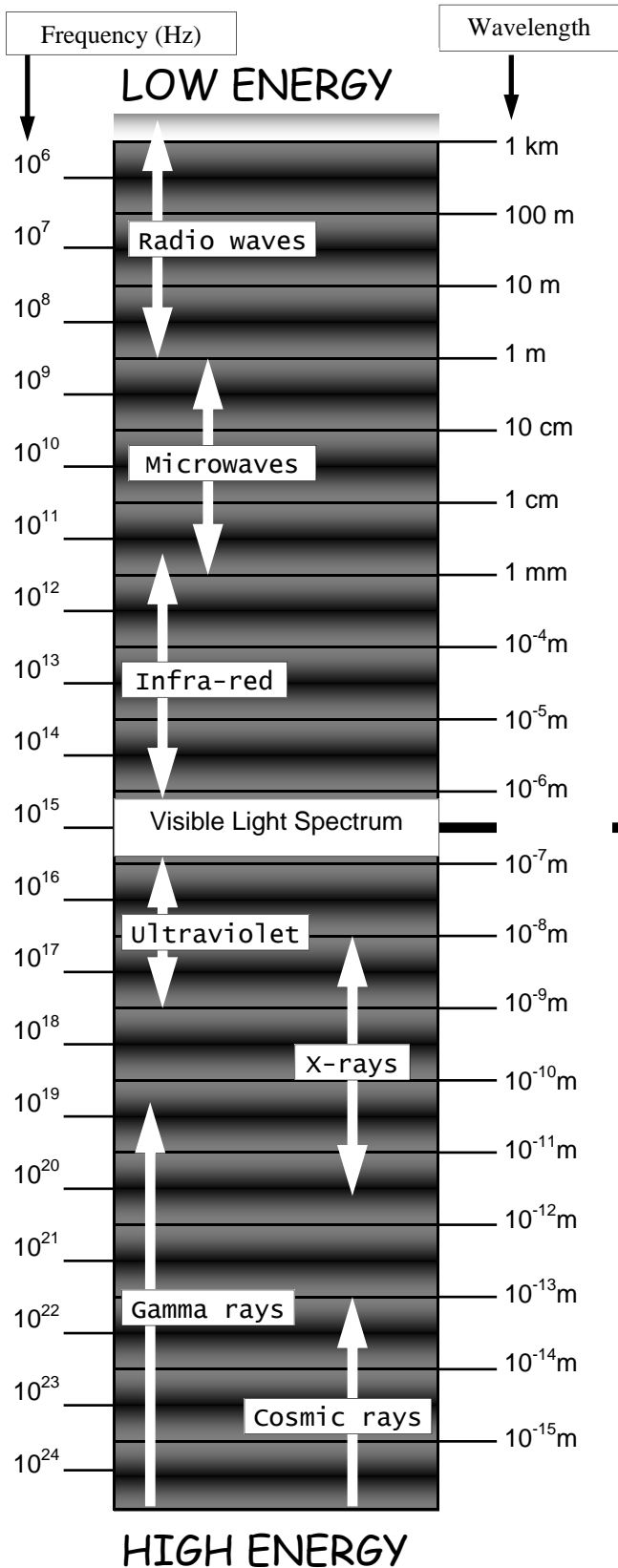




THE ELECTROMAGNETIC SPECTRUM

Domain: 5.6
 applies basic physical models, theories and laws to situations involving energy, force and motion

The Spectrum



Electromagnetic radiation consists of **magnetic** and **electrical vibrations**. It travels as a **transverse wave** and exhibits the following important properties:

- travels through a **vacuum**;
- travels at **300 000 000 metres per second** in a vacuum;
- travels at different speeds in other **mediums**.

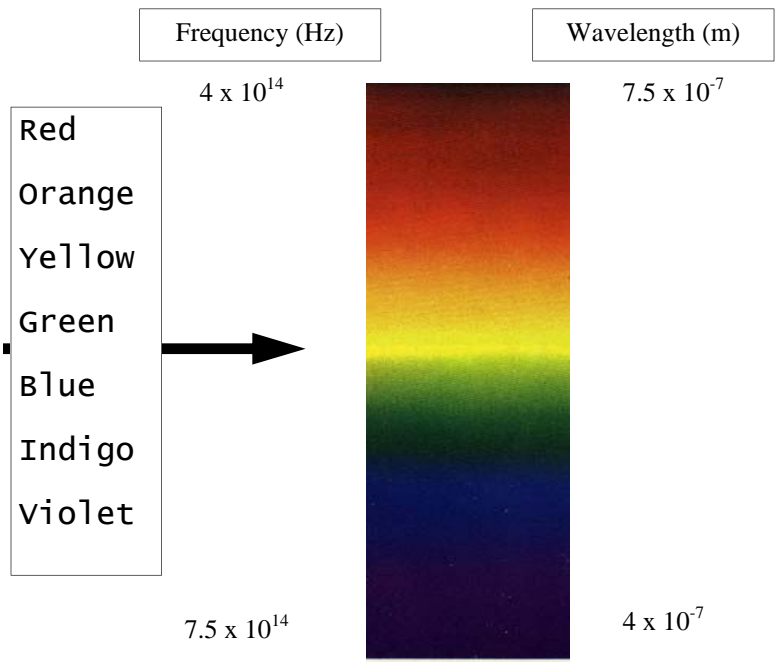
The electromagnetic spectrum is made up of waves which have varying wavelength and thus, varying frequency.

The waves with long wavelength have low frequency and are known as low energy waves.

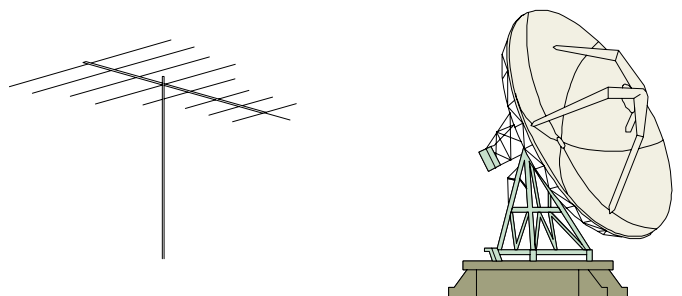
The waves with short wavelength have high frequency and are known as high energy waves.

Remember the equation:

$V = f\lambda$ if **v** is constant, **f** will increase as **λ** decreases and vice versa.



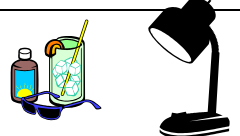


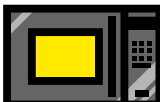



Each wavelength carries a different amount of energy. Light is part of the EM spectrum as shown in the chart.





Using Electromagnetic Waves

Wave Type	Uses	Sources	
Gamma Rays	Photographs of stress fractures and cracks in metals structures. Radiation treatment of cancer cells.	Radioactive materials.	
X-Rays	X-Ray photographs of the internal parts of the human body, e.g. bones.	X-ray tubes.	
Ultraviolet Rays	"Black light" signature detectors. Suntan lamps.	Extremely hot objects and glowing gases.	
Visible Light	Lighting.	Very hot objects.	
Infra-red Rays	Electric heaters. Heat lamps. Remote control devices for electrical appliances such as televisions.	Warm objects.	
Microwaves	Cooking food. Satellite communication. Radar for locating position. Police radar units for measuring speed.	Electronic circuits (in which electrons are vibrated) and transmitters.	
Radio waves	<i>See table below</i>		



UHF	↑ TELEVISION ↓	FM RADIO	Transmitter (88-108 MHz)
VHF			
HF	↑ AM RADIO ↓		Transmitter (540-1600 kHz)
MF			
LF			
VLF			

Questions:

- (a) What does electromagnetic radiation consist of? (b) What type of wave does it travel as?
(c) Electromagnetic waves travel at the same velocity of _____ m/s.
- (a) How does the wavelength of a wave relate to its energy?
(b) How does the frequency of a wave relate to its energy?
- List the following types of electromagnetic radiation from highest energy to lowest energy:
infra-red, X-rays, radio waves, cosmic rays, microwaves, ultraviolet, visible light.
- What is the range of wavelength for visible light?
- What type of electromagnetic energy is used to/for:
(a) remote controls?; (b) FM radio?; (c) lighting?; (d) photographs of internal organs and bones?;
(e) suntan lamps; (f) satellite communication?; (g) photographs of stress fractures in metal structures?