Exam 1 Review

Percent

$$\% = \frac{\text{Part}}{\text{whole}} \times 100$$

If a wine is listed 12.5% alcohol (Equality; By volume). How much alcohol (Desired) would be consumed if you drank 250. mL of wine (Given)?

$$\text{Percent} = \frac{12.5 \text{ parts}}{100 \text{ whole}}$$

$$\frac{12.5 \text{ mL alcohol}}{100 \text{ mL wine}}$$

any units of volume they must be the same

$$\frac{12.5 \text{ gal alcohol}}{100 \text{ gal wine}}$$

Equality

12.5 mL alcohol = 100 mL wine

Roadmap

mL wine ⟶ mL alcohol

$$250.\ \text{mL wine} \times \frac{12.5 \text{ mL alcohol}}{100 \text{ mL wine}} = 31.25 \text{ mL alcohol}$$

(3 sig figs; × 12.5 mL alcohol / 100 mL wine)

$$= 31.3 \text{ mL alcohol}$$

Types of %

$$\%\text{ by volume} = \frac{x\text{ mL part}}{100\text{ mL whole}} \text{ or } \frac{x\text{ L part}}{100\text{ L whole}}$$

$$\%\text{ by mass} = \frac{x\text{ g part}}{100\text{ g whole}} \text{ or } \frac{x\text{ lbs part}}{100\text{ lbs whole}}$$

Density problems

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Formula

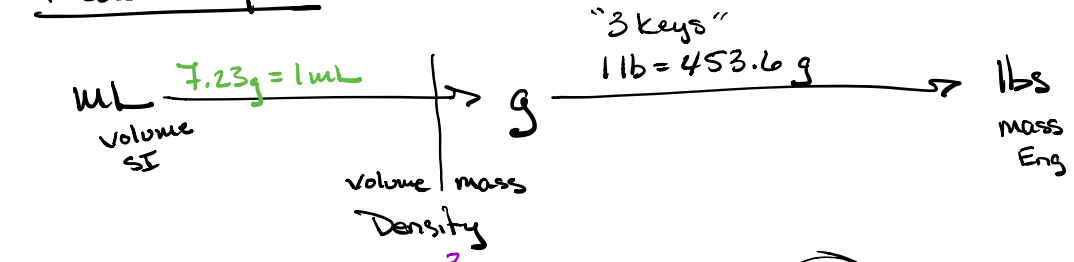
$$d = \frac{\text{mass}}{\text{vol}} = \frac{g}{mL}$$

$$d = g/mL$$

The density of aluminum is 7.23 g/mL. How many pounds would a block of aluminum weigh if the volume of the block is 562 mL?

7.23 g = 1 mL "per" = "equals"

Road Map



$$562\ mL\ \text{aluminum} \times \frac{7.23\ g}{1\ mL} \times \frac{1\ lbs}{453.6\ g} = 8.957804\ lbs$$

$$= 8.96\ lbs$$

If a solution has a volume of 9.62 mL and a mass of 10.37 g, what is the density of the solution?

$$d = \frac{\text{mass}}{\text{volume}}$$

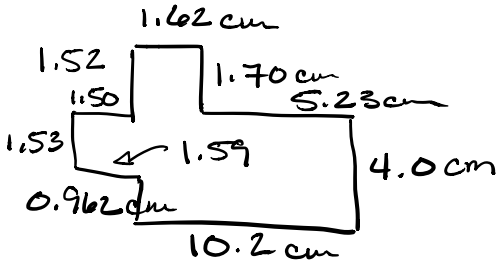
$$d = \frac{10.37\,\text{g}}{9.62\,\text{mL}} = 1.077962\ \text{g/mL}$$

$$= 1.08\ \text{g/mL} = 1.08\ \frac{\text{g}}{\text{mL}}$$

or

$$\frac{1.08\,\text{g}}{1\,\text{mL}}$$

Sig Figs with addition & Subtraction



	1.62	3 ±0.01	all in cm
	1.70	3 ±0.01	
	5.23	3 ±0.01	
	4.0	2 ±0.1	
	10.2	3 ±0.1	
	0.962	3 ±0.001	
	1.59	3 ±0.01	
	1.53	3 ±0.01	
	1.50	3 ±0.01	
+	1.52	3 ±0.01	
	22.8 52 cm		

$$= 22.9\ \text{cm}$$

Example with both

$$\frac{(3.27 + 100.6) \times 0.813}{0.962}$$

1st

⇒ Do sig figs in order of operation

$$\begin{array}{r} 3.27 \\ +\ 100.6 \\ \hline 103.87 \end{array}$$

$103.9 \Leftarrow$ 4 sig figs

$$\frac{(103.87) \times 0.813}{0.962} = 87.782027$$

4 sig figs 3 3

$= 87.8$

Metric Conversions

	Giga	G	1×10^{9}	base
	mega	M	1×10^{6}	base
Greater than 1 ↑	Kilo	k	1×10^{3}	base
	Base unit		1	
Smaller than 1 ↓	cent	c	1×10^{-2}	base
	milli	m	1×10^{-3}	base
	micro	μ	1×10^{-6}	base

Example

Convert 1.627 km into mm

Road map

base

Km → m → mm

def def

$$1.627\ \text{km} \times \frac{1 \times 10^{3}\ \text{m}}{1\ \text{km}} \times \frac{1\ \text{mm}}{1 \times 10^{-3}\ \text{m}} =$$

1.627 x 1 E 3 ÷ 1 E (-) 3 = 1627000 mm

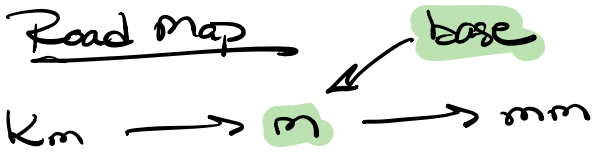
EE EE (±)

= 1,627,000 mm

or

1.627×10^{6} mm

Road map



$$1.627\ \text{km} \times \frac{1\times10^{3}\ \text{m}}{1\ \text{km}} \times \frac{1\ \text{mm}}{1\times10^{-3}\ \text{m}} = 1.627\times10^{6}\ \text{mm}$$

(4; def; def)

or

$$1.627\ \text{km} \times \frac{1000\ \text{m}}{1\ \text{km}} \times \frac{1\ \text{mm}}{0.001\ \text{m}} = 1.627\times10^{6}\ \text{mm}$$

or

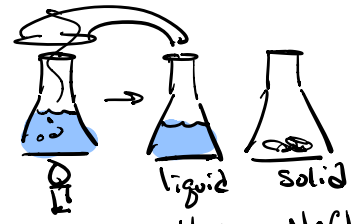
$$1.627\ \text{km} \times \frac{1000\ \text{m}}{1\ \text{km}} \times \frac{1000\ \text{mm}}{1\ \text{m}} = 1.627\times10^{6}\ \text{mm}$$

milli $= 1\times10^{-3}$

1 millimeter $= 1\times10^{-3}\ \text{m} = 0.001\ \text{m}$

Mixture vs. pure Substances

Salt water
H_2O & NaCl
} mixture
2 or more pure Substances



liquid H_2O solid NaCl

physical seperation

Pure Substances Cannot be Seperated by physical means

H_2O pure substance Compound (Two or more elements in fixed ratios)

Electrolysis

H_2 gas O_2 gas

pure substance Elements Cannot be broken down by any means

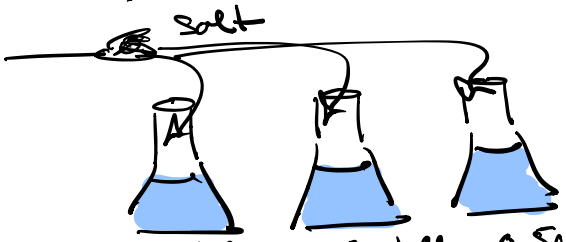
NaCl pure substance Compound

Electrolysis

Na metal Cl_2 gas

Elements

The difference between a mixture & pure substance has to do with fixed ratios



Mixture

} composition of a mixture can vary

Pure Substance

H_2O

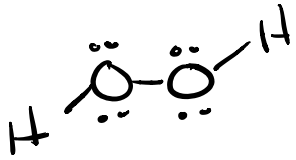
↑↑

Ratio fixed

water

H_2O_2

Hydrogen peroxide

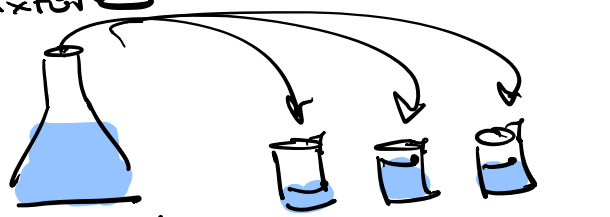


Pure Substances

Compounds	Elements
Two or more Elements in fixed ratios H_2O, $C_6H_{12}O_6$ glucose	Single Symbol H_2, O_2, S_8, Na Fe

Homogeneous vs. Heterogeneous (Mixtures)

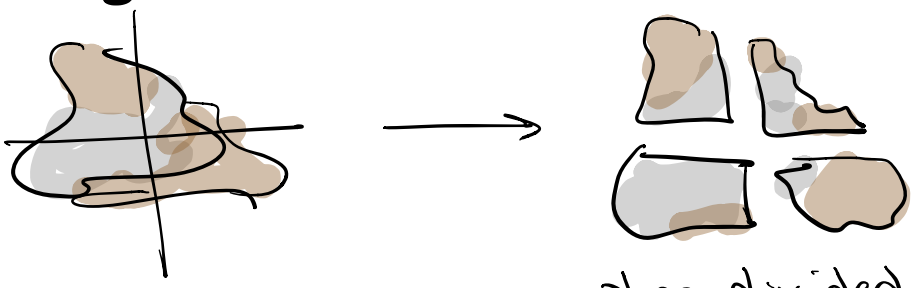
Homogeneous Mixture → Single phase → Uniform Composition



0.1g NaCl dissolved in 10.0 mL H_2O

Same ratio of NaCl to H_2O
all 0.1g NaCl / 10.0mL H_2O

Heterogeneous → not uniform in Composition



When divided the pieces have different Ratios.

$\underline{\underline{Na}}$ Element

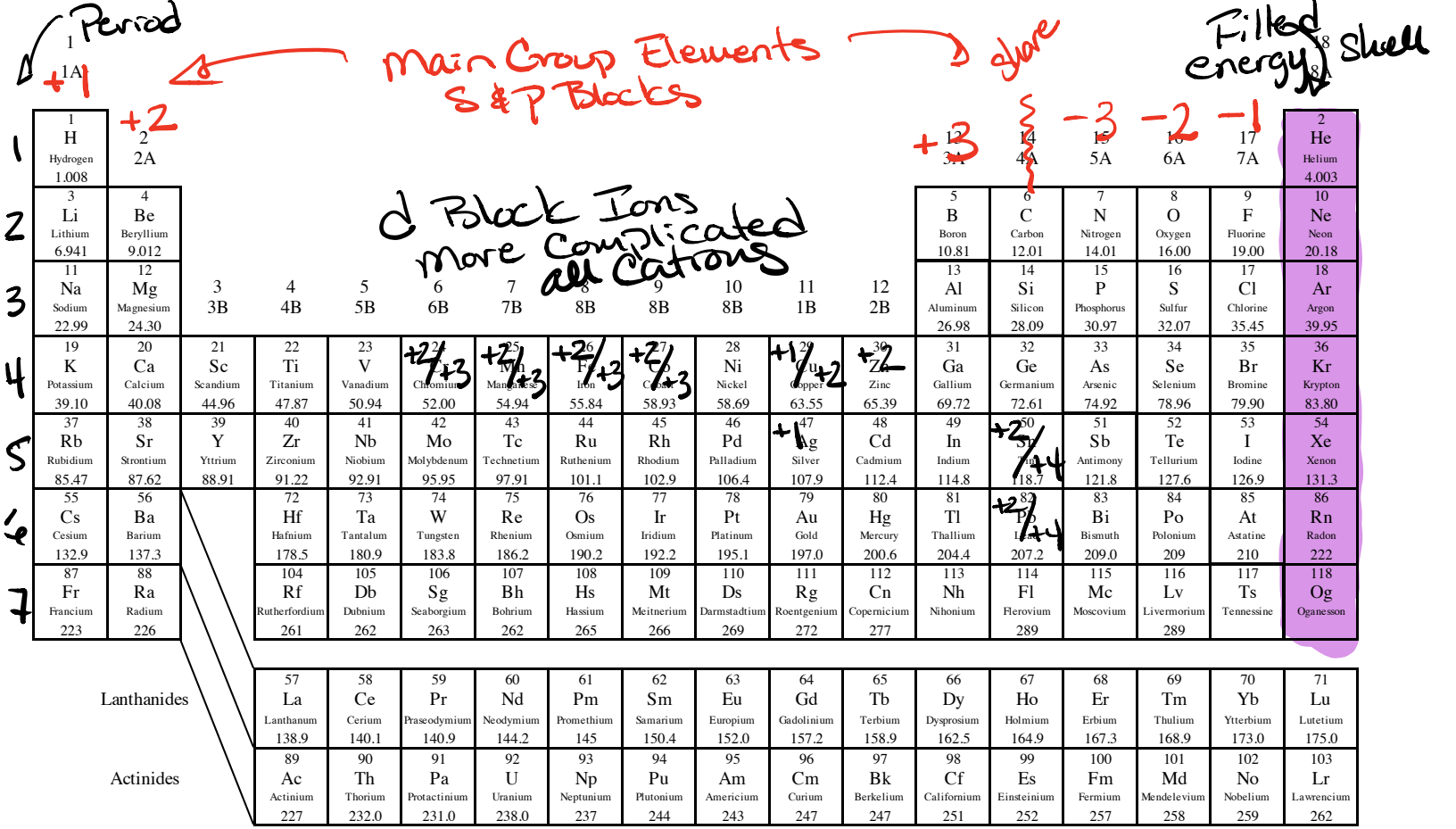
O_2 Oxygen

Na_2O Sodium oxide

NaO Sodium oxide

Na_3N Sodium nitride

Fe_2O_3 Iron(III) oxide


Period
Main Group Elements
S & P Blocks
d Block Ions
More Complicated
all Cations
Filled Energy Shell
1 1A +1
2 2A +2
3 3B
4 4B
5 5B
6 6B +2 +3 Cr
7 7B +2 +3 Mn
8 8B +2 +3 Fe
9 8B +2 +3 Co
10 8B
11 1B +1 +2 Cu
12 2B +2 Zn
13 3A +3
14 4A
15 5A -3
16 6A -2
17 7A -1
18 8A
1 H Hydrogen 1.008
2 He Helium 4.003
3 Li Lithium 6.941
4 Be Beryllium 9.012
5 B Boron 10.81
6 C Carbon 12.01
7 N Nitrogen 14.01
8 O Oxygen 16.00
9 F Fluorine 19.00
10 Ne Neon 20.18
11 Na Sodium 22.99
12 Mg Magnesium 24.30
13 Al Aluminum 26.98
14 Si Silicon 28.09
15 P Phosphorus 30.97
16 S Sulfur 32.07
17 Cl Chlorine 35.45
18 Ar Argon 39.95
19 K Potassium 39.10
20 Ca Calcium 40.08
21 Sc Scandium 44.96
22 Ti Titanium 47.87
23 V Vanadium 50.94
24 Cr Chromium 52.00
25 Mn Manganese 54.94
26 Fe Iron 55.84
27 Co Cobalt 58.93
28 Ni Nickel 58.69
29 Cu Copper 63.55
30 Zn Zinc 65.39
31 Ga Gallium 69.72
32 Ge Germanium 72.61
33 As Arsenic 74.92
34 Se Selenium 78.96
35 Br Bromine 79.90
36 Kr Krypton 83.80
37 Rb Rubidium 85.47
38 Sr Strontium 87.62
39 Y Yttrium 88.91
40 Zr Zirconium 91.22
41 Nb Niobium 92.91
42 Mo Molybdenum 95.95
43 Tc Technetium 97.91
44 Ru Ruthenium 101.1
45 Rh Rhodium 102.9
46 Pd Palladium 106.4
47 Ag Silver 107.9
48 Cd Cadmium 112.4
49 In Indium 114.8
50 Sn Tin 118.7 +2 +4
51 Sb Antimony 121.8
52 Te Tellurium 127.6
53 I Iodine 126.9
54 Xe Xenon 131.3
55 Cs Cesium 132.9
56 Ba Barium 137.3
72 Hf Hafnium 178.5
73 Ta Tantalum 180.9
74 W Tungsten 183.8
75 Re Rhenium 186.2
76 Os Osmium 190.2
77 Ir Iridium 192.2
78 Pt Platinum 195.1
79 Au Gold 197.0
80 Hg Mercury 200.6
81 Tl Thallium 204.4
82 Pb Lead 207.2 +2 +4
83 Bi Bismuth 209.0
84 Po Polonium 209
85 At Astatine 210
86 Rn Radon 222
87 Fr Francium 223
88 Ra Radium 226
104 Rf Rutherfordium 261
105 Db Dubnium 262
106 Sg Seaborgium 263
107 Bh Bohrium 262
108 Hs Hassium 265
109 Mt Meitnerium 266
110 Ds Darmstadtium 269
111 Rg Roentgenium 272
112 Cn Copernicium 277
113 Nh Nihonium
114 Fl Flerovium 289
115 Mc Moscovium
116 Lv Livermorium 289
117 Ts Tennessine
118 Og Oganesson
Lanthanides
57 La Lanthanum 138.9
58 Ce Cerium 140.1
59 Pr Praseodymium 140.9
60 Nd Neodymium 144.2
61 Pm Promethium 145
62 Sm Samarium 150.4
63 Eu Europium 152.0
64 Gd Gadolinium 157.2
65 Tb Terbium 158.9
66 Dy Dysprosium 162.5
67 Ho Holmium 164.9
68 Er Erbium 167.3
69 Tm Thulium 168.9
70 Yb Ytterbium 173.0
71 Lu Lutetium 175.0
Actinides
89 Ac Actinium 227
90 Th Thorium 232.0
91 Pa Protactinium 231.0
92 U Uranium 238.0
93 Np Neptunium 237
94 Pu Plutonium 244
95 Am Americium 243
96 Cm Curium 247
97 Bk Berkelium 247
98 Cf Californium 251
99 Es Einsteinium 252
100 Fm Fermium 257
101 Md Mendelevium 258
102 No Nobelium 259
103 Lr Lawrencium 262

Main group Elements 1A – 7A

– All predictable by position in periodic table

Transition Metals have multiple charge states and you must be told either by name or formula what the charge state is.

$^{+1}/_{+2}$	$^{+2}/_{+3}$	$^{+2}/_{+4}$
Cu^{+1}/Cu^{+2}	Fe^{+2}/Fe^{+3}	Sn^{+2}/Sn^{+4}
Hg_2^{2+}/Hg^{2+}	Cr^{+2}/Cr^{+3}	Pb^{+2}/Pb^{+4}
	Mn^{2+}/Mn^{3+}	
	Co^{2+}/Co^{3+}	

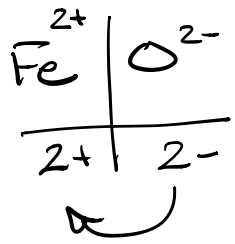
$(Hg^{+}-Hg^{+})^{2+}$

Memorize possibilities

Iron (II) = Fe^{2+}

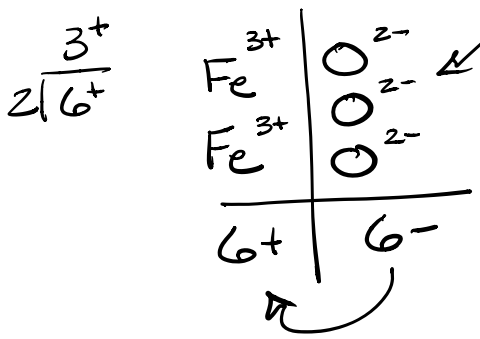
Iron (III) = Fe^{3+}

FeO



Iron(II) oxide

Fe_2O_3



Iron(III) oxide