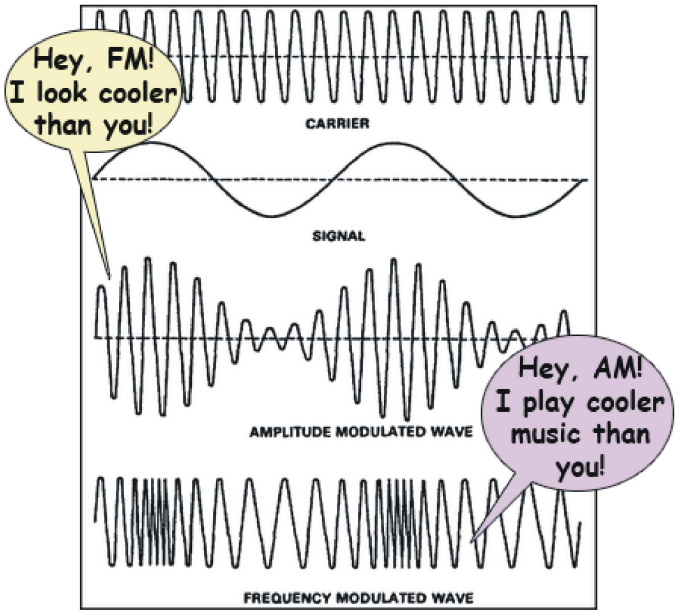
Electromagnetic Waves and Communication

Radio waves are used to send and receive information over long distances to radios, TVs, and telephones. They pass through walls and windows easily, and do not interact with humans, so they are not dangerous.

Radio. Each radio station or channel broadcasts an assigned frequency carrier wave. The carrier wave is modified or modulated through interference to carry information. In **amplitude modulation** (AM), the amplitude of the carrier wave is changed to carry information. An AM receiver tunes to the frequency of the carrier wave. The varying amplitude creates an electric current in the receiver antenna. A loudspeaker converts the current into sound. In **frequency modulation** (FM) the frequency of the carrier wave is changed to carry information. An FM receiver has components that convert varying frequencies into an electric current that the loudspeaker converts into sound.



Telephones. There are two main types of telephones: land-lines and remote phones. Land-lines produce an electrical signal through a microphone in the mouthpiece. The signal is transmitted in several possible ways. It may go through wires, be converted into radio waves or microwaves for transmission through the air, or converted to light for transmission through fiber-optic cables. The signal to land-lines, which is received through the phone lines, is converted back to electric current. A speaker in the earpiece converts the electric signal into sound. Remote phones include cordless phones, cell phones, and pagers. An antenna in the cordless phone broadcasts to a base station which transmits and receives like a land-line phone. The base station also broadcasts to the cordless phone. The base station cannot be more than 0.5 km away. Cell phones broadcast to and receive from a base station or cell tower that is several kilometers or more away. The cell tower has a large antenna and may communicate with other cell towers in the network. When a pager is dialed, a base station receives the signal. From there a signal is sent to the pager.

Communication satellites. Communication satellites are used for long distance communication. Radio waves travel in straight lines. The earth's surface is curved and radio waves can't curve around or pass through the earth. Radio signals can be sent to satellites which can transmit to other satellites or to ground stations. Some satellites are geosynchronous, meaning they move at the same rate as the earth spins so they remain above the same point on the ground. The Global Positioning System (GPS) consists of several satellites and ground based stations or portable units with receivers. The GPS receiver measures the time it takes for radio waves to travel from several satellites to the receiver. The receiver uses the information to calculate its latitude, longitude, and elevation.

Answer the questions below based on the reading above and on your knowledge of physics.

1. What is the function of the carrier wave of a radio station? _____

_____

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2. What are two reasons that radio waves are preferred for communication over other types of electromagnetic waves? _____

3. How is AM radio different from FM radio? _____

4. What property of waves makes it possible to modulate one wave with another? _____

5. What is the basic difference between land-line phones and remote phones? _____

6. What are the differences between a cordless phone and a cell phone? _____

7. When referring to cell phones, what is a base station? _____

8. What is the purpose of communication satellites? Why are they necessary? _____

9. What is GPS? How does it work? _____

10. Why do GPS satellites need to be geosynchronous? _____