YUAN CHING SECONDARY SCHOOL
Secondary Four Normal (Academic) Course
Preliminary Examination 2022

CANDIDATE NAME			
CLASS		INDEX NUMBER	

SCIENCE

5105/02

Paper 2 Physics

12 Aug 2022

Candidates answer on the Question Paper.

No Additional Materials are required.

Papers 1 and 2: 1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

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

Answer **all** questions in Section A 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.

For Examiner's Use	
Section A	/14
Section B	/16
Total	/30

Section A (14 marks)

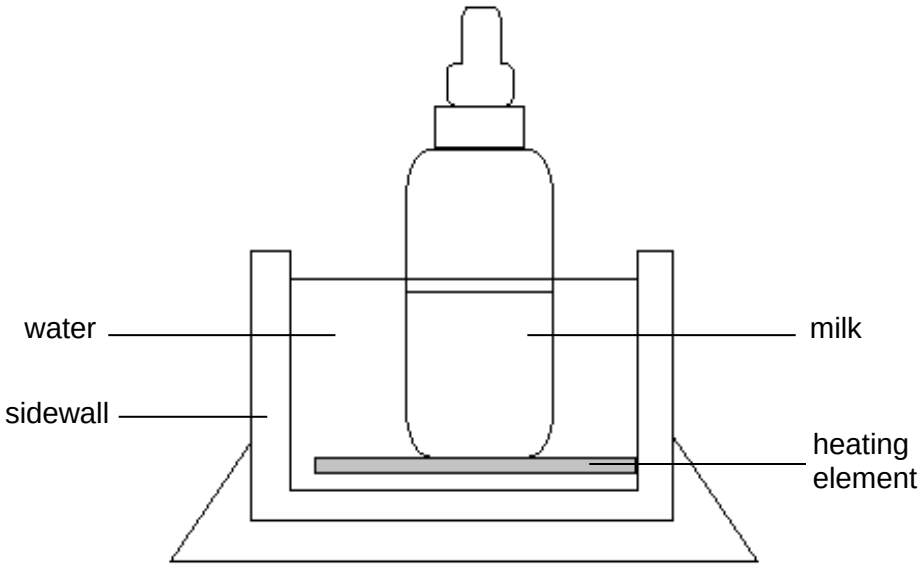
Answer **all** the questions in the spaces provided.

1 Complete the table below to show the physical quantity and its SI unit, in words, measured by each of the apparatus.

apparatus	physical quantity measured	SI unit
stopwatch	time	
electronic balance		kilogram
ammeter		

[2]

2 The diagram below shows a milk warmer heating up frozen milk to the desired temperature. A heating element is used to raise the temperature of the water to 40 °C.



(a) State the main process by which thermal energy is being transferred

(i) from the heating element to the milk bottle,

…… [1]

(ii) throughout the milk.

…… [1]

(b) The material used to make the sidewall is often plastic.
Explain why the use of plastic makes it safer for someone who uses this type of milk warmer.

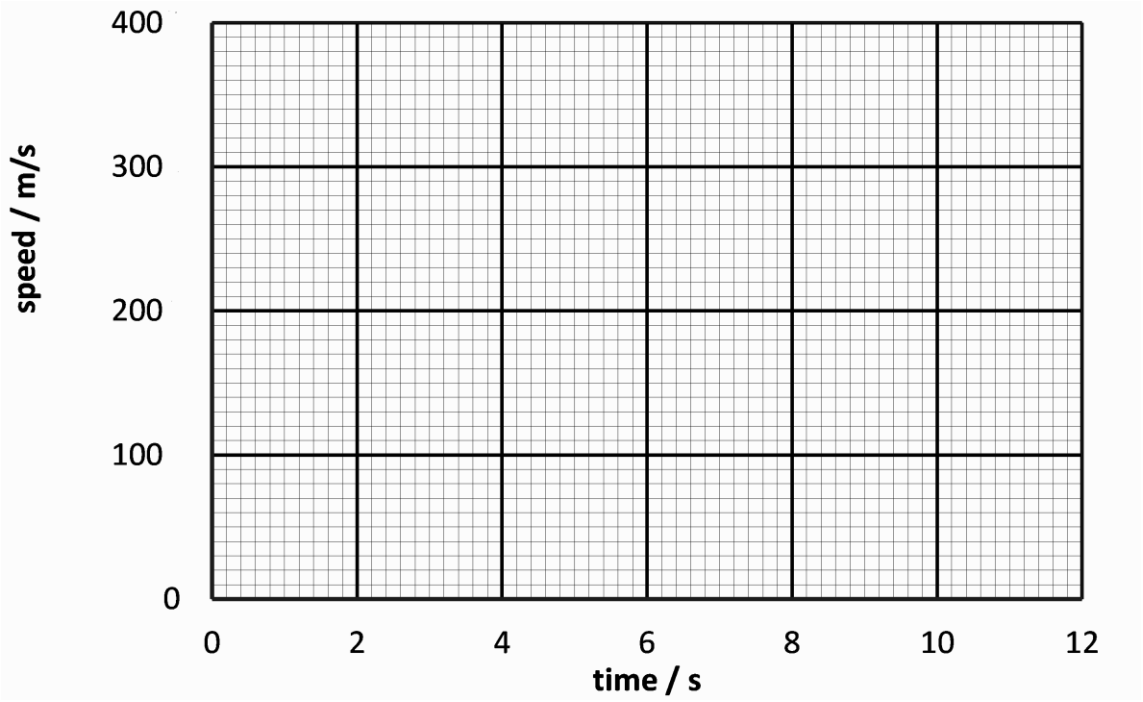
……

…… [1]

3 A submarine fires a test missile underwater. The speed of the missile is tracked and recorded every two seconds for ten seconds as it travels in the water. The table below shows the speed of the missile every two seconds of travel.

time / s	speed / m/s
0	0
2	20
4	60
6	140
8	240
10	340

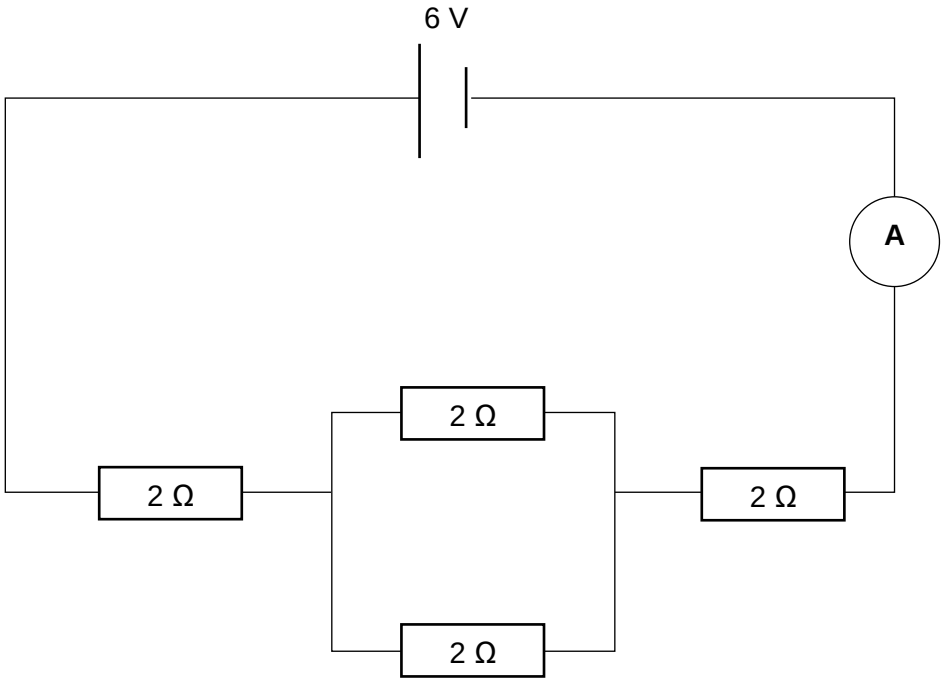
(a) On the grid below, plot a graph of these results. Draw a best-fit curve taking into account all the plotted points. [2]



(b) Using the plotted graph, estimate the time when the speed of the missile reaches 300 m/s.

time = ... s [1]

4 The diagram below shows a simple circuit with four identical resistors of resistance 2 Ω and an ammeter.



(a) Determine the effective resistance of the circuit.

effective resistance = ... Ω [2]

(b) The circuit is rearranged such that all four resistors are now placed in series with each other.

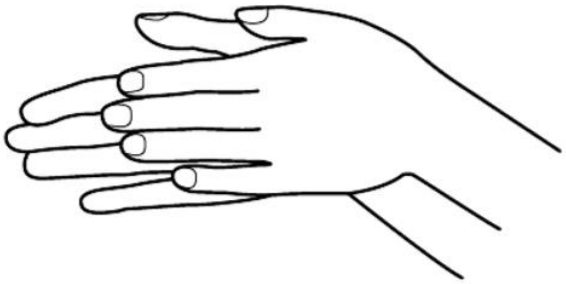
State and explain how the value in the ammeter changes.

.....

.....

..... [2]

5 The diagram below shows a student rubbing her hands together.



The average force used to slide one hand against the other hand is 1.5 N.
In each movement, one hand moves 4.0 cm forwards and backwards while the other hand remains stationary.

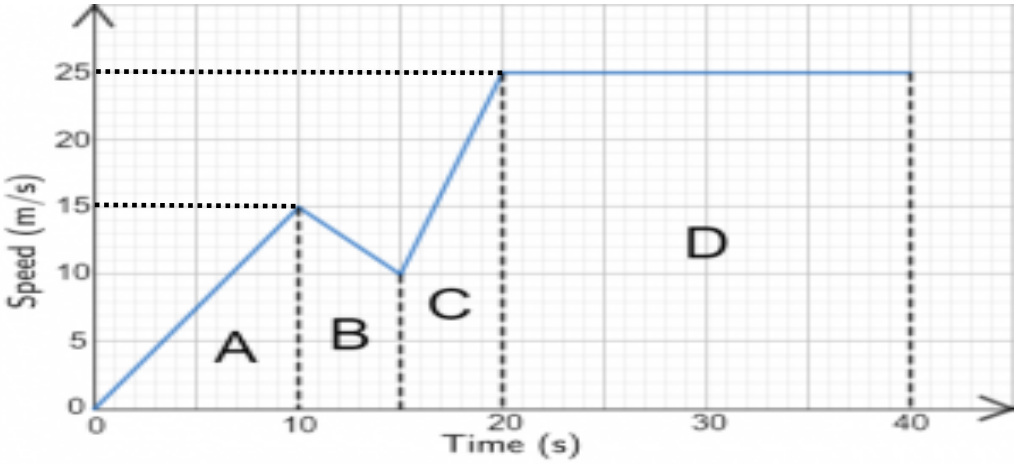
Calculate the average amount of work done by one hand in each movement.

work done = ... J [2]

Section B (16 marks)

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

6 Jason was traveling on his e-scooter of mass 13 kg to meet his friends near the school. The speed-time graph below shows a part of his journey as he left the school.



(a) Describe Jason's motion in the following regions.

(i) B: ..... [1]

(ii) C: ..... [1]

(b) Calculate

(i) Jason's acceleration in region A,

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

(ii) the kinetic energy that the e-scooter possesses in region D.

kinetic energy = ... J [2]

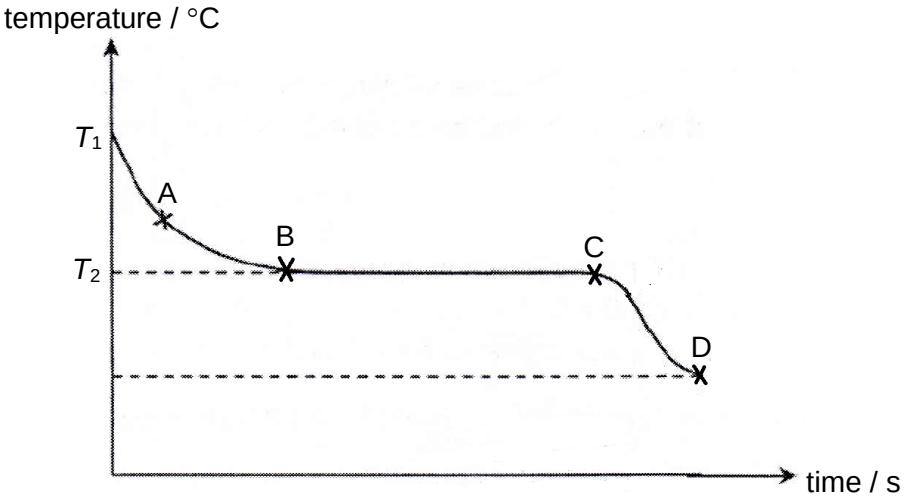
(c) State and explain in which region did Jason travelled the longest distance.

.....

.....

..... [2]

7 A staff in a restaurant puts water at room temperature T_1 into the freezer compartment of a refrigerator to make ice cubes. The cooling curve of the water is shown in the diagram below.



(a) Describe the arrangement of the water molecules at point A.

..... [1]

(b) Explain why there is no change in temperature at section BC of the graph although thermal energy is released as the water cools.

.....

.....

..... [2]

(c) Describe the changes, if any, that occur to the motion of the water molecules as it cools from C to D.

..... [1]

(d) State a suitable value for T_2.

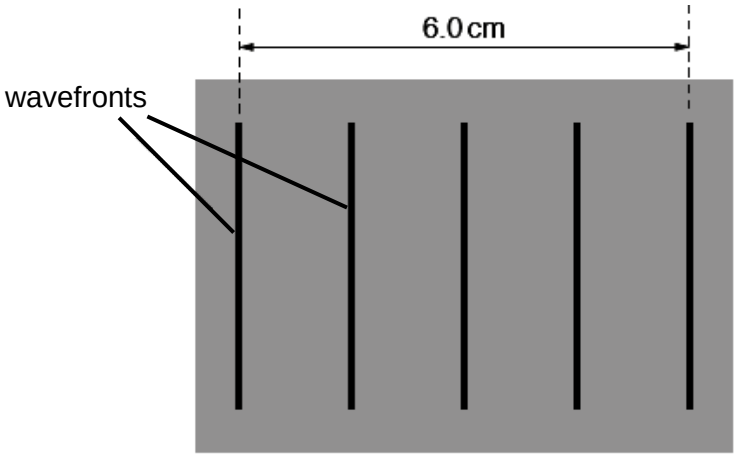
T_2 = ... °C [1]

(e) The refrigerator is rated '300 W, 240 V'.
The cost of 1 kWh of electricity consumed is 24.8 cents.

Calculate the cost of using this refrigerator in a week, assuming a usage of 24 hours every day.

cost = $ ..... [3]

8 The diagram below shows the *wavefronts* of a water wave in a ripple tank.



(a) Explain what is meant by *wavefronts* of a water wave.

.....[1]

(b) Determine the wavelength of the wave.

wavelength = ... cm [1]

(c) The frequency of the wave in deep water is 5 Hz.

Calculate the

(i) period of the wave,

period = ... s [1]

(ii) speed of the wave.

speed = ... cm/s [2]

(d) Water wave is known as transverse waves whereas sound wave is known as longitudinal waves.

Describe the difference between a transverse wave and a longitudinal wave.

……

……

…… [2]

(e) Explain why microwaves can be used as a form of communication signal in outer space in astronauts.

…… [1]

------END OF PAPER------

EFFORTS TODAY, REWARDS TOMORROW

2022 4NA SCI(PHY) PRELIMINARY EXAMINATION MARK SCHEME

P2 Section A Answers

<table>
<tr><th>Qn</th><th>Section A (14 marks)</th><th>Marks / Remarks</th></tr>
<tr><td>1</td><td>
<table>
<tr><td>apparatus</td><td>physical quantity measured</td><td>SI unit</td></tr>
<tr><td>stopwatch</td><td>time</td><td>second</td></tr>
<tr><td>electronic balance</td><td>mass</td><td>kilogram</td></tr>
<tr><td>ammeter</td><td>current</td><td>ampere</td></tr>
</table>
</td><td>1 for at least 1 correct answer

2 for all 4correct answers</td></tr>
<tr><td>2(a)(i)</td><td>Conduction</td><td>1</td></tr>
<tr><td>2(a)(ii)</td><td>Convection</td><td>1</td></tr>
<tr><td>2(b)</td><td>Plastic is a poor conductor of thermal energy, hence the warmer is not hot to touch.</td><td>1</td></tr>
<tr><td>3(a)</td><td>All points plotted correctly with an X.
Best-fit smooth curve drawn through the plots</td><td>1
1</td></tr>
<tr><td>3(b)</td><td>9.2 s (or corresponding value read correctly off graph drawn)</td><td>1</td></tr>
<tr><td>4(a)</td><td>Eff R = 2 Ω + 2 Ω + (½ + ½)$^{-1}$ Ω
= 5 Ω</td><td>1
1</td></tr>
<tr><td>4(b)</td><td>The value in the ammeter will decrease.
The effective resistance of the circuit increases.</td><td>1
1</td></tr>
<tr><td>5</td><td>Work done = (1.5 N)(0.04 m)
= 0.6 J</td><td>1
1</td></tr>
</table>

P2 Section B Answers

Qn	Section B (16 marks)	Marks / Remarks
6(a)(i)	Constant deceleration	1
6(a)(ii)	Constant acceleration	1
6(b)	a = (15 m/s – 0 m/s) / 10 s = 1.5 m/s^2	1 1
6(c)	KE = (½)(13 kg)(25 m/s)^2 = 4062.5 J = 4060 J (3sf)	1 1
6(d)	Region D. The area under the graph of a speed-time graph, which represents distance travelled, is the largest in region D.	1 1
7(a)	The molecules in A are not held in fixed positions and do not have a regular pattern.	1
7(b)	Average kinetic energy of the molecules remain the same. Thermal energy released is used to form the attractive forces between the molecules.	1 1
7(c)	They vibrate slower across smaller distances.	1
7(d)	0 °C	A1
7(e)	Electricity consumption in 1 day = (0.3 kW)(24 h) = 7.2 kWh Total electricity consumption = (7.2 kWh)(7 days) = 50.4 kWh Total cost = (50.4 kWh)(24.8 cents) = 1249.92 cents = 1250 cents (3sf) or $12.50 (2dp)	1 1 1

8(a)	Wavefronts refer to the imaginary line that joins all peaks of the water wave.	1
8(b)	$\lambda = 6 \text{ cm} / 4 = 1.5 \text{ cm}$	1
8(c)(i)	$T = 1 / 5 \text{ Hz} = 0.2 \text{ s}$	1
8(c)(ii)	$v = (5 \text{ Hz})(1.5 \text{ cm})$ $= 7.5 \text{ cm/s}$	1 1
8(d)	A transverse wave travels perpendicularly to the direction of particle motion. A longitudinal wave travels in a direction which is parallel to the direction of particle motion.	1 1
8(e)	Microwaves can travel through vacuum.	1