

# Unit 3 Class Work

NAME  
10/31/13

## 3.5 Distinguishing Atoms

### SPARK

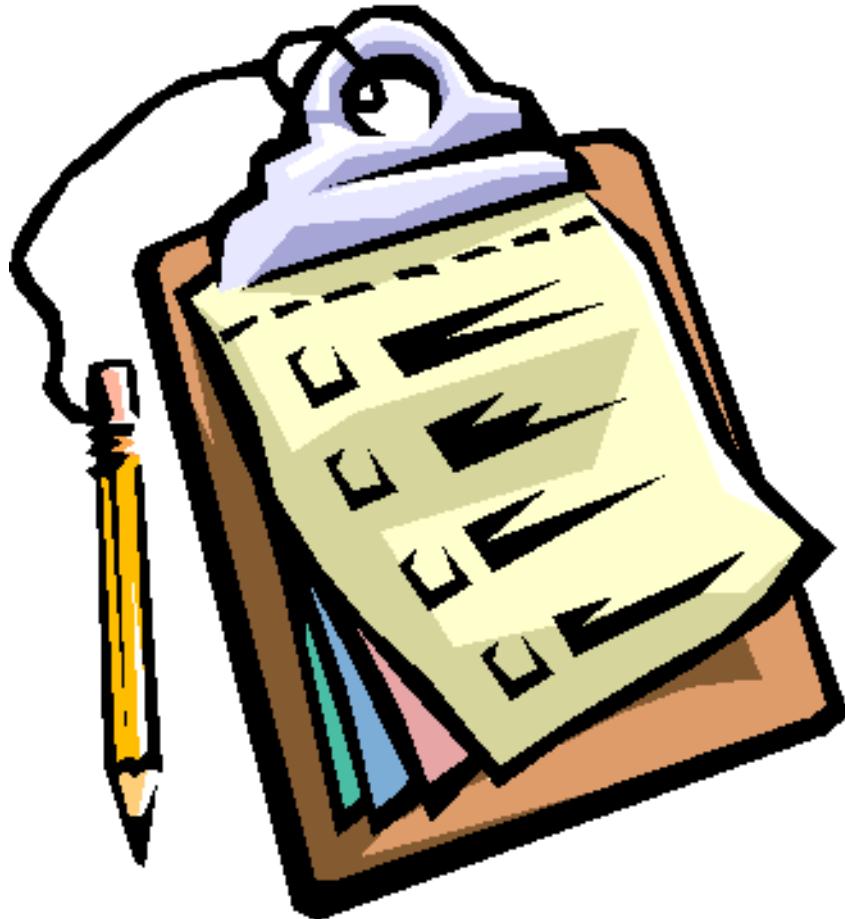
1. What was concluded about the structure of the atom as the result of the gold foil experiment?
  - (1) a positively charged nucleus surrounded by positively charged particles
  - (2) a positively charged nucleus surrounded by mostly empty space
  - (3) a negatively charged nucleus is surrounded by positively charged particles
  - (4) a negatively charged nucleus is surrounded by mostly empty space

## Objective

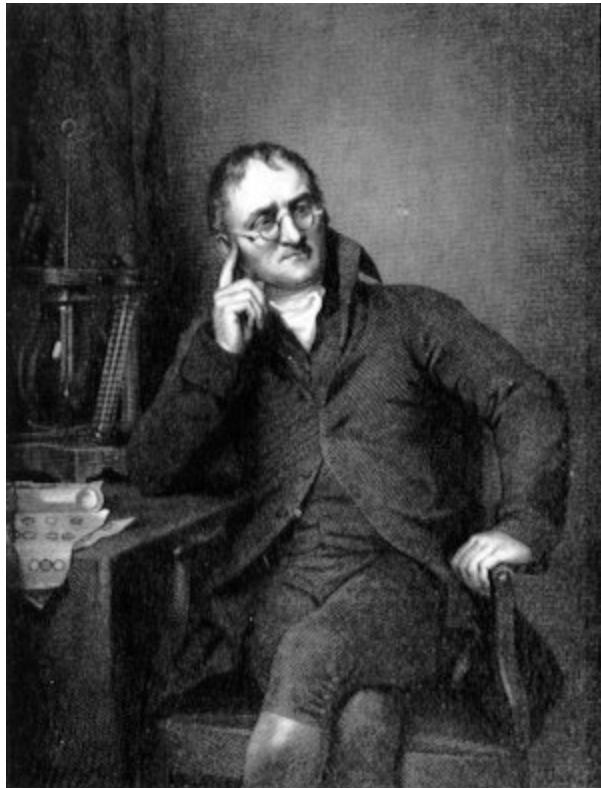
SWBAT identify an element given its atomic number and calculate the mass of an atom, the number of neutrons or the number of protons, given the other two values.

# Agenda:

- SPARK
- Objective
- Notes
- Practice
- Homework



# Where Dalton was Wrong!



\*\*\*All atoms of a given element are NOT identical

Postulate should read: all atoms of a given element have the same # of protons

# Atom Brainpop

# Atomic Number

- **Atomic number (Z)** of an element is the number of protons in the nucleus of each atom of that element.
- The number of protons defines the element.
- It can be found on the periodic table of elements. You have been memorizing this!

Atomic number is in on the top or in top the right.

...so how many protons does hydrogen have????

For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

Periodic Table Design & Interface Copyright © 1997 Michael Dayah, Ptable.com Last updated Sep 30, 2012

	<b>57 La</b> Lanthanum 138.90547	<b>58 Ce</b> Cerium 140.115	<b>59 Pr</b> Praseodymium 140.90765	<b>60 Nd</b> Neodymium 144.242	<b>61 Pm</b> Promethium (145)	<b>62 Sm</b> Samarium 150.36	<b>63 Eu</b> Europium 151.964	<b>64 Gd</b> Gadolinium 157.25	<b>65 Tb</b> Terbium 158.92535	<b>66 Dy</b> Dysprosium 162.5	<b>67 Ho</b> Holmium 164.93032	<b>68 Er</b> Erbium 167.259	<b>69 Tm</b> Thulium 168.93421	<b>70 Yb</b> Ytterbium 173.054	<b>71 Lu</b> Lutetium 174.95658
	<b>89 Ac</b> Actinium (227)	<b>90 Th</b> Thorium 232.03806	<b>91 Pa</b> Protactinium 231.03588	<b>92 U</b> Uranium 238.02891	<b>93 Np</b> Neptunium (237)	<b>94 Pu</b> Plutonium (244)	<b>95 Am</b> Americium (243)	<b>96 Cm</b> Curium (247)	<b>97 Bk</b> Berkelium (247)	<b>98  Cf</b> Californium (251)	<b>99 Es</b> Einsteinium (252)	<b>100 Fm</b> Fermium (257)	<b>101 Md</b> Mendelevium (258)	<b>102 No</b> Nobelium (259)	<b>103 Lr</b> Lawrencium (262)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																	
1 <b>H</b> Hydrogen 1.00794	2 <b>He</b> Helium 4.002602	3 <b>C</b> Solid	4 <b>Hg</b> Liquid	5 <b>H</b> Gas	6 <b>Rf</b> Unknown	7 Metalloids	8 Nonmetals	9 Other nonmetals	10 Halogens	11 Noble gases	12 <b>B</b> Boron 10.811	13 <b>Al</b> Aluminum 26.9815386	14 <b>N</b> Nitrogen 14.0067	15 <b>Si</b> Silicon 28.0855	16 <b>P</b> Phosphorus 30.973762	17 <b>S</b> Sulfur 32.065	18 <b>Cl</b> Chlorine 35.453	19 <b>Ar</b> Argon 39.948																
2 <b>Li</b> Lithium 6.941	3 <b>Na</b> Sodium 22.98976928	4 <b>Mg</b> Magnesium 24.305	5 <b>Sc</b> Scandium 44.955912	6 <b>Ti</b> Titanium 47.867	7 <b>V</b> Vanadium 50.9415	8 <b>Cr</b> Chromium 51.9961	9 <b>Mn</b> Manganese 54.938045	10 <b>Fe</b> Iron 55.845	11 <b>Co</b> Cobalt 58.933195	12 <b>Ni</b> Nickel 58.6934	13 <b>Cu</b> Copper 63.546	14 <b>Zn</b> Zinc 65.38	15 <b>Ga</b> Gallium 69.723	16 <b>Ge</b> Germanium 72.63	17 <b>As</b> Arsenic 74.9216	18 <b>Se</b> Selenium 78.96	19 <b>Br</b> Bromine 79.904	20 <b>Kr</b> Krypton 83.798																
21 <b>Ca</b> Calcium 40.078	22 <b>Y</b> Yttrium 88.90585	23 <b>Zr</b> Zirconium 91.224	24 <b>Nb</b> Niobium 92.90638	25 <b>Mo</b> Molybdenum 95.96	26 <b>Tc</b> Technetium (98)	27 <b>Ru</b> Ruthenium 101.07	28 <b>Rh</b> Rhodium 102.9055	29 <b>Pd</b> Palladium 106.42	30 <b>Ag</b> Silver 107.8682	31 <b>Cd</b> Cadmium 112.411	32 <b>In</b> Indium 114.818	33 <b>Sn</b> Tin 118.71	34 <b>Sb</b> Antimony 121.76	35 <b>Te</b> Tellurium 127.6	36 <b>I</b> Iodine 126.90447	37 <b>Rb</b> Rubidium 65.4678	38 <b>Sr</b> Strontium 67.62	39 <b>Y</b> Yttrium 88.90585	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.90638	42 <b>Mo</b> Molybdenum 95.96	43 <b>Tc</b> Technetium (98)	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.9055	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.8682	48 <b>Cd</b> Cadmium 112.411	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.71	51 <b>Sb</b> Antimony 121.76	52 <b>Te</b> Tellurium 127.6	53 <b>Xe</b> Xenon 131.293		
55 <b>Cs</b> Caesium 132.9054519	56 <b>Ba</b> Barium 137.327	57-71 <b>Hf</b> Hafnium 178.49	72 <b>Ta</b> Tantalum 180.94788	73 <b>W</b> Tungsten 183.84	74 <b>Re</b> Rhenium 186.207	75 <b>Os</b> Osmium 190.23	76 <b>Ir</b> Iridium 192.217	77 <b>Pt</b> Platinum 195.084	78 <b>Au</b> Gold 196.966569	79 <b>Hg</b> Mercury 200.59	80 <b>Tl</b> Thallium 204.3833	81 <b>Pb</b> Lead 207.2	82 <b>Bi</b> Bismuth 208.9804	83 <b>Po</b> Polonium (209)	84 <b>At</b> Astatine (210)	85 <b>Rn</b> Radon (222)	86 <b>Fr</b> Francium (223)	87 <b>Ra</b> Radium (226)	88-103 <b>Rf</b> Rutherfordium (267)	104 <b>Db</b> Dubnium (268)	105 <b>Sg</b> Seaborgium (271)	106 <b>Bh</b> Bohrium (272)	107 <b>Hs</b> Hassium (270)	108 <b>Mt</b> Meitnerium (276)	109 <b>Ds</b> Darmstadtium (281)	110 <b>Rg</b> Roentgenium (280)	111 <b>Cn</b> Copernicium (285)	112 <b>Uut</b> Ununtrium (284)	113 <b>Fl</b> Flerovium (289)	114 <b>Uup</b> Ununpentium (288)	115 <b>Lv</b> Livermorium (293)	116 <b>Uus</b> Ununseptium (294)	117 <b>Uuo</b> Ununoctium (294)	118 <b>Lu</b> Ununoctium (294)

How many protons does nitrogen have?

es.

Periodic Table Design & Interface Copyright © 1997 Michael Dayah. Ptable.com Last updated Sep 30, 2012

57 <b>La</b> Lanthanum 138.90547	58 <b>Ce</b> Cerium 140.116	59 <b>Pr</b> Praseodymium 140.90765	60 <b>Nd</b> Neodymium 144.242	61 <b>Pm</b> Promethium (145)	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.92335	66 <b>Dy</b> Dysprosium 162.5	67 <b>Ho</b> Holmium 164.93032	68 <b>Er</b> Erbium 167.259	69 <b>Tm</b> Thulium 168.93421	70 <b>Yb</b> Ytterbium 173.054	71 <b>Lu</b> Lutetium 174.9668
89 <b>Ac</b> Actinium (227)	90 <b>Th</b> Thorium 232.03806	91 <b>Pa</b> Protactinium 231.03588	92 <b>U</b> Uranium 238.02891	93 <b>Np</b> Neptunium (237)	94 <b>Pu</b> Plutonium (244)	95 <b>Am</b> Americium (243)	96 <b>Cm</b> Curium (247)	97 <b>Bk</b> Berkelium (247)	98 <b>Cf</b> Californium (251)	99 <b>Es</b> Einsteinium (252)	100 <b>Fm</b> Fermium (257)	101 <b>Md</b> Mendelevium (258)	102 <b>No</b> Nobelium (259)	103 <b>Lr</b> Lawrencium (262)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18				
1 <b>H</b> Hydrogen 1.00794	2 <b>He</b> Helium 4.002602	3 <b>C</b> Solid	4 <b>Hg</b> Liquid	5 <b>H</b> Gas	6 <b>Rf</b> Unknown	7	8	9	10	11	12	13	14	15	16	17 <b>x</b>	18				
1 <b>Li</b> Lithium 6.941	2 <b>Be</b> Beryllium 9.012182	3 <b>Na</b> Sodium 22.98976928	4 <b>Mg</b> Magnesium 24.305	5 <b>Ca</b> Calcium 40.078	6 <b>Sc</b> Scandium 44.955912	7 <b>Ti</b> Titanium 47.867	8 <b>V</b> Vanadium 50.9415	9 <b>Cr</b> Chromium 51.9961	10 <b>Mn</b> Manganese 54.938045	11 <b>Fe</b> Iron 55.845	12 <b>Co</b> Cobalt 58.933195	13 <b>Al</b> Aluminum 26.9815386	14 <b>Si</b> Silicon 28.0855	15 <b>P</b> Phosphorus 30.973762	16 <b>S</b> Sulfur 32.065	17 <b>Cl</b> Chlorine 35.453	18 <b>Ar</b> Argon 39.948				
11 <b>Na</b> Sodium 22.98976928	12 <b>Mg</b> Magnesium 24.305	21 <b>Sc</b> Scandium 44.955912	22 <b>Ti</b> Titanium 47.867	23 <b>V</b> Vanadium 50.9415	24 <b>Cr</b> Chromium 51.9961	25 <b>Mn</b> Manganese 54.938045	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.933195	28	120	120	5	6	7	8	9	273				
19 <b>K</b> Potassium 39.0983	20 <b>Ca</b> Calcium 40.078	37 <b>Rb</b> Rubidium 65.4678	38 <b>Sr</b> Strontium 67.62	39 <b>Y</b> Yttrium 88.90585	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.90638	42 <b>Mo</b> Molybdenum 95.96	43 <b>Tc</b> Technetium (98)	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.9055	46	47 <b>Ag</b> Silver 107.8682	48	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.71	51 <b>Sb</b> Antimony 121.76	52 <b>Te</b> Tellurium 127.6	53 <b>I</b> Iodine 126.90447	54 <b>Xe</b> Xenon 131.293		
55 <b>Cs</b> Caesium 132.9054519	56 <b>Ba</b> Barium 137.327	57-71 57-71	72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.94788	74 <b>W</b> Tungsten 183.84	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.217	78	108	109	110	111	112	113	114	115	116	117	118	119
87 <b>Fr</b> Francium (223)	88 <b>Ra</b> Radium (226)	89-103 89-103	104 <b>Rf</b> Rutherfordium (267)	105 <b>Db</b> Dubnium (266)	106 <b>Sg</b> Seaborgium (270)	107 <b>Bh</b> Bohrium (272)	108 <b>Hs</b> Hassium (270)	109 <b>Mt</b> Meitnerium (270)	110 <b>Ds</b> Darmstadtium (270)	111 <b>Rg</b> Roentgenium (270)	112 <b>Cn</b> Copernicium (270)	113 <b>Uut</b> Ununtrium (270)	114 <b>Fl</b> Flerovium (270)	115 <b>Uup</b> Ununpentium (293)	116 <b>Lv</b> Livermorium (293)	117 <b>Uus</b> Ununseptium (294)	118 <b>Uuo</b> Ununoctium (294)	119 <b>Rn</b> Radon (222)			
How many protons does silver have?																					

Periodic Table Design & Interface Copyright © 1997 Michael Dayah. Ptable.com Last updated Sep 30, 2012

57 <b>La</b> Lanthanum 138.90547	58 <b>Ce</b> Cerium 140.116	59 <b>Pr</b> Praseodymium 140.90765	60 <b>Nd</b> Neodymium 144.242	61 <b>Pm</b> Promethium (145)	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.92335	66 <b>Dy</b> Dysprosium 162.5	67 <b>Ho</b> Holmium 164.93032	68 <b>Er</b> Erbium 167.259	69 <b>Tm</b> Thulium 168.93421	70 <b>Yb</b> Ytterbium 173.054	71 <b>Lu</b> Lutetium 174.9668			
89 <b>Ac</b> Actinium (227)	90 <b>Th</b> Thorium 232.03806	91 <b>Pa</b> Protactinium 231.03588	92 <b>U</b> Uranium 238.02891	93 <b>Np</b> Neptunium (237)	94 <b>Pu</b> Plutonium (244)	95 <b>Am</b> Americium (243)	96 <b>Cm</b> Curium (247)	97 <b>Bk</b> Berkelium (247)	98 <b>Cf</b> Californium (251)	99 <b>Es</b> Einsteinium (252)	100 <b>Fm</b> Fermium (257)	101 <b>Md</b> Mendelevium (258)	102 <b>No</b> Nobelium (259)	103 <b>Lr</b> Lawrencium (262)			

# Mass Number

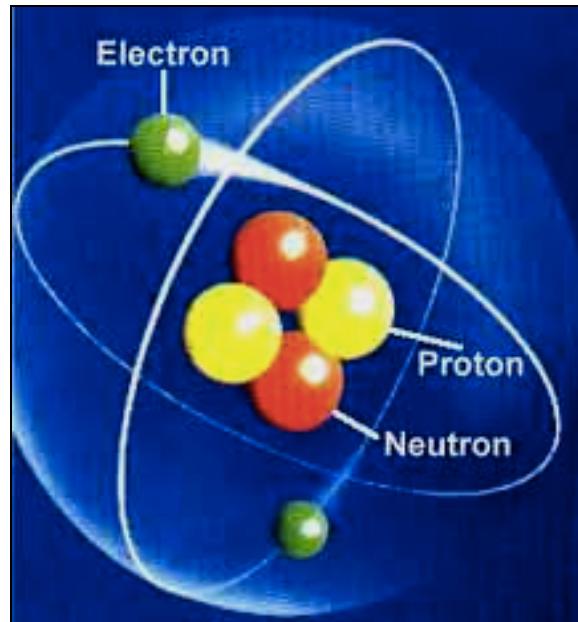
- Recall the mass of our subatomic particles...
- a.m.u. = atomic mass units

Particle	Charge	Mass (a.m.u)	Location
Electron	-1	[REDACTED]	Electron cloud
Proton	+1	[REDACTED]	Nucleus
Neutron	0	[REDACTED]	Nucleus

# Mass Number

Mass number is the number of protons and neutrons in the nucleus of an atom.

$$\text{Mass #} = p^+ + n^0$$



$$n^0 = \text{Mass #} - p^+$$

$$p^+ = \text{Mass #} - n^0$$

# Mass Number

If an atom has 8 protons and 8 neutrons, what is its mass number?

$$p^+ + n^0 = \text{Mass \#}$$

$$8 + 8 = 16$$

# Mass Number

Mass number is the number of protons and neutrons in the nucleus

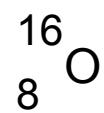
$$\text{Mass \#} = p^+ + n^0$$

Neutral Atom	p <sup>+</sup>	n <sup>0</sup>	e <sup>-</sup>	Mass #
Oxygen - 18	8	10	8	18
Arsenic - 75	33	42	33	75
Phosphorus - 31	15	16	15	31

# How do we write mass number

- Elements can be written to tell you the mass number of the atom.
  - Carbon – 12 has a mass # of 12
  - Fluorine – 19 has a mass # of 19

Or as



» Means mass # of 16 and 8 protons



» Means mass # of \_\_ and \_\_ protons

16

# Think and Write

- Why is it NOT true that an atom is the smallest thing we can have?

# Think and Write

- Why is the charge of a nucleus always going to be positive even though the nucleus is made up of protons AND neutrons?

# Think and Write

- Why are atoms NEUTRAL in charge?

# Independent Work

- Describe the structure of a typical atom. Identify where each subatomic particle is located.
- Compare and contrast Thomson's plum pudding atomic model with Rutherford's nuclear atomic model?

# HOMEWORK

Complete 3.5 HW