



FORM 4

PHYSICS

TIME: 1h 30min

Name: _____

Class: _____

Answer ALL questions in the spaces provided on the exam paper.
All working must be shown. The use of a calculator is allowed.
Where necessary take the acceleration due to gravity, g to be 10 m/s^2 .

Forces & Motion	$W = mg$	$F = ma$
	$v = u + at$	$s = ut + \frac{1}{2} a t^2$
	$s = \frac{(u+v)}{2} t$	$v^2 = u^2 + 2as$
	Average speed = $\frac{\text{Total distance}}{\text{Total time}}$	Area of trapezium = $\frac{1}{2} h(a+b)$
Waves	$v = f \lambda$	$f = \frac{1}{T}$
	$m = \frac{\text{image distance}}{\text{object distance}}$	$m = \frac{\text{height of image}}{\text{height of object}}$
	$n = \frac{\text{real depth}}{\text{apparent depth}}$	$n = \frac{\text{speed of light (air)}}{\text{speed of light (medium)}}$

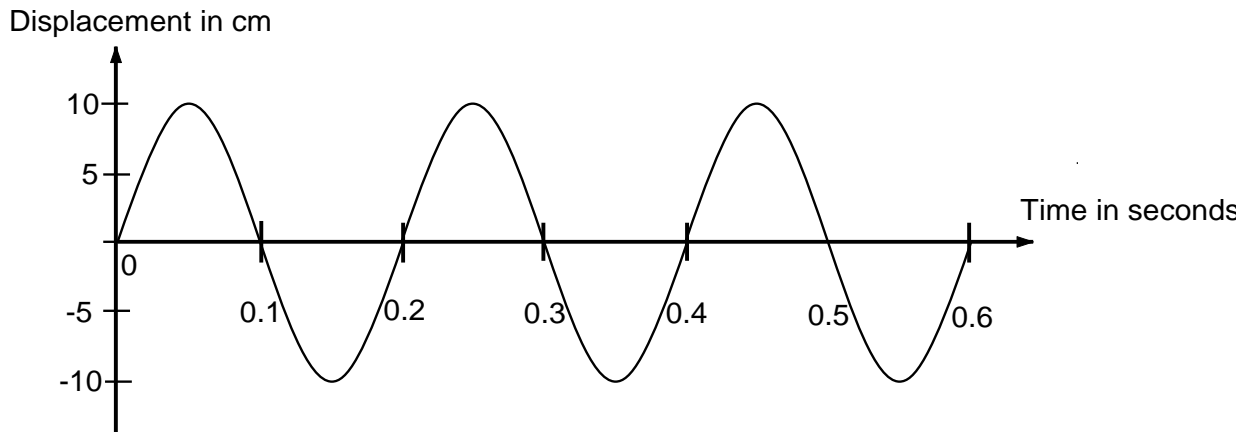
Number	1	2	3	4	5	6	7	8	Total
Maximum mark	8	8	8	8	8	15	15	15	85
Actual mark									

	Total Theory	Total Practical	Final Mark
Actual Mark			
Maximum Mark	85	15	100

SECTION A

This section carries 40 marks

1. The diagram below shows a displacement-time graph of a **water wave**.



a) Is this wave a transverse or a longitudinal wave?
_____ [1]

b) On the graph mark a crest with a letter **C** and a trough with a letter **T** [2]

c) From the graph answer the following questions:

i. Find the amplitude of the wave _____ [1]

ii. Find the time of one wave _____ [1]

d) In order to find the frequency of a wave we use the formula:

$$f = \frac{1}{T}$$

i. Find the frequency of the wave above: _____ [1]

ii. The wavelength of the above wave is 0.2 metres. Hence find the velocity of the wave.

_____ [2]

2a. **Fill in** the following empty spaces in the diagram below to complete the electromagnetic spectrum.

Gamma-Rays		Ultraviolet	Visible Light	Infra-Red		Radio-Waves
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[2]

From the above diagram:

b. Name **two** types of waves that can be used for communications.

_____ [1]

c. Name **one** type of wave that can be used to treat cancer.

_____ [1]

d. Name **one** use of Infra-Red rays.

_____ [1]

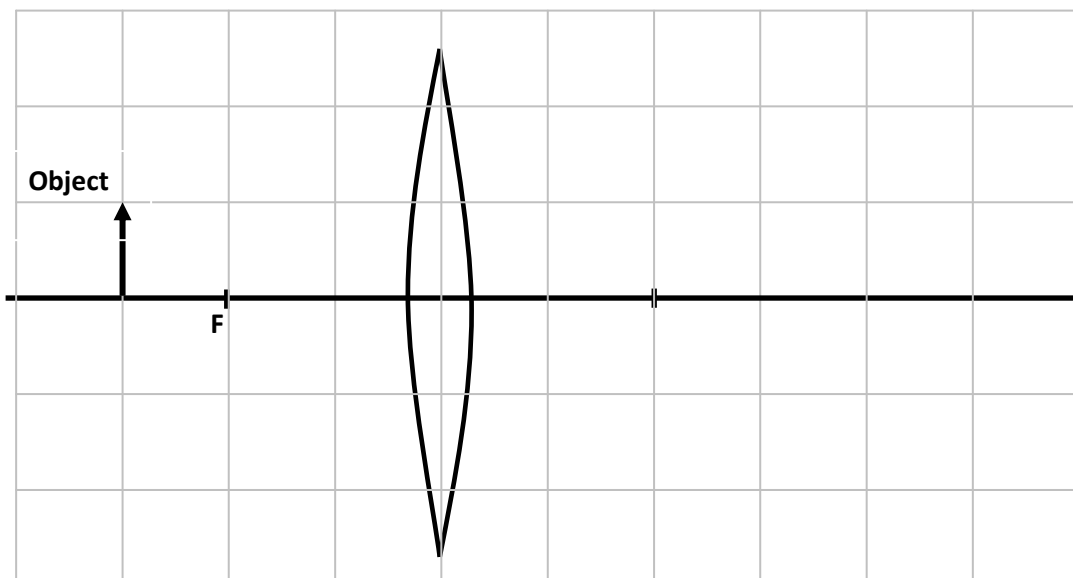
e. Name a common **property** for all the waves of the electromagnetic spectrum .

_____ [1]

f. Why it is advisable to cover exposed skin with a suitable cream if you stay outdoors in summer on a sunny day?

 _____ [2]

3. The lens of a projector is used to put an image on a screen.



a. Draw **two** rays on the diagram to show how the image is produced. [2]

b. Is this image:

i) Magnified or diminished? _____ [1]

ii) Upright or inverted? _____ [1]

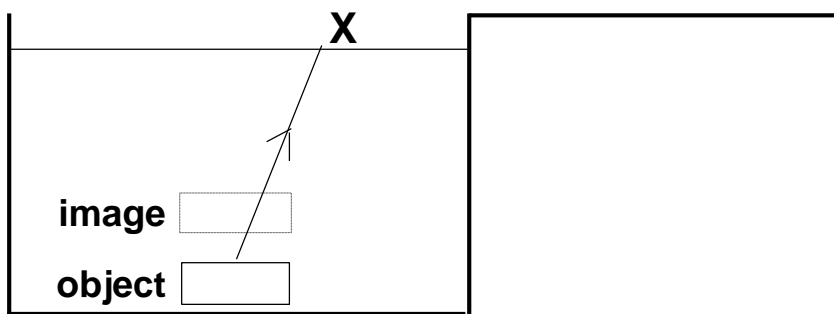
c. Calculate the magnification of the lens.

_____ [2]

d. Describe **two** changes which occur to the image when the object is moves very close to the lens

_____ [2]

4. John looks at a stationary object on the bottom of a swimming pool as shown in the diagram below.



a. The object appears to be closer to the water surface. This effect is caused by

_____ [1]

b. On the diagram above:

i. draw the ray of light as it emerges from under the water, [1]

ii. mark the angle of incidence (**i**) and the angle of refraction (**r**). [2]

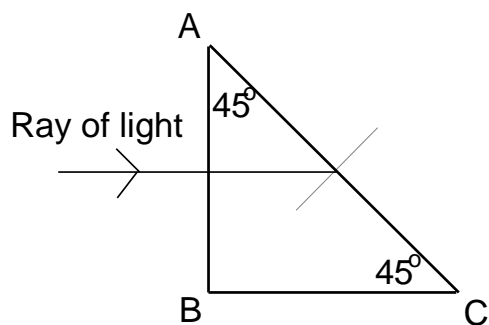
c. If the pool is 2m deep and the object appears to be only 1.5m below the water surface, calculate the refractive index of water.

[2]

d. Given that the speed of light in air is 300,000,000m/s, calculate the speed of light in water.

[2]

5. A ray of light hits side AB of an isosceles right-angled glass prism. The critical angle for glass is 42° .



a. Explain why the ray of light passes straight through and is not deviated when entering the glass block at side AB.

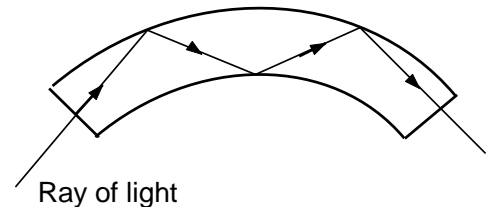
[2]

b. Complete the diagram to show the passage of the ray of light as it passes through the prism. [1]

c. What is the size of the angle of reflection? Explain.

[2]

d. The diagram shows an optical fibre.



Complete using some of the following words.

reflection, refraction, smaller, larger

A ray of light that passes through an optic fibre undergoes total internal _____ . This happens because the angle of incidence of light in glass is _____ than the critical angle. [2]

e. State one practical application of optical fibres.

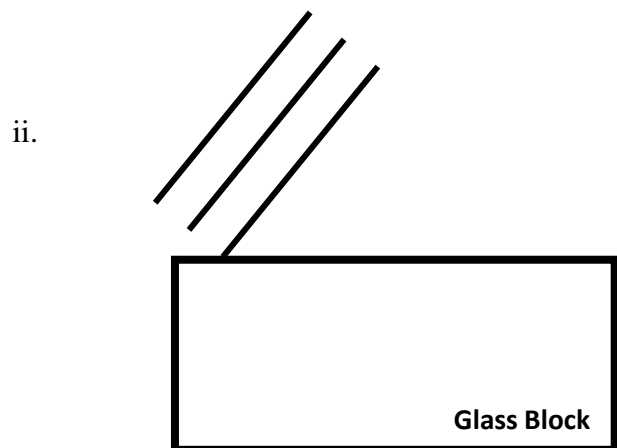
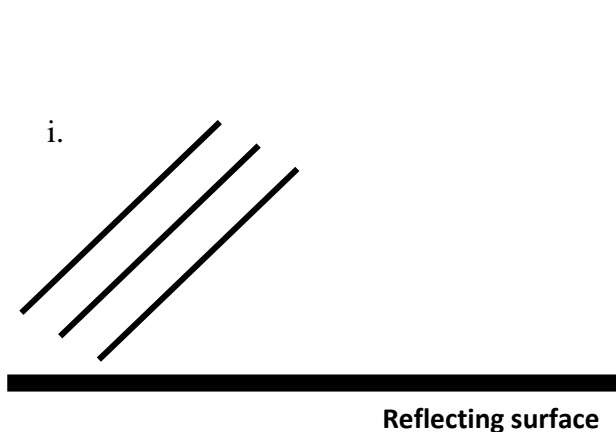
_____ [1]

SECTION B

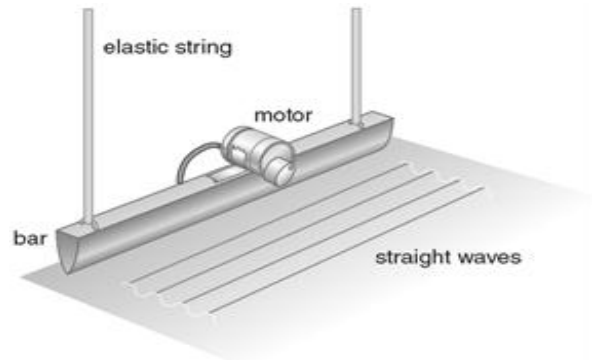
This section carries 45 marks

6. A ripple tank is used to observe the properties of waves. The diagrams below show reflection and refraction of water waves.

a. **Complete each diagram** to show how waves travel in each situation. [4]



b. A plastic bar is used in the ripple tank to produce straight waves that have a **frequency of 4Hz**.



i. Explain the term **frequency**.

_____ [2]

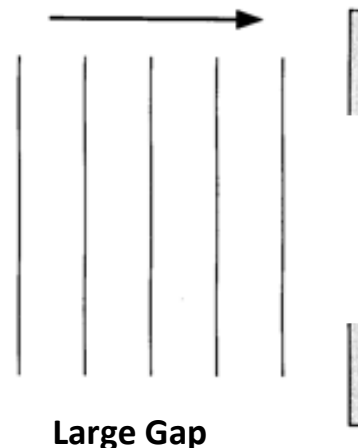
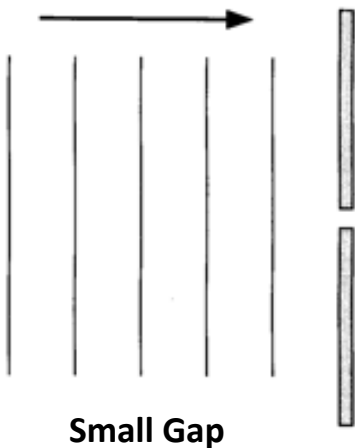
ii. The **wavelength of the waves is 0.05m**, calculate the **velocity of the waves** in the ripple tank.

_____ [2]

iii. **Explain** what happens to the **frequency** if the motor rotates faster.

_____ [2]

c. Two students placed two barriers in the ripple tank leaving a gap in between. **Complete** the following diagrams. [4]



d. **Underline** the correct word: In both diagrams the waves are undergoing (*Reflection, Diffraction, Refraction*). [1]

7. A racing car was driven to test a new engine. The engineer moved with a low velocity on a straight track to check the engine's performance.



The velocity of a car during the first part of a lap was measured and is shown in the table below.

Velocity/ m/s	0	3	6	9	12	12	12	6	0	0
Time/ s	0	2	4	6	8	10	12	14	16	18

a. Plot a graph of **velocity (y-axis)** against **time (x-axis)** on the graph paper provided. [4]

b. What is the **highest velocity** reached by the car?

_____ [1]

c. From the graph, find the **velocity** of the car in the **3rd second**?

_____ [1]

d. Describe the motion of the car. Choose from the following:

(**acceleration, deceleration, constant velocity, at rest**)

i. the **8th to the 12th second**: _____ [1]

ii. the **12th to the 14th second**: _____ [1]

iii. the **16th to the 18th second**: _____ [1]

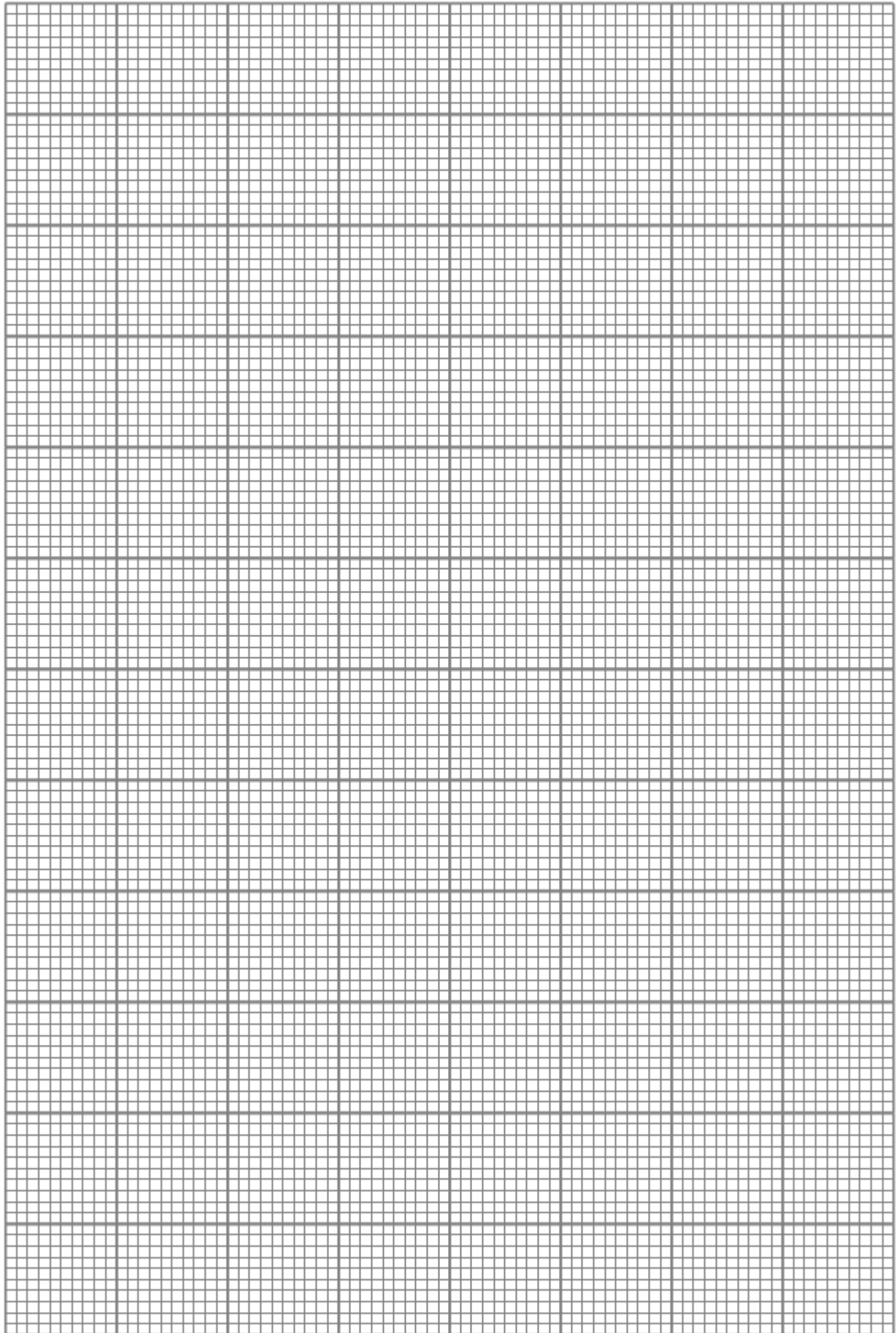
e. Calculate the area under the graph during the first 8seconds.

_____ [2]

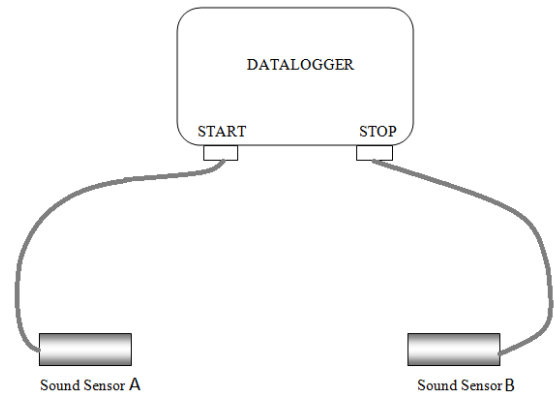
f. **Underline** the correct answer:

i. The area under the graph gives you the (*distance travelled, acceleration, velocity*) of the car. [2]

ii. The slope of this graph gives you the (*distance travelled, acceleration, velocity*) of the car. [2]



8. a. Nathan and Jane use a data logger to measure the speed of sound in air. The diagram shows the experimental setup.



i. Describe how Nathan and Jane can use the setup above to **measure the speed of sound** in air by marking the order of the following sentences in the table below. [4]

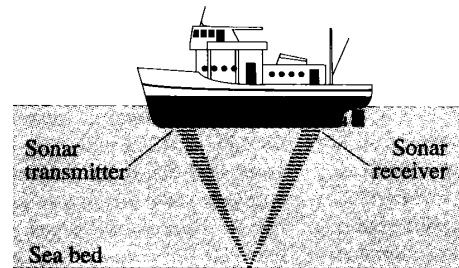
	Find the speed of sound using the formula Average speed = distance / time
	The distance between the sensors was measured.
	Repeat the experiment and take an average.
	Start the sound signal and take the time for the sound to reach sensor B

ii. Give **one precaution** they should take during the experiment.

_____ [1]

b. Ultrasounds are sounds that have a high frequency.

A fishing boat is using a sonar device which works by ultrasounds. A short pulse sent by the transmitter takes 0.3s to reach the seabed.



i. How long does it take the pulse to travel from the transmitter to the receiver?

_____ [1]

ii. Calculate the **depth of the sea**, if the speed of sound in water is 1500m/s.

 _____ [2]

iii. What is the distance travelled by the pulse from the transmitter to the receiver?

_____ [1]

- c. Ultrasounds can also be used to obtain information about the internal structure of the body. A wave is transmitted into the body, where it is reflected at the boundaries between different type of tissue.

Medium	Ultrasound Velocity (m/s)
Muscle	1590
Soft tissue	1540

- i. A wave with a frequency of 1.5×10^5 Hz (150000 Hz) is transmitted through muscle. Calculate the **wavelength** of the wave.

_____ [2]

Underline the correct answer:

- ii. Ultrasound travels (*faster, slower*) in muscle. [1]
- iii. (*Gamma rays, x-rays*) can be used to obtain information about the bone structure of the body. [1]

- d. **Explain** why the wave you chose in (c iii) is **not used** with unborn babies.

_____ [2]