

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.