



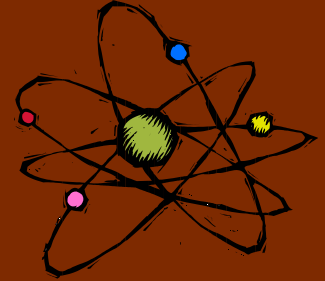
CHAPTER 18 NOTES

Properties of Atoms and the Periodic Table

CHEMICAL SYMBOLS

- Chemical symbol – short abbreviated way to write the name of an element
- Element – made up of only one kind of atom – cannot be broken down
- How to write symbols – 1 capital letter or a capital and small letter

PARTS OF AN ATOM



- Nucleus – positively charged center; contains most of the mass of the atom
- Electron – particles that move around the nucleus forming a cloud of negative charge
- Proton – particle that gives the nucleus its positive charge
- Neutron – particle with no charge; also in the nucleus

PARTS OF AN ATOM

(continued)



- net charge on nucleus is positive
- Amount of positive charge is = to the amount of negative charge
- Quarks – smaller particles that make up protons and neutrons

COUNTING ATOMS

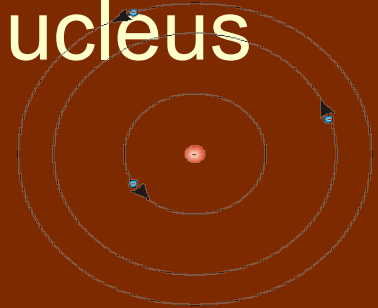
- All atoms of an element have same # of protons
- The # of protons in nucleus determines what the element is
- Atomic # - # of protons in an atom
- Atoms are neutral – the cloud of negative actually balances positive charge
- # of electrons = # of protons

MODELS OF ATOMS

- John Dalton – atoms were solid spheres
- J. J. Thomson – an atom contained small, negatively charged particles
- Rutherford – proposed that almost all the mass of an atom and all of its positive charges were concentrated in a central atomic nucleus surrounded by electrons

MODELS (continued)

- Niels Bohr – atoms had a dense center; electrons traveled in fixed orbits around the atom's nucleus



- Present day – electrons do not follow fixed orbits but tend to occur more frequently in certain areas around the nucleus

ELECTRON CLOUD

- Area around the nucleus of an atom where its electrons are most likely found
- Farther an electron is from the nucleus, the more energy
- Electrons with lower amount of energy are in the first level
- 1st – 2 electrons 2nd – 8 electrons
3rd – 18 electrons 4th – 32 electrons

ATOMIC MASS

- Protons tell what the element is
- Atomic # - # of protons in an atom
- Mass of an atom depends on # of protons & neutrons
- Mass # - the sum of the protons & the # of neutrons
- If you know the mass # & atomic # can find the # of neutrons
- # of neutrons = mass # - atomic #

ISOTOPES

- atoms of the same element with different #s of neutrons

example – hydrogen has 3 isotopes
0, 1, or 2

- 2 ways to show difference between isotopes:

1. name of element followed by mass #
2. write the symbol with the mass # and atomic #

PERIODIC TABLE

- Mendeleev – classified elements by arranging the elements in order of increasing atomic mass
- Periodic table – table of elements arranged by increasing atomic number & by changes in physical and chemical properties

PERIODIC TABLE

- Elements are arranged in vertical rows called groups or families
- Groups labeled 1-18; each group contains elements with similar properties

example: Group 11 Cu, Ag, Au all metals, shiny, and conductors

[illegible]

PERIODIC TABLE (cont)

- Halogen family – Group 17 – each element has 7 electrons on outer energy level (valence electrons); form compounds with elements in group 1
- Noble gas family – Group 18 – all but one element has 8 valence electrons; occur in nature; no compounds are found in nature
- Horizontal rows of periodic table are called periods

PERIODIC TABLE (cont)

- Period 2 begins with Li and ends with Ne
- Each element across is in a different group

Click on an element for more information

• Each group has different properties

1																	18				
1 H																	1 2 He				
2 3 Li	2 4 Be															13 5 B	14 6 C	15 7 N	16 8 O	17 9 F	18 10 Ne
3 11 Na	3 12 Mg															13 13 Al	14 14 Si	15 15 P	16 16 S	17 17 Cl	18 18 Ar
4 19 K	4 20 Ca	4 21 Sc	4 22 Ti	4 23 V	4 24 Cr	4 25 Mn	4 26 Fe	4 27 Co	4 28 Ni	4 29 Cu	4 30 Zn	4 31 Ga	4 32 Ge	4 33 As	4 34 Se	4 35 Br	4 36 Kr				
5 37 Rb	5 38 Sr	5 39 Y	5 40 Zr	5 41 Nb	5 42 Mo	5 43 Tc	5 44 Ru	5 45 Rh	5 46 Pd	5 47 Ag	5 48 Cd	5 49 In	5 50 Sn	5 51 Sb	5 52 Te	5 53 I	5 54 Xe				
6 55 Cs	6 56 Ba	*	6 72 Hf	6 73 Ta	6 74 W	6 75 Re	6 76 Os	6 77 Ir	6 78 Pt	6 79 Au	6 80 Hg	6 81 Tl	6 82 Pb	6 83 Bi	6 84 Po	6 85 At	6 86 Rn				
7 87 Fr	7 88 Ra	**	7 104 Rf	7 105 Db	7 106 Sg	7 107 Bh	7 108 Hs	7 109 Mt	7 110 Ds	7 111 Rg	7 112 Uub	7 113 Uut	7 114 Uuq	7 115 Uup	—	—	—				
<div> <div>LANTHANIDE SERIES</div> <div>ACTINIDE SERIES</div> </div>		6 57 La	6 58 Ce	6 59 Pr	6 60 Nd	6 61 Pm	6 62 Sm	6 63 Eu	6 64 Gd	6 65 Tb	6 66 Dy	6 67 Ho	6 68 Er	6 69 Tm	6 70 Yb	6 71 Lu					
		7 89 Ac	7 90 Th	7 91 Pa	7 92 U	7 93 Np	7 94 Pu	7 95 Am	7 96 Cm	7 97 Bk	7 98 Cf	7 99 Es	7 100 Fm	7 101 Md	7 102 No	7 103 Lr					

- Each group has different properties

PERIODIC TABLE (still)

- Metals – located on the left side; most atoms have 3 or fewer valence electrons; they are shiny, conduct electricity & heat, tend to lose electrons when they react

1		2	
1	1		
H			
2	3	2	4
Li		Be	
3	11	3	12
Na		Mg	
4	19	4	20
K		Ca	
5	37	5	38
Rb		Sr	
6	55	6	56
Cs		Ba	
7	87	7	88
Fr		Ra	

LANTHANIDE :

ACTINIDE :

ALKALINE EARTH METALS

2	
4	Be
12	Mg
20	Ca
38	Sr
56	Ba
88	Ra

- Group 2
- Have 2 valence electrons

NONMETALS

- On the right side of table
- Usually 5 or more valence electrons except C, H, He.
- Poor conductors of heat & electricity
- Most are gases at room temp, some are brittle solids
- tend to gain electrons when reacting with

formation

					18
					1 2
					He
13	14	15	16	17	
2 5	2 6	2 7	2 8	2 9	2 10
B	C	N	O	F	Ne
3 13	3 14	3 15	3 16	3 17	3 18
Al	Si	P	S	Cl	Ar
4 31	4 32	4 33	4 34	4 35	4 36
Ga	Ge	As	Se	Br	Kr
5 49	5 50	5 51	5 52	5 53	5 54
In	Sn	Sb	Te	I	Xe
6 81	6 82	6 83	6 84	6 85	6 86
Tl	Pb	Bi	Po	At	Rn
7 113	7 114	7 115	7 116	7 117	7 118
Uut	Uuq	Uup	—	—	—
6 66	6 67	6 68	6 69	6 70	6 71
Dy	Ho	Er	Tm	Yb	Lu
7 98	7 99	7 100	7 101	7 102	7 103
Cf	Es	Fm	Md	No	Lr

ALKALI METALS

- Group 1
- Usually shiny, reflect light, malleable, ductile, good conductors of heat & electricity, soft, relatively low melting point

1	
1	1
H	
2	3
Li	
3	11
Na	
4	19
K	
5	37
Rb	
6	55
Cs	
7	87
Fr	

LANTH

AC

METALLOIDS

- Elements along a stair line
- Have properties of metals and nonmetals
- Boron, Silicon, Germanium, Arsenic, Antimony, Tellurium, Polonium,

13	14	15	16	17
2 5 B	2 6 C	2 7 N	2 8 O	2 9 F
3 13 Al	3 14 Si	3 15 P	3 16 S	3 17 Cl
4 31 Ga	4 32 Ge	4 33 As	4 34 Se	4 35 Br
5 49 In	5 50 Sn	5 51 Sb	5 52 Te	5 53 I
6 81 Tl	6 82 Pb	6 83 Bi	6 84 Po	6 85 At
7 113 Uut	7 114 Uuq	7 115 Uup	7 116 —	7 117 Uus