Honors Chemistry
Ms. Ye

Name _____
Date _____Block _____

Average Atomic Mass Practice:

1. Argon has three naturally occurring isotopes: argon-36, argon-38, and argon-40. Based on argon's reported atomic mass, which isotope do you think is the most abundant in nature? Explain.

2. Calculate the atomic mass of silicon. The three silicon isotopes have atomic masses and relative abundances of 27.9769 amu (92.2297%), 28.9765 amu (4.6832%) and 29.9738 amu (3.0872%).

3. Calculate the atomic mass of lead. The four lead isotopes have atomic masses and relative abundances of 203.973 amu (1.4%), 205.974 amu (24.1%), 206.976 amu (22.1%) and 207.977 amu (52.4%).

Given the atomic masses and average atomic mass, find the percent abundance of each isotope:

4. Antimony has two naturally occurring isotopes. The mass of antimony-121 is 120.904 amu and the mass of antimony-123 is 122.904 amu. Using the average mass from the periodic table, find the abundance of each isotope.

5. There are 2 isotopes of copper that occur naturally; ^{63}Cu and ^{65}Cu. The ^{63}Cu atoms have a mass of 62.929601 amu and the ^{65}Cu atoms have a mass of 64.927794 amu. Using the average mass from the periodic table, What is the percent natural abundance for each isotope?

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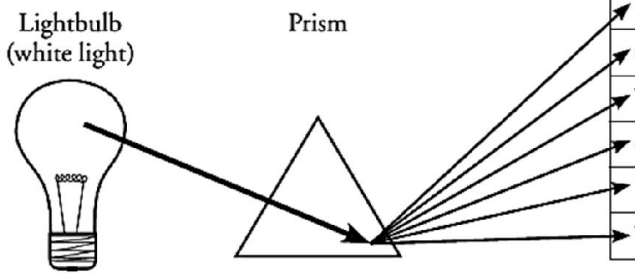
From fireworks to stars, the color of light is useful in finding out what's in matter. The emission of light by hydrogen and other atoms has played a key role in understanding the electronic structure of atoms. Trace materials, such as evidence from a crime scene, lead in paint or mercury in drinking water, can be identified by heating or burning the materials and examining the color(s) of light given off in the form of bright-line spectra.

Model 1 – White Light



Color	Photon Energy ($\times 10^{-21}$) (J)	Wavelength Range (nm)	Speed (m/s)
Reds	269–318	625–740	3.00×10^8
Oranges	318–337	590–625	3.00×10^8
Yellows	337–352	565–590	3.00×10^8
Greens	352–382	520–565	3.00×10^8
Blues	382–452	440–520	3.00×10^8
Violets	452–523	380–440	3.00×10^8

1. What happens to white light when it passes through a prism?

2. Do all colors of light travel at the same speed?

3. Do all colors of light have the same energy? If no, which colors have the highest energy and the least energy, respectively?

4. Consider the light illustrated in Model 1.
   a. Which color corresponds to the longest wavelengths?

   b. Which color corresponds to the shortest wavelengths?

   c. Describe the relationship (direct/inverse) between wavelength and energy of light.

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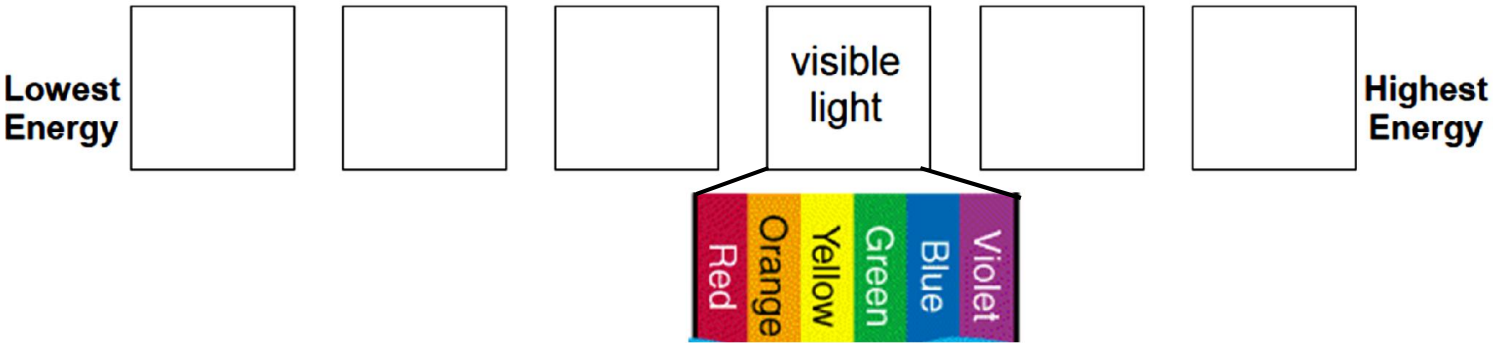
Electromagnetic Radiation

- a form of _____that has wavelike properties
- all forms found in the _____spectrum
- The different forms of EMR arranged in order from lowest energy to highest energy



Examples of Electromagnetic Radiation:

Type of EMR	Real-life example
Radio waves	
Microwaves	
Infrared	
Visible light	
Ultraviolet (UV) light	
X-rays	

Examples of Waves

All EMR waves move following a specific pattern, but the energies and characteristics associated with the waves can vary

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Determining Characteristics of a Wave

1. Have two people sit apart from each other in a straight line, each holding an end of a slinky
2. One person should hold the end of the slinky perfectly still. The other person should start moving the end of the slinky back and forth so that you start creating a wave pattern.

   Ex: 

For questions 3-5: try to move the slinky back and forth at a constant speed so that your waves are approximately the same size for these responses.

3. Measure the height of your wave. This is the **amplitude** of the wave _____

4. You may notice that you are creating a repeating pattern (several waves). Measure the size of just ONE wave. This is your **wavelength**. _____

   One Wave =  or 

5. Use a timer to measure how many waves you can create (how many times your hand swings back and forth) in 10 seconds. This is the **frequency** of your wave. _____

Move the slinky back and forth at a quicker speed than you were above. Keep up this new, quicker speed to answer the following questions

6. You may notice that you are creating a repeating pattern (several waves). Measure the size of just ONE wave. This is your **wavelength**. _____

7. Use a timer to measure how many waves you can create (how many times your hand swings back and forth) in 10 seconds. This is the **frequency** of your wave. _____

Summary:

1. Compare responses #4 and #6 (wavelength).
   a. For which case were you putting more energy into making the wave?

   b. What is the relationship between amount of energy and wavelength?

2. Compare responses #5 and #7 (frequency).
   a. For which case were you putting more energy into making the waves?

   b. What is the relationship between amount of energy and frequency?

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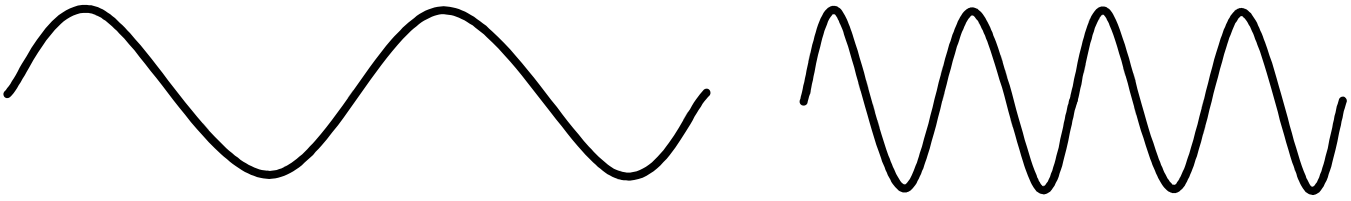
Energy, Wavelength, and Frequency: Qualitative Comparisons:

1.



WAVE A **WAVE B**

- Wave B has a _____ frequency than wave A.
- Wave B has a _____ wavelength than wave A.
- Wave B has a _____ energy than wave A.

2. When comparing the radio stations 96.7 MHz and 92.3 MHz
   a. Which one has a higher energy?

   b. Which one has a longer wavelength?

3. Red light has a longer wavelength than blue light
   a. Which color light has a higher energy associated with it?

   b. Which color light is emitted at a higher frequency?

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Photons

- Released during _____.
- Tiny particles that have no _____ which carry a quantum of _____
- All photons travel at the _____ in a vacuum (c = 3.00 x 10^8 m/s)
- Can calculate wavelength if we know frequency and vice versa.
- Photons behave as particles
  - Quantum – the _____ amount of energy that can be absorbed or released from an atom. Cannot be any value but are in discrete energy levels

ENERGY EQUATIONS

$E = h\nu$ $\quad$ $c = \nu\lambda$

$$E = \frac{hc}{\lambda}$$

E= energy
h= Planck's Constant = 6.626 x 10^{-34} J*s
c= speed of light = 3.00 x 10^8 m/s
ν= frequency (in Hz or 1/sec)
λ=wavelength in meters

EXAMPLES:

1. What is the frequency of green light, which has a wavelength of 4.9 x 10^{-7} m?

2. A popular radio station broadcasts with a frequency of 94.6 MHz (= 94,600,000 Hz). What is the wavelength of the broadcast?

3. What is the energy of an infrared wave with the frequency of 2.56 x 10^{11} s^{-1}?

4. What is the energy of an x-ray which has a wavelength of 2.4 x 10^{-10} m?

5. The energy of a wave is 1.98 x 10^{-20} J. What is the wavelength and the type of wave?