

Ham 7 – Moving Zeroes
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1. Unit abbreviations are two letters. If it is honorary name for someone, the first letter is always capital.
a. Because of the size of some numbers, it is easier to get rid of three-zeroes and apply a different prefix.

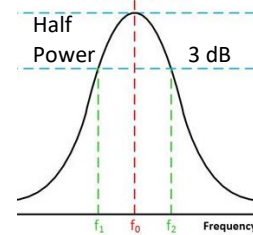
kilo = 1,000 = 1 thousand	k	milli = .001 = 1 thousandth	m
Mega = 1,000,000 = 1 million	M	micro = .000 001 = 1 millionth	μ
giga = 1,000,000,000 = 1 billion	g	pico = .000 000 000 001 = 1 million millionth	p

- b. $25.1 \text{ MHz} = 25,100 \text{ kHz} = 25,100,000 \text{ Hz}$ $1,000,000 \text{ pF} = 1 \text{ microF} = .001 \text{ milliFarad}$

2. Human hearing can detect whispers to explosions. To prevent damage at extremely high levels, the ear is designed to attenuate large noise at a natural rate called a logarithmic scale. We define decibels (dB) to represent the sound level without using huge numbers.

$$dB = 10 \log_{10} (P_{out}/P_{in})$$

Power ratio	dB
0.1	-10
0.25	-6
0.5	-3
1	0
2	3
4	6
5	7
10	10
100	20
1,000,000	60
1E+12	120



- a. For the exam, you only need to use the power ratio for 3 dB or 10 dB.
b. power ratio of 2 = 3 dB
c. power ratio of 10 = 10 dB
d. Increase of power is positive dB, decrease of power is negative dB.

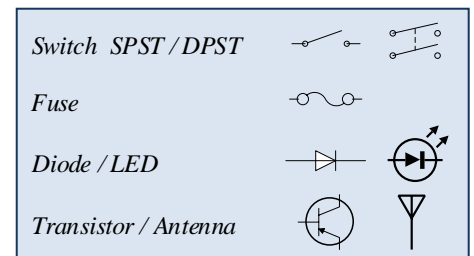
Example: Power decrease from 12 to 3 watts
 $12/3 = 4 \text{ times} = [2] * 2 \text{ times} = [2] * 3dB = 6dB$

3. Protection removes power.
a. *Switch* turns electric devices on and off and is commonly marked by (1/0).
The switch can be manual, a relay, or a transistor.
b. *Fuse* protects other components from overloads.
c. A schematic (scheme) is an electrical wiring diagram that uses standard symbols to show connection of components.

4. Solid State electronics are made of semi-conductors, which are a part-time conductor and part insulator (glass).
a. *Diode* has two terminals or electrodes. The cathode (bar) is negative & shorter leg. The anode (arrow) is positive. Current flows in the direction of the arrow, but is blocked by the bar. A diode is a rectifier making DC from AC.
b. *Transistor* has three layers (terminals). One terminal switches the diode on or off.

A transistor can be a switch to control current flow or an amplifier by controlling current to increase *gain*.
Field Effect Transistor (FET), Metal Oxide Semiconductor (MOS), and bipolar are types of transistors.

- c. *Light emitting diode (LED)* is a diode which releases visible light.



5. AC / DC
a. *Direct Current (DC)* flows in one direction. The source is batteries. DC is used for portable power. The most common mobile source is 12 VDC.
b. *Alternating Current (AC)* reverses direction many cycles per second called the frequency. Common AC power is 120 VAC, 60 Hz from the wall outlet.
c. *Rectifier* also called a diode, converts AC to varying DC. These are in a power supply.
d. *Regulator* controls the voltage from a power supply.
e. Rechargeable batteries are lead-acid (vehicle), gel-cell (alarm), ni-cad, nickel metal hydride, or lithium ion.
f. Non-rechargeable are carbon-zinc (flashlight and alkaline).

6. *Radio Frequency (RF)* is alternating current operating at higher frequencies.
a. Frequency is kiloHertz, megaHertz or greater. The wave is both electric & magnetic (electromagnetic) fields.
b. A field is energy operating in space. For example, a magnetic does not have to touch to move an iron object.
c. In general, the orientation of the antenna describes the polarization.
d. Horizontal polarization is parallel to the earth surface. Vertical is perpendicular.
e. The electric field from the antenna defines the polarization or direction of movement around the earth.
f. Magnetic field is the opposite (perpendicular) polarization.
g. Horizontal polarization hugs the earth, so it is better for long-distance, weak signals.
h. Vertical polarization works best for portable and mobile, short range.
i. Receiving antenna opposite from the transmitting antenna results in about 18 dB signal loss.
j. Because of antennas, VHF/UHF FM (voice) are usually vertical while SSB/CW are horizontal.
k. Vertical is different around the globe. A vertical antenna over the horizon is not parallel to local, not line-of-sight.

