

Worksheet - Wave Formula

1. This question is about waves on a pond.
- a. The grass on the pond edge starts moving when the wave hits it - what does this tell you about waves and energy?

Waves carry energy

- b. A rubber duck on the pond bobs up and down as the wave passes, but stays in the same place on the pond - what does this tell you about waves and particles?

Waves transfer energy without net transfer of matter

- c. If the tops of waves are 5cm apart what is the wavelength

5cm

- d. If 14 waves pass in one second what is the frequency

~~14 Hz~~ 14 Hz

- e. If 8 waves pass in two seconds what is the frequency

$$\frac{8}{2} = 4 \text{ Hz}$$

2. What is the speed of these water waves?

- a. Wavelength 5cm, frequency 2Hz

$$0.05 \times 2 = 0.1 \text{ m/s}$$

$$\lambda = \frac{v}{f} \quad v = \lambda f$$

- b. Wavelength 10cm, frequency 4Hz

$$0.1 \times 4 = 0.4 \text{ m/s}$$

3. This question is about radio waves. Radio waves are electromagnetic waves.

- a. What is the speed of a radio wave which has wavelength 1000m and frequency 300kHz?

$$1000 \times 3 \times 10^5 = 3 \times 10^8 \text{ m/s}$$

- b. What is the speed of all electromagnetic waves?

$$3 \times 10^8 \text{ m/s}$$

- c. A radio wave has wavelength 1m - what must its frequency be?

$$f = \frac{v}{\lambda} = \frac{3 \times 10^8}{1} \text{ Hz}$$

- d. Radio waves of frequency 103 million Hz are transmitted by 'Key 103' in Manchester. What is their wavelength?

$$103 \times 10^6 \quad \frac{3 \times 10^8}{103 \times 10^6} = \frac{300 \times 10^6}{103 \times 10^6} \approx 3 \text{ m}$$

$$\lambda = \frac{v}{f}$$

$$\text{So } 6 \times 10^{-7} = \frac{3 \times 10^8}{4.5 \times 10^{14}}$$