The background of the slide features a blue waveform, resembling a sine wave or a complex signal, plotted against a black grid. The waveform is centered vertically and horizontally, with its peaks and troughs clearly visible. The grid lines are thin and light blue, creating a subtle pattern across the entire slide.

Waves, Wavelength, Frequency and Bands

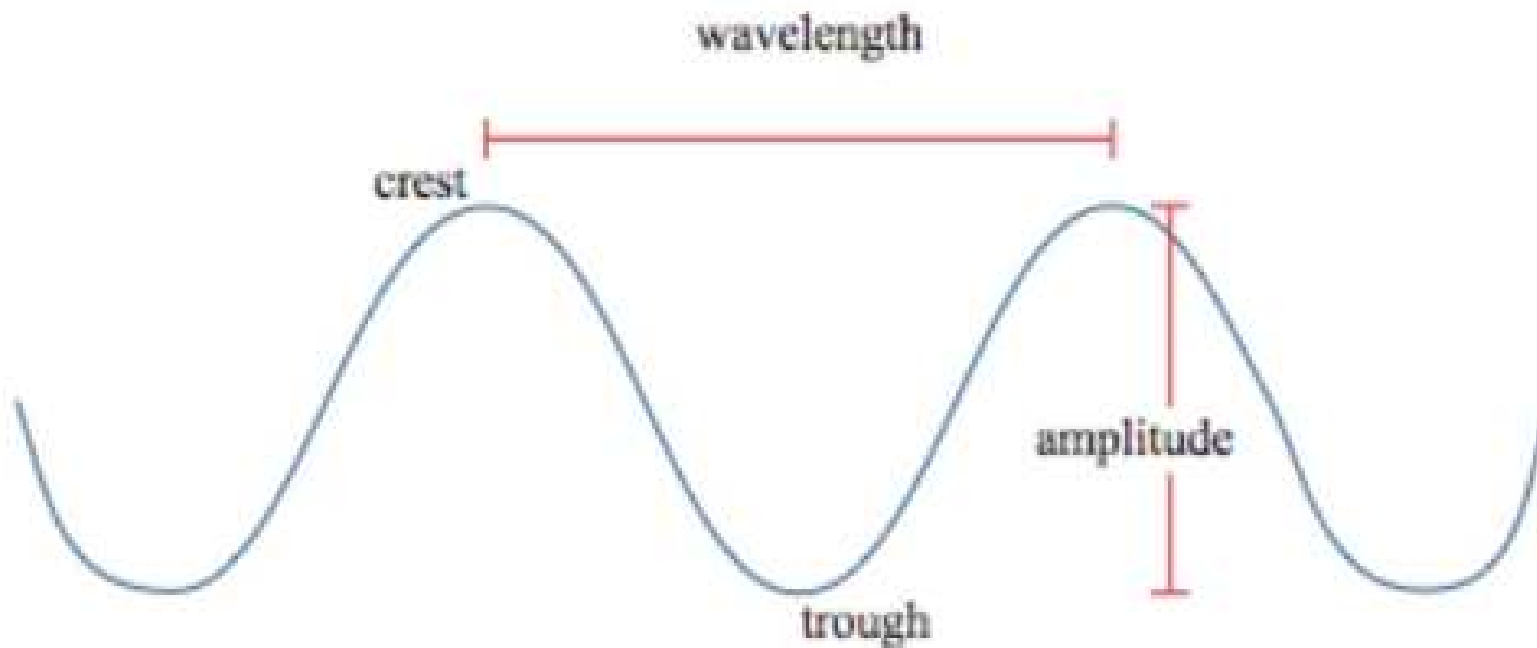
Al Penney
VO1NO

Objective

On completion, you should be able to:

- Define Frequency, Wavelength, Band;
- Perform simple calculations involving frequency and wavelength; and
- Be familiar with the bands that make up the Electromagnetic Spectrum.

Wave Motion Terminology



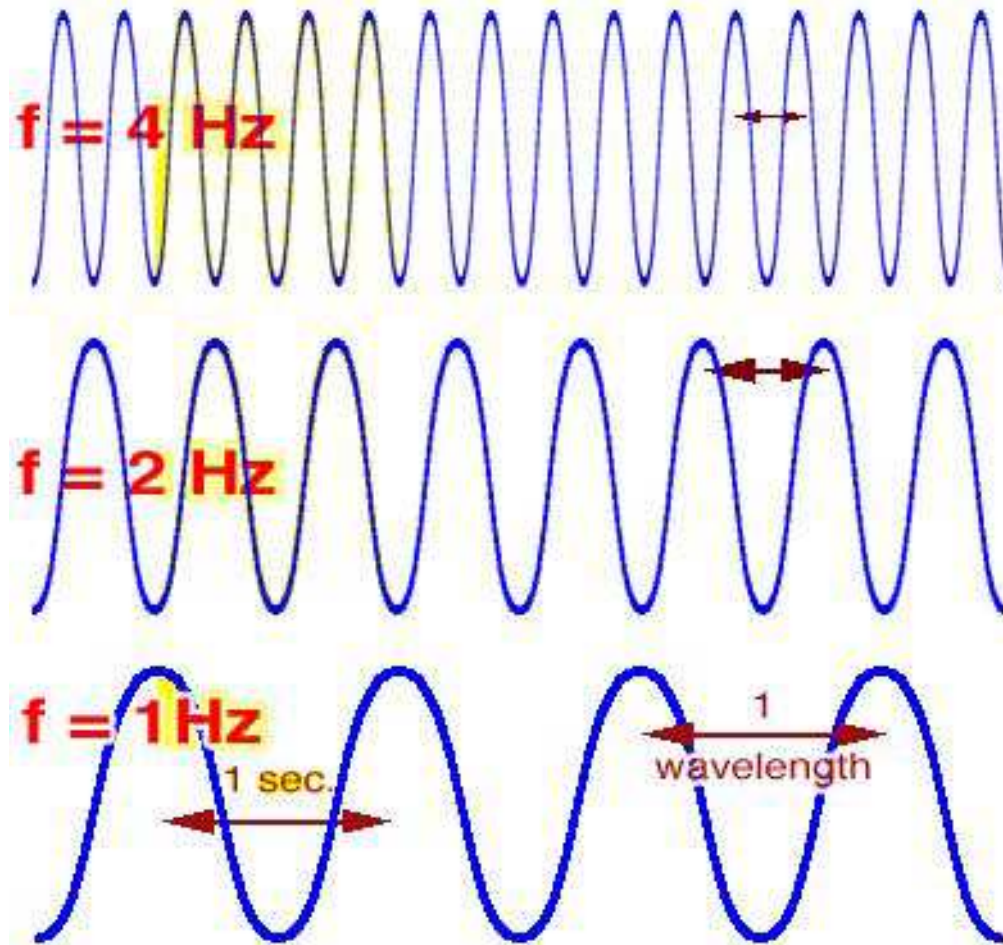
Frequency

- Defined as the number of **identical** parts of a wave that pass a given point in a fixed period of time.
- For Electromagnetic (EM) waves, we use the second as the period of time.

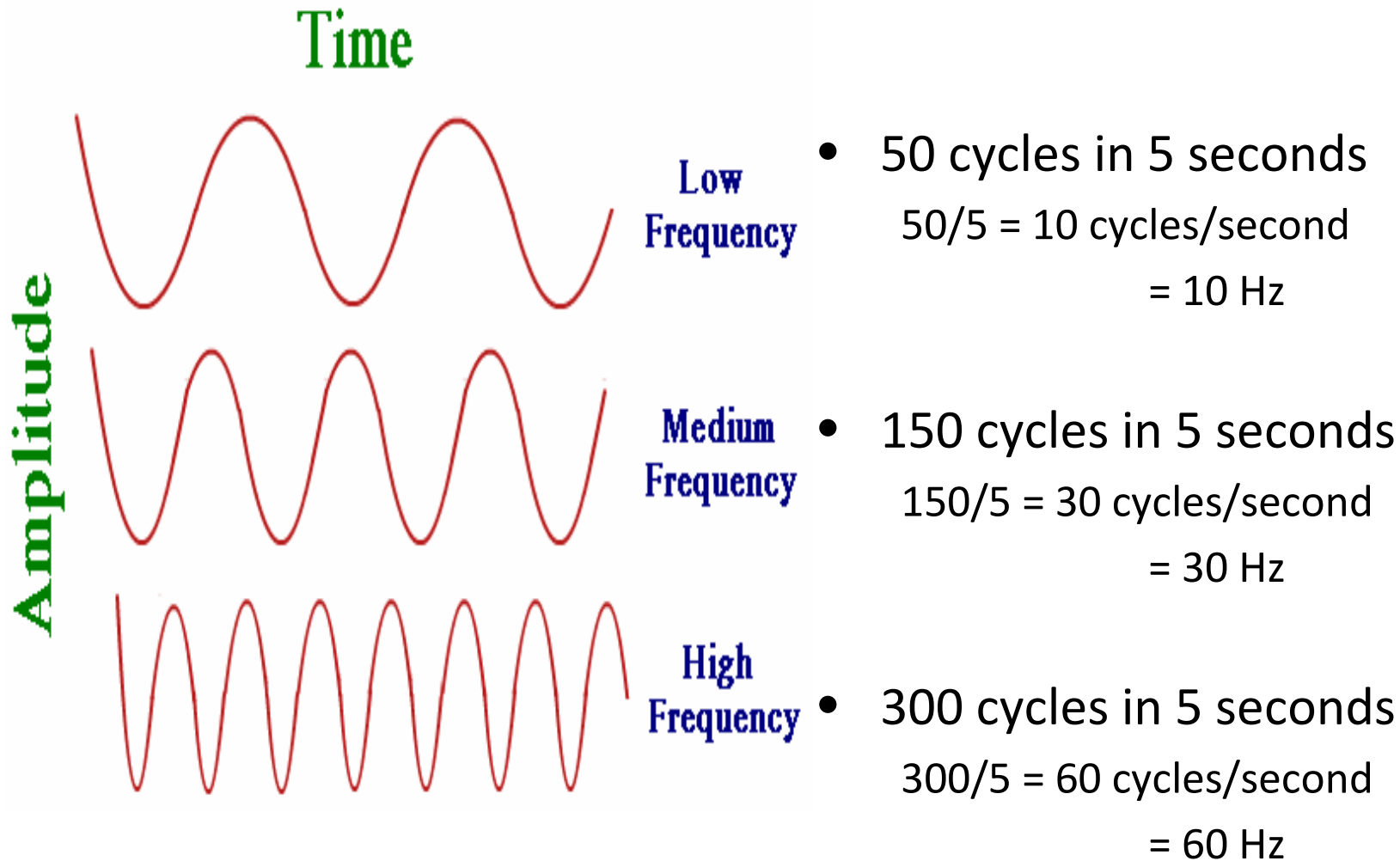
Frequency

- Unit of measurement is the **Hertz**.
- Abbreviation is Hz.
- One Hertz = **1 cycle per second**.
- Example: 500 waves pass a point in 2 seconds.
What is the frequency?
 - $500 \text{ cycles} / 2 \text{ seconds} = 250 \text{ Hz}$

Frequency



Frequency



Frequency Units

- The Hertz is too small for radio purposes.
- We use **Kilohertz, Megahertz and Gigahertz** as applicable:
 - 1 Kilohertz (KHz) = 1,000 Hz
 - 1 Megahertz (MHz) = 1,000,000 Hz = 1,000 KHz
 - 1 Gigahertz (GHz) = 1,000 MHz
- Example:
 - 3,750,000 Hz
 - = 3,750 KHz
 - = 3.750 MHz

Frequency Conversions

- To change Kilohertz (KHz) to Megahertz (MHz), **divide by 1000**:

$$3755 \text{ KHz} = 3755/1000 \text{ MHz} = 3.755 \text{ MHz}$$

- To change Megahertz (MHz) to Kilohertz (KHz), **multiply by 1000**:

$$14.295 \text{ MHz} = 14.295 \times 1000 \text{ KHz} = 14,295 \text{ KHz}$$

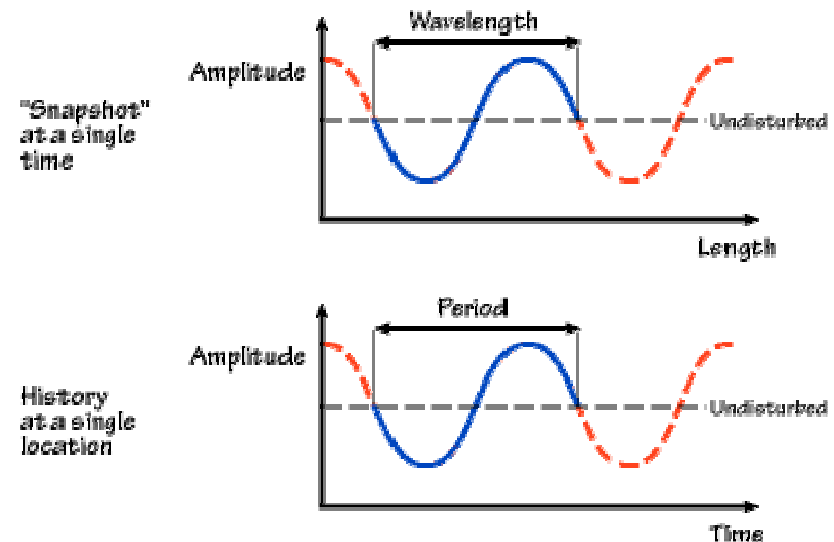
Period

- The period of a wave is the time it takes to complete one full cycle.
- It is measured in seconds.
- Abbreviated T
- $T = 1/f$
- Example: $f = 100 \text{ Hz}$

$$T = 1/f$$

$$T = 1/100 \text{ Hz}$$

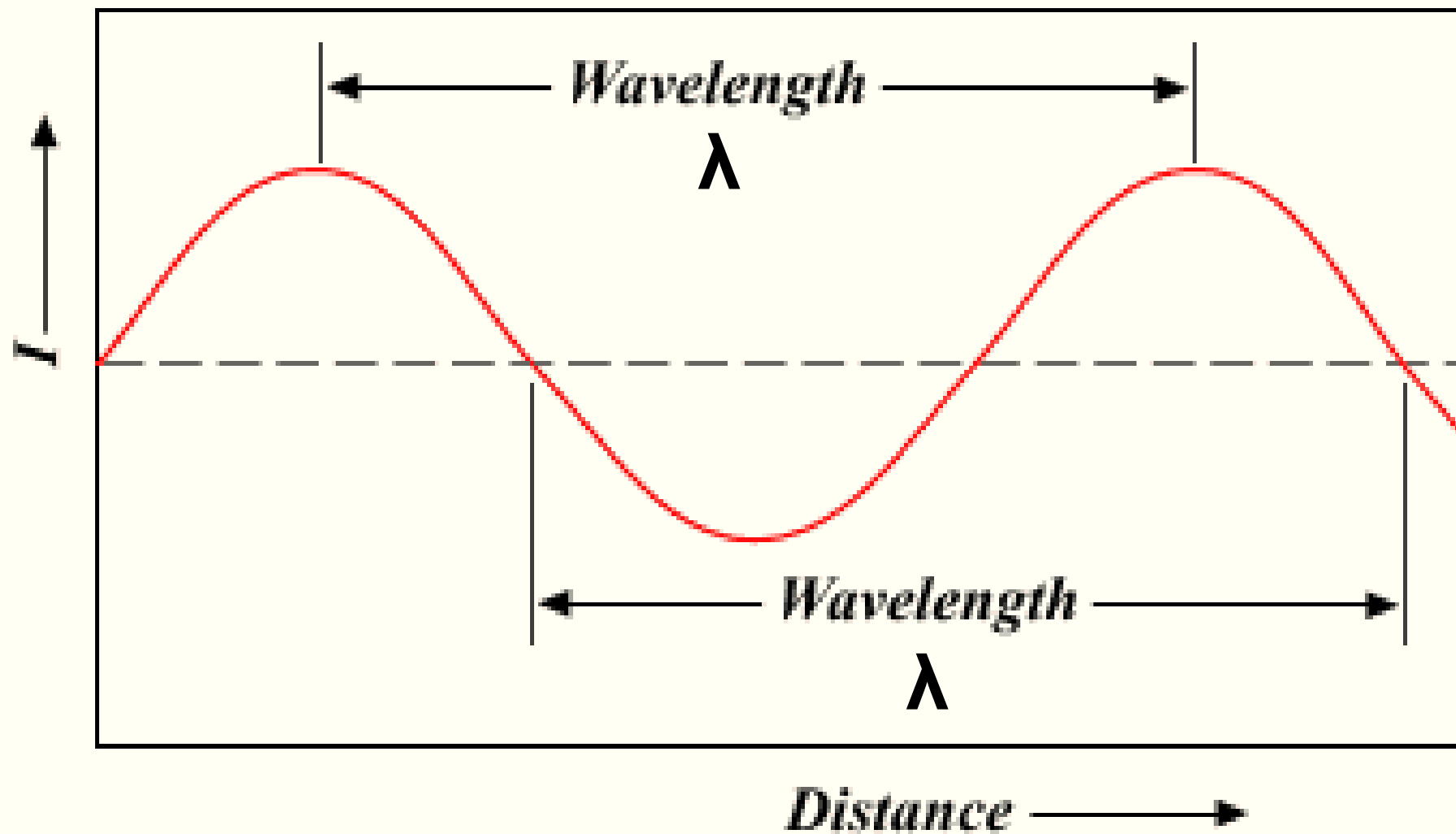
$$T = 0.01 \text{ seconds}$$



Wavelength

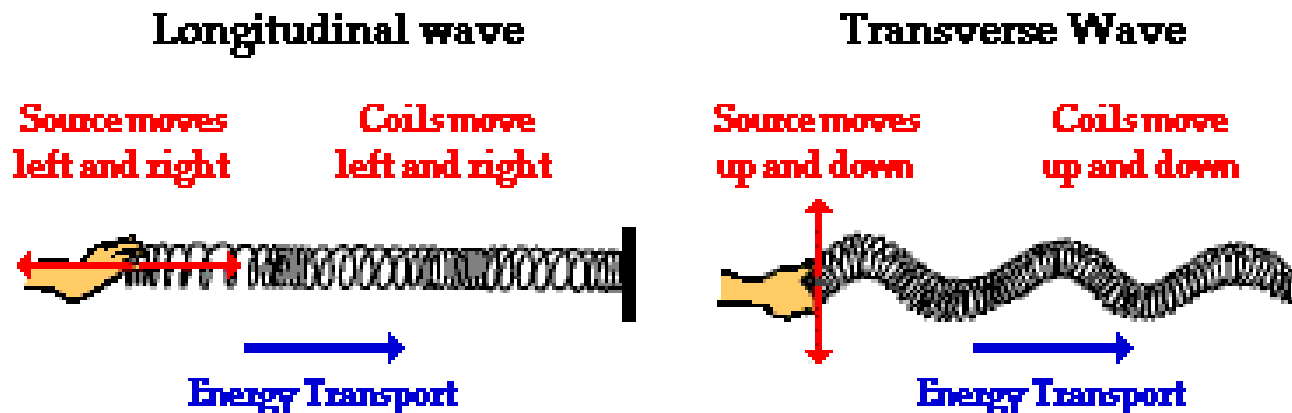
- The **distance** a wave travels during one cycle is the **Wavelength**.
- For radio waves, the **meter** is the most common unit of length.
- For microwave frequencies, the centimeter is sometimes used.
- The symbol for wavelength is the **Greek letter lambda λ** .

Wave



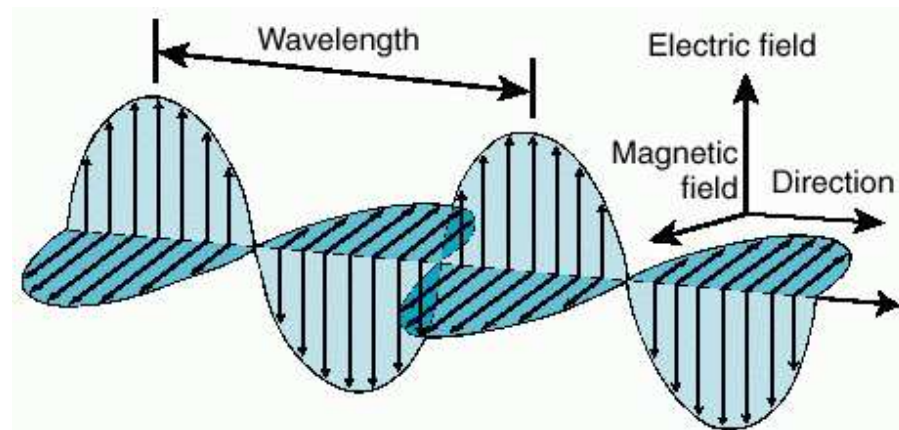
Waves

- Transverse
 - Vibration is at right angles to direction of propagation, e.g.: guitar string
- Longitudinal
 - Vibration is parallel to direction of propagation, e.g.: sound waves

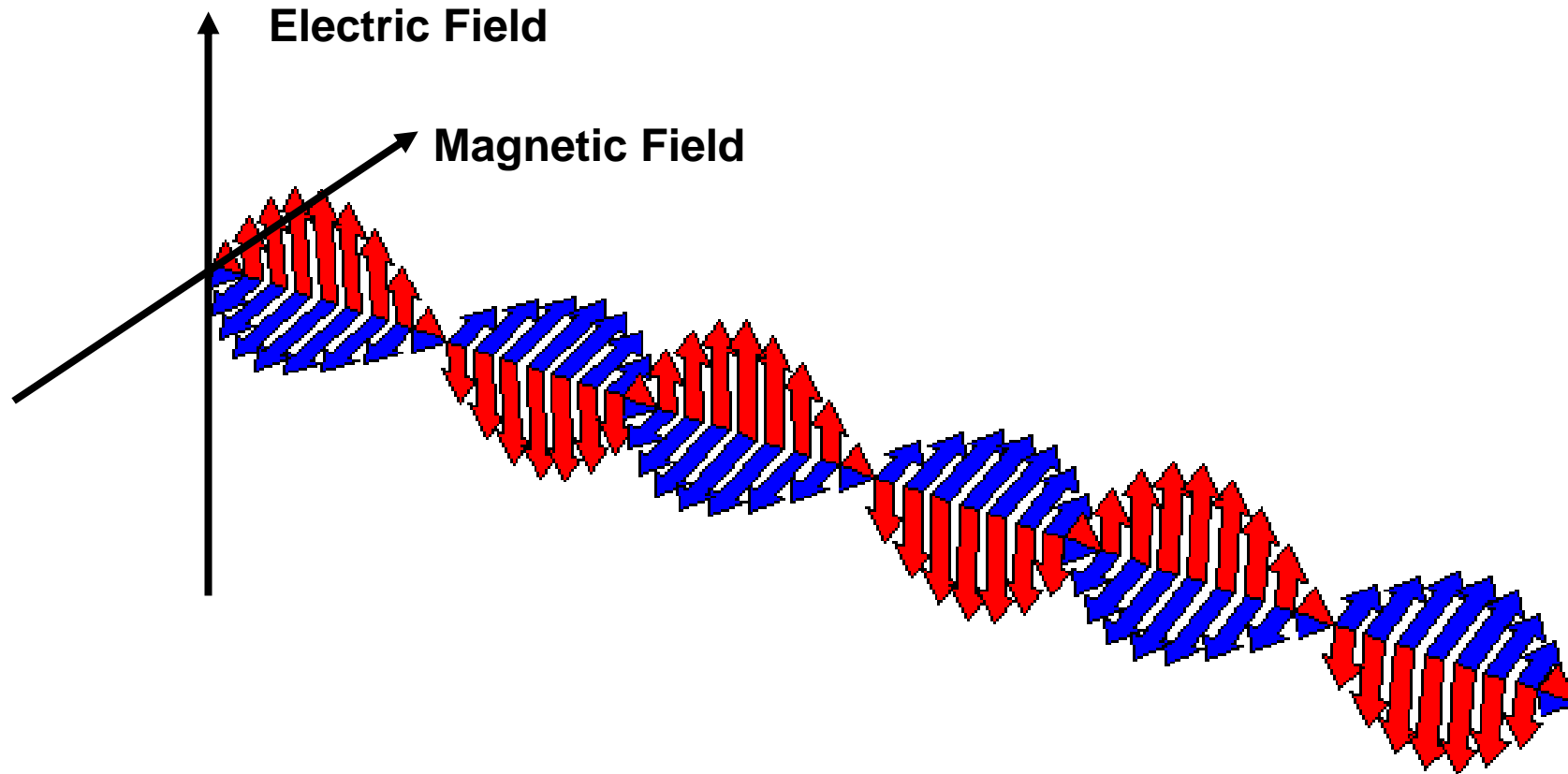


Electromagnetic (EM) Waves

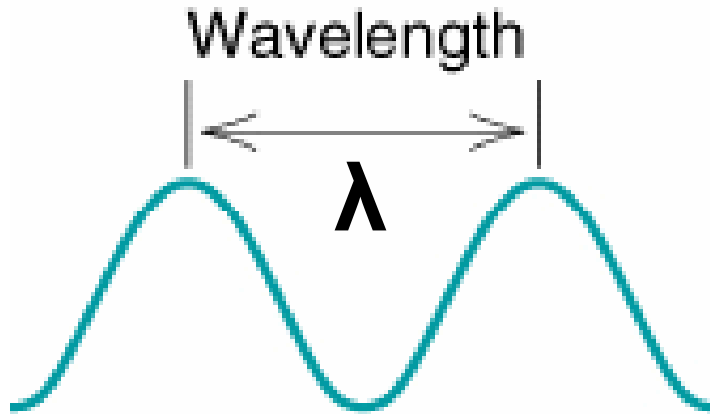
- Transverse waves
- Consist of Electric and Magnetic components:
 - In phase with each other; and
 - At right angles to each other.
- Orientation of Electric field determines Polarization.



Electromagnetic Waves



Radio Signal Wavelength



- EM waves travel at the **speed of light: c**
- $c = 300,000,000$ m/sec
- The relationship between wavelength and frequency for an EM wave is given as:

$$\lambda = \frac{c}{f}$$

$$\lambda = \frac{c}{f}$$

- λ in meters, f in hertz and $c = 300,000,000$ m/sec

Frequency Equations

- Because the Hertz is too small a unit to use for most practical radio work, we can use the following equations:

$$\lambda = 300 / f \text{ and}$$

$$f = 300 / \lambda$$

where λ is in meters, and f in Megahertz

Calculating Wavelength

- What is the wavelength of an EM wave with a frequency of 7,200 KHz?

Calculating Wavelength

- What is the wavelength of an EM wave with a frequency of 7,200 KHz?

Convert 7,200 KHz to MHz

Calculating Wavelength

- What is the wavelength of an EM wave with a frequency of 7,200 KHz?

Convert 7,200 KHz to MHz

$$7,200/1000 = 7.2 \text{ MHz}$$

$\lambda =$

Calculating Wavelength

- What is the wavelength of an EM wave with a frequency of 7,200 KHz?

Convert 7,200 KHz to MHz

$$7,200/1000 = 7.2 \text{ MHz}$$

$$\lambda = 300 / f$$

=

Calculating Wavelength

- What is the wavelength of an EM wave with a frequency of 7,200 KHz?

Convert 7,200 KHz to MHz

$$7,200/1000 = 7.2 \text{ MHz}$$

$$\lambda = 300 / f$$

$$= 300/7.2$$

$$= 41.66 \text{ meters}$$

Calculating Frequency

- What is the frequency of an EM wave with a wavelength of 5.9 meters?

$f =$

Calculating Frequency

- What is the frequency of an EM wave with a wavelength of 5.9 meters?

$$f = 300 / \lambda$$

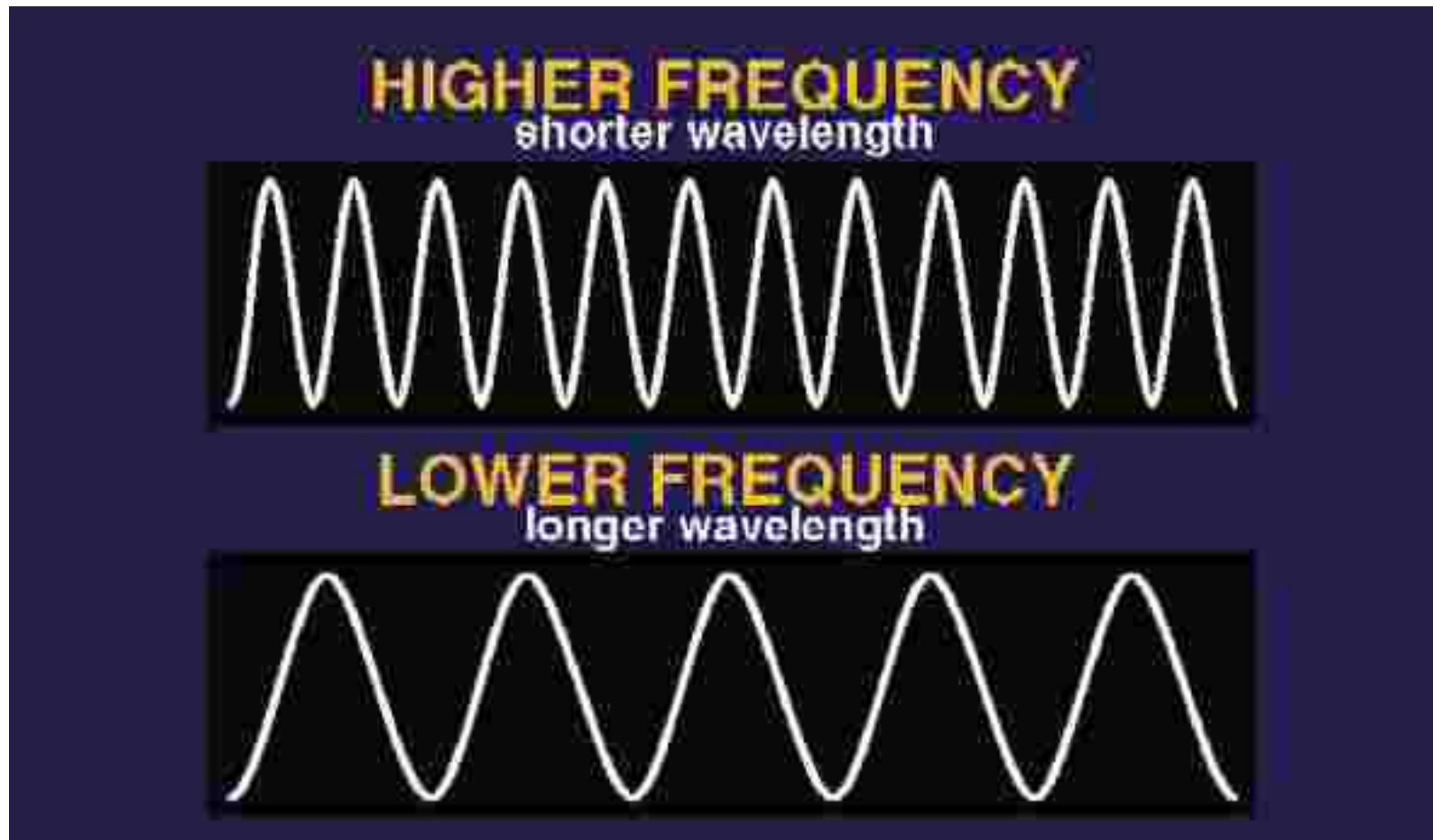
=

Calculating Frequency

- What is the frequency of an EM wave with a wavelength of 5.9 meters?

$$\begin{aligned} f &= 300 / \lambda \\ &= 300 / 5.9 \text{ meters} \\ &= 50.847 \text{ MHz} \end{aligned}$$

Wavelength versus Frequency



Harmonics

- Integer multiples of a given frequency.
- Example:
 - 3.550 MHz is the **Fundamental** frequency.
 - Two x 3.550 MHz = 7.100 MHz (**2nd Harmonic**)
 - Three x 3.550 MHz = 10.650 MHz (**3rd Harmonic**)
 - Four x 3,550 MHz = 14.200 MHz (**4th Harmonic**)
- Note: The slang term for a Ham's children is harmonics!

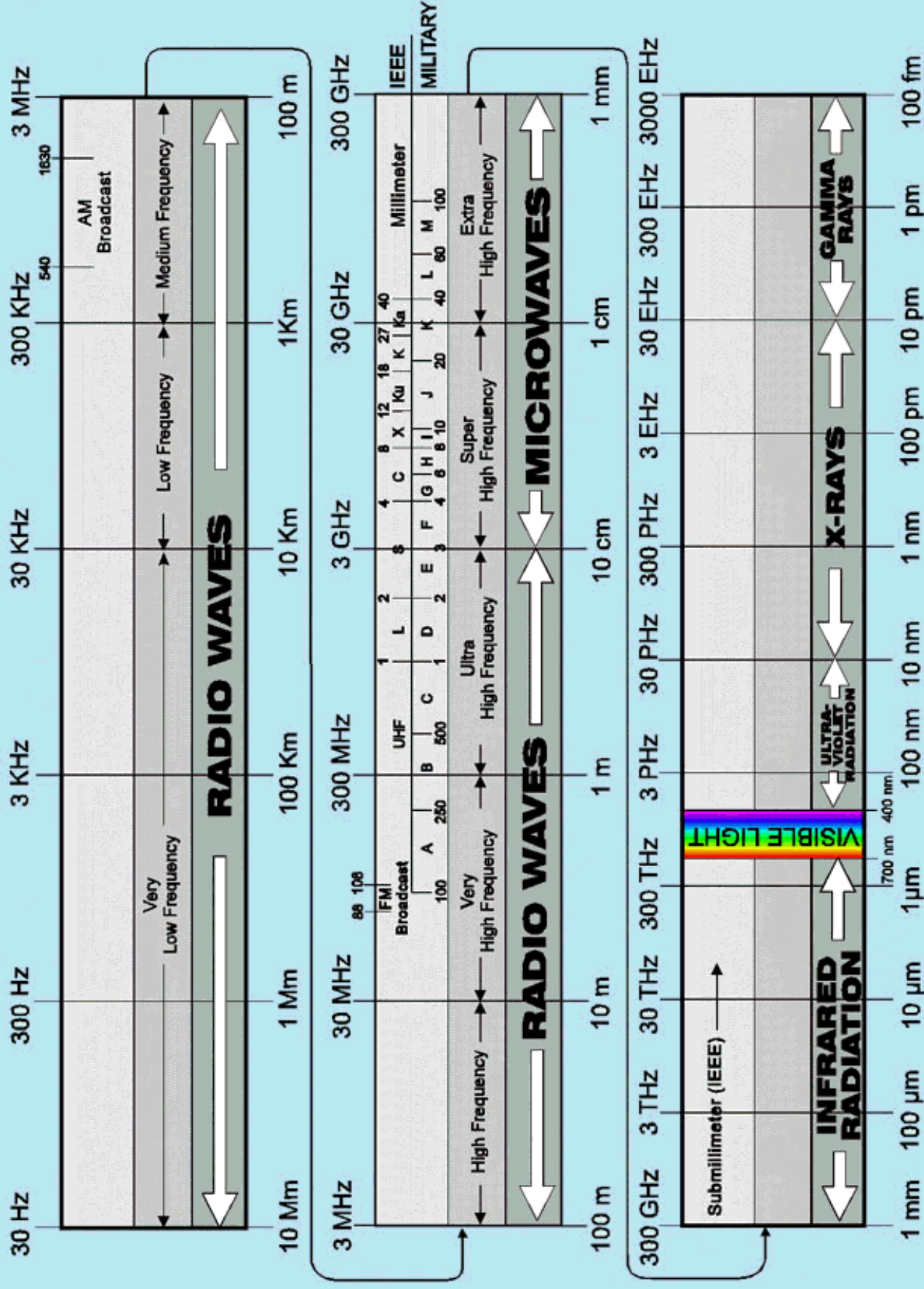
Frequency Allocations

- Electromagnetic Spectrum consists of all frequencies that EM waves could have.
- We are concerned primarily with those between 3 KHz and 3000 GHz however.
- For convenience, there are two ways to group frequencies:
 - By a range of frequencies possessing similar characteristics; and
 - By groups of frequencies with a similar wavelength.

Electromagnetic Spectrum

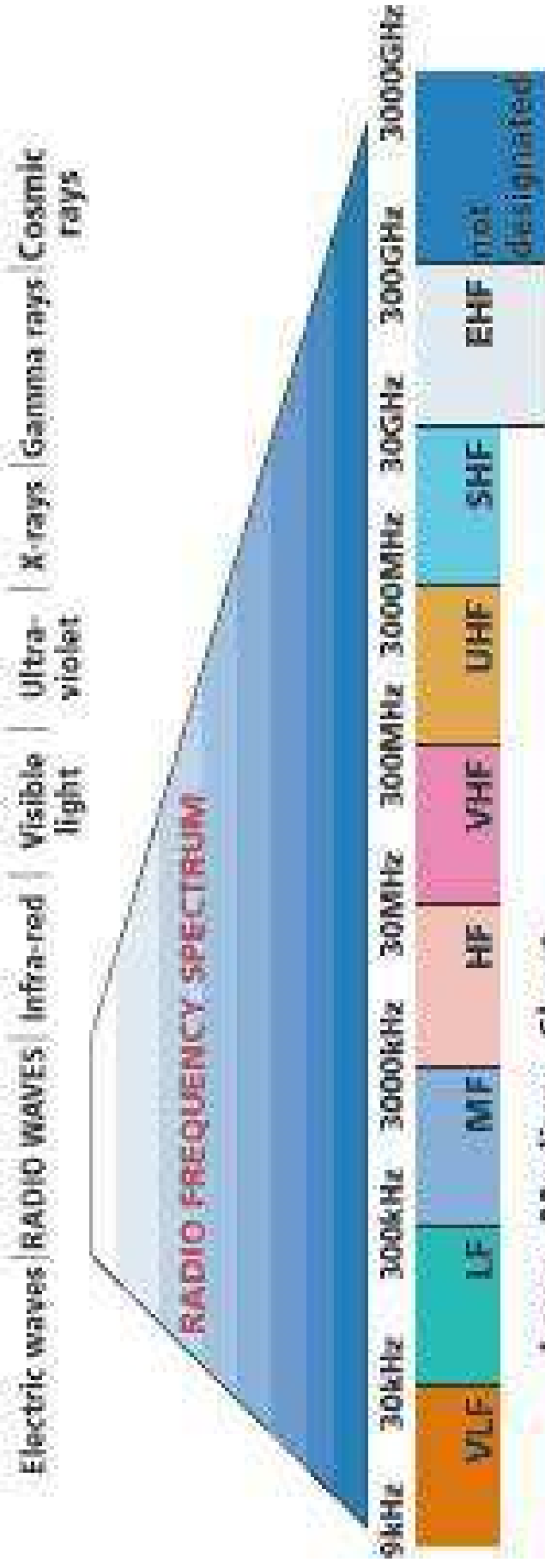
FREQUENCY	DESCRIPTION
30 GHz – 300 GHz	Extremely high frequency (EHF)
3 GHz – 30 GHz	Super high frequency (SHF)
300 MHz – 3 GHz	Ultrahigh frequency (UHF)
30 MHz – 300 MHz	Very high frequency (VHF)
3 MHz – 30 MHz	High frequency (HF)
300 kHz – 3 MHz	Medium frequency (MF)
30 kHz – 300 kHz	Low frequency (LF)
3 kHz – 30 kHz	Very low frequency (VLF)
300 Hz – 3 kHz	Voice frequency
up to 300 Hz	Extremely low frequency (ELF)

RADIO FREQUENCY SPECTRUM



ELECTROMAGNETIC SPECTRUM

SHOWING THE RADIO FREQUENCY SPECTRUM



Long wave Medium wave Short wave

VLF Very Low Frequency
 LF Low Frequency
 MF Medium Frequency
 HF High Frequency

VHF Very High Frequency
 UHF Ultra High Frequency
 SHF Super High Frequency
 EHF Extremely High Frequency

Bands

- A group of frequencies that lie between two clearly defined limits.
- Identified by a numerical value that is close to the wavelength of one of the frequencies near the center of the group.
- Example: 80 meter band is 3.5 to 4.0 MHz
f =

Bands

- A group of frequencies that lie between two clearly defined limits.
- Identified by a numerical value that is close to the wavelength of one of the frequencies near the center of the group.
- Example: 80 meter band is 3.5 to 4.0 MHz
 $f = 300 / \lambda =$

Bands

- A group of frequencies that lie between two clearly defined limits.
- Identified by a numerical value that is close to the wavelength of one of the frequencies near the center of the group.
- Example: 80 meter band is 3.5 to 4.0 MHz
 $f = 300 / \lambda = 300/80 =$

Bands

- A group of frequencies that lie between two clearly defined limits.
- Identified by a numerical value that is close to the wavelength of one of the frequencies near the center of the group.
- Example: 80 meter band is 3.5 to 4.0 MHz
 $f = 300 / \lambda = 300/80 = 3.75 \text{ MHz}$

Canadian Amateur Bands

Frequency Band	Maximum Bandwidth*	Operating Provisions	Operator Qualifications
1.800 - 2.000 MHz 3.500 - 4.000 MHz 7.000 - 7.300 MHz 10.100 - 10.150 MHz	6 kHz 6 kHz 6 kHz 1 kHz		B and 5, B/H, B&A B and 5, B/H, B&A B and 5, B/H, B&A B and 5, B/H, B&A
14.000 - 14.350 MHz 18.068 - 18.168 MHz 21.000 - 21.450 MHz 24.890 - 24.990 MHz	6 kHz 6 kHz 6 kHz 6 kHz		B and 5, B/H, B&A B and 5, B/H, B&A B and 5, B/H, B&A B and 5, B/H, B&A
28.000 - 29.700 MHz 50.000 - 54.000 MHz 144.000 - 148.000 MHz 222.000 - 225.000 MHz	20 kHz 30 kHz 30 kHz 100 kHz	0	B and 5, B/H, B&A B B B
430.000 - 450.000 MHz 902.000 - 928.000 MHz 1.240 - 1.300 GHz 2.300 - 2.450 GHz	12 MHz 12 MHz Not specified Not specified	1 1 1 1	B B B B
3.300 - 3.500 GHz 5.650 - 5.925 GHz 10.000 - 10.500 GHz 24.000 - 24.050 GHz 47.000 - 47.200 GHz	Not specified Not specified Not specified Not specified Not specified	1 1 1 	B B B B B

Table 5-1

Bands currently assigned for use by Amateur radio by Industry Canada

137 KHz (2200 Meters)

- 135.7 to 137.8 KHz
- Max bandwidth 100 Hz
- Max EIRP 1 Watt

160m BAND PLAN (July 8, 2008)

1800 - 1810	CW, Narrow band digital (Note 1)
1810 - 1840	CW (Notes 1 & 2)
1840 - 1999	CW, Phone (Notes 3, 4 & 5)
1999 - 2000	Beacons

NOTES:

- | | | |
|-----|-------------|---|
| 1 - | 1800 - 1840 | CW may be used anywhere in the band but is normally used only up to 1840kHz |
| 2 - | 1830 - 1840 | CW Priority for intercontinental operation (DX window) |
| 3 - | 1840 - 1850 | SSB Priority for intercontinental operation (DX window) |
| 4 - | 1905 - 1915 | DX Listening Window for JA CW |
| 5 - | 1850 - 1999 | Includes AM and SSTV modes |

In addition, the following “Centres of Activity” are recognized:

- | | |
|------|----------------|
| 1812 | QRP CW Centre |
| 1890 | SSTV Centre |
| 1910 | QRP SSB Centre |

GENERAL NOTES:

- Where Notes are shown, these activities have priority over other activities.
- During major weekend Contest activities, activity in certain modes can spill over into other segments.
- Sideband Usage Below 10MHz use lower sideband (LSB)
- Phone modes should not operate closer than 3000Hz to the lower segment edge.
- Narrow band digital modes: All modes using up to 500Hz bandwidth.

80m BAND PLAN (July 8, 2008)

3500 - 3580	CW (Note 1)
3580 - 3600	CW, Wide band, Narrow band digital (Notes 2, 3, 4 & 5)
3600 - 4000	CW, Phone (Notes 6 & 7)

NOTES:

1 - 3500 - 3510	CW Priority for intercontinental operation (DX window)
2 - 3510 - 3560	CW Contest preferred
3 - 3580 - 3583	PSK-31 and other Very Narrow Band Digital
4 - 3590	RTTY DX
5 - 3590 - 3600	Automatically controlled data stations (unattended)
6 - 3700 - 3775	SSB Contest preferred
7 - 3775 - 3800	SSB Priority for intercontinental operation (DX window)

In addition, the following "Centres of Activity" are recognized:

3530	IOTA CW Centre
3555	QRS CW Centre
3560	QRP CW Centre in IARU Regions 1 and 2, 3530 MHz in Australia
3630	Digital Voice Centre
3690	QRP SSB Centre
3735	Image Centre
3755	IOTA SSB Centre
3760	Emergency Centre
3845	SSTV & FAX Centre
3885	AM Phone Calling Frequency
3985	QRP SSB Calling Frequency

GENERAL NOTES:

- Where Notes are shown, these activities have priority over other activities.
- During major weekend Contest activities, activity in certain modes can spill over into other segments.
- Sideband Usage Below 10MHz use lower sideband (LSB)
- Phone modes should not operate closer than 3000Hz to the lower segment edge.
- Wide band digital refers to any digital mode using more than 500Hz bandwidth.
- Narrow band digital modes: All modes using up to 500Hz bandwidth.
- Image modes: Any analogue or digital image using bandwidth up to 2700Hz.

40m BAND PLAN (July 8, 2008)

7000 - 7035	CW (Note 1)
7035 - 7040	CW, Narrow Band Digital with other Regions (Notes 2 & 3)
7040 - 7050	CW, Phone, Narrow Band Digital with other Regions (Notes 3 & 4)
7050 - 7080	CW, Phone (Note 4)
7080 - 7125	CW, Phone, Narrow Band digital
7125 - 7165	CW, Phone
7165 - 7175	CW, SSTV, FAX, Phone
7175 - 7300	CW, Phone

Notes

- 1 - 7000 - 7025 CW Priority for intercontinental operation (DX window)
- 2 - 7035 - 7038 PSK-31 and other Very Narrow Band Digital
- 3 - 7038 - 7043 Automatically controlled data stations (unattended)
- 4 - 7040 - 7065 SSB Priority for intercontinental operation (DX Window)

In addition, the following “Centres of Activity” are recognized:

7027	QRP CW Centre 1
7030	IOTA CW Centre
7040	QRP CW Centre 2 and QRS Centre
7043	Image Centre 1
7055	IOTA SSB Centre 1
7060	SSB Emergency Centre 1
7070	Digital Voice Centre
7090	SSB QRP Centre 1
7165	Image Centre 2
7240	SSB Emergency Centre 2
7255	IOTA SSB Centre 2
7285	SSB QRP Centre 2
7290	AM Centre
7295	SSB Emergency Centre 3

GENERAL NOTES:

- Where Notes are shown, these activities have priority over other activities.
- During major weekend Contest activities, activity in certain modes can spill over into other segments.
- Sideband Usage Below 10MHz use lower sideband (LSB)
- Phone modes should not operate closer than 3000Hz to the lower segment edge.
- Wide band digital refers to any digital mode using more than 500Hz bandwidth.
- Narrow band digital modes: All modes using up to 500Hz bandwidth.
- Image modes: Any analogue or digital image using bandwidth up to 2700Hz.

30m BAND PLAN (July 6, 2008)

10100-10130	CW
10130-10140	CW, Narrow band digital
10140-10150	CW, Narrow band and Wide band digital (Note 1)

Note:

1 - 10142 - 10145 PSK-31 and other Very Narrow Band Digital

In addition, the following “Centres of Activity” are recognized:

10115	IOTA CW Centre
10116	CW QRP Centre

GENERAL NOTES:

- Where Notes are shown, these activities have priority over other activities.
- Wide band digital refers to any digital mode using more than 500Hz bandwidth.
- Narrow band digital modes: All modes using up to 500Hz bandwidth.

20m BAND PLAN (July 8, 2008)

14000 - 14070	CW (Note 1)
14070 - 14095	CW, Narrow band digital (Note 2)
14095 - 14099.5	CW, Narrow band and Wide band digital (Note 3)
14099.5 - 14100.5	Beacons
14100.5 - 14112	CW, Narrow band and Wide band digital (Note 4)
14112 - 14350	CW, Phone (Notes 5 & 6)

NOTES:

1 -	14025 - 14060	CW Contest preferred
2 -	14070 - 14073	PSK-31 and other Very Narrow Band Digital
3 -	14089 - 14099	Automatically controlled data stations (unattended)
4 -	14101 - 14112	Automatically controlled data stations (unattended)
5 -	14190 - 14200	SSB DXpedition priority
6 -	14112 - 14285	SSB Contest preferred

In addition, the following “Centres of Activity” are recognized:

	14040	IOTA CW
14055	CW QRS Centre	
14060	CW QRP Centre	
14130	Digital Voice Centre	
14140	Canadian Cross-country SSB Centre	
14230	Image Centre	
14260	IOTA SSB	
14285	SSB QRP Centre	
14286	AM Centre	
14300	Global Emergency Centre	

GENERAL NOTES:

- Where Notes are shown, these activities have priority over other activities.
- During major weekend Contest activities, activity in certain modes can spill over into other segments.
- Phone modes should not operate closer than 3000Hz to the upper band edge.
- Wide band digital refers to any digital mode using more than 500Hz bandwidth.
- Narrow band digital modes: All modes using up to 500Hz bandwidth.
- Image modes: Any analogue or digital image using bandwidth up to 2700Hz.

17m BAND PLAN

(July 8, 2008)

18068-18095	CW
18095-18105	CW, Narrow band digital (Note 1)
18105-18109.5	CW, Narrow band and Wide band digital (Note 2)
18109.5-18110.5	Beacons
18110.5-18168	CW, Phone (Notes 3 & 4)

Notes:

- | | |
|----------------|---|
| 1- 18100-18103 | PSK-31 and other Very Narrow Band Digital |
| 2- 18105-18109 | Automatically controlled data stations (unattended) |
| 3- 18111-18120 | Automatically controlled data stations (unattended) |
| 4- 18160 | Global Emergency Centre |

In addition, the following “Centres of Activity” are recognized:

18086	CW QRP Centre
18098	IOTA CW Centre
18128	IOTA SSB Centre
18130	SSB QRP Centre

GENERAL NOTES:

- Phone modes should not operate closer than 3000Hz to the upper band edge.
- Wide band digital refers to any digital mode using more than 500Hz bandwidth.
- Narrow band digital modes: All modes using up to 500Hz bandwidth.

15m BAND PLAN (July 8, 2008)

21000-21070	CW
21070-21090	CW, Narrow band digital (Note 1)
21090-21125	CW, Narrow band and Wide band digital (Note 2)
21125-21149.5	CW
21149.5-21150.5	Beacons
21150.5-21335	CW, Phone
21335-21345	CW, Phone, SSTV, FAX
21345-21450	CW, Phone (Note 3)

Notes:

- | | | |
|-----|---------------|---|
| 1 - | 21080 - 21083 | PSK-31 and other Very Narrow Band Digital |
| 2 - | 21090 - 21120 | Automatically controlled data stations (unattended) |
| 3 - | 21360 | Global Emergency Centre |

In addition, the following “Centres of Activity” are recognized:

21040	IOTA CW Centre
21055	CW QRS Centre
21060	CW QRP Centre
21180	Digital Voice Centre
21260	IOTA SSB Centre
21285	SSB QRP Centre
21340	Image Centre
21385	SSB QRP Centre

GENERAL NOTES:

- Where Notes are shown, these activities have priority over other activities.
- During major weekend Contest activities, activity in certain modes can spill over into other segments.
- Phone modes should not operate closer than 3000Hz to the upper band edge.
- Wide band digital refers to any digital mode using more than 500Hz bandwidth.
- Narrow band digital modes: All modes using up to 500Hz bandwidth.
- Image modes: Any analogue or digital image using bandwidth up to 2700Hz.

12m BAND PLAN (July 8, 2008)

24890-24920	CW
24920-24925	CW, Narrow band digital (Note 1)
24925-24929.5	CW, Narrow band and Wide band digital (Note 2)
24929.5-24930.5	Beacons
24931-24940	CW, Narrow band and Wide band digital (Note 3)
24940-24990	CW, Phone

Note:

- | | | |
|------------|--------------------|--|
| 1 - | 24920-24923 | PSK-31 and other Very Narrow Band Digital |
| 2 - | 24925-24929 | Automatically controlled data stations (unattended) |
| 3 - | 24931-24940 | Automatically controlled data stations (unattended) |

In addition, the following “Centres of Activity” are recognized:

24905	CW QRP Centre
24920	IOTA CW
24950	IOTA SSB
24950	SSB QRP Centre

GENERAL NOTES:

- Where Notes are shown, these activities have priority over other activities.
- Phone modes should not operate closer than 3000Hz to the upper band edge.
- Wide band digital refers to any digital mode using more than 500Hz bandwidth.
- Narrow band digital modes: All modes using up to 500Hz bandwidth.

10m BAND PLAN (July 8, 2008)

28000-28070	CW
28070-28120	CW, Narrow band digital
28120-28189.5	CW, Narrow band and Wide band digital (Notes 1 & 2)
28189.5-28199.5	Beacon Network #2
28199.5-28200.5	Intra-regional Beacons
28200.5-28225	CW, Beacons
28225-28300	CW, Phone, Beacons
28300-28320	CW, Narrow band and Wide band digital (Note 3)
28320-28670	CW, Phone
28670-28690	CW, Phone, SSTV, FAX
28690-29300	CW, Phone (Note 4)
29300-29510	Satellites
29510-29520	Guard Band, no transmissions allowed
29520-29590	FM repeater inputs
29600	FM simplex
29620-29690	FM repeater outputs

Notes:

- | | | |
|-----|-------------|---|
| 1 - | 28120-28123 | PSK-31 and other Very Narrow Band Digital |
| 2 - | 28120-28150 | Automatically controlled data stations (unattended) |
| 3 - | 28300-28320 | Automatically controlled data stations (unattended) |
| 4 - | 29000-29200 | AM |

In addition, the following “Centres of Activity” are recognized:

28040	IOTA CW Centre
28055	CW QRS Centre
28060	CW QRP Centre
28330	Digital Voice Centre
28360	QRP SSB Centre
28460	IOTA SSB Centre 1
28560	IOTA SSB Centre 2
28680	Image Centre

GENERAL NOTES:

- Where Notes are shown, these activities have priority over other activities.
- During major weekend Contest activities, activity in certain modes can spill over into other segments.
- SSB and AM Phone modes should not operate closer than 3000Hz to an upper band edge.
- FM Bandwidth is not to exceed 6000Hz.
- Wide band digital refers to any digital mode using more than 500Hz bandwidth.
- Narrow band digital modes: All modes using up to 500Hz bandwidth.
- Image modes: Any analogue or digital image using bandwidth up to 2700Hz.

6m Band Plan: 50-54 MHz

Status: Amateur Exclusive
 Size: Spectrum allocated: 4 MHz
 Date: This plan was approved October 1997

FREQUENCY	UTILIZATION
50.0 - 50.6 <i>further sub-allocated as:</i> 50.0 - 50.050 50.050 - 50.1 50.1 50.1-50.6	<i>Narrow Band Modes (SSB, AM)</i> CW Beacons /Moonbounce CW/ Beacons CW Calling Frequency SSB and AM Modes (Bandwidth ≤ 2.3 kHz)
50.105 - 50.115 50.110 50.125 50.4	DX Window (listen for DX here) ³ DX Window calling frequency ⁴ National SSB calling frequency AM calling frequency
50.6 - 51.0 <i>further sub-allocated as:</i> 50.7 50.8 - 50.98 51.0 - 51.1 51.1 - 52.0 51.7	<i>Experimental Modes</i> ¹ RTTY, AMTOR calling frequency Radio control of models, ten channels on a 20 kHz raster Pacific (ZL) DX window (SSB/CW only) ² FM Voice simplex, and packet ¹ National simplex packet calling frequency
52.0 - 52.05 52.0 - 53.0 52.525 53.0 - 54.0	Pacific (VK) DX window (SSB/CW only) ² FM voice repeater inputs National FM calling frequency FM voice repeater outputs

Notes to 6 m Band Plan:

- 1) In North America the following frequencies are suggested for Packet digipeater and packet scatter operation: 50.62/51.62, 50.68/51.68, 50.76/51.76, 50.64/51.64, 50.72/51.72, 50.78/51.78, 50.66/51.66, 50.74/51.74. **For**-located voice and packet repeaters, use high (input) and low (output) to provide maximum mutual frequency isolation.
- 2) Amateurs are requested to avoid using fm or other wide band modes on these frequencies to minimize interference to Australian and New Zealand amateurs working into region 2 on SSB/CW.
- 3) North American Amateurs are requested to avoid calling *CQ DX* on 50.110 MHz.

2m Band Plan: 144-148 MHz

Status: Amateur Exclusive

Size: Spectrum allocated: 4 MHz

Date: This plan was approved September 1995

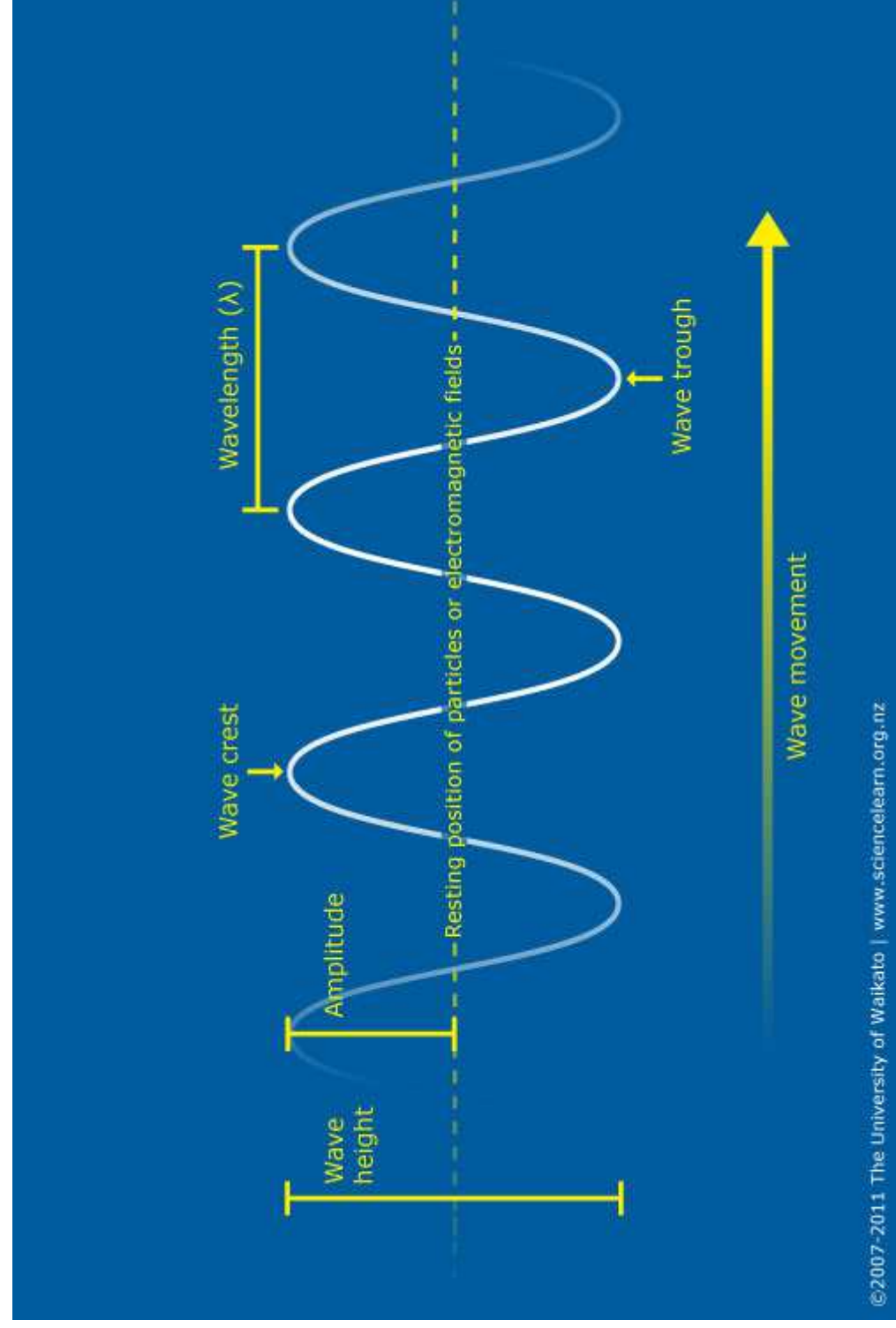
FREQUENCY	UTILIZATION
144.000 - 144.100	moonbounce and terrestrial CW
144.100 - 144.275	CW/SSB weak signal
144.200	CW/SSB calling frequency
144.200 - 144.275	(ACSSB, SSB, CW, RTTY), other modes with bandwidth less than 3 kHz (FAX, SSTV calling frequency) ¹
144.275 - 144.300	Propagation beacon network exclusive
144.300 - 144.500	Digital ²
144.340	National ATV coordination frequency ¹
144.390	National APRS frequency ⁹
144.500 - 144.600	Primary: Repeater inputs
	Secondary: Linear translator inputs ¹⁰
144.600 - 144.900	Repeater inputs ¹⁰
144.900 - 145.100	Digital ³
145.100 - 145.200	Primary: repeater outputs
	Secondary: Linear translator outputs ¹⁰
145.500 - 145.590	SAREX/ARISS links
145.590 - 145.790	Digital ⁴
145.800 - 146.000	Amateur satellite service, ARISS, exclusive
146.010 - 146.370	Repeater inputs
146.400 - 146.580	FM simplex ^{5,6}
146.520	National FM calling frequency ¹
146.610 - 147.390	Repeater Outputs ¹⁰
147.420 - 147.570	FM simplex (30 kHz raster) ⁷
147.435 - 147.585	Digital (30 kHz raster) ⁸
147.600 - 147.990	Repeater inputs ¹⁰

Notes on 2 m Band Plan:

- 1) Once communications are established move off the frequency to another channel.
- 2) Seven (7) frequencies on a 20 kHz channel raster 144.37, 144.39, 144.41, 144.43, 144.45, 144.47, 144.49. Occupancy to occur ONLY when available Digital frequencies within the sub bands 144.9 - 145.1 MHz and 145.59 - 145.79 MHz are exhausted. Consult with your local digital coordination body regarding maximum ERP. Bandwidth and coverage area within this sub band. Operation may occur on 144.31 MHz provided operating bandwidth, ERP do NOT cause harmful interference within the propagation beacon network sub band.
- 3) Ten (10) frequencies on a 20 kHz channel raster. 144.91, 144.93, 144.95, 144.97, 144.99, 145.01, 145.03, 145.05, 145.07, 145.09. Consult with your local coordination body.
- 4) Eleven (11) frequencies on a 20 kHz channel raster 145.59, 145.61, 145.63, 145.65, 145.67, 145.69, 145.71, 145.73, 145.75, 145.77, 145.79 MHz. Consult with your local coordination body.
- 5) The frequencies 146.40, 146.43, 146.46 MHz continue to be used as repeater inputs in some areas. Consult with your local coordination body.

The background is a deep blue with intricate, glowing purple and white patterns that resemble a complex network or a stylized tree. A central vertical column is composed of a series of overlapping, translucent, diamond-like shapes, creating a textured, columnar effect. To the right of this central column, the word "Questions?" is written in a bold, yellow, sans-serif font.

Questions?



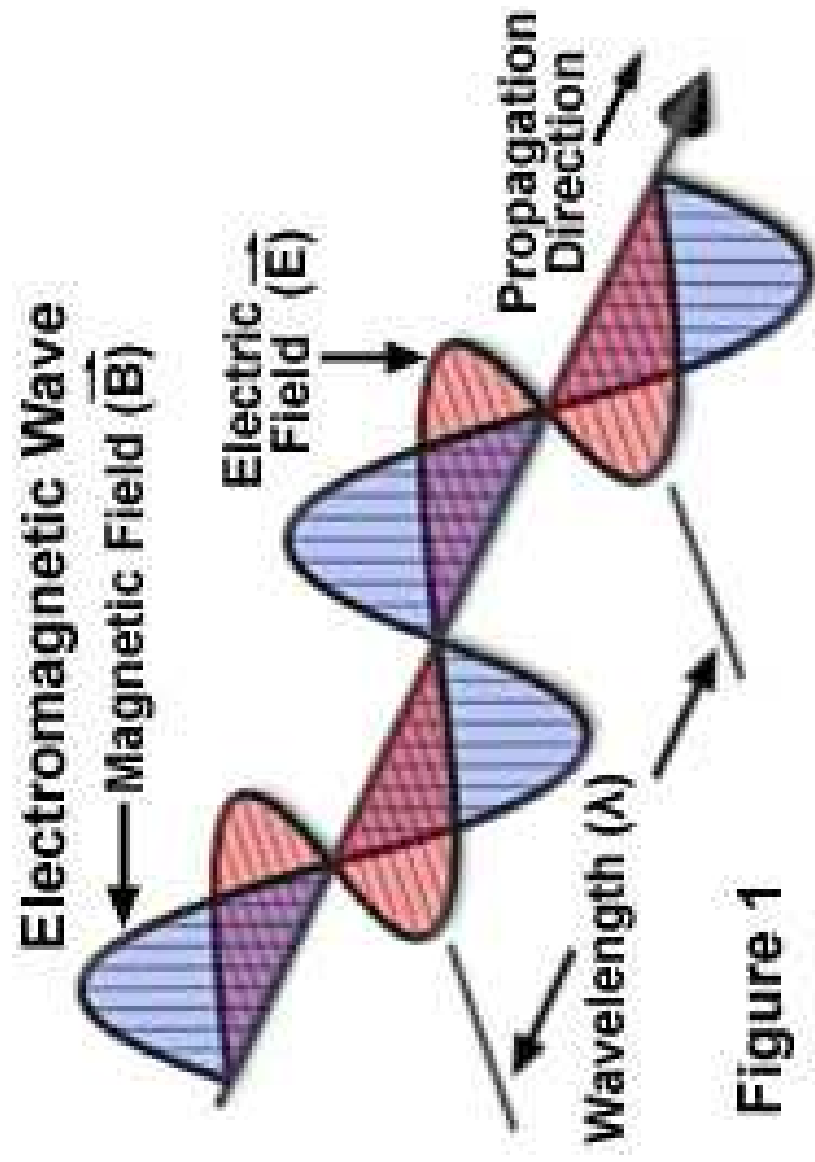


Figure 1