



What is light?

Light is part of the electromagnetic spectrum. The spectrum is the collection of all waves and includes visible light, microwaves, radio waves, X-rays, and gamma rays.

In the late 1600s, important questions were raised, asking whether light is made up of particles or waves.

Sir Isaac Newton held the theory that light was made up of tiny particles. In 1678, the Dutch physicist Christiaan Huygens proposed that light was made up of waves that vibrated up and down perpendicular to the direction of travel of the light, and therefore formulated a way of visualising wave propagation. This became known as Huygens' Principle. Huygens' theory was the first successful theory of light wave motion in three dimensions. Huygens suggested that the peaks of light waves form surfaces like the layers of an onion. In a vacuum, or other uniform medium, the light waves are spherical, and these wave surfaces advance or spread out as they travel at the speed of light. This theory explains why light shining through

a pin hole or slit will spread out rather than going in a straight line.

Newton's theory came first, but Huygens' theory better described early experiments. Huygens' principle enables one to predict where a given wavefront will be in the future, if you have the knowledge of where the given wave front is at the present time.

At that time, some of the experiments conducted on light theory for both the wave theory and particle theory, had some unexplained phenomenon. Newton could not explain the phenomenon of light interference and this favour the wave theory over Newton's particle theory. This difficulty was due to the unexplained phenomenon of light polarisation: scientists were familiar with the idea that wave motion was parallel to the direction of travel of a wave, NOT perpendicular to the direction of travel, as is the case for light.

(Taken from <http://www.nightlase.com.au/education/optics/light.htm>)

EXERCISES

1 True or false?

- a. The electromagnetic spectrum does not include microwaves. T F
- b. According to Newton's theory, light is made of waves. T F
- c. Christiaan Huygens was born in Germany. T F
- d. Using Huygens' principle the position of a given wavefront can be predicted. T F

2 Complete.

Light theory started to be in the late 1600s. and Huygens elaborated the important light According to the first, is made of tiny, according to the second it is composed of Huygens theory some questions that Newton's couldn't According to this second theory, the light waves are mediums, and these wave surfaces at the of light. This theory explained why light through a pinhole out rather than proceeding in a straight

resolve • Newton • explained • shining • most • light • formulated • waves • line • theories • advance • particles • speed • spherical • uniform • spreads

3 Match questions and answers.

QUESTIONS		ANSWERS	
A	What is the main difference between Newton's and Huygens' theories?	1	It is a way of visualising wave propagation based on the hypothesis that light is made up of waves vibrating up and down perpendicular to the direction of travel of the light.
B	What is Huygens' principle?	2	According to Newton light was made up of tiny particles, whilst Huygens believed that light was made up of waves.
C	According to Huygens how can we describe light motion?	3	Light waves are spherical and vibrate up and down perpendicular to the direction of motion. In a uniform medium they travel at the speed of light.
A		B	
		C	