OVERMUGGED O LEVEL MOCK PAPER 2021
SECONDARY 4 EXPRESS
SECONDARY 5 NORMAL ACADEMIC

COMBINED SCIENCE (PHYSICS) **5076/02**
PAPER 2 **September 2021**
1 hour 15 mins

INSTRUCTIONS TO CANDIDATES

Write in dark blue or black pen.
You may use an HB pencil for diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer **all** questions, the last question is in the form either/or.
Write your answers in the spaces provided on the Question Paper.

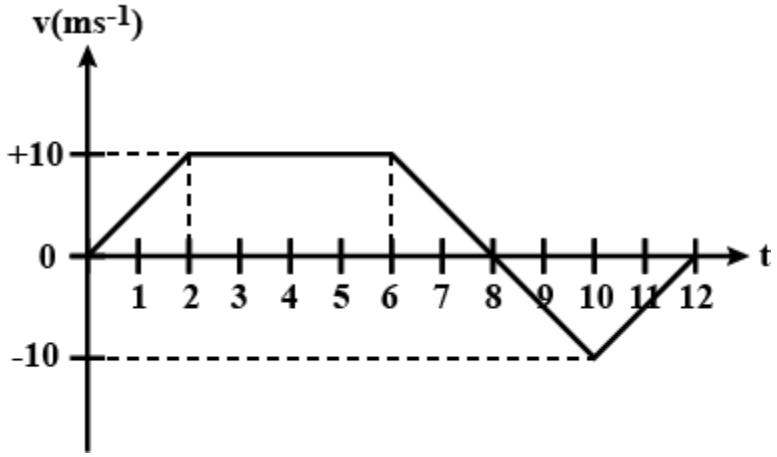
Electronic calculators may be used.

The number of mark is given in brackets [ ] at the end of each question or part question.

**Questions in this mock paper may contain adapted questions from the Ten Year Series and Prelim Papers from various schools in Singapore.*

Section A

1. Refer to the velocity time graph below.

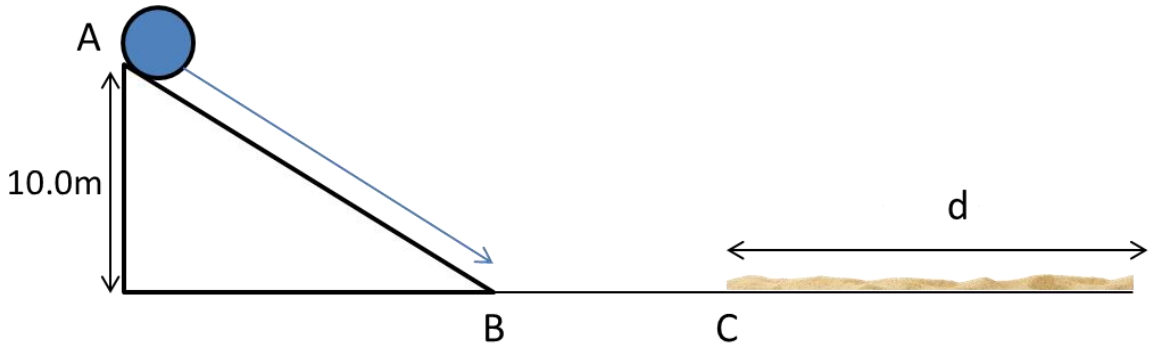


a) What is the **average speed** of the car over 12s? [2]

b) What is the **average velocity** of the car? [2]

c) What is the **instantaneous speed** of the car at 1s? [1]

2. A ball with unknown mass x kg travels down a **frictionless slope**, from point A to point B.



a) **State** the **'Principle of Conservation of Energy'.** [1]

b) State the conversion of energy as the ball rolls from point A to point B. [1]

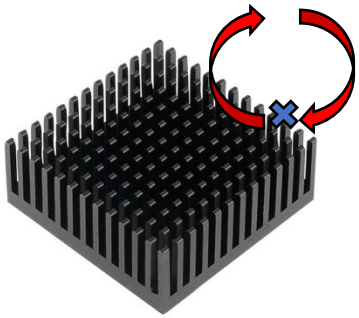
c) Determine the **speed of the ball** when it reaches **point B**. [2]

d) The ball then travels along a frictionless surface from B to C before entering a **sand pit with frictional force of 60N**.

Assuming the **ball travels 5.5m before coming to a stop**; determine the **mass of the ball**. [2]

e) State 2 examples when **friction is useful**. [2]

3. A computer processor produces heat energy that is dissipated by heat sinks with black metal fins.



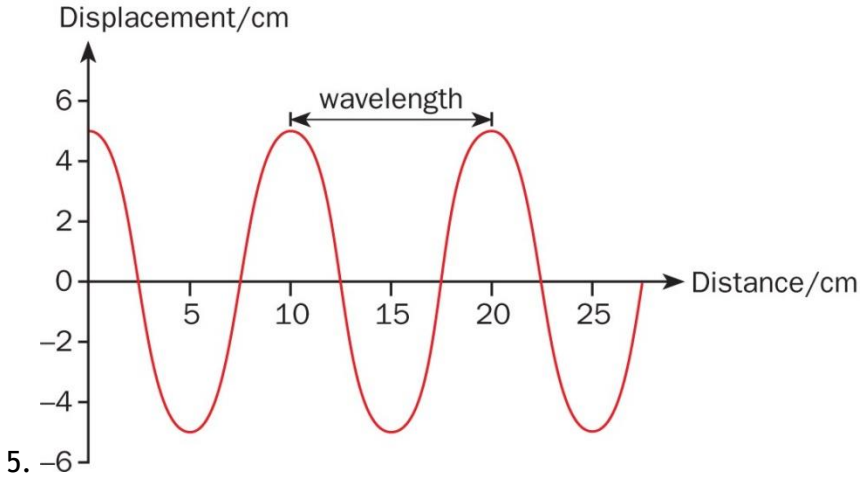
a) **State two differences between conduction and convection.** [2]

b) **State how the design of the black metal fins helps to dissipate heat efficiently.** [3]

Heat transfer	**Explanation**
Conduction	
Convection	
Radiation	

c) Refer to the 'x' on the diagram above. **Draw** the **convection current** that will be formed and **explain how convection current works.** [2]

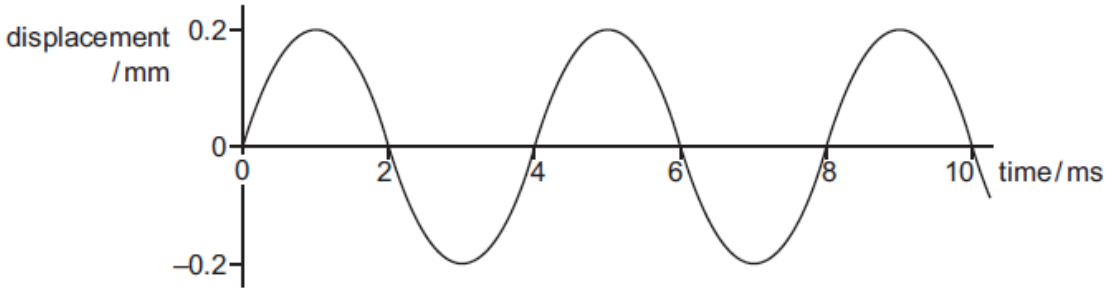
4. Refer to the graph below for wave A.



a) What is the **amplitude of wave A?** [1]

b) What is the **wavelength of wave A?** [1]

Refer to the graph of wave B.

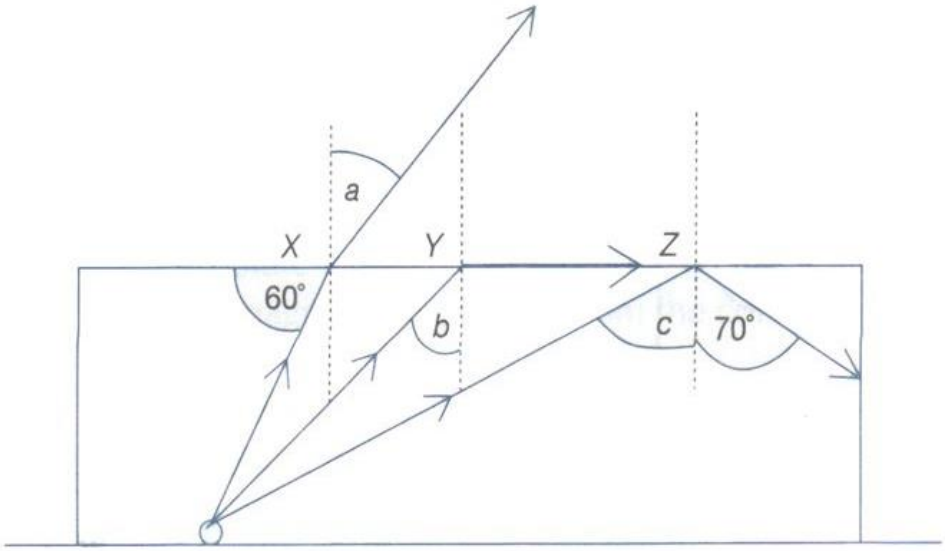


c) Determine **the period, T, of wave B.** [1]

d) Determine **frequency** of **wave B.** [1]

e) Assuming that **wave A's wavelength is twice that of wave B**, determine the **speed of wave B.** [2]

5. The diagram below shows how light bends went it goes through a block of glass. The **refractive index of the glass is 1.5**.



a) Calculate the value of **a**. [1]

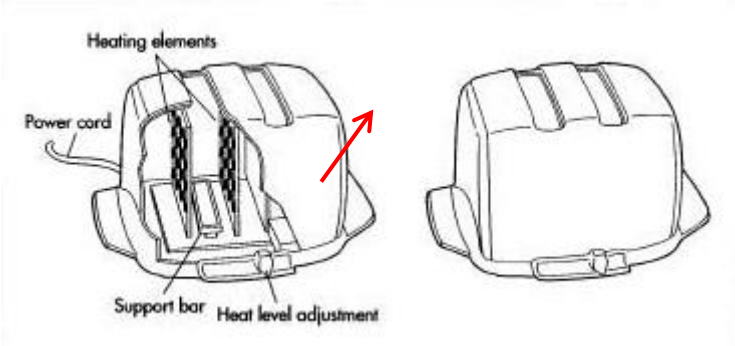
b) Calculate the value of **b**. [1]

c) State the **two conditions** for the ray to behave in such a manner at point Z. [2]

d) State the value of c. [1]

e) Diamond has a **higher refractive index** than glass. Predict how the **value of b** will change. [1]

6. A toaster is used to make bread taste crispier. It typically contains a heating element.



The appliance is set up with a fuse and **other safety precautions** as well.

a) Name **two other safety features** the toaster should have and how it protects the user. [2]

b) The toaster has a **power rating of 900W** and is connected to a 240V main supply. Calculate the **current it draws**. [1]

c) Suggest a **suitable fuse rating** and **explain** how the fuse works. [2]

d) The toaster also experiences power loss in the form of thermal energy when current flows through the wire.

Assuming the power loss has to be capped at 40W, what is the **maximum resistance** the wire can be? [1]

e) Two toasters are used for 5 minutes daily for 30 days. **Calculate the cost** if one unit of electricity is 15 cents. [2]

Section B

7. Refer to the extract from an online article below:

The northern lights, or Aurora Borealis, the spectacular cosmic shimmer is caused by powerful electromagnetic waves.

Auroras are in fact caused by interactions between energetic particles from the Sun and the Earth's magnetic field.

Electromagnetic waves transfer energy to electrons, which then hitch a ride toward Earth.

The electrons eventually collide with atoms and molecules in a brilliant light show — the aurora.

a) **Substantiating using information** found in the article, state **two properties of EM waves**. [2]

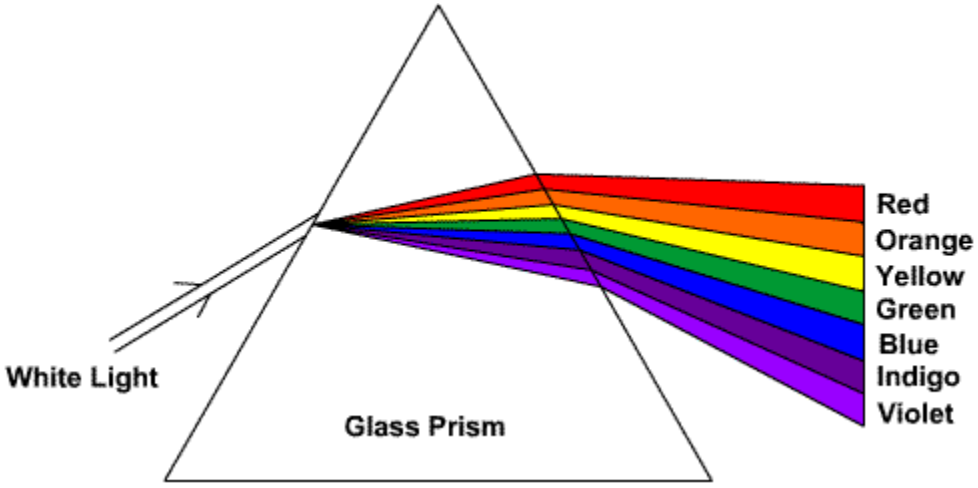
b) Deduce a **possible explanation** why the northern lights **appears in a variety of colours** when seen by the human eye. [1]

c) State **two other EM waves** with **higher frequency** than **visible light**. [1]

d) State the **two uses of the EM waves** mentioned in part c. [2]

When white light passes through a glass prism, a spectrum of colours can be seen as shown in the diagram below.

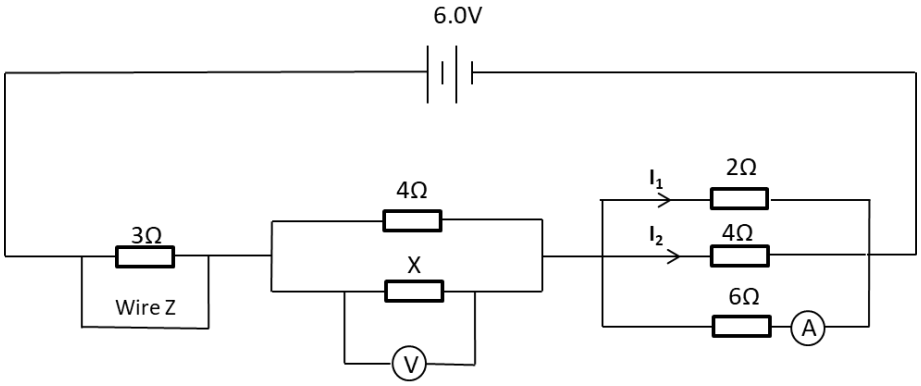
This separation of visible light into its different colors is known as '**dispersion of light**'.



e) State and explain how the dispersion of light is achieved. [1]

f) **Deduce** and **explain** whether **red light or violet light has a greater wavelength**. [3]

8. Refer to the circuit diagram below.



a) Define **current**. [1]

b) The ammeter registered a reading of 0.5A. Determine the **I_1 & I_2**. [2]

c) Find the **total current** of the circuit. [1]

d) Find the **reading on the voltmeter**. [1]

e) Determine the **resistance of X**. [2]

f) Wire Z is now removed. Explain what happens to the current flow in the circuit. [1]

g) Calculate the **new reading in the ammeter**. [2]