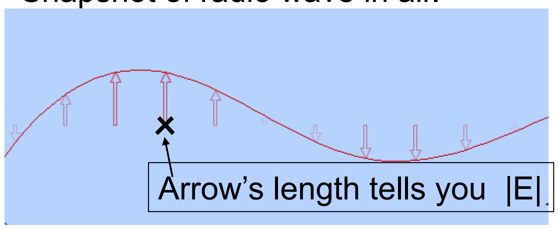
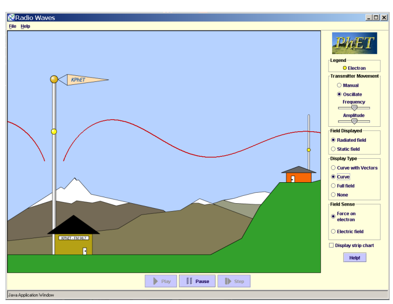
Snapshot of radio wave in air.



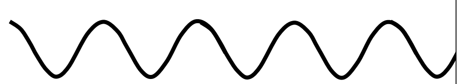
What is <u>physically</u> moving up and down in space as radio wave passes?

a. electric field
b. electrons
c. air molecules
d. light ray
e. nothing

EM radiation often represented by a sinusoidal curve.



OR

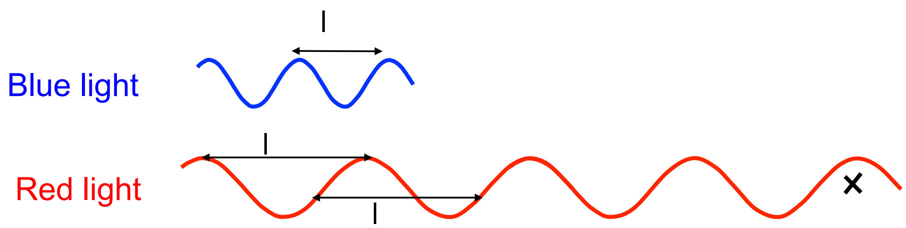


What does the curve tell you?

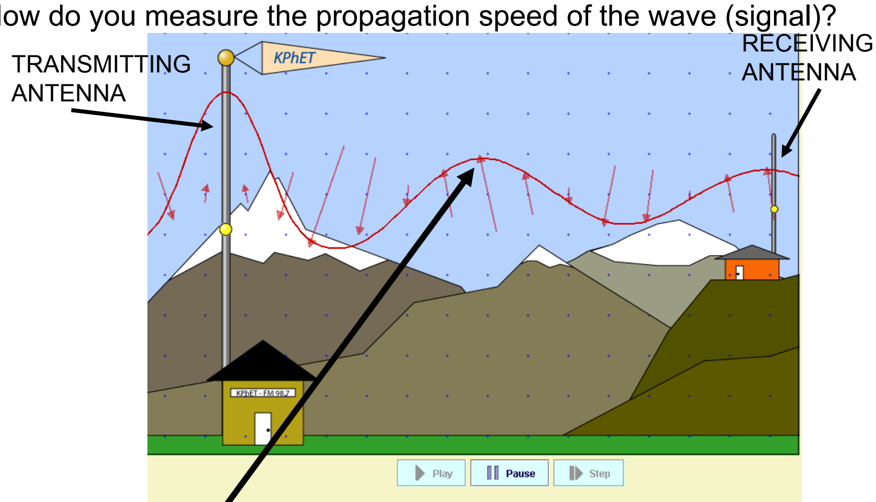
a. The spatial extent of the E-field. At the peaks and troughs the E-field is covering a larger extent in space
b. The E-field's direction and strength along the center line of the curve
c. The path that the light travels
d. more than one of these
e. none of these.

Electromagnetic Spectrum

Spectrum: All EM waves. Complete range of wavelengths.

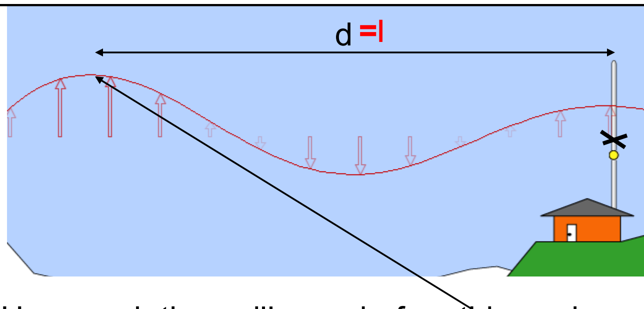


How do you measure the propagation speed of the wave (signal)?



The speed of the wave (signal) is measured as…

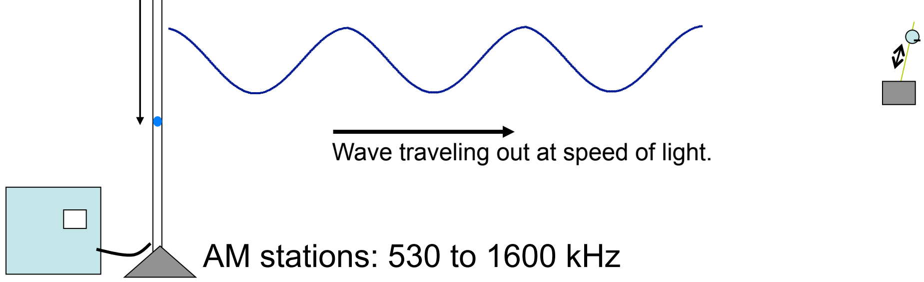
a. how fast this peak moves towards antenna.
b. how fast this peak moves up and down.
c. both a and b



How much time will pass before this peak reaches antenna?
c=speed of light

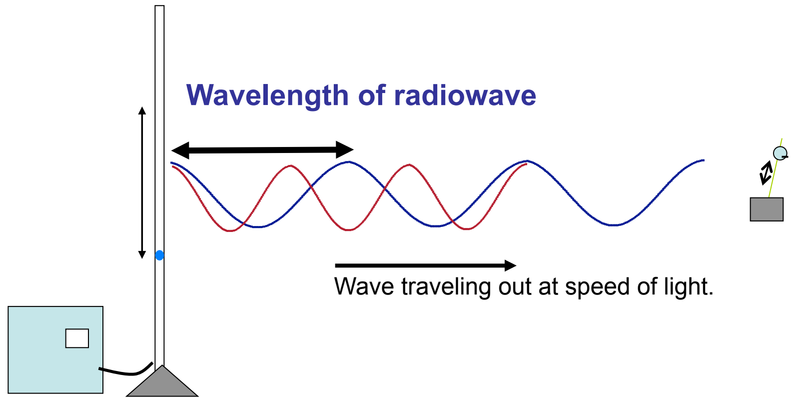
a. cd b. c/d c. d/c
d. sin(cd) e. none of the above

To broadcast radiowaves:
Electrons oscillate up and down in antenna
(a rapidly oscillating electric current)



AM stations: 530 to 1600 kHz

(530 kHz means 530,000 cyles per sec:
530,000 complete oscillations of electron up and down/sec)



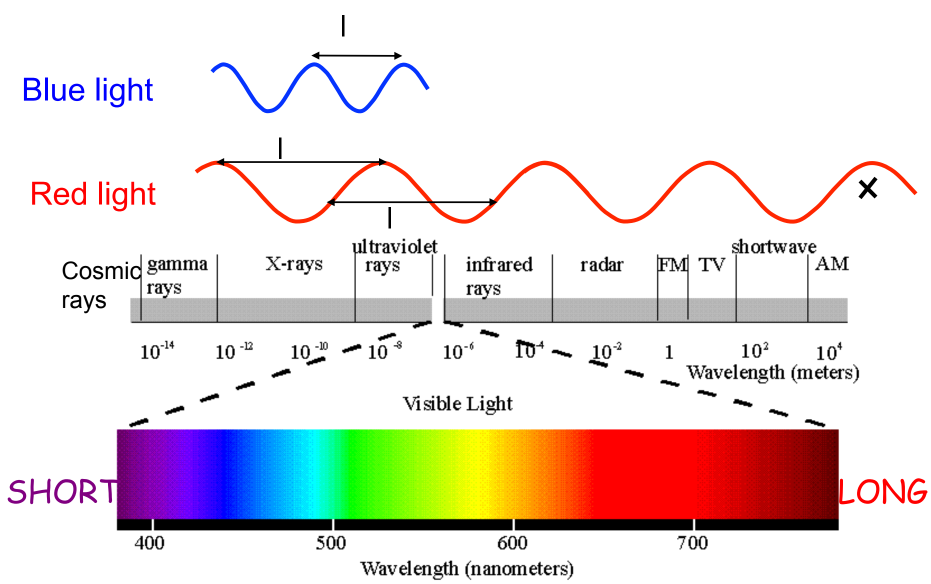
If electrons oscillate up and down transmitting antenna more times per second (higher frequency), the wavelength of the radio wave will:

a. Increase b. Decrease c. Stay the same.

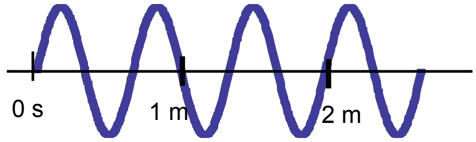
$$f \times \lambda = c = 3 \times 10^{8}\,\mathrm{m/s}$$

Electromagnetic Spectrum

Spectrum: All EM waves. Complete range of wavelengths.

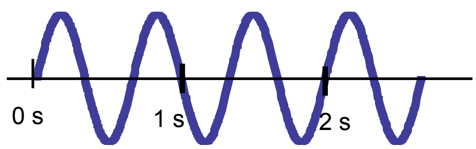


The graph shows E as a function of *position* (at a fixed moment in time, it's a "snapshot"). What is the *wavelength* of this wave?



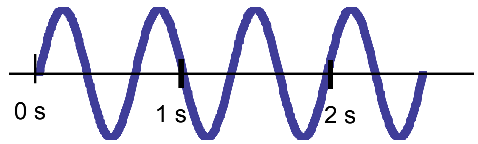
A) 0.33 m B) .67 m
D) 1.0 m D) 1.5 m
E) None of these/not enough information!

The graph shows E as a function of time. What is the *period* of this wave?

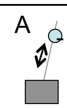


A) 0.33 sec B) .67 sec
D) 1.0 sec D) 1.5 sec
E) None of these/not enough information!

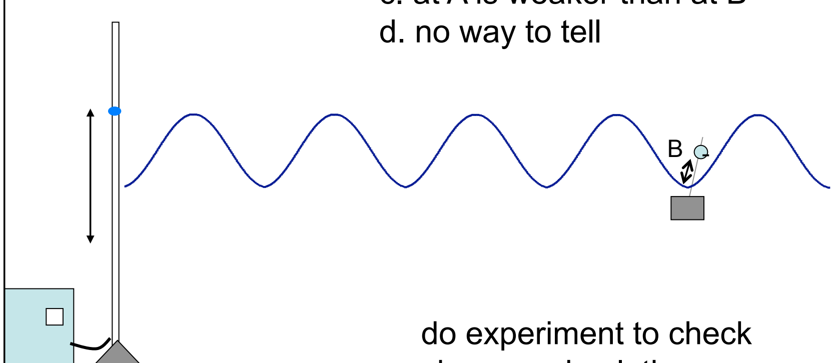
The graph shows E as a function of time.
What is the *frequency* of this wave?



A) 0.33 Hz B) .67 Hz
D) 1.0 Hz D) 1.5 Hz
E) None of these/not enough information!



signal strength (electric force field)
a. at A is stronger than at B
b. at A is same as at B
c. at A is weaker than at B
d. no way to tell



do experiment to check
show on simulation.

A radio transmitter has a vertical antenna.
Which is best for the receiving antenna?

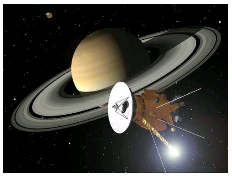
A) It should also be vertical
B) It should be horizontal
C) Makes absolutely no difference

Same question, but for the case where you are using a "loop" antenna?

Note: Loop antennas use the Faraday effect: a changing B field through the loop induces an EMF (which makes currents flow)

NASA's Cassini probe orbits Saturn, and radios earth at a frequency of 8 GHz (8 x 10^9 Hz). If Cassini doubles the frequency to 16 GHz, the time required for the radio signal to travel from Cassini to Earth will

A) Increase
B) Decrease
C) Remain constant
D) Not enough info



A radio wave of wavelength 2 meters passes by a person with a radio receiver. E and B go up and down as the wave travels past.
After 1 second, the number of waves that moved past the person is:

A) 1 wave
B) 3E8 waves
C) 1.5E8 waves
D) 6E8 waves
E) None of these!

A radio wave of λ =20 m passes by a person with a radio receiver. Later, a new radio wave passes the person. She observes that E and B oscillate 10x faster than the original wave. What is the best conclusion?

A) Second wave has λ=0.2 m
B) Second wave has λ =20 m
C) Second wave travels 10x faster
D) Second wave has 1/10 the frequency
E) None of these!

If the wavelength of the wave is doubled, what happens to the wave speed v_{wave}?

A)it doubles
B) it halves
C) it stays the same

”Concert A" corresponds to a frequency of 440 Hz. Does that mean that a flute playing concert A is emitting low frequency (440 Hz) electromagnetic radiation which we "hear"?

A) Yes, sound is one form of electromagnetic wave.
B) No, sound is not an electromagnetic wave.

The graph below shows a snapshot of a wave on a string which is traveling to the right. There is a bit of paint on the string at point P.
At the instant shown, the velocity of paint point P has which direction?