

Announcements

Monday, September 21, 2009

Grades are updated in D2L with quiz 1, first 2 labs and first 2 homework assignments.

Quiz 1 answer key is available under Content in the D2L course.

MasteringChemistry due dates (all at 11:59 pm):

- Ch 3: Fri, Sep 25

Exam 1: next Mon, Sep 28.

- 20-25 multiple choice questions
- Short answer (naming, chemical equations)
- 2 show your work problems

For exam practice:

- Practice exams on webpage
- End-of-chapter problems (check answers in back of book)
- Rework MasteringChemistry exercises for practice (without using hints)

Polyatomic ions

(ammonia NH_3)

Polyatomic ions: charged molecules, multi-atom ions

Acetate $\text{C}_2\text{H}_3\text{O}_2^-$

Ammonium NH_4^+ \uparrow

Bicarbonate HCO_3^-

Carbonate CO_3^{2-}

Chlorate ClO_3^-

Hydroxide OH^-

Nitrate NO_3^-

Phosphate PO_4^{3-}

Sulfate SO_4^{2-}

Removing one oxygen changes ending to -ite:

NO_2^- : nitrite

PO_3^{3-} : phosphite

ClO_2^- : chlorite

SO_3^{2-} : sulfite

Addition of H^+ reduces negative charge by 1

If >2 oxyanions in a series, use hypo- or per-

sulfate SO_4^{2-}

hydrogen sulfate HSO_4^-
or (bisulfate)

also:
 BrO_x^-
 IO_x^-
 ClO^- hypochlorite
 ClO_2^- chlorite
 ClO_3^- chlorate
 ClO_4^- perchlorate

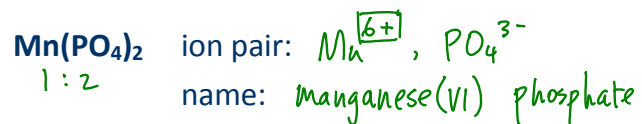
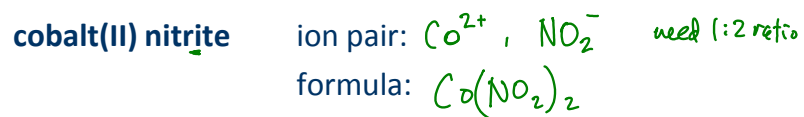
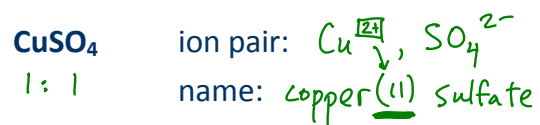
Carbonate CO_3^{2-}
hydrogencarbonate HCO_3^-
or (bicarbonate)

PO_4^{3-}
phosphate

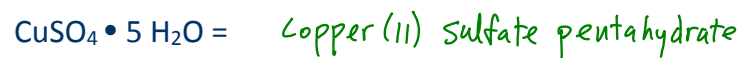
HPO_4^{2-}
hydrogen phosphate

H_2PO_4^-
dihydrogen phosphate

Compounds containing polyatomic ions, Hydrates



Hydrates: contain a certain number of water molecules per formula unit



Naming binary molecular compounds

1. Is it a molecular compound?
binary molecular: 2 nonmetals
2. Binary molecular compounds use Greek prefixes in name to show how many atoms are in the formula

Greek prefixes for quantity

1 (mono)

2 di

3 tri

4 tetra

5 penta

6 hexa

7 hepta

8 octa

9 nona

10 deca

NO_2 nitrogen dioxide

N_2O_4 dinitrogen tetroxide

CO carbon monoxide

CO_2 carbon dioxide

P_2O_7 diphosphorous heptoxide

3. First element: prefix (not mono) then element name
4. Second element: prefix then element root + ide
5. Avoid "ao" and "oo" combinations - drop first vowel

Naming binary acids

Acid: formula with H as first element

- release H^+ ions when dissolved in water
- named as normal binary molecular compounds when pure

Binary acids contain just H and one other nonmetal.

- Names of binary acids start with hydro- and end with -ic acid

HCl (g) = pure binary molecular compound

H-Cl hydrogen chloride (gas)

HCl (aq) = (binary acid) hydrochloric acid

HF (aq) hydrofluoric acid

HBr (aq) hydrobromic acid

HI (aq) hydroiodic acid I^- : iodide

HBr (g) hydrogen bromide

ion	acid
-ide	hydro- -ic acid

HCN (aq) (CN^- : cyanide) **HCN (aq)** = hydrocyanic acid

Naming oxyacids

Oxyacids contain hydrogen and an oxyanion (polyatomic ion w/ a nonmetal and oxygen)

Use the oxyanion to name the oxyacid:

oxyanion	acid
-ate	-ic acid
-ite	-ous acid

no hydro!

HNO₃ (aq) H^+ , NO_3^- = nitrate **HNO₃** = nitric acid

HNO₂ nitrous acid

H₃PO₄ H^+ , PO_4^{3-} phosphoric acid

HClO₃ chloric acid

HClO₂ chlorous acid

HClO hypochlorous acid

HClO₄ perchloric acid

Formula mass and molar mass

Formula mass of a compound is the sum of the atomic masses of all atoms in the compound, multiplied by their subscripts. Unit = amu

$\text{Fe}_2(\text{SO}_4)_3 = 1$ formula unit of iron (III) sulfate

$$\begin{aligned}\text{formula mass} &= 2 \times \text{Fe} + 3 \times \text{S} + 12 \times \text{O} = \text{formula mass} \\ &= 399.88 \text{ amu}\end{aligned}$$

Molar mass of a compound is just the formula mass with units of g/mol. 399.88 g/mol ↗

How many H_2O molecules are in 25 mg of H_2O ?

$$\text{mg} \rightarrow \text{g} \xrightarrow{\text{molar mass}} \text{mol} \xrightarrow{\text{Av. \#}} \text{H}_2\text{O molecules}$$

$$\begin{aligned}25 \text{ mg H}_2\text{O} \times \frac{1 \text{ g}}{1000 \text{ mg}} \times \frac{1 \text{ mol H}_2\text{O}}{18.016 \text{ g H}_2\text{O}} \times \frac{6.022 \times 10^{23} \text{ H}_2\text{O molecules}}{1 \text{ mol H}_2\text{O}} \\ \text{molar mass of H}_2\text{O} \uparrow \\ = 8.4 \times 10^{20} \text{ H}_2\text{O molecules}\end{aligned}$$

Mass percent composition

Mass percent of element in a compound:

$$\text{Mass \%} = \frac{\text{mass of element}}{\text{total mass of compound}} \times 100\%$$

To get this from a chemical formula,

- assume 1 mol of compound
- (use molar masses!)

What is the mass % of C and H in octane, C_8H_{18} ?

$$\text{Molar mass C}_8\text{H}_{18} = 114.224 \text{ g/mol}$$

1 mol C_8H_{18} contains 8 mol C and 18 mol H.

$$\text{Mass \% C} = \frac{8 \times 12.01 \text{ g}}{114.224 \text{ g}} \times 100\% = 84.12\%$$

$$\text{Mass \% H} = \frac{18 \times 1.008 \text{ g}}{114.224 \text{ g}} \times 100\% = 15.88\%$$