



GCSE WAVE CALCULATIONS



$$\text{velocity} = \text{frequency} \times \text{wavelength}$$

1. Write down the equation using symbols rather than words.
2. Write down the equation describing the relationship between the frequency and the time period of a wave.
3. Calculate the velocity of:
 - a. A wave with a wavelength of 12 m and a frequency of 3.0 Hz
 - b. A wave with a wavelength of 0.10 m and a frequency of 120 Hz
 - c. A wave with a wavelength of 1.0×10^{-6} m and a frequency of 3.0×10^{14} Hz
 - d. Explain what type of wave travels at the same velocity as the wave in part c.
4. i) Rearrange the wave speed equation to make λ the subject, then ii) rearrange to make f the subject.
 - i)
 - ii)
5. Fill in the table with the missing values.

Velocity (m/s)	Wavelength (m)	Frequency (Hz)	Space for calculations
	5.0	66	
	1.0×10^7	30	
3.0×10^8		4.7×10^{12}	
330		2.2×10^4	
3.0×10^8	1.2×10^{-6}		
14.2	499		





6. Batman is developing some sonar technology for his echolocation goggles. He stands in a cave holding a speaker and a timer 99.0 m away from the far end of the cave. Batman remembers that sound travels at about 330 m/s in air.
- a. Calculate the time the sound waves take to travel to the far end and back

The sound wave completes 1,200 wave cycles in the time it takes to travel to the far end and back.

- b. Calculate the time period of one wave cycle
- c. Hence, calculate the frequency of the sound wave
- d. Hence, calculate the wavelength of the sound wave to 2 sf
7. The Joker is developing some high-powered torches for his fight against Batman. He reads that the torch has a frequency of 5.30×10^{14} Hz and a wavelength of 5.66×10^{-7} m.
- a. Show that the speed of light is about 3.00×10^8 m/s



The Joker claims that if he increases the frequency, then he could make the light travel faster.

- b. Explain whether the Joker is correct or not

The Joker wants to produce light in the infrared zone at a wavelength, $\lambda = 950$ nm.

- c. Calculate the frequency of this infrared light ($1 \text{ nm} = 1 \times 10^{-9} \text{ m}$)

The Joker increases the frequency by 1.2%.

- d. Calculate the new i) frequency and ii) wavelength of the light
- i.
- ii.

