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BOYS' SECONDARY MOSTA
HALF-YEARLY EXAMINATIONS 2011/2012

SUBJECT: PHYSICS **Form 4** **TIME: 1 HR 30 MIN**

NAME : _____

CLASS: _____ INDEX NO : _____

Track 3

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 m/s^2.

Waves and Optics	$v = f \lambda$	$f = \frac{1}{T}$
	$m = \frac{v}{u}$	$m = \frac{\text{height of image}}{\text{height of object}}$
	$\eta = \frac{\text{speed of light (air)}}{\text{speed of light (medium)}}$	$\eta = \frac{\text{real depth}}{\text{apparent depth}}$
Forces and Motion	$W = mg$	$v^2 = u^2 + 2as$
	$v = u + at$	$s = ut + \frac{1}{2} a t^2$
	Average speed = $\frac{\text{Total Distance}}{\text{Total time}}$	$s = \frac{(u+v)}{2} t$

For examiner's use:

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

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

SECTION A

This section carries 40 marks.

1. A slinky spring is being used to produce waves as shown in Figure 1.

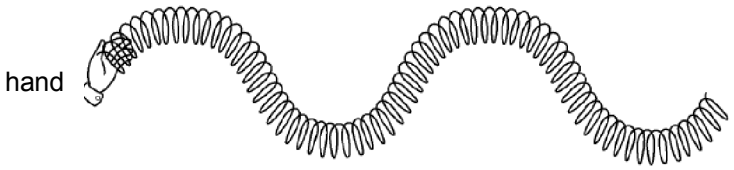


Figure 1

a) What type of wave is shown in Figure 1? _____ [1]

b) To produce such waves, the hand is moved _____ and _____. [2]

c) If 3 waves are produced in one second, then the frequency = _____ Hz. [1]

d) If the frequency increases, the _____ decreases. [1]

e) What is the time to complete one single wave called? _____ [1]

f) What property of the wave changes if the spring is moved harder? _____ [1]

g) Other types of waves of which sound is an example are called _____. [1]

2. Figure 2 shows an incomplete ray diagram.

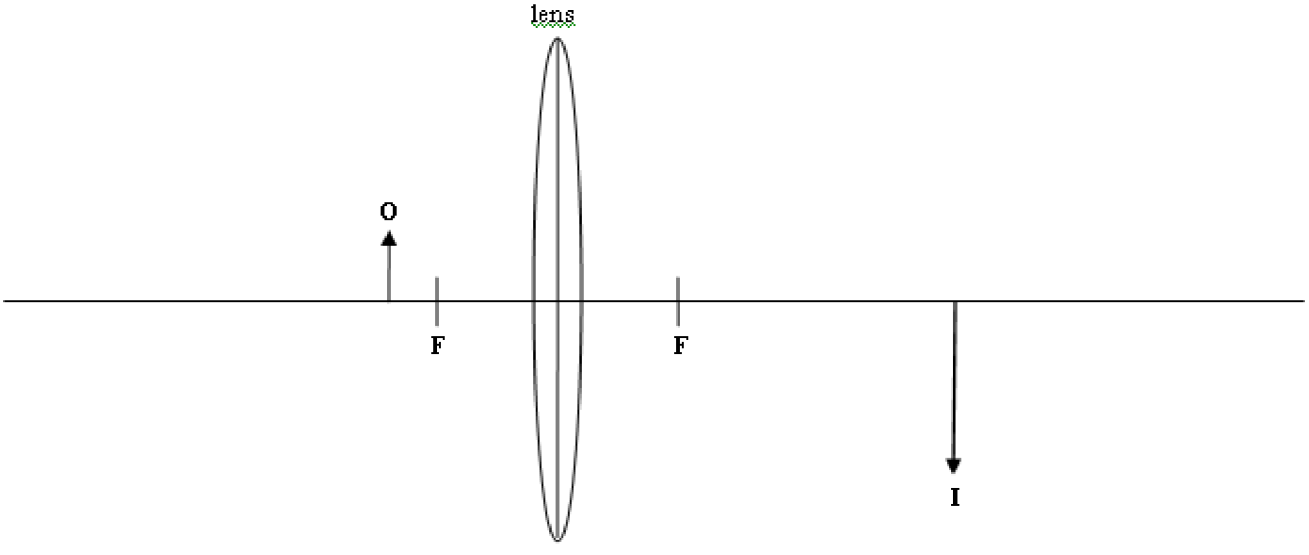


Figure 2

a) Add the missing rays to the ray diagram above. [3]

b) Apart from being inverted, name **two** other properties of the image formed.

(i) _____ (ii)_____ [2]

c) Give a suitable use for the ray diagram in Figure 2.

_____ [1]

d) Calculate the magnification of the lens.

_____ [1]

e) What would happen to the size of the image if the object is moved away from the lens but everything else is unchanged?

_____ [1]

3. XFM is a radio station which broadcasts at a frequency of 100.2 MHz. Radio waves travel at a speed of 3×10^8 m/s.

a) Change 100.2 MHz to Hz. _____ [1]

b) Calculate the wavelength of these waves.

_____ [1]

c) Would a radio station using a frequency of 89.7 MHz have shorter or longer waves? Explain.

_____ [2]

d) Apart from light waves and radio waves, name **two** other electromagnetic waves.

(i) _____

(ii) _____ [2]

e) Which electromagnetic wave has the lowest frequency? _____ [1]

f) Name **one** common property of all electromagnetic waves.

_____ [1]

4. The diagram below shows water wavefronts approaching a wall.

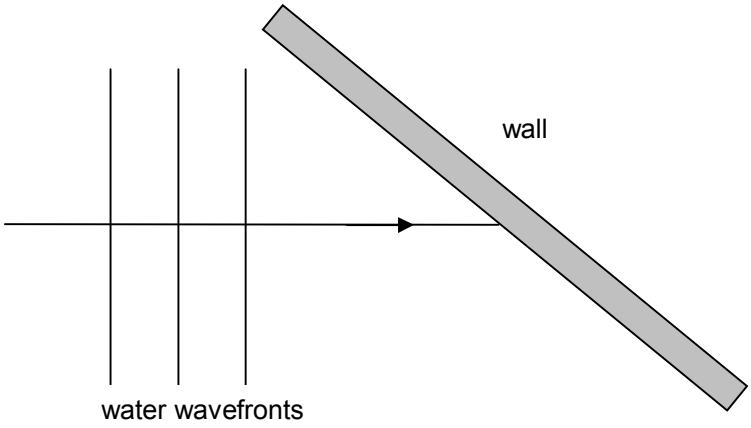


Figure 3

a) Add a normal to the diagram (Figure 3). [1]

b) Complete the diagram to show the direction taken by the wavefronts. [2]

c) *Underline the correct answer:*

What happens to each of the following **after** the wavefronts hit the wall?

(i) **wavelength** (increases, decreases, remains the same).

(ii) **frequency** (increases, decreases, remains the same).

(iii) **velocity** (increases, decreases, remains the same). [3]

d) Calculate the frequency of the waves if their wavelength is 0.02 m and they travel at 2.4 m/s.

_____ [2]

5. Figure 4 shows a ray incident onto a semi-circular glass block.

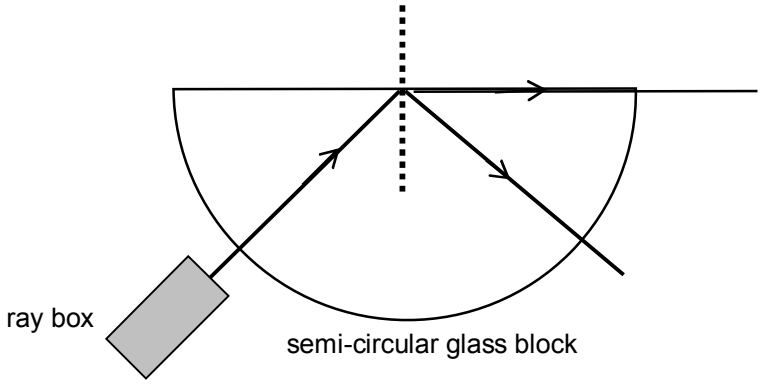


Figure 4

a) Why is it that the rays are not refracted at the curved surface?

_____ [1]

b) In Figure 4, the angle of refraction = _____ ^{0}. At this point the angle of incidence is called the _____ angle. [2]

c) What would happen if the angle of incidence is increased further?

_____ [2]

d) The speed of light in air is 3 x 10^8 m/s, while that in glass is 2 x 10^8 m/s. Find the refractive index of glass.

_____

_____ [2]

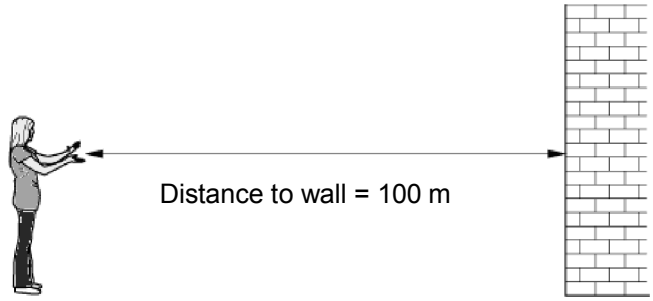
e) Light and sound are both types of waves. Name one difference between them.

_____ [1]

SECTION B

This section carries 45 marks.

6. A student claps and hears a reflected sound after 0.58 seconds.



a) What is the reflected sound called?

_____ [1]

b) Calculate the speed of sound in air.

_____ [3]

c) Why is this method of timing not so accurate?

_____ [2]

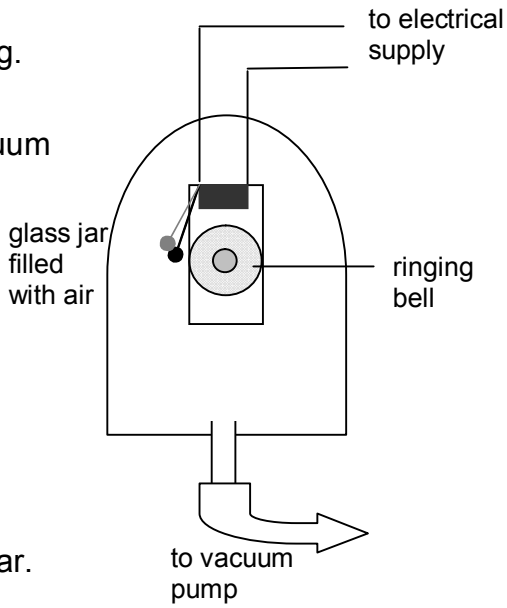
d) *Underline the correct answer:*

(i) If the student claps **harder**, the speed of sound (increases, decreases, remains the same). [1]

(ii) If the student blows a whistle instead of clapping, the speed of sound (increases, decreases, remains the same). [1]

(iii) If the student moves **closer** to the wall, the **time** to receive the reflected sound will (increase, decrease, remain the same). [1]

. e) When the jar is full of air, the bell can be heard ringing.



(i) What happens to the sound level when the vacuum pump is switched on?

_____ [2]

(ii) What does this experiment show?

_____

_____ [2]

f) State the range of frequencies which humans can hear.

_____ [2]

7. Light is reflected when incident onto a plane mirror.

a) Complete the diagram (Figure 5) by adding the missing labels.

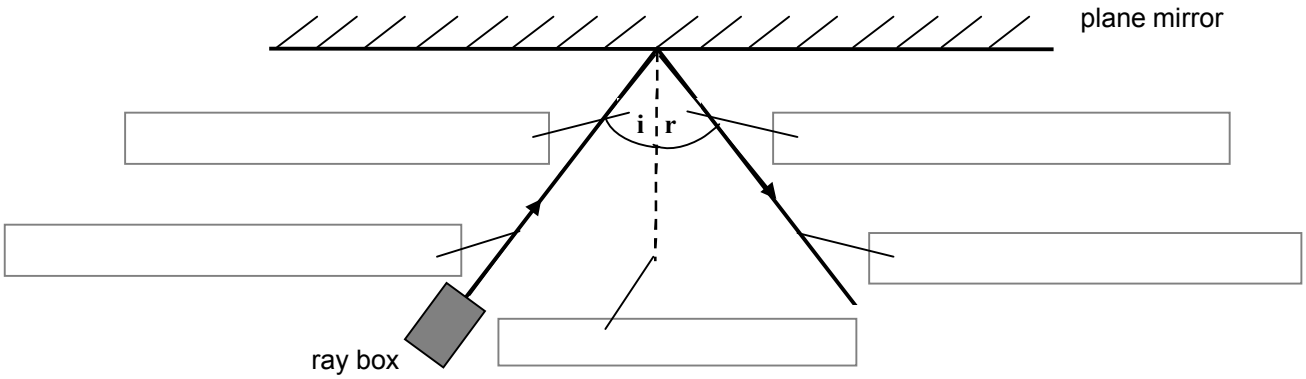


Figure 5

[5]

b) A student changes several times the **angle i** by moving the ray box. Each time, he notes the corresponding value of **angle r**.

Angle i (^{0})	10	20	30	40	50	60
Angle r (^{0})	10	20	33	40	50	60

(i) The student measures the angles by using a _____. [1]

(ii) Plot a graph of **angle r (^{0})** on the y-axis against **angle i (^{0})** on the x-axis. [5]

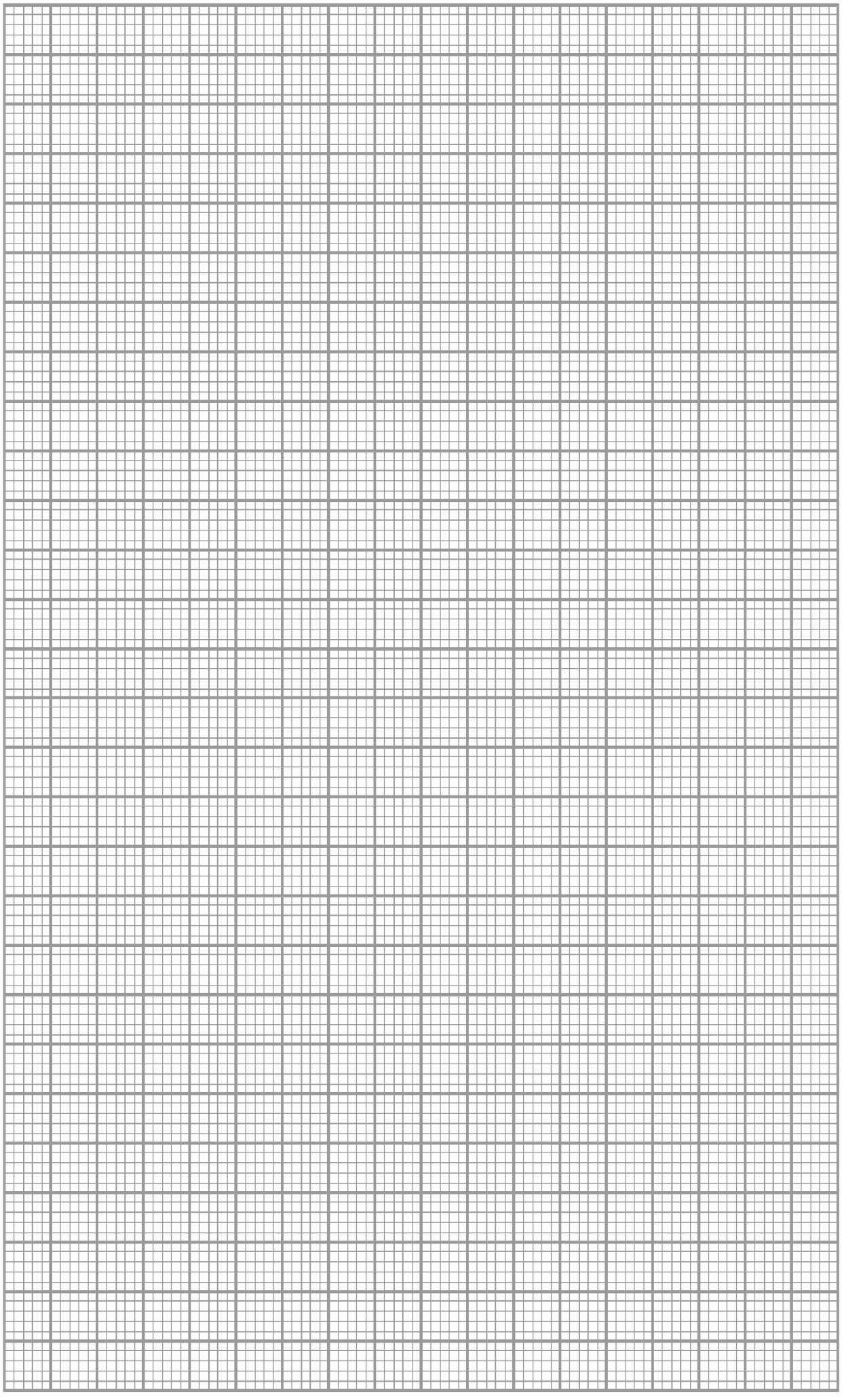
(iii) The value of the wrongly read **angle r** should be _____^{0}. [1]

c) Name 3 properties of an image formed in a plane mirror.

(i) _____

(ii) _____

(iii) _____ [3]



8. The following questions are about motion.

a) In 2009 during the Athletics World Championships held in Berlin, Usain Bolt set a new world record. Starting from **rest**, he ran the **100 m race** in a **total** time of **9.58 seconds**. The table below shows the time intervals for each 10 m he ran.

Distance (m)	Time (s)
0 -10	1.89
10-20	0.99
20-30	0.90
30-40	0.86
40-50	0.83
50-60	0.82
60-70	0.81
70-80	0.82
80-90	0.83
90-100	0.83

(i) What was his initial velocity?

_____ [1]

(ii) Find the **total** time he took to run the first 30 m.

_____ [1]

(iii) His acceleration for the first 30 m was 4.2 m/s^2. Find his velocity after 30 m.

_____

_____ [2]

(iv) Between which distances was he running at constant speed?

_____ [1]

(v) What was his acceleration at this point? _____ [1]

(vi) Between which distances was he slowest? _____ [1]

PLEASE TURN OVER

(vii) Calculate his average speed for the whole race.

_____ [1]

b) One of the latest Ferrari models can reach a maximum speed of 325 km/h.

(i) Change 325 km/h to m/s.

_____

_____ [2]

(ii) Starting from <u>rest</u> it can reach a speed of 27 m/s in just 3 seconds.

Find its **acceleration** and the **distance travelled** while accelerating.

Acceleration: _____

_____

_____ [3]

Distance travelled: _____

_____

_____ [2]

END OF PAPER