Name _____ Period _____

LTHS: Chemistry

Unit 3 Review - The Atom

I can identify the contributions that each scientist made to the model of the atom

1. State the experiment (when applicable) and contribution to atomic theory for each of the following scientists (include a diagram for models):

a. Democritus

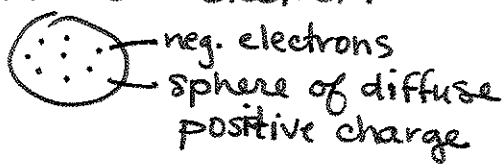
1st scientist to propose idea of atoms.
Called them "atomos"

b. Dalton

Proposed an atomic theory with multiple parts
believed atom was a solid object
"Billiard Ball" model

c. Thomson

performed the cathode ray tube experiment
discovered negative charged particle - electron
"Plum Pudding" model

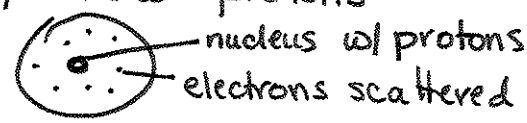


d. Millikan

performed oil drop experiment
determined charge and mass of an electron
- no model -

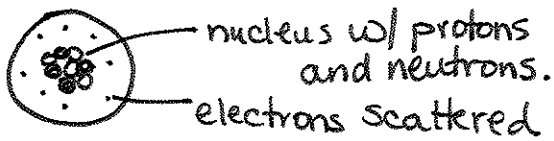
e. Rutherford

performed gold foil experiment
discovered small dense positive center - nucleus
and later individual positive particles - protons



f. Chadwick

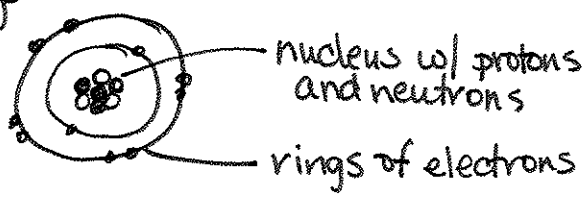
discovered the neutron



g. Bohr

Placed electrons on levels/rings around the nucleus.

"Solar System" model



2. What are the five parts of Dalton's Atomic Theory

- atoms are indivisible
- atoms of the same atom are identical
- atoms of different elements are different
- atoms combine in wndy # ratios to form compounds
- atoms are not created/destroyed in a chemical reaction, only rearranged.

I can determine the protons, neutrons and electrons in an atom

I can identify the difference between atoms, ions and isotopes

3. Name the three subatomic particles and complete the chart below:

Name	Location in the Atom	Symbol	Charge	Relative Mass
proton	nucleus	p^+	+1	~1amu
neutron	nucleus	n	0	~1amu
electron	electron cloud / electron rings	e^-	-1	~0amu

4. Define isotope and give an example of two isotopes of the same element using shorthand notation. atoms of the same element with different amounts of neutrons / different masses. $^{23}_{12}Mg$ $^{24}_{12}Mg$

Carbon-12
carbon-14

5. Using your knowledge of atoms ions and isotopes complete the following table.

Element Symbol	Mass Number	Atomic Number	No. of protons	No. of Neutrons	No. of electrons	Charge
$^{35}_{17}Cl^{-1}$	35	17	17	18	18	-1
$^{40}_{20}Ca$	40	20	20	20	20	0
$^{23}Na^{+1}_{11}$	23	11	11	12	10	+1
$^{107}_{46}Pd$	107	46	46	61	46	0
$^{36}_{17}Cl$	36	17	17	19	17	0
$^{14}N^{-3}_{7}$	14	7	7	7	10	-3

I can use the speed of light equation to calculate frequency or wavelength
I can use the energy equation to calculate frequency, wavelength and energy.

Know <u>how</u> and <u>when</u> to use the following equations:

$$c = \lambda \upsilon \qquad E = h\upsilon \qquad E = \frac{hc}{\lambda}$$

And these constants:

c = 3.00 x 10^8 m/s c = 3.00 x10^{17} nm/s h = 6.626x10^{-34} Js h = 3.989x10^{-13} kJs/mol

6. What is the relationship between wavelength and frequency?

inverse relationship Long wavelength = low frequency
Short wavelength = high frequency

7. What is the relationship between frequency and energy?

direct relationship high frequency = high energy

I can differentiate between types of electromagnetic radiation based on the wavelength, frequency and energy

8. List the seven types of electromagnetic radiation from lowest energy to highest energy.

Radiowaves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays

9. List the colors of visible light from longest wavelength to shortest

Red, orange, yellow, green, blue, indigo, violet

10. If a wave has a wavelength of 480 nm, calculate the frequency

$C = 3.00 \times 10^{17}$ nm/s $C = \lambda \upsilon$

$\lambda = 480$ nm

$f = ?$

$$f = \frac{c}{\lambda} = \frac{3.00 \times 10^{17}\ \text{nm/s}}{480\ \text{nm}} = 6.3 \times 10^{14}\ \text{Hz}$$

11. If there is a wave with a frequency of 4.56×10^{14} Hz, calculate the wavelength in nm.

$c = 3.00 \times 10^{17}$ nm/s
$\lambda = ?$
$f = 4.56 \times 10^{14}$ Hz

$\lambda = \frac{c}{f} = \frac{3.00 \times 10^{17} \text{ nm/s}}{4.56 \times 10^{14} \text{ Hz}} = 658 \text{ nm}$

12. If a wave has a frequency of 5.67×10^{9} Hz, calculate its energy.

$E = hf$
$E = ?$
$h = 6.626 \times 10^{-34}$ Js
$f = 5.67 \times 10^{9}$ Hz

$E = 6.626 \times 10^{-34} \text{ Js} \times 5.67 \times 10^{9} \text{ Hz} = 3.76 \times 10^{-24} \text{ J}$

or

$E = 3.989 \times 10^{-13} \text{ kJ/mol} \times 5.67 \times 10^{9} \text{ Hz} = 2.26 \times 10^{-3} \text{ kJ/mol}$

I can differentiate between an absorption spectrum and emission spectrum and explain what causes them.

13. What is the difference between a continuous spectrum and an emission spectrum?

Continuous - contains all wavelengths between 400nm & 700nm
emission - contains specific wavelengths released by an atom

14. Explain the process necessary for an atom to emit a photon of light.

absorb energy → electron jumps to an excited state
then → return back to ground state by emitting light.

Know <u>how</u> and <u>when</u> to use the following equation:

$$\Delta E = E_{final} - E_{initial}$$

15. Use your values for the energies of levels in the Hydrogen atom from your pre-lab to complete the following tables. Circle the transitions that produce visible light. Determine which transition produces the highest energy.

Transition	Energy (kJ/mol)	Wavelength (nm)	Frequency (Hz)
6→3	$-146 - -36.4$ 109.6 kJ/mol	$E = \frac{hc}{\lambda}$ $\lambda = \frac{hc}{E}$ $E = \frac{3.989 \times 10^{-13} \text{ kJ/mol} \times 3.00 \times 10^{17} \text{ nm/s}}{109.6} = 1092 \text{ nm}$	$\frac{c}{\lambda} = f = \frac{3.00 \times 10^{17} \text{ nm/s}}{1092 \text{ nm}}$ $= 2.75 \times 10^{14} \text{ Hz}$
4→2	$-328 - -82.0$ 246 kJ/mol	$E = \frac{hc}{\lambda} = \frac{3.989 \times 10^{-13} \times 3.00 \times 10^{17}}{246}$ $= 486 \text{ nm}$	$f = \frac{3.00 \times 10^{17} \text{ nm/s}}{486}$ $= 6.17 \times 10^{14} \text{ Hz}$
4→1	$-812 - -82.0$ 1230 kJ/mol	$= \frac{hc}{E} = \frac{3.989 \times 10^{-13} \times 3.00 \times 10^{17}}{1230}$ $= 97.3 \text{ nm}$	$f = \frac{3.00 \times 10^{17} \text{ nm/s}}{97.3}$ $= 3.08 \times 10^{15} \text{ Hz}$