



FORM 4

PHYSICS

TIME: 1 hr 30 min

Name: _____

Class: _____

INFORMATION FOR CANDIDATES

- Where necessary take acceleration due to gravity ‘g’ to be 10 m/s².
- The use of a calculator is allowed.
- The number of marks for each question is given in brackets at the end of each question.
- You may find these equations useful:

| | | | |
|--------------------|--|--|----------------------------|
| Force | $F = m a$ | $W = m g$ | |
| Motion | $Average\ Speed = \frac{total\ distance}{total\ time}$ | $s = \frac{(u + v) t}{2}$ | $s = ut + \frac{1}{2}at^2$ |
| | $v = u + at$ | $v^2 = u^2 + 2as$ | Momentum = $m v$ |
| Electricity | $Q = I t$ | $V = I R$ | $E = Q V$ |
| | $R \propto L/A$ | $E = I V t$ | |
| | $R_{TOTAL} = R_1 + R_2 + R_3$ | $\frac{1}{R_{TOTAL}} = \frac{1}{R_1} + \frac{1}{R_2}$ | |
| Waves | $\eta = \frac{real\ depth}{apparent\ depth}$ | $\eta = \frac{speed\ of\ light\ in\ air}{speed\ of\ light\ in\ medium}$ | |
| | $v = f \lambda$ $f = \frac{1}{T}$ | magnification = $\frac{h_i}{h_o} = \frac{image\ height}{object\ height}$ | |
| Others | Area of triangle = $\frac{1}{2}bh$ | Area of Trapezium = $\frac{1}{2}(a + b)h$ | |

INSTRUCTIONS TO CANDIDATES

- Use blue or black ink. Pencil should be used for diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer ALL questions.
- All working must be shown

For Examiner’s Use Only

| Question | Max | Mark |
|------------------|------------|------|
| 1 | 8 | |
| 2 | 8 | |
| 3 | 8 | |
| 4 | 8 | |
| 5 | 8 | |
| 6 | 15 | |
| 7 | 15 | |
| 8 | 15 | |
| Written | 85 | |
| Practical | 15 | |
| Total | 100 | |

This document consists of 10 printed pages.

SECTION A

Each question carries 8 marks. This section carries 40 marks of the total marks for this paper.

1. Figure 1 shows a slinky spring used to demonstrate transverse waves.

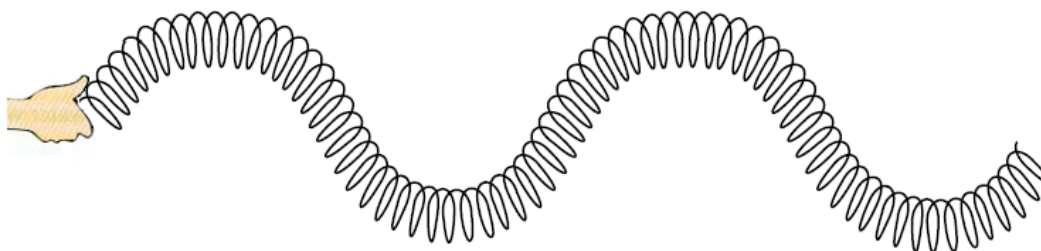


Figure 1

a) On the above figure, draw arrows that show the direction the hand must move to produce a transverse wave. [1]

b) Mark on the diagram the wavelength λ of the wave. [1]

c) What is the periodic time of the transverse wave if its frequency is 2.0 Hz?

_____ [2]

d) The speed of the wave is 1.40 m/s. Calculate its wavelength.

 _____ [2]

e) What happens to the wavelength if the frequency is **doubled**?

_____ [2]

2. A candle stands 1.0 m away from a plane mirror mounted on a wall.

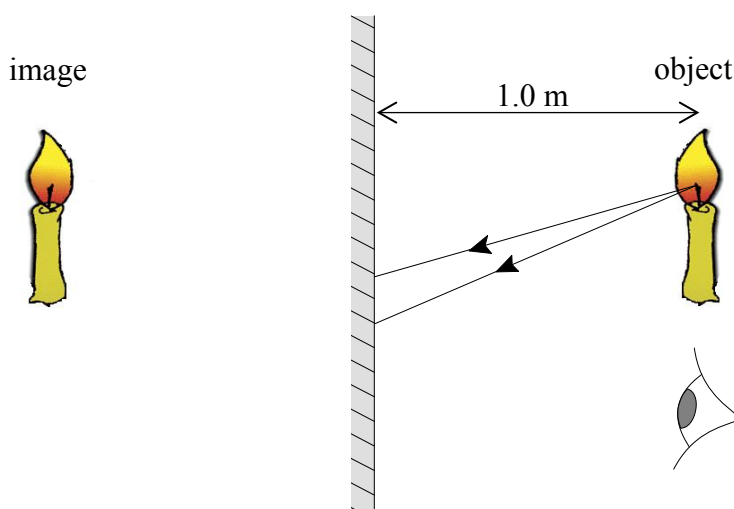


Figure 2

a) Complete the ray diagram to show how the image is formed. The diagram should include a normal. [2]

b) On the ray diagram, label an angle of incidence i and an angle of reflection r . [2]

c) How far is the image behind the mirror?

_____ [1]

d) **Underline the correct answers.**

The image formed is (*real, virtual*) and it is (*magnified, same size*). [2]

e) Name the property of images formed by plane mirrors that makes it difficult to read words.

_____ [1]

3. King Kong falls off the Empire State Building. The building is 354 m tall. Assume that there is no air resistance.

a) What is the acceleration of King Kong as it falls freely towards the ground?

_____ [1]

b) State the initial velocity of King Kong.

_____ [1]

c) Calculate the time it will take to reach the ground.

_____ [3]

d) Find King Kong's final velocity just before it hits the ground.

_____ [2]

e) On the axis below, sketch a graph that shows how the velocity of King Kong changes as it falls. [1]



Figure 3



Figure 4

4. Doreen sets up the following apparatus to measure the speed of sound in air. Timing starts when the sound reaches Microphone A and stops when the same sound reaches Microphone B.

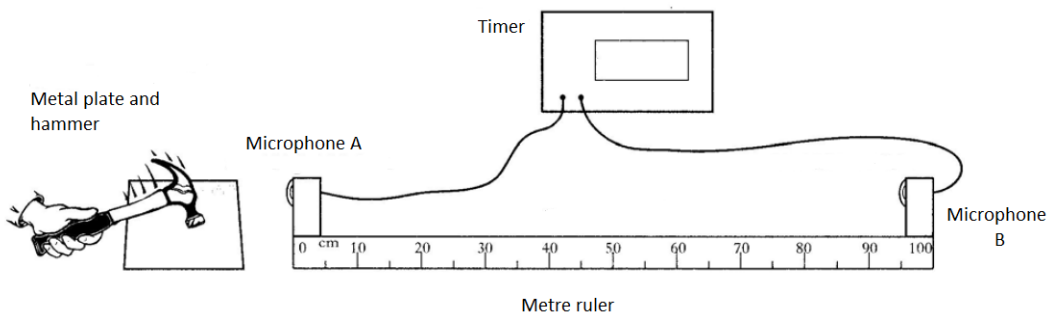


Figure 5

- a) What type of waves are sound waves?

_____ [1]

- b) The timer registers 0.003 s. If the distance between the microphones is 0.96 m, calculate the speed of sound.

_____ [2]

- c) Doreen connects one of the microphones to an oscilloscope. The waveform she obtains is shown in Figure 6. Draw on the same figure the waveform Doreen obtains if she hits the metal plate more gently. The sound produced has the same frequency. [1]

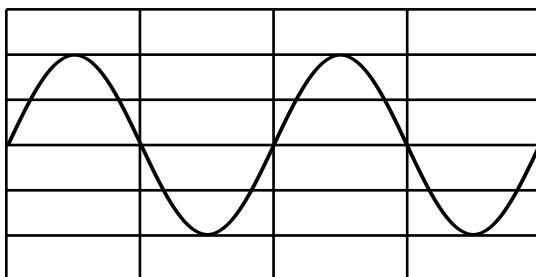


Figure 6

- d) One method of measuring liquid level in a sealed container is by using ultrasound.

- i) What is meant by the term ultrasound?

_____ [1]



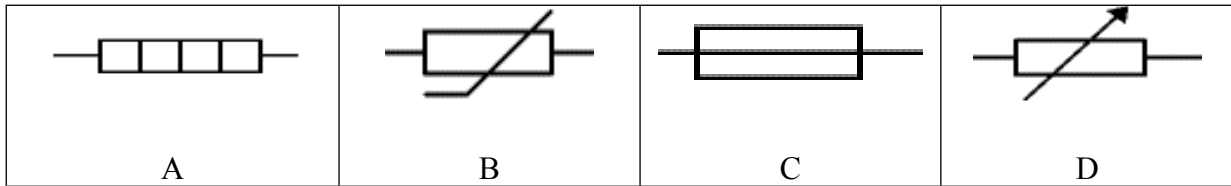
Figure 7

- ii) Underline the ultrasonic frequency. (15000 Hz, 24000 Hz, 10 Hz) [1]

- iii) Name **TWO** other uses of ultrasound.

_____ [2]

5. A student was investigating how the current through a thermistor changes with voltage across it.
- a) A thermistor is a (conductor, insulator, semiconductor). [1]
- b) Which symbol represents the thermistor? _____ [1]



- c) The graph shown in Figure 8 shows how the current through a thermistor changes with increasing voltage.

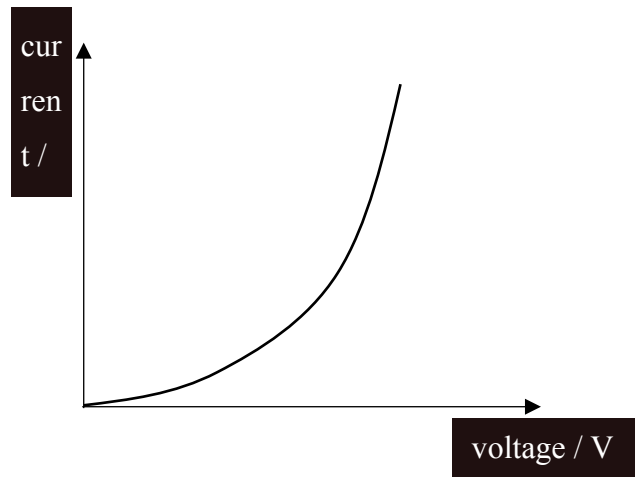


Figure 8

- i) Does a thermistor obey Ohm's Law? _____ [1]
- ii) How can you tell from the graph?
 _____ [2]
- d) What happens to the resistance of a thermistor as temperature increases?
 _____ [1]
- e) Name **ONE** other semiconductor component and draw its circuit symbol in the space provided.

Name: _____

Symbol:



[2]

SECTION B

Each question carries 15 marks. This section carries 45 marks of the total marks for this paper.

6. A truck was moving with a **constant velocity** of 20 m/s along a road.

a) What is the resultant force acting on the truck? _____ [1]

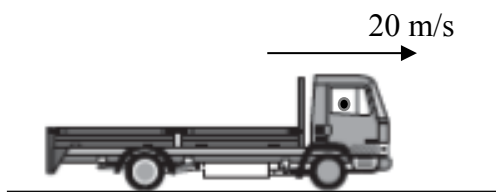


Figure 9

Suddenly the driver had to brake. The following table gives information about the motion of the truck.

| | | | | | | | |
|----------------|----|----|----|----|----|----|----|
| velocity (m/s) | 20 | 20 | 20 | 15 | 10 | 5 | 0 |
| time (s) | 0 | 10 | 20 | 30 | 40 | 50 | 60 |

b) Plot a graph of velocity in m/s on the y-axis against time in s on the x-axis. [5]

c) Find the total distance travelled by the truck.

_____ [2]

d) Given that the truck has a mass of 1800 kg, calculate the momentum of the truck when it is moving at 20 m/s.

_____ [2]

e) Using the equation $v = u + at$, calculate the deceleration of the truck.

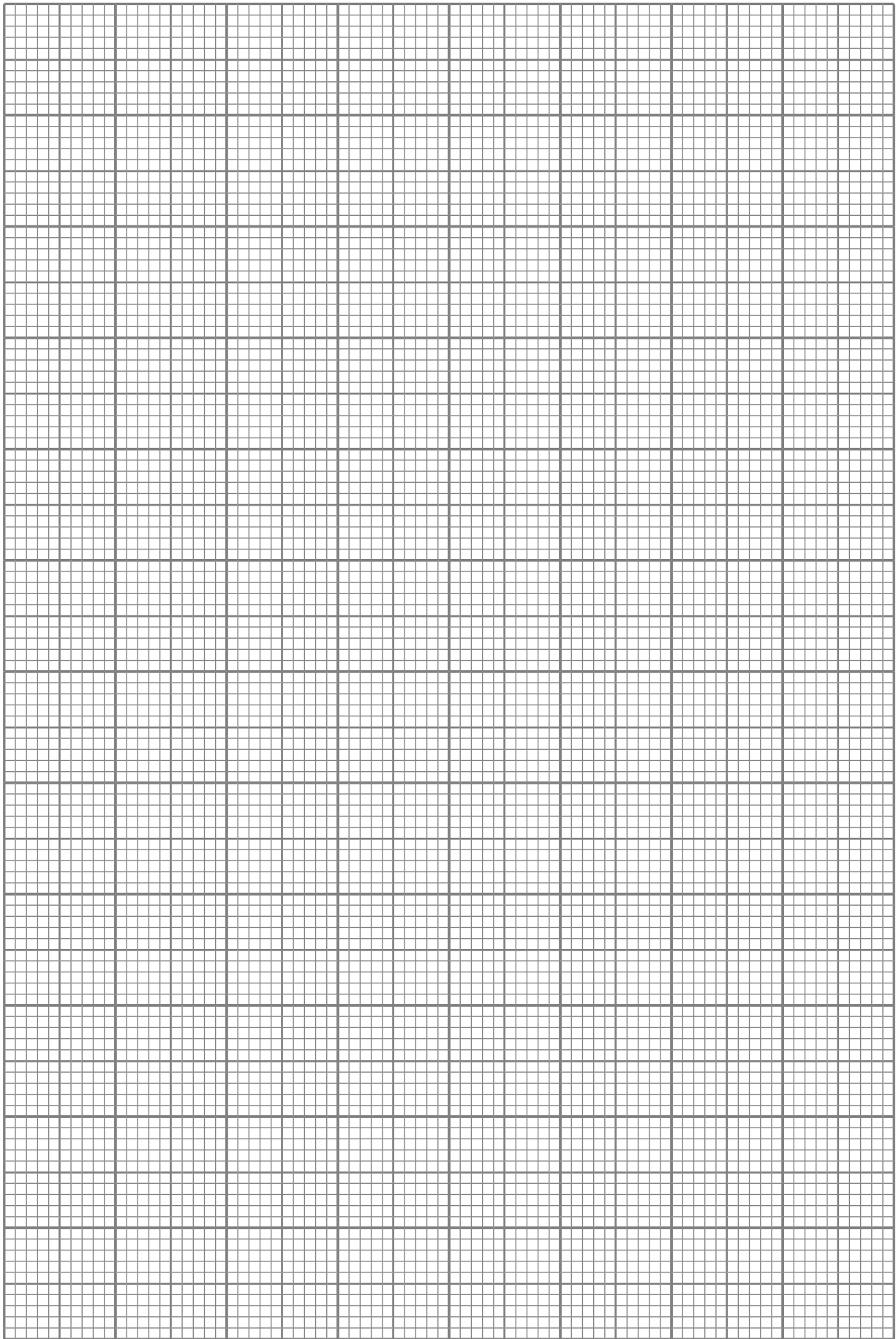
_____ [2]

f) Calculate the braking force applied.

_____ [2]

g) If the road was slippery, how would this affect the braking distance?

_____ [1]



7. Two charged metal balls A and B are hanging freely close to positively charged metal plate.

a) Which of the two balls is attracted to the plate?

_____ [1]

b) Draw a (+) sign on the ball that is positively charged and a (-) sign on the negatively charged ball.

c) State what would happen if the charged Ball B is brought close to a charged polythene rod.

Explain your answer.

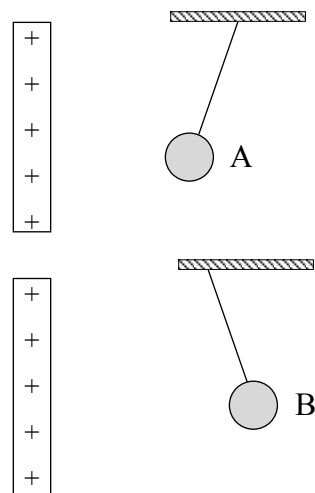


Figure 10

[2]

_____ [2]

d) In the circuit below, the voltmeter reads 12 V and the resistance of the bulbs are as shown.

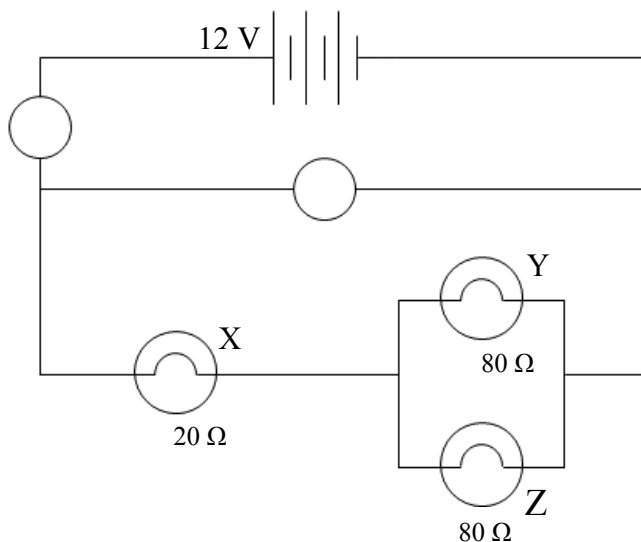


Figure 11

i) Label an ammeter and a voltmeter in the space provided. [2]

ii) On the diagram, draw an arrow that shows the direction of the current. [1]

iii) Calculate the resistance of bulbs Y and Z that are connected in parallel.

_____ [2]

iv) Calculate the total resistance of the three bulbs.

_____ [1]

v) If the ammeter shows a current of 0.20 A, calculate the voltage across Bulb X.

_____ [1]

vi) What is the voltage across the parallel bulbs?

_____ [1]

vii) Why does an equal current flow through bulbs Y and Z?

_____ [1]

8. Luke performs an experiment to investigate the magnification of a thin converging lens. An object is placed in front of the flashlight. The setup is shown below.

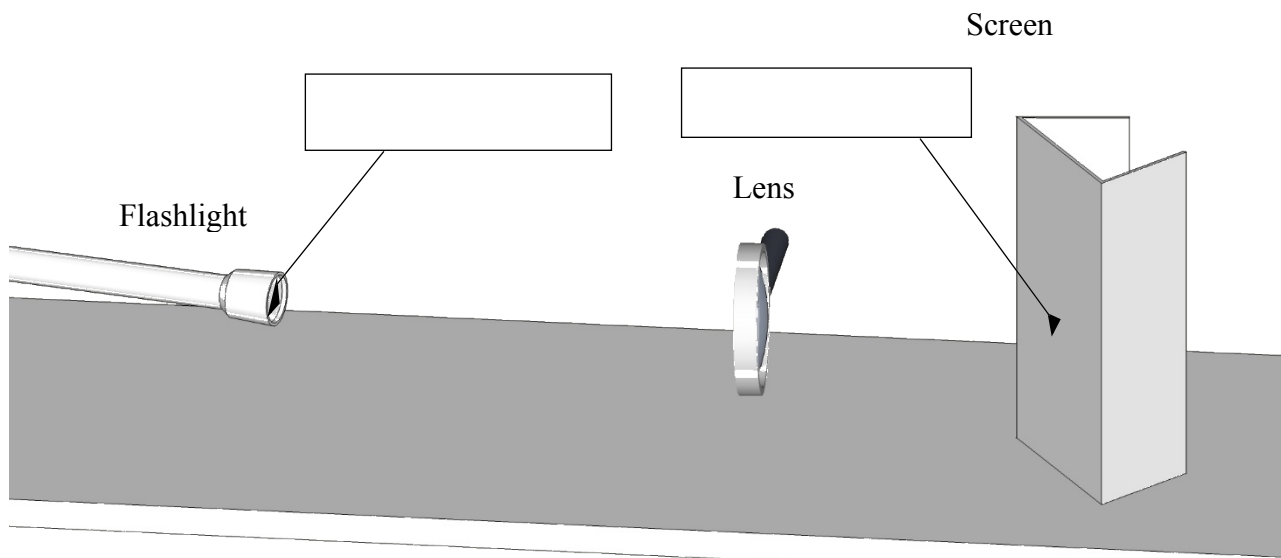


Figure 12

a) On the above diagram, label the **object** and the **image** in the space provided. [2]

b) Fill in the space provided to explain how Luke carried out the experiment.

i) The flashlight, lens and screen are _____ so that a _____ image forms on the screen. [2]

ii) Two readings are taken. List them below.

_____ [2]

c) Name **TWO** properties of the image formed.

_____ [2]

d) This is a set of Luke's results:

| distance between object and lens in mm | distance between image and lens in mm |
|--|---------------------------------------|
| 120 | 60 |

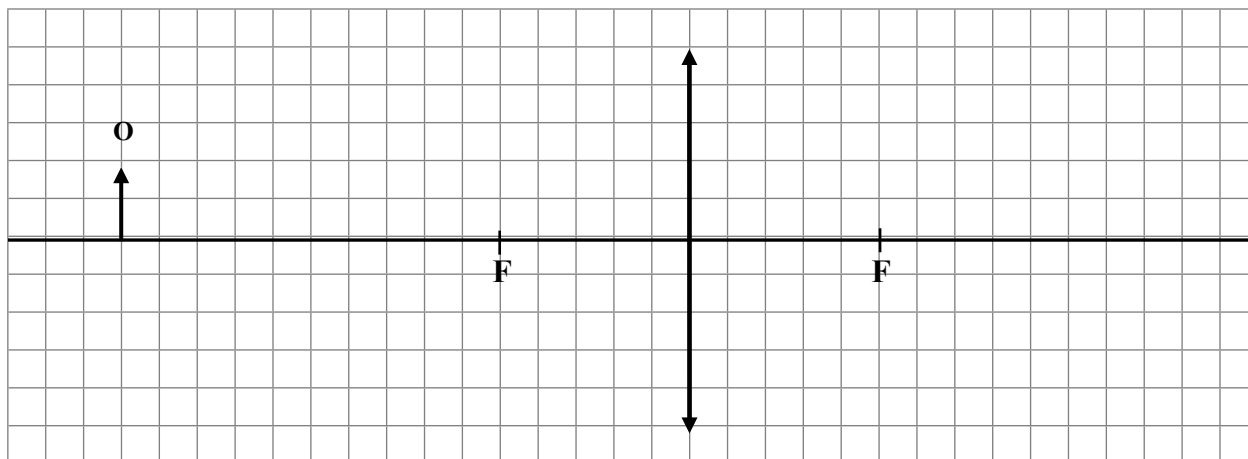
Use these results to calculate the magnification of the lens.

_____ [2]

e) Help Luke construct a ray diagram for this converging lens using the diagram below by:

i) drawing two rays from the object to the image; [2]

ii) drawing and labeling the image I. [1]



f) If each square represents 1 cm, what is the focal length of the lens?

_____ [1]

g) Mention **ONE** use of the setup.

_____ [1]

END OF PAPER