Chemistry
Ms. Ye

Name _____
Date _____Block_____

Do Now: Bohr Diagram, Lewis Structures, Valence Electrons

1. What is the maximum number of electrons you can fit in each shell?

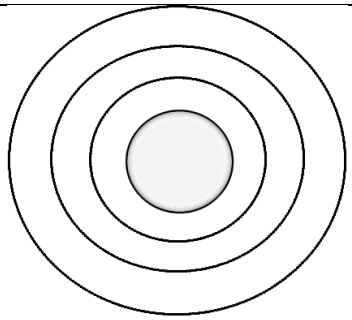
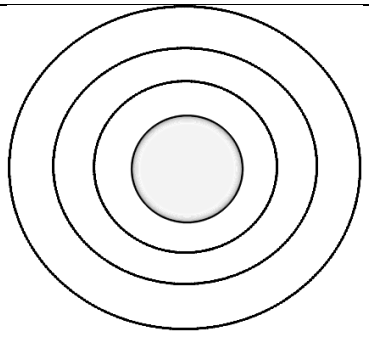
   1st shell _____ 2nd shell _____ 3rd shell _____ 4th shell _____

2. What are valence electrons?

3. What is the main difference between a Bohr diagram and a Lewis structure?

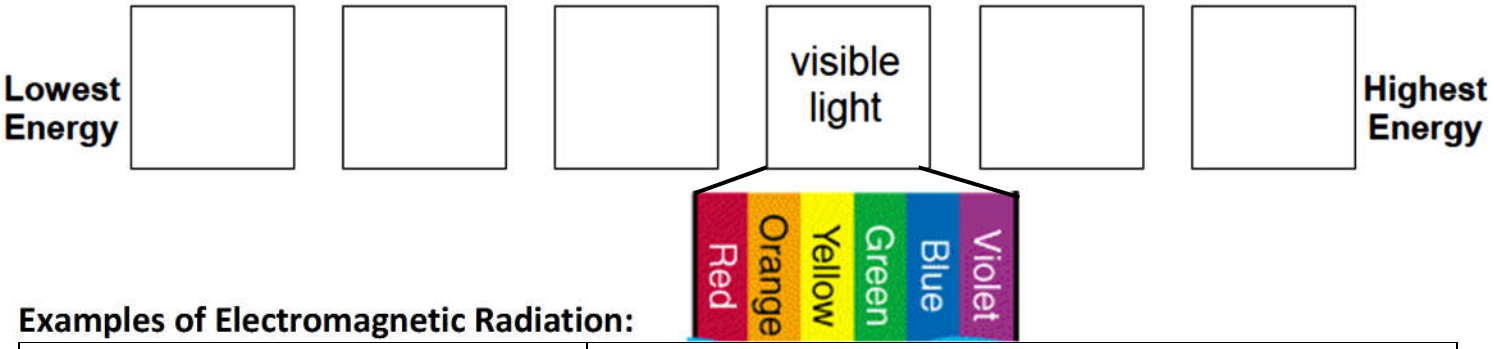
4. What is the maximum number of valence electrons an atom can have?

Complete the Table Below:

Element	Subatomic Particles	Bohr Diagram	# Valence Electrons	Lewis Structure
Phosphorus-31	# protons= # neutrons= # electrons=			
Fluorine-19	# protons= # neutrons= # electrons=			

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

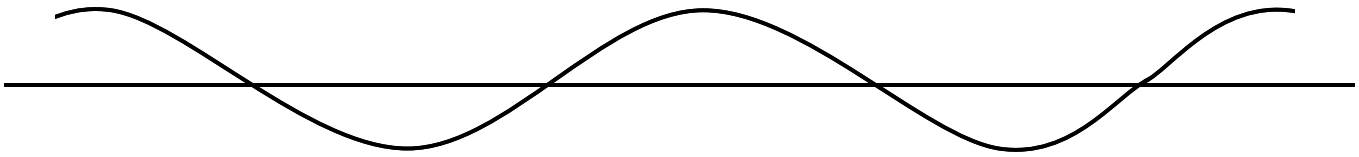


Examples of Electromagnetic Radiation:

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

Properties of Waves

i. _____ and _____ are two important properties of waves.



ii. _____ - The shortest distance between two equivalent points (meters)

iii. _____ - How many waves pass a certain point per second (1/s or s^{-} or Hz).

iv. _____ - The height of a wave from crest to origin.

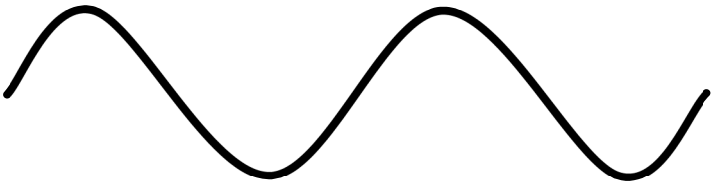
v. What kind of relationship do frequency and wavelength have?

vi. What kind of relationship do frequency and Energy have?

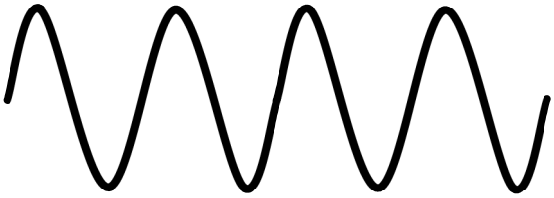
vii. What kind of relationship do energy and wavelength have?

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? How do you know?

   b. Which one has a longer wavelength? How do you know?

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

   b. Which color light is emitted at a higher frequency? How do you know?

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= 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

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

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?

Electrons and Energy Levels

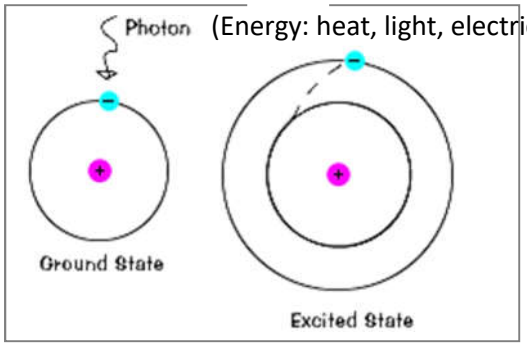
- Each electron has a distinct amount of _____ related to the energy level (shell) it is in
- Electrons with the **lowest energy** are found in the shell _____
- Electrons with the **highest energy** are found in the shell _____
- The _____ from the nucleus, the _____ of the electron

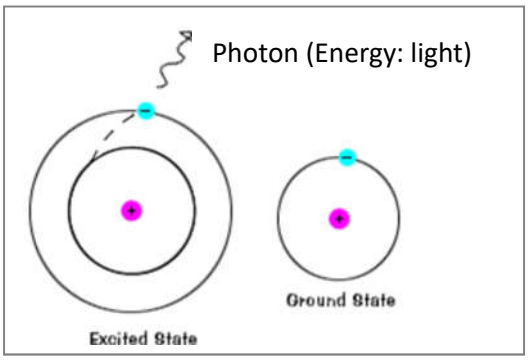
How many electrons can each energy level (electron shell) hold?

Electron Shell	# of electrons
n=1	
n=2	
n=3	
n=4	

Ground State vs. Excited State

- **Ground state**=when the electrons occupy the _____
- **Excited state**=electrons are _____ (even when a lower energy levels is not completely full)
- When an electron _____, it jumps to a _____ energy level or shell
  - This is a very _____ condition
  - We call this condition the _____
- Very rapidly, an electron in the excited state will _____ and move back to a _____ energy level or shell
  - When excited electrons fall from an excited state to a lower energy level, they release energy in the form of _____ (which can be infrared, ultraviolet, or visible)





Summary:

Ground State → Excited State	**Excited State → Ground State**
• Energy is _____ • _____ is produced	• Energy is _____ • _____ is produced

Bright Line Emission Spectrum (Visible Light Spectrum)

- Electrons falling from an _____ down to the _____ give off _____ light
- Different elements produce different colors of light or _____
- The atomic emission spectrum is _____ for _____
  (just like a human fingerprint is unique to each person)
- We use spectral lines to identify different elements.

Demo:

Substance	Color

1. Which statement describes how an atom in the ground state becomes excited?
   a) The atom absorbs energy, and one or more electrons move to a higher electron shell
   b) The atom absorbs energy, and one or more electrons move to a lower electron shell
   c) The atom releases energy, and one or more electrons move to a higher electron shell
   d) The atom releases energy, and one or more electrons move to a lower electron shell

2. The light emitted from a flame is produced when electrons in an excited state
   a) Absorb energy as they move to lower energy states
   b) Absorb energy as they move to higher energy states
   c) Release energy as they move to lower energy states
   d) Release energy as they move to higher energy states

Waves & Energy HW: Describe the relationships between ***energy, frequency, and wavelength***

1. What is the relationship between energy and frequency?

2. What is the relationship between energy and wavelength?

3. What is the relationship between frequency and wavelength?

4. In the diagrams below, which wave has the higher frequency? Higher wavelength? Higher energy?

Wave A Wave B

ENERGY EQUATIONS	
$\boldsymbol{E = h\nu}$ $\quad$ $\boldsymbol{c = \nu\lambda}$	**E**= energy
	h= Planck's Constant = 6.626 x 10^{-34} J*s
	c= speed of light = 3.00 x 10^{8} m/s
$\boldsymbol{E = \frac{hc}{\lambda}}$	**ν**= frequency (in Hz or 1/sec)
	λ=wavelength in meters

5. One of the lines in the emission spectrum of sodium has a wavelength of 5.9 x 10^{-7}m. What is the frequency of this line?

6. A radio station broadcasts at a frequency of 9.13×10^{7} Hz. What is the wavelength of this EM wave?

7. Calculate the energy of a gamma ray photon with a frequency of 6.0×10^{22} Hz.

8. When an electron in a hydrogen atom drops from the fifth to the second energy level, 4.58×10^{-19} J of energy is released. Find the frequency of the photon that is produced.

9. Describe the energy changes that happen when an electron transitions between ground and excited state. During which transition to we see light given off?