

Accelerated General Chemistry
Problem Set 1
Due Monday, September 14, 2009 (at 4:00 p.m.)
Total Points on This Assignment = 72

As I discussed in the course description, Chemistry 115 assumes that you have a solid background in high school chemistry. Both required texts for the course also make this assumption. However, the book we start and end our semester with (*Chemical Principles: The Quest for Insight*, 4th Edition) does a nice job of summarizing in a preliminary Fundamentals section introductory material like the periodic table, atomic structure, nomenclature, simple chemical reactions, and stoichiometry calculations. To aid your review of this important material, you will turn in solutions to the problems listed below from this section.

When solving numerical problems, be sure to show your reasoning clearly. Report all final numerical answers to the correct number of significant figures and with appropriate units attached. (Refer to pp. A5-A6 for the rules governing significant figures.)

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1. (12 points) Exercise A.24 (p. F15). Report the density in g cm^{-3} and the radius in m.
 2. (6 points) Exercise B.12 (p. F22). Justify your answers by writing out a table listing the atomic number (Z), neutron number (N), and mass number (A) for all atoms.

There are no problems assigned from Section C. You are not responsible for depicting molecular structure (as shown on p. F24) for now, as we will spend a lot of time on this during the semester. You are, however, responsible for the rest of the section's content.

3. (6 points) Exercises D.6 and D.12 (p. F37)
4. (4 points) Exercise D.14 (p. F37)

You are responsible for knowing all chemical formulas and names on the attached handout.

5. (4 points) Exercise E.24 (p. F45). Report the mass in g.
6. (7 points) Exercise F.14 (p. F51)
7. (6 points) Exercise G.16 (p. F60). Report the concentration in M and the mass in g. Note that to use the dilution equation (p. F58), it is not necessary to convert volumes to L. All that is necessary is that the same unit for volume be used for both V_{initial} and V_{final} .

There are no problems assigned from Section H, but being able to describe chemical reactions with balanced equations is a skill you have to use for the rest of the problem set.

Problem Set 1 continues on the back.

8. (7 points) Exercise I.20 (p. F71). Two additional requirements: (A) Write the complete ionic equation for each of the three reactions. (B) Choose different spectator ions for each of the three reactions.

You do not need to memorize Table I.1 (p. F69), but you should know how to use it.

9. (5 points) Exercise J.4 (pp. F76-F77). Be sure to balance each of the overall equations. (You may write the hydrogen ion either as H^+ or as H_3O^+ .)

We will be covering oxidation and reduction reactions (Section K) at the end of this semester, so we will skip this section for now.

10. (4 points) Exercise L.14 (p. F92). Report molar mass in g mol^{-1} .

11. (11 points) Exercise M.20 (p. F101)

Chemical Formulas and Names to Memorize (adapted from Atkins and Jones)Prefixes for Naming Compounds

mono-	1	penta-	5	nona-	9
di-	2	hexa-	6	deca-	10
tri-	3	hepta-	7	undeca-	11
tetra-	4	octa-	8	dodeca-	12

Common Cations Whose Charges/Oxidation States Do Not Vary

+1:	All Group 1 Elements	Silver (Ag^+)	Ammonium (NH_4^+)	Hydronium (H_3O^+)
+2:	All Group 2 Elements	Zinc (Zn^{2+})	Cadmium (Cd^{2+})	
+3:	Aluminum (Al^{3+})			

Important Cations Whose Charges/Oxidation States Vary

+1/+2:	Copper	Cu(I) and Cu(II)	Cu^+ and Cu^{2+}
	Mercury	Hg(I) and Hg(II)	Hg_2^{2+} (note: diatomic!) and Hg^{2+}
+2/+3:	Iron	Fe(II) and Fe(III)	Fe^{2+} and Fe^{3+}
+2/+4	Tin	Sn(II) and Sn(IV)	Sn^{2+} and Sn^{4+}

Common Anions

Group 17:	Fluoride (F^-)	Chloride (Cl^-)	Bromide (Br^-)	Iodide (I^-)
	Hypochlorite (ClO^-)	Chlorite (ClO_2^-)	Chlorate (ClO_3^-)	Perchlorate (ClO_4^-)
Group 16:	Oxide (O^{2-})	Peroxide (O_2^{2-})	Superoxide (O_2^-)	Hydroxide (OH^-)
	Sulfide (S^{2-})	Sulfite (SO_3^{2-})	Sulfate (SO_4^{2-})	Thiosulfate ($\text{S}_2\text{O}_3^{2-}$)
	Hydrogen Sulfide (HS^-)	Hydrogen Sulfite (HSO_3^-)	Hydrogen Sulfate (HSO_4^-)	
Group 15:	Nitrite (NO_2^-)	Nitrate (NO_3^-)		
	Phosphate (PO_4^{3-})	Hydrogen Phosphate (HPO_4^{2-})	Dihydrogen Phosphate (H_2PO_4^-)	
Group 14:	Cyanide (CN^-)	Cyanate (OCN^-)	Thiocyanate (SCN^-)	
	Carbonate (CO_3^{2-})	Hydrogen Carbonate (HCO_3^-)	Formate (HCOO^-)	Acetate (CH_3COO^-)
Others:	Hydride (H^-)	Permanganate (MnO_4^-)	Chromate (CrO_4^{2-})	Dichromate ($\text{Cr}_2\text{O}_7^{2-}$)

Important Acids

Group 17:	Hydrofluoric (HF)	Hydrochloric (HCl)	Hydrobromic (HBr)	Hydroiodic (HI)
	Hypochlorous (HOCl)	Chlorous (HClO_2)	Chloric (HClO_3)	Perchloric (HClO_4)
Group 16:	Hydrosulfuric (H_2S)	Sulfurous (H_2SO_3)	Sulfuric (H_2SO_4)	
Group 15:	Nitrous (HNO_2)	Nitric (HNO_3)	Phosphoric (H_3PO_4)	
Group 14:	Hydrocyanic (HCN)	Carbonic (H_2CO_3)	Formic (HCOOH)	Acetic (CH_3COOH)

Common Substances

Group 18:	Helium (He)	Neon (Ne)	Argon (Ar)	Krypton (Kr)	Xenon (Xe)
Group 17:	Fluorine (F_2)	Chlorine (Cl_2)	Bromine (Br_2)	Iodine (I_2)	
Others:	Hydrogen (H_2)	Nitrogen (N_2)	Oxygen (O_2)	Carbon Monoxide (CO)	
	Methane (CH_4)	Ammonia (NH_3)	Water (H_2O)	Nitric Oxide (NO)	