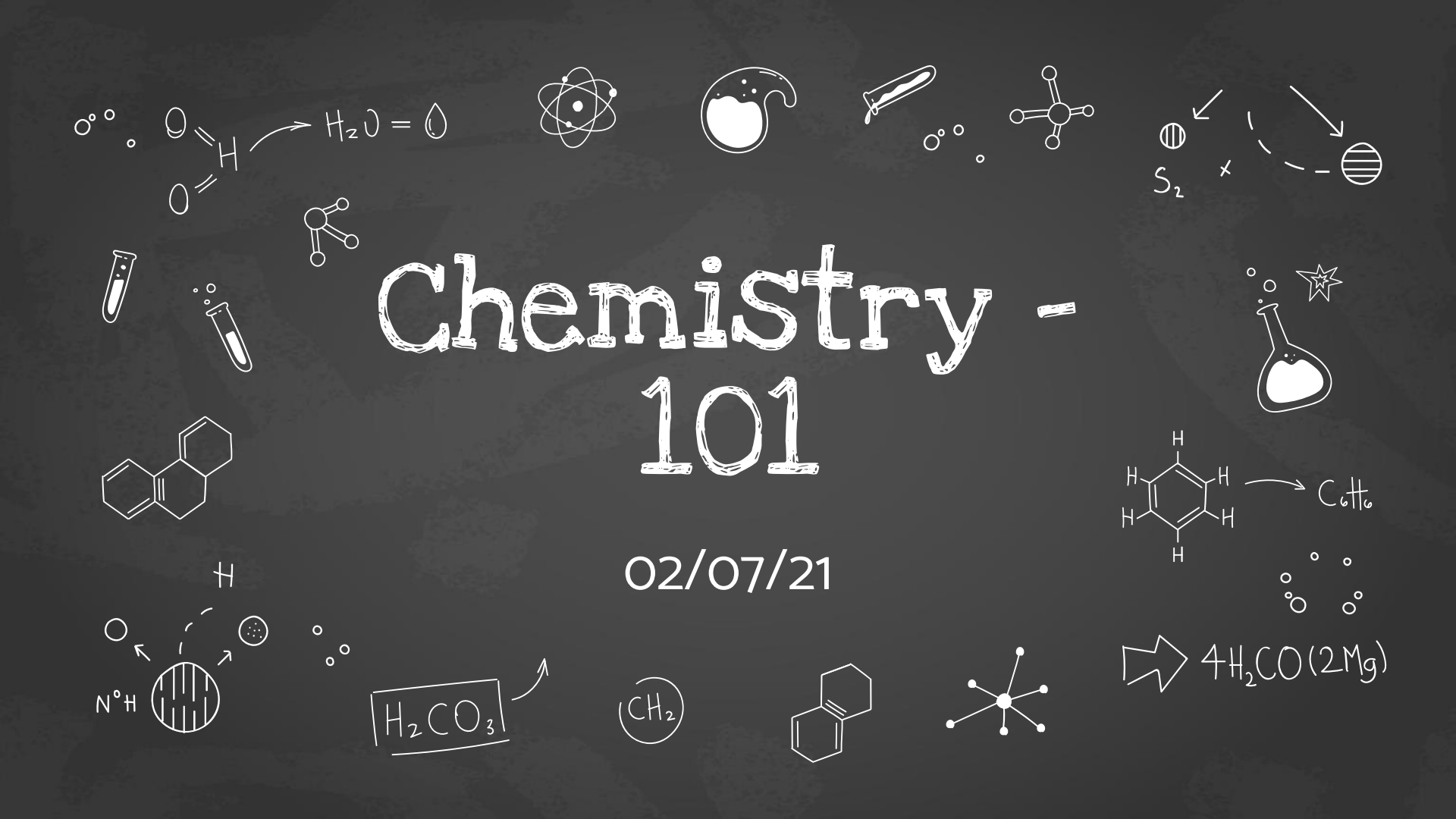

Chemistry - 101
02/07/21
H_2O
S_2
C_6H_6
H_2CO_3
CH_2
$4H_2CO(2Mg)$

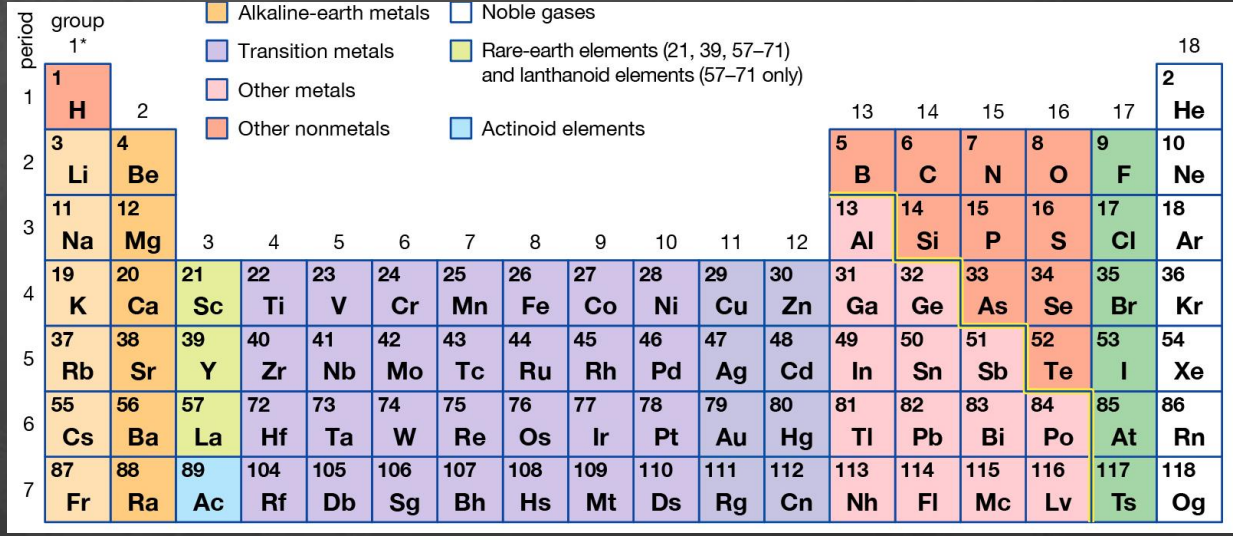
S^2p^6 – octet, complete electron shell

Atoms interact by their electrons in the outer shells to achieve octets

To combine into molecules some atoms will give electrons to get octet and others will accept electrons to get octet

In periodic table of elements,
group # = # electrons in the outer shell
period # = # of the outer shell

A bond is made by a pare of electrons



Consider examples

group #1

group #17 (7 w/o d-$\bar{e}$)

K (1) and Cl (17)

K (1) and O (16)

group #16 (6 w/o d-$\bar{e}$)

K (1) and $(OH)^-$, $(NO_3)^-$, $(SO_4)^{2-}$

Ca (2) and $(SO_4)^{2-}$

polyatomic ions act as a single charged unit

Writing chemical formulas

Team #1 (Ashley and Jaycie)

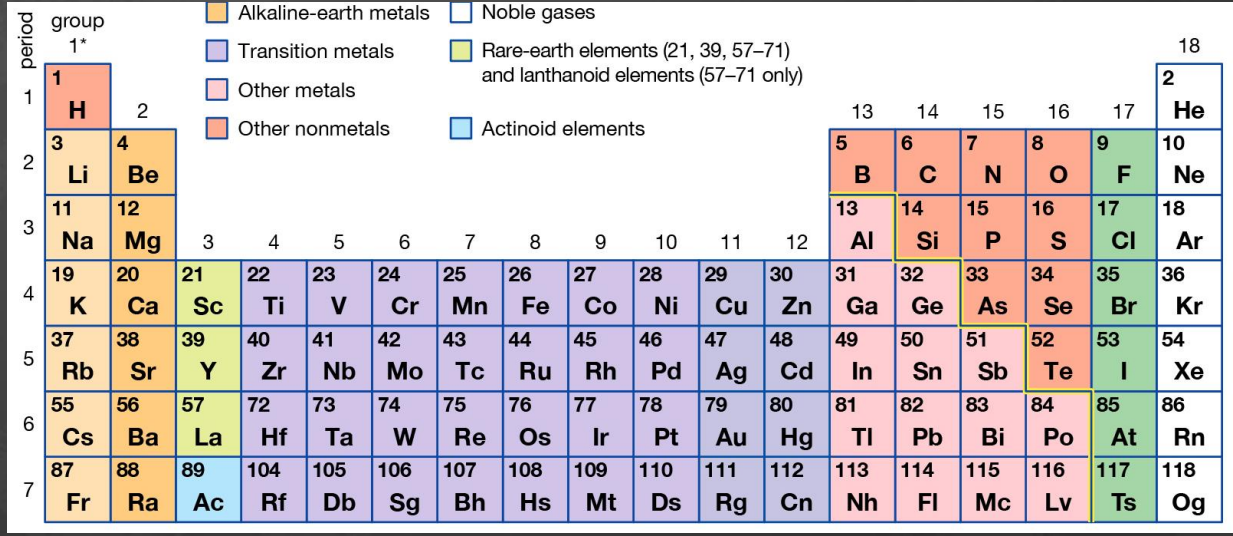
K (1) and I (17)
Ca (2) and S (16)
Na (1) and Cl (17)
Mg (2) and O (16)

Team #2 (Aastha and Albert)

Ca (2) and F (17)
C (14) and Cl (17)
Zn (12) and Cl (17)
H (1) and O (16)

Team #3 (Anna, Kavin, Ethan)

Ca (2) and $(OH)^-$
Al (13) and O (16)
P (15) and O (16)
N (15) and H (1)

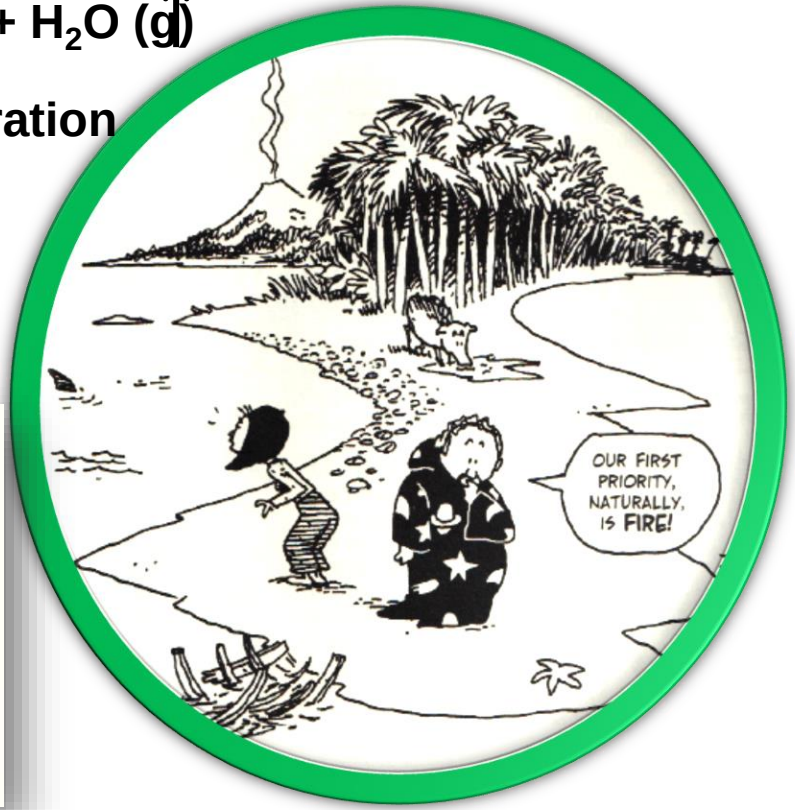


Combustion

Our priority naturally is Fire!

$$CH_2O(s) + O_2(g) \xrightarrow{\Delta} CO_2(g)\uparrow + H_2O\,(g)\uparrow$$

Water evaporation



Let's make a better fuel – charcoal

Limit access of oxygen – burn in a pit using wood and coconut shells

$$CH_2O(s) \xrightarrow{\Delta} C(s) + H_2O\,(g)\uparrow$$

Let's use charcoal to make our dinner

Build a stove and fuel it with charcoal

$$C(s) + O_2(g) \rightarrow CO_2(g)\uparrow$$

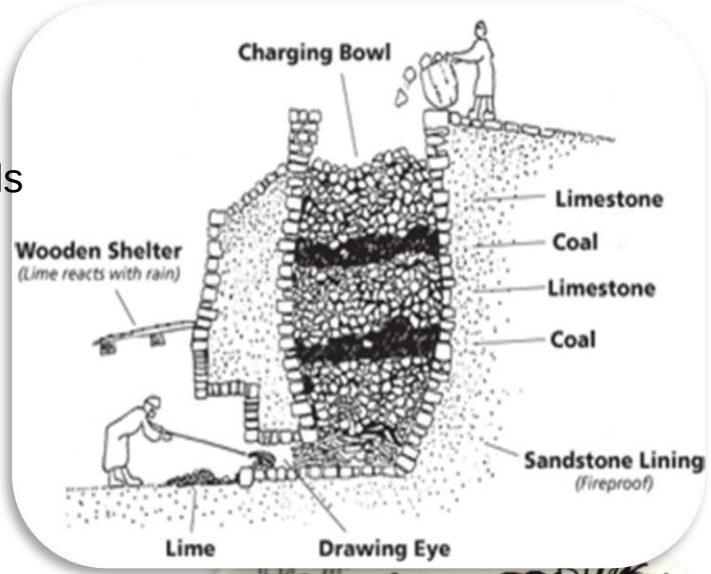
Building materials

Collect limestone, chalk, and/or seashells

calcination

limestone $\xrightarrow{\Delta}$ Quick lime

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)\uparrow$$



Slacked lime

$$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq)$$

$$Ca(OH)_2(s) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(g)$$

Limestone
Again!

Mixing CaO together with volcanic ash makes Roman cement.
Add water, sand and pebbles – concrete! Let's build!

Castaways mixed lime and sand to make mortar for their brick house

$$CaO + H_2O = Ca(OH)_2$$

Ca 40 amu

O 16 amu

H 1 amu

CaO

$1\ amu - 1.67 \times 10^{-24}\ g$

$N\ particles - 1\ g$

$N = 6 \times 10^{23}\ particles$ (Avagadro's number)

$6 \times 10^{23}\ amu = 1\ g$

One mole of a substance is the amount whose mass equals **the molecular or atomic weight** of the substance **expressed in grams**

The equation's coefficients let us find relative masses of products and reactants.

The calculation uses a unit called **Mole.**

One mole of a substance is the amount whose mass equals **the molecular or atomic weight** of the substance **expressed in grams**

	"MOLECULAR" WEIGHT	MOLAR WEIGHT
O_2	32 AMU	32 GRAMS
SiO_2	60 AMU	60 GRAMS
$Al_2Si_2O_5(OH)_4$	258 AMU	258 GRAMS
Fe	56 AMU	56 GRAMS
PROTON	1 AMU	1 GRAM
NaCl	58.5 AMU	58.5 GRAMS

Periodic Table of the Elements

1 IA												13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	8A
1 H Hydrogen 1.008	2 IIA 2A																2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.990	12 Mg Magnesium 24.305	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8	9 VIII 8	10	11 IB 1B	12 IIB 2B	13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 84.798
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.95	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.711	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.249
55 Cs Cesium 132.905	56 Ba Barium 137.328	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.085	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [208.982]	85 At Astatine 209.987	86 Rn Radon 222.018
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Flerovium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [298]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown

This class uses the materials from the following books:
Larry Gonick and Graig Criddle “The cartoon guide to chemistry”
Manyuilov and Rodionov “Chemistry for children and adults”
Kuzmenko, Eremin, Popkov “Beginnings of chemistry”
http://school-collection.edu.ru (experiments)