



SERANGOON GARDEN SECONDARY SCHOOL

PRELIMINARY EXAMINATION

CANDIDATE
NAME

CLASS

INDEX
NUMBER

SCIENCE(PHYSICS)

5105/02

5 August 2022

Secondary 4 Normal(Academic)

Papers 1 and 2: 1 hour 15 minutes

1100 - 1215

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class register number and class on the Answer Sheet in the spaces provided unless this has been done for you.

Answer all questions in Section A and any **two** questions in Section B.

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

In calculations, you should show all the steps in your working, giving your answer at each stage.

You are advised to spend no more than **30 minutes** on **Paper 1**.

You may proceed to answer Paper 2 as soon as you have completed Paper 1.

At the end of the examination hand in your answers to Paper 1 and Paper 2 separately.

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

For Examiner's Use	
A	14
B	16
Total	30

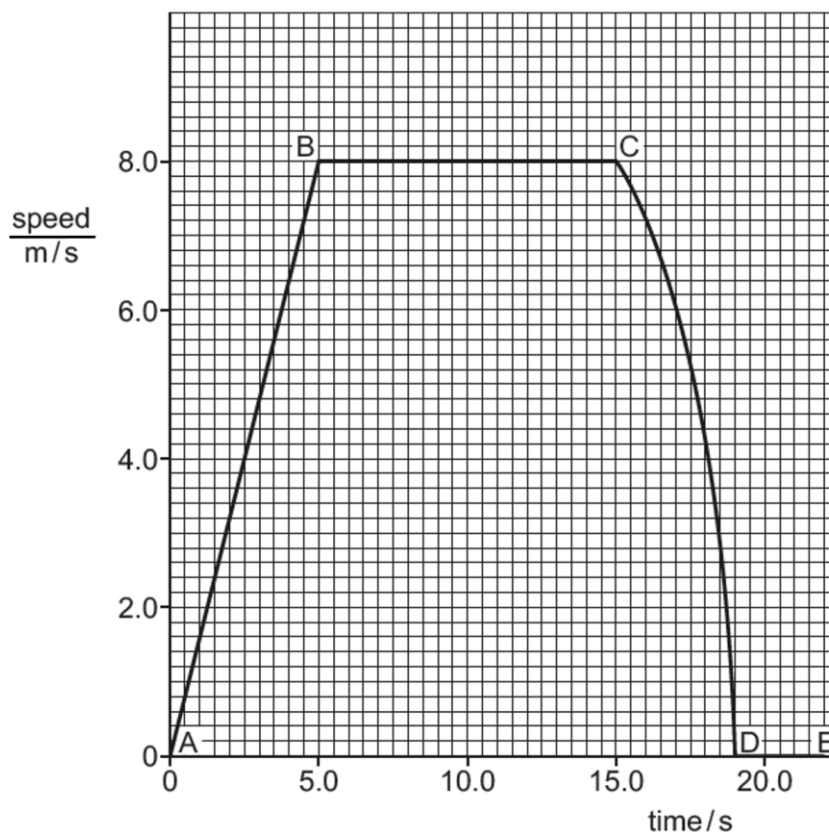
This question paper consists of **11** printed pages and **1** blank page.

BLANK PAGE

Section A

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

- 1 A student does some running exercises. The diagram below shows the speed-time graph for one exercise.



- (a) Determine the speed of the student:

- (i) when the time is 2.5 s

speed = m/s [1]

- (ii) when the student is moving with a constant speed.

speed = m/s [1]

- (b) Describe how the speed of student changes in section CD.

..... [1]

- (c) Determine the distance travelled by the student in section AB.

distance travelled = m [2]

- 2 In countries with winters that have heavy snowfall, a thin layer of ice often forms on the roads. For safety, drivers are required to put on snow chains onto their tires. An example of this is shown in the following diagram.

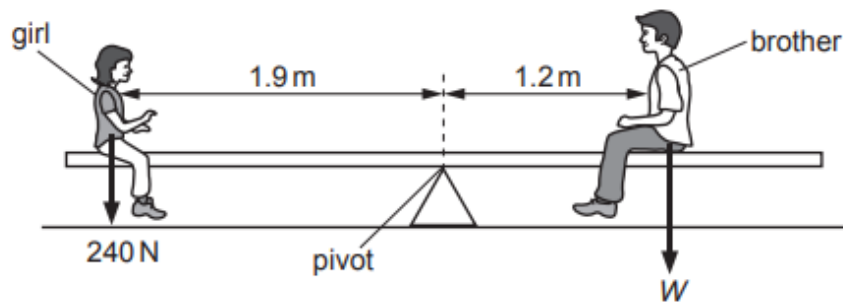


Explain how the snow chains help prevent the tires from slipping when travelling over the thin layers of ice on the roads.

.....

 [2]

- 3 A girl and her brother sit on opposite sides of a see-saw as shown in the diagram.



The see-saw is balanced horizontally.

Calculate the weight W of the brother.

$W = \dots\dots\dots$ N [2]

- 4** A 5.0 kg bag is dropped a vertical distance of 1.2 m onto the floor by a student. The effects of air resistance should be ignored.

(a) Calculate the change in gravitational potential energy of the bag.

Use $g = 10 \text{ N/kg}$ in your calculations.

change in the gravitational potential energy = J [2]

(b) How much kinetic energy does the bag have just as it hits the floor?

kinetic energy = J [1]

(c) Calculate the velocity of the mass just as it hits the floor.

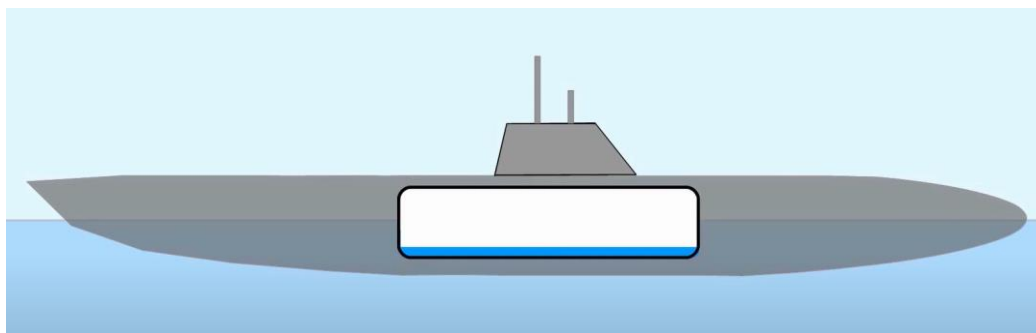
velocity of the bag = m/s [2]

Section B

Answer any **two** questions from this section in the spaces provided.

- 5** Submarines have large tanks which they can fill with either air or water to help them to sink or float.

The diagram shows a picture of a submarine, with a volume of 2400 m^3 .



- (a)** When the water tanks are filled with air, the total mass of the submarine and its contents is $2\,100\,000 \text{ kg}$.

Determine the density of the submarine when its tanks are filled with air.

density = kg/m^3 [1]

- (b)** The tanks of the submarine are then filled with 500 m^3 of water, causing it to sink.

The density of water is 1000 kg/m^3 .

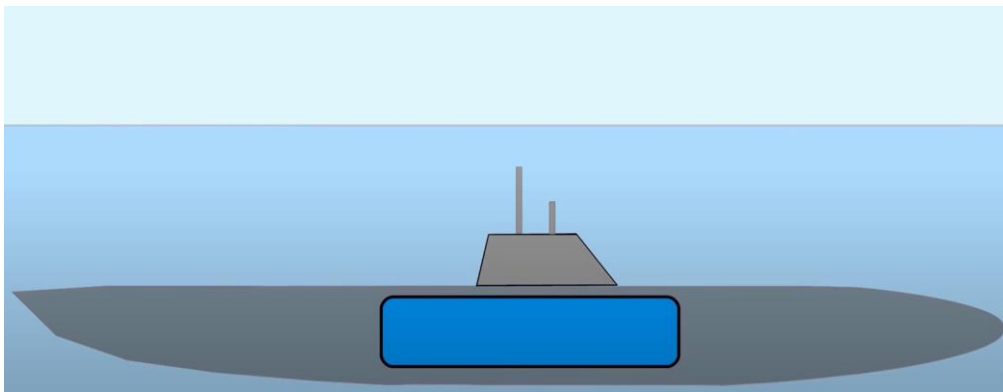
- (i)** Calculate the weight of the submarine with its tanks filled with water.

Use $g = 10 \text{ N/kg}$ in your calculations.

weight = N [3]

- (ii) The submarine sinks vertically at constant speed.

On the following diagram, draw and label **two** arrows to show the main forces acting on the submarine as it is sinking. [1]



- (iii) State what you can conclude about the size of each of these forces as it sinks vertically at constant speed.

.....
 [1]

- (c) Submarines use sound waves to navigate under water.

- (i) What type of wave is a sound wave?

..... [1]

- (ii) The sound waves travel faster under water than in the air above water. Explain why.

.....
 [1]

- 6 The diagram shows an electric travel mug that is used in a car to heat water.



The mug is plugged in and switched on. Energy present in the car battery is transferred to the water.

- (a) State the overall energy conversion that takes place.

..... [1]

- (b) The heater is placed near the bottom of the mug, so the temperature of the water at the base increases first.

Convection causes the temperature of all the water in the mug to increase.

Describe how convection is produced in the water.

.....

 [2]

- (c) Explain why the manufacturers have made the mug with a smooth silver exterior.

.....

 [2]

- (d) The electromotive force (e.m.f.) of the car's battery is 12 V and the current in the heater in the mug is 15 A.

- (i) Calculate the power of the heater.

power = W [2]

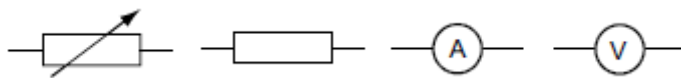
- (ii) Explain whether a 12 A fuse is suitable for the heater circuit.

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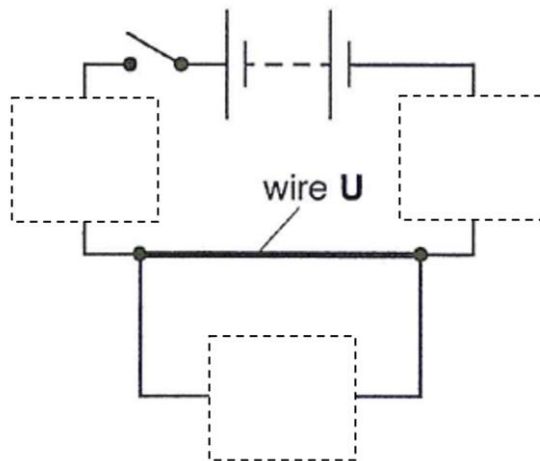
..... [1]

- 7 A student investigates how changing the current flowing through a wire **U** affects the potential difference (p.d.) across it.

The student was provided with the following components represented by these symbols.



- (a) Using only some of these components, complete the student's circuit such that it can be used to carry out the investigation.

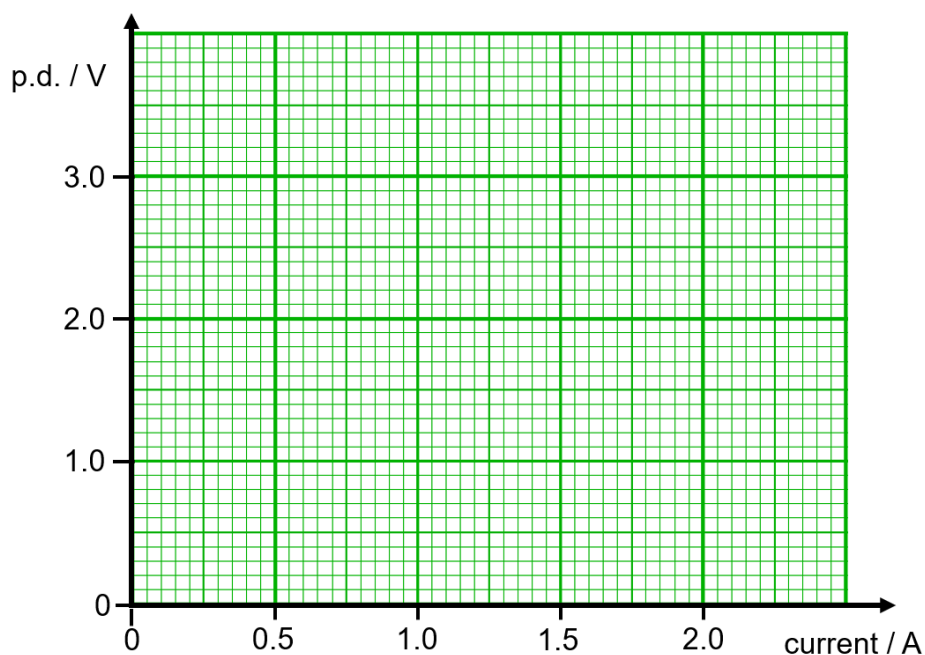


[2]

- (b) The student's table of results is shown.

Current / A	p.d. / V
0.00	0.0
0.25	1.9
0.50	2.6
0.75	2.9
1.00	3.1
1.25	3.2
1.50	3.3
2.00	3.4

- (i) Plot a graph of these results, marking each point with a cross (x). [1]
- (ii) Draw a best-fit curved line, taking into account all the plotted points. [1]



- (iii) The student states that the results show that the resistance of the wire remained constant throughout the experiment.

Explain whether you agree with the student.

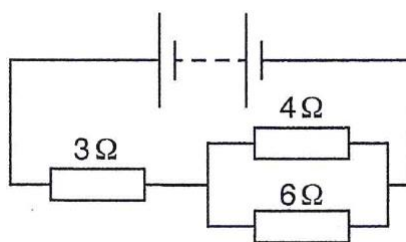
.....

..... [1]

- (iv) Using the data provided, determine the resistance of wire **U** when a current of 2.00 A flows through it.

resistance = Ω [1]

- (c) Calculate the combined resistance of the three resistors shown in the following circuit.



combined resistance = Ω [2]

END OF PAPER