

## Questions

Q1.

A toy produces continuous waves when floating on the surface of a pool of water.

The waves spread out as circular wavefronts.

Diagram 1 shows the wavefronts produced when the toy is not moving, as viewed from above.

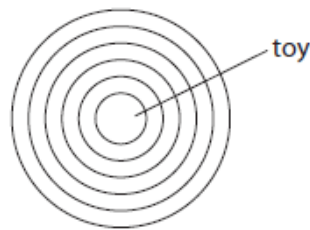


Diagram 1

Diagram 2 shows the wavefronts produced when the toy is moving across the surface of the pool of water.

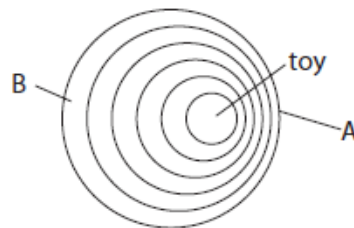


Diagram 2

(a) Draw an arrow on diagram 2 to show the direction the toy is moving.

(1)

(b) Explain how the frequency of the waves at point A is different to the frequency of the waves at point B.

(4)

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**(Total for question = 5 marks)**

Q2.

This question is about waves.

(a) (i) Which of these waves is longitudinal?

**(1)**

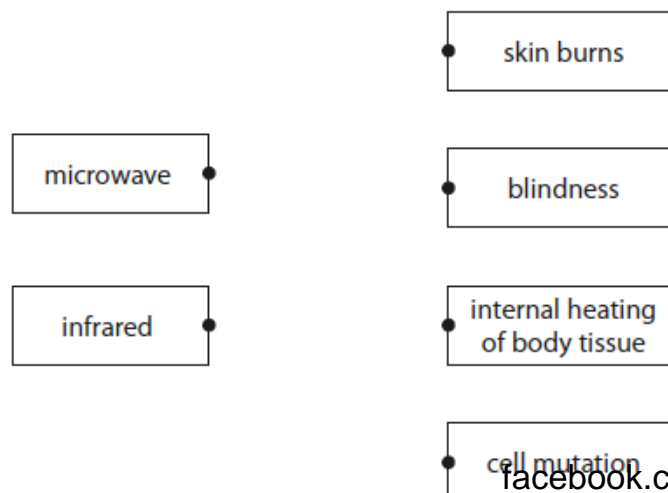
- A** infrared
- B** radio
- C** sound
- D** ultraviolet

(ii) Draw a straight line linking each electromagnetic wave to its correct hazard.

**(2)**

**Electromagnetic wave**

**Hazard**



(b) (i) Which of these is a use for x-rays?

(1)

- A** checking for broken bones
- B** cooking food
- C** detecting forged banknotes
- D** smoke detectors

(ii) Which of these is a use for infrared waves?

(1)

- A** checking for broken bones
- B** cooking food
- C** detecting forged banknotes
- D** sterilising medical instruments

**(Total for question = 5 marks)**

Q3.

Sound travels as a wave.

(a) A buzzer produces a sound wave of frequency 2.9 kHz and wavelength 12 cm.

(i) State the equation relating wave speed, frequency and wavelength.

(1)

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(ii) Calculate the speed of the sound wave.

(3)

speed = ..... m/s

(b) Some electromagnetic waves are dangerous to people.

Describe how the dangers of these electromagnetic waves vary with wavelength.

(4)

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**(Total for question = 8 marks)**

Q4.

This question is about sound waves.

(a) Describe an experiment to measure the speed of sound in air.

You may draw a diagram to help your answer.

(5)

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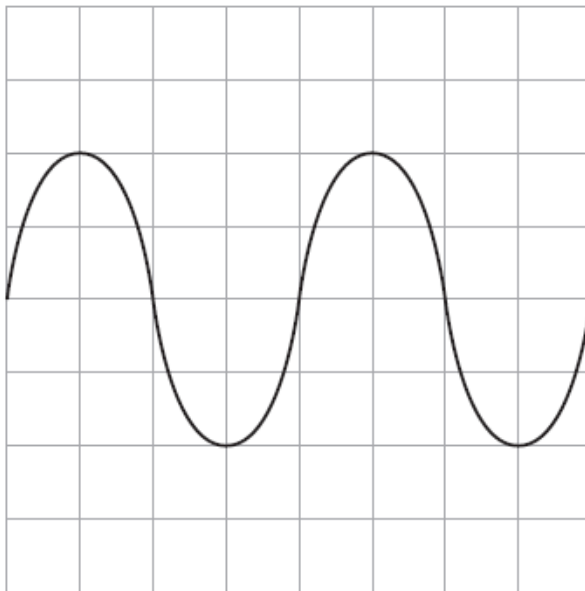
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(b) An oscilloscope can be used to determine the frequency of a sound wave.

The diagram shows an oscilloscope trace of a sound wave.



**Oscilloscope settings**  
 y direction: 1 square = 1 V  
 x direction: 1 square = 0.25 ms

(i) Calculate the period of this sound wave.

(3)

period = ..... s

(ii) Calculate the frequency of this sound wave.

(2)

frequency = ..... Hz

**(Total for question = 10 marks)**

Q5.

A dentist takes an x-ray image of a patient's teeth using photographic film.



(a) The film, which is initially white, changes to black when it absorbs x-rays.

The film is placed inside the patient's mouth and the x-ray source is outside the patient's body.

The teeth and soft tissue appear differently on the x-ray image.

Use words from the box to complete the sentences.

(2)

absorbed   emitted   reflected   transmitted

The tooth appears white because most of the x-rays are .....  
by the tooth.

The soft tissue appears darker in colour because most of the x-rays are  
.....  
by the soft tissue.

(b) Explain why the dentist has to leave the room before taking the x-ray image but it  
is safe for the patient to stay in the room.

(2)

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(c) The x-rays used have a frequency of  $3.5 \times 10^{16}$  Hz.

(i) State the formula linking wave speed, frequency and wavelength.

(1)

(ii) X-rays have a speed of  $3.0 \times 10^8$  m/s.

Calculate the wavelength of these x-rays.

(3)

wavelength = ..... m

(d) X-rays are electromagnetic waves.

Radio waves are also electromagnetic waves.

State one other similarity and one difference between x-rays and radio waves.

(2)

similarity .....

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difference .....

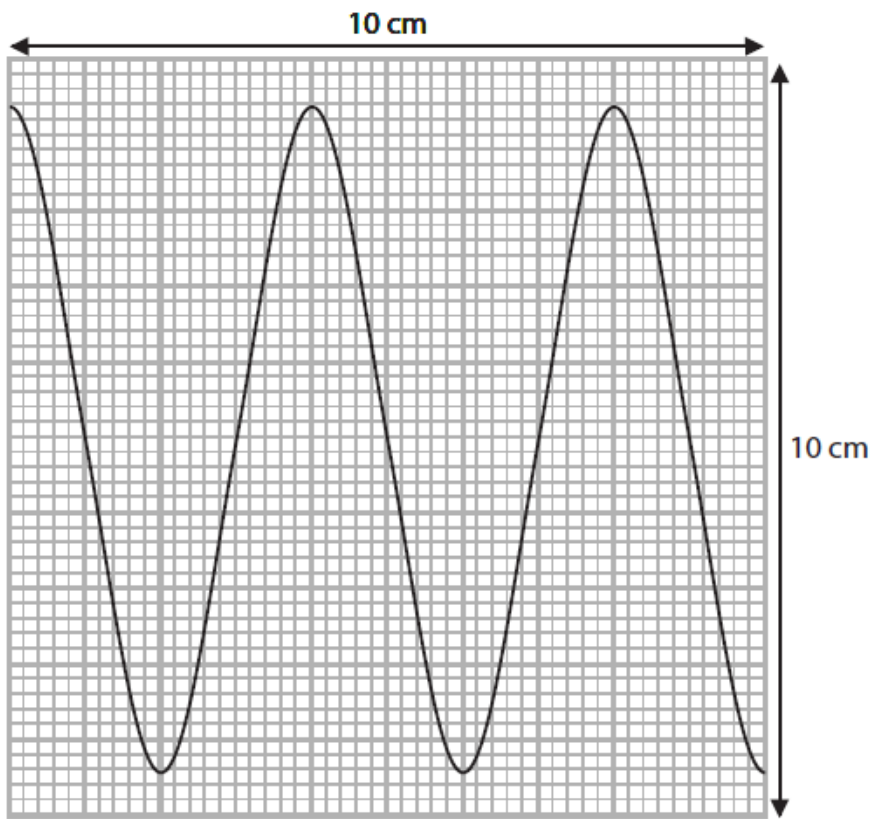
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**(Total for question = 10 marks)**

Q6.

This question is about waves.

(a) The diagram shows a wave.



(i) What is the wavelength of the wave?

(1)

- A** 4.0 cm
- B** 4.4 cm
- C** 5.0 cm
- D** 8.8 cm

(ii) What is the amplitude of the wave?

(1)

- A** 4.0 cm
- B** 4.4 cm
- C** 5.0 cm
- D** 8.8 cm

(b) The diagram shows the types of radiation in the electromagnetic spectrum.

radio waves	microwaves	infrared	visible light	ultraviolet	x-rays	gamma rays
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(i) Which of the following statements about electromagnetic waves is correct?

- A** they all have the same amplitude
- B** they all have the same frequency
- C** they all have the same speed in free space
- D** they all have the same wavelength

(ii) Electromagnetic waves have many different uses.

Explain the uses of **three** different radiations in the electromagnetic spectrum.

(6)

1 .....

Use .....

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2 .....

Use .....

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3 .....

Use .....

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**(Total for question = 9 marks)**

Q7.

A car is moving along a road.

(a) The car has an initial velocity of 26 m / s.

The car then accelerates at 1. 2 m / s<sup>2</sup> until it reaches a velocity of 35 m / s.

(i) State the formula linking acceleration, change in velocity and time taken.

(1)

(ii) Calculate the time taken for the car to accelerate to 35 m/s.

(3)

time = ..... s

(b) A radar speed gun is used to measure the speed of the moving car.



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The radar speed gun emits radio waves towards the moving car.

The moving car reflects the radio waves back to a detector on the gun.

The detected radio waves have a different frequency from the emitted radio waves.

This change in frequency is used to measure the speed of the moving car.

Explain this change in frequency when the car is moving towards the radar speed gun.

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**(Total for question = 8 marks)**

Q8.

Sound travels as a wave.

(a) Which of these statements about sound waves is **incorrect**?

(1)

- A** they can be reflected
- B** they can travel through a vacuum
- C** they can be refracted
- D** they transfer energy

(b) Sound waves are a type of wave known as longitudinal waves.

(i) Name the other type of wave.

(1)

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(ii) Give **one** example of this other type of wave.

(1)

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(c) A buzzer produces a sound wave of frequency 2.9 kHz and wavelength 12 cm.

(i) State the equation relating wave speed, frequency and wavelength.

(1)

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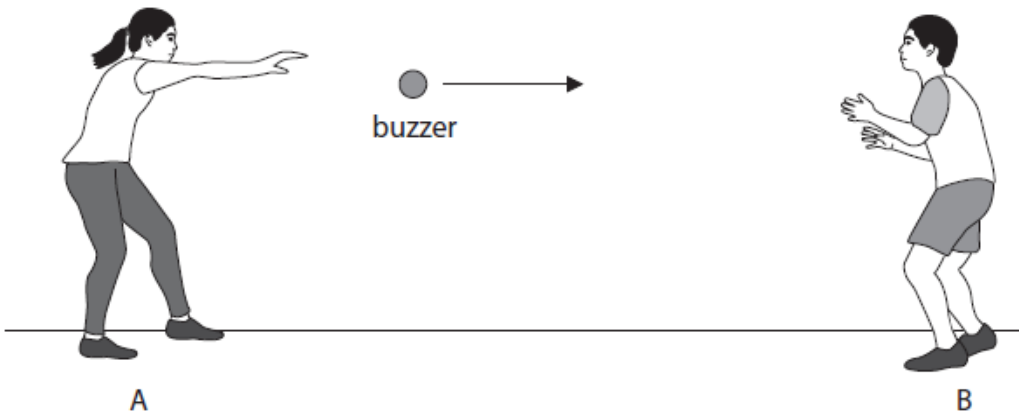
(ii) Calculate the speed of the sound wave.

(3)

speed = .....m/s

(d) Two students investigate the Doppler effect by throwing a buzzer to each other.

Student A throws the buzzer to student B.



When the buzzer is thrown, student A notices that the sound produced changes.

Explain how the sound heard by student A changes.

You may include a diagram in your answer.

(3)

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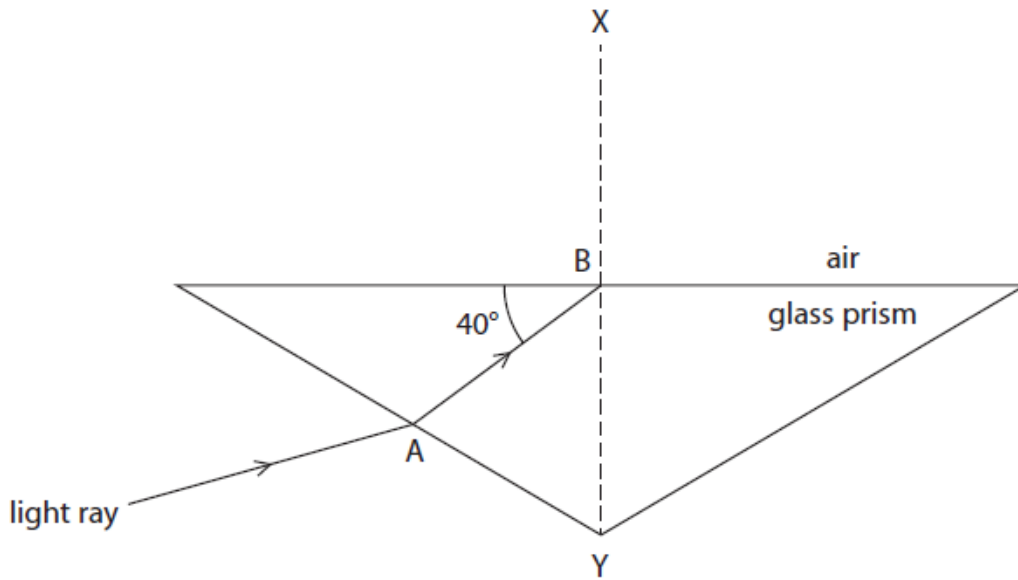
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**(Total for question = 10 marks)**

Q9.

This question is about light.

(a) Diagram 1 shows a light ray entering a glass prism.



**Diagram 1**

(i) Describe what happens to the light ray when it enters the prism at point A.

(2)

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(ii) State the name of line XY.

(1)

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(iii) State the formula linking critical angle and refractive index.

(1)

(iv) The refractive index for the glass in this prism is 1.6

Calculate the critical angle for the glass in this prism.

(3)

critical angle = ..... °

(v) Complete Diagram 1 by continuing the path of the light ray from point B.

(2)

(b) Diagram 2 shows a similar prism that is made from a material with a different refractive index.

Complete Diagram 2 by continuing the path of the light ray.

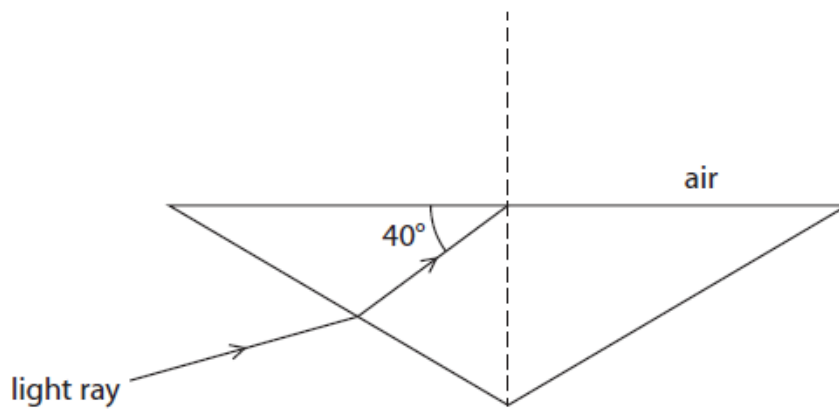


Diagram 2

(2)

(Total for question = 11 marks)

Q10.

This question is about refraction.

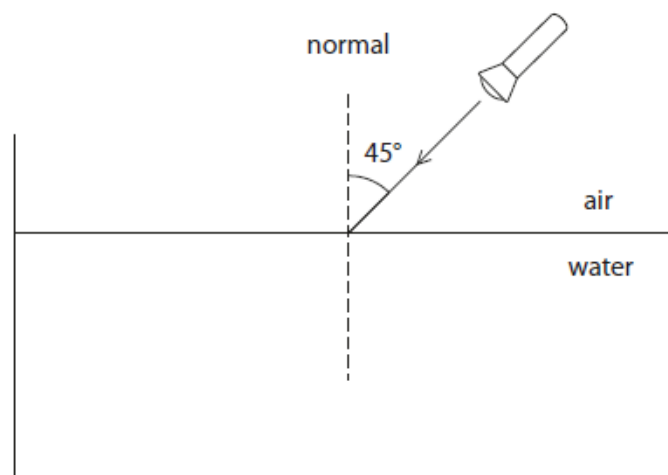
(a) State what is meant by the term **refraction**.

(1)

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(b) The diagram shows a ray of light from a torch incident on the surface of a pool of water.



The angle of refraction of the ray of light is  $33^\circ$

(i) Draw the path of the ray of light in the water.

(2)

(ii) State the formula linking refractive index, angle of incidence and angle of refraction.

(1)

(iii) Show that the refractive index of water is about 1.3

(2)

(c) The torch is moved below the surface of the water. Light from the torch is incident on the water surface at an angle greater than the critical angle.

(i) Explain the meaning of the term **critical angle**.

You may draw a diagram to help your answer.

(2)

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(ii) State the formula linking critical angle and refractive index.

(1)

(iii) Calculate the critical angle of water.

Assume the refractive index of water is 1.3

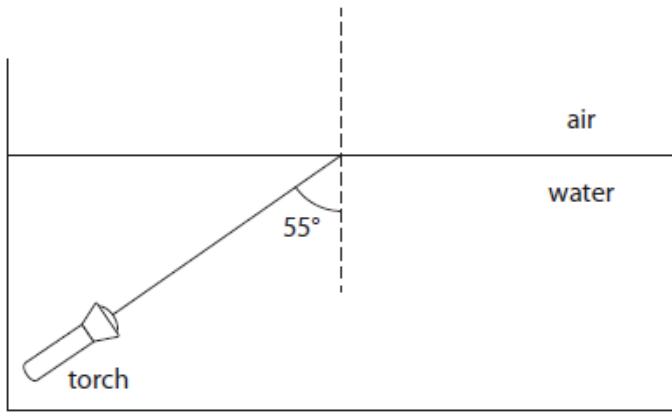
(3)

critical angle = ..... $^\circ$

(iv) A ray of light leaves the torch as shown in the diagram.

Complete the path of the ray of light.

(2)



**(Total for question = 14 marks)**