

Code: 24/2012



GIRLS' JUNIOR LYCEUM BLATA L-BAJDA

HALF-YEARLY EXAMINATIONS 2012  
St Ignatius College

Subject: Physics

Form: 4

Time: 1 hour 30 minutes

Name & Surname: \_\_\_\_\_

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  $g = 10 \text{ m/s}^2$ .  
Good Luck!

<u>Equations for Half-Yearly Exam Physics</u>				
Optics	$\text{magnification} = \frac{\text{height of image}}{\text{height of object}}$		$\text{magnification} = \frac{\text{image distance}}{\text{object distance}}$	
	$\text{refractive index of glass or water} = \frac{\text{speed of light in air}}{\text{speed of light in glass or water}}$			
	$\text{refractive index of glass or water} = \frac{\text{real depth in glass or water}}{\text{apparent depth in glass or water}}$			
Waves	$\text{Speed} = \frac{\text{distance}}{\text{time}}$	$v = f \lambda$	$T = \frac{1}{f}$	$f = \frac{\text{number of waves}}{\text{time}}$
Electricity	$Q = I t$			

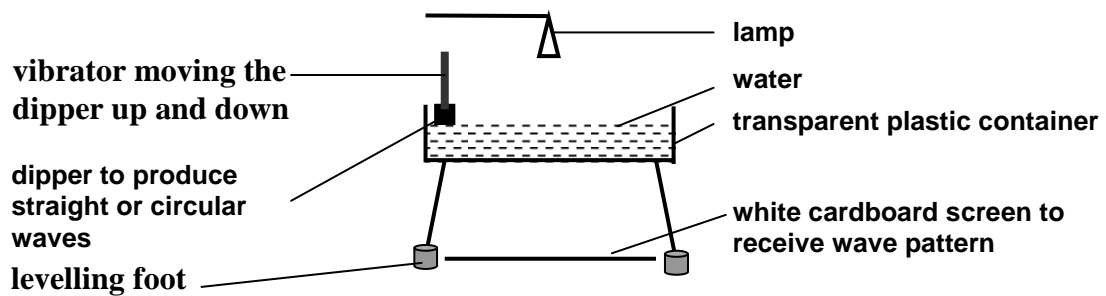
Marks Grid: For the Examiners' use ONLY

Question	1	2	3	4	5	6	7	8	Theory	Practical	Total
Max. Mark	8	8	8	8	8	15	15	15	85	15	100
Score											

**Section A**

**This Section carries 40 marks.**

1. Jane uses the apparatus in Figure 1 below to study water waves.



**Figure 1**

a. Name the apparatus represented by Figure 1. \_\_\_\_\_ **1**

b. Complete the following statements using **four** appropriate words from the list below:

*longitudinal, transverse, troughs, rarefactions, crests, compressions, medium, frequency, wavelength.*

i. Water waves are \_\_\_\_\_ waves. **1**

ii. Water waves are made up of \_\_\_\_\_ and \_\_\_\_\_. **2**

iii. The size of the velocity of both transverse waves and longitudinal waves depends **only** on the \_\_\_\_\_ through which the waves travel. **1**

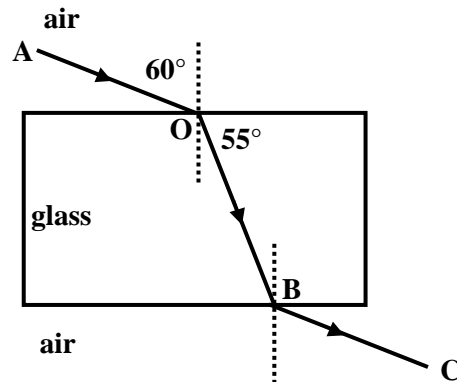
c. Jane obtains a real image of 8 straight complete water waves on the cardboard in 2 s. The length taken up on the white cardboard screen by the 8 complete waves is 0.4 m. Calculate the:

i. wavelength of the water waves in m, **1**

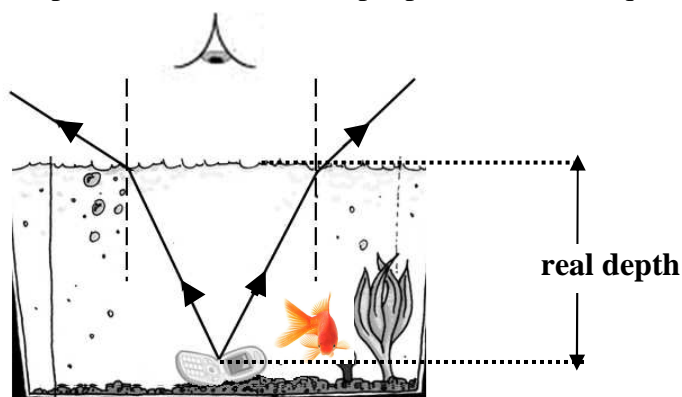
ii. frequency of the water waves in Hz, **1**

iii. velocity of the waves in m/s. **1**

2. Pamela sets up an experiment to investigate what happens when a ray of light travels from air through a rectangular glass block and out into the air again. The results of her investigation are shown in the figure below.



- a. Complete:
- This change in direction of ray AO due to a change in its speed as it travels through glass is referred to as \_\_\_\_\_.
  - The angle in glass (the angle of refraction) is equal to \_\_\_\_\_°.
- b. The teacher tells Pamela that the speed of light through the air is 300 000 000 m/s ( $3 \times 10^8$  m/s) and that the refractive index of glass ( $n_g$ ) is 1.5.
- Explain what is meant by 'the refractive index of glass ( $n_g$ ) is 1.5'.
  - Calculate the speed of light through glass.
- c. Pamela runs to her aquarium to watch the goldfish her father has just bought. Unfortunately, her mobile phone falls out of her top's pocket into the aquarium.



- Complete the above diagram to find the position of the image of the mobile phone when viewed from above. Indicate this position by the letter **I**.
- The refractive index of water ( $n_w$ ) is 1.33. Calculate the real depth of the mobile phone given that its apparent depth is 0.38 m below the surface of the water.

3. Electromagnetic waves are a group of waves having similar properties.
- a. Complete the following about some of the characteristics/properties of electromagnetic waves. Electromagnetic waves:
- are all \_\_\_\_\_ waves, 1
  - travel at the same \_\_\_\_\_ in vacuum, 1
  - have different \_\_\_\_\_ and wavelength. 1
- b. The incomplete table below shows the members of the electromagnetic spectrum.

gamma rays	x-rays	P	visible light	Q	microwaves	radio waves
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- Radiation P is \_\_\_\_\_ and radiation Q is \_\_\_\_\_. 2
- Which of these two members of the electromagnetic radiations has the higher frequency? \_\_\_\_\_ 2
- Name the type of electromagnetic radiation used to detect fractures in bones. \_\_\_\_\_ 1

4. Figure 1 represents a ray of light KL incident at the curved edge of a semicircular glass block

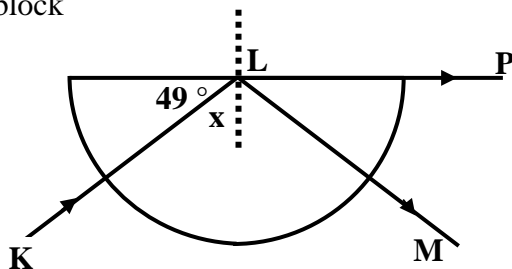


Figure 1

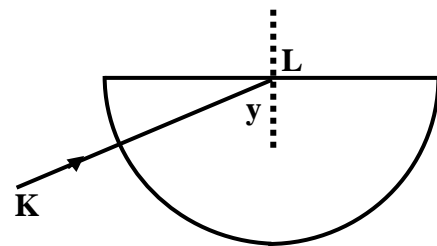


Figure 2

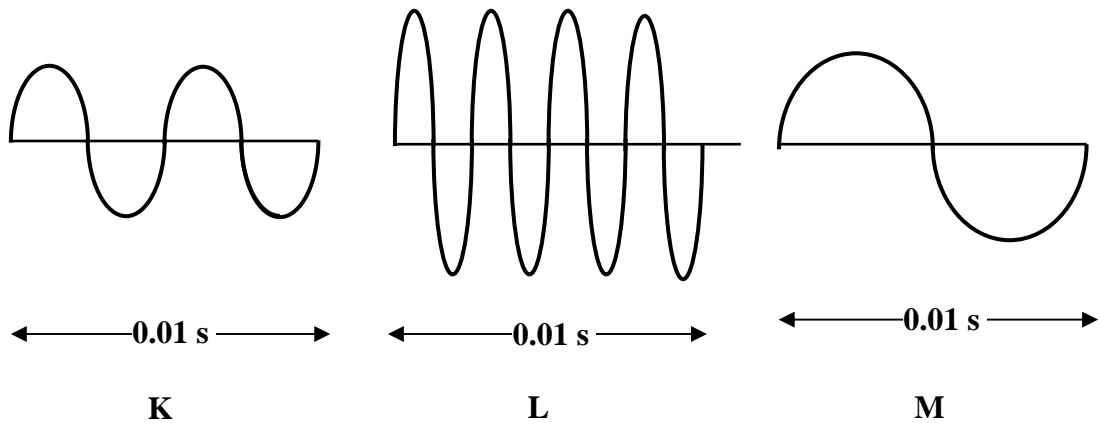
- a. Complete the following statements:
- The angle of refraction in air at the plane surface of the semicircular glass block in Figure 1 is \_\_\_\_\_°. 1
  - Angle x in Figure 1 is referred to as the \_\_\_\_\_ angle. 1
- b.
- Calculate angle x in Figure 1. \_\_\_\_\_ 1
  - State what takes place when the angle x in Figure 1 is increased. 1
- c.
- Complete Figure 2 to show what happens when angle x is increased to angle y. 1
  - Name **one** practical use of this kind of reflection. 1
- d. Explain why rays KL and LM pass straight through the semicircular glass block at the curved edge without any change in direction. 2

5. a. Complete the following statements:

i. A longitudinal wave is made up of \_\_\_\_\_ and rarefactions. 1

ii. Sound waves do not travel through a \_\_\_\_\_. 1

b. The wave diagrams below represent sound waves K, L and M travelling through the **air** in **0.01s** set up by three different vibrating tuning forks.



i. The note of lowest frequency is given by sound wave \_\_\_\_\_. 1

ii. The loudest note is produced by sound wave \_\_\_\_\_. 1

iii. Which of the sound waves, if any, is travelling with the greatest speed? 1

iv. Explain your answer to question b. iii. 1

c. Calculate the:

i. frequency  $f$  in Hz of the note represented by sound wave L. 1

ii. Calculate the wavelength  $\lambda$  in m of the note emitted by sound wave L given that the speed of sound in air is 320 m/s 1

**PLEASE TURN OVER FOR SECTION B**

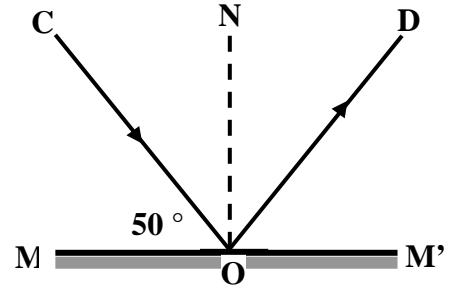
**Section B.**

**This Section carries 45 marks.**

**6. This question is about the Reflection of light by a plane mirror.**

The figure below represents a ray of light striking and being reflected by a plane mirror.

- a. In Figure 1:
  - i. CO represents the \_\_\_\_\_ ray.
  - ii. \_\_\_\_\_ represents the normal.
  - iii. OD represents the \_\_\_\_\_ ray.
  - iv. MM' represents the \_\_\_\_\_.



**Figure 1**

- b. On Figure 1 label the:
  - i. angle of incidence using the letter 'i'
  - ii. angle of reflection using the letter 'r'
- c. For Figure 1 calculate the:
  - i. angle of incidence, 1
  - ii. angle of reflection, 1
  - iii. angle between the incident and the reflected rays. 1

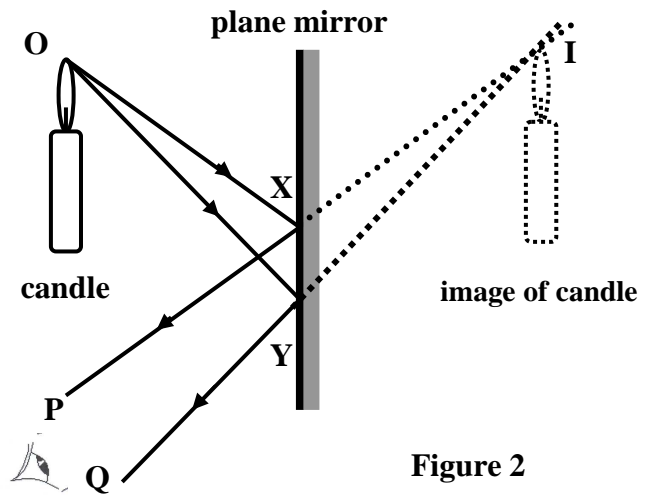
d. Figure 2 below shows the image of a candle produced by a plane mirror.

Complete the following statements:

The image produced by the plane always appears to be as far \_\_\_\_\_ the mirror as the object is in front.

e. List four other properties of the image produced by a plane mirror.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

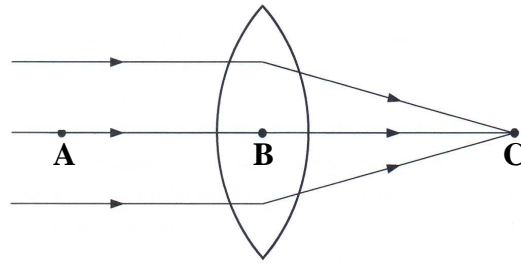


**Figure 2**

f. Explain why the rays **XI** and **YI**, together with the image of the candle **I** in Figure 2, are drawn in dotted (broken) lines. 2

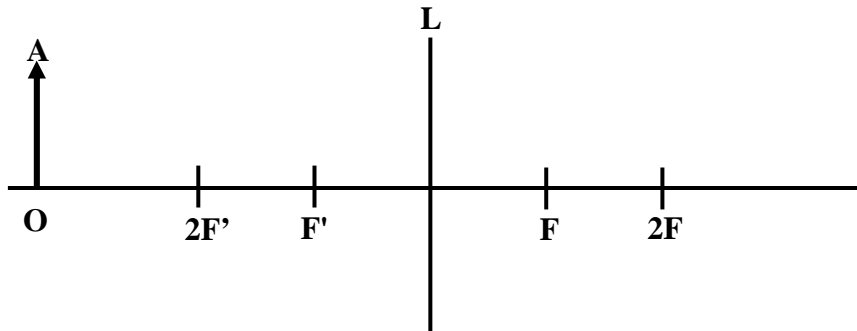
**7. This question is about Lenses**

a. The figure below represents a parallel beam of light incident on to a lens.



- i. What type lens is shown in the figure? \_\_\_\_\_
- ii. Line ABC is referred to as the \_\_\_\_\_ axis of the lens.
- iii. Point C is the \_\_\_\_\_ of the lens.
- iv. What is distance BC called? \_\_\_\_\_

b. The figure below represents an object AO placed in front of a convex lens L.



- i. Draw two rays from A to find the position of the image I formed. 1
- ii. The image I of the of the object AO is: 1
  - real or virtual? \_\_\_\_\_
  - upright or inverted? \_\_\_\_\_
  - magnified, diminished or same size as the object? \_\_\_\_\_

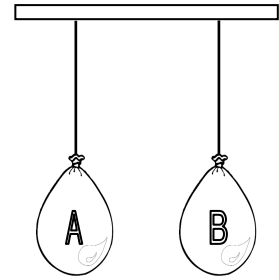
c. A converging lens is used to produce an image of an illuminated object. The image distance for six different object distance positions (object distance) are recorded as given in the table below. 3

object distance $u$ / cm	20	25	30	35	40	45
image distance $v$ / cm	60	38	30	26	24	22

- i. Plot a graph of image distance  $v$  (y-axis) against the object distance  $u$  (x-axis). Draw a smooth curve. 3
- ii. Use your graph to find the magnification of the lens when the image distance is 35 cm.

**8. This question is about conductors and insulators**

Two balloons, A and B, are hanging from nylon threads. Jessica wants to investigate the forces between them when one of them is left uncharged (neutral) and also when they are both charged.



- a. Complete the following table to indicate whether the balloons attract or repel each other.

Charge on balloon A	Charge on balloon B	Attraction or Repulsion
Neutral	Positive	
Negative	Neutral	
Positive	Positive	
Negative	Negative	

- b. i. What is the difference between a conductor of electricity and an insulator?
- ii. Give an example of a material, which is:
- a conductor: \_\_\_\_\_
  - an insulator: \_\_\_\_\_
- c. Jessica is given a box of objects made of different materials. She is asked to separate conductors from insulators.
- i. Draw a labelled diagram of the circuit, which she sets to separate conductors from insulators. Jessica is supplied with the following apparatus:  
**battery, switch, bulb, connecting wire.**
- ii. Explain how she uses the circuit to separate the conductors from the insulators.
- d. The current flowing through the circuit of a torch is 0.3 A. Calculate the charge passing through the circuit in 20 minutes.




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