

PHYSICS
AUDIOFREQUENCIES
FORM 5

The human ear can detect sound with the following frequencies: 20Hz – 20000Hz (20Hz – 20kHz). Frequencies below or above this range are not detected. All waves undergo reflection, refraction, diffraction and interference.

Electromagnetic Waves

These are waves with the following properties:

1. Identical speed in a vacuum $3.0 \times 10^8 \text{m/s}$
2. They are transverse waves.
3. They can travel in a vacuum.
4. They transmit energy from a source.
5. They obey the laws of reflection and refraction.
6. Can undergo diffraction.
7. Can undergo interference.
8. Can be emitted and absorbed by matter.
9. Carries no charge.

The Electromagnet Spectrum

Name	Wavelength	Source	Special Properties
Gamma Rays	10^{-12}m	Cosmic rays, radioactive nuclei	Very dangerous. Used to kill cells,, eg. Sterilisation
X-Rays	10^{-10}m	X-Ray tube	Used to detect bone fractures, used to treat skin disorders and the study of the structure of crystals
UV Light	10^{-8}m	Very hot objects, sparks, mercury vapour, lamps	Is absorbed by glass, causes chemical reactions, treatment of skin diseases, skin cancer and damage to the retina
Visible Light	$0.6 \times 10^{-6} \text{m}$	Sun lasers	Detected by the retina to allow vision. Used for photosynthesis
Infrared Rays	10^{-4}m	Any hot object, sun or fire	Causes heating when absorbed.
Radiowaves	3m	TV and Radio transmitters/microwave ovens	Communication, radar detection, microwaves for cooking.

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Light Waves

Visible light forms part of the electromagnetic spectrum and therefore has all the properties of the electromagnetic spectrum.

Nature of Light

There are two proposed theories as to the nature of light, combined they are called the Dual Nature of Light.

Two Theories are as follows:

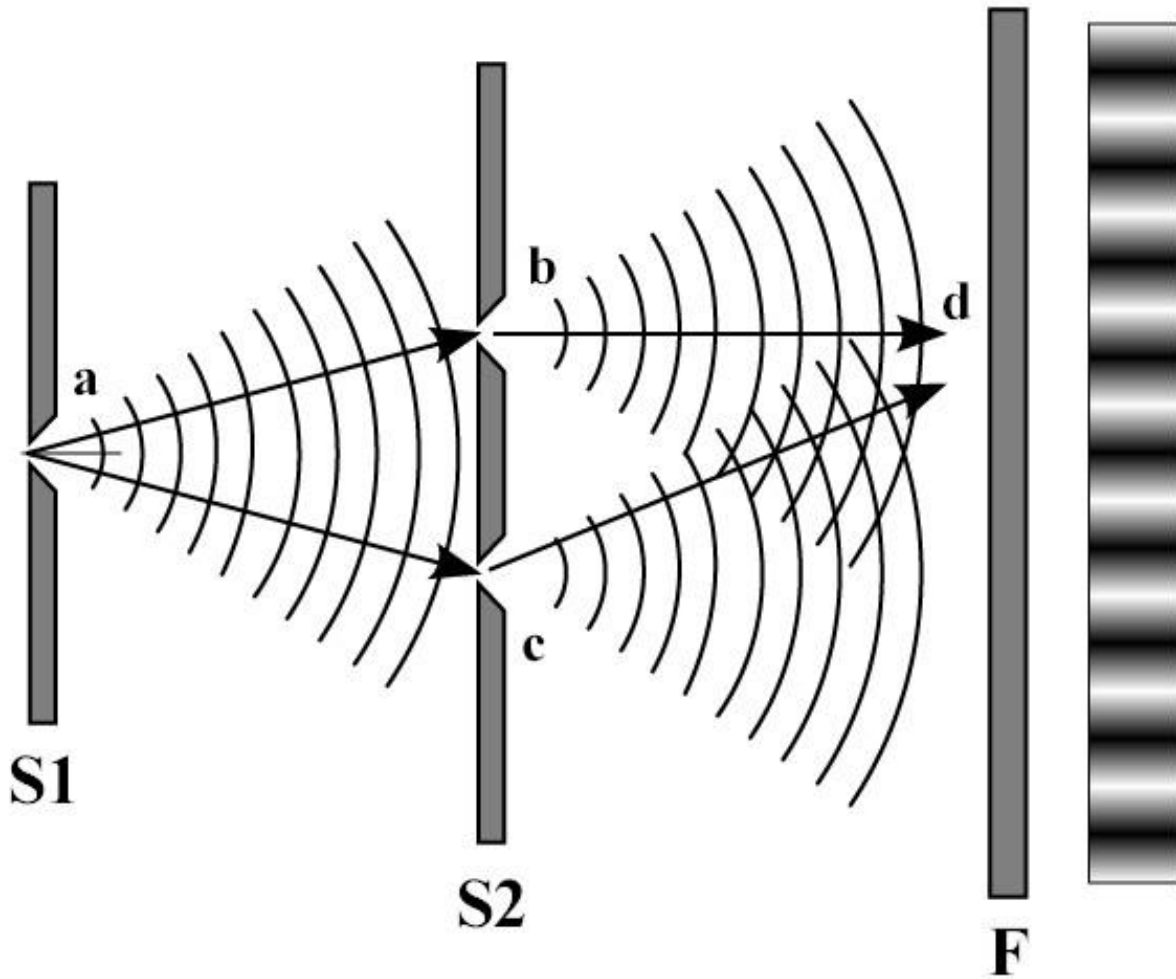
1. Corpuscular Theory – This was proposed by Newton which suggested that light travels as small particles called corpuscles.

Evidence for this theory was based on the fact that these tiny particles would obey Newton's Laws of motion, hence the reason light waves reflect and refract. This theory cannot explain how light waves diffract or undergo interference.

2. Wave Theory – Evidence of wave theory was demonstrated by Thomas Young. In this theory, light is considered to be an electromagnetic wave. Being a wave it explains how light can undergo reflection, refraction, diffraction and interference.

Albert Einstein proposed that both theories had merit. He suggested that the particles were tiny packets of energy and were called photons. The photons contained a certain quantum of energy. The photons were so tiny that they possess wave properties. This has led to a branch of Physics called Quantum Physics.

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The alternating dark and light lines indicate that light waves undergo diffraction and interference and therefore light must exist as a wave form.