



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

PURE PHYSICS
PAPER 2

6091/02
September 2021
1 hour 45 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.

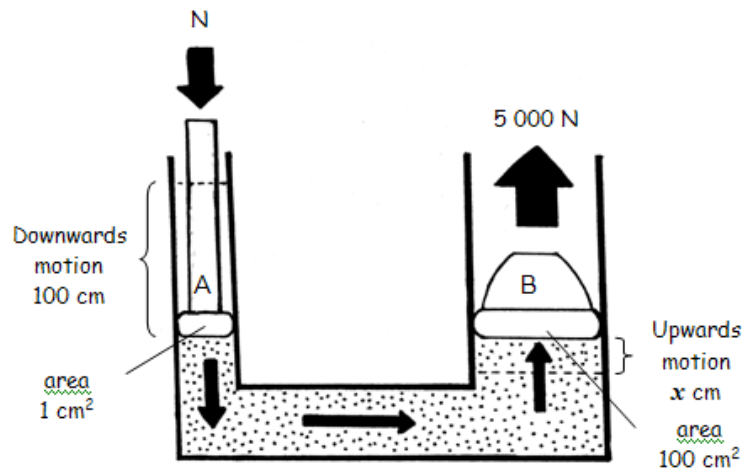
You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

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. A hydraulic system multiplies the effort so a small effort can be used to lift a much greater load. Object B has a weight of 5000N.



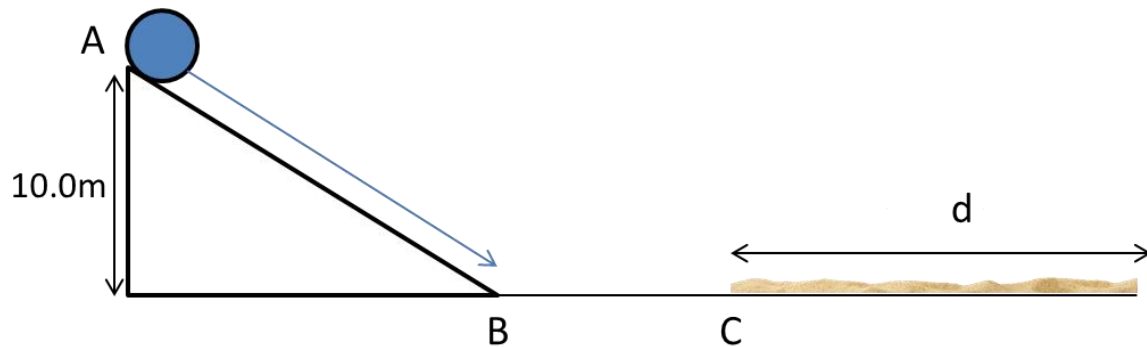
a) State 3 difference between mass and weight. [2]

b) Calculate the force acting on A. [2]

c) Calculate distance x. [2]

d) Assuming that there were bubbles inside the fluid, **predict and explain** whether the value of x will increase, decrease or remain the same. [2]

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]

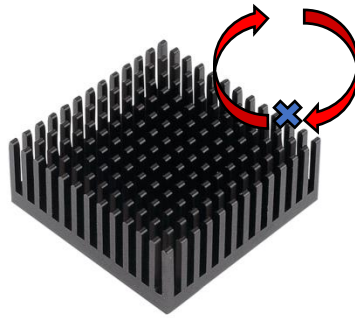
b) State the conversion of energy as the ball rolls from point A to point B. [1]

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]

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



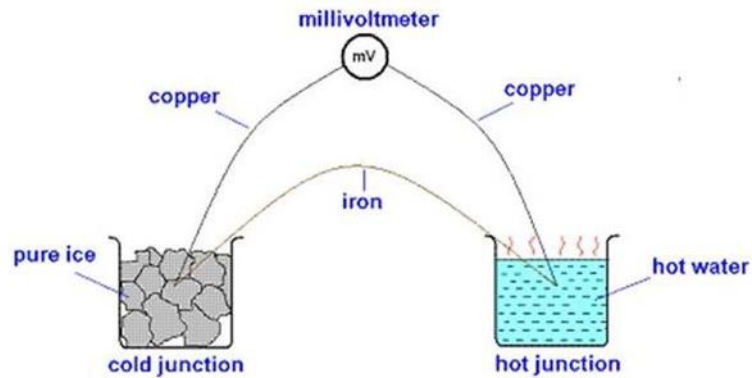
a) State two differences between conduction and convection. [2]

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. The following diagram shows a thermocouple.



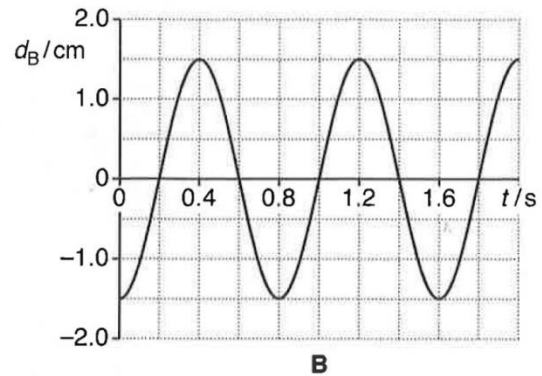
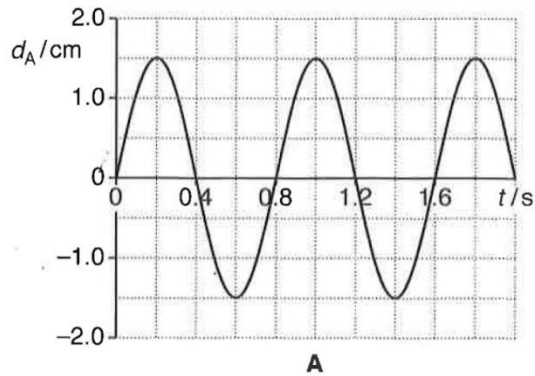
a) State the thermometric property used for a thermocouple. [1]

b) The thermocouple shows a reading of **2.50V** when placed in pure ice and hot boiling water. When the hot junction is taken out and placed in another solution, the reading dropped to **1.5V**. Determine the **temperature of the new solution**. [2]

c) The hot junction is now placed back into the boiling hot water and the **cold junction** is moved to **another liquid at -150°C** . Determine the **new reading** on the thermocouple. [2]

d) State **two advantages** of a thermocouple. [2]

5. A wave travels along a rope from left to right. Two points on the rope, point A and point B displayed the following waveforms.



a) State the **amplitude** of the wave in its SI unit. [1]

b) Define the term ‘**period of a wave**’. [1]

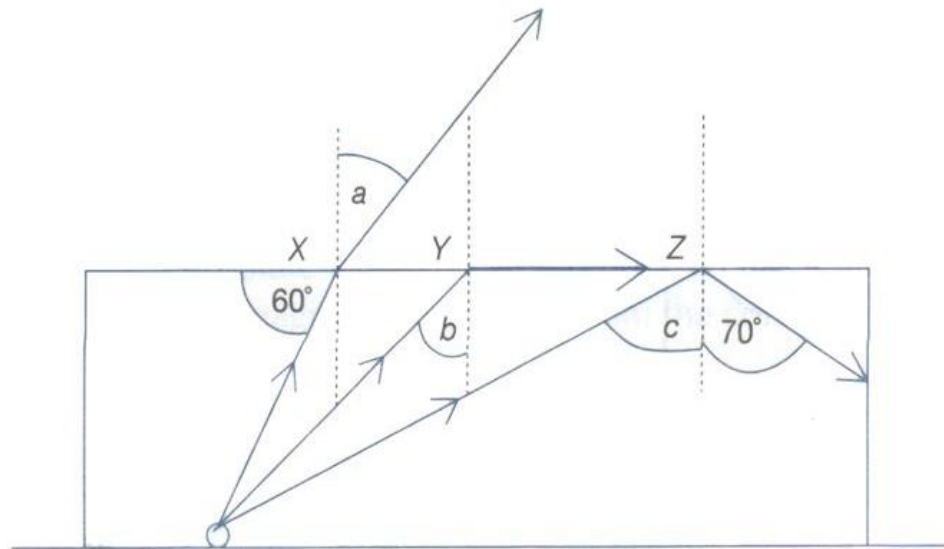
c) Determine the **frequency** of the wave. [1]

d) Point B is 50 cm to the right of Point A.

Explain, with working clearly shown, why the **speed of the wave** is 250 cm/s. [2]

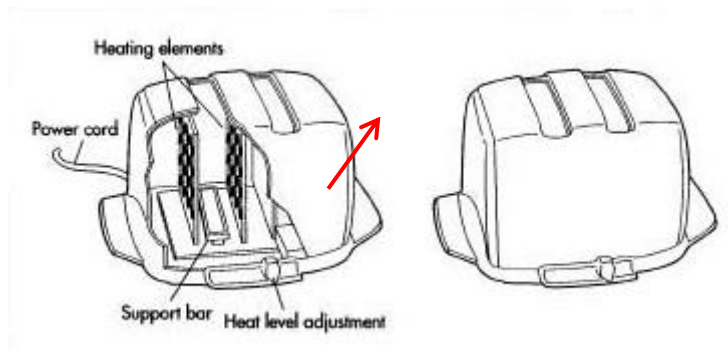
e) **Explain** why the speed of the waves could be **other values** as well, not just 250 cm/s. [1]

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



- Calculate the value of **a**. [1]
- Calculate the value of **b**. [1]
- State the **two conditions** for the ray to behave in such a manner at point Z. [2]
- State the value of **c**. [1]
- Diamond has a **higher refractive index** than glass. Predict how the **value of b** will change. [1]
- Name **one application** of the phenomenon at point Z and **explain how it works**. [2]

7. 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

8. 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]

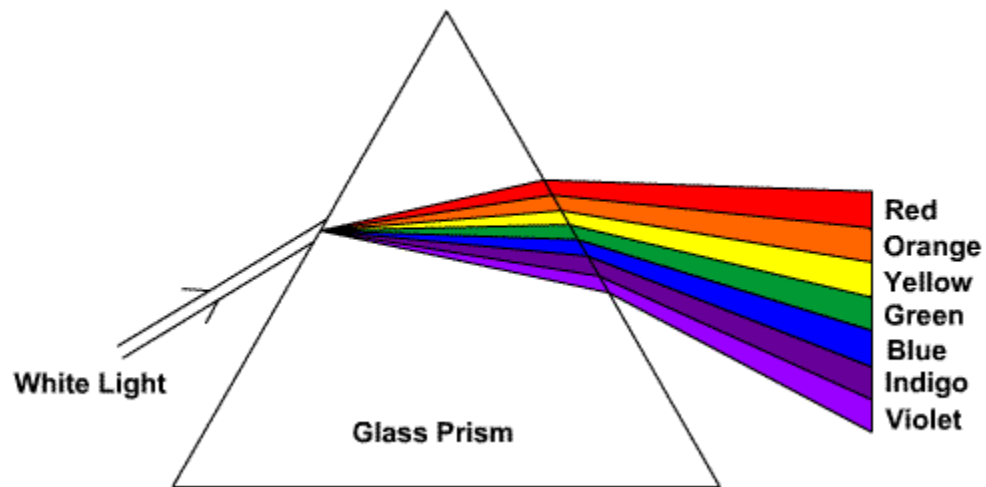
b) Deduce a **possible explanation** why the northern lights appears in a **variety of colours** when seen by the human eye. [1]

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.

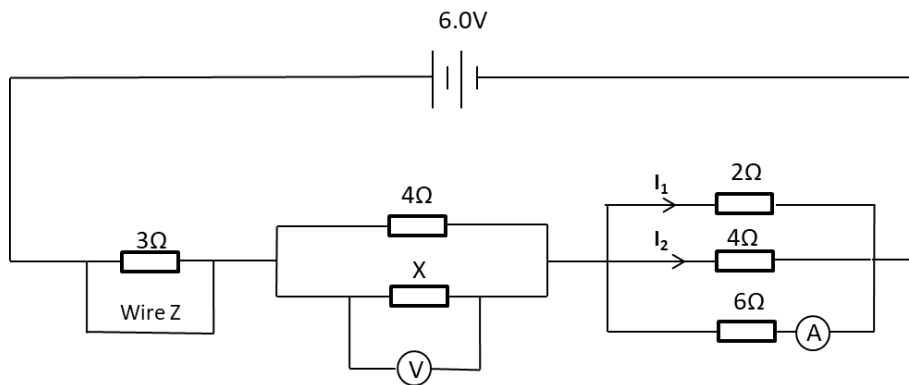
This separation of visible light into its different colors is known as ‘dispersion of light’.



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]

9. Refer to the circuit diagram below.



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

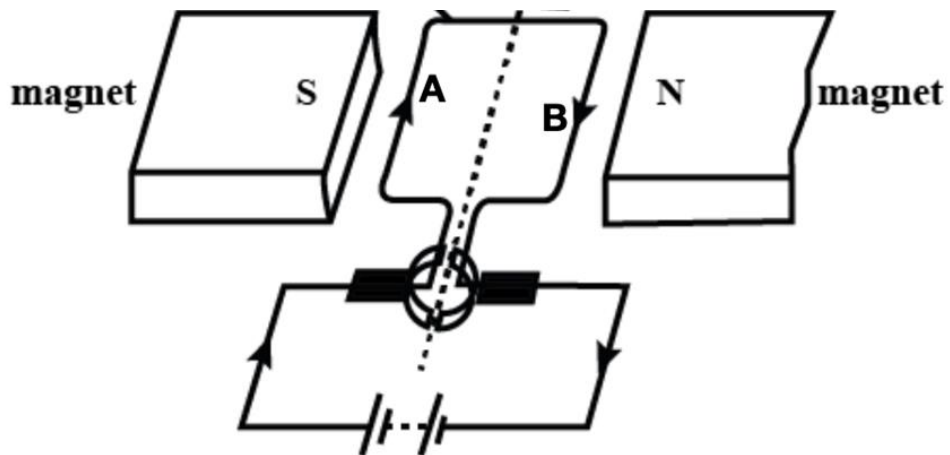
b) Find the **total current** of the circuit. [1]

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

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

e) Wire Z is now removed. Calculate the **new reading in the ammeter**. [2]

10. The diagram below shows a simple D.C. motor.

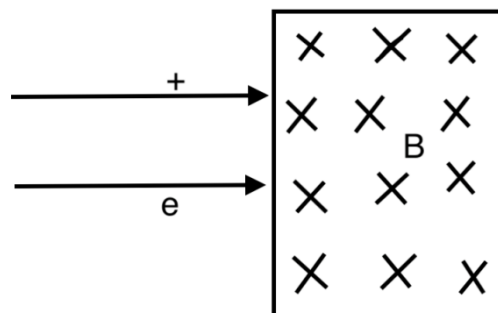


a) Explain why a split ring commutator is required in a D.C motor set-up? [2]

b) State and explain what is happening at point A and B respectively. [3]

c) Explain why the coil does not stop rotating at the vertical point. [1]

Two streams of parallel positive and negatively charged particles move into the magnetic field as shown in the diagram below.



d) **Describe** what will happen to the **2 stream of particles before** and **after** entering the magnetic field. [2]

e) **Draw** the path of the stream of charges if the direction of magnetic field is **reversed**. [2]