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 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, ammonium or barium.
2.	All sulfide salts are not soluble. EXCEPT those that contain: sodium, potassium or ammonium.
3.	All carbonate, phosphate, chromate, and oxide salts are not soluble. EXCEPT those that contain: sodium, potassium or ammonium.

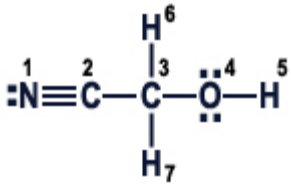
NOTE:

YOU MUST SHOW ALL WORK TO OBTAIN ANY PARTIAL CREDIT ON THIS EXAM.

SID _____ Last _____ First _____

Question 1
18 Points

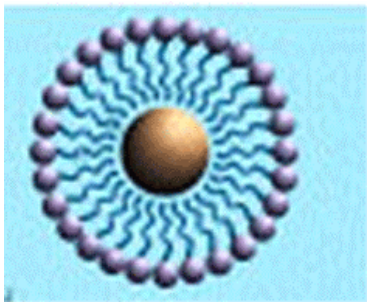
1. The atoms that form a sigma bond by the overlap of an **sp** and an **sp^3** hybrid orbitals? _____



2. The atoms that form a sigma bond by the overlap of an **sp^3** and an **sp^3** hybrid orbitals? _____
3. The **total** number of **sigma bonds** in this molecule is: _____
4. The **total** number of **pi bonds** in this molecule is: _____
5. The hybridization used to describe the bonding around:

   N1 is: _____ ***C2*** is: _____ ***C3*** is: _____
6. Orbital used by **H5** to form a sigma bond with the _____ orbital on ***O4*** : _____

Question 2
4 Points



A surfactant molecule with a polar head group and a non-polar tail is depicted on the left.

From this depiction it can be inferred that the solvent that this molecule was placed in is _____ and that the molecule inside the surfactant molecules is _____

Question 3
6 Points

Give the formula for the precipitate that is formed when each of the following aqueous solutions are mixed.

1. Iron(III) bromide and sodium hydroxide _____
2. Calcium chloride and ammonium sulfide _____

Question 4
16 Points

1. Consider the reaction when aqueous solutions of **aluminum 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 **potassium hydroxide** and **hydrofluoric acid** (HF) 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 5
6 Points

A sample of ethylene glycol with a mass of **77.0g** at **4^{0}C** is placed into a perfectly insulated container together with **89.0g** of glass at **56^{0}C**. Calculate the final temperature of the sample when thermal equilibrium is reached?

Heat capacities: Glass = 0.84 J/g^{o}C Ethylene glycol = 2.41 J/g^{0}C

Final Temperature:_____**°C**

Question 6
10 Points

19.0g of LiCl are dissolved in **175.0g** of water in a calorimeter the following data was collected:

Initial Temperature: **42.5^{0}C** Final Temperature: **58.5^{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**?

Heat of solution:_____**J/mol**

Question 7
6 Points

Given the following thermodynamic data:

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

Determine the enthalpy change associated with the following reaction:

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

Question 8
6 Points

70.0g of water at **60°C** is added to **55.0g** of ice at **0°C**. Some of the ice melts and the water cools to 0°C. When the ice and water mixture are at 0°C, how much ice has melted?

ΔH_{fusion} ice = 333 J/g Heat Capacity of water = 4.184 J/g°C

Quantity of **ice** melted:_____g

Question 9
8 Points

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

Grams of **barium hydroxide**:_____

Question 10
10 Points

58.8 mL of **0.297 M hydrobromic acid** is added to **39.6** mL of calcium hydroxide, and the resulting solution is found to be acidic.
29.2 mL of **0.126 M barium hydroxide** is required to reach neutrality.
What is the molarity of the original **calcium hydroxide** solution?

Calcium hydroxide concentration: _____M

Question 11
6 Points

Nitrogen monoxide is produced by combustion in an automobile engine. For the following reaction, **0.534** moles of **nitrogen monoxide** are mixed with **0.514** moles of **oxygen** gas.

nitrogen monoxide (g) + oxygen (g) = nitrogen dioxide (g)

What is the **FORMULA** for the limiting reagent?
What is the **maximum amount (in moles)** of **nitrogen dioxide** that can be formed?

Formula for limiting reagent: _____

Maximum amount of **nitrogen dioxide** produced: _____

Question 12
4 Points

An observation is that a fixed quantity of a gas occupies a smaller volume as the temperature decreases (under constant pressure). Why is this?

Do Not Write Below This Line

Exam III Score		