Name	Class				Index Number		

BROADRICK SECONDARY SCHOOL
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)
PRELIMINARY EXAMINATION 2021

SCIENCE (PHYSICS/CHEMISTRY) 5076/01

Paper 1 Multiple Choice September 2021

Additional Materials: Multiple Choice Answer Sheet 1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, index number and class on the OTAS answer sheet.

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

Setter: Mr Foo (Physics) and Mr Liang (Chemistry)

This question paper consists of **X** printed pages including this page.

[Turn over

1 Ahmad wishes to calculate the area of a bathroom tile so that he can estimate the amount of adhesive that he needs to buy.

What must he use?

A a ruler only

B a measuring cylinder only

C a measuring cylinder and a clock only

D a measuring cylinder and a ruler only

2 An inventor makes a clock using a brass rod and a heavy mass as a pendulum.

What happens when the clock is colder?

A The pendulum would shorten and the clock would go faster.

B The pendulum would lengthen and the clock would go faster.

C The pendulum would shorten and the clock would go slower.

D The pendulum would lengthen and the clock would go slower.

3 A car decelerates uniformly from 20 m / s to 0 m / s in a time interval of 2.0 s.

What are its acceleration and the distance travelled during this time interval?

	Acceleration / m / s^2	Distance / m
A	10	20
B	10	40
C	-10	20
D	-10	40

4 A block of mass 5 kg is pushed along a road with a force of 30 N.
The frictional force is 10 N.

What is the acceleration of the block?

A 2.0 m / s^2

B 4.0 m / s^2

C 6.0 m / s^2

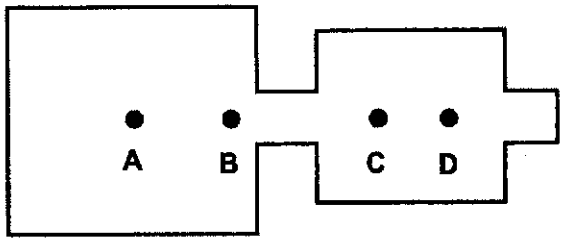
D 8.0 m / s^2

5 How does the mass and weight of a satellite in orbit around the Earth change compared to when the satellite is on Earth before launch?

	Mass in orbit	Weight in orbit
A	unchanged	unchanged
B	unchanged	lesser than on Earth
C	lesser than on Earth	unchanged
D	lesser than on Earth	lesser than on Earth

6 Below is a lamina of uniform thickness.

Where is its centre of gravity most likely to be?



7 The wind pressure acting on the face of a wall is 150 Pa.
The dimensions of the wall are 20 cm by 30 cm.

What is the total force applied by the wind on the wall?

A 0.25 N

B 9 N

C 2 500 N

D 90 000 N

8 A tennis ball is dropped onto a horizontal surface. As the ball bounces up and down, the height of each bounce gradually decreases.

What happens during the motion of the ball?

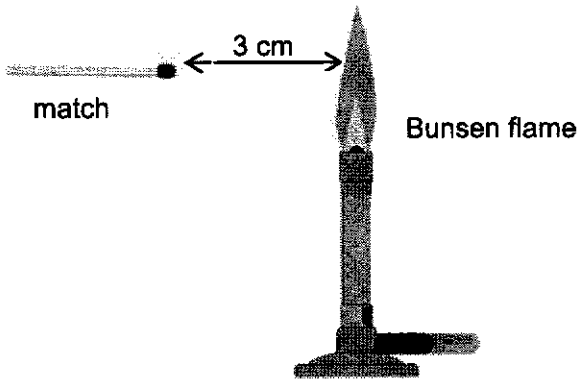
A The kinetic energy of the ball is constant.

B The potential energy of the ball is constant.

C The sum of the kinetic and potential energies of the ball is constant.

D The total energy of the ball, ground and air is constant.

9 A match is held 3.0 cm from a Bunsen flame as shown in the diagram below. The match burst into flame after some time.



What is the main heat transfer that causes the match to burst into flame?

A The match is heated by conduction and convection.

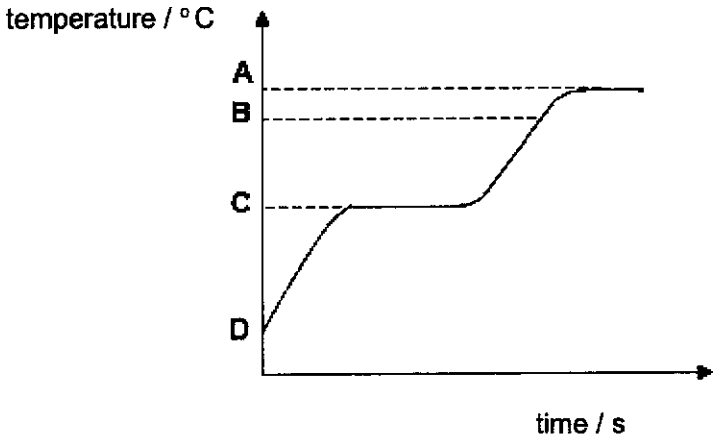
B The match is heated by conduction and radiation.

C The match is heated by conduction.

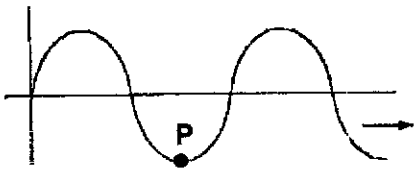
D The match is heated by radiation.

10 Some ice cubes are taken from a deep-freeze and placed in a metal container. The container is heated at a steady rate and the temperature / time readings are taken. The results are recorded on a graph.

Which temperature corresponds to 0 °C?



11 The transverse wave shown below is moving from left to right. At a certain instant, particle **P** of the wave is 2.0 cm away from the source at the trough of the wave.



What is the position of particle **P** after a time lapse of one period?

A At its present position.

B A distance of one amplitude vertically upward from its present position.

C A distance of one wavelength horizontally to the left from its present position.

D A distance of one wavelength horizontally to the right from its present position.

12 An object projected across a thin converging lens forms an image on the opposite side of the lens.

Which of the following statements about the image formed by the thin converging lens is true?

A It is real and upright.

B It is real and inverted.

C It is diminished and virtual.

D It is magnified and upright.

13 During a routine medical examination of a pregnant woman, a scanner is used to monitor the development of her baby.

What do such scanners use to detect the baby?

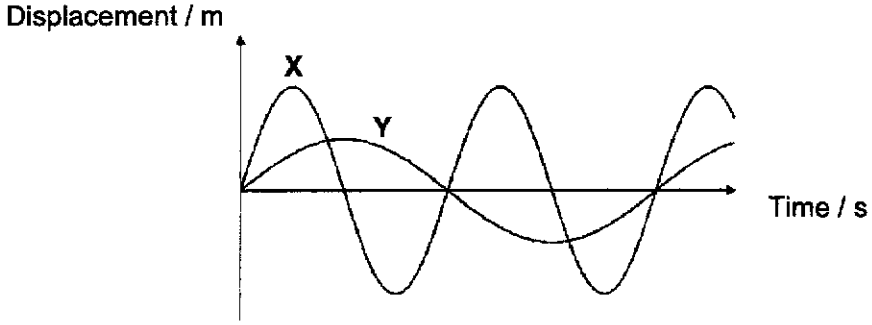
A gamma rays

B infrared waves

C ultrasound waves

D X-rays

14 A musician produces two musical notes. The waveforms of the two notes are shown in the diagram below.



Which of the following statements about **X** and **Y** is true?

A **X** is softer than **Y**.

B **X** and **Y** have the same frequency.

C **X** and **Y** have the same speed.

D **Y** has a higher pitch than **X**.

15 Stanley holds a rod in one hand and rubs the rod with a thin sheet of material held in his other hand. Both the rod and the thin sheet become charged and remain charged.

From what could the rod and the thin sheet be made of?

	rod	thin sheet
A	copper	silk cloth
B	glass	aluminium foil
C	iron	paper handkerchief
D	nylon	woolen duster

16 A positively charged object attracts a suspended light conducting ball.

Which of the following show(s) the possible charge on the light conducting ball?

1 negatively charged
2 neutral
3 positively charged

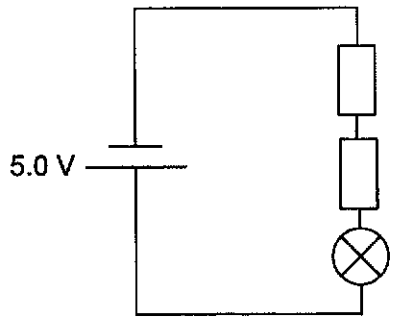
A **1** only

B **3** only

C **1** and **2** only

D **2** and **3** only

17 A 5.0 V dry cell is connected in series with two identical resistors and a lamp as shown in the diagram below.



If the potential difference across the lamp is 1.0 V, what is the potential difference across each of the resistors?

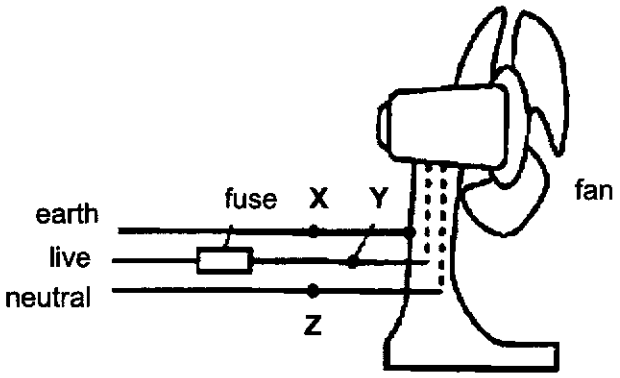
A 2.0 V **B** 4.0 V **C** 5.0 V **D** 6.0 V

18 A constant voltage source is connected to a resistor which has a current *X* through it. Two more identical resistors are then added in series with the first.

What is the current now?

A 0.25*X* **B** 0.33*X* **C** *X* **D** 3*X*

19 The diagram below shows the simple circuit of an electric fan.



Which of the following actions will blow the fuse?

1 Point **X** touches point **Y**.
2 Point **Y** touches point **Z**.
3 Point **X** touches point **Z**.

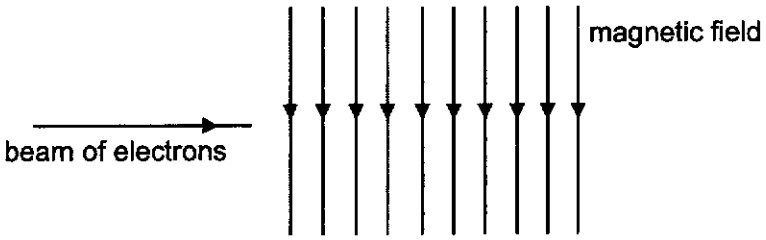
A **1** and **2** only

B **2** and **3** only

C **1** and **3** only

D **1**, **2** and **3**

20 A beam of electrons enters a magnetic field as shown below.



What is the effect of the magnetic field on the electrons?

A They deflect downwards.

B They deflect upwards.

C They deflect perpendicularly into the paper.

D They deflect perpendicularly out of the paper.

[Turn over

Name	Class				Index Number		

BROADRICK SECONDARY SCHOOL
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)
SECONDARY 4 NORMAL (ACADEMIC) SBB
PRELIMINARY EXAMINATION 2021

SCIENCE (PHYSICS) 5076/02

Paper 2 August 2021

Candidates answer on the Question Paper 1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST
Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid. If working is needed for any question it must be shown with the answer. Omission of essential working will result in loss of marks. Calculators should be used where appropriate.

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.
[Take g to be 10 m / s^2 or the weight of 1 kg to be 10 N]

For Examiner's Use
65

This question paper consists of **15** printed pages including this page.

[Turn over

Setter: Mr Foo SK

Section A (45 Marks)

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

1 **(a)** A motorcycle is driven along a straight road. **Fig. 1.1** shows a speed/time graph for the motion of the motorcycle from the time the rider sees a car approaching and gradually slows down.

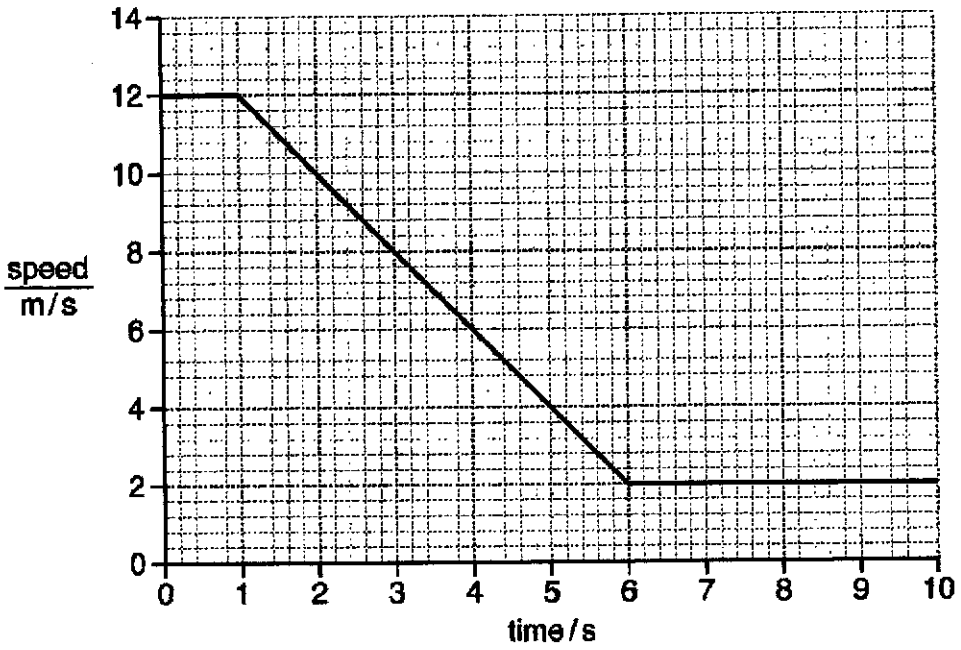


Fig. 1.1

(i) State the speed at which the rider was travelling before he slowed down.

speed = ... m / s [1]

(ii) State whether the motorcycle stopped during the period of ten seconds shown in **Fig. 1.1**.

Explain your answer.

.....

..... [2]

(b) As the motorcycle drives along, the temperature of the air in the tyres increases.

By referring to the motion of molecules in air, explain why this results in an increased tyre pressure.

.....

.....

.....

..... [3]

2 **(a)** A light vertical triangular piece of rigid plastic **PQR** is pivoted at corner **P**. A horizontal 5 N force acts at **Q**, as shown in **Fig. 2.1**.

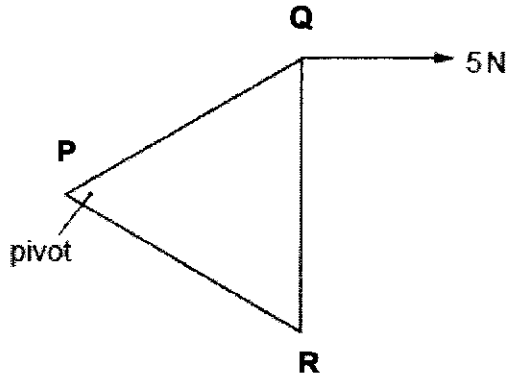


Fig. 2.1

Describe what, if anything, will happen to the piece of plastic when the force is removed.

.....

..... [2]

(b) Then, an additional horizontal 5 N force acts at **R**, as shown in **Fig. 2.2**.

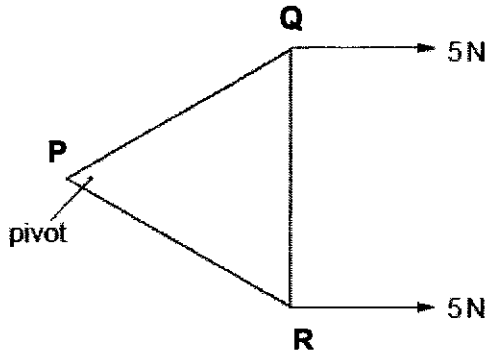


Fig. 2.2

(i) Describe what, if anything, will happen to the piece of plastic now.

..... [1]

(ii) On **Fig. 2.2**, mark the force that the pivot exerts on the piece of plastic. Show the direction of the force by means of an arrow and write the magnitude of the force next to the arrow. [3]

3 **Fig. 3.1** shows an immersion heater placed into some crushed ice at 0 °C. The immersion heater is then switched on.

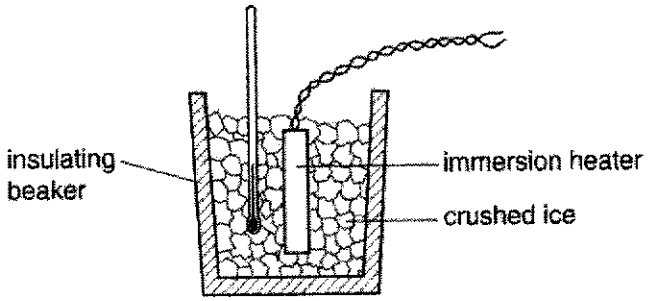


Fig. 3.1

(a) Describe the main process by which thermal energy is transferred from the immersion heater to the crushed ice and throughout the crushed ice.

.....

.....

.....

.....

..... [2]

(b) Suggest a suitable material for the insulating beaker so that most of the energy from the heater is transferred to the crushed ice. Explain your choice.

.....

.....

..... [2]

4 Most of the radiation from the sun reaches the earth in the form of light rays, which have a wavelength of 400 to 700 nm. However, other electromagnetic waves, which have a wavelength slightly shorter than 400 nm, and slightly longer than 700 nm are also emitted by the sun and reaches the earth.

(a) State the two other components of the electromagnetic spectrum that are emitted by the sun.

(1) .....

(2) ..... [1]

(b) Calculate the frequency of a 400 nm light ray from the sun.

frequency = ... Hz [3]

5 **Fig. 5.1** shows a student standing midway between a bell tower and a steep mountainside.

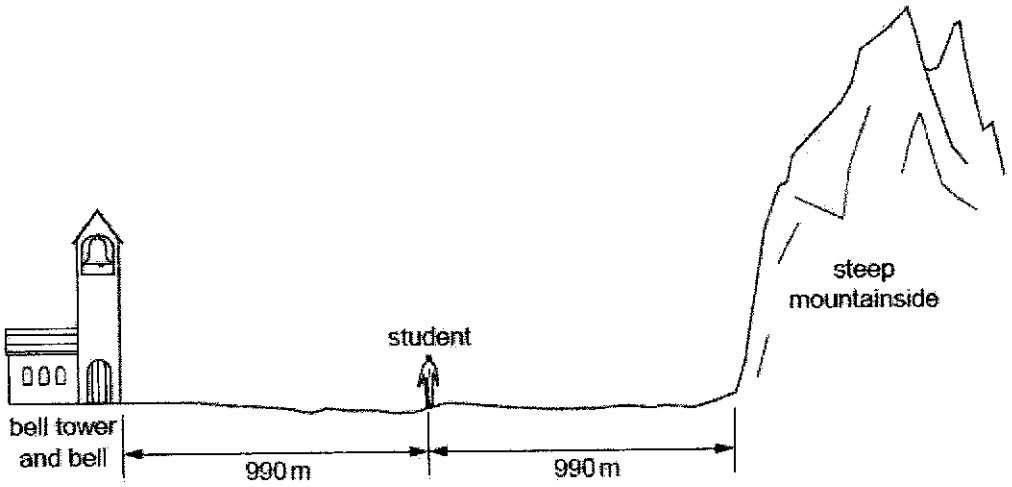


Fig. 5.1

The bell rings once, but the student hears two rings separated by a short time interval.

(a) Explain why the student hears two rings.

.....

..... [2]

(b) State which of the sounds is louder, and explain why.

.....

..... [2]

(c) Sound in that region travels at 330 m / s.

(i) Calculate the time interval between the bell ringing and the student hearing it for the **first** time.

time interval = ... s [1]

(ii) Calculate the time interval between the bell ringing and the student hearing it for the **second** time.

time interval = ... s [2]

(iii) Calculate the time interval between the two rings.

time interval = ... s [1]

6 **Fig. 6.1** shows two conducting balls hung from insulating threads.
Ball **X** is positively charged while ball **Y** is negatively charged.

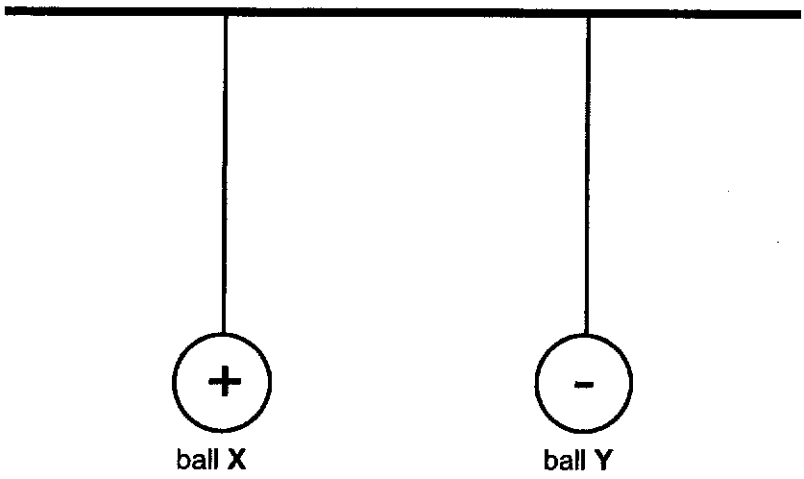


Fig. 6.1

(a) Describe what happens when ball **X** is brought near to ball **Y** without touching.
Explain your answer.

.....

.....

.....

..... [2]

(b) On **Fig. 6.1**, draw the electric field between ball **X** and ball **Y**. [2]

7 (a) A warning on the packaging of a light switch purchased from an electrical store reads

> **SAFETY WARNING**
>
> This push-button switch is not suitable for use in a washroom. Lights in washrooms should be operated by pull-cord switches.

(i) Explain why it might be dangerous to use a push-button switch in a washroom.

.....

.....

..... [2]

(ii) Explain why it is safe to use a pull-cord switch in a washroom.

.....

..... [1]

(b) An electric heater, sold in the electrical store, has a current of 8 A when it is working normally. The cable fitted to the heater has a maximum safe current of 12 A.

State a suitable fuse rating, 10 A or 13 A, for the electric heater.
Explain your answer.

.....

.....

..... [2]

(c) The cable for connecting an electric cooker is much thicker than the cable on a table lamp.

(i) Explain why cookers need a much thicker cable.

.....

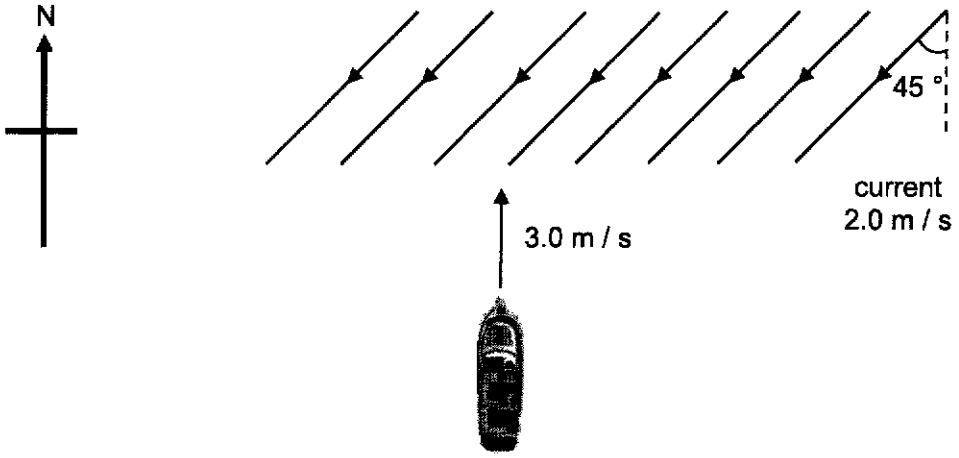
..... [1]

(ii) State what would happen if a thin cable were used for wiring a cooker to the supply.

.....

..... [1]

8 **(a)** A motor boat travels due north at a steady speed of 3.0 m/s through calm water in which there is no current. The boat then enters an area of water in which a steady current flows at 2.0 m/s in a south-west direction as shown in the diagram below. Both the engine and the course setting of the boat remains unchanged.



Using a scale of 2 cm : 1 m / s, draw a vector diagram to show the velocity of the boat and the velocity of the current. Use the diagram to find

(i) the magnitude of the resultant velocity of the boat,

(ii) the angle between due north and the resultant direction of travel.

magnitude = ...

angle = ... [4]

(b) **Fig. 8.1** shows part of the motor of the boat. Two ends, end **X** and end **Y**, of a soft iron core are each wrapped by a coil of wire. The wire is connected to a battery. A bar magnet is placed in between the two ends.

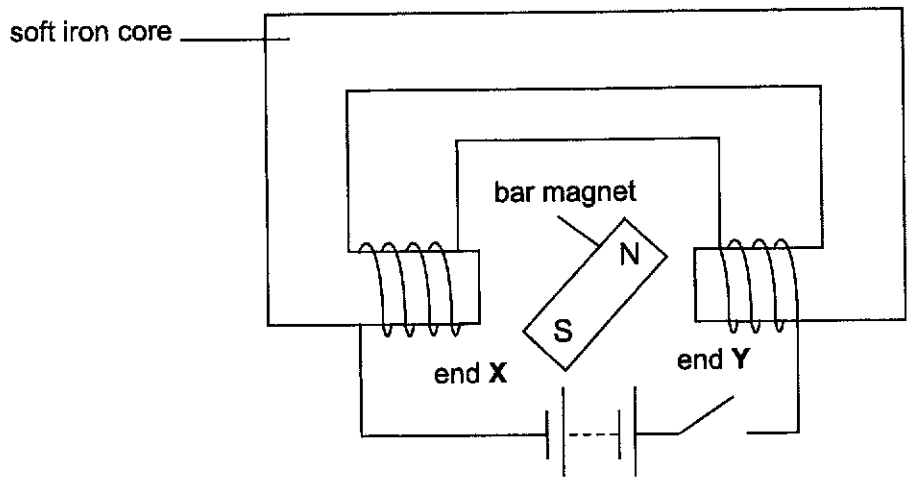


Fig. 8.1

The current is switched on.

(i) State the polarity of the iron core at

end **X** :.....

end **Y** :..... [1]

(ii) State one difference between soft iron and steel.

.....

..... [1]

Section B (20 Marks)
Answer any **two** questions from this section.

Write your answers in the spaces provided.

9 **Fig. 9.1** shows a small ball bearing rolling down a smooth hemispherical bowl. The ball bearing has a mass of 0.045 kg.

The ball bearing was released from rest from **X**.

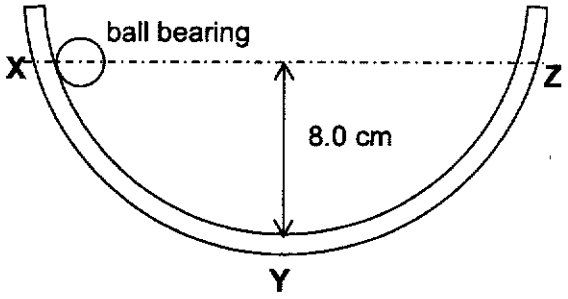


Fig. 9.1

(a) State the Principle of Conservation of Energy.

.....

.....

..... [2]

(b) Calculate the loss in gravitational potential energy as the ball bearing rolls from **X** to **Y**.

loss in gravitational potential energy = ... [2]

(c) Calculate the power of the ball bearing if it takes 0.50 s to move from **X** to **Y**.

power = ... [2]

[Turn over

(d) Calculate the speed of the ball bearing when it is at **Y**.

speed = ... [2]

(e) Explain why the ball bearing is not able to reach point **Z** if the bowl is not smooth.

.....

..... [2]

10 (a) **Fig. 10.1** shows parallel rays of light passing through a piece of glass acting as a lens and being focused on the ground.

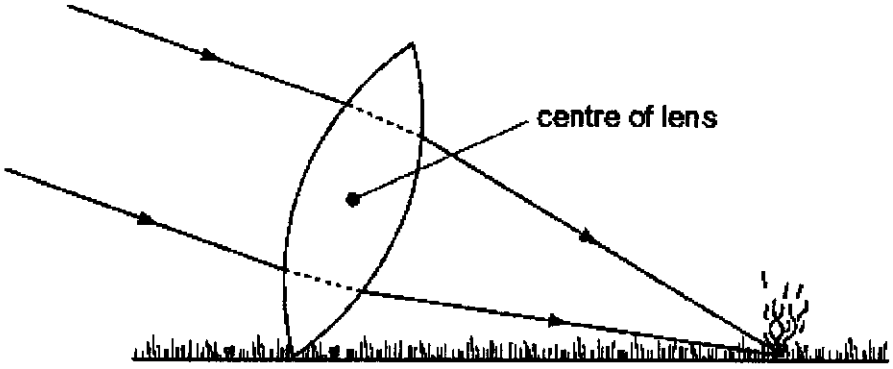


Fig. 10.1

(i) On **Fig. 10.1**, use the letter **P** to label the principal focus of the piece of glass. [1]

(ii) Measure the focal length of the piece of glass in **Fig. 10.1**.

..... [1]

(iii) The glass acting as a lens produces a real image of the Sun.
Explain what is meant by the term real image.

..... [1]

(b) The mass of the piece of glass is 0.01 kg and the volume is 4 cm^3.
Calculate the density of the glass.

density = ... [2]

(c) (i) Light is able to travel down optical fibres by total internal reflection. The material used for the optical fibre has a refractive index of 1.56.

Complete **Fig. 10.2** to show how the ray of light passes down the optical fibre. [2]

Fig. 10.2 Diagram not drawn to scale.

(ii) Estimate the angle of incidence in **Fig. 10.2**. Justify your answer.

.....

.....

..... [3]

11 (a) (i) In the space below, draw a diagram of the circuit that you would use to determine the resistance of a coil of wire using a voltmeter and an ammeter.

Use conventional symbols and label the coil clearly. [3]

(ii) State the equation you would use to calculate the resistance of the coil.

..... [1]

(iii) State two properties of the wire on which the resistance of the coil depends.

(1) .....

(2) ..... [2]

(b) In **Fig. 11.1**, **AB** is a 2.0 m length of uniform resistance wire, connected into a circuit. Ignore the resistance of the battery.

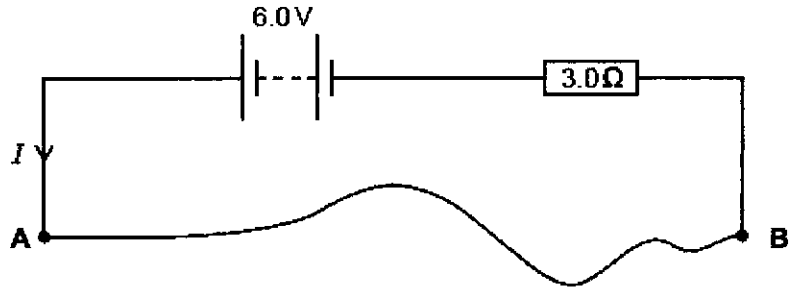


Fig. 11.1

The current I is 1.5 A.
Calculate the resistance per metre of the resistance wire.

resistance per metre = ... [4]

----- End of Paper -----

Paper 1

1.	A
2.	A
3.	C
4.	B
5.	B
6.	B
7.	B
8.	D
9.	D
10.	C

11.	A
12.	B
13.	C
14.	C
15.	D
16.	C
17.	A
18.	B
19.	A
20.	D

Paper 2 Section A (45 Marks)

1 **(a)** **(i)** 12 m / s [1]

(ii) no [1]
speed never drops to x-axis (0) [1]

(b) as temperature increases
kinetic energy / velocity of molecules increases;
increased force / energy of collisions;
increased frequency of collisions;
collisions with walls of tyre [any 3] [3]

2 **(a)** it turns / rotates [1]
clockwise [1]

(b) **(i)** stationary / nothing [1]

(ii) horizontal arrow from pivot [1]
Direction to left [1]
10 N [1]

3 **(a)** The immersion heater will transfer thermal energy to the ice it is in contact with by conduction. [1]
The heated ice molecules vibrate faster as it gains internal kinetic energy. [1]
They then collide with the neighbouring molecules and transfer energy in the process.

(b) The suitable material is glass / plastic / foam [1]
because it is a poor conductor of heat.
Hence it can reduce the rate of energy loss through conduction. [1]

4 **(a)** **(1)** Infrared
(2) Ultraviolet rays [1]

(b) 400 nm = 400×10^{-9} m conversion [1]
$v = f\lambda$
$f = v / \lambda = (3.0 \times 10^{8}) / (400 \times 10^{-9})$ working [1]
$= 7.5 \times 10^{14}$ Hz answer [1]

5	(a)		one sound direct one sound after reflection/echo	[1] [1]
	(b)		first second one suffers absorption, dispersion / energy is lost when sound is reflected as echo	[1] [1]
	(c)	(i)	distance = speed x time time to hear 1st sound = 990/330 or 3 s	[1]
		(ii)	time to hear 2nd sound = (3 × 330)/330 = 9 s	[1] [1]
		(iii)	interval = 6 s	[1]
6	(a)		Ball **X** and **Y** will be attracted to each other. Unlike charges attract (or similar idea).	[1] [1]
	(b)		correct field pattern and direction of arrow from **X** to **Y**.	[1] [1]
7	(a)	(i)	water conducts/water lowers resistance could get an electric shock	[1] [1]
		(ii)	idea of cord insulating user from electricity OR cord not a conductor OR idea of separates user from the electrics / live parts	[1]
	(b)		10 A fuse, 13 A too high max safe current is 12 A.	[1] [1]
	(c)	(i)	large(r) current (reject: more electricity)	[1]
		(ii)	insulation / cable would overheat / melt (reject: cause fire, blow up, damaged, fuse blows)	[1]
8	(a)		diagram Magnitude = 2.1 ± 0.1 m/s Angle = 42 ± 1°	[2] [1] [1]
	(b)	(i)	End **X**: South End **Y**: North	[1] [1]
		(II)	Soft iron can be easily magnetized while steel is difficult to magnetize. Soft iron can be easily demagnetized while steel is difficult to demagnetize. (any reasonable difference)	[1]

Section B (20 Marks)

9 **(a)** Energy cannot be created or destroyed, but only changes from one form to another. [1]
Total amount of energy in a system remains constant. [1]

(b) GPE = mgh = 0.045 x 10 x 0.08 [1]
= 0.036 J [1]

(c) Power = E / t = 0.036 / 0.50 [1]
= 0.072 W [1]

(d) KE = 0.5 x 0.045 x v^2 = 0.036 [1]
v = 1.2649 = 1.26 m / s [1]

(e) Some energy will be **converted to other forms of energy** [1]
such as heat and sound **due to friction**. [1]

10 **(a)** **(i)** labelled where rays meet [1]

(ii) 62.0 mm – 64.0 mm [1]

(iii) an image which can be projected onto a screen [1]

(b) density = mass / volume
= 10 / 4 = 2.5 g / cm^3 [2]

(c) **(i)** ray continued as series of straight lines
angles approximately correct [2]

(ii) Any angle >39.9 deg but less than 70 deg [1]
n = 1 / sin c ➔ c = 39.9 ° [1]
TIR occur when angle of incidence is greater than critical angle. [1]

11 **(a)** **(i)** accept any recognisable symbols
battery/cell, ammeter, coil in series (ignore any switch or rheostat) [1]
voltmeter clearly in parallel with coil [1]
standard symbols used for battery/cell, voltmeter and ammeter [1]

(ii) R = V/I in any form [1]

(iii) length (of wire)
diameter/cross-section/area (of wire)
resistivity/type of material
temperature
(any 2) [2]

(b) total resistance = 6 / 1.5 = 4 Ω [1]
Resistance of AB = 4 – 3 = 1 Ω [1]
Resistance per metre = 1 / 2 = 0.5 [1]
Ω/m [1]

OR

p.d. across 3Ω = 1.5 x 3 = 4.5 V
p.d. across AB = 6.0 – 4.5 = 1.5 V [1]
Resistance of AB = 1.5 / 1.5 = 1 Ω [1]
Resistance per metre = 1 / 2 = 0.5 [1]
Ω/m [1]

End of Paper