Neap:

PHYSICS VCE UNITS 3&4
DIAGNOSTIC TOPIC TESTS

TEST 7: HOW CAN WAVES EXPLAIN THE BEHAVIOUR OF LIGHT? (I)

TOTAL 45 MARKS (45 MINUTES)

Student's Name: _____ Teacher's Name: _____

Directions to students

Write your name and your teacher's name in the spaces provided above.
Answer all questions in the spaces provided.

Use $c = 3.0 \times 10^8$ m s^{-1}

Question 1 (3 marks)

Figure 1 shows two wave types, A and B.

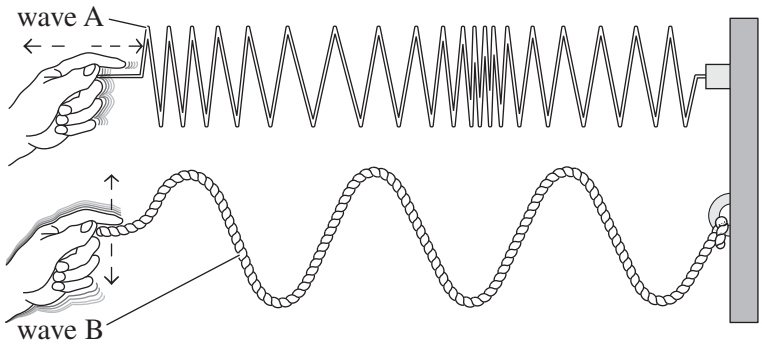

Figure 1

State one difference and two similarities between wave A and wave B.

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Question 2 (7 marks)

Below is a diagram showing a particular wave type. The wave transmits energy from the left. Two points, 1 and 2, are indicated on Figure 2. Five lengths, A–E, are also indicated on Figure 2.

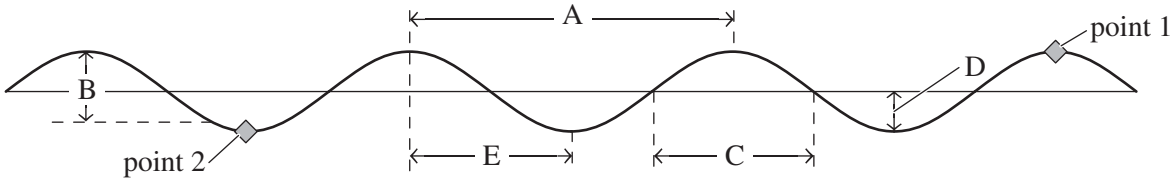

Figure 2

a. The wavelength of the waveform above is given by which letter (choose from A–E)? 1 mark

b. The amplitude of the waveform above is given by which letter (choose from A–E)? 1 mark

The frequency of the wave is 5.0×10^{14} Hz and the wave travels at 3.0×10^{8} m s^{-1}.

c. Determine the wavelength of the wave. 2 marks

m

d. How long does it take the wave to travel two wavelengths? 2 marks

s

e. Which of the options **A.–D.** below correctly represents the motion of the particles at points 1 and 2 for the instant shown in Figure 2? 1 mark

	Point 1	**Point 2**
A.	moving to the right	about to move down
B.	about to move up	moving to the left
C.	about to move up	about to move down
D.	about to move down	about to move up

Question 3 (4 marks)

Two waves, both of wavelength 2.0 cm, are produced by two different sources and meet constructively at point P. The wave from source 1 travels a further distance than the wave from source 2.

The two waves produced are emitted simultaneously and are in phase (identical in profile when compared at the same instant of time). This is shown in Figure 3.

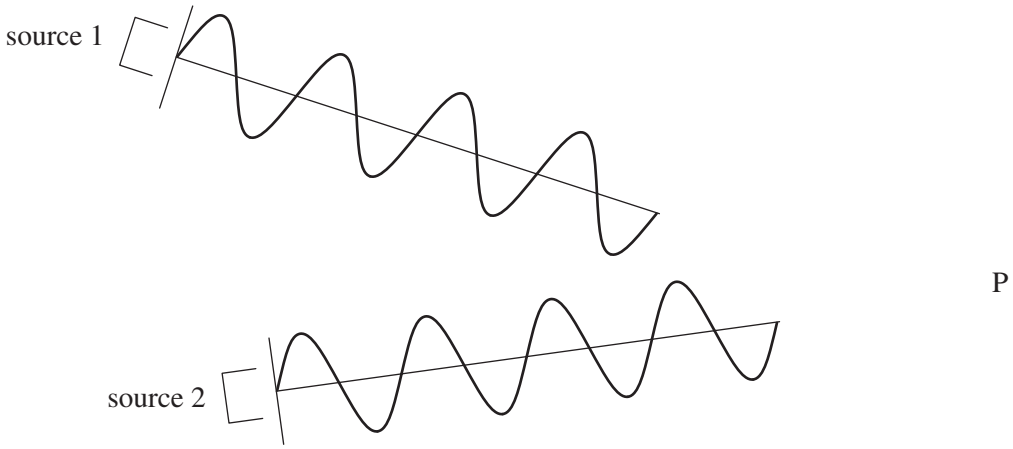

Figure 3

a. State three possibilities for how much farther the wave from source 1 travels in comparison to the wave from source 2. 2 marks

cm

A different position is observed where the same two waves meet destructively. Again, the wave from source 1 travels a further distance than the wave from source 2.

b. State three possibilities for how much further the wave from source 1 travels in comparison to the wave from source 2. 2 marks

cm

Question 4 (8 marks)

Figure 4 below shows circular waves of the same wavelength emanating in their forward direction from two identical sources, S_1 and S_2. The waves are of the same wavelength. The dark circular lines represent crests for both sets of waves. The lighter circular lines represent troughs for both waves. Four positions A–D are shown as black dots at particular positions where the two sets of waves pass through each other.

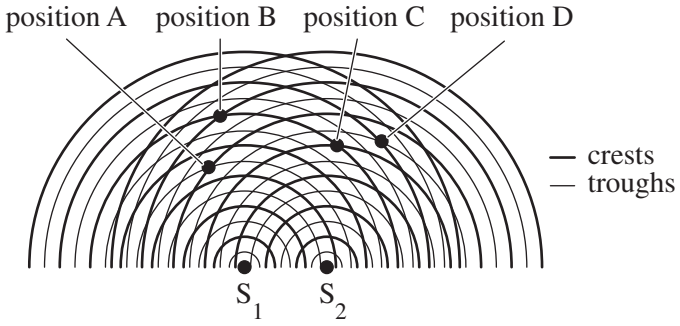

Figure 4

The wavelength of the wave sets is 3.0 cm.

a. In terms of interference, explain what is happening at position A. 2 marks

_____

_____

_____

_____

b. In terms of interference, explain what is happening at position B. 2 marks

_____

_____

_____

_____

c. How much further is position C from S_1 than from S_2, in cm? 2 marks

cm

d. How much further is position D from S_1 than from S_2, in cm? 2 marks

cm

Question 5 (4 marks)

Figure 5 shows a man standing on a footpath and a car with its horn on passes him by. The driver presses the horn of the car the entire time from when the car approaches the man to when the car has passed the man. The car horn sound consists of a single frequency.

Figure 5

a. Explain how the frequency of the car horn is perceived by the man as the car approaches him to when the car has passed him. 2 marks

b. Explain the physics that accounts for your answer to part **a.** 2 marks

Question 6 (7 marks)

A guitar string is plucked and a note of a single frequency is heard coming from the string.

a. Explain the nature of the motion of the guitar string that produced the single note. In your answer make reference to the physics of the production of the wave that produces the sound. 4 marks

A string on a guitar has a length of 60.0 cm. It is plucked. The smallest frequency that can be created is 150 Hz.

b. What is the next lowest frequency that can be created by plucking the string? 1 mark

Hz

A rope of length 3.0 m is tied to a retort stand and a student waves the other end of the rope sideways to create a resonance effect in the rope.

c. What are two longest wavelengths able to be created by waving the rope sideways? 2 marks

m

Question 7 (4 marks)

Figure 6 shows water waves travelling to the right and passing through an opening in a wall. Once they have passed through the opening, they fan out in a circular manner on the other side. Figure 6 shows the opening in the wall as the gap width. The straight vertical lines represent the crests of the water waves approaching the gap wall. The wavelength is the distance between neighbouring crests.

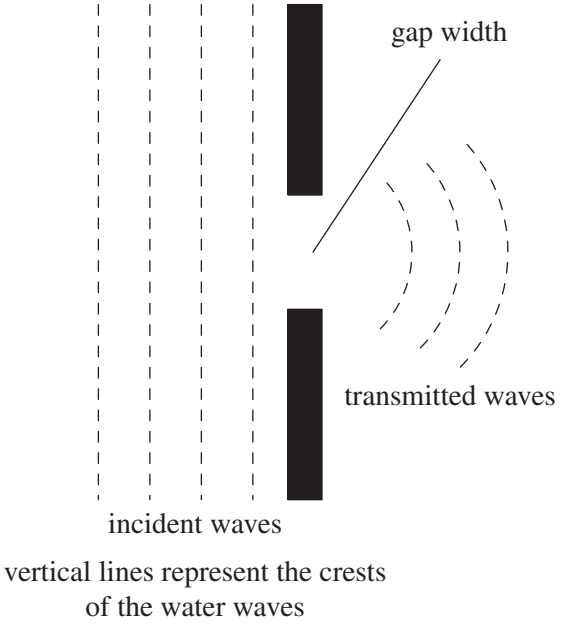

Figure 6

Figure 6 is reproduced in Figure 7 with the original incident and transmitted waves. Figure 8 has a new set up showing a change in the gap width.

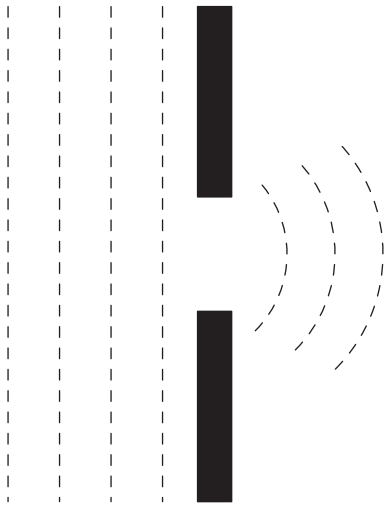

Figure 7

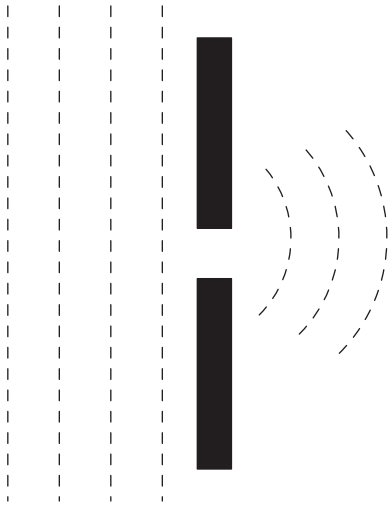

Figure 8

a. On Figure 8, by drawing over the original transmitted waves, show the transmitted waves as they would pass through the opening. 2 marks

Figure 6 is reproduced in Figure 9, with the original incident and transmitted waves. Figure 10 has a new set up showing a change in the incident waves.

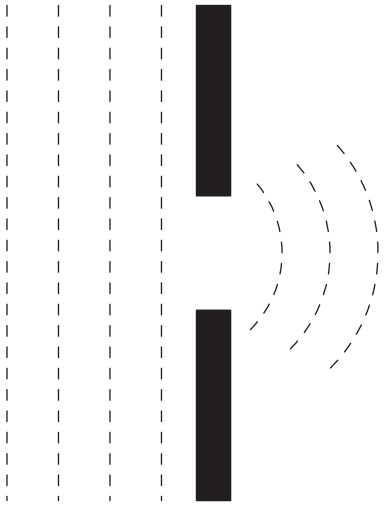

Figure 9

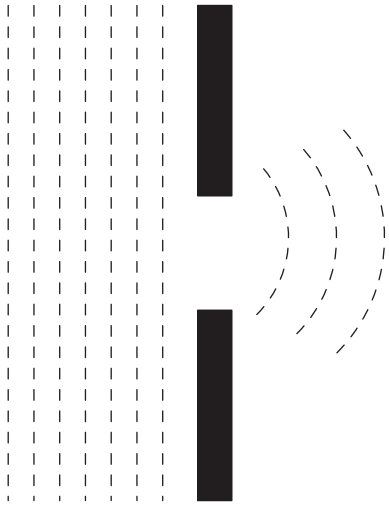

Figure 10

b. On Figure 10, show the transmitted waves as they would pass through the opening. 2 marks

Question 8 (4 marks)

a. Explain why light is referred to as an electromagnetic wave. 2 marks

_____

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b. Explain how light is produced by making reference to the action of electrons inside an atom. 2 marks

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Question 9 (4 marks)

Figure 11 represents an incomplete spectrum for long wavelength to short wavelength light. Visible light is shown in the middle of the spectrum

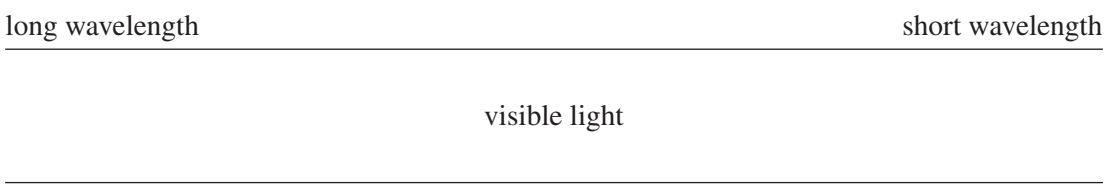

Figure 11

a. On the spectrum in Figure 11, mark the positions of X-ray, microwave, gamma, infrared, ultraviolet and radio. 2 marks

b. State one use or occurrence in nature of the following categories of light radiation.

i. infrared 1 mark

_____

_____

ii. gamma 1 mark

_____

_____