

Chem 141

Exam 2a

Fall 2006

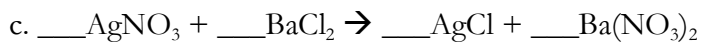
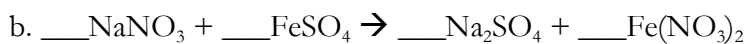
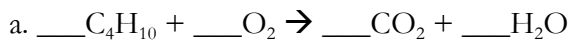
Name: _____

Show all work to receive full credit. You must use the conversion factor method for all problems involving moles!

Q1. How many moles of aluminum are there in an aluminum can with a mass of 3.20 g?
(6 pts.)

Q2. Calculate the percent composition by element of Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), a mineral used in the manufacture of plaster. (8 pts.)

Q3. Balance the following equations using the lowest whole-number coefficients: (12 pts.)



Q4. (a) How many grams of H_2O are formed from the complete combustion of 25.7 g of benzene, C_6H_6 in an excess of O_2 ? (8 pts.)

The unbalanced equation is: $\text{C}_6\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$.

(b) If 12.7 g of H_2O were formed, then what is the percent yield of this reaction? (2 pts.)

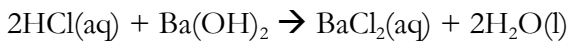
Q5. Calculate the molar mass of: (6 pts.)

(a) benzene, C_6H_6

(b) water, H_2O

(c) DDT, $\text{C}_{14}\text{H}_9\text{Cl}_5$

Q6. HCl reacts with Ba(OH)₂ according to the equation:



Suppose you mix 5 moles of HCl with 4 moles of Ba(OH)₂. How many moles of BaCl₂ are formed? Which species is the *limiting reagent*? (5 pts.)

Q7. A sample of white gold is formed from mixing 2.5 g of zinc with 56.2 g of gold. Identify the solute and the solvent. (4 pts.)

Q8. Give an example of an electrolyte, and a non-electrolyte. (4 pts.)

Electrolyte:

Non-Electrolyte:

Q9. Write the *balanced* molecular, full ionic, and net ionic equations for the reaction between aqueous lithium sulfate, Li₂SO₄(aq), and aqueous barium bicarbonate, Ba(HCO₃)₂(aq). *Be sure to include state symbols.* (12 pts.)

Molecular:

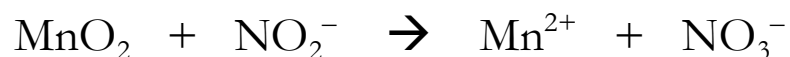
Full Ionic:

Net Ionic:

Q10. Identify the Brønsted acid in the following reaction: (3 pts.)



Q11. (a) Assign oxidation numbers to each atom in the following (unbalanced) redox reaction: (8 pts.)



(b) Identify the reducing agent.

Q12. How many moles of $\text{CO}_2(\text{g})$ are formed when 14.5 mL of 0.338 M HCl is added to an excess amount of chalk $\text{CaCO}_3(\text{s})$? Start by writing a *balanced* chemical equation. (8 pts.)

Q13. How many moles of H_2SO_4 are contained in 57.6 mL of a 12.3 M solution? (4 pts.)

Q14. Predict whether the following compounds will be soluble or insoluble in water: (5 pts.)

- a) Lithium hydroxide
- b) Iron(III) carbonate
- c) Magnesium chlorate
- d) Copper(I) nitrate
- e) Ammonium sulfate

Q15. Explain how you could prepare 1.00-L of a 3.25 M HNO_3 solution from a stock solution of 15.0 M HNO_3 . (6 pts.)

Q16. BONUS. Explain the basic operation of a mass spectrometer. (5 pts.)

Useful Information

Periodic Table of the Elements

I										IIA																				IIIA										IVA										VA										VIA										VIIA										VIIIA									
1 H 1.01																				2 He 4.00																																																																					
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																																																									
11 Na 22.99		12 Mg 24.31																				13 Al 26.98		14 Si 28.09		15 P 30.97		16 S 32.07		17 Cl 35.45		18 Ar 39.95																																																									
19 K 39.10		20 Ca 40.08		21 Sc 44.96		22 Ti 47.87		23 V 50.94		24 Cr 52.00		25 Mn 54.94		26 Fe 55.85		27 Co 58.93		28 Ni 58.69		29 Cu 63.55		30 Zn 65.39		31 Ga 69.72		32 Ge 72.61		33 As 74.92		34 Se 78.96		35 Br 79.90		36 Kr 83.80																																																							
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 101.07		45 Rh 102.91		46 Pd 106.42		47 Ag 107.87		48 Cd 112.41		49 In 114.82		50 Sn 118.71		51 Sb 121.76		52 Te 127.60		53 I 126.90		54 Xe 131.29																																																							
55 Cs 132.91		56 Ba* 137.33		71 Lu 174.97		72 Hf 178.49		73 Ta 180.95		74 W 183.84		75 Re 186.21		76 Os 190.23		77 Ir 192.22		78 Pt 195.08		79 Au 196.97		80 Hg 200.59		81 Tl 204.38		82 Pb 207.20		83 Bi 208.98		84 Po [210]		85 At [210]		86 Rn [222]																																																							
87 Fr [223]		88 Ra** [226]		103 Lr [262]		104 Rf [261]		105 Db [262]		106 Sg [266]		107 Bh [264]		108 Hs [265]		109 Mt [268]		110 [269]		111 [272]		112 [277]		113 [285]		114 [285]		115 [289]		116 [289]		117 [293]		118 [293]																																																							
*		57 La 138.91		58 Ce 140.12		59 Pr 140.91		60 Nd 144.24		61 Pm [145]		62 Sm 150.36		63 Eu 151.96		64 Gd 157.25		65 Tb 158.93		66 Dy 162.50		67 Ho 164.93		68 Er 167.26		69 Tm 168.93		70 Yb 173.04																																																													
**		89 Ac [227]		90 Th 232.04		91 Pa 231.04		92 U 238.03		93 Np [237]		94 Pu [244]		95 Am [243]		96 Cm [247]		97 Bk [247]		98 Cf [251]		99 Es [252]		100 Fm [257]		101 Md [258]		102 No [259]																																																													

TABLE 4.2 Solubility Rules for Common Ionic Compounds in Water at 25°C

Soluble Compounds	Exceptions
Halides (Cl^- , Br^- , I^-)	Halides of Ag^+ , Hg_2^{2+} , and Pb^{2+}
Sulfates (SO_4^{2-})	Sulfates of Ag^+ , Ca^{2+} , Sr^{2+} , Ba^{2+} , Hg_2^{2+} , and Pb^{2+}
Insoluble Compounds	Exceptions
Carbonates (CO_3^{2-}), phosphates (PO_4^{3-}), chromates (CrO_4^{2-}), and sulfides (S^{2-})	Compounds containing alkali metal ions and the ammonium ion
Hydroxides (OH^-)	Compounds containing alkali metal ions and the Ba^{2+} ion

$$N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$$

$$M_i V_i = M_f V_f$$