All About EM—Notes Outline Answers

The Electromagnetic Spectrum

The EM Spectrum is the whole range of EM waves in order of increasing frequency and decreasing wavelength. This means as you go from left to right on the chart, the wavelengths get smaller and the frequency gets larger. An inverse relationship exists between size of the wave and frequency. Remember: all EM waves travel at the same speed. The equation for speed is wavelength times the frequency. So, for the answer to always be 300,000km/s, as one number goes up, the other must go down. All EM waves are radiation. The higher the frequency, the more energy in the wave.

The Spectrum of Waves

1. Radio waves have the longest wavelength and lowest frequency; wavelength can go from 1000s of meters to .001 meters. (The shortest radio waves are the microwaves.) Radio waves are used for: RADAR, sending sound, pictures, cell phones, cooking food, and satellite transmissions.

2. Infrared waves-(heat) have shorter wavelengths, from .001 m to 700 nm, and higher frequency. Infrared is used for: finding people in the dark and in your TV remote.

3. Visible light is what we can see in the EM spectrum. Wavelengths of visible light go from about 700 nm (red light) to 400 nm (violet light); the frequencies are higher than infrared.

4. Ultraviolet wavelengths from about 400 nm to 10 nm; the frequency (and therefore the energy) is high enough with UV rays to penetrate living cells and cause damage. Too much UV can lead to sunburn and skin cancer. However, we need UV to produce Vitamin D in our bodies. UV rays are easily stopped. Although humans cannot see UV light, bees, butterflies, and some small birds and rodents can.

5. X-ray wavelengths are from 10 nm to .001 nm; they have enough energy to penetrate deep into tissues, but are stopped by dense materials. They are used for: looking at solid structures such as bones and bridges, and for cancer treatments.

6. Gamma rays have the shortest wavelengths (less than one trillionth of a meter), therefore the highest frequencies, therefore carry the most energy. These are the most damaging to tissues. They are hard to stop! You would need a 3-4 foot thick concrete wall to stop them.