NA

TAMPINES SECONDARY SCHOOL

Secondary Four Normal Academic
PRELIMINARY EXAMINATION 2022

NAME					
CLASS				**REGISTER NUMBER**	

SCIENCE (Physics) **5105/02**

PAPER 2 **01 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 name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
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 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.

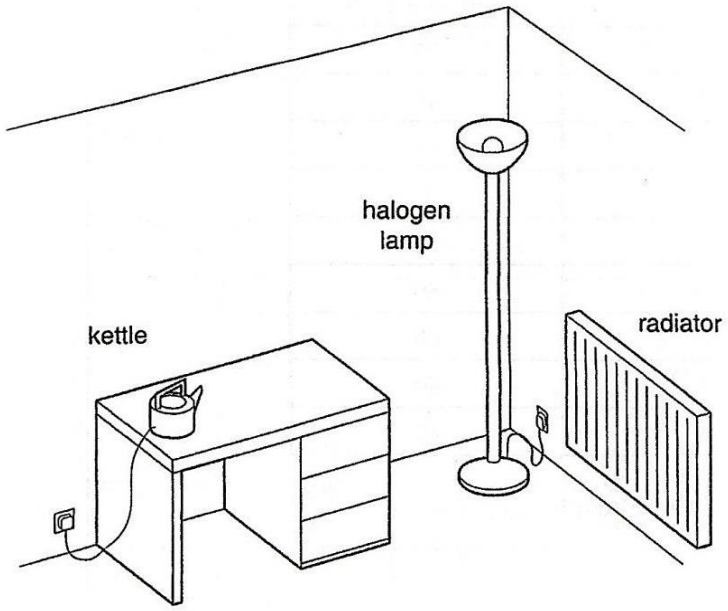
At the end of the examination, hand in your answers to Paper 1 and Paper 2 separately.
The number of marks is given in brackets [ ] at the end of each question or part question

For Examiner's Use	
SECTION A (14 marks)	
SECTION B (16 marks)	
TOTAL (30 marks)	

Section A

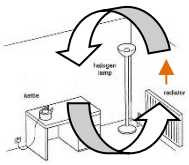
Answer **all** questions in the space provided.

1 The diagram below shows part of a hotel room. The radiator is heating the room.



(a) Draw arrow(s) on the diagram above to show the movement of the warm air around the room. [1]

- **ANS:** Mark given as long as the arrow is upwards



(b) Name the process involved in part (a).

- Convection current [1]

……..……..…… [1]

(c) Explain why the radiator is placed at the bottom of the room.

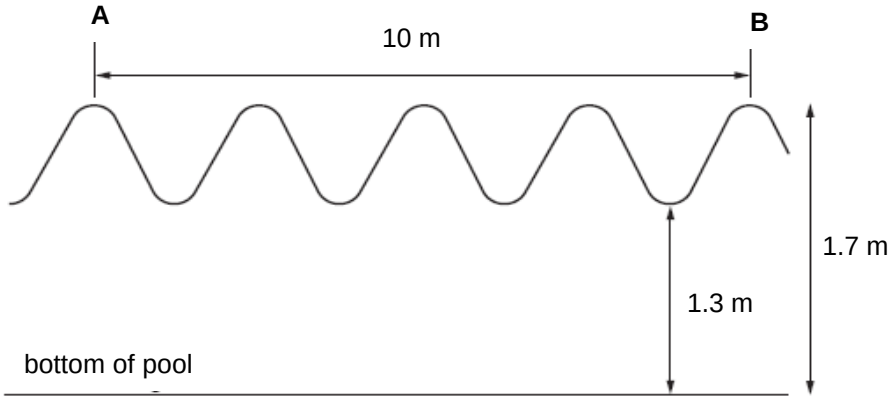
- Hot air from the radiator **<u>rises</u>** as it is **<u>less dense</u>** [1]

(Do not accept 'hot air rises and cold air sinks' if student do not mention density or less dense.)

……..……..……

……..……..…… [1]

2 The diagram below shows a side view of the water waves produced in a swimming pool by a wave machine.



Use the information given in the diagram to determine:

(a) the amplitude of the waves,

Crest to trough: 1.7 – 1.3 = 0.4 m

Amplitude = 0.4/2 = 0.20 m [1]

amplitude = …….. m [1]

(b) the number of complete waves between **A** and **B**,

- 4 waves

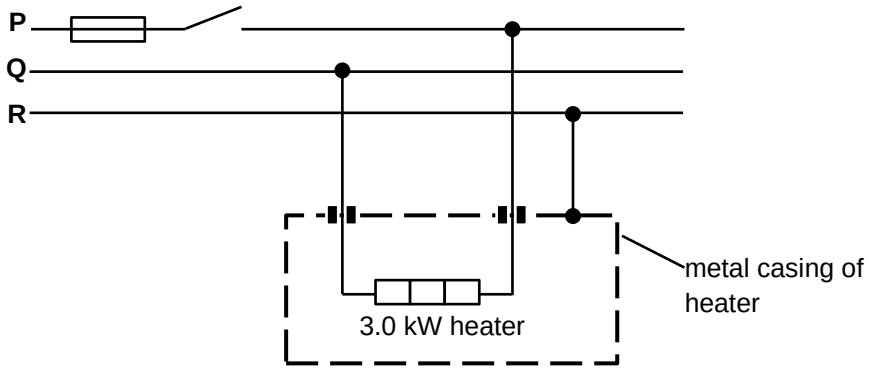
number of complete waves = …… [1]

(c) the wavelength of the water waves.

wavelength = 10 / 4 waves = 2.5 m [1]

wavelength = …… m [1]

3 The live wire of a 240 V mains supply is protected by a 15 A fuse. A 3.0 kW heater is connected to the supply. The arrangement is shown in diagram below.



(a) Identify wire **R** and state its colour of the insulation of the wire.

- Earth wire & Yellow-green [1]

*must state 2 colors for earth wire

……..……..…….

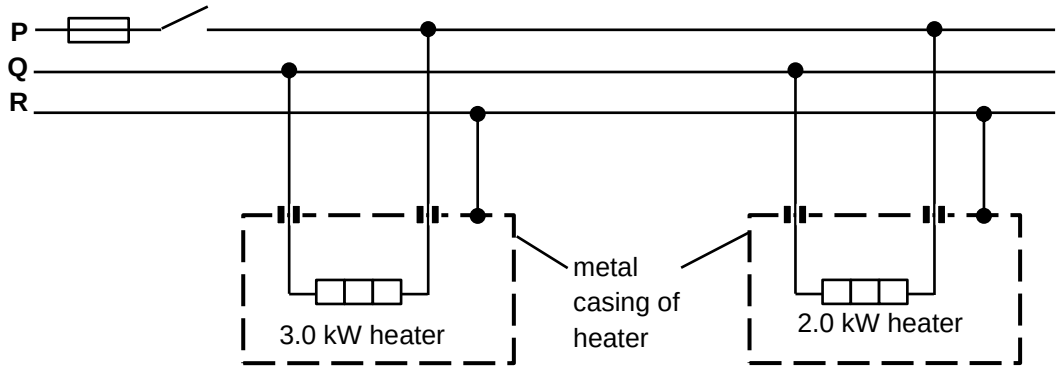
……..……..……. [1]

(b) Calculate the current through the 3.0 kW heater under normal working conditions.

P = V I
3000 = 240 x I
I = 12.5 A [1]

current = **……** A [1]

(c) Dora wishes to connect a 2.0 kW heater in parallel with the 3.0 kW heater, with the same 15 A fuse as shown below.



Give a reason, with suitable calculations, why this is not a sensible idea.

$P = V I$

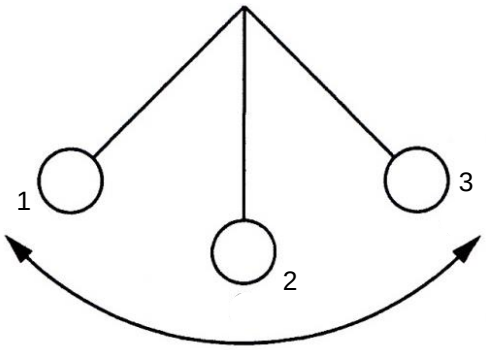
$(3000 + 2000) = 240 \times I$

$I = 20.8$ A [1]

The fuse will blow as the current exceeds the 15 A fuse/ higher than fuse rating. [1]

……..……..…… [2]

4 The diagram below shows a pendulum swinging freely between positions 1 and 3.



(a) State which position, 1, 2 or 3, the pendulum has maximum kinetic energy.

- Position 2 [1]

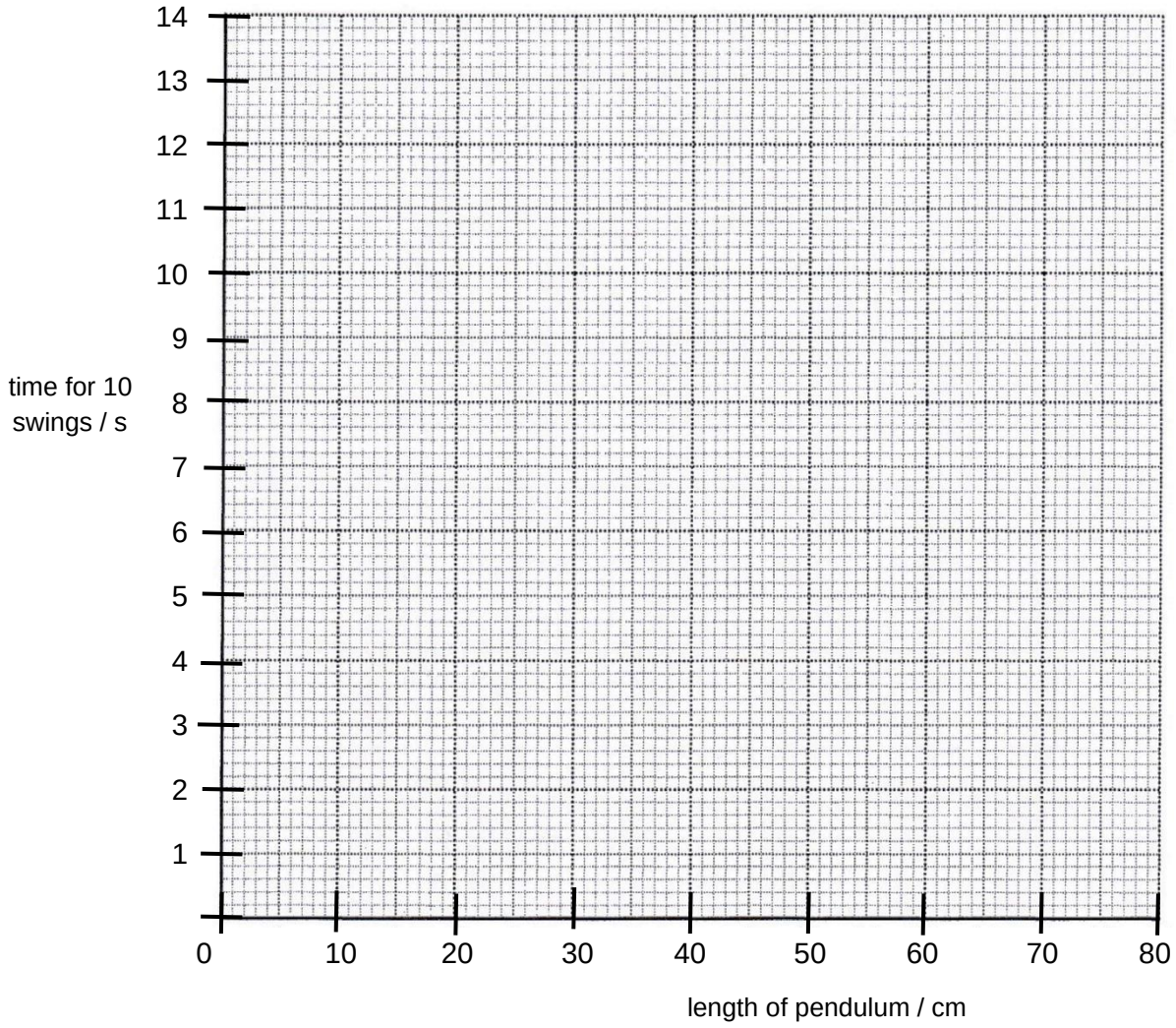
……..……..…… [1]

(b) Zi Yao carries out an experiment to find the total time for 10 complete swings of a pendulum. She repeats the experiment using different lengths of the pendulum. The results are shown in the table below.

pendulum length / cm	time for 10 swings / s
10.0	6.2
20.0	8.8
30.0	10.8
40.0	12.6
50.0	14.0

(i) On the grid provided in page 6, plot these results, marking each point with a cross (x). [1]

(ii) Draw a curved line of best fit for your plotted points [1]

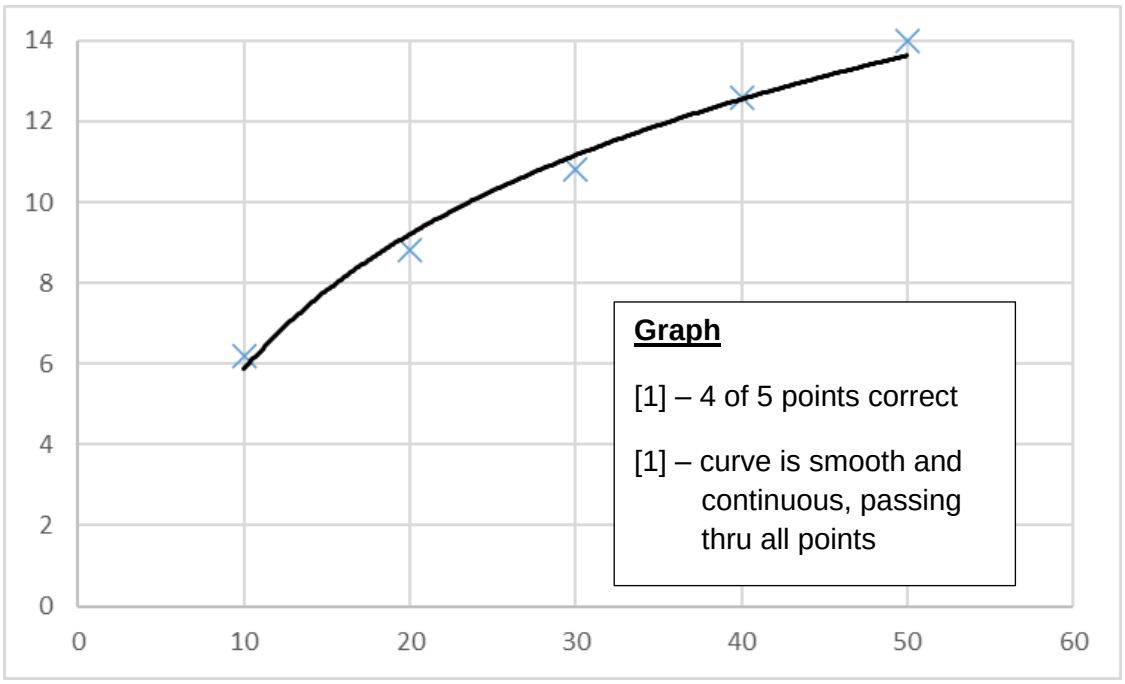


(iii) Suggest what Zi Yao can do to improve the accuracy of her experiment.

- **<u>Record more sets</u>** of reading and **<u>take average</u>**
- OR **<u>Record more oscillations.</u>** [1]

** no marks for citing “reduce parallex/zero error”

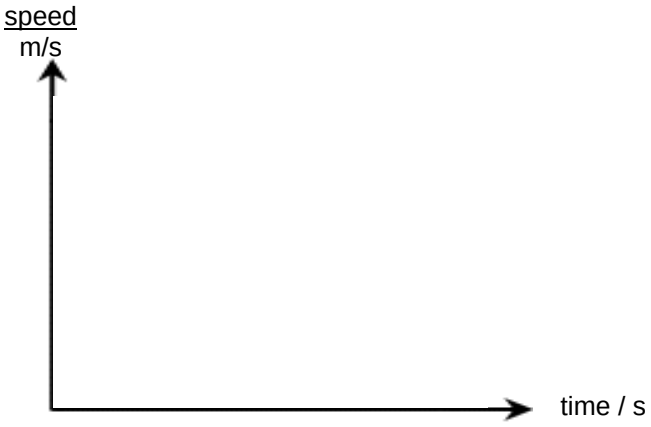
…….……..…… [1]



Section B

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

5 A car of mass 1200 kg is travelling at a uniform speed of 30 m/s for 10 s. The brakes are applied to bring the car to rest. The car decelerates uniformly to rest over 150 m.



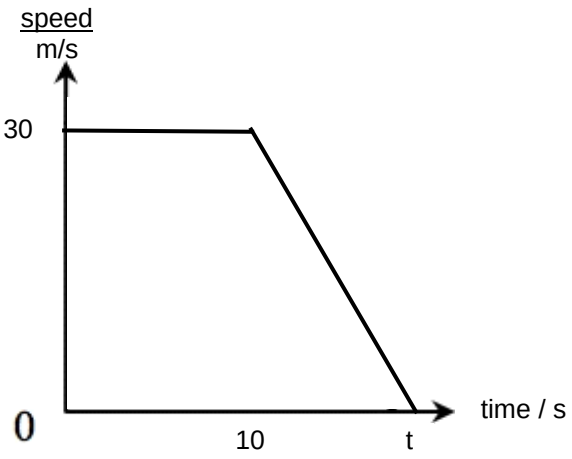
(a) Describe what is meant by "…speed of 30 m/s".

- Distance of 30 m travelled per second [1]

……..……..…… [1]

……..……..……

(b) Sketch the shape of the speed-time graph in the diagram provided above.
(Include all the relevant numerical values) [2]



[1] for correct shape
[1] for correct labelling of 30 and 10
** no need to write "t"

(c) Calculate distance travelled by the car in the first 10 s.

distance travelled = area under speed-time graph
= 30 x 10
= 300 m [1]

distance = …….. m [1]

(d) Determine the time taken for the car to come to a stop.

distance travelled = area under speed-time graph

150 m = ½ (30) (t) [1]

t = 10 s [1]

t = …….. s [2]

(e) Calculate the deceleration experienced by the car.

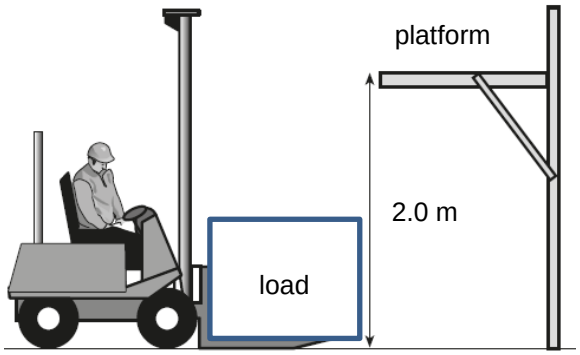
acceleration = (0 – 30) / 10 [1]

= – 3.0 m/s^2

deceleration = 3.0 m/s^2 [1]

deceleration = …….. m/s^2 [2]

6 A forklift truck carries a 25 000 N load to place it onto a 2.0 m high platform.



(a) Calculate the mass of the load.

m = W/g = 25000/10 [1]

= 2500 kg [1]

mass = …….. kg [2]

(b) When lifting the load up the platform, the forklift truck remains stable and does not topple in the clockwise direction.

Using the concept of stability, explain why this is so.

- The forklift has a **large/ heavy base.** [1]
- For it to be stable, its **centre of gravity is low/within the base** even when lifting the load. [1]

……..……..…….

……..……..…….

……..……..……. [2]

(c) Calculate the gravitational potential energy of the load when it is lifted to the platform.

G.P.E. = mgh

= 2500 x 10 x 2 [1]

= 50 000 J [1]

energy = …….. J [2]

(d) The load is not placed properly at the platform and fell to the ground.

Calculate the speed of the load just before it hits the ground.

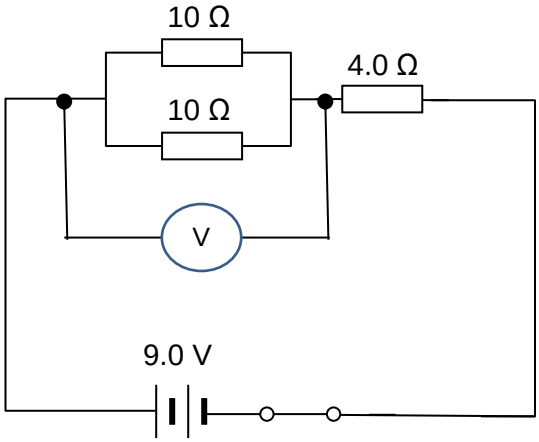
G.P.E lost = K.E. gained

$50\,000 = ½ \times 2500 \times v^2$ [1]

$v = 6.3$ m/s [1]

speed = …….. m/s [2]

7 A circuit with three resistors and a voltmeter are connected to a 9.0 V supply as shown in the diagram below.



(a) **(i)** State how the two 10 Ω resistors are connected.

- Parallel arrangement [1]

…..……. [1]

(i) Determine the combined resistance of the three resistors.

combined resistance = $(1/10 + 1/10)^{-1} + 4$ [1m for $R_{//} = 2$ Ω OR the working for $R_{//}$]

= 9.0 Ω [1]

resistance = …….. Ω [2]

(b) Determine the current flowing through the 4.0 Ω resistor.

V = (I)(R)

current from battery = 9 V / 9 Ω

= 1.0 A [1]

current = …….. A [1]

(c) Calculate the potential difference measured by the voltmeter.

$V_4 = I_4 R_4$ = (1) (4) = 4 V [1]

$V_{voltmeter}$ = 9 – 4 = 5.0 V [1]

potential difference = …….. V [2]

(d) One of the 10 Ω resistor is now removed from the circuit.

State whether the current flowing through the remaining 10 Ω resistor will increase, decrease, or remain the same.

Explain your answer.

- Current will **<u>decrease</u>** [1]
- The **<u>total resistance</u>** is higher now. [1]

……..……..…….

……..……..…….

……..……..…….

……..……..……. [2]

END OF PAPER