

New England Radio Discussion Society: **“Electronics for Amateur Radio operators”**



“Getting down to
nuts and volts”

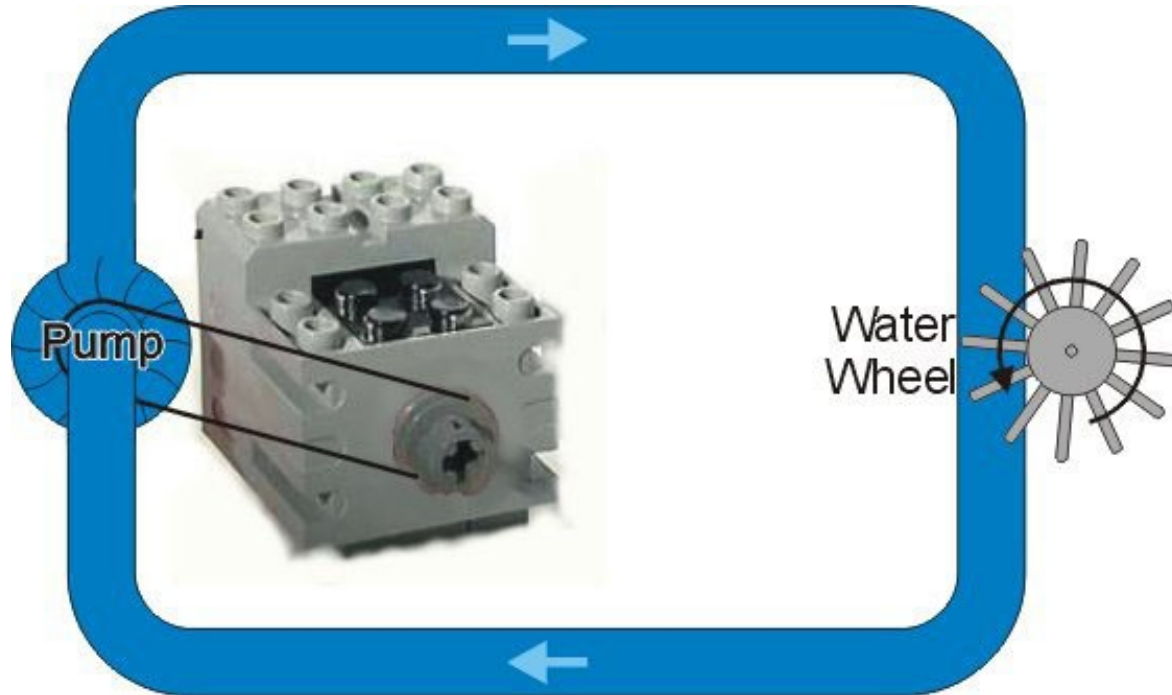
**Phase Two,
September 2016**

Our *voltmeters* measure electrostatic field differences, or potential, or EMF

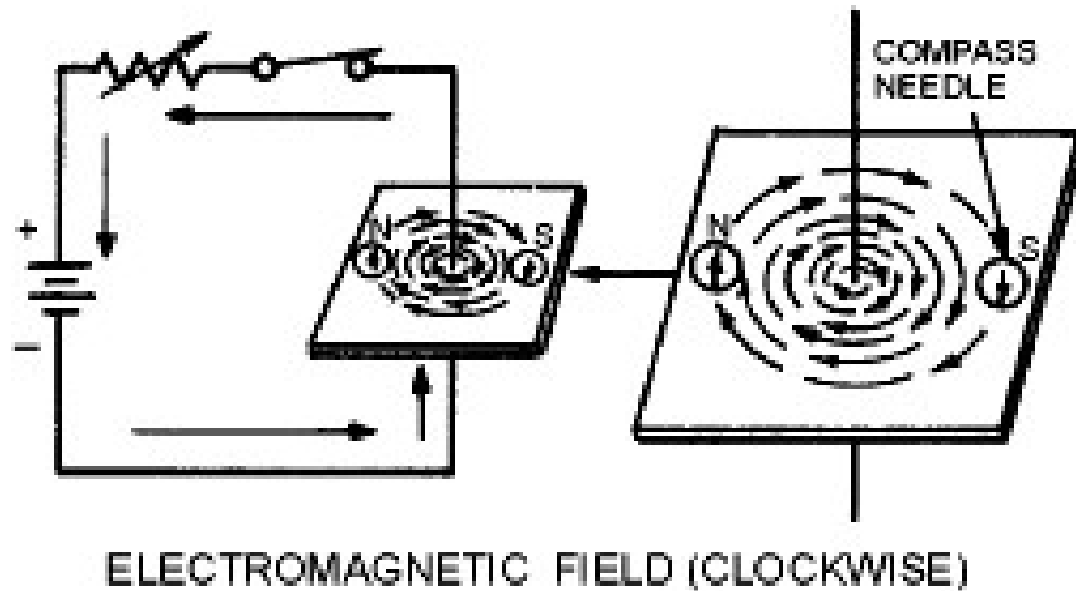


Remember the red horseshoe magnet in this classroom voltmeter?

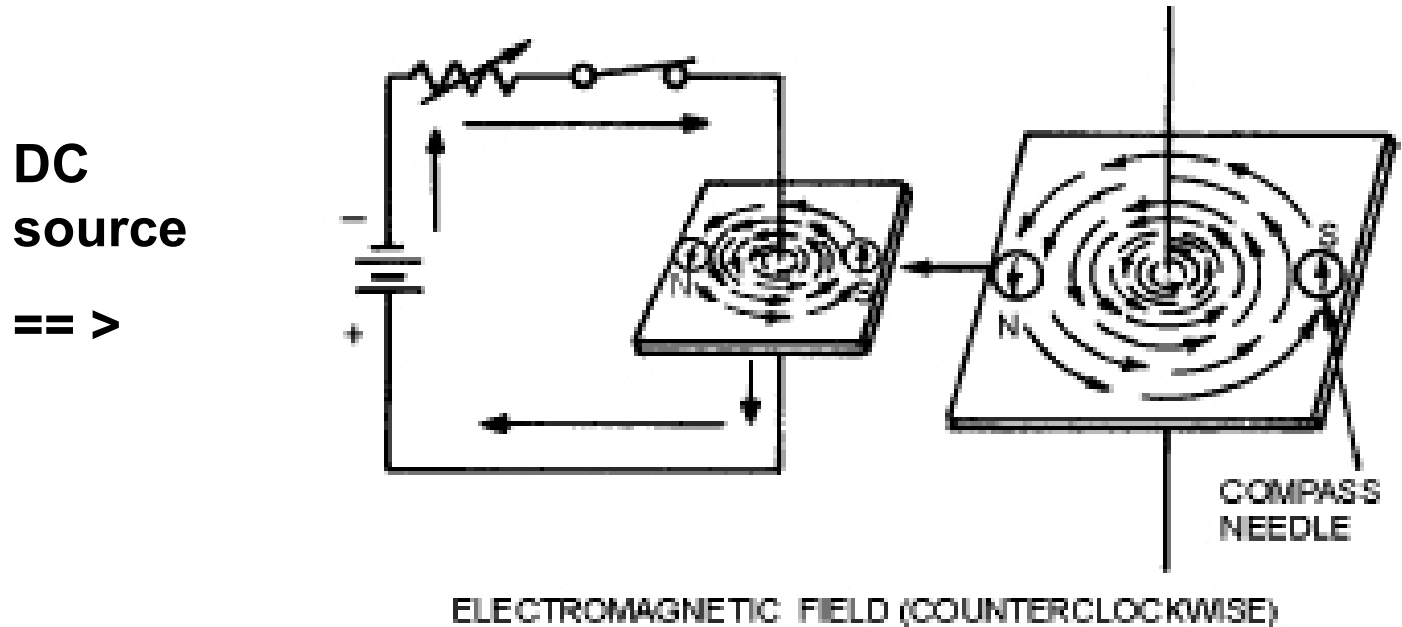
Recall the water wheel analogy



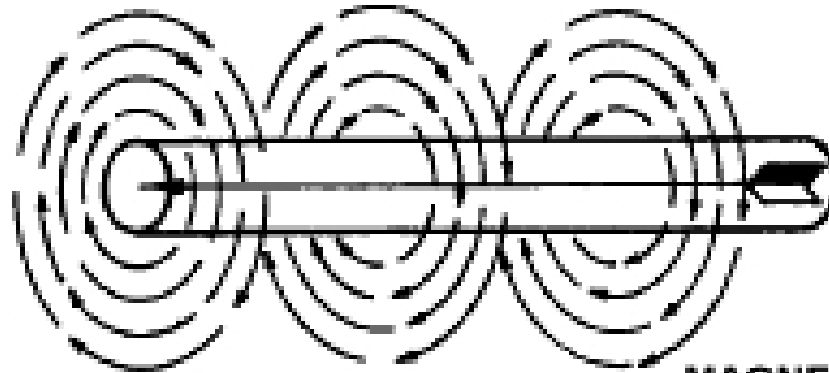
Magnetic fields surround DC conductors



Magnetic fields “reverse” as the polarity of a DC source flips



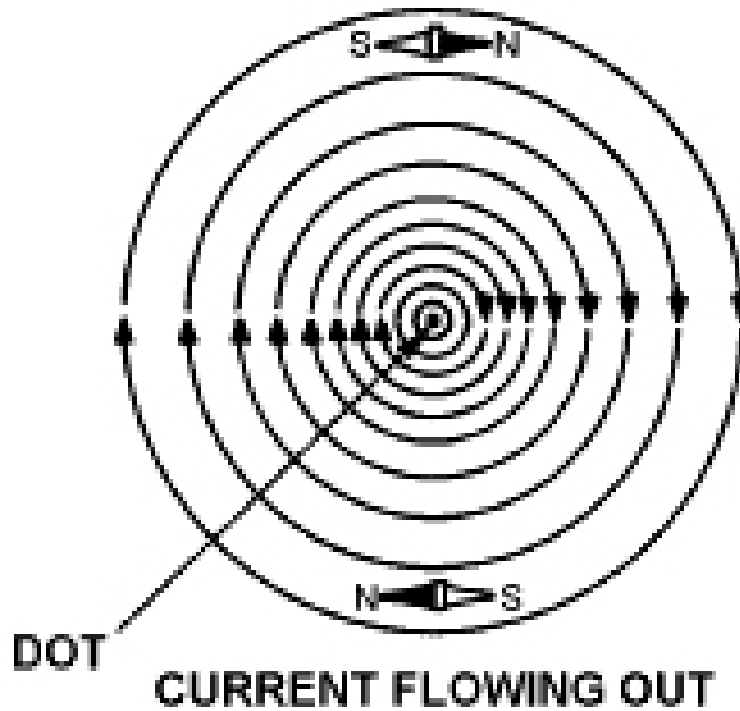
Symbols help visualize these invisible fields



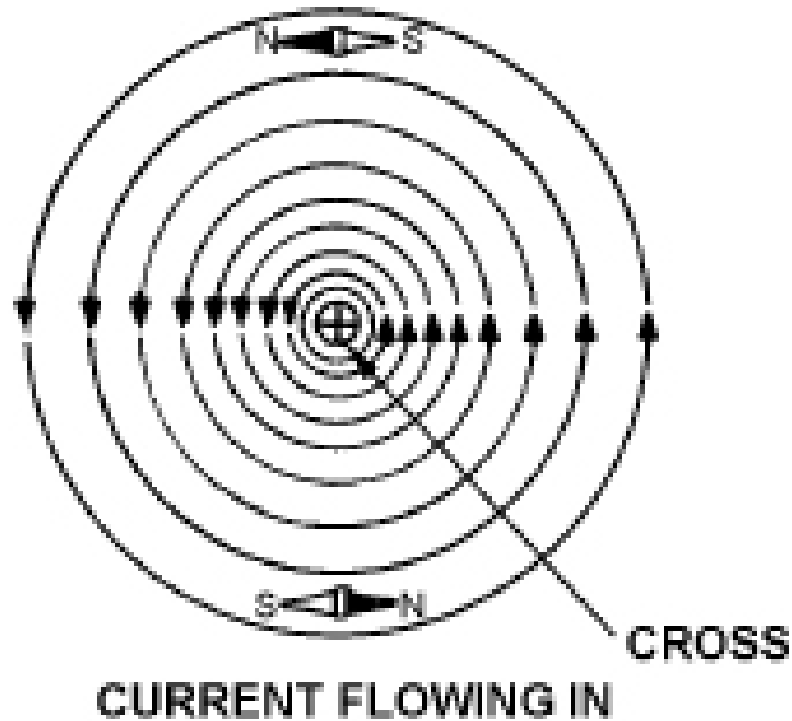
Note the
feathered
arrow
symbol

MAGNETIC
FIELDS ARE
PERPENDICULAR
TO CONDUCTOR

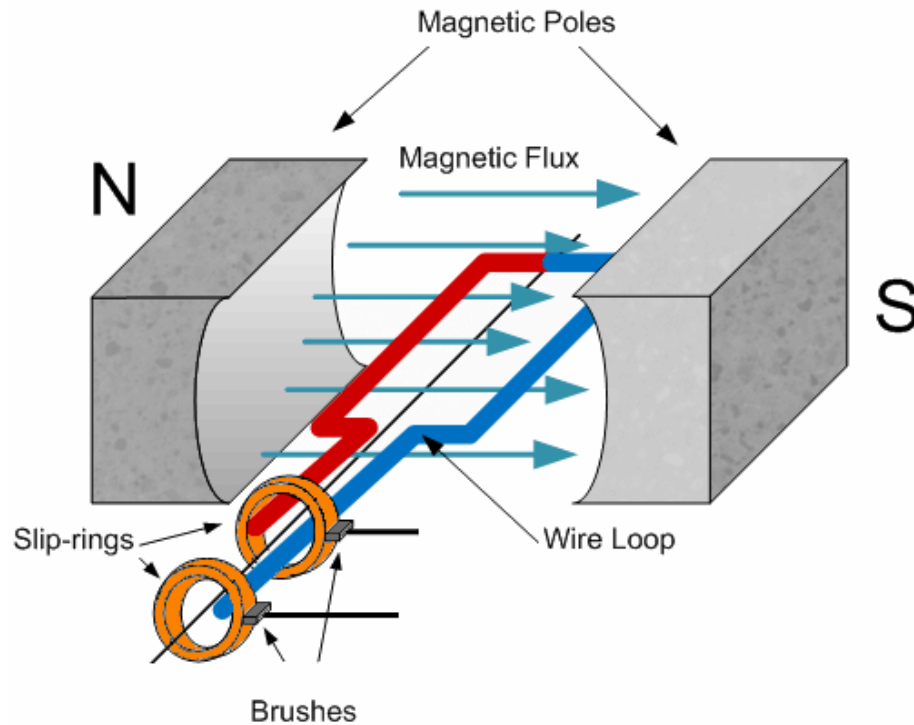
Consider the dot as the head of a conceptual arrow as it flies towards you!



Think of the cross as the tail feather of the arrow as it flies away from you.

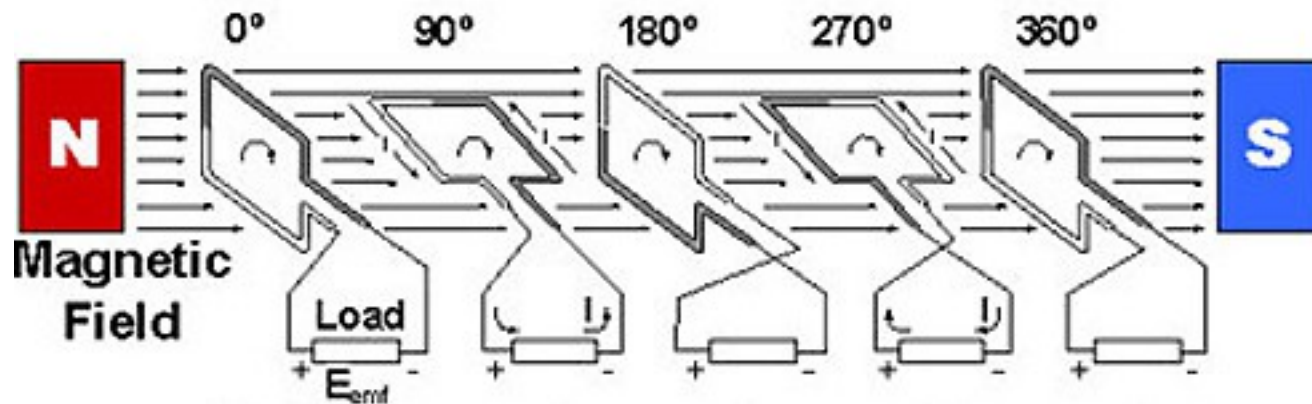


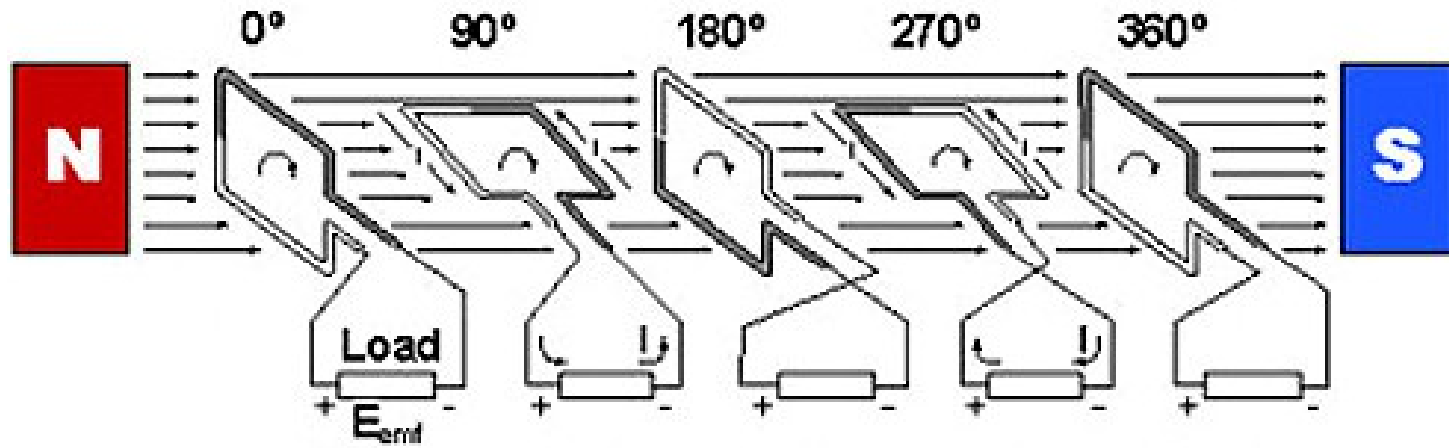
A basic mechanical rotating generator



Consider a single conductor rotating in a fixed magnetic field

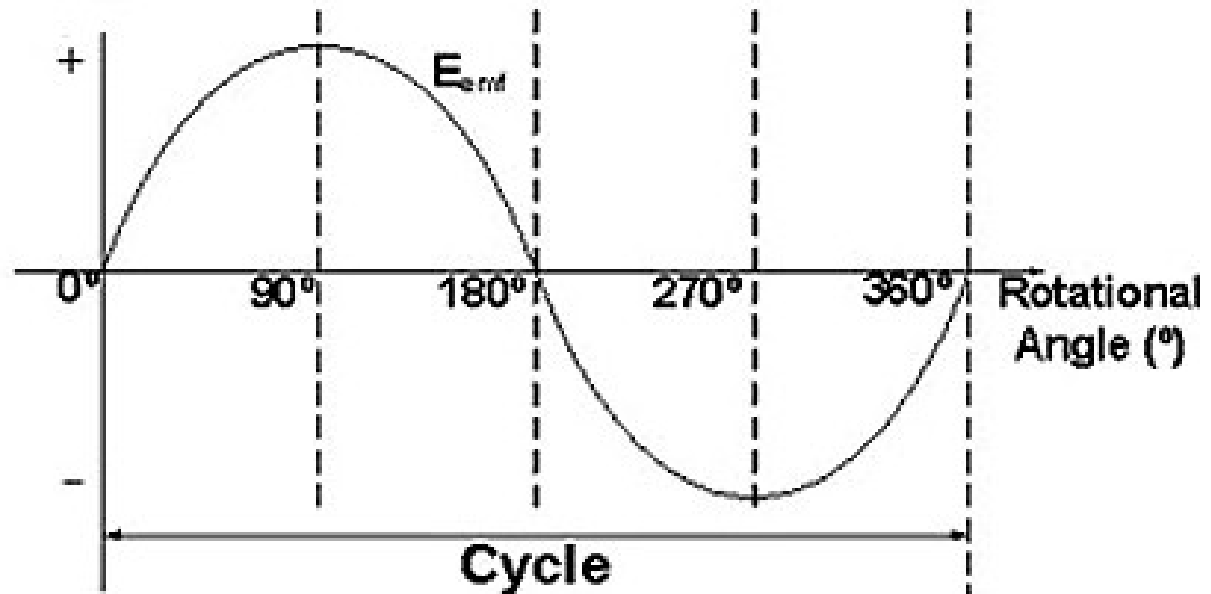
Coil Positions During Rotation



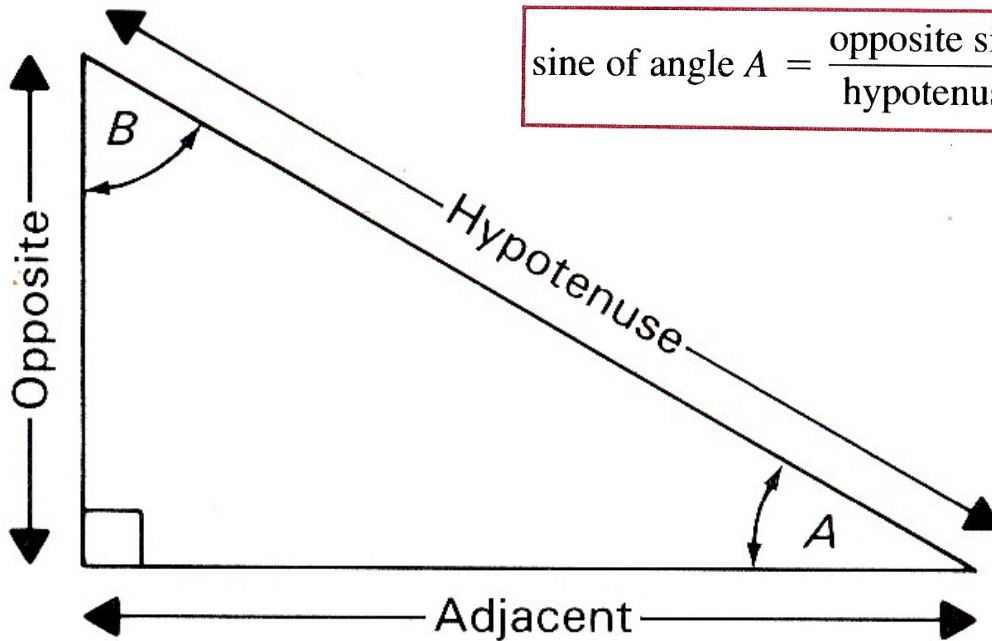


Here is the resulting “waveform”

== >



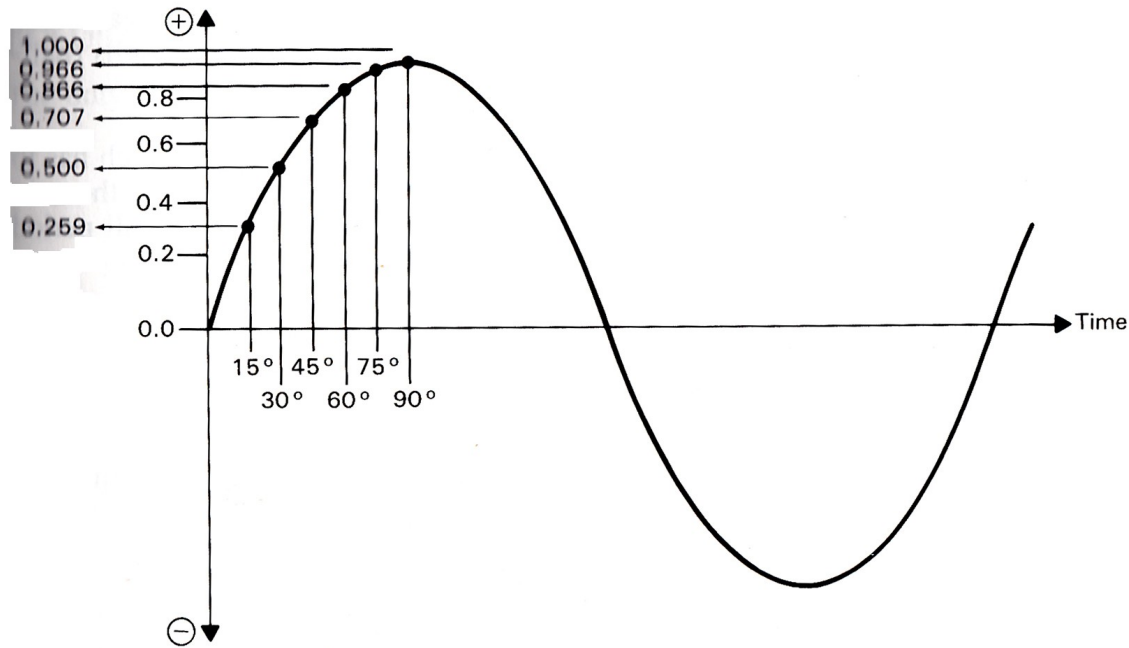
Simple trig and the *Right Triangle*



$$\text{sine of angle } A = \frac{\text{opposite side}}{\text{hypotenuse}}$$

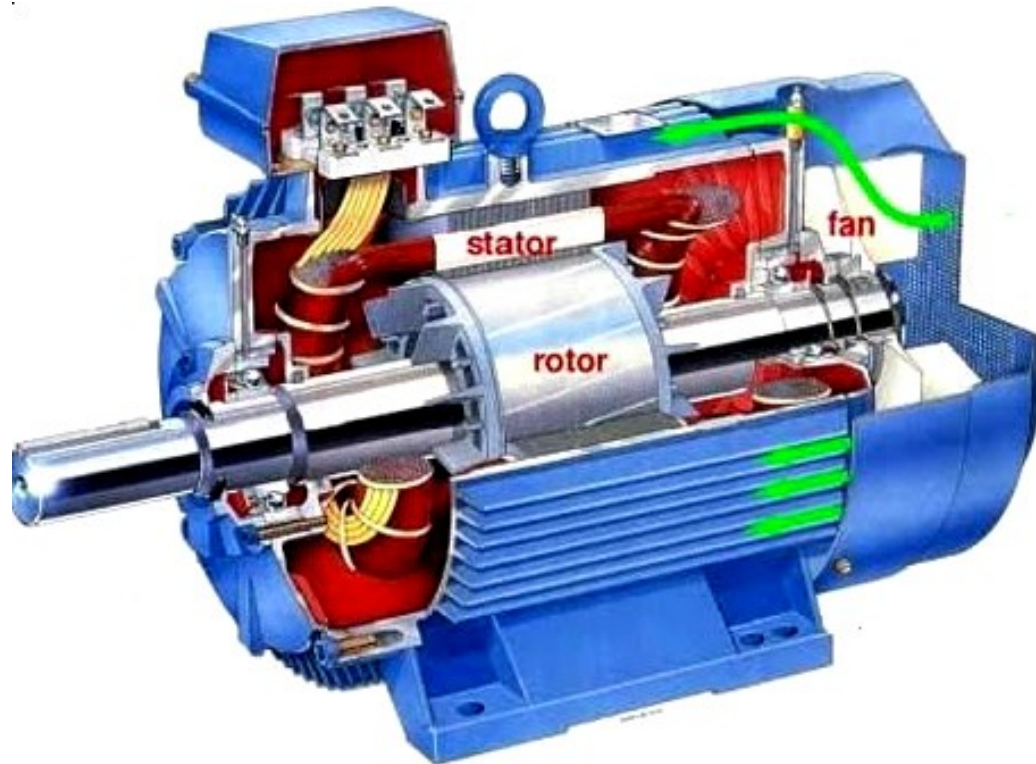
Angle	Sine
0°	0.000
15	0.259
30	0.500
45	0.707
60	0.866
75	0.966
90	1.000

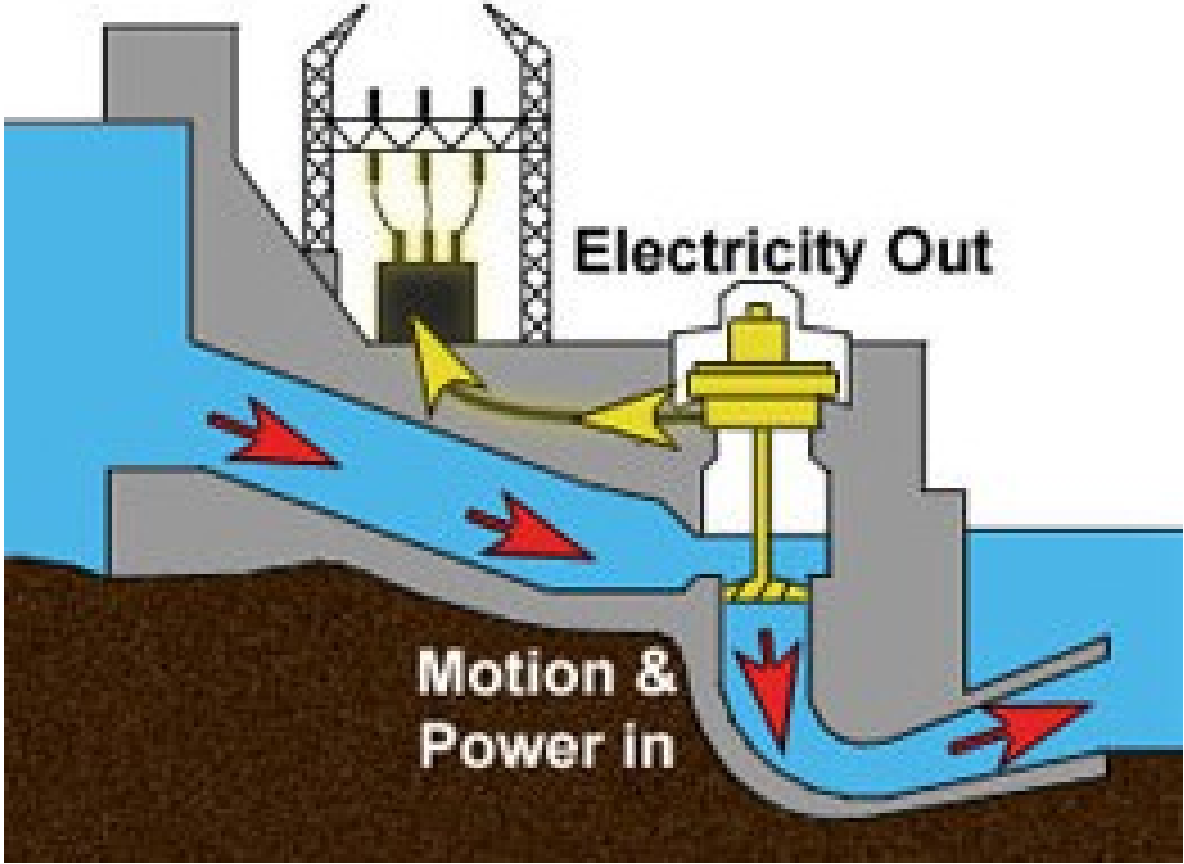
The sine of the angle reveals the amplitude, or voltage, of the wave at any instant in time



This is a *single cycle* of what's called a *sine wave*

An actual mechanical AC generator might look like this:





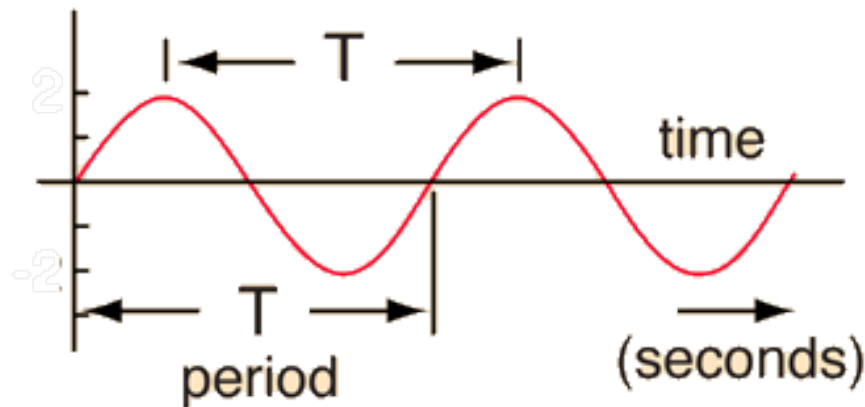
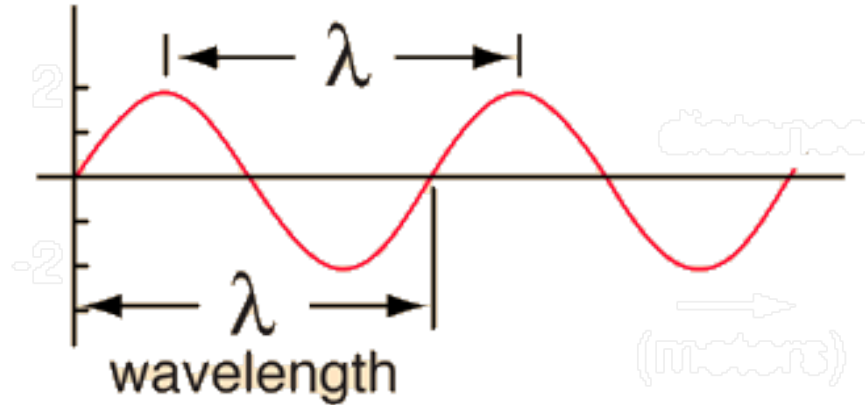
Sine waves can also be delivered electronically by bench instruments called *signal generators*



Alternating current (AC) waveforms are also generated by Amateur Radio transmitters



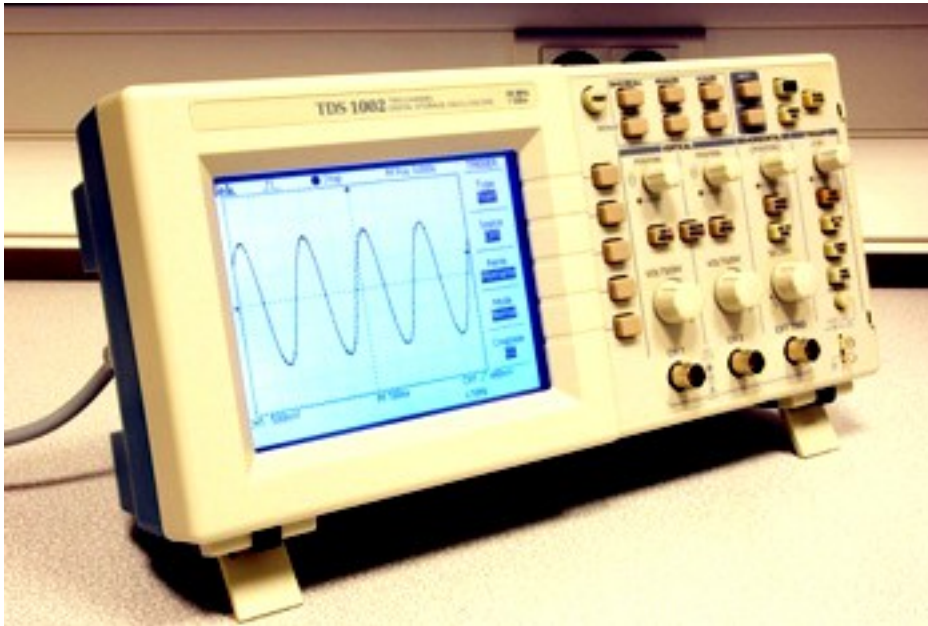
This is the relationship between a wave's period and frequency



$$f = \frac{1}{T} \quad f = \text{frequency}$$

$$T = \frac{1}{f} \quad T = \text{period}$$

**AC waveforms can be displayed on
bench instruments called
*oscilloscopes***



**A “scope” can
visually reveal
a wave’s
period and/or
its frequency**

**Let's finish
up with those
concepts for
now.**

**More to
come about
AC, so stay
tuned!**



Thank you and 73 DE AI2Q, Alex