

Test 2, Chemistry 121
Spring 2006

Name: _____

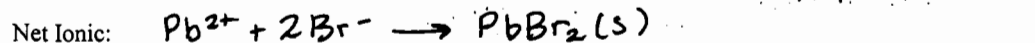
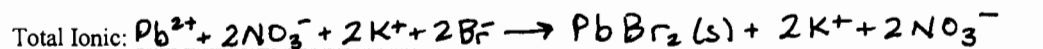
Instructions: You have 75 minutes to complete this 100-point exam. You may use a simple scientific calculator. No programmable calculators allowed.

I. Solubility (10 pts): Indicate whether the following compounds are soluble in water.

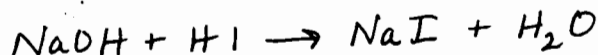
- | | | | | | |
|-----------------------------|---------|-----------|---------------------------------|---------|-----------|
| 1. Na_3PO_4 | Soluble | Insoluble | 6. AgCl | Soluble | Insoluble |
| 2. ZnCl_2 | Soluble | Insoluble | 7. TiNO_3 | Soluble | Insoluble |
| 3. FeCrO_4 | Soluble | Insoluble | 8. $(\text{NH}_4)_2\text{CO}_3$ | Soluble | Insoluble |
| 4. $\text{Ca}(\text{OH})_2$ | Soluble | Insoluble | 9. AlPO_4 | Soluble | Insoluble |
| 5. PbSO_4 | Soluble | Insoluble | 10. MgSO_4 | Soluble | Insoluble |

II. Writing and Balancing Equations

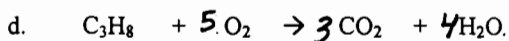
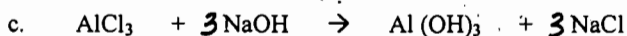
1. (15 pts) Write the balanced molecular, total ionic and net ionic equations for the reaction of lead (II) nitrate with potassium bromide. (make sure you identify the solid precipitate)



2. (5 pts) Write the balanced molecular equation for the reaction of sodium hydroxide with hydroiodic acid (HI).



3. (20 pts) Balance the following equations:



III. Calculations – show all work for partial credit

1. (15 pts) Sodium thiosulfate pentahydrate, $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ is used in photography development.

- a. Calculate its molar mass. (show all work)

$$\begin{aligned} 2\text{Na} &= 2(22.99) = 45.98 \\ 2\text{S} &= 2(32.06) = 64.12 \\ 8\text{O} &= 8(16.00) = 128.00 \\ 10\text{H} &= 10(1.008) = 10.08 \\ \hline &248.18 \text{ g/mol} \end{aligned}$$

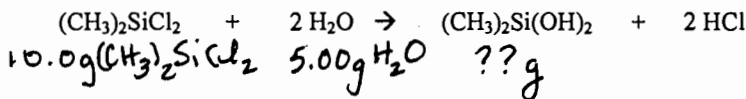
- b. A solution of $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ has a concentration 0.500 M. How many grams of $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ are in 15.0 mL of the solution? (Use the MM from part a)

$$15.0 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.500 \text{ mol}}{\text{L}} \times \frac{248.18 \text{ g}}{1 \text{ mol}} = 1.86 \text{ g } \text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$$

2. (10 pts) Propylene glycol ($\text{CH}_3\text{CHOHCH}_2\text{OH}$) is used as a safe alternative to ethylene glycol, the main ingredient in antifreeze. How many molecules of propylene glycol are in 5.0 mg of $\text{CH}_3\text{CHOHCH}_2\text{OH}$? (MM of $\text{CH}_3\text{CHOHCH}_2\text{OH}$ = 76.09 g/mol)

$$5.0 \text{ mg} \times \frac{1 \text{ g}}{1000 \text{ mg}} \times \frac{1 \text{ mol}}{76.09 \text{ g}} \times \frac{6.02 \times 10^{23}}{1 \text{ mol}} = 4.0 \times 10^{19} \text{ molecules}$$

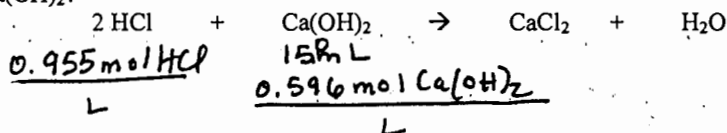
3. (15 pts) Silicone bracelets have become extremely popular in the last two years. The basic molecular unit of these bracelets is dimethylsiloxane $(\text{CH}_3)_2\text{Si}(\text{OH})_2$. This is made by reacting dimethyl dichlorosilane, $(\text{CH}_3)_2\text{SiCl}_2$, with water. How many grams of $(\text{CH}_3)_2\text{Si}(\text{OH})_2$ are prepared by the reaction of 10.0g of $(\text{CH}_3)_2\text{SiCl}_2$ with 5.00g of water? (MM of $(\text{CH}_3)_2\text{SiCl}_2 = 129.06 \text{ g/mol}$, MM of $\text{H}_2\text{O} = 18.02 \text{ g/mol}$, MM of $(\text{CH}_3)_2\text{Si}(\text{OH})_2 = 92.17 \text{ g/mol}$)



$$10.0\text{g}(\text{CH}_3)_2\text{SiCl}_2 \times \frac{1\text{mol}(\text{CH}_3)_2\text{SiCl}_2}{129.06\text{g}} \times \frac{1\text{mol}(\text{CH}_3)_2\text{Si}(\text{OH})_2}{1\text{mol}(\text{CH}_3)_2\text{SiCl}_2} \times \frac{92.17\text{g}(\text{CH}_3)_2\text{Si}(\text{OH})_2}{1\text{mol}(\text{CH}_3)_2\text{Si}(\text{OH})_2} = 7.14\text{g}$$

$$5.00\text{g}\text{H}_2\text{O} \times \frac{1\text{mol}\text{H}_2\text{O}}{18.02\text{g}\text{H}_2\text{O}} \times \frac{1\text{mol}(\text{CH}_3)_2\text{Si}(\text{OH})_2}{2\text{mol}\text{H}_2\text{O}} \times \frac{92.17\text{g}(\text{CH}_3)_2\text{Si}(\text{OH})_2}{1\text{mol}(\text{CH}_3)_2\text{Si}(\text{OH})_2} = 12.8\text{g}$$

4. (10 pts) What volume (in mL) of 0.955 M HCl is required to exactly neutralize 15.0 mL of 0.596 M $\text{Ca}(\text{OH})_2$?



$$15.0\text{mL} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{0.596\text{mol}\text{Ca}(\text{OH})_2}{1\text{L}} \times \frac{2\text{mol}\text{HCl}}{1\text{mol}\text{Ca}(\text{OH})_2} \times \frac{1\text{L}}{0.955\text{mol}\text{HCl}} \times \frac{1000\text{mL}}{1\text{L}} = 18.7\text{mL}$$

5. (10 pts) Determine the empirical formula of a compound that contains 53.5 % Xe and 46.5 % F.

Assume 100g

$$53.5\text{g Xe} \times \frac{1\text{mol Xe}}{131.30\text{g Xe}} = 0.407\text{mol Xe}$$

$$46.5\text{g F} \times \frac{1\text{mol F}}{19.00\text{g F}} = 2.45\text{mol F}$$

$$\frac{\text{Xe}_{0.407} \text{F}_{2.45}}{0.407 \quad 0.407} = \boxed{\text{XeF}_6}$$

1	IA	1	H	1.008	IIA	2	He	4.00																																														
2	3	Li	6.94	4	Be	9.01	5	B	10.81	6	C	12.01	7	N	14.01	8	O	16.00	9	F	19.00	10	Ne	20.18																														
3	11	Na	22.99	12	Mg	24.31	13	Al	26.98	14	Si	28.09	15	P	30.97	16	S	32.06	17	Cl	35.45	18	Ar	39.95																														
4	19	K	39.10	20	Ca	40.08	21	Sc	44.96	22	Ti	47.90	23	V	50.94	24	Cr	52.00	25	Mn	54.94	26	Fe	55.85	27	Co	58.93	28	Ni	58.71	29	Cu	63.55	30	Zn	65.37	31	Ga	69.72	32	Ge	72.59	33	As	74.92	34	Se	78.96	35	Br	79.90	36	Kr	83.80
5	37	Rb	85.47	38	Sr	87.62	39	Y	88.91	40	Zr	91.22	41	Nb	92.91	42	Mo	95.94	43	Tc	[98]	44	Ru	101.1	45	Rh	102.9	46	Pd	106.4	47	Ag	107.9	48	Cd	112.40	49	In	114.8	50	Sn	118.7	51	Sb	121.8	52	Te	127.60	53	I	126.90	54	Xe	131.30
6	55	Cs	132.9	56	Ba	137.3	57	La	138.9	58	Ce	140.1	59	Pr	140.9	60	Nd	144.2	61	Pm	[145]	62	Sm	150.4	63	Eu	152	64	Gd	157.3	65	Tb	158.9	66	Dy	162.5	67	Ho	164.93	68	Er	167.3	69	Tm	168.9	70	Yb	173						
7	87	Fr	[223]	88	Ra	[226]	89	Ac	[227]	90	Th	232	91	Pa	[231]	92	U	238	93	Np	[237]	94	Pu	[244]	95	Am	[243]	96	Cm	[247]	97	Bk	[251]	98	Cf	[252]	99	Es	[257]	100	Fm	[258]	101	Md	[259]	102	No	[259]						

57	58	59	60	61	62	63	64	65	66	67	68	69	70
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb
138.9	140.1	140.9	144.2	[145]	150.4	152	157.3	158.9	162.5	164.93	167.3	168.9	173
89	90	91	92	93	94	95	96	97	98	99	100	101	102
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No
[227]	232	[231]	238	[237]	[244]	[243]	[247]	[247]	[251]	[252]	[257]	[258]	[259]