

Code: 24/2011



GIRLS' JUNIOR LYCEUM BLATA L-BAJDA

HALF-YEARLY EXAMINATIONS 2011  
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!

Equations for Half-Yearly Exam Physics

Optics	magnification = $\frac{\text{height of image}}{\text{height of object}}$		magnification = $\frac{\text{image distance}}{\text{object distance}}$	
	refractive index of glass = $\frac{\text{speed of light in air}}{\text{speed of light in glass}}$			
Waves	Speed = $\frac{\text{distance}}{\text{time}}$	$V = f \lambda$	$T = \frac{1}{f}$	$f = \frac{\text{number of waves}}{\text{time}}$
Electricity	$Q = I t$			

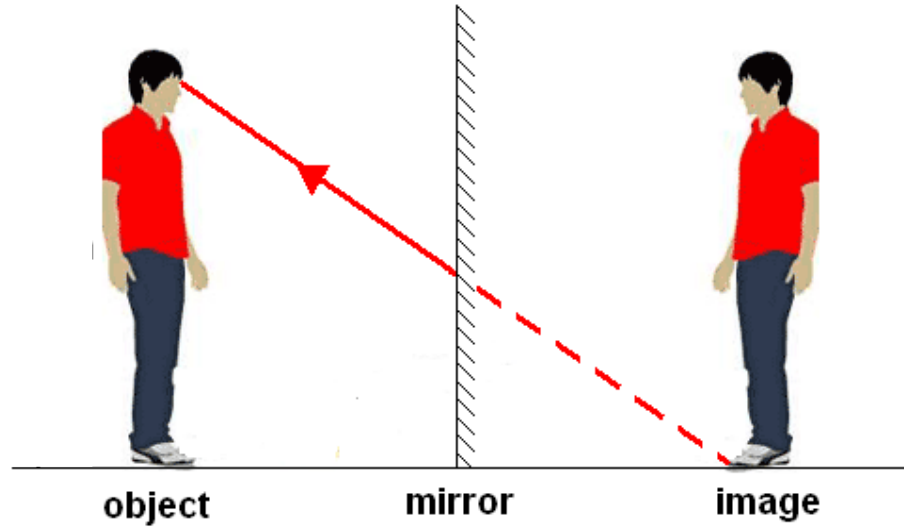
Marks Grid: For the Examiners' use ONLY

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. James stands in front of a plane mirror as shown in the diagram below. The reflected ray drawn, shows how James sees his shoes.



- a. On the above diagram draw the:
- i. incident ray. 1
  - ii. normal 1
- b. Indicate on the above diagram the angle of:
- i. incidence  $i^\circ$  1
  - ii. reflection  $r^\circ$  1
- c. What can you say about the angle of incidence and angle of reflection? 1
- d. Is the image produced by a plane mirror:
- i. real or virtual? \_\_\_\_\_ 1
  - ii. upright or inverted? \_\_\_\_\_ 1
  - iii. Name one other property of the image produced by a plane mirror. 1

2. The table below shows the members of the electromagnetic spectrum.

Gamma Rays	X-rays	Ultraviolet	<b>K</b>	Infrared	Microwaves	Radio & TV waves
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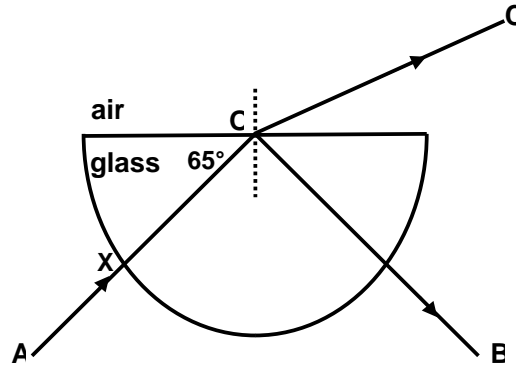
a. Ryan forgot the name of one of the radiations of the electromagnetic spectrum and labelled it **K** as shown in the above table.

- i. Name the radiation labelled **K**. \_\_\_\_\_ 1
- ii. Name one **natural** source of this radiation \_\_\_\_\_ 1

b. Name the radiation which:

- i. is used to check if you have a broken bone; \_\_\_\_\_ 1
- ii. is used to cook food in a microwave oven; \_\_\_\_\_ 1
- iii. can lead to **skin** cancer; \_\_\_\_\_ 1
- iv. is emitted by a hot iron; \_\_\_\_\_ 1
- v. gives you a suntan; \_\_\_\_\_ 1
- vi. mobile phones transmit and receive \_\_\_\_\_ 1

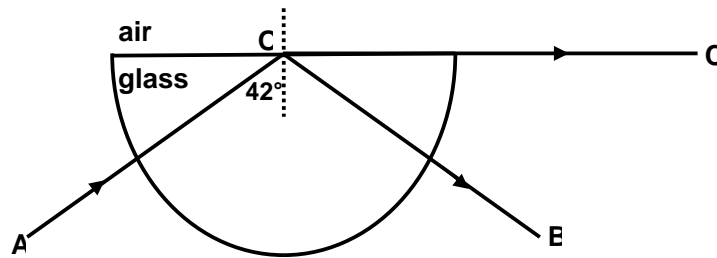
3.



a. The above figure shows a ray of light AO incident on to a semicircular glass block.

- i. Ray \_\_\_\_\_ is the refracted ray. 1
- ii. The angle of incidence in glass is \_\_\_\_\_ ° 1

b. The angle of incidence in glass is increased to 42° as shown in the figure below.

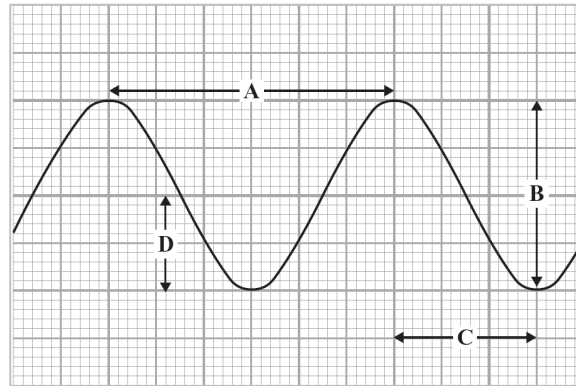


- i. Complete the following statement:  
The critical angle of glass is a special angle of incidence in glass for which the corresponding angle of refraction in air is \_\_\_\_\_ °. 1
- ii. The critical angle of glass of this semicircular glass block is \_\_\_\_\_ °. 1

c. When the angle of incidence in glass in the semicircular glass block is increased to 50° total internal reflection takes place.

- i. What is meant by 'total internal reflection'. 1
- ii. Name the two conditions for total internal reflection to take place in the semicircular glass block. 2
- iii. Name a practical application of total internal reflection. \_\_\_\_\_ 1

4. The diagram shows an oscilloscope trace of a note produced by a musical instrument.



- a. Which of the letters A, B, C and D represents the:
- amplitude of the sound wave? \_\_\_\_\_ 1
  - wavelength of the sound wave? \_\_\_\_\_ 1

- b. John blows his whistle in front of a long high wall as shown in the figure below. After a short time, he hears the sound of the whistle again, though it is much fainter this time.



- What name is given to the repeated sound? \_\_\_\_\_ 1
- The time interval between blowing the whistle and hearing the whistle a second time is 0.8 s. The distance to the wall is 138 m. How long did the sound of the whistle take to reach the wall? 2
- Using John's measurements, calculate the speed of sound in air. 2

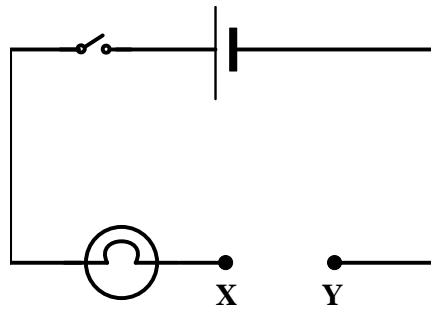
- c. Underline the correct answer:

We cannot hear ultrasound. The frequencies of ultrasound are:

1

- below 20 Hz
- from 20 Hz to 20 000 Hz
- above 20 000 Hz.

5. Matthew sets up the circuit as shown below, in order to find whether particular materials conduct electricity.



- a. Matthew connects a piece of copper wire across points X and Y and closes the switch.

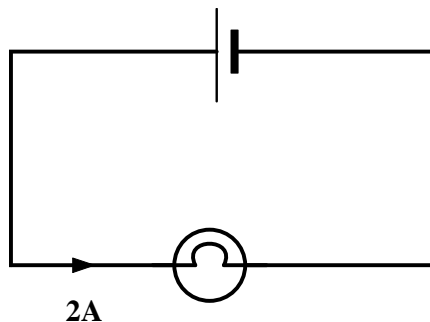
- i. Complete the following:

The bulb in the circuit \_\_\_\_\_ because copper is a \_\_\_\_\_. **2**

- ii. Matthew replaces the copper wire across XY by a plastic rod and closes the switch.

The bulb in the circuit \_\_\_\_\_ because plastic **1**  
is an \_\_\_\_\_. **1**

- b. Matthew now sets the circuit as shown below.



- i. The current flowing through the circuit is 2A.

This means that two \_\_\_\_\_ of charge flow through the bulb every \_\_\_\_\_ **1**  
**1**

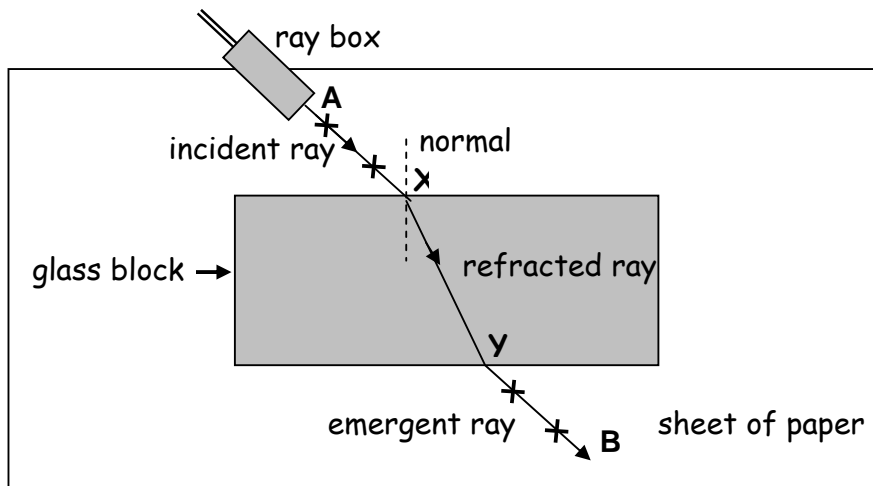
- ii. Calculate the charge flowing through the bulb in 2 minutes. **2**

**Section B.**

**This section carries 45 marks**

**6. This Question is about Refraction and Dispersion of Light**

- a. Martha wants to investigate the path of a ray of light through a rectangular glass block **and** to measure the angle of incidence (angle in air) and the angle of refraction (angle in glass). She sets up the apparatus as shown in the diagram below.



- i. Name the measuring instrument that Martha needs to measure the angle of incidence (angle in air) and the angle of refraction (angle in glass). \_\_\_\_\_ **1**
- ii. Martha follows the following steps.  
Indicate the order in which the steps of the experiment have to be performed. **4**

<b>1</b>	Place the glass block on a sheet of paper and draw its outline Mark the incident ray and emergent ray with two crosses.
<b>2</b>	Mark the normal at X. Set up the ray box as shown in the diagram. Measure the angle of incidence and the angle of refraction Remove the glass block to draw the normal, the incident ray AX, the emergent ray YB and the refracted ray XY.

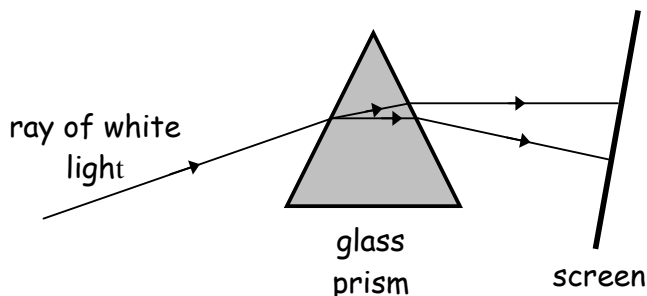
- iii. Name **one** precaution that Martha should take during the experiment. **1**

- b. The results are recorded in a table.

<b>Angle of incidence / <math>i^\circ</math></b>	0	5	10	15	20	25	30	35	40
<b>Angle of refraction / <math>r^\circ</math></b>	0	8	15	23	31	39	49	59	75

- i. Plot a graph of angle of refraction  $r / [y\text{-axis}]$  against angle of incidence  $i / [x\text{-axis}]$  on the graph paper provided. Draw the best smooth curve through the points **5**
- ii. The speed of light in glass is  $2 \times 10^8$  m/s and the speed of light in air is  $3 \times 10^8$  m/s. Calculate the refractive index for glass. **1**

c. Martha then projects a ray of white light onto a glass prism as shown.



- i. Martha sees seven colours on the screen. Mark the position of the red light with the letter 'R' and the position of the violet light with the letter 'V' on the screen. 2
- ii. The separation of white light into seven colours is called \_\_\_\_\_. 1

**7. This question is about Waves.**

a. Complete the following statements:

- i. A \_\_\_\_\_ wave is a wave in which the vibrations are at 90° to the direction of wave travel. 1
- ii. A \_\_\_\_\_ wave is a wave in which the vibrations are at 0° to the direction of wave travel. 1
- iii. The quantity of energy transferred by both kinds of waves depends on the \_\_\_\_\_ of the wave. 1
- iv. The velocity of both kinds of waves depends **only** on the \_\_\_\_\_ through which the wave travels. 1
- v. \_\_\_\_\_ waves are longitudinal waves. 1

b. Complete the missing S.I. symbol and S.I. unit for the quantities in the table below.

QUANTITY	S.I. SYMBOL	S.I. UNIT
frequency		Hz
wavelength	$\lambda$	
velocity		m/s

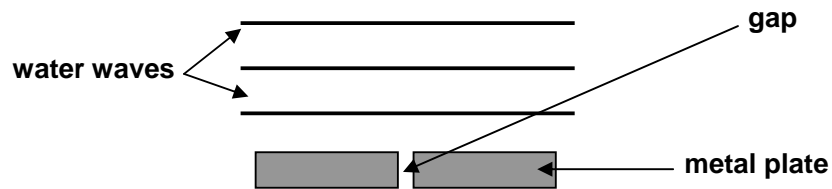
- c. A local radio station transmits at a frequency of 103 MHz. The velocity of the radio waves is  $3.0 \times 10^8$  m/s (300000000 m/s).
  - i. 103 MHz = \_\_\_\_\_ Hz 1
  - ii. Calculate the wavelength of the radio waves in metres. 1



- d. Martina counts her heartbeats and finds that her heart beats 75 times in one minute. Calculate:
- i. The frequency of her heartbeat in Hz. 1
- ii. The periodic time of her heartbeat. 2

e. The figure below shows water waves in a ripple tank approaching two metal plates with a gap between them.

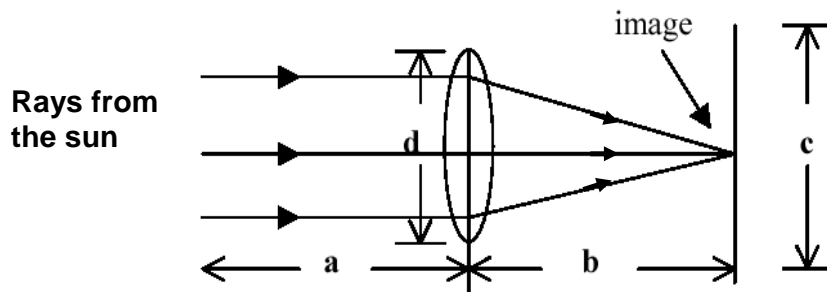
- i. Complete the figure below to show the shape of the waves after passing through the gap. 1



- ii. The change, taking place when a water wave travels through a gap is referred to as \_\_\_\_\_ . 1

**8. This question is about Converging Lenses**

a. Keith set up a converging lens to receive light rays from the sun. He used a white cardboard to get a sharp clear image of the sun on it as shown in the diagram below.

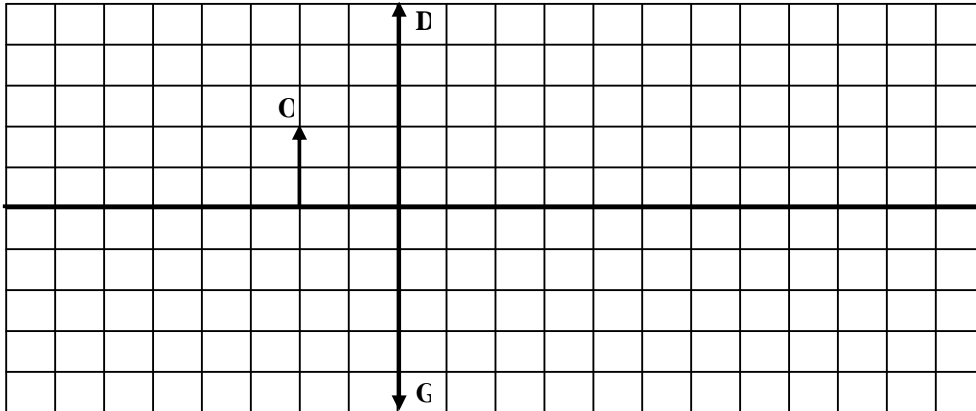


- i. Underline the correct answer. **The focal length of the lens in the diagram is:**  
 length a; length b; length c; length d. 1

- ii. Underline the correct answers.  
**The image produced by the lens in the diagram is:**
- Real OR Virtual 1
  - Magnified OR Diminished 1
  - Upright OR Inverted 1

- b. Keith then places an object of height 2 cm in front of the converging lens PQ of focal length 4 cm.
- i. Complete the ray diagram below to locate (to find) the position of the image I produced by the converging lens DG 4

**Note: 1 square represents 1 cm.**



- ii. What is the height of the image? \_\_\_\_\_ cm. 1
- iii. Calculate the magnification produced by the lens. 2
- iv. Name three properties of this image produced by the lens. 3
- v. Suggest one practical use of the lens as shown in the ray diagram. 1

