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# YUHUA SECONDARY SCHOOL PRELIMINARY EXAMINATION 2022 SECONDARY FOUR NORMAL (ACADEMIC)

^	CANDIDATE NAME		
Α	CLASS	INDEX NUMBER	

## SCIENCE (PHYSICS)

### Paper 2

17 August 2022 Papers 1 and 2: 1 hour 15 minutes

Candidates answer on the Question Paper. No additional materials are required. Setter: Mr Kenny Low

5105 / 02

#### **READ THESE INSTRUCTIONS FIRST**

Write your name, class and index number on all the work you hand in. Write in dark blue and black pen.

You may use a soft pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, 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.

Enter the question numbers of the questions you have answered in Section B on the dotted lines in the grid below.

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		
Section B		
Total		

This document consists of <u>9</u> printed pages, inclusive of this page.

Section A Answer all the questions in the spaces provided.

1 Some bricks are carried in a wheelbarrow, as shown in Fig. 1.1.



Fig. 1.1

The combined mass of the wheelbarrow and bricks is 120 kg.

(a) Calculate the combined weight of the wheelbarrow and bricks. Take g = 10 N/kg.

(b) The line of action of the combined weight of the wheelbarrow and the bricks acts at a perpendicular distance of 0.80 m from the pivot of the wheelbarrow.

A vertical force F is applied at the handle, a distance of 0.50 m from the line of action of the combined weight, as shown in Fig. 1.1.

Calculate the force *F* needed at the handle to hold the wheelbarrow and bricks in the position shown in Fig. 1.1.

Total: [4]

- **2** An X-ray machine can be used to obtain pictures of the bones in our bodies without surgery. The wavelength of the X-rays used are 0.1 nm.
  - (a) State the speed of X-rays in vacuum. [1]
  - (b) Calculate the frequency of the X-rays that are used.

(c) Gamma rays are another type of electromagnetic radiation. State how the frequency, wavelength and speed in vacuum of gamma rays compare to that of X-rays.

You may use words from the following list to complete the table. Each word may be used once, more than once, or not at all.

equal	higher	lower	longe	er shorter	
frequency of gamma rays compared to X-rays					
wavelength of gamma rays compared to X-rays					
speed of gamma rays in vacuum compared to X-rays					

Total: [5]

[2]

**3** In the circuit shown in Fig. 3.1, the battery has an emf of 6 V, and is connected to three resistors. An ammeter is also connected to measure the current in the circuit.



(a) Calculate the effective resistance of the circuit.

(b) Hence, calculate the reading on the ammeter.

reading on ammeter = ......[2]

(c) Without doing any further calculations, suggestion how the ammeter reading would change if all three resistors were connected in parallel, instead of the arrangement shown in Fig. 3.1.

The ammeter reading would ...... (decrease / increase / remain the same). [1]

Total: [5]

#### Section B

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

4 The Singapore Grand Prix will take place at the Marina Bay Street Circuit on 2<sup>nd</sup> October this year.

The current track record is 1 min 41.905 secs, clocked by K Magnussen in 2018.

- (a) (i) Convert the track record of 1 min 41.905 secs to seconds.
  - track record in seconds = .....s [1]
  - (ii) Each lap of the circuit is 5.063 km. Hence, calculate the average speed of K Magnussen's car during this lap, in m/s.

- average speed = ..... m/s [2]
- (b) (i) During the start of the race, the Formula One cars accelerate from rest to 55 m/s in 7 s.Calculate the acceleration of the Formula One cars at the start of the race.

- (ii) Given that the Formula One cars have a mass of 920 kg, calculate the driving force acting on the cars at the start of the race.

 (d) There was heavy rain during the Singapore Grand Prix in 2017. State and explain how the stopping distance of the cars would be affected due to the rain.

 The stopping distance of the cars would ......

 Explanation:

 Image: Total:

 [8]

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 Sec 4 Normal (A) Science (Physics) (Paper 2)

**5** A solid substance is heated until it becomes a liquid. The variation with time of the temperature of the substance is shown in Fig. 5.1.



- (a) On Fig. 5.1, mark with an 'x' where there is a mixture of the solid and liquid states. [1]
- (b) Describe the changes in the arrangement and movement of the molecules as the substance changes from the solid to the liquid state.

	solid state	liquid state
arrangement of molecules		
movement of molecules		

[4]

The mass of the substance was also measured during this period, and the results are shown in the Table 5.1 below.

Table 5.1		
time / mins	mass / g	
0	200.0	
1	200.0	
2	200.0	
3	199.8	
4	199.6	
5	199.3	
6	198.8	
7	198.2	
8	197.4	
9	196.2	
10	195.0	

- (c) (i) Using the data in Table 5.1, plot a graph on the grid below to show how the mass of the substance changes with time. Mark each point with a cross. The first three points have been plotted for you.
  - (ii) Draw a line of best fit, taking into account all the points.





(iii) Suggest why the mass of the substance decreases after 2 minutes.

 Total:	[1] <b>[8]</b>

6 On 10 December 2020, three people died from electrocution after the cables in a plug supplying power to an instant water heater in the flat fused together. The heater was powered by a three-pin plug connected to an extension socket, which was in turn connected to a power outlet in the kitchen.

Fig. 6.1 shows the 3-pin plug used.



(a) Name the terminal labelled X and state the colour of the wire connected to this terminal.

Terminal X is .....

Colour of wire connected to terminal **X** is .....

- (b) At the highest power rating, the heater drew a current of 14.2 A, when connected to the 240 V supply.
  - (i) If the heater is switched on for 5 minutes, calculate the amount of charge flowing through the heater during this period.

[1]

(ii) Calculate the highest power supplied by the heater.

(iii) A fuse is inserted into YZ and the fuses available are 1 A, 3 A, 5 A, 10 A, 13 A, 15 A and 20 A.

Determine the most suitable rating for the fuse.

The electrocution would not have happened if the water heater had been connected to newer wiring system in the home, which is protected by the Residual Current Circuit Breaker (RCCB).

(c) Describe two safety features that would have been activated when the neutral and earth wires became joined together, if the water heater is connected to the RCCB.

	Total:	[8]
		[2]
2.		
1.		

#### END OF PAPER 2