Name: _____

Instructor: Mills

Chemistry 100: 2nd Practice Midterm Examination

Answer all five questions. Each question is worth 30 points. Please ensure you have all *five* pages of questions, as well as a formula sheet *before* starting work. For numerical answers, include the correct number of **significant figures** and appropriate **S.I. unit(s)**. For full credit you must….

SHOW ALL WORK

Question	Score
1	
2	
3	
4	
5	
Total	

"Ionic"

Write the formulas and names of nine ionic compounds that may be formed through combining the anions and cations ions listed immediately below.

H^+ Cu^{2+} Al^{3+} Cl^- SO_4^{2-} PO_4^{3-}

Ionic Formula	Name of Ionic Compound

State whether your compounds from part 2a are soluble or insoluble:

Soluble Compounds Insoluble Compounds

"Balance"

Write balanced chemical equations that describe the following processes. Remember to include state symbols in your equations:

a. The burning of liquid propane (C_3H_8 (l)) in air

b. The Neutralization of stomach acid (hydrochloric acid solution) with caustic soda (sodium hydroxide solution)

c. The reaction of solid diphosphorus pentoxide with water to form aqueous phosphoric acid

d. The decomposition of chalk ($CaCO_3$), when heated, to form solid calcium oxide and carbon dioxide gas

e. The reaction of metallic zinc with aqueous sulfuric acid to form aqueous zinc sulfate and hydrogen gas

Extra Credit: State to which one of the five general *classes of reaction each of the above processes belong.*

"Those Three Equations"

Write *balanced*, *complete* and *net* ionic equations illustrating the reaction between solutions of barium nitrate and sodium sulfate.

List the names and formulas of five insoluble ionic compounds containing the phosphate anion.

"Moles"

Expect a question relating to converting grams, volume of a gas and number of particles to and from moles of material (see HWK and class notes for examples)

"Slides and Ladders"

For the following *unbalanced* chemical reaction, determine the quantities listed below (Hint: balance the reaction first):

$$Fe(s) + O_2(g) \rightarrow Fe_2O_3(s)$$

The mass of iron (III) oxide produced when 2.56 g of solid iron is burnt in excess oxygen gas:

The number of oxygen molecules consumed in part (a)

Extra Credit*: State to which one of the five general *classes of reaction the above processes belongs.

"Electron addresses"

Draw *Lewis symbols* and *'Dot' structures* for the following:

Atom or Ion	Lewis Symbol	Dot Structure
C		
O^{2-}		

"Air bag"

Vehicle safety 'air' bags actually inflate with nitrogen gas during collisions. If a standard car's 'air' bag has a volume of 36.0 L and inflates to a pressure of 745 Torr at 15 ^{o}C, then:

How many moles of N_2 (g) are contained within the inflated 'air' bag described above?

If the car's air bag described above was instead inflated at – 20 ^{o}C (i.e. on a Chicago winter's day), to what pressure would the 'air' bag inflate?

Extra credit: Do you think the process described in (b) would be dangerous? Explain.

Data sheet (periodic table also provided)

Density = mass/volume	1 kg = 2.205 lb	1 cm^3 = 1 mL = 1 $x10^{-6}$ m^3
Density copper (Cu) = 8.95 gcm^{-3}	1 inch = 2.54 cm	1 mile = 1.6039 km
1 a.m.u. = 1.6606 x 10^{-24} g	1 ft = 12 inches (exactly)	1 gallon = 3.786 L
Volume cylinder = $\pi r^2 h$	1dm^3 = 1L = $10^{-3}m^3$	PV = nRT
R = 0.0821 Latm/molK	1 atm = 760 Torr	$P_1V_1/T_1 = P_2V_2/T_2$

Common Decimal Prefixes

Prefix	Symbol	Exponential Notation
Giga	G	10^9
Mega	M	10^6
Kilo	k	10^3
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}

Solubility rules:

Soluble Compounds		Exceptions
Compounds containing	NO_3^-	None
	Cl^-	Ag^+, Hg^{2+},Pb^{2+}
	Br^-	Ag^+, Hg^{2+},Pb^{2+}
	I^-	Ag^+, Hg^{2+},Pb^{2+}
	SO_4^{2-}	Ba^{2+}, Hg^{2+},Pb^{2+}

Insoluble Compounds		Exceptions
Compounds containing	CO_3^{2-}	NH_4^+ & group IA cations
	PO_4^{3-}	NH_4^+ & group IA cations
	OH^-	group IA cations Ca^{2+},Sr^{2+}, Ba^{2+} & NH_4^+