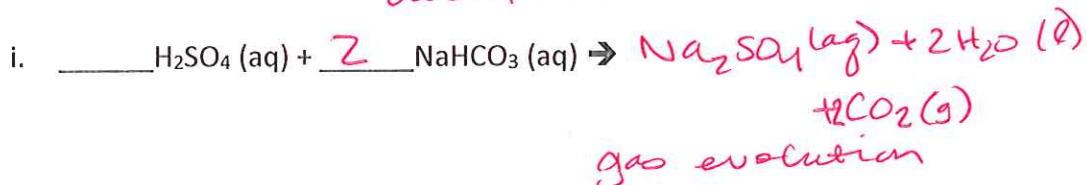
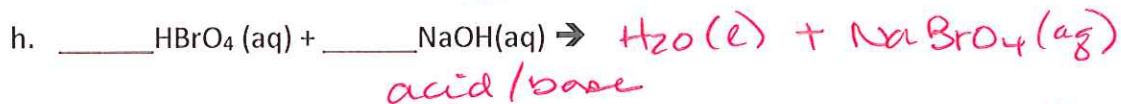
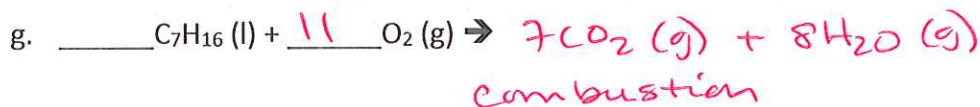
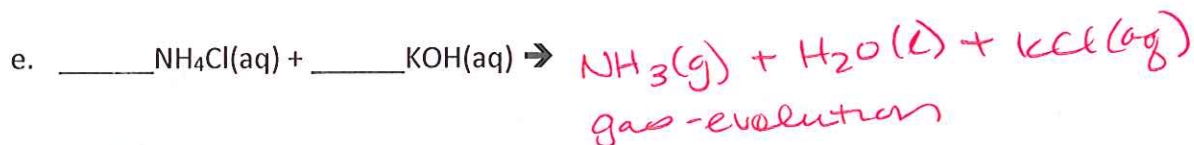
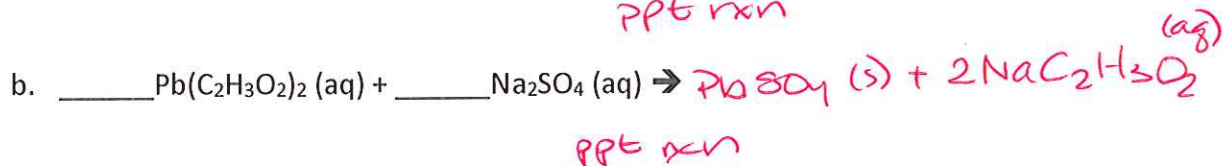
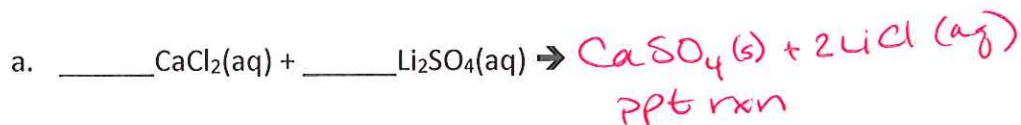


Name Key

Exam #3 – 100 points

Directions: Answer each question below to the best of your ability. Show all work where calculations are required. An information sheet with a periodic table is attached to the back of the exam; you may remove it if you wish.

1. (27) Fill in the product(s) of each chemical reaction below (with states), then balance the chemical equation. Provide the name of the specific reaction type. Write "No Reaction" if you do not expect a reaction to occur. For reactions that do occur, assume the reaction will go to completion.



2. (12) Write balanced chemical equations for each of the following reactions.

a. Ethyl butyrate is a liquid that smells like pineapples and has a molecular formula of $C_6H_{12}O_2$. It is burned in air.



b. Solid magnesium reacts with aqueous copper (I) nitrate



c. Solid magnesium chloride reacts with bromine liquid

no rxn

3. (10) For the reaction below, (i) complete and balance the chemical equation, (ii) provide a complete ionic equation, and (iii) write the net ionic equation. If a reaction does not occur write "No Reaction".

a. Solutions of barium hydroxide and ammonium phosphate are mixed together



b. Complete ionic equation:



c. Net ionic equation:



* no net ionic eq after decomposed with OH decomposed

a. Solid magnesium is added to liquid water yielding soluble magnesium hydroxide and a gas



b. Complete ionic equation:



is soluble
c. Net ionic equation:
 $Mg^{+2} + 2OH^- + 2H^+ + 2OH^- \rightarrow Mg^{+2} + 2OH^- + H_2(g)$



4. (3) Circle the least reactive metal:

Zinc
 or
 Copper

5. (6) Pure oxygen gas can be prepared in the laboratory by the decomposition of solid potassium chlorate to form solid potassium chloride and oxygen gas. How much oxygen gas in micrograms can be prepared from 85.4 g of potassium chlorate?

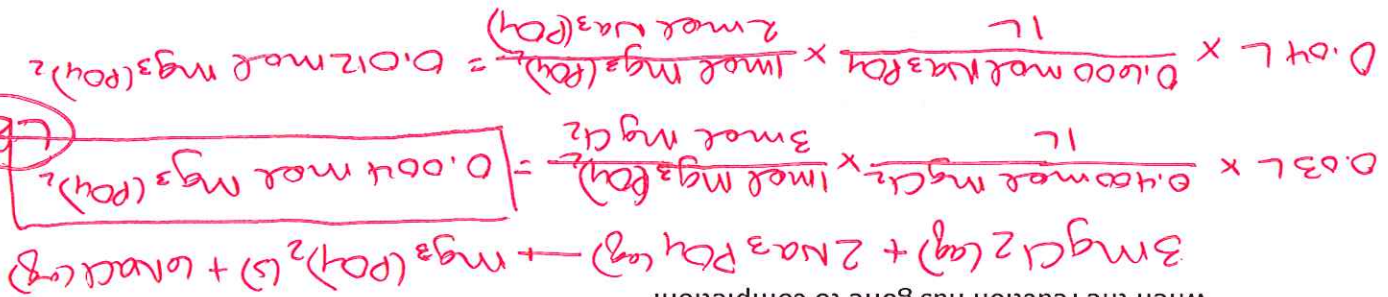
$$85.4 \text{ g KClO}_3 \times \frac{1 \text{ mol KClO}_3}{122.55 \text{ g KClO}_3} \times \frac{3 \text{ mol O}_2}{2 \text{ mol KClO}_3} \times \frac{32.00 \text{ g O}_2}{1 \text{ mol O}_2} \times 10^6 \frac{\mu\text{g}}{\text{g}} = 3.34 \times 10^7 \mu\text{g O}_2$$

$$2\text{KClO}_3(\text{s}) \rightarrow 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$$

6. (5) Present a balanced chemical equation of your choice (HINT: use something simple). For your equation you will have 25.0 g of each reactant, provide a WRITTEN explanation of how you would determine which reactant is limiting. You may use a calculation to illustrate your answer, but a calculation alone is worth ZERO points.

See text for definition

7. (15) When 30.0 mL of 0.400 M $MgCl_2$ are mixed with 40.0 mL of 0.600 M Na_3PO_4 , $Mg_3(PO_4)_2$ is precipitated. Determine the number of moles of $Mg_3(PO_4)_2$ that will be precipitated and the concentration of each ion remaining in solution when the reaction has gone to completion.



$$[Cl^-] \quad 0.03L \times \frac{0.400 \text{ mol } MgCl_2}{1L} \times \frac{2 \text{ mol } Cl^-}{2 \text{ mol } MgCl_2} = 0.024 \text{ mol} = 0.343M$$

$[Mg^{+2}]$ all consumed

$$[Na^+] \quad 0.04L \times \frac{0.600 \text{ mol } Na_3PO_4}{1L} \times \frac{3 \text{ mol } Na^+}{2 \text{ mol } Na_3PO_4} = 0.072 \text{ mol} = 1.03M$$

$$[PO_4^{-3}] \quad 0.012 - 0.004 = 0.008 \text{ mol } PO_4^{-3} \times \frac{2 \text{ mol } Na_3PO_4}{2 \text{ mol } Na_3PO_4} \times \frac{1 \text{ mol } PO_4^{-3}}{1 \text{ mol } Na_3PO_4} \times \frac{1}{0.07L} = 0.229M$$

8. (5) How much of a 6.0 M HNO_3 solution should you use to make 750.0 mL of a 0.250 M HNO_3 solution?

$$M_1V_1 = M_2V_2$$

$$V_1 = \frac{0.250M \times 750 \text{ mL}}{6.0M}$$

$$= 31 \text{ mL}$$

9. (5) A 10.00 mL sample of unknown H_3PO_4 solution requires 112 mL of 0.100 M KOH to completely react with the H_3PO_4 . What was the molarity of the unknown H_3PO_4 solution?



$$112 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.100 \text{ mol KOH}}{1 \text{ L}} \times \frac{3 \text{ mol KOH}}{1 \text{ mol H}_3\text{PO}_4} \times \frac{1}{0.01 \text{ L}} = 0.336 \text{ M H}_3\text{PO}_4$$

10. (12) What volume in milliliters of 0.0895 M potassium hydroxide solution is required to reach the equivalence point in the complete titration of a 15.0 mL sample of 0.130 M phosphoric acid?



$$15 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.130 \text{ mol}}{1 \text{ L}} \times \frac{3 \text{ mol KOH}}{1 \text{ mol H}_3\text{PO}_4} \times \frac{1 \text{ L}}{0.0895 \text{ mol}} \times \frac{1 \text{ L}}{1000 \text{ mL}} =$$

15.4 mL

Periodic Table

1	1A	1	2	3	4	5	6	7
1	H	3	Li	11	19	37	55	87
2	He	4	Be	12	20	38	56	88
3	2A	5	Na	22.99	39.10	85.47	132.9	223
4	3A	6	Mg	24.31	40.08	87.62	137.3	(226)
5	4A	7	Al	13	Ca	88.91	138.9	(227)
6	5A	8	Si	14	Sc	44.96	178.5	(263)
7	6A	9	P	15	Ti	47.88	180.9	(266)
8	7A	10	S	16	V	50.94	183.8	(269)
9		11	Cl	35.45	Cr	52.00	186.2	(272)
10		12	Ar	39.95	Mn	54.94	190.2	(277)
11		13			Fe	55.85	197.0	(281)
12		14			Co	58.93	198.9	(283)
13		15			Ni	58.69	200.6	(286)
14		16			Cu	63.55	204.4	(291)
15		17			Zn	65.39	207.2	(295)
16		18			Ga	69.72	209.0	(301)
17		19			Ge	72.59	210	(307)
18		20			As	74.92	210	(313)
		21			Se	78.96	210	(319)
		22			Br	79.90	210	(325)
		23			Kr	83.80	210	(331)
		24					210	(337)
		25					210	(343)
		26					210	(349)
		27					210	(355)
		28					210	(361)
		29					210	(367)
		30					210	(373)
		31					210	(379)
		32					210	(385)
		33					210	(391)
		34					210	(397)
		35					210	(403)
		36					210	(409)
		37					210	(415)
		38					210	(421)
		39					210	(427)
		40					210	(433)
		41					210	(439)
		42					210	(445)
		43					210	(451)
		44					210	(457)
		45					210	(463)
		46					210	(469)
		47					210	(475)
		48					210	(481)
		49					210	(487)
		50					210	(493)
		51					210	(499)
		52					210	(505)
		53					210	(511)
		54					210	(517)
		55					210	(523)
		56					210	(529)
		57					210	(535)
		58					210	(541)
		59					210	(547)
		60					210	(553)
		61					210	(559)
		62					210	(565)
		63					210	(571)
		64					210	(577)
		65					210	(583)
		66					210	(589)
		67					210	(595)
		68					210	(601)
		69					210	(607)
		70					210	(613)
		71					210	(619)
		72					210	(625)
		73					210	(631)
		74					210	(637)
		75					210	(643)
		76					210	(649)
		77					210	(655)
		78					210	(661)
		79					210	(667)
		80					210	(673)
		81					210	(679)
		82					210	(685)
		83					210	(691)
		84					210	(697)
		85					210	(703)
		86					210	(709)
		87					210	(715)
		88					210	(721)
		89					210	(727)
		90					210	(733)
		91					210	(739)
		92					210	(745)
		93					210	(751)
		94					210	(757)
		95					210	(763)
		96					210	(769)
		97					210	(775)
		98					210	(781)
		99					210	(787)
		100					210	(793)
		101					210	(799)
		102					210	(805)
		103					210	(811)
		104					210	(817)
		105					210	(823)
		106					210	(829)
		107					210	(835)
		108					210	(841)
		109					210	(847)
		110					210	(853)
		111					210	(859)

Activity Series (shortened)

Li	Displaces water from cold water, steam, and acids	Most Active
K		
Ca		
Na		
Al	Displaces water from steam, and acids	
Zn		
Cr		
Fe		
Ni	Displaces water from acids	
Pb		
H ₂		
Cu	Does not displace water from cold water, steam, and acids	Least Active
Ag		
Au		

Solubility Rules for Selected Anions

71	Lu	175.0
70	Yb	173.0
69	Tm	168.9
68	Er	167.3
67	Ho	164.9
66	Dy	162.5
65	Tb	158.9
64	Gd	157.3
63	Eu	152.0
62	Sm	150.4
61	Pm	(145)
60	Nd	144.2
59	Pr	140.9
58	Ce	140.1
57	La	138.9
56	Ba	137.3
55	Cs	132.9
54	Xe	131.3
53	I	126.9
52	Te	127.6
51	Sb	121.8
50	Sn	118.7
49	In	114.8
48	Cd	112.4
47	Ag	107.9
46	Pd	106.4
45	Rh	102.9
44	Ru	101.1
43	Tc	(98)
42	Mo	95.94
41	Nb	92.91
40	Zr	91.22
39	Y	88.91
38	Sr	87.62
37	Rb	85.47
36	Kr	83.80
35	Br	79.90
34	Se	78.96
33	As	74.92
32	Ge	72.59
31	Ga	69.72
30	Zn	65.39
29	Cu	63.55
28	Ni	58.69
27	Co	58.93
26	Fe	55.85
25	Mn	54.94
24	Cr	52.00
23	V	50.94
22	Ti	47.88
21	Sc	44.96
20	Ca	40.08
19	K	39.10
18	Ar	39.95
17	Cl	35.45
16	S	32.07
15	P	30.97
14	Si	28.09
13	Al	26.98
12	B	10.81
11	Be	9.012
10	Li	6.941
9	H	1.008
8	He	4.003

The solubility rules for other ions which you were supposed to memorize are not shown on this table.

chlorates	all are soluble
sulfates	all are soluble except Ag ⁺ , Pb ²⁺ , Hg ₂ ²⁺ , Hg ₂ ⁺ , Ba ²⁺ , Sr ²⁺ , and Ca ²⁺
sulfides	none soluble except Group 1A, NH ₄ ⁺ , and Group 2A
carbonates and phosphates	none soluble except Group 1A NH ₄ ⁺