



ST. CLARE COLLEGE
GIRLS' SECONDARY SCHOOL - PEMBROKE
 HALF-YEARLY EXAMINATION FEBRUARY 2012



FORM 4

PHYSICS

TIME: 1 h 30 min

Name: _____ Class: _____ Total Mark:

ANSWERS MUST BE WRITTEN IN INK. EXCEPT WHERE THEY ARE EXPRESSLY REQUIRED, PENCILS MAY BE USED ONLY FOR DRAWING, SKETCHING, OR GRAPHICAL WORK.

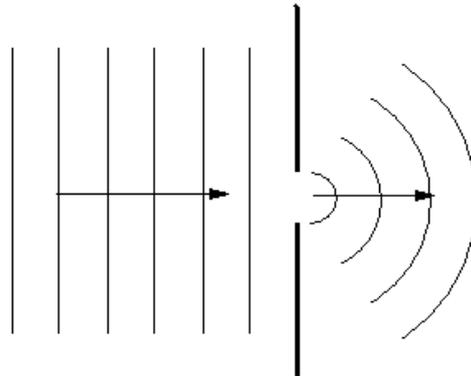
The following formulae may be useful.

| | |
|------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| $v = f\lambda$ | $T = \frac{1}{f}$ |
| $v = \frac{s}{t}$ | $n = \frac{\text{speed of light in air}}{\text{speed of light in other substance}}$ |
| $n = \frac{\text{real depth}}{\text{apparent depth}}$ | magnification = $\frac{\text{height of image}}{\text{height of object}}$ |
| magnification = $\frac{\text{image distance}}{\text{object distance}}$ | $v = u + at$ |
| $s = \frac{(u+v)t}{2}$ | $s = ut + \frac{1}{2} at^2$ |
| $v^2 = u^2 + 2as$ | area of trapezium = $\frac{(a+b)h}{2}$ |

| Question | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | Theory | Practical | Total |
|----------|---|---|---|---|---|---|---|---|---|--------|-----------|-------|
| Mark | | | | | | | | | | | | |

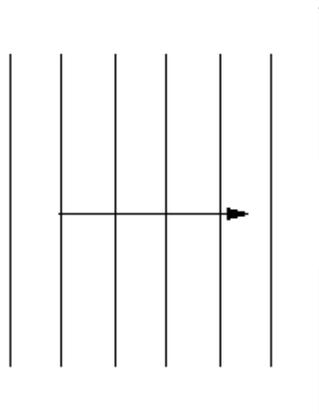
Section A: This section carries 40 marks.

1a. The diagram shows water waves passing through a narrow gap.



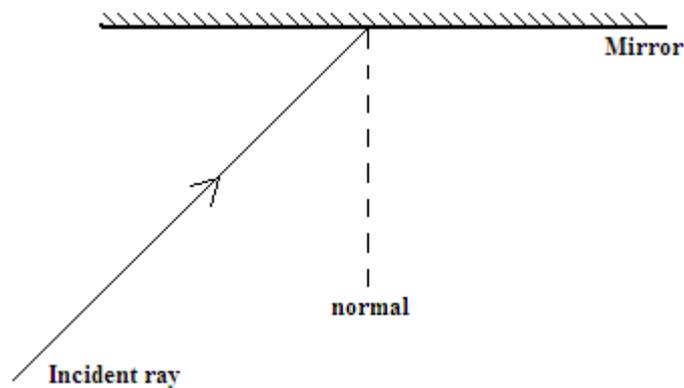
Name the effect shown. _____ (1 mark)

b. Complete the diagram below to show what happens to waves of the same wavelength when they pass through a much larger gap.



(2 marks)

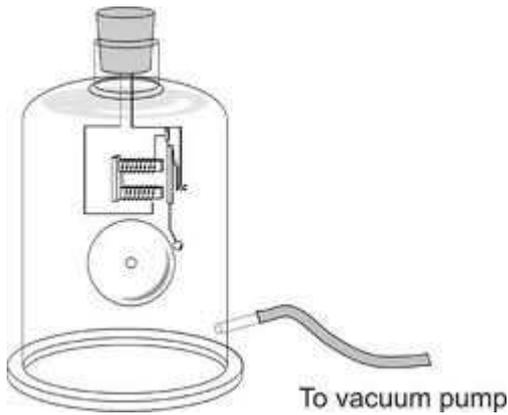
c. The diagram below shows a ray of light incident on a plane mirror at an angle of 45° .



(2 marks)

Draw the reflected ray on the diagram and clearly label the angle of reflection.

2.



The diagram represents the apparatus which may be used to investigate the transmission of sound through air. In an experiment, the bell is switched on while there is still air in the jar.

a. What happens to the air inside the jar when the pump is switched on?

(1 mark)

b. What is heard when the pump is switched on?

(1 mark)

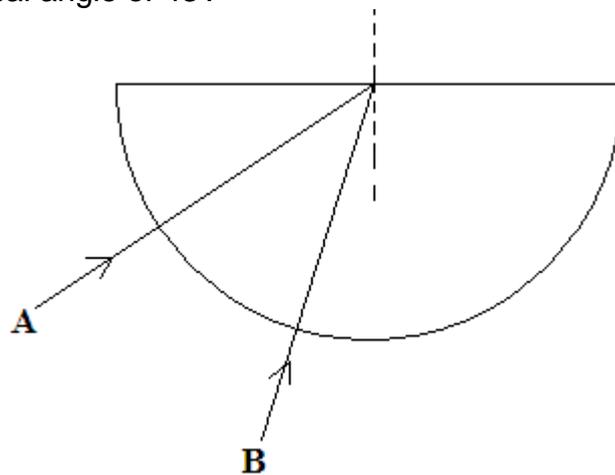
c. What can you conclude about transmission of sound?

(2 marks)

d. A student put her ear against the jar and noted that she could hear the bell ringing. Explain why this is so.

(2 marks)

3. The diagram shows 2 rays, A and B, entering a semi-circular glass block which has a critical angle of 43° .



a. Complete the diagram by drawing the path followed by the one ray (A or B) which undergoes total internal reflection. (2 marks)

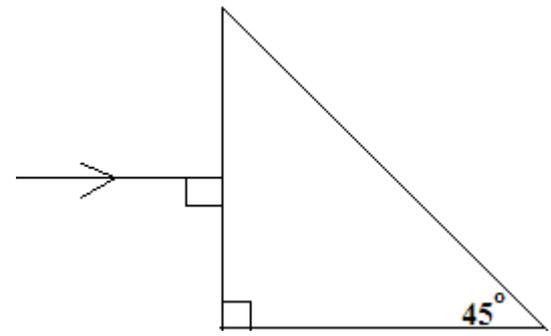
b. The rays entering the block are not bent because _____

_____ (1 mark)

c. Mention one thing that is necessary for total internal reflection to occur.

_____ (2 marks)

d. Complete the below diagram.



(2 marks)

4. A toy boat moves up and down in the water in the middle of a swimming pool.

a. Draw 2 complete waves formed.

(2 marks)

b. The velocity of the waves is 0.03m/s and the boat moves up and down 2 times per second.

i. What is the frequency of the waves?

_____ (1 mark)

ii. Calculate the wavelength.

_____ (2 marks)

c. Water waves are transverse waves. What do we mean by *transverse* waves?

_____ (2 marks)

d. What do you consider to be the biggest difference between water and sound waves?

(1 mark)

5. A light bulb emits visible light when a current passes through the filament inside it.

a. What radiation of longer wavelength than visible light is emitted by the bulb?

(1 mark)

b. Energy reaching the Earth from the Sun contains both visible light and the radiation named above. What property must these two types of radiation have in common?

(1 mark)

c. Give two other properties that all radiations of the Electromagnetic spectrum have in common.

(2 marks)

d. Name one other type of radiation which is usually found in sunlight at ground level.

(1 mark)

6a. A body changes its velocity from 2m/s to 24m/s in 11s. Find the
i. acceleration during these 11s.

(2 marks)

ii. the distance moved during these 11s.

(3 marks)

b. The velocity then decreases until the body comes to rest in a further 8s.

i. Find the size of the deceleration during these 8s.

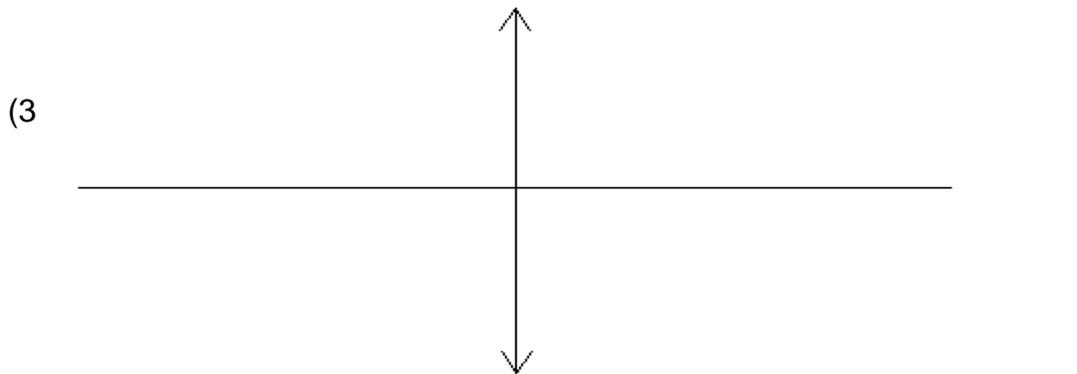
(2 marks)

ii. Find the distance moved during these 8s.

(2 marks)

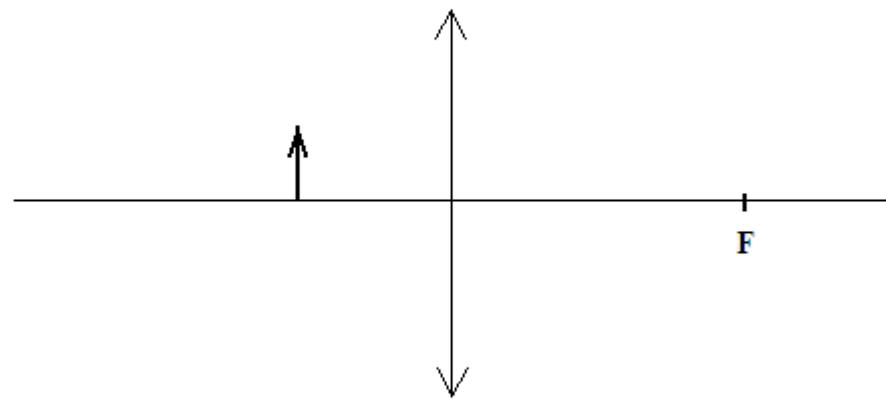
Section B. This Section carries 45 marks.

1ai. Draw a diagram to show how you would find the approximate focal length of a converging lens using a distant object outside the window. Show clearly on the diagram which distance is the focal length.



- ii. Is the image real or virtual? _____ (1 mark)
- iii. Is the image upright or inverted? _____ (1 mark)
- iv. Is the image magnified or diminished? _____ (1 mark)

b. The figure below shows an object placed in front of a converging lens.



- i. Draw rays to find the position of the image. (3 marks)
- ii. Measure the image distance. _____ (1 mark)

iii. Work out the magnification?

_____ (2 marks)

iv. Is the image real or virtual?

_____ (2 marks)

v. Is the image upright or inverted?

_____ (2 marks)

2. During trials, the speed (v) in m/s of a racing car was measured for a time (t) seconds.

The table below shows how speed varied with time during one trial.

| | | | | | | | | | | | | | |
|------------------|---|----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|
| Speed/m/s | 0 | 50 | 100 | 150 | 200 | 200 | 200 | 200 | 160 | 120 | 80 | 40 | 0 |
| Time/s | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |

a. Plot a graph of speed (y-axis) against time (x-axis).

(6 marks)

b. Describe briefly the type of motion of the car during,

i. the first 20 seconds of its motion _____

_____ (2 marks)

ii. between the 20th and the 35th second _____

_____ (2 marks)

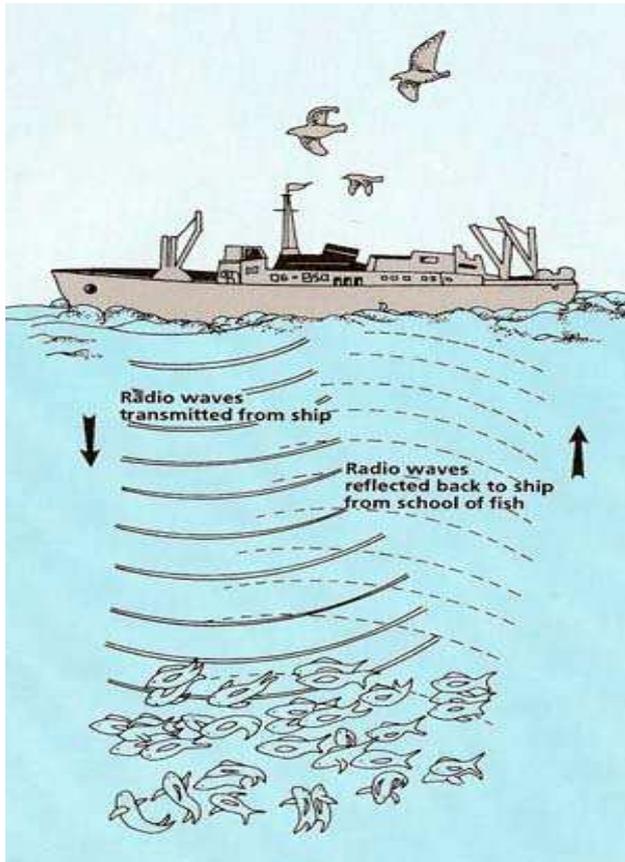
iii. the last 20 seconds of its motion _____

_____ (2 marks)

c. Use your graph to find the total distance covered by the car in the 60 seconds interval during which it was being tested.

_____ (3 marks)

3. A fishing trawler is using ultrasonic waves to detect the presence of schools of fish, and determine their depth under the sea.



ai. The speed of these waves in sea water is 1500m/s. If it takes 0.04 seconds for the signal to be transmitted, reflected back, and detected, what is the depth of the fish?

(3 marks)

aii. The refractive index for water is 1.3. At what depth would the image of the fish be seen from above?

(3 marks)

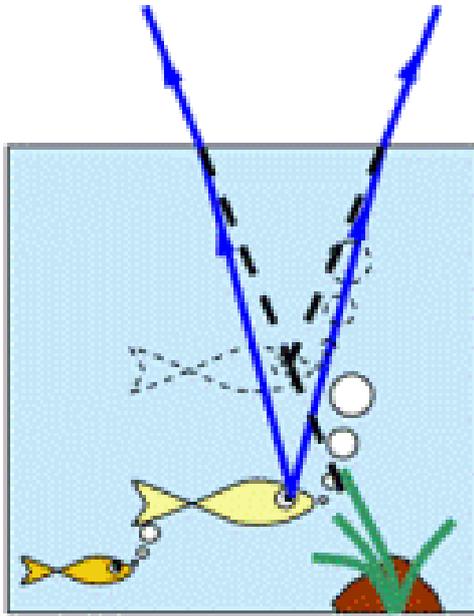
aiii. Are ultrasonic waves transverse or longitudinal waves?

(1 mark)

b. A scientist decided to use ultrasonic waves in space so spacecrafts can detect any rocks floating in space. Would this technique work in this case? Why?

(3 marks)

- c. The ray diagram below shows how an image is formed in water.
- i. On the diagram, label clearly the incident rays, the refracted rays, and the image.



(3 marks)

- ii. Is the image formed in water real or virtual? _____
(1 mark)

- iii. What happens to the speed of light when it leaves the water?

(1 mark)