NAME		INDEX NO.		CLASS	

NORTHLAND SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary 4 Normal Academic

SCIENCE (PHYSICS) **5105/02**

Paper 2 Physics **17 August 2022**

Paper 1 and 2: 1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

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 longer 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 is given in brackets [ ] at the end of each question or part question.

Section	For Examiner's Use
A	14
B	16
TOTAL	30

Setter: Mr Lim Yong Liang

Vetter: Mr Aaron Rajoo

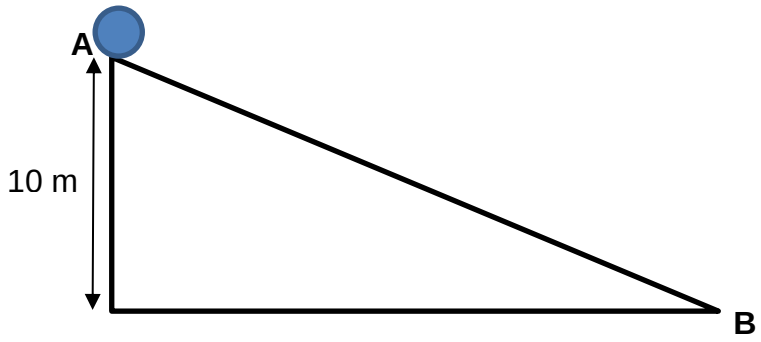
This document consists of **11** printed pages including the cover page and 1 blank page.

[Turn over

Section A

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

1 An object of mass 7 kg is released from rest from the top of a ramp at **A**. The ramp has a smooth surface. The object moves down along the ramp from **A** to **B**.



(a) Calculate the gravitational potential energy of the object at **A**, the top of the ramp.

gravitational potential energy = ……..…. J [1]

(b) Hence, determine the speed of the object at **B**, the bottom of the ramp.

speed = ……..…. m/s [2]

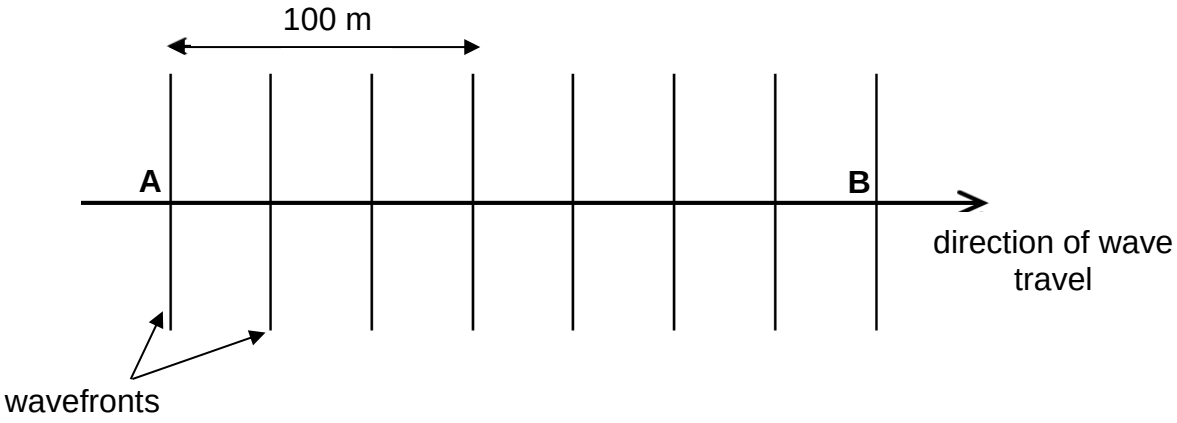
(c) If the same object were to be rolled down a **steeper** slope from height 10 m above the ground, would the object have a higher speed, lower speed or the same speed as the answer in **(b)** when it reaches the bottom of the ramp? Explain your answer.

……

…….. [1]

[Total: 4]

2 The diagram shows successive wavefronts of a water wave. The distance between the first and fourth wavefront is 100 m. The wavefront at **A** takes 49 seconds to reach **B**.



(a) Calculate the wavelength of the wave.

wavelength = …….…. m [1]

(b) Determine the period of a single wave.

period = …….…. s [1]

(c) Hence, calculate the speed of the wave.

speed = …….…. m/s [2]

[Total: 4]

3 Complete the table to compare the differences between the movement and arrangement of the three different states of matter.

	arrangement	movement
solid	*packed closely in an orderly arrangement*	
liquid	*packed closely in a disorderly arrangement*	
gas		*moves rapidly and randomly in all directions*

[2]

[Total: 2]

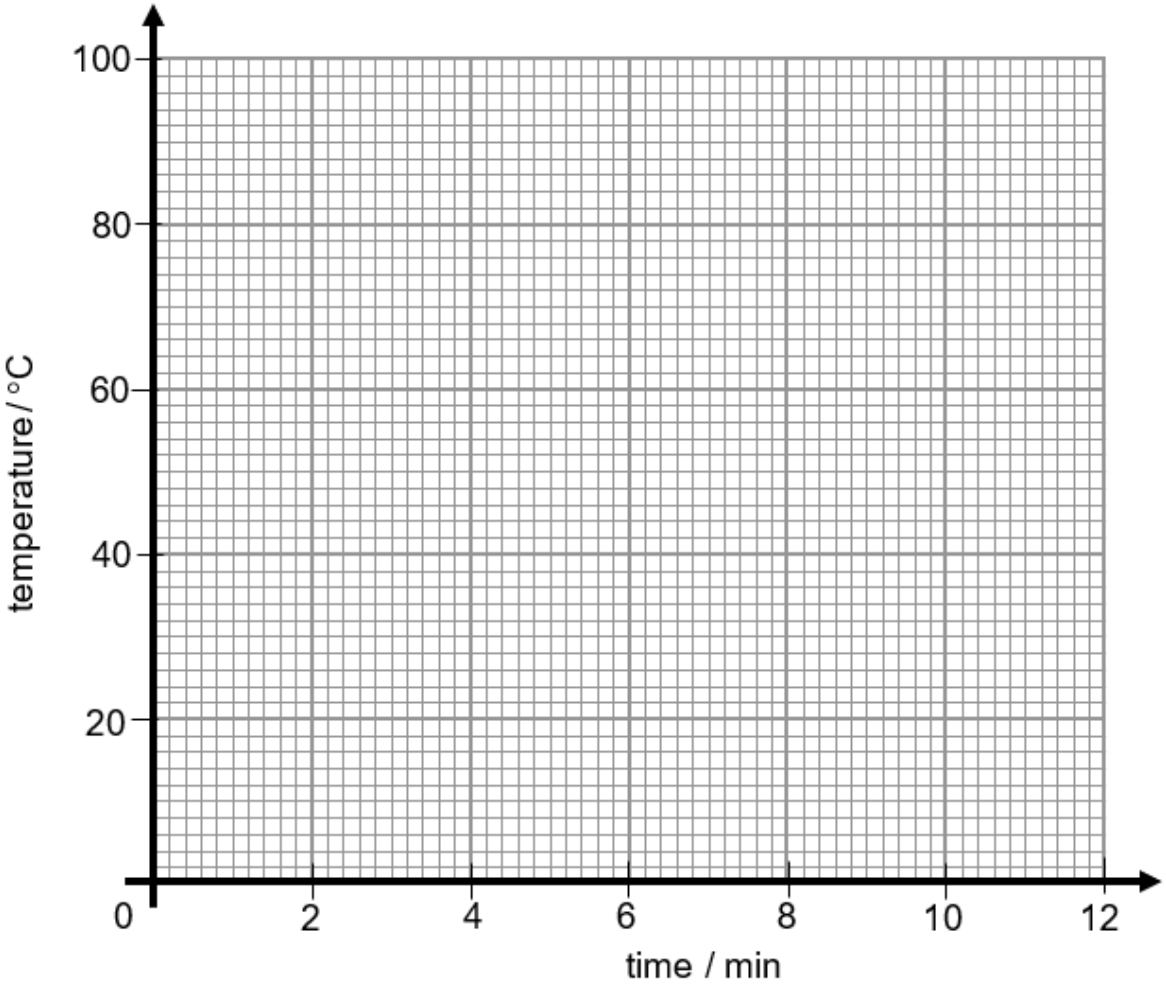
4 A beaker of unknown liquid was heated in the Science laboratory from room temperature.

The temperature of the unknown liquid was recorded every two minutes.

time / min	0	2	4	6	8	10	12
temperature / °C	30	67	78	82	82	82	94

(a) On the grid on page 5, plot a graph of temperature against time. Mark each point with a cross (x). [2]

(b) Draw a curved line of best fit, taking into account all the plotted points. [1]



(c) From the graph or otherwise, determine the boiling point of the liquid.

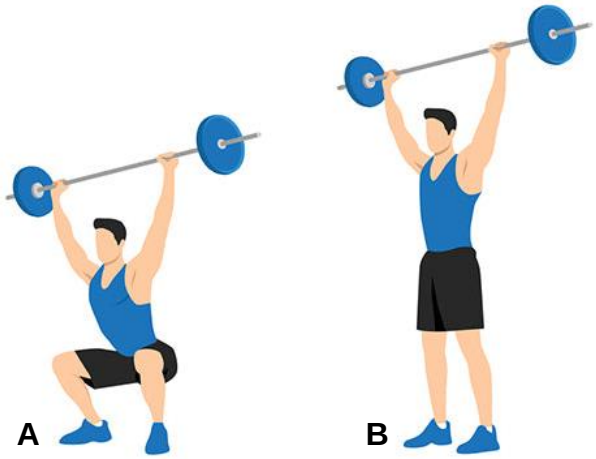
boiling point = ……..…. °C [1]

[Total: 4]

Section B

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

5 The diagram shows a F1 driver doing an overhead squat as part of his training routine.



(a) State if any work was done on the barbell by the F1 driver as he stood up from position **A** to position **B**. Explain your answer.

……

…….. [1]

(b) The mass of the loaded barbell and the F1 driver is 50 kg and 75 kg respectively.

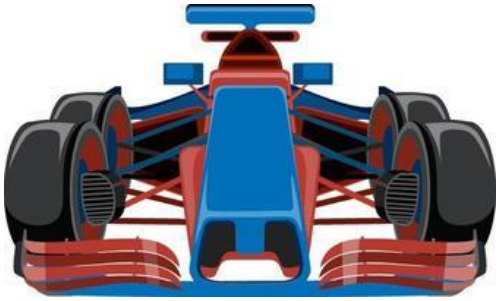
Calculate the combined weight of the loaded barbell and the F1 driver.

weight = …….….. N [1]

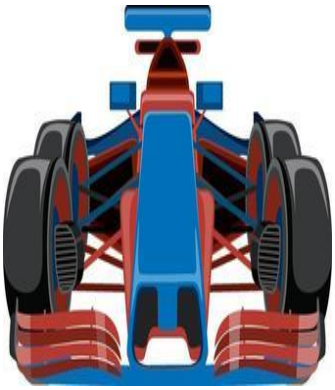
(c) Hence, determine the pressure exerted by the F1 driver on to the ground, given that the contact surface area of each shoe with the ground is 0.20 m^2.

pressure = …….….. N/m^2 [2]

(d) During a pre-season meeting, the F1 driver was asked to decide on the design of his race car and was presented with two options.



Design A



Design B

With the safety of the driver in mind, suggest the design you would recommend the F1 driver to adopt. Explain your answer.

……

…….. [2]

(e) In order to qualify for the Singapore Grand Prix, the F1 driver is required to complete the lap in 1 minute and 45 seconds.

(i) Given that the length of the circuit is 5.063 km, determine the average speed required for the F1 driver to complete the lap in 1 minute and 45 seconds.

average speed = …….…. m/s [1]

(ii) Calculate the average acceleration of the car if it takes 10 seconds to reach 75 m/s from rest.

average acceleration = …….…. m/s^2 [1]

[Total: 8]

6 A group of students want to build a makeshift shelter in the school courtyard using one of the four materials that is provided.

dull black canvas sheet	dull white canvas sheet
shiny aluminium plate	zinc plate coated with dull black paint

(a) With reference to the heat transfer methods, suggest which material would provide the best makeshift shelter during hot weather. Support your choice with **<u>two</u>** reasons.

material chosen: ……..

reason 1: ..……

……

reason 2: ..……

…….. [3]

The students then set up a fire and started cooking their instant noodles in the pot as shown below.

(b) State the process through which thermal energy is transferred:

(i) from the base of the pot to the water, ……. [1]

(ii) throughout the water in the pot. ……. [1]

(c) With reference to density changes, explain the process in **(b)(ii)**.

……

……

……

…….. [2]

(d) The water in the pot reaches 100 °C and continues to be heated.

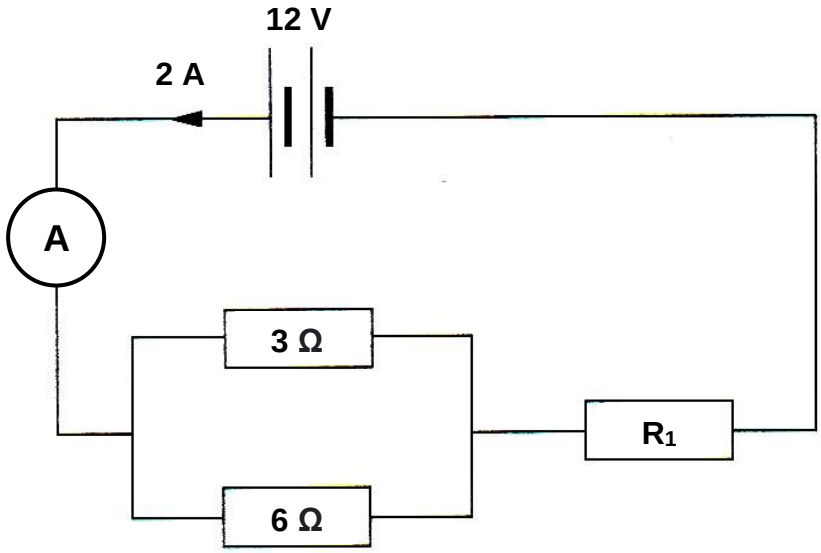
State how the internal potential energy and internal kinetic energy changes (increase/ decrease/ no change) when the water is being heated at 100 °C.

internal potential energy: ……

internal kinetic energy : …… [1]

[Total: 8]

7 **(a)** A 12 V car battery is connected to two known resistors of resistance 3 Ω and 6 Ω and one unknown resistor R_1 as shown in the diagram.



A current of 2 A flows through the circuit. The potential difference across R_1 is 8 V.

(i) Calculate the resistance of R_1.

resistance = ……..…. Ω [1]

(ii) Calculate the potential difference across the 3 Ω resistor.

potential difference = ……..…. V [1]

(iii) Hence, state the potential difference across the 6 Ω resistor.

potential difference = ……..…. V [1]

(iv) With the aid of **(iii)**, calculate the current flowing through the 6 Ω resistor.

current = ……..…. A [1]

(b) The power of an electric iron is 1500 W. A household uses the iron once a day for about 1 hour and 30 minutes each time.

(i) Given that the cost of electricity is 30 cents per kWh, what is the cost of using the electric iron daily for 2 weeks?

cost = $ ……..…. [2]

(ii) Earthing is a safety measure that is in place to ensure that the user of the electric appliance remains safe while using it.

Name the part of the electric iron which an earth wire must be connected to and explain how it ensures the safety of the person using the electric iron.

……..

……..

……. [2]

[Total: 8]

[End of Paper 2]