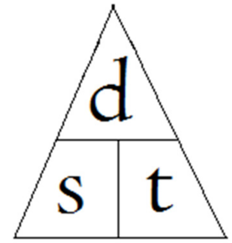
Speed of Light Name____

The speed of any object is a ratio of the distance over the time: $s = \frac{d}{t}$



1. Jamal drove his ’64 Impala to Cowtown speedway, 125 miles away, in 2.5 hours. What was his average speed?

2. Thelma drove from Texas to Georgia in 20 hours. Her average speed was 70 miles per hour. What distance did Thelma drive?

3. Jacob skis down a hill that is 550 meters long. He is traveling at a rate of 10 meters per second. If he does not fall, how long does it take him to get to the bottom of the hill?

The speed or velocity of a light wave is similar to the speed of a car or snow skier. It travels at a rate of speed, it travels a distance and it takes an amount of time to travel.

The speed (or velocity) of light is a universal constant. The speed of light is represented by the letter *c*.

$$c = f \cdot \lambda$$

c = speed of light	λ = wavelength	*f* = frequency (waves/sec)
3.0×10^{8} m/s *or*	in meters (m)	$^{1}/_{sec}$ or sec^{-1}
3.0×10^{17} nm/s	or nanometers (nm)	Inverse second = Hertz (Hz)
(Match units to the λ)		

4. What is the wavelength of radiation (a name for electromagnetic wave) with frequency of 1.50×10^{-13} Hz?

5. What is the frequency of radiation if there is a wavelength of 5.00×10^{-8} m?

6. What frequency is radiation whose wavelength is 7.00×10^{-7} m?

7. Calculate the wavelength of the yellow light emitted by a sodium lamp if the frequency of the radiation is 5.10×10^{14} Hz (Hz = s^{-1}).

8. The wavelength of green light is about 522 nm. What is the frequency of this radiation?

9. What is the wavelength of a photon that has a frequency of 2.10×10^{14} Hz? Answer in nanometers.

Photon

A photon is a packet of light which is emitted when an excited electron drops back to a lower energy level. When light behaves like an individual particle instead of like a wave it is called a photon. We are interested in how much energy a photo has. The unit of energy for the photon is the Joule (J).

Planck recognized that energy is quantized and related to the energy of radiation (emitted or absorbed) to its frequency. Planck proposed the following relationship between the quantum of energy and the frequency of radiation.

$$E_{photon} = h \cdot f \qquad \text{or} \qquad E_{photon} = \frac{hc}{\lambda}$$

Where E_{photon} = energy (Joules), h = Planck's constant (6.626×10^{-34} J·s), *f* = frequency, and c = speed of light

10. Which of the following are **directly** related?
    a. Energy and wavelength.
    b. Wavelength and Frequency.
    c. Frequency and energy.

11. A classical radio station broadcasts and 93.5×10^{6} Hz = 93.5×10^{6} sec^{-1} (or hertz). Find the energy of one of these photons, in Joules.

12. What is the energy of a photon of light whose frequency is 7.85×10^{15} Hz?

13. If one photon of light is known to have energy of 3.33×10^{-19} J, what is the frequency?

14. What is the wavelength of light for the photon in the previous problem?