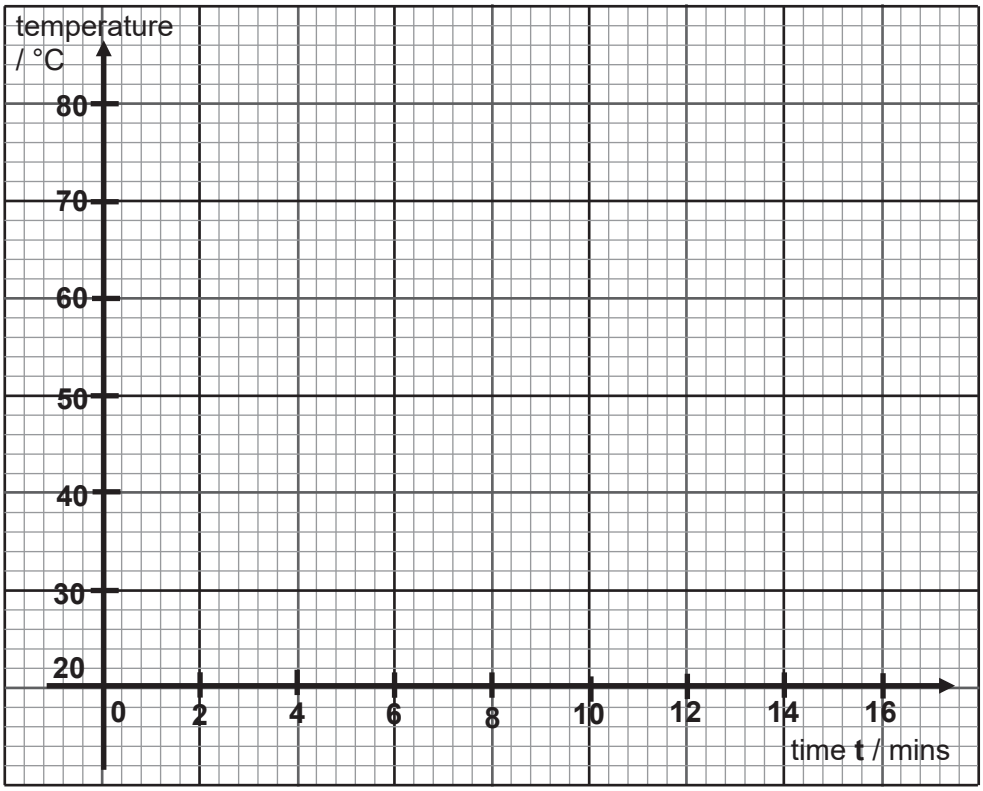


Fig 13.2

[2]

(ii) Explain the shape of the graph that you had drawn in **(a)(i)**.
(Note: You may label segments of the graph with alphabets to assist with your explanation)

……

……

……

…….. [2]

(iii) Describe, in terms of the movement and arrangement of particles, what is happening during solidification.

……

……

……

…….. [2]

(iv) Complete the following sentence:

As the substance cools, its …….. energy decreases. [1]

(b) **Fig 13.3** shows the process by which molecules near the surface of water escape.

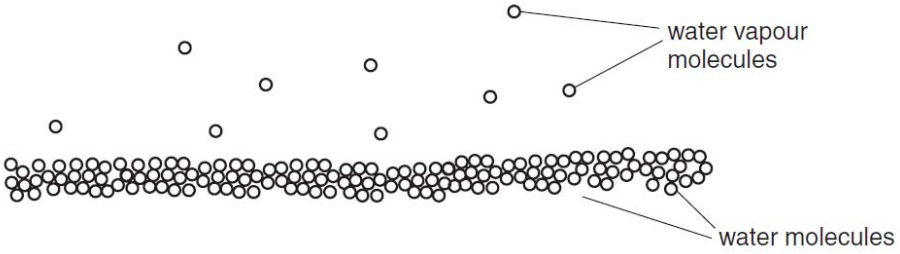


Fig 13.3

(i) What is the name of the process seen in **Fig 13.3**?

…….. [1]

(ii) What effect does this process named in **(b)(i)** have on the temperature of the water?

……

…….. [1]

(iii) When the temperature is increased, describe and explain any change in the process named in **(b)(i)**.

……

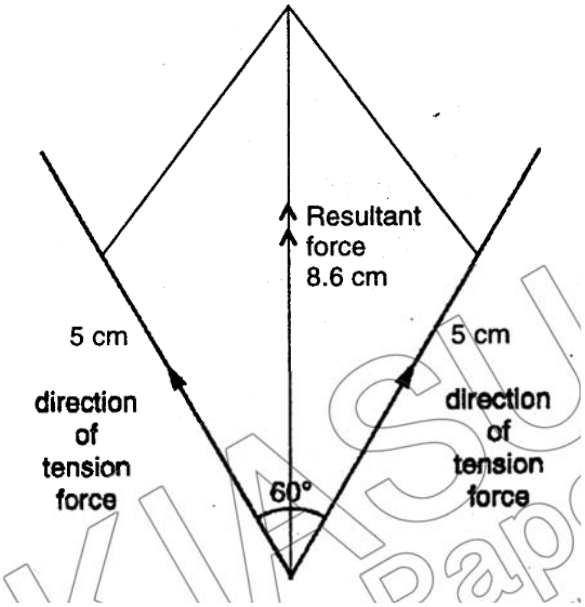
…….. [1]

END OF PAPER

2019 Yuhua 4E/5NA Science Physics Prelimin Paper 1 Answer Scheme

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

2019 Yuhua 4E/5NA Science Physics Prelimin Paper 2 Answer Scheme

1	 Construction of parallelogram [1] Resultant force = 34.4 N [1] Direction of resultant force correctly indicated [1]

2	(a)	The distance from the nail to the pivot is nearer than the distance from the handle to the pivot. [1] By principle of moment, a small force exerted at the handle will create a larger force at the nail. [1]
	(b)	By principle of moments Total clockwise moment = total anti-clockwise moment 6 N x 0.2 m = f x 0.05 m [1] F = 24 N [1]

3	(a)	Ep = mgh = 1 x 10 x 0.1 = 1 J [2]
	(b)	Gain in K.E = Loss in G.P.E = 1 J [1] $1 = ½ mv^2$ $2 = v^2$, v = 1.414 = **1.41 m/s** [1]
	(c)	Some of the energy is converted to thermal energy. [1] The remaining of the energy is converted to GPE at B. [1]

4	(a)	This is because cold air in the frozen food storage is denser and will remain at the bottom [1] while hot air in the cooking compartment is less dense and will remain at the top in the cooking compartment / will not sink to the storage space [1]
	(b)	There should be an insulating material between the cooking compartment and storage space. This would reduce thermal energy transfer by conduction. OR The exterior of the cooking compartment should be light-coloured to reduce the loss of thermal energy by radiation.[1]
	(c)	The exterior should be painted in white. [1] The white exterior is a bad absorber, so heat gain from the hot oven is reduced. [1]

5	(a)	Imaginary line joining up points with the same phase of neighbouring transverse waves together. [1]	
	(b)	(i)	0.15 / 5 = 0.03 m [1]
		(ii)	s = D / t = 0.15 /5 = 0.03 m/s [1]
		(iii)	f = v /λ = 0.03 / 0.03 = 1 Hz [1]

6	(a)	Two correct rays [1] Draws correct image from two rays.[1]
	(b)	Real, inverted and magnified [1]
	(c)	Projector or photographer enlarger [1]

7	(a)	Positive charges [1]	
	(b)	As the base of the thunder clouds are filled with negatively charged particles, the electrons / negatively charged particles in the copper strip will move from the tip to earth [1] since like charges repel [1].	
	(c)	(i)	Q = It = 10 000 x 0.0002 = 2 C [1]
		(ii)	W =VQ = 4.0 x 106 x 2 OR 4.0 x 2 [1] = 8.0×10^6 J [1]

8	(a)	Current = 2 + 2 = 4 A [1]
	(b)	Resistance of each lamp = $\frac{12}{2}$ [1] = 6 Ω [1]
	(c)	$\frac{1}{R_{total}} = \frac{1}{6} + \frac{1}{6}$ [1] R_{total} = 3Ω [1]

9	(a)	The earth wire touches the metal plate of the iron. [1]	
	(b)	(i)	use of I = P/V = 1500/240 = 6.25 A [1]
		(ii)	use of E = Pt

			= 1.5 x 10 = 15 kWh [1] use of Cost = E x unit cost = 15 x 15 = 225 ¢ or $2.25 [1] allow e.c.f for cost, if working shown

10	(a)	When the current is switched on, the iron core becomes an electromagnet. By applying the right-hand grip rule, we find that the right side of the iron core becomes the N-pole of the electromagnet. [1] As like poles repel, the permanent magnet moves away from the iron core. [1]
	(b)	When the current is switched on, the iron core still becomes an electromagnet with the right side as the N-pole. Due to the magnetic field created by the electromagnet, the iron rod becomes an induced magnet with the left side of the iron rod becoming an induced S-pole.[1] As unlike poles attract, the iron rod will be attracted to the iron core.[1]

11	(a)		Straight line graph with a positive slope from (0,0) to (20,30).[1] Horizontal graph from (20,30) to (50,30). [1] Straight line graph and going downhill from (50,30) to (60,0). [1]
	(b)		Rate of change of velocity is constant OR Change of velocity per unit time is constant [1]
	(c)	(i)	acceleration = (v-u)/t = (30 ms^{-1} – 0 ms^{-1}) /20s [1] = 1.5 ms^{-2} [1]
		(ii)	Area under speed-time graph = total distance = ½ (30 + 60)(30) m [1] = 1350 m (allow e.c.f if wrong graph is plotted) [1]
	(d)		Train has higher inertia due to larger mass. [1] Braking distance of train increases. [1]

12	(a)	(i)	n = sin i / sin r
			= sin 20 / sin 13 [1]
			= 1.52 [1]
		(ii)	n = sin i / sin r
			1.52 = sin 35 / sin X [1]
			X = 22.2˚ [1]
		(iii)	n = 1 / sin c
			c = $\sin^{-1}$ (1 / 1.52) [1]
			c = 41.1˚
		(iv)	light makes an incidence angle greater than the critical angle in the optically denser medium [1] Light undergoes total internal reflection where angle of incidence is equal to the angle of reflection [1]
	(b)		Rays 2 and 3 bend away from the normal as they pass from glass into air. Rays 2 and 3 travel in air (optically less dense medium) faster thus they bend away from the normal. [1] Ray 1 does not bend because its angle of incidence is zero.[1]

13	(a)	(i)	1m for flat part of curve at 52°C 1m for flat part of curve at 25°C Minus one mark if there is any point that is incorrectly plotted.
		(ii)	At 60°C, solidification occurs. There is no change in temperature as the energy released is used to form/strengthen the intermolecular bonds.[1] The temperature of the substance does not go below 30°C, as it has reached thermal equilibrium with the room.[1]
		(iii)	The particles are initially slipping and sliding over each other and then starts to vibrate about a fixed position.[1] The arrangement of the particles are initially disorderly, and then become in an orderly arrangement.[1]
		(iv)	Thermal / Kinetic / Internal energy [1]
	(b)	(i)	Evaporation [1]
		(ii)	The temperature decreases as a result of evaporation, as the more energetic molecules escape, leaving the less energetic molecules behind.[1]
		(iii)	Rate of evaporation increases. There are more particles with sufficient energy to escape the surface of the liquid.[1]