

Electromagnetic (EM) Spectrum wave calculations.

[Total mark = 15]

Prefixes for very large numbers				
k	kilo	One thousand	1 000	1×10^3
M	Mega	One million	1 000 000	1×10^6
G	Giga	One billion	1 000 000 000	1×10^9

Prefixes for very small numbers				
m	milli	One thousandth	$1/1000^{\text{th}}$	1×10^{-3}
μ	Micro	One millionth	$1/1\,000\,000^{\text{th}}$	1×10^{-6}
η	Nano	One billionth	$1/1\,000\,000\,000^{\text{th}}$	1×10^{-9}

Worked example calculation.

Calculate the wavelength of a radio station broadcasting radio waves with a frequency of 1000 kHz.

$c = 3 \times 10^8 \text{ m/s}$	$\lambda = c / f = 3 \times 10^8 \div 1 \times 10^6$
$f = 1000 \text{ kHz} = 1000\,000 \text{ Hz}$	$\lambda = 300 \text{ m}$
$\lambda = ?$	

Calculations.

- 1) Nova FM Radio station transmits radio waves at 100 MHz. (3 marks)
What is the wavelength of these waves?
- 2) Red light is part of the visible spectrum and has a wavelength of around 700 nm. (3 marks)
Calculate the frequency of red light.
- 3) X-rays used for medical diagnosis can have a very high frequency of 4 GHz. (3 marks)
Calculate the wavelength of these X-rays.
- 4) Visible light can have a range of frequencies and wavelengths (ROY.G.BIV). (3 marks)
Describe how the frequency and wavelength of Blue light compares to that of Red light.
- 5) Microwaves also have a range of frequencies and wavelengths. Find out the value of the wavelength of the microwaves used in a microwave oven to cook food. Now calculate their frequency. (3 marks)

Research questions.

- 6) Investigate the full range of wavelengths and frequencies that are associated with the EM spectrum.
- 7) For the full EM spectrum research and:
 - a) explain some of the uses
 - b) understand some of the detrimental effects they may cause to humans