Name: Date: Pd: 5

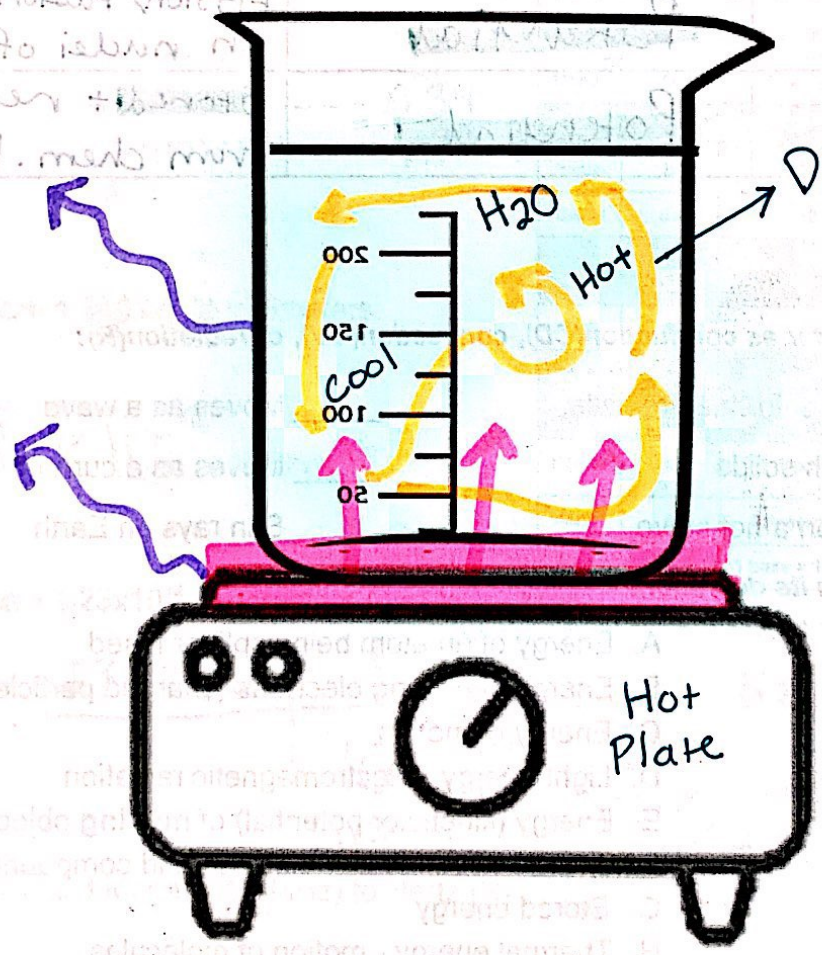
Unit 3, Section 1 - Energy Forms and Electromagnetic Radiation - HONORS

Energy Transfer:

Energy transfer (High E to Low E) is the process in which energy is transferred from an object to another. This process can be broken down into three different methods: conduction, convection, and radiation. Conduction is the first method of which energy is directly transferred from one object to another. The second method, Convection, is when energy is transferred due to the presence and movement of fluids or gases. The third method, radiation, is the process in which energy is transferred through waves, or more specifically electromagnetic waves. It is important to note that this method of energy transfer **does not** require the objects to be in direct contact.

* Law of Conservation of Energy (Mass)

Label and color the diagram below to show conduction, convection, and radiation:



Driven by temperature based density (High T = Low D = Rise, Low T = High D = Sink)

Types of Energy:

Kinetic Energy	Potential Energy
Motion	Stored / Position

Forms of Energy:

Energy Form	Type of Energy (Kinetic or Potential)	Description
Electrical	Kinetic	Flow of moving e^-
Thermal	Kinetic	Temperature; Heat transfer
Radiant	Kinetic	Electromagnetic radiation; Light
Mechanical	K/P	Stored or released by machines
Nuclear	Potential	Fission/Fusion; stored in nuclei of atoms
Chemical	Potential	Stored + released from chem. bonds

Practice:

Identify the type of heat transfer as conduction(CD), convection(CV), or radiation(R):

R The heat you feel from a fireplace

CD Transfer through solids

CD A pan heating on a hot stove

R Moves as a wave

CV Moves as a current

R Sun rays on Earth

Match the form of energy with its definition.

1. H Heat
2. A Nuclear
3. D Radiant
4. E Mechanical
5. F Chemical
6. B Electrical
7. G Potential
8. C Kinetic

A. Energy of an atom being split or fused
B. Energy of moving electrons (charged particles)
C. Energy of motion
D. Light energy - electromagnetic radiation
E. Energy (kinetic or potential) of **moving** objects
F. Energy of bonds in molecules and compounds
G. Stored energy
H. Thermal energy - motion of molecules

Electromagnetic Radiation (Light) (Radiant Energy):

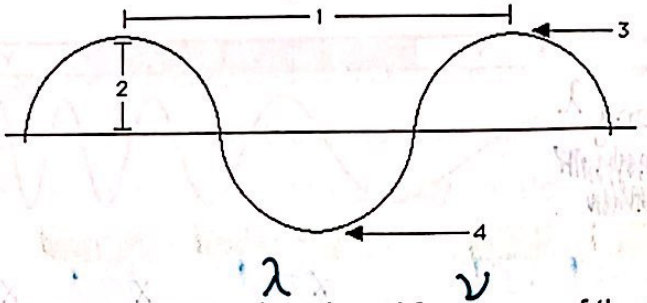
As a form of energy, light (electromagnetic radiation) travels in waves through the environment. Below are the parts of a wave:

1- Wavelength (λ)

2- Amplitude (brightness)

3- Crest

4- Trough



Energy of a wave can be identified in two easy ways: wavelength and frequency of the wave. Wavelength is a measurement of the distance from crest to crest on two consecutive waves and is often measured in meters or nanometers. Frequency refers to the number of waves that pass a point per second, measured in Hertz (Hz). → (waves per sec)

Let's practice some metric conversions!

- Convert from 34 cm to meters:

$$\frac{34 \text{ centimeters (cm)}}{1 \text{ centimeters (cm)}} \left| \frac{(1) \text{ 0.01 meters (m)}}{(100)} \right. = 0.34 \text{ m}$$

- Convert from 1,340 km to millimeters:

1.34×10^{9} mm

- Convert from 1.23×10^{14} nanometers (nm) to meters:

$$\frac{1.23 \times 10^{14} \text{ nm}}{10^{9} \text{ nm}} \left| \frac{1 \text{ m}}{(1)} \right. = 123{,}000 \text{ m} \text{ or } 1.23 \times 10^{5} \text{ m}$$

(10^{-9}) (1 billion)

- Convert from 2.3 Megahertz (MHz) to Hertz (Hz):

2.3×10^{6} Hz

Common Prefixes Used with SI Units			
Prefix	Symbol	Conversion Factor to Base Unit	Order of Magnitude
Giga-	G	1,000,000,000 base = 1 Giga	10^{9}
Mega-	M	1,000,000 base = 1 Mega	10^{6}
kilo-	k	1,000 base = 1 kilo	10^{3}
hecto	h	100 base = 1 hecto	10^{2}
deka-	da	10 base = 1 deka	10^{1}
	Base Unit	1 base	10^{0}
deci-	d	1 base = 10 deci	10^{-1}
centi-	c	1 base = 100 centi	10^{-2}
milli-	m	1 base = 1,000 milli	10^{-3}
micro-	μ	1 base = 1,000,000 micro	10^{-6} (0.0001)
nano-	n	1 base = 1,000,000,000 nano	10^{-9}
pico-	p	1 base = 1,000,000,000,000 pico	10^{-12}

Base = m, L, g, Hz, bytes

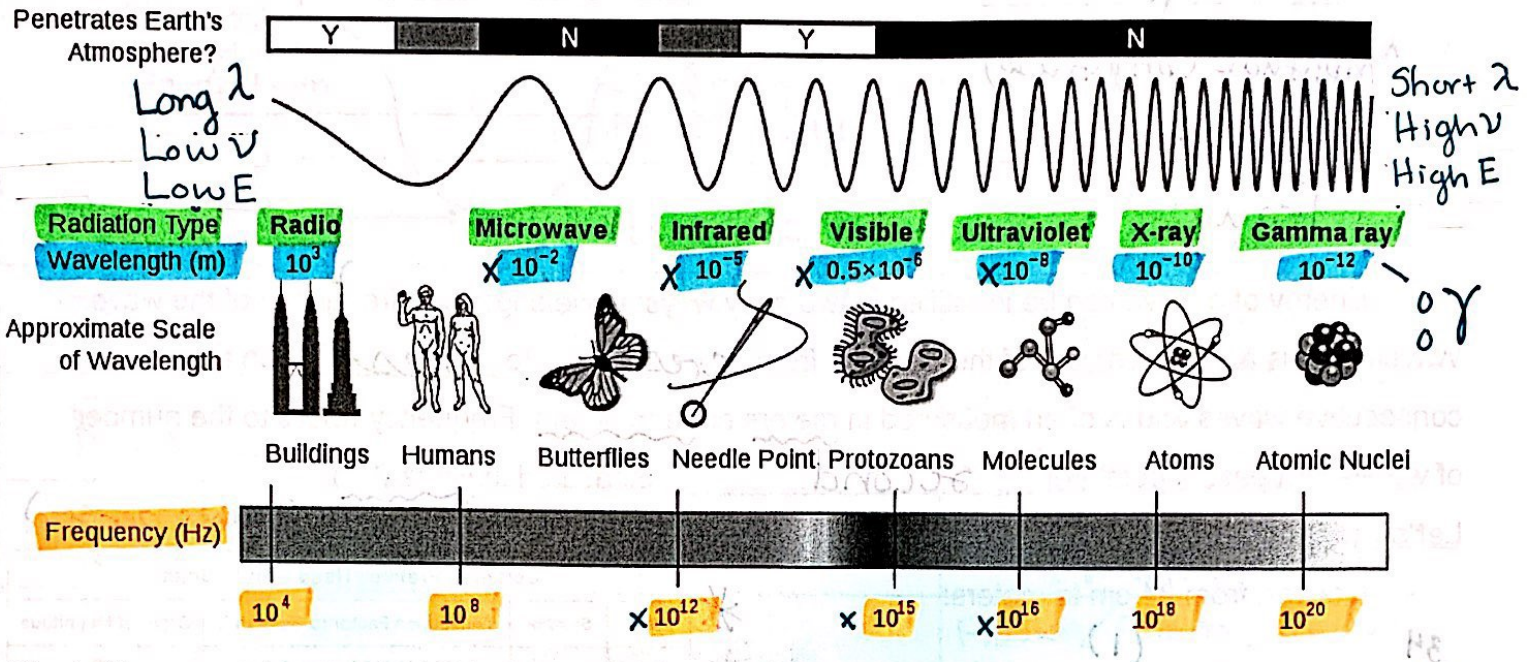
- meter

base = 1 prefix unit

Electromagnetic Spectrum:

The electromagnetic spectrum is the full spectrum of all light energy. The spectrum is designed based on decreasing wavelength λ and increasing frequency ν. The shorter the wavelength, the greater the energy of the wave.

E



Circle the correct answer for the statements/questions below:

1. The waves to the RIGHT on the spectrum are at a (**higher energy** / **lower energy**) than the waves to the left.
2. Which of the following energies has the LONGER wavelength? (**Radio**) or **Infrared**
3. Which of the following energies has the SHORTER wavelength? (**X-Ray**) or **Microwave**

Match the following wavelengths/frequencies of light with their correct type of radiation:

1. Wavelength of 1.0 x 10^{-5} meters (m) = Infrared
2. Wavelength of 9.43 x 10^{-10} meters (m) = _____
3. Frequency of 1.22 x 10^{5} meters (m) = Radio
4. Frequency of 5.4 x 10^{15} meters (m) = _____

Now, let's put it all together. Convert the following, then identify the correct type of radiation:

1. 49 nanometers (nm) = _____ meters (m) - _____
2. 0.0032 nanometers (nm) = _____ meters (m) - _____