The Periodic Table

IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB	VIIIB	VIIIB	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
H 1 1.01																	He 2 4.00
Li 3 6.94	Be 4 9.01											B 5 10.81	C 6 12.01	N 7 14.01	O 8 16.00	F 9 19.00	Ne 10 20.18
Na 11 22.99	Mg 12 24.31											Al 13 26.98	Si 14 28.09	P 15 30.97	S 16 32.07	Cl 17 35.45	Ar 18 39.95
K 19 39.10	Ca 20 40.08	Sc 21 44.96	Ti 22 47.88	V 23 50.94	Cr 24 52.00	Mn 25 54.94	Fe 26 55.85	Co 27 58.93	Ni 28 58.69	Cu 29 63.55	Zn 30 65.39	Ga 31 69.72	Ge 32 72.61	As 33 74.92	Se 34 78.96	Br 35 79.90	Kr 36 83.80
Rb 37 85.47	Sr 38 87.62	Y 39 88.91	Zr 40 91.22	Nb 41 92.91	Mo 42 95.94	Tc 43 (97.9)	Ru 44 101.07	Rh 45 102.91	Pd 46 106.42	Ag 47 107.87	Cd 48 112.41	In 49 114.82	Sn 50 118.71	Sb 51 121.76	Te 52 127.60	I 53 126.90	Xe 54 131.29
Cs 55 132.91	Ba 56 137.33	La 57 138.91	Hf 72 178.49	Ta 73 180.95	W 74 183.85	Re 75 186.21	Os 76 190.2	Ir 77 192.22	Pt 78 195.08	Au 79 197.97	Hg 80 200.59	Tl 81 204.38	Pb 82 207.2	Bi 83 208.98	Po 84 (209)	At 85 (210)	Rn 86 (222)
Fr 87 223.02	Ra 88 226.03	Ac 89 227.03	Rf 104 (261)	Db 105 (262)	Sg 106 263)	Bh 107 (262)	Hs 108 (265)	Mt 109 (266)	Ds 110 (271)	Rg 111 (272)	Uub 112 (285)	Uut 113 (284)	Uuq 114 (289)	Uup 115 (288)			

												Ce 58 140.12	Pr 59 140.91	Nd 60 144.24	Pm 61 (145)	Sm 62 150.36	Eu 63 152.97	Gd 64 157.25	Tb 65 158.93	Dy 66 162.50	Ho 67 164.93	Er 68 167.26	Tm 69 168.93	Yb 70 173.04	Lu 71 174.97
												Th 90 232.04	Pa 91 231.04	U 92 238.03	Np 93 237.05	Pu 94 (240)	Am 95 243.06	Cm 96 (247)	Bk 97 (248)	Cf 98 (251)	Es 99 252.08	Fm 100 257.10	Md 101 (257)	No 102 259.10	Lr 103 262.11

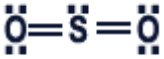
Solubility Guidelines:

Soluble Ionic Compounds	
1.	All sodium, potassium and ammonium salts are soluble.
2.	All nitrate, acetate, chlorate and perchlorate salts are soluble
3.	All chloride, bromide and iodide salts are soluble. Except those that contain: lead, silver or mercury(I) (Hg_2^{2+}).
4.	All fluoride salts are soluble. Except those that contain: magnesium, calcium, strontium, barium or lead.
5.	All sulfate salts are soluble. Except those that contain: calcium, silver, mercury(I), strontium, barium or lead.
Not Soluble Ionic Compounds	
1.	All hydroxide and oxide salts are not soluble. Except those that contain: sodium, potassium or barium.
2.	All sulfide salts are not soluble. Except those that contain: sodium, potassium ammonium or barium.
3.	All carbonate and phosphate salts are not soluble. Except those that contain: sodium, potassium or ammonium.

SID _____ Last _____ First _____

Question 1
24 Points

The following questions refer to the molecules whose Lewis Dot Structure are depicted below.

A	B	C	D
			

1. The **number** of molecules whose bonding about the central atom is best described by **sp** sybridization? _____
2. The **molecule(s)** whose bonding about the central atom is best described using **sp^2** hybrid orbitals? _____
3. The bonding about the central **I** atom in **B** is best described using what type of **hybridization?** _____
4. The molecule with the **greatest** number of **pi bonds?** _____
5. The molecule with the **greatest** number of **sigma bonds?** _____

The following questions refer to the O_3 (Molecule C)

6. The lone pair on the central oxygen atom is best described as being in what **type** of **orbital?** _____
7. The ***O*=*O*** bond is best described: as a sigma bond formed from the overlap of a(n) _____ on ***O*** with a(n) _____on ***O***; and a pi bond formed by the overlap of a(n) _____ orbital on O with a(n) _____orbital on O.

Question 2
12 Points

Complete the following chemical reactions: (Give the formula for the products)

A. Iron(III) perchlorate + Sodium hydroxide = _____
B. Hydrofluoric acid (HF) + potassium hydroxide = _____
C. Cobalt(II) carbonate + hydrochloric acid = _____

With respect to the above reactions:

1. Acid base reaction: _____
2. Gas forming reaction: _____
3. Precipitation reaction: _____

Question 3
12 Points

1. Consider the reaction when aqueous solutions of **calcium nitrate** and **potassium hydroxide** are combined. The net ionic equation for this reaction is:

_____

2. Write a net ionic equation for the reaction that occurs when aqueous solutions of **lithium hydroxide** and **hydrocyanic acid** (HCN) are combined.

_____

3. Write a net ionic equation for the reaction that occurs when aqueous solutions of **sodium carbonate** and **hydroiodic acid** are combined.

_____

Question 4
6 Points

A sample of ethylene glycol with a mass of **74.0**g at **6^0C** is placed into a perfectly insulated container together with **93.0**g of glass at **76^0C**. Calculate the final temperature of the sample when thermal equilibrium is reached?

Heat capacities: Glass = 0.84 J/g^oC Ethylene glycol = 2.41 J/g^0C

Question 5
4 Points

The Ideal Gas equation, PV = nRT, breaks down at high pressures. Why is this?

Question 6
8 Points

21.0g of **LiCl** are dissolved in **170.0**g of **water** in a calorimeter the following data was collected:

Initial Temperature:	**24.4^{0}C**
Final Temperature:	**42.5^{0}C**
Heat capacity of the solution:	**4.184 J/g^{0}C**
Calorimeter constant:	**63.9 J/^{0}C**

What is the heat of solution for this compound in J/mol?

Question 7
8 Points

How many grams of solid **barium hydroxide** are needed to exactly neutralize **12.1** mL of a **0.562 M nitric acid** solution? Assume that the volume remains constant.

Question 8
12 Points

For the following reaction, **4.34** grams of **benzene (C_6H_6)** are allowed to react with **5.6** grams of **oxygen gas**.

benzene (C_6H_6) (l) + **oxygen** (g) = **carbon monoxide** (g) + **water** (g)

1. What is the maximum amount **in moles** of **carbon monoxide** that can be formed?

2. What is the **FORMULA** for the limiting reagent? _____

What amount **in grams** of the excess reagent remains after the reaction is complete?
Grams

Question 9
6 Points

For the following reaction, **5.61** grams of sulfur are mixed with excess carbon monoxide. The reaction yields **3.16** grams of **carbon**. What is the percent yield?

sulfur (s) + carbon monoxide (g) = sulfur dioxide (g) + carbon (s)

Question 10 Given the following thermodynamic data:

8 Points

$\Delta H^0_f MnO_2(s)$ = -504.0 kJ/mol $\Delta H^0_f Al_2O_3(s)$ = -1675.7 kJ/mol

What quantity of heat is absorbed or evolved upon the production of **27g** of **Al_2O_3**:

4 Al(s) + 3 MnO_2(s) = 3 Mn(s) + 2 Al_2O_3(s)

Do Not Write Below This Line

Exam III Score		