BP-203

NAME: ______________________________ (   ) CLASS: 3E_____

HOUGANG SECONDARY SCHOOL

SEMESTRAL ASSESSMENT 1 / 2017

SCIENCE (PHYSICS) 5076 / 01
PAPER 1

SECONDARY THREE EXPRESS

Monday 8 May 2017

Total duration for Paper 1 and 2:
1 hour 30 minutes

MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE
MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE
MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE
MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE
MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, register number and class on the **OTAS** in the spaces provided.

There are **fifteen** questions on this paper. Answer **all** questions. For each question there are four possible answers, **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate **OTAS** provided.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

Hand in your OTAS, Paper 1 and Paper 2 separately.

This document consists of 5 printed pages (including this cover page).

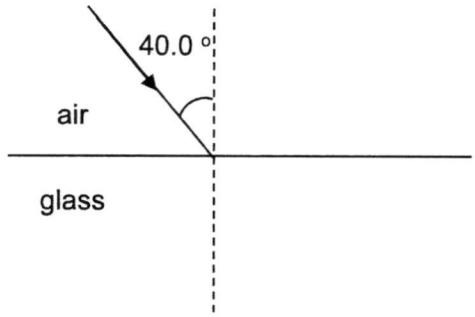
[Turn over

Answer ALL the questions.
Shade your answers in the OTAS provided.

1 Which of the following statements about the image of an object formed by reflection in a plane mirror is false?

A The distance of the image from the mirror is the same as the distance of the object from the mirror.
B The image can be formed on a screen.
C The image has the same size as the object.
D The image is upright.

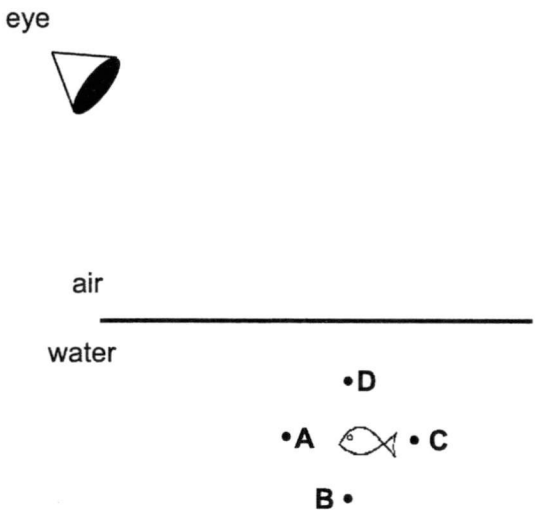
2 The diagram shows a ray of light entering a glass block of refractive index 1.40 at an angle of incidence of 40.0 °.



By how many degrees does the light ray **change direction** when entering the glass?

A 12.7 °
B 27.3 °
C 64.0 °
D 64.1 °

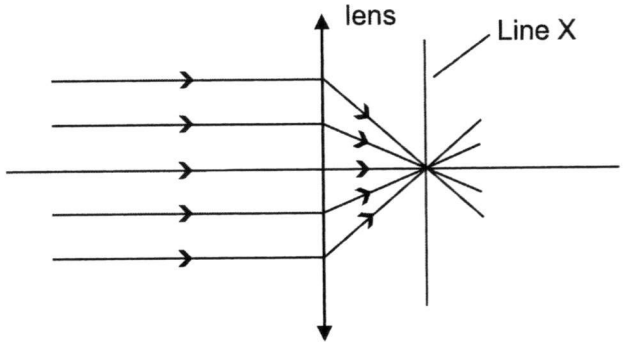
3 The diagram below shows a boy looking at a fish in a pond. At which position would the virtual image of the fish be seen?



4 An object is placed in front of a thin converging lens. Which type of image cannot be seen?

A real, inverted and diminished,
B real, inverted and magnified,
C virtual, upright and diminished,
D virtual, upright and magnified.

5 Line X in the following diagram is known as

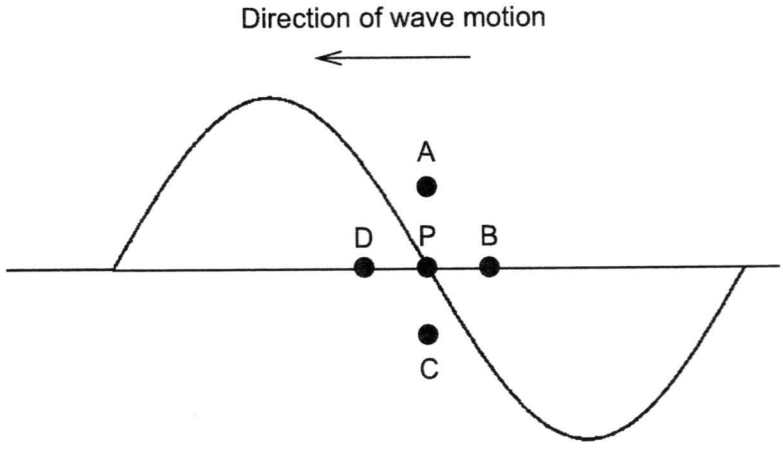


A focal length.
B focal plane.
C focal point.
D optical centre.

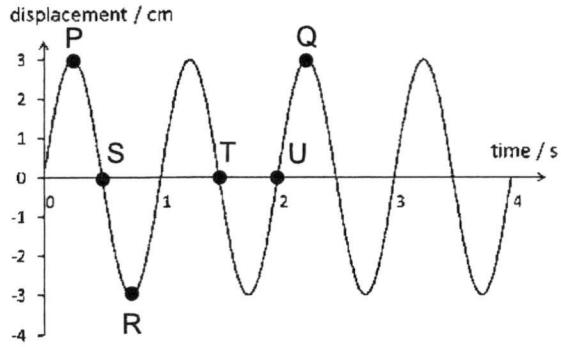
6 Water waves travel across the surface of a lake, covering a distance of 200 m in 40.0 s. The distance between consecutive crests is 5.00 m. What is the number of complete waves formed?

A 8
B 40
C 100
D 1000

7 Point **P** represents the position of a wave particle at time t = 0 s. Predict the position of this particle at the next moment.



8 The diagram shows a graph of wave motion.



Which points in the graph represents the period of the wave?

A from point **P** to point **R**
B from point **P** to point **Q**
C from point **S** to point **T**
D from point **S** to point **U**

9 A spring is moved from side to side to produce a wave. The speed of the wave is 2.50 m/s and the frequency is 2.50 Hz.
How long does it take for a wave to travel 3.00 m along the spring?

A 1.00 s
B 1.20 s
C 5.00 s
D 7.50 s

10 It is given that microwaves have a frequency of 5000 MHz and a speed of 3.00×10^8 m/s. What is its wavelength?

A 0.06 m
B 16.7 m
C 60 000 m
D 1.5×10^{12} m

11 Which of the following statements about waves is false?

A An example of longitudinal wave is sound wave.
B Speed of waves can change due to a change in the medium it is travelling in.
C The source of a wave is a vibration or an oscillation.
D Waves transfer energy and matter from one point to another.

12 Which of the following statements about electromagnetic waves is true?

A Electromagnetic waves can be either transverse or longitudinal waves.
B Electromagnetic waves can travel at 3.00×10^8 m/s through any medium.
C Electromagnetic waves can travel through outer space.
D The frequency of electromagnetic waves changes when travelling from one medium to another.

13 Which of the following sequence of electromagnetic waves is arranged in decreasing wavelength?

	Longest wavelength ⟶ Shortest wavelength			
A	gamma rays	x-rays	visible light	radio waves
B	radio waves	visible light	x-rays	gamma rays
C	radio waves	x-rays	gamma rays	visible light
D	x-rays	radio waves	visible light	gamma rays

14 Which of the following is an application for infrared radiation?

A intruder alarm
B laser cutter
C microwave oven
D sunbeds

15 In telecommunications, microwaves are more frequently used for satellite broadcasting whereas radiowaves are used in local broadcasting.
Which statement best describes the reason behind this?

A Cost of microwave satellite is cheaper.
B Microwaves have higher frequency, and therefore higher energy to travel further.
C Radiowaves are loud.
D Radiowaves travel slower in outer space as compared to microwaves.

End of Paper 1

NAME: ________________________________ (   ) CLASS: 3E_____

HOUGANG SECONDARY SCHOOL

SEMESTRAL ASSESSMENT 1 / 2017

SCIENCE (PHYSICS) 5076 / 02
PAPER 2

SECONDARY THREE EXPRESS

Monday 8 May 2017

Total duration for Paper 1 and 2:
1 hour 30 minutes

MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE
MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE
MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE
MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE
MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE RESPECT OURSELVES RESPECT OTHERS MAKE THE DIFFERENCE

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class on all the work you hand in.
You may use an HB pencil for any diagrams or graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A
Answer **all** questions.
Write your answers in the space provided on the question paper.

Section B
Answer **all** questions.
Write your answers in the space provided on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

Hand in your OTAS, Paper 1 and Paper 2 separately.

Target : /70			
PAPER 1	PAPER 2		TOTAL
	Section A	Section B	
15	35	20	70

This document consists of 10 printed pages (including this cover page).

Section A (35 marks)
Answer **all** the questions in this section.

1

(a) A ray of light is incident normally onto a plane mirror as shown in Fig. 1.1. State the angle of incidence, *i* and reflection, *r*.

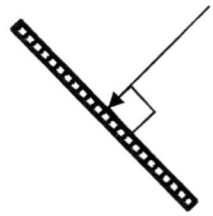


Fig. 1.1

i = _____°

r = _____° [1]

(b) Two students, **P** & **R**, stand apart in front of a plane mirror, as shown in the diagram below.

student **P**

student **R**

(i) Indicate the position of the image of student **P**, showing clearly your construction line. [2]

(ii) Complete the ray diagram to show why student **P** can be seen by student **R**. [2]

2 Fig. 2.1 below shows a customer getting his eyesight tested. A chart with letters is placed behind him to test his eyesight as he looks at the image in the mirror.

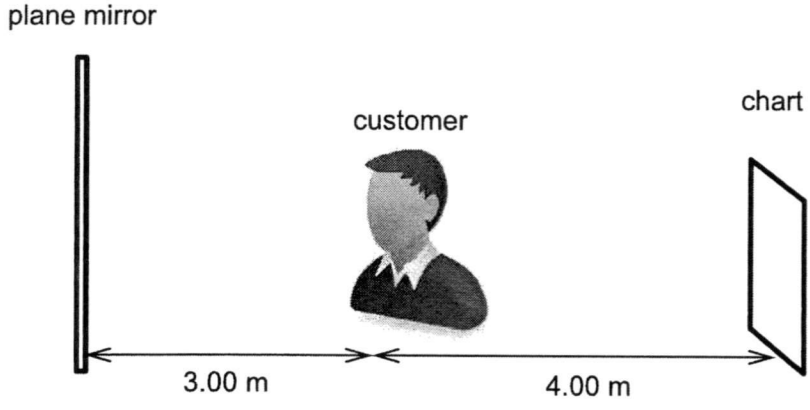
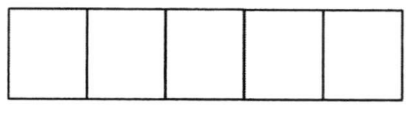


Fig. 2.1

(a) Calculate the distance of the image of the chart from the customer.

distance = ...m [2]

(b) If the customer sees the image in the plane mirror as "EXCEL", write down how this word is written on the chart. [2]



(c) If the mirror is moved further away from the customer at a speed of 1.50 m/s, state the speed that the image is moving away from the customer.

speed = ...m/s [1]

3 Light travels from medium **X** into air as shown in Fig. 3.1 below. The angle of refraction in air is 74.6 ° and the refractive index of medium **X** is 1.70.

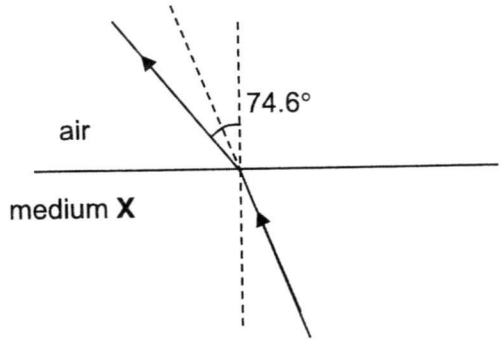


Fig. 3.1

(a) Explain why light ray will bend upon entering air.

.....

.....

.....

.....[2]

(b) Calculate the angle of incidence in medium **X**.

angle of incidence = ...° [2]

(c) Comment on the path of the light ray if air is now replaced with another medium of refractive index 1.50, with the same angle of incidence in **(b)**. Assume no total internal reflection will take place.

.....

.....

.....[2]

4 A ray of light is travelling within a semi-circular block of glass as shown in Fig. 4.1 below. The refractive index of the glass block is 1.46.

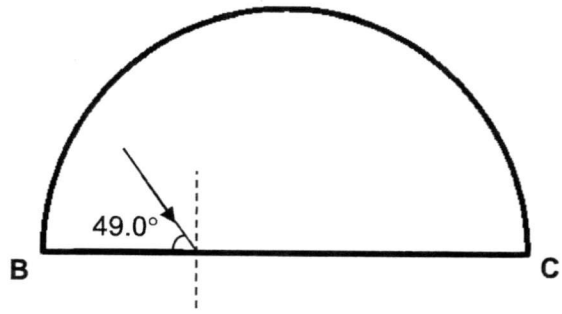


Fig. 4.1

For total internal reflection to take place, one of the condition is that the angle of incidence in the optically denser medium must be greater than the critical angle.

(a) State one other condition for total internal reflection to take place.

.....

.....

.....[1]

(b) Calculate the critical angle, c, of the glass block.

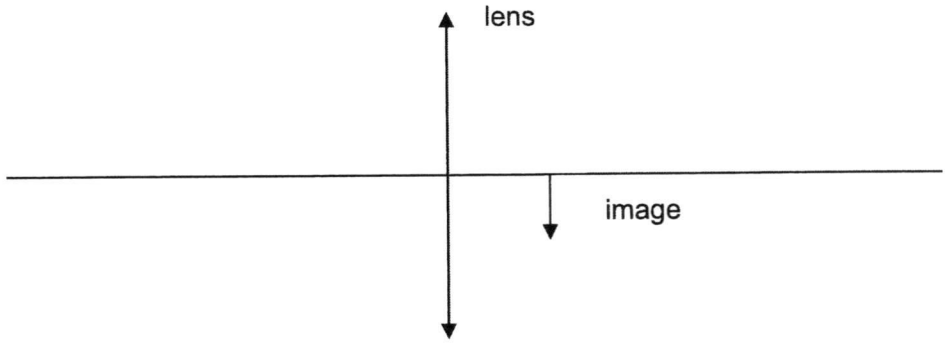
c = ...° [2]

(c) Calculate the speed of light in the glass, v, given that the speed of light in vacuum is 3.00×10^8 m/s.

v = ...m/s [2]

(d) In Fig. 4.1, complete the path of the light ray after it is incident at side **BC**. Indicate all relevant angle(s) **in the glass block**. [2]

5 The diagram below shows a real and inverted image formed by a converging lens. It is given that the **object is twice the size of the image**.



(a) Complete the ray diagram to locate the object and indicate the focal point, F. [4]

(b) State one use for such a lens arrangement.

.....

.....[1]

6 Fig. 6.1 and 6.2 below shows the graphs of wave motion.

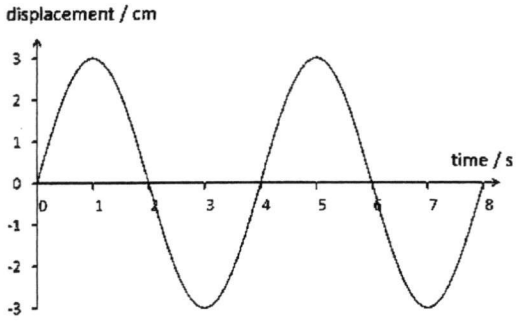


Fig. 6.1

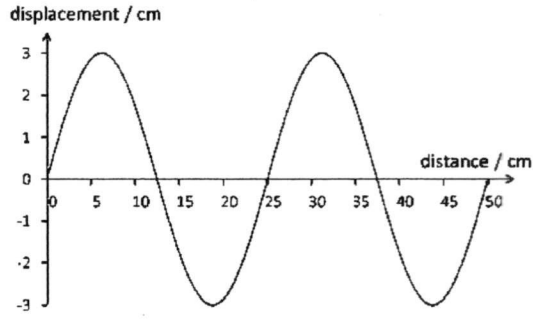


Fig. 6.2

(a) State the amplitude, period and wavelength of the wave.

amplitude = ...cm [1]

period = ...s [1]

wavelength = ...cm [1]

(b) Calculate the frequency of the wave.

frequency = ...Hz [2]

(c) If the speed of the wave is now decreased, explain the changes, if any, that occur in the wavelength and frequency of the wave.

.....

.....

.....[2]

Section B (20 marks)
Answer **all** the questions in this section.

7 An object is placed in front of a thin converging lens with focal length, f, as shown in Fig. 7.1 below.

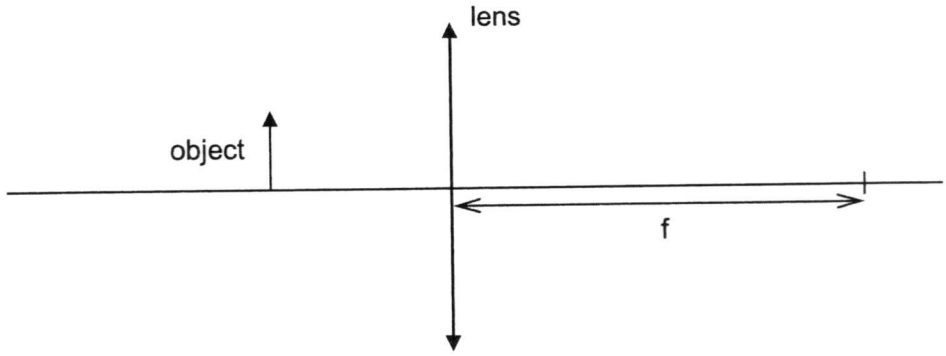


Fig. 7.1

(a) **(i)** On Fig 7.1, complete the ray diagram to show how a virtual image can be formed. [4]

(ii) If the object is moved nearer to the lens, state the change in the position and size of the virtual image formed as compared to your image drawn in **(a)(i)**.

.....

.....[2]

(b) Fig. 7.2 below shows light rays from a distant object passing through a converging lens to form a diminished image.

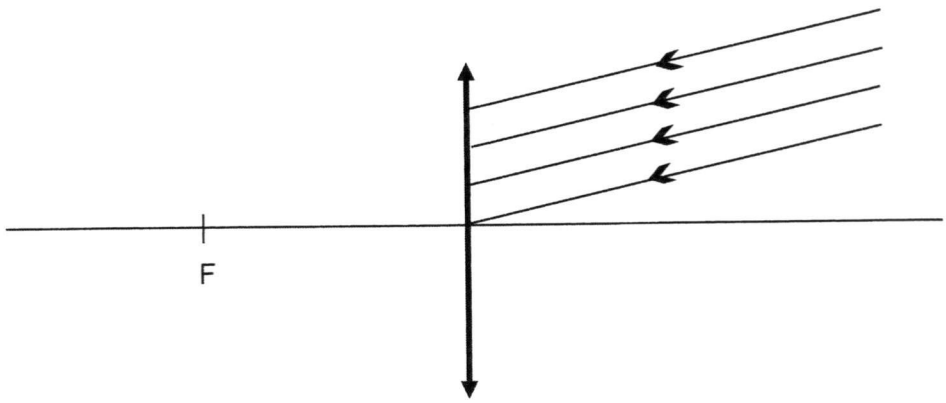


Fig. 7.2

(i) Complete the ray diagram to locate the image. [3]

(ii) State **two other** characteristics of the image formed in **(b)(i)**.

.....

.....[1]

8 In a ripple tank, an oscillating dipper produced four plane waves on the surface of the water, as shown in Fig. 8.1.

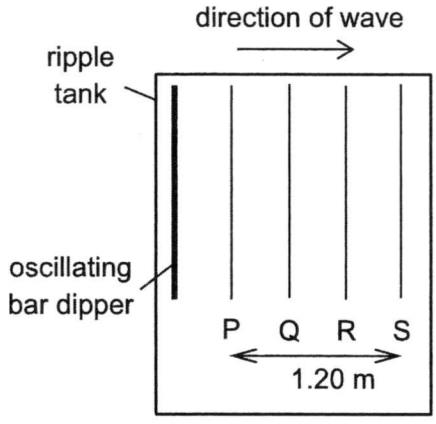


Fig. 8.1

The distance between wavefront **P** and **S** is 1.20 m. The time taken for a wave to travel from **P** to **S** is 2.00 s.

(a)

(i) Define wavefront.

.....

.....[1]

(ii) Calculate the wavelength of the wave.

wavelength = ...m [1]

(iii) Calculate the speed of the wave.

wave speed = ...m/s [2]

(iv) Calculate the frequency of the wave.

frequency = ...Hz [2]

(b) One of the main application of gamma rays is in Gamma Knife radio surgery to kill cancer cells.

(i) Explain why gamma rays are used in radiation therapy instead of radiowaves.

.....

.....

.....[2]

(ii) Complete the table below by filling in two **other** electromagnetic waves with **one health related** application each. [2]

Electromagnetic Waves	**Health Application**
Example: gamma rays	Gamma Knife radio surgery

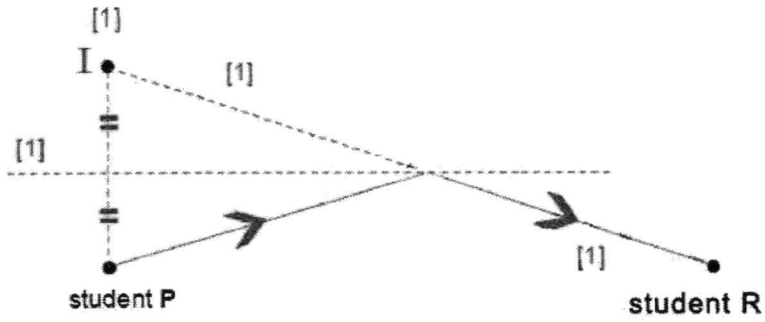
End of Paper 2

SA1 2017 PHYSICS

1. **B**
2. **A**
3. **D**
4. **C**
5. **B**
6. **B**
7. **C**
8. **C**
9. **B**
10. **A**
11. **D**
12. **C**
13. **B**
14. **A**
15. **B**

1. (a) i = 0°, r = 0° [1]

(b)



2 (a) 3.00 + 3.00 + 4.00 = 10.0 m [1] for working
[1] for correct answer

(b)

[1] for correct order
[1] for lateral inversion of each letter

(c) 1.50 x 2 = 3.00 m/s [1]

3 (a) Air is of lower optical density compared to medium X [1].
Therefore, light rays will travel faster in air, causing it to bend away from the normal. [1]

(b)

$$n = \frac{\sin}{\sin i}$$

$$1.70 = \frac{\sin 74.6}{\sin i} \quad [1]$$

$$\sin i = \frac{\sin 74.6}{1.70}$$

$$i = 34.5^{o} \ [1]$$

(c) The light ray will still bend away from the normal [1]
but with a smaller angle of refraction. [1]

4 (a) The light ray must be travelling from a medium of higher optical density to a medium of lower optical density. [1]

(b)

$c = \sin^{-1}\left(\frac{1}{n}\right)$

$c = \sin^{-1}\left(\frac{1}{1.46}\right)$ [1]

$c = 43.2^{o}$ [1]

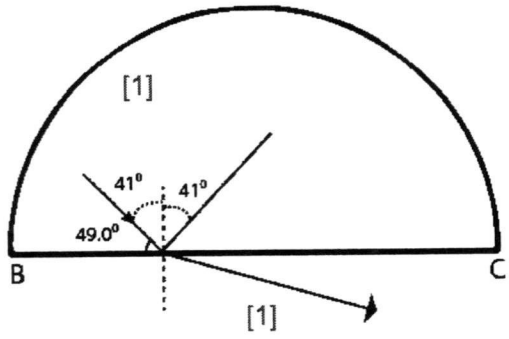
(c)

$n = \frac{c}{v}$

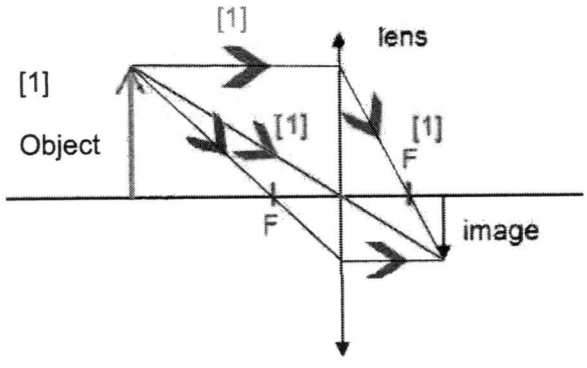
$1.46 = \frac{3\times10^{8}}{v}$ [1]

$v = 2.05 \times 10^{8}$ m/s [1]

(d)



5 (a)



(b) camera [1]

6 (a)

(i) Amplitude = 3 cm [1]
(ii) Period = 4 s [1]
(iii) Wavelength = 25 cm [1]

(b)

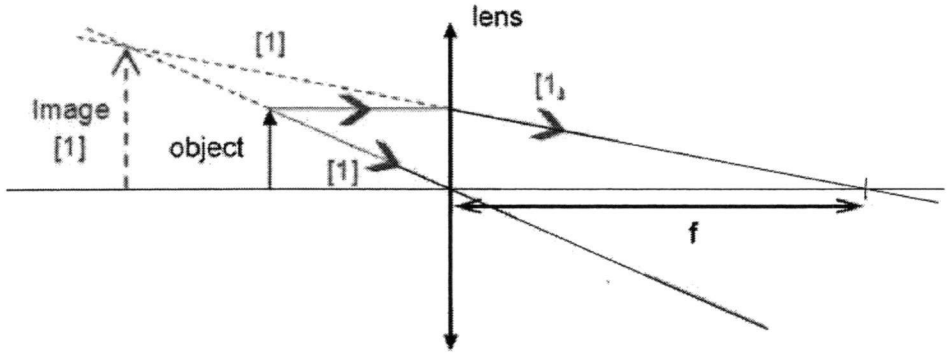
$$f = \frac{1}{T}$$

$$f = \frac{1}{4}\,[1]$$

$$f = 0.25\ \text{Hz}\,[1]$$

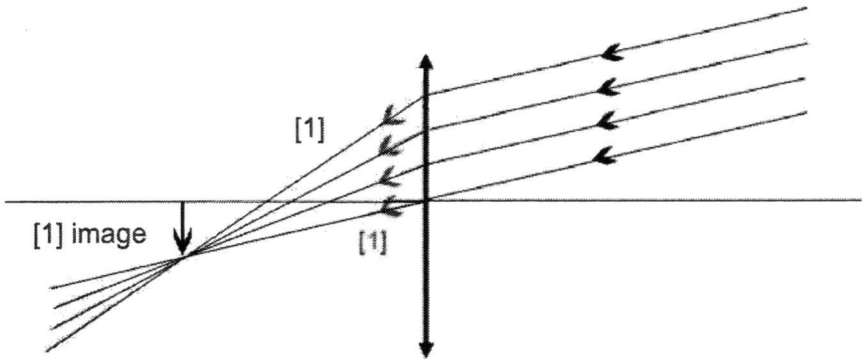
(c) The frequency of the wave depends on its source, hence it remains unchanged. [1]
From the formula $v = f\lambda$, its wavelength will decrease. [1]

7(a)(i),



(ii) the image will be smaller [1]
and nearer from the lens. [1]

(b)(i)



(ii) real and inverted [1]

8(a)(i) Wavefront is an imaginary line on a wave that joins all adjacent points that are in phase. [1]

(ii)

$\frac{1.20}{3} = 0.400$ m [1]

(iii)

$$speed = \frac{distance}{time}$$

$speed = \frac{1.20}{2}$ [1]

$= 0.600\ m/s$ [1]

(iv)

$v = f\lambda$
$0.600 = f \times 0.400$ [1]
$f = \frac{0.600}{0.400} = 1.50$ Hz [1]

and therefore have sufficient energy to kill cancer cells. [1]

any correct answer, max [2]

Electromagnetic Waves	Health Application
gamma rays	Gamma Knife radio surgery
Infrared radiation	measure temperature in thermometer
Ultraviolet radiation	sterilise medical equipment
X-rays	produce X-ray images or treat cancer through radiation therapy
Visible Light	Optical fibres for medical purposes