

## Waves Equations Worksheet

Level: GCSE / A-Level | Difficulty: Intermediate | Topic: Waves & Optics

Practice the wave equations with 10 problems covering wave speed, frequency, period, and wavelength. Includes full worked answers.

### Equations you will need

|                |                                     |
|----------------|-------------------------------------|
| $v = f\lambda$ | Wave speed = frequency x wavelength |
| $T = 1/f$      | Period = 1 / frequency              |
| $f = 1/T$      | Frequency = 1 / period              |

### Symbol key

| Symbol    | Quantity   | Unit       |
|-----------|------------|------------|
| $v$       | wave speed | m/s        |
| $f$       | frequency  | Hz (hertz) |
| $\lambda$ | wavelength | m          |
| $T$       | period     | s          |

### Practice problems

1. A wave has frequency 50 Hz and wavelength 4 m. Find its speed.
2. A sound wave travels at 340 m/s with wavelength 2 m. Find the frequency.
3. Find the period of a 25 Hz wave.
4. A water wave has a period of 0.5 s and wavelength 1.2 m. Find its speed.
5. Radio waves travel at  $3 \times 10^8$  m/s. Find the wavelength of a 100 MHz station.
6. A wave on a string completes 60 oscillations in 4 s. Find the frequency and period.
7. A wave has speed 300 m/s and period 0.01 s. Find the wavelength.
8. Visible red light has wavelength 700 nm. Find its frequency. ( $c = 3 \times 10^8$  m/s)

9. A wave has frequency 200 Hz and travels 50 m in 0.25 s. Find the wavelength.
10. Two waves: A has period 0.02 s, B has period 0.05 s. Which has higher frequency?

## Answer key

Full worked solutions for each problem.

1.  $v = f\lambda = 50 \times 4 = 200 \text{ m/s}$
2.  $f = v/\lambda = 340/2 = 170 \text{ Hz}$
3.  $T = 1/f = 1/25 = 0.04 \text{ s}$
4.  $f = 1/0.5 = 2 \text{ Hz}$ ;  $v = 2 \times 1.2 = 2.4 \text{ m/s}$
5.  $\lambda = v/f = (3 \times 10^8)/(108) = 3 \text{ m}$
6.  $f = 15 \text{ Hz}$ ;  $T = 0.0667 \text{ s}$
7.  $f = 100 \text{ Hz}$ ;  $\lambda = 300/100 = 3 \text{ m}$
8.  $f = c/\lambda = 3 \times 10^8 / 7 \times 10^{-7} = 4.29 \times 10^{14} \text{ Hz}$
9.  $v = 50/0.25 = 200 \text{ m/s}$ ;  $\lambda = 200/200 = 1 \text{ m}$
10.  $f_A = 50 \text{ Hz}$ ;  $f_B = 20 \text{ Hz}$ ; A has higher frequency