The Electromagnetic Spectrum

The electromagnetic spectrum is comprised of various types of electromagnetic waves. Although they vary in frequency and wavelength, they share the same features:
- All transverse waves
- Can all travel through a vacuum
- All travel at a speed of 300,000 m/sec

<table>
<thead>
<tr>
<th>Wavelength/m</th>
<th>Frequency/Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10^{-12}$</td>
<td>$10^{20}$</td>
</tr>
<tr>
<td>$10^{-9}$</td>
<td>$10^{17}$</td>
</tr>
<tr>
<td>$10^{-6}$</td>
<td>$10^{14}$</td>
</tr>
<tr>
<td>$10^{-3}$</td>
<td>$10^{11}$</td>
</tr>
<tr>
<td>$1$</td>
<td>$10^{8}$</td>
</tr>
<tr>
<td>$10^{3}$</td>
<td>$10^{5}$</td>
</tr>
</tbody>
</table>

1. Label this diagram of the electromagnetic spectrum, using the keywords below.

   - Gamma Ray
   - Infrared
   - Microwaves
   - Ultraviolet
   - Radio Waves
   - Visible
   - X-Rays

2. Which wave type has the shortest wavelength?

3. Which wave type has the longest wavelength?

4. Which wave type has the lowest frequency?

5. Which wave type has the highest frequency?
Radio Waves

Radio waves have the lowest frequency of all electromagnetic waves. This means they also:

1. have the lowest ___________ and the longest ___________.

3. Label this diagram of a radio wave:

**Keywords:**
- Wavelength
- Amplitude
- Undisturbed position

**Diagrams to show the main differences between three types of radio waves:**

**Medium Frequency**
- Used in older military radios

**Very High Frequency (VHF) or Ultra High Frequency (UHF)**
- Used by commercial radio or TV bands

**Extremely Low Frequency (ELF)**
- Used by submarines
How do radio waves work?

Radio waves are produced through a **transmitter** in the form of **space waves**, which travel through the atmosphere. Another **receiver** (usually a radio or a television) is used as a **receiver**. The receiving aerial picks up the waves and converts them into an alternating current with the same **frequency** as the radio waves.

**alternating currents, aerial, receiver, transmitting, frequency**

Radio waves can experience **interference** caused by **obstructions** such as mountains. Other broadcasts, tuned to a similar **frequency** can also interfere.

**interference, frequency, obstructions**

Radio waves cannot be **heard** or **seen**, but when they reach a **space wave**, they are converted into **receiver**, **sound**, **pictures**, **seen**.
Microwaves

I. Describe the properties of microwaves using some of the prompt words listed below:

- Reflected
- Glass
- Plastic
- Atmosphere
- Ionosphere
- Absorbed
- Frequency
- Wavelength
- Heat
- Vibrate

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2. Looking at your descriptions of their properties, why do you think microwaves might be suitable for the uses shown in these photographs?

3. Complete the table below with as many applications of microwave-based technology as you can think of. Try to include some examples of military applications.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
</tbody>
</table>
Wireless technology

1 Explain what is wireless technology.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2 Think of as many examples of wireless technology in the home or at school as you can and write your answers below (if required, continue on a separate sheet of paper).
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

3 What do you think the advantages of wireless technology are in the following circumstances:

   a To a business person who travels a lot for work?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

   b To phone operators?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

   c To soldiers in a combat situation in a foreign country?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________