3.6 Waves: 30-minute Pack

AQA 8463 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A wave has an amplitude, a wavelength and a frequency.

(a) State what is meant by the amplitude of a wave. **(1)**

(b) State what is meant by the wavelength of a wave. **(1)**

(c) State what is meant by the frequency of a wave. **(1)**

(Total for Question 1 is 3 marks)

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2 A water wave travelling across a pond has a wavelength of 0.4 m and a frequency of 5 Hz.

(a) Write down the word equation linking wave speed, frequency and wavelength. **(1)**

.....

(b) Calculate the speed of the wave. Use the Physics Equations Sheet: wave speed = frequency x wavelength **(2)**

.....

(Total for Question 2 is 3 marks)

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3 Here are five types of electromagnetic wave, listed in a jumbled order: visible light, γ rays, microwaves, ultraviolet, radio waves. Write the five waves in order of increasing frequency, starting with the lowest frequency.

(Total for Question 3 is 4 marks)

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4 When a wave hits a flat, smooth surface such as a mirror, it can be reflected.

(a) State the law of reflection. **(1)**

(b) Describe the difference between specular reflection and diffuse reflection. **(2)**

(Total for Question 4 is 3 marks)

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5 The electromagnetic spectrum is a continuous range of waves, grouped into seven types.

(a) List the seven types of electromagnetic wave in order, starting with the type that has the longest wavelength. **(1)**

(b) State how the speed of electromagnetic waves in a vacuum compares across the seven types. **(1)**

(Total for Question 5 is 2 marks)

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6 Different types of electromagnetic wave have different everyday uses.

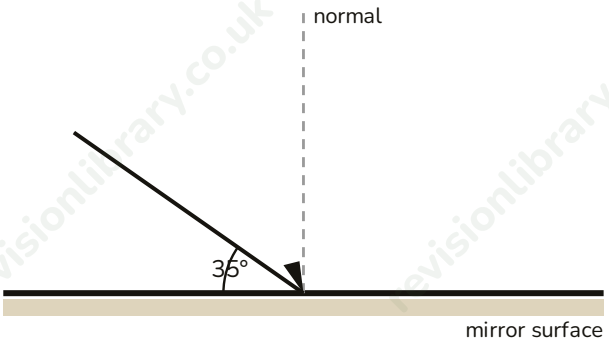
(a) Give one everyday use of microwaves. **(1)**

(b) Give one everyday use of infrared radiation. **(1)**

(c) Explain why people are advised to limit their exposure to ultraviolet radiation from the Sun. **(1)**

(Total for Question 6 is 3 marks)

7 A ray of light strikes a plane mirror.



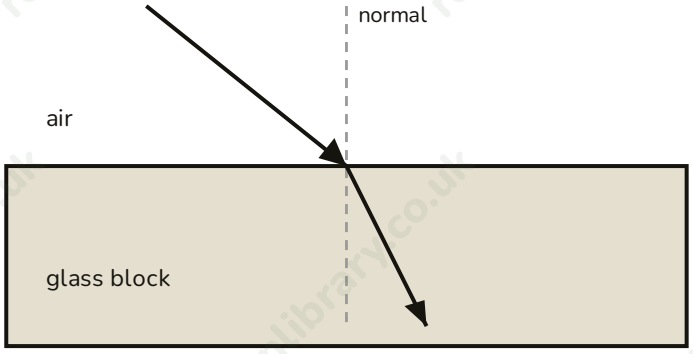
(a) State the law of reflection. **(1)**

(b) A ray of light hits the mirror surface at an angle of 35 degrees, measured from the mirror surface (not the normal). Calculate the angle of reflection, measured from the normal. **(2)**

(Total for Question 7 is 3 marks)

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8 A ray of light travels from air into a glass block, hitting the boundary at an angle (not along the normal).



(a) State what happens to the speed of the light wave as it passes from air into the glass block. **(1)**

(b) Explain, in terms of the wavefronts, why this change in speed causes the ray of light to bend towards the normal as it enters the glass block. **(3)**

(Total for Question 8 is 4 marks)

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Mark scheme · 3.6 Waves: 30-minute Pack

Question 1

(a) the maximum displacement of a point on the wave from its undisturbed (rest) position, oe **B1**

(a) Answer: The maximum displacement of a point on the wave from its undisturbed (rest) position.

(b) the distance from a point on one wave to the equivalent point on the next wave (e.g. crest to crest), oe **B1**

(b) Answer: The distance from a point on one wave to the equivalent point on the adjacent wave, for example from one crest to the next crest.

(c) the number of waves passing a point (or produced by a source) each second, oe **B1**

(c) Answer: The number of waves passing a point, or produced by a source, each second.

Question 2

(a) wave speed = frequency x wavelength **B1**

(a) Answer: wave speed = frequency x wavelength

(b) substitution: v = 5 x 0.4 **M1**

(b) v = 2 m/s, cao, with unit **A1**

(b) Answer: v = 2 m/s

Question 3

radio waves placed before microwaves **B1**

microwaves placed before visible light **B1**

visible light placed before ultraviolet **B1**

ultraviolet placed before γ rays **B1**

Answer: radio waves, microwaves, visible light, ultraviolet, γ rays (lowest to highest frequency)

Question 4

(a) the angle of incidence is equal to the angle of reflection, oe **B1**

(a) Answer: The angle of incidence is equal to the angle of reflection.

(b) specular reflection happens at a smooth surface, and all the reflected rays travel in the same (one) direction, oe **B1**

(b) diffuse reflection happens at a rough surface, and the reflected rays are scattered in many different directions, oe **B1**

(b) Answer: Specular reflection happens at a smooth surface, where all the reflected rays travel in the same direction. Diffuse reflection happens at a rough surface, where the reflected rays are scattered in many different directions.

Question 5

(a) radio, microwave, infrared, visible light, ultraviolet, X-ray, γ cao **B1**

(a) Answer: Radio, microwave, infrared, visible light, ultraviolet, X-ray, γ.

(b) all types of electromagnetic wave travel at the same speed in a vacuum, oe **B1**

(b) Answer: All seven types travel at the same speed as each other in a vacuum.

Question 6

(a) e.g. cooking food, or satellite communication, oe **B1**

(a) Answer: For example, cooking food (or satellite communication).

(b) e.g. cooking (grilling/toasting), thermal imaging cameras, or remote controls, oe **B1**

(b) Answer: For example, cooking (grilling), thermal imaging cameras, or television remote controls.

(c) UV radiation can damage skin cells/DNA, which increases the risk of skin cancer (and can cause premature skin ageing), oe **B1**

(c) Answer: UV radiation can damage skin cells and DNA, which increases the risk of skin cancer.

Question 7

(a) the angle of incidence equals the angle of reflection (both measured from the normal), oe **B1**

(a) Answer: The angle of incidence equals the angle of reflection.

(b) angle of incidence (from the normal) = 90 - 35 = 55 (degrees) **M1**

(b) angle of reflection = 55 degrees, cao, since angle of reflection = angle of incidence **A1**

(b) Answer: 55 degrees

Question 8

(a) the speed of the light wave decreases, since glass is a denser (optically denser) medium than air **B1**

(a) Answer: The speed decreases.

(b) one side of the wavefront reaches the boundary and slows down before the rest of the wavefront, which is still travelling faster in the air **B1**

(b) this causes the wavefront (and therefore the direction of travel of the wave) to change direction/pivot at the boundary **B1**

(b) the ray bends towards the normal because it is entering a denser medium in which the wave travels more slowly **B1**

(b) Answer: The part of the wavefront reaching the glass first slows down while the rest keeps moving faster in air, turning the wavefront and bending the ray towards the normal.

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