COMMONWEALTH SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2022

SECONDARY FOUR NORMAL (ACADEMIC)

Name: _____ ( ) Class: _____

SCIENCE (PHYSICS) **5105/02**

Paper 2 **12 Aug 2022 (Fri)**
1130 - 1245

Candidates answer on the Question Paper **Papers 1 and 2: 1 hour 15 minutes**
No additional materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all work you hand in.
Write in dark blue or black pen on both sides of the paper.
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 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 answer 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**
Section B	**Q5:**
	Q6:
	Q7:
	16
Total	**30**

Name of setter: Ms Ye Dan

Parents' / Guardian's Signature

Section A

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

1 Name the most suitable apparatus used to measure the

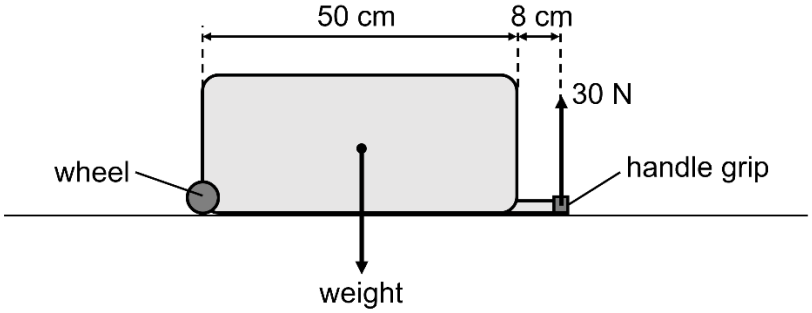
(a) mass of a wooden block, ……...

(b) thickness of an IC card, ……..…..

(c) period of a simple pendulum, ……

[2]

2 A suitcase lies on the floor, as shown in the diagram.



A man lifts the suitcase up by exerting an upward force of 30 N at the handle grip and turning it about the wheels. The wheels are locked from rotating.

(a) Calculate the moment produced by the upward force of 30 N. Indicate the direction of the moment.

moment = …… N cm

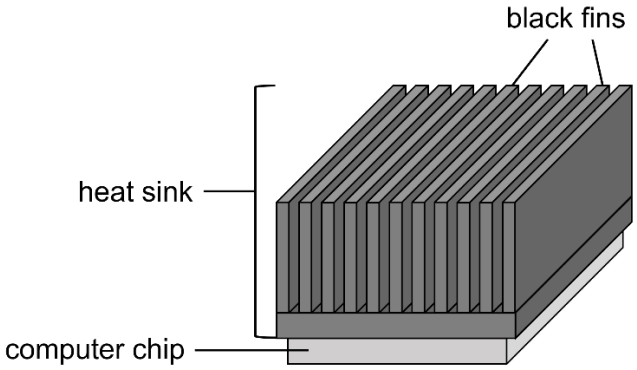
direction of moment is ……... [2]

(b) The man extended the handle of the suitcase further before lifting it. Explain how this helps him to lift the suitcase with a smaller force.

……

……... [1]

3 When a computer chip works, it generates a lot of heat. A heat sink with black fins is usually fitted to the top of the chip to cool it by transferring heat to the surrounding.

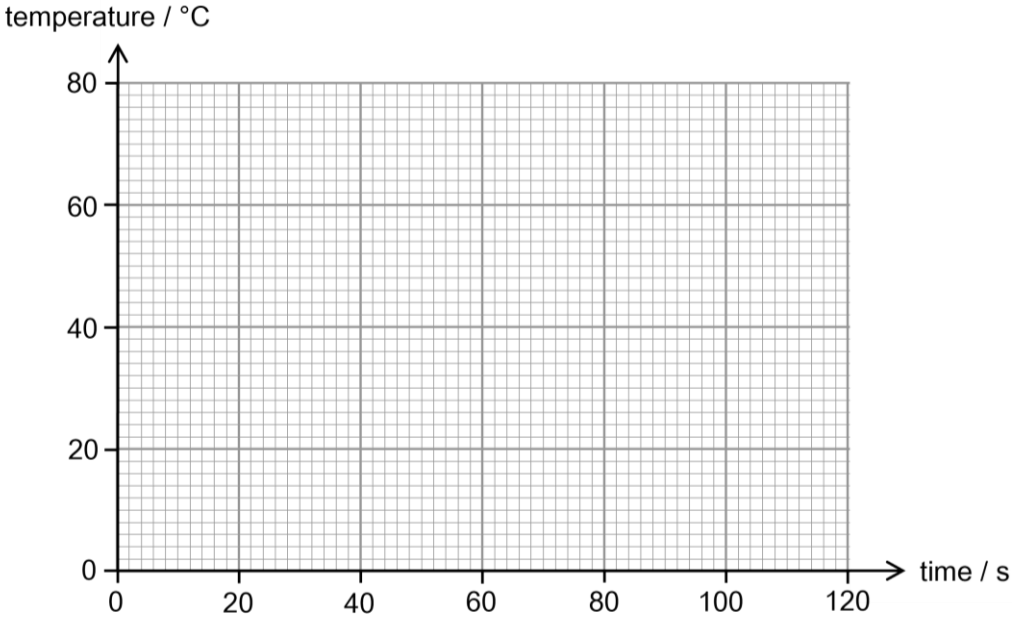


A heat sink fitted to a heated computer chip is tested in an air-conditioned laboratory. The temperature of the computer chip is measured for 2 minutes. The results obtained are shown in the table.

time / s	temperature / °C
0	76
20	56
40	42
60	33
80	27
100	24
120	22

(a) **(i)** Plot a graph on the grid to show how the temperature varies with time. Mark each point with a cross (x). [1]

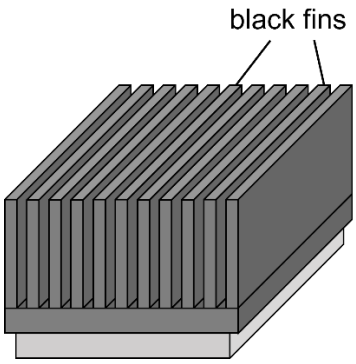
(ii) Draw a curved line of best fit, taking into account all the points. [1]



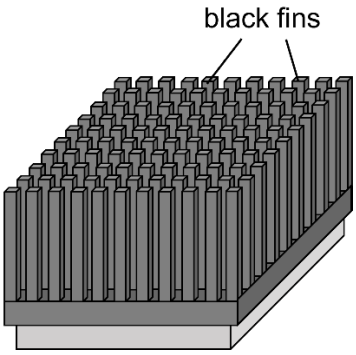
(iii) Use your graph to determine the time it takes for the temperature to drop to 40°C.

time = …… s [1]

(b) The diagram shows two different designs of heat sinks, **A** and **B**. Both have the same colour and dimension.



design **A**



design **B**

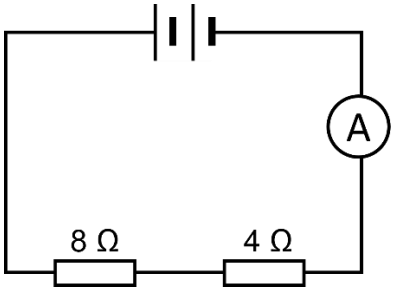
Which design would be able to cool the same heated computer chip faster? Explain your answer.

design …….

explanation ……...

……..... [1]

4 A student sets up a circuit with a 8 Ω resistor and a 4 Ω resistor, as shown in the diagram.



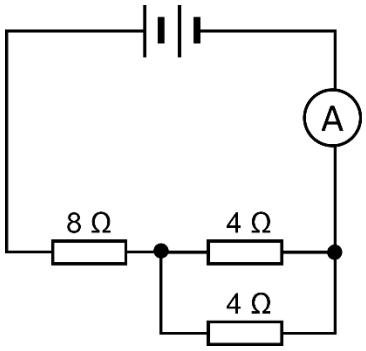
(a) What name is given to this arrangement of resistors?

……..... [1]

(b) The potential difference across the 8 Ω resistor is 4.0 V.
Determine the reading on the ammeter.

reading on the ammeter = ……..... A [1]

(c) Another resistor with a resistance of 4 Ω is added to the circuit as shown.



(i) Calculate the total resistance of all three resistors in the circuit.

total resistance = …..... Ω [2]

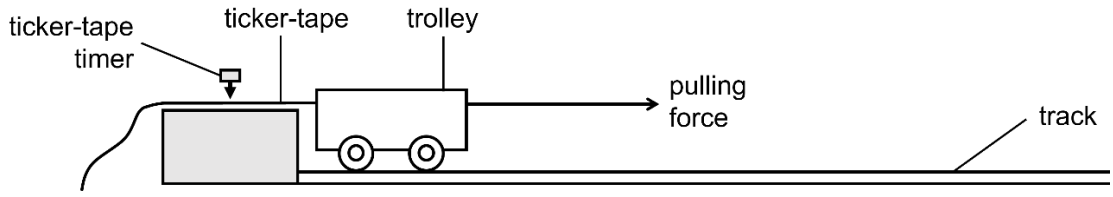
(ii) How does the reading on the ammeter change?

……..... [1]

Section B

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

5 A student performs an experiment to investigate the motion of a trolley under a pulling force along a smooth track using a ticker-tape timer. The apparatus is set up as shown.



(a) The student applies a pulling force of 0.32 N. The trolley has a mass of 0.40 kg. Assuming the pulling force is the only horizontal force applied on the trolley.

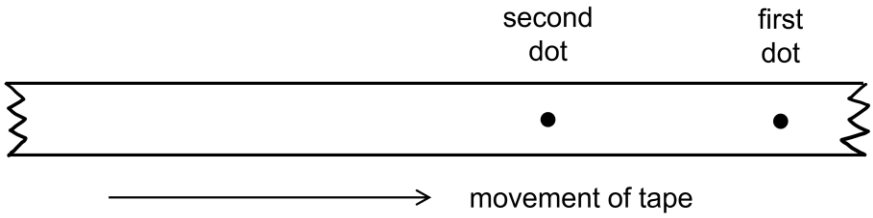
(i) Calculate the expected acceleration of the trolley due to the pulling force.

expected acceleration = ... m/s^2 [1]

(ii) State what is meant by *acceleration*.

..... [1]

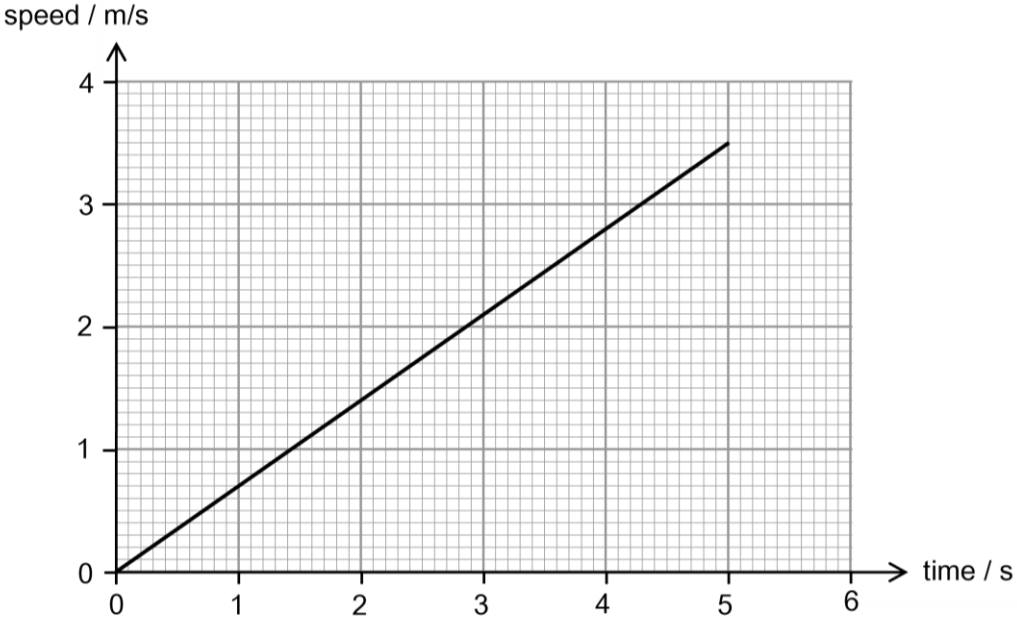
(iii) When the trolley moves along the track, it pulls the ticker-tape through the ticker-tape timer. The timer makes dots on the tape at fixed time intervals.
A diagram of the ticker-tape from the start of the experiment is shown.



(drawing not to scale)

On the diagram, draw the possible position of the third dot to show the motion of the trolley. [1]

(b) The actual speed of the trolley is tracked by a sensor and plotted into a graph.



(i) From the graph, calculate the actual acceleration of the trolley.

actual acceleration = ... m/s^2 [2]

(ii) The actual acceleration calculated from the graph is different from what was calculated in **(a)(i)**. Suggest a possible reason why they are different.

.....

..... [1]

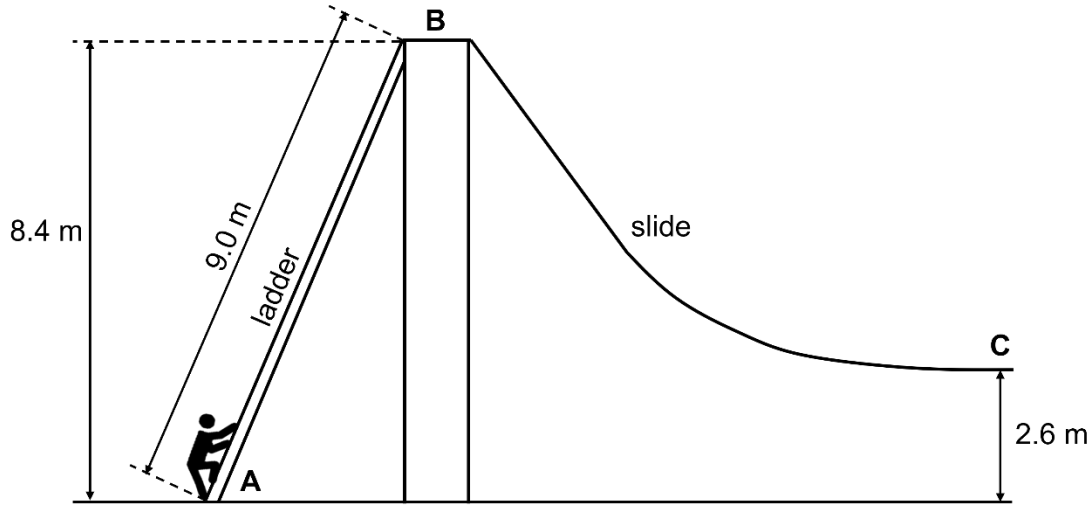
(iii) From the graph, calculate the actual total distance travelled by the trolley from 0 to 5.0 s.

total distance = ... m [1]

(iv) Calculate the actual average speed of the trolley from 0 to 5.0 s.

average speed = ... m/s [1]

6 An amusement park has a giant slide. Players at position **A** have to climb up the ladder to reach position **B**, before sliding down to reach **C**.



(a) A man of mass 80 kg climbs up the ladder from **A** to **B**.

(i) Calculate the weight of the man. Take gravitational field strength to be 10 N/kg.

weight = ... N [1]

(ii) Calculate the useful work done by the man to climb up the ladder from **A** to **B** against gravity.

work done = ... J [1]

(iii) The man climbed from **A** to **B** in 16 s. Calculate the useful power of the man.

power = ... W [1]

(b) **(i)** State the *Principle of Conservation of Energy*.

……

……

…….. [1]

(ii) The man starts from rest at **B** and slides down. Assuming no energy loss to the surrounding, calculate the amount of kinetic energy the man has at **C**.

kinetic energy = ……. J [2]

(c) The amusement park plans to install an electrical lift to transport players from **A** to **B**.

(i) The lift needs to have a power of 2200 W. It will be connected to 240 V mains. Calculate the current that needs to be supplied to the lift.

current = ……. A [1]

(ii) The electrician installing the lift has a choice of 1 A, 2 A, 5 A, 10 A and 13 A fuses. State which fuse should be fitted to the electrical lift. Explain your choice of fuse.

fuse …….

explanation ……..

…….. [1]

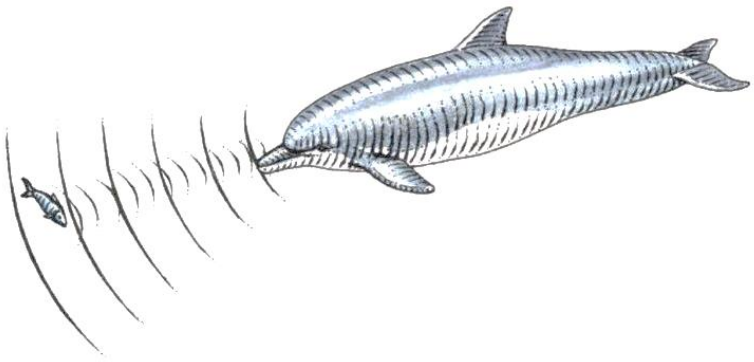
7 A dolphin can “see with sound”. It produces pulses of “clicking” sound which travels in water and bounces off objects as echoes. Upon receiving the echo of the sound, the dolphin can locate the objects around it.

(a) Sound is an example of longitudinal wave.
Explain what is a *longitudinal wave*.

……

…… [1]

(b) **(i)** A dolphin emits a sound wave and receives an echo reflected by a fish 0.14 s later.



Taking the speed of sound in water to be 1500 m/s, calculate the distance between the dolphin and the fish.

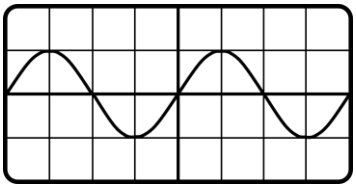
distance = ……..……..……. m [2]

(ii) The use of sound and echo to locate is being used by humans for various applications, such as SOund Navigation And Ranging (SONAR) used by ships and ultrasound scan of organs inside a human body.
Explain why echo of sound cannot be used by astronaut in outer space to locate space debris.

……

…… [1]

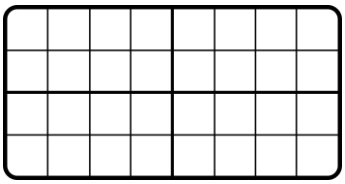
(c) The sound produced by a dolphin is captured by a microphone, which is connected to a piece of apparatus that shows waveforms as distance-time graph.
A segment of output trace, **A**, is shown on the screen of the apparatus.



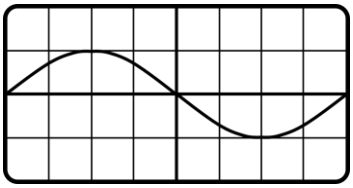
trace **A**

The controls of the apparatus are **not** altered throughout the experiment.

(i) In another segment, the dolphin produces a softer sound.
Sketch on the diagram the output trace **B** seen on the screen. [1]



(ii) In a third segment, the output trace **C** seen on the screen is as shown.



trace **C**

Explain the difference between trace **A** and trace **C**.

……...

…….. [1]

(d) The wavelength of the sound in trace **C** is 1.20 cm.

(i) Write 1.20 cm in m.

1.20 cm = ……. m [1]

(ii) Given the speed of sound in water is 1500 m/s, calculate the frequency of the trace **C** sound produced by the dolphin.

frequency = ……. Hz [1]

End of Paper 2