

FORM 4

CHAPTER 5

Paper 1

- 1 D 2 A 3 B 4 C 5 A
6 D 7 A 8 B 9 C 10 D

Paper 2

Structured Question

- 1 (a) The time it takes for one wave to travel one wavelength
(b) (i) 10 cm
(ii) Period, $T = 0.4$ seconds

$$\begin{aligned} \text{Frequency, } f &= \frac{1}{T} \\ &= \frac{1}{0.4} \\ &= 2.5 \text{ Hz} \end{aligned}$$

- (iii) 4 cm
(iv) $v = f\lambda$
 $= 2.5 \times 4$
 $= 10 \text{ cm s}^{-1}$
- 2 (a) Wave interference
(b) (i) Light waves experience constructive interference

$$\begin{aligned} \text{(ii) } \lambda &= \frac{ax}{D} \\ x &= \frac{D\lambda}{a} \\ &= \frac{3 \times 7 \times 10^{-7}}{2.0 \times 10^{-2}} \\ &= 1.05 \times 10^{-4} \text{ m} \end{aligned}$$

- (iii) The distance between two consecutive dark fringes increases.

$$\lambda = \frac{ax}{D} \Rightarrow x = \frac{D\lambda}{a}$$

$$x \propto D$$

As D increases, x increases

- 3 (a) Microwave
(b) Detect counterfeit banknotes
(c) (i) $0.5 \text{ nm} = 0.5 \times (1 \times 10^{-9}) = 5 \times 10^{-10} \text{ m}$

$$\begin{aligned} \text{(ii) } f &= \frac{c}{\lambda} \\ &= \frac{3.0 \times 10^8}{5 \times 10^{-10}} \\ &= 6 \times 10^{17} \text{ Hz} \end{aligned}$$

- (d) Transverse waves

Essay Questions

- 4 (a) (i) Ultrasonic waves are sound waves with a frequency above 20 kHz.
(ii) An ultrasonic wave transmitter produces ultrasonic waves that are directed towards the seabed. Ultrasonic waves are reflected from the seabed and detected by ultrasonic wave receivers. The time taken for the transmission and reception of the wave is used to estimate the depth of the seabed based on the formula:

$$\text{Depth} = \text{Ultrasonic wave speed} \times \frac{\text{Time the wave travelled}}{2}$$

$$\begin{aligned} \text{(b) (i) Depth} &= 1580 \times \frac{220 \times 10^{-3}}{2} \\ &= 173.8 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{(ii) } v &= f\lambda \\ \lambda &= \frac{v}{f} \\ &= \frac{1580}{60 \times 10^3} \\ &= 0.026 \text{ m} \end{aligned}$$

- (c) Loudspeaker position. So that the sound waves produced are not blocked by other objects. The echo will also be reduced.

The distance between the two speakers is large. From the formula

$$x = \frac{D\lambda}{a}, \text{ when } a \text{ is large, the value of } x, \text{ which is the distance}$$

between two consecutive strong or weak sound areas, will decrease.

The microphone is placed behind the speaker. Sound waves will not enter the microphone directly and cause noise interference. Soft boards are used to absorb sound waves. Thus, echoes can be avoided. Sound system B is most suitable because the speaker position is high, the distance between the two speakers is large, soft boards are used and the microphone is placed behind the speakers.