Unit I

PART I.   MATH TOOLS FOR CHEMISTRY
I. The Metric System
The metric system is the scientific system of units of measurement

Length

Volume

Mass

METRIC BASIC UNITS

LENGTH	MASS	VOLUME	TIME
meter	gram	liter	sec
Abbr. m	g	l	s

Metric Prefixes
Metric prefixes are all related by a factor of ten

Know:	Prefix	Symbol	Exponential form	Standard form
Memorize these!	Mega-	M	10^6	1,000,000
	*Kilo-	K	10^3	1,000
	*Deca-	da	10^1	10
	*Deci-	d	10^{-1}	0.1
	*centi-	c	10^{-2}	0.01
	*milli-	m	10^{-3}	0.001
	*micro-	μ	10^{-6}	0.000001
	*nano-	n	10^{-9}	0.000000001

1 ml = 1 cc = 1 cm^3

English-English conversions (Do not memorize)

Mass	volume	length	time
1 ton = 2000 pounds	4 quart = 1 gal.	3 feet = 1 yd.	60 sec = 1min
16 ounces = 1 pound	1 quart = 2 pints	1 foot = 12 inches	60 min.= 1hour
		1 mile = 5280 feet	24 hr. = 1day

Metric English Conversions (Do not memorize)

Unit	English	Metric
Mass	1 oz	28.35 g
	2.20 lbs	1 kg
Length	1 in	2.54 cm
	3.28 ft	1 m
	1.09 yd	1 m
	1 mi	1.61 km
Volume	1 cu in	16.4 cm^3
	35.31 cu ft.	1 m^3
	1.31 cu yd	1 m^3
	1 fl. oz	29.6 ml
	1.06 qt	1 l
	1 gal	3.79 l

II. Calculations
Dimensional Analysis is a method used to convert from one unit to another.
Examples: A. SINGLE-STEP PROBLEMS

a) How many liters in .250 ml

b) How many grams in 200 kg

c) How many kg in 55 grams

d) How many grams in 10.5 oz.

e) Convert 1.77 centimeters to meters

f) How many millimeters are in 3.4 meters

g) How many liters in 55 µL?

B MULTISTEP
Key: Go thru the base unit.

1. Metric ↔ Metric conversions
    a. How many Kilometers are in 3.46   mm?

    b. How many milliliters are in 1.2 deciliters?

Part II CHEMISTRY

I. Mass and Weight

Weight is the gravitational force with which a planet attracts an object (like the earth)

Mass is the quantity of a matter in an object

II. Density

Density measures how closely the **mass** of a given substance is packed in a given **volume**

$$D = \frac{Mass}{Volume}$$

Density is a ratio of the mass to the volume of a substance

Densities of some common materials

Material	Density g/ml or g/cc
Water	1.0
Cement	3.0
Gold	19.3
Oak wood	.6
Lead	11.3

Problems: a. If 40.53 g gold = 2.10 cm^3, what is its density?

How is density calculated?

1. What is the density of a block that has a mass of 252 grams and a volume of 328 ml?

2. What is the volume of a liquid that has a density of 1.45 g/cc and a mass of 28 grams?

3. What is the mass of a rock that has a volume of 48 cm^3 and a density of 2.68 g/ cm^3?

4. Calculate the mass of 251 mL of Al. (Density of Al = 2.7 g Al / cm^3 Al)
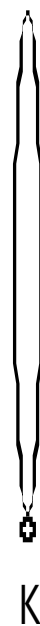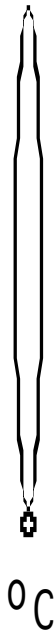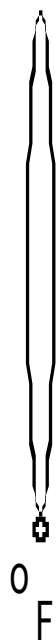
Note: 1cm^3 = 1 ml = 1cc (know)

III. Temperature

Temperature ,T^O, is a measurement of hotness or coldness.

    A. Celsius & Kelvin

    B. ^{O}F

    C. Thermometers

^{0}F ^{0}C   K

    D. Temperature conversions:

1. Celsius to Kelvin ^{o}C + 273 = K

Convert 25 ^{o}C into K

2. Kelvin to Celsius K – 273 = ^{o}C

Convert 25 K into ^{o}C

IV. THE PERIODIC TABLE

A. ELEMENTS→ Memorize selected elements. Correct spelling is essential!!!
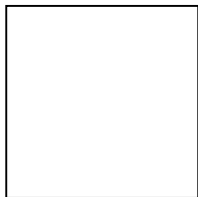
B.

Periods are horizontal rows on the periodic table

Groups are vertical columns on the periodic table

Group	Name
IA	Alkali Metals
IIA	Alkaline Earth Metals
VIIA	Halogens
VIIIA	Noble Gases

Families are groups (essentially). These elements have similar properities.

Diatomic Elements are those elements that exists as <u>two</u> atoms bonded together

Representative elements are "A" group elements

Metals are those elements which have the characteristic properities of: high luster, good conductors of heat and electricity, and are malleable

Nonmetals are those elements, unlike metals do not have a high luster and generally are not good conductors of heat and electricity

Transition elements (metals) are the "B" group elements

Mettaloids are elements with properities that are intermediate between those of metal and nonmetals

Physical States of elements- Elements exists as either a gas (g), liquid (l) or solid (s).

Gases: H_2, N_2, O_2, F_2, Cl_2, He, Ne, Ar, Kr, Xe, Rn

Liquids: Cs, Fr, Hg, Ga, Br_2

Symbols and Name of Some Common Elements (Memorize these)

Nonmetals		Metals		Metalloids	
Symbol	**Name**	**Symbol**	**Name**	**Symbol**	**Name**
H	hydrogen	Li	lithium	B	boron
He	helium	Be	beryllium	Si	silicon
C	carbon	Na	sodium	As	arsenic
N	nitrogen	Mg	magnesium		
O	oxygen	Al	aluminum		
F	fluorine	K	potassium		
Ne	neon	Ca	calcium		
P	phosphorus	Mn	manganese		
S	sulfur	Fe	iron		
Cl	chlorine	Co	cobalt		
Ar	argon	Ni	nickel		
Br	bromine	Cu	copper		
Kr	krypton	Zn	zinc		
I	iodine	Rb	rubidium		
Xe	xenon	Sr	strontium		
		Ag	silver		
		Cd	cadmium		
		Sn	tin		
		Ba	barium		
		Au	gold		
		Hg	mercury		
		Pb	lead		