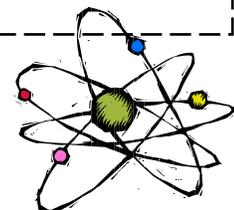


MS1 & 2: Lesson 1

Outcome: Examine the role of valence electrons in the formation of chemical bonds

Indicators:

- Trace the historical development of the model of the atom.
- Examine how evidence and experimentation inform the development and refinement of theories in chemistry
- Explain the relationship between the position of an element on the periodic table and its number of valence electrons with reference to the octet rule.
- Explain the formation of ions and predict their charge in group 1 and 2 elements and non-metals, based on an understanding of valence electrons and the octet rule.
- Draw Lewis structures (electron dot structures) for group 1 and 2 elements and non-metals, based on an understanding of valence electrons.



Chemistry Intro

What is chemistry?

- Chemistry is the study of the composition and properties of _____.
- Matter has two general properties; it occupies _____ and has _____.

Why study chemistry?

- Chemistry can help to explain how things work.
- Chemistry may help you in your future career. Even if you are not planning on being a chemist, many jobs require a basic understanding of chemistry.
- Chemistry can help you to be an informed citizen. Knowledge of chemistry can help you to evaluate data, arrive at an informed opinion and take appropriate action.

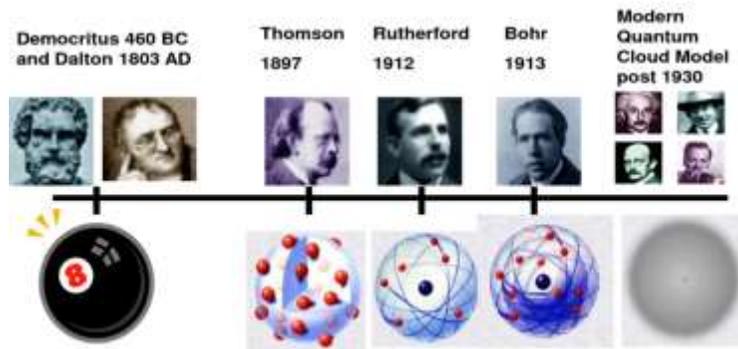
Tallest Tower Challenge Assignment

The Scientific Method:

- Scientific method is the process that scientists follow in order to perform _____ to investigate the world around them.
- The scientific method:
 - Gather information through _____
 - Define the _____
 - Create a _____
 - _____ an experiment to test the hypothesis
 - _____ and observe the experiment
 - _____ data from experiment
 - Modify or create new _____

Model of the Atom

<http://thehistoryoftheatom.weebly.com/>



Lived from: 460-370 BC
 Put forward atomic model in: 442 BC
 His contribution to atomic theory:



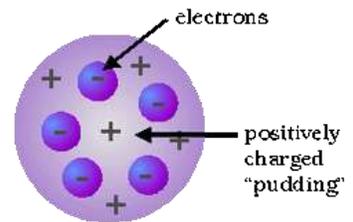
Democritus (400 B.C.)

Lived from: 1766-1844
 Put forward atomic model in: 1803
 Nickname for his model: _____ Model
 His contribution to atomic theory:

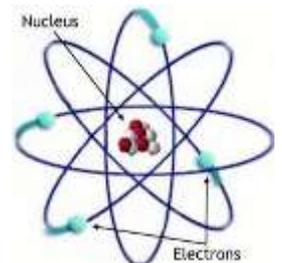


Dalton 1803-1805

J.J. _____
 Lived from: December 18, 1856 - August 30, 1940.
 Put forward atomic model in: 1904
 Nickname for his model: _____ Model (or Raisin Bread Model)
 His contribution to atomic theory:



LORD ERNEST _____
 Lived from: 1871- 1937
 Put forward atomic model in: 1911
 Nickname for his model: _____ Model
 His contribution to atomic theory:



MAX _____

Put forward atomic model in: 1900

His contribution to atomic theory:

ALBERT _____

Put forward atomic model: 1905

His contribution to atomic theory:

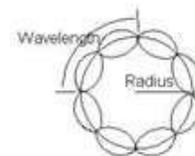
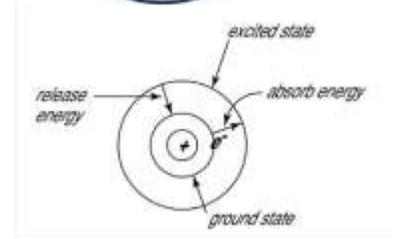
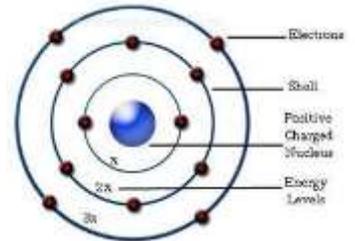
NIELS _____

Lived from: 1885 to 1962

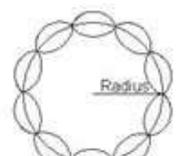
Put forward atomic model in: 1913

Nickname for his model: _____ Model

His contribution to atomic theory:



Electron Orbit = Four Wavelengths



Electron Orbit = Five Wavelengths

LOUIS _____

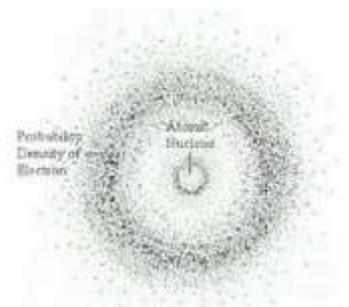
Date: 1924

His Contribution to atomic theory:

ERWIN _____ **& WERNER** _____

Date: Late 1920's

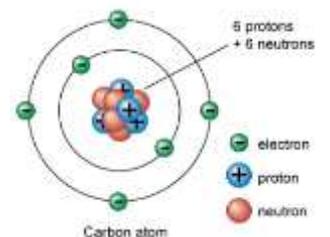
His contribution to atomic theory:



JAMES _____

Date: 1932

His contribution to atomic theory:



See History of the atom & periodic table assignment (Q1 & 2)

About the Periodic Table

What is the periodic table?

- A way to organize _____
- Contains all elements ever discovered or _____

Development of the Periodic Table:

- The periodic table was developed by _____ (Russian Chemist). He recognized trends in properties of elements when organized by _____.
- He used these _____ to organize the periodic table.
- He was then able to use the periodic table to _____ the properties of elements that had not yet been discovered or created.

How is the periodic table organized?

- The periodic table is organized by increasing _____ number.
- It is organized into families and periods. _____ are the horizontal rows of the periodic table, and _____ (or groups) are the vertical rows of the periodic table. Most elements in a family have similar _____.

Label the periodic table

Periods and Groups & diatomic elements (elements found in pairs in nature):

1 H 1.008																	2 He 4.003	
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180	
11 Na 22.990	12 Mg 24.305											13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.06	17 Cl 35.453	18 Ar 39.948	
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.88	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.69	29 Cu 63.546	30 Zn 65.38	31 Ga 69.723	32 Ge 72.64	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.8	
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc 98	44 Ru 101.07	45 Rh 101.07	46 Pd 106.32	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.6	53 I 126.905	54 Xe 131.29	
55 Cs 132.91	56 Ba 137.33	57-70 * Lanthanide series	71 Lu 174.967	72 Hf 178.49	73 Ta 180.948	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.22	78 Pt 195.084	79 Au 196.967	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89-102 ** Actinide series	103 Lr 260	104 Rf 261	105 Db 262	106 Sg 263	107 Bh 264	108 Hs 265	109 Mt 266	110 Uun 267	111 Uuu 268	112 Uub 269	113 Uuq 270					

* Lanthanide series

57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 144.91	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.05
--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------

** Actinide series

88 Ac 227	89 Th 232.04	90 Pa 231.04	91 U 238.03	92 Np 237	93 Pu 244	94 Am 243	95 Cm 247	96 Bk 247	97 Cf 251	98 Es 252	99 Fm 257	100 Md 258	101 No 259
-----------------	--------------------	--------------------	-------------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	------------------	------------------

Metals, Non Metals Metalloids:

1	H	2	He																																
3	Li	4	Be	5	B	6	C	7	N	8	O	9	F	10	Ne																				
11	Na	12	Mg	13	Al	14	Si	15	P	16	S	17	Cl	18	Ar																				
19	K	20	Ca	21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Cu	30	Zn	31	Ga	32	Ge	33	As	34	Se	35	Br	36	Kr
37	Rb	38	Sr	39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd	49	In	50	Sn	51	Sb	52	Te	53	I	54	Xe
55	Cs	56	Ba	57	* Lu	58	Hf	59	Ta	60	W	61	Re	62	Os	63	Ir	64	Pt	65	Au	66	Hg	67	Tl	68	Pb	69	Bi	70	Po	71	At	72	Rn
87	Fr	88	Ra	89	** Lr	90	Rf	91	Db	92	Sg	93	Bh	94	Hs	95	Mt	96	Uun	97	Uuu	98	Uub	99	Uuq	100	Uuq	101	Uuq	102	Uuq	103	Uuq	104	Uuq

* Lanthanide series

57	La	58	Ce	59	Pr	60	Nd	61	Pm	62	Sm	63	Eu	64	Gd	65	Tb	66	Dy	67	Ho	68	Er	69	Tm	70	Yb
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** Actinide series

89	Ac	90	Th	91	Pa	92	U	93	Np	94	Pu	95	Am	96	Cm	97	Bk	98	Cf	99	Es	100	Fm	101	Md	102	No
----	----	----	----	----	----	----	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	----	-----	----	-----	----

Solids Liquids and Gases (@ room temp):

1	H	2	He																																
3	Li	4	Be	5	B	6	C	7	N	8	O	9	F	10	Ne																				
11	Na	12	Mg	13	Al	14	Si	15	P	16	S	17	Cl	18	Ar																				
19	K	20	Ca	21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Cu	30	Zn	31	Ga	32	Ge	33	As	34	Se	35	Br	36	Kr
37	Rb	38	Sr	39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd	49	In	50	Sn	51	Sb	52	Te	53	I	54	Xe
55	Cs	56	Ba	57	* Lu	58	Hf	59	Ta	60	W	61	Re	62	Os	63	Ir	64	Pt	65	Au	66	Hg	67	Tl	68	Pb	69	Bi	70	Po	71	At	72	Rn
87	Fr	88	Ra	89	** Lr	90	Rf	91	Db	92	Sg	93	Bh	94	Hs	95	Mt	96	Uun	97	Uuu	98	Uub	99	Uuq	100	Uuq	101	Uuq	102	Uuq	103	Uuq	104	Uuq

* Lanthanide series

57	La	58	Ce	59	Pr	60	Nd	61	Pm	62	Sm	63	Eu	64	Gd	65	Tb	66	Dy	67	Ho	68	Er	69	Tm	70	Yb
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** Actinide series

89	Ac	90	Th	91	Pa	92	U	93	Np	94	Pu	95	Am	96	Cm	97	Bk	98	Cf	99	Es	100	Fm	101	Md	102	No
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Valence Electrons

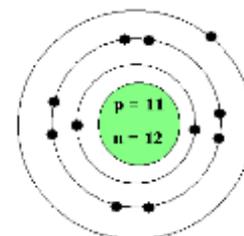
What are they?

- Valence electrons are those that are in the _____ electron shell (valence shell) of an atom. The valence shells are the outermost s and p orbitals. The outermost s and p orbitals are the highest _____ orbitals of an atom.
- Valence electrons determine how an element _____ with other elements.
 - The _____ valence electrons an atom has, the less stable it is and the more likely it is to react.
 - The _____ valence electrons an atom has, the more stable it is and the less likely it is to react. Something that is unlikely to react is called _____.

Octet Rule:

- The most valence electrons an atom can have is 8, because that is a full valence (2 electrons in the s orbital, 6 electrons in the p orbital). All atoms would like to have 8 valence electrons because then they are stable. This is called the _____ rule (or the rule of 8).
 - Exceptions:
 - Hydrogen and helium can only have 2 electrons in their valence shell (1s).
 - _____ metals (+ a few others) are also exceptions because orbitals can hybridize. We will not be learning about hybridized orbitals in this course.

NOTE: 8 valence electrons and 0 valence electrons both make for stable atoms because with 0 valence electrons, they essentially do have 8 because the next valence shell below the one that was emptied is full...



Easy Way to Determine Number of Valence Electrons:

- Group 1 has ___ valence electron, group 2 has ___ valence electrons, groups 3 to 12 are transition metals so we don't need to determine the number of valence electrons they have, group 13 has ___ valence electrons, group 14 has ___ valence electrons, group 15 has ___ valence electrons, group 16 has ___ valence electrons, group 17 has ___ valence electrons, group 18 has ___ valence electrons.

Lewis dot diagrams

- Electron-dot formula* method or _____ *Formula* method is used to represent the number of _____ in the valence shell.
 - The core is represented by the _____ for the element; valence electrons are represented by _____.
 - The symbol is assumed to have _____ sides and the valence electrons are distributed around the sides.
 - When we distribute valence electrons, we first place _____ dot on each of the four sides before we locate _____ of electrons on any one side. Usually no more than _____ electrons can be placed on any one side.

Examples:

calcium

selenium

bromine

Finish Assign 1 & Valence Electrons, Ions & Lewis dot Assignment (columns 1 & 4)

Name: _____

Tallest Tower Challenge

The Challenge:

As a group build the best tower. Your tower must be free standing (not taped to anything but itself or supported by anything). Your tower will be made from one sheet of paper and 1 foot of scotch tape. You will be able to use scissors, but they cannot be incorporated into your structure. Be sure to think about your design before you build it. You will have one trial tower and then be given a chance to adjust your design and create a new tower.

Design: Draw a picture of your initial tower design and your redesigned tower design.



Analysis:

1. Why did you decide on the design you used? _____

2. Did your initial design work well? Explain why or why not. _____

3. How did you adjust your design to improve it? Why did you adjust it the way you did?

4. What designs worked best in the class? What elements of the design made them work well? Why?

5. How did this challenge relate to what scientists and engineers do? _____

6. What was your thinking process throughout this task? (how did you come up with your design? How did you decide what to do to improve it?) _____

7. How was the process you went through with this task similar to the classic “scientific method”? ← *wait to answer this until we have learned about the scientific method* _____

8. Do you think that the scientific method is the only process that should/can be used to do scientific research? Explain. _____

History of the Atom & the Periodic Table

1. Explain why we study the historical development of the model of the atom (give at least 2 reasons)
2. Draw and label the current model of the atom:
3. Describe the arrangement of the periodic table with regards to the following:
 - a. Metals and non-metals
 - b. Solids, liquids and gases
 - c. Valence Electrons
4. In your own words, explain why an empty valence shell is equivalent to a full valence shell.

Name: _____

Valence Electron, Ions & Lewis dot Assignment

Complete the following table:

Name	# of valence electrons	# of electrons to gain or lose	Common charge	Lewis dot for neutral atom	Lewis dot for common ion
Aluminum					
Argon					
Beryllium					
Boron					
Carbon					
Chlorine					
Fluorine					
Helium					
Hydrogen					
Lithium					
Magnesium					
Neon					
Nitrogen					
Oxygen					
Phosphorus					
Silicon					
Sodium					
Sulfur					

2. Describe two ways an ion forms from an atom: