

# KULLEĠĠ SAN BENEDITTU

## Boys' Secondary, Kirkop

Mark

HALF-YEARLY EXAMINATION – 2012/13

Track 3



FORM 4	PHYSICS	TIME: 1 hr 30 mins
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Question	1	2	3	4	5	6	7	8	Global Mark
Max. Mark	11	11	11	11	11	15	15	15	100
Mark									

DO NOT WRITE ABOVE THIS LINE

Name: \_\_\_\_\_

Class: \_\_\_\_\_

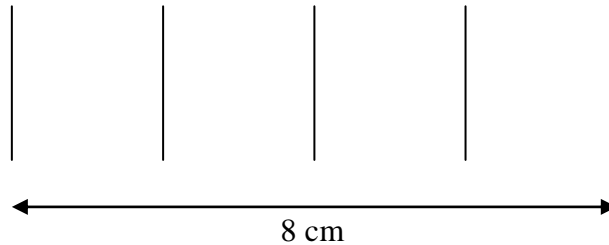
- Answer ALL questions in the spaces provided on the Exam Paper.
- All working must be shown. The use of a calculator is allowed.
- Where necessary take the acceleration due to gravity,  $g = 10\text{m/s}^2$ .
- To gain marks you should write your ideas in good English. Put them in a sensible order and use the correct scientific words.
- You may find some of these equations useful:-

Force & Motion	$W = mg$	
	Average speed = $\frac{\text{total distance}}{\text{time}}$	Velocity = $\frac{\text{change in displacement}}{\text{time}}$
	Acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$	
	$v = u + at$	$s = ut + \frac{1}{2}at^2$
	$s = \frac{(u + v)}{2}t$	$v^2 = u^2 + 2as$
Waves	$v = f \lambda$	$f = \frac{1}{T}$
	$m = \frac{\text{height of image}}{\text{height of object}}$	$m = \frac{\text{image distance}}{\text{object distance}}$

**Section A: This section carries 55 marks**  
**Answer all questions**

**1. This question is about waves.**

a) These wave fronts are shown in a ripple tank.



i. What is the **wavelength** of the ripples shown above? \_\_\_\_\_ [1]

ii. If the periodic time is 2.5 seconds, what is the **frequency** of the waves?

\_\_\_\_\_

\_\_\_\_\_

[2]

iii. Calculate the **speed** of the waves.

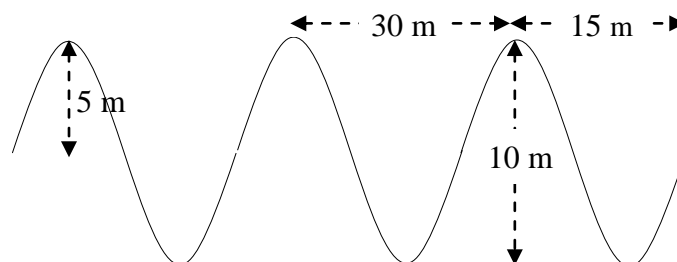
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[3]

b) The diagram below shows a wave with various measurements taken along the wave.



i. What is the **amplitude** of the wave? \_\_\_\_\_ [1]

ii. What is the **wavelength** of the wave? \_\_\_\_\_ [1]

c) Match each **Quantity** with its **meaning** and **units**.

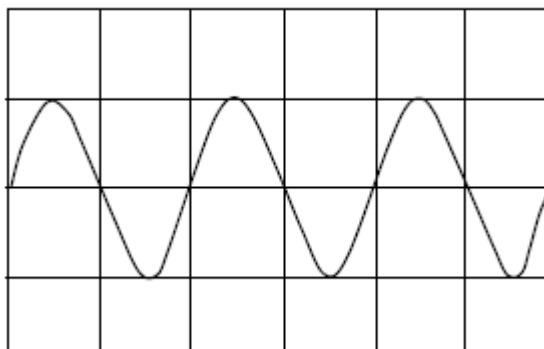
[3]

frequency	The maximum height a wave can reach.	m/s
amplitude	The distance a wave travels in one second.	Hz
wave speed	The number of waves in one second.	m

[11 marks]

## 2. This question is about Sound waves

a) The diagram shows the shape of the wave produced on an oscilloscope. The wave on the screen has a **frequency of 400Hz**.



i. On the same diagram draw what you would see if the same note was played quieter. Label the diagram Q. [1]

ii. On the same diagram draw what you would see if the note was played with a frequency of 800Hz. Label this diagram F. [2]

b) Choose words from the list below to complete the sentences:-

<b>Higher,</b>	<b>Lower,</b>	<b>Louder,</b>	<b>Quieter</b>
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- A musical note with a high frequency sounds \_\_\_\_\_ than a musical note played at a low frequency.
- A musical note with large amplitude sounds \_\_\_\_\_ than a musical note with small amplitude.

[2]

- c) A musician plays a note that has a frequency of 400Hz. The speed of sound in air is 300m/s. What is the **wavelength** of the wave?

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[3]

- d) **Underline** the correct word in these sentences:

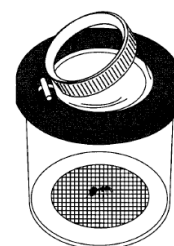
- A (*transverse*, *longitudinal*) wave is formed when the vibration is at right angles to the direction of the wave.
- A (*transverse*, *longitudinal*) wave is formed when the vibration is along the direction of the wave.
- The speed of sound is (*smaller*, *greater*) than the speed of light.

[3]

[11 marks]

### 3. This question is about lenses.

- a) A 'bug viewer' has a plastic chamber with a lens in the lid. It is used to get a magnified view of small insects placed on the base of the chamber.

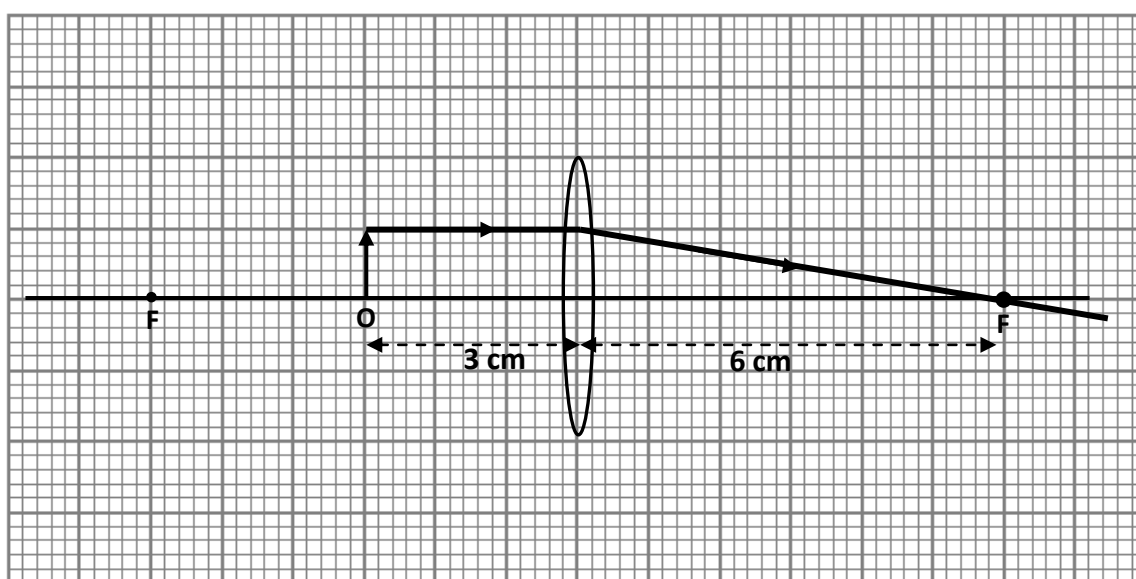


- What type of lens should be used?

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[1]

- The lens used has a focal length of 6 cm and the base of the chamber is 3 cm from the lens. The object O has a height of 1 cm. Complete this diagram by adding another ray to show where the image of the bug will be formed. Label this image I.



[3]

b) **Underline** the correct word in each bracket:

- i. The image formed is (*real or virtual*), (*magnified or diminished*) and (*upright or inverted*).
- ii. To get a longer focal length a (*thicker or thinner*) lens is used.

[4]

c) Measure the height of the image. \_\_\_\_\_cm.

[1]

d) Calculate the **magnification** of the image.

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[2]

[11 marks]

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#### 4. This question is about the properties of sound waves

a) The diagram below shows a wave travelling along a slinky spring.



i. What is this type of wave called? \_\_\_\_\_

[1]

ii. Use a ruler to measure the wavelength of the wave. \_\_\_\_\_

[1]

iii. Describe how sound travels through air.

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[2]

b) Write whether each statement is **TRUE** or **FALSE**:

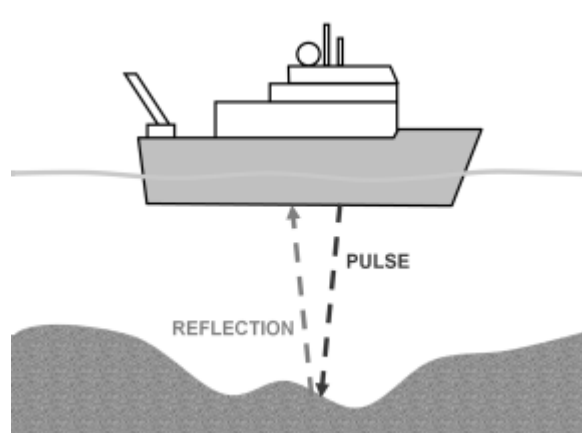
i. Sound waves travel faster in air than in water \_\_\_\_\_

[1]

ii. Sound does not travel through a vacuum. \_\_\_\_\_

[1]

- c) The diagram shows a ship using an Echo locator (SONAR) to find the depth of the seabed. The pulsed wave is transmitted from the ship, which is then reflected off the top of the seabed and is then picked up by the receiver.



- i. The time taken to receive the echo is 0.2s after transmission.  
Calculate how deep the ship has to lower its fishing nets to catch the top of the shoal if the speed of sound in sea water is 1560 m/s.

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[3]

- ii. What is an 'ultrasound wave'?

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[1]

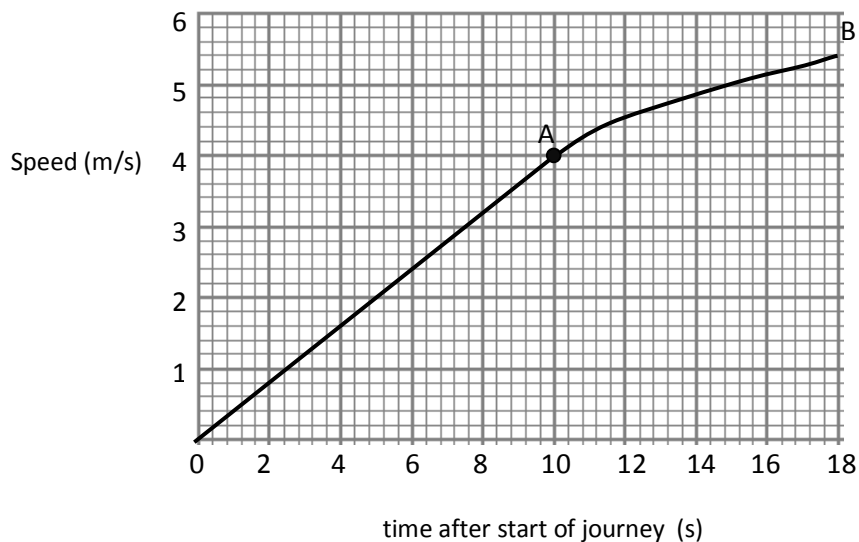
- iii. Give one other use of ultrasound waves. \_\_\_\_\_

[1]

**[11 marks]**

**5. This question is about motion.**

Eric cycles to school each morning along a straight flat road. The graph shows his speed for the first 18 seconds of his journey to school.



- a) Use the graph to determine whether Eric travelled at a constant speed throughout his journey. \_\_\_\_\_ [1]
- b) What is Eric's maximum speed in this journey? \_\_\_\_\_ [1]
- c) State whether each of the following statements is **true** or **false**:
- i. In region OA, Eric was travelling at a constant speed. \_\_\_\_\_ [1]
- ii. In region AB, Eric was accelerating uniformly. \_\_\_\_\_ [1]
- d) During the first 10 seconds of the journey, Eric's acceleration was constant. How can you tell this from the graph? \_\_\_\_\_ [2]  
\_\_\_\_\_
- e) Explain how you can find the acceleration from the graph. \_\_\_\_\_ [1]  
\_\_\_\_\_

f) Calculate his **acceleration** during this 10 s period, giving the correct units.

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[3]

g) In the first 10 seconds, Eric travelled about 20m. Describe how this could be worked out using the graph.

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[1]

[11 marks]

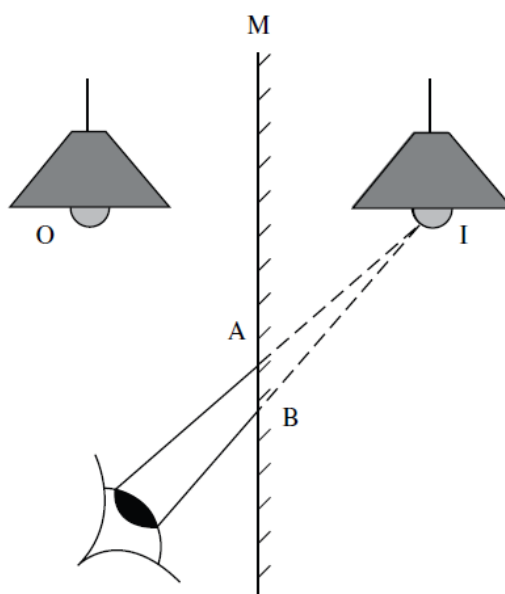
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**Section B: This section carries 45 marks**

**Answer all questions**

**6. This question is about light waves.**

a) The incomplete ray diagram below shows the image I of a lamp O, in a plane mirror M.



Draw on the diagram:

- i. The normals at points A and B. [1]
- ii. The corresponding incident rays. [1]
- iii. The arrows to show the direction of the incident rays. [1]

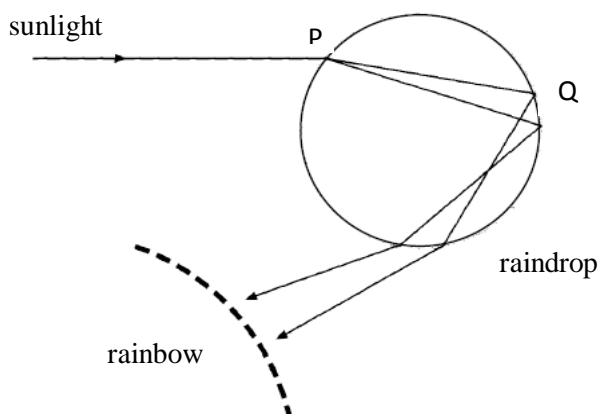


b) The image in a plane mirror is virtual. Name three other properties of this image.

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_,

[3]

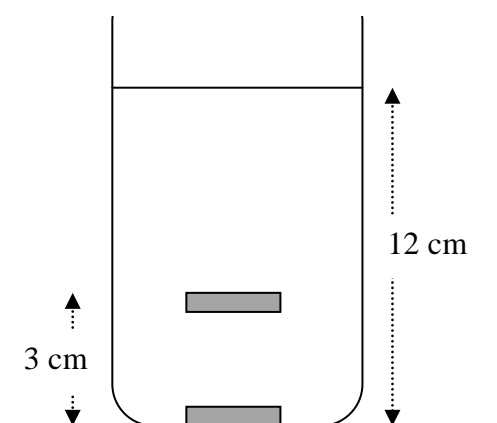
c) When the sun shines during a shower of rain, a rainbow can sometimes be seen. The diagram shows what happens to sunlight when it enters a raindrop.



- At point P, the waves are being \_\_\_\_\_.
- Name the wave effect that happens at point Q. \_\_\_\_\_.
- Which colour of the rainbow has the longest wavelength? \_\_\_\_\_.

[3]

d) A student wishes to measure the refractive index of water. She places a coin in a beaker with water as shown in the diagram. The depth of the water is 12cm and the coin appears to be 3 cm above the bottom of the beaker.



- Calculate the **apparent depth** of the coin.

\_\_\_\_\_  
\_\_\_\_\_

[1]

- ii. Calculate the **refractive index of water**.

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[2]

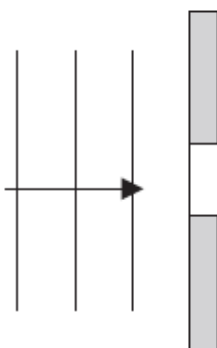
- iii. The speed of light in air is  $3 \times 10^8$  m/s. Use the answer in (ii) above to calculate the **speed of light in water**.

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[2]

- e) Some water waves pass through this gap. Draw the four waves as they come out of the gap.



[1]

[15 marks]

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## 7. This question is about electromagnetic waves

- a) The following questions are all about the electromagnetic spectrum. Tick the correct answer.

- i. Which statement about the electromagnetic waves is correct?

- ☐ They all have the same frequency in a vacuum.
- ☐ They all have the same wavelength in a vacuum.
- ☐ They all have the same speed in a vacuum.

- ii. Which of these types of electromagnetic waves has the highest frequency?

- ☐ Gamma rays
- ☐ Visible light
- ☐ Microwaves

iii. Which of these types of electromagnetic waves has the longest wavelength?

- ☐ X-rays
- ☐ Microwaves
- ☐ Infrared light

iv. Which of these can be used to check bones?

- ☐ X-rays
- ☐ Microwaves
- ☐ Radio waves

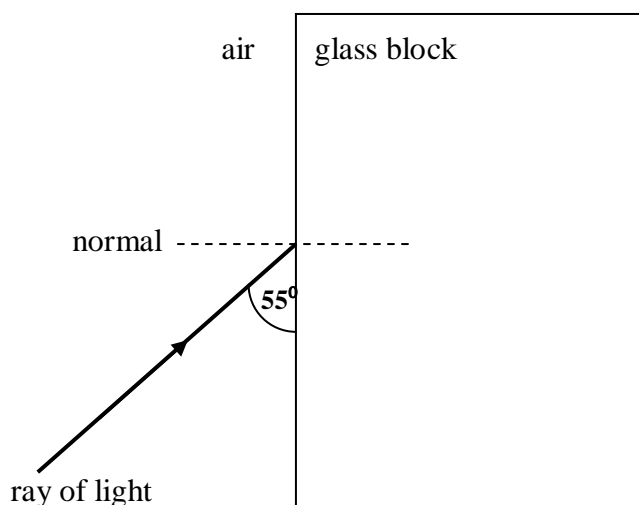
[4]

b) The table below shows the electromagnetic spectrum. Fill in the missing types of waves in this spectrum:

<b>Gamma rays</b>		<b>UV</b>	<b>Visible</b>		<b>Microwaves</b>	
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[3]

c) A ray of red light is incident on a glass block as shown below:



i. Calculate the angle of incidence.

\_\_\_\_\_

[1]

ii. Complete the diagram to show the path of the ray inside the glass block.

[2]

- iii. The refractive index of glass is 1.5. Calculate the **speed of light** in the glass block given that the speed of light in air is  $3 \times 10^8$  m/s.

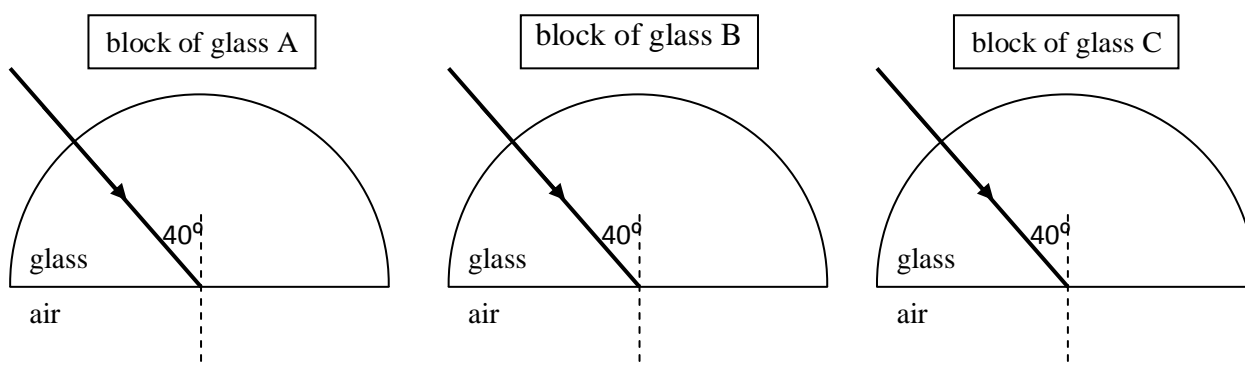
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[2]

- d) In another experiment, rays of red light are incident on three semi-circular blocks of glass as shown. Each block is made of a different type of glass.



The critical angle for each block of glass is given below:

Glass Type	Critical Angle
A	$40^\circ$
B	$44^\circ$
C	$38^\circ$

- i. On the diagram above, **for each** glass block, **complete the ray of light** to show what happens.

[3]

[15 marks]

**8. This question is about motion**

- a) Christian cycles from home to a nearby grocer to buy bread for his mother. He tabulated the results of his journey to the grocer and back in the table below.

<b>Distance (m)</b>	0	60	120	180	180	180	180	180	180	180	180	90	0
<b>Time (s)</b>	0	30	60	90	120	150	180	210	240	270	300	330	360

- i. On the graph paper provided plot a graph of distance (y-axis) against time (x-axis). [5]
- b) From your graph work out:
- ii. how long Christian takes to arrive to the grocer; \_\_\_\_\_
- iii. how far the grocer is from home; \_\_\_\_\_
- iv. how long Christian takes to cycle from the grocer back to home. \_\_\_\_\_ [3]
- c) Calculate Christian's **average velocity** during his journey from home to the grocer.
- \_\_\_\_\_
- \_\_\_\_\_ [2]
- d) What happened between the 90<sup>th</sup> and the 300<sup>th</sup> second?
- \_\_\_\_\_
- \_\_\_\_\_ [1]
- e) During which part of the journey did Christian cycle faster? Give one reason for your answer.
- \_\_\_\_\_
- \_\_\_\_\_ [2]
- f) The next day Christian decides to walk to the grocer and back. In what ways will the graph change?
- \_\_\_\_\_ [2]

**[15 marks]**

**END OF EXAMINATION**