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	$C_2H_3O_2^-$
Ammonium	NH_4^+
Bicarbonate	HCO_3^-
Carbonate	CO_3^{2-}
Chlorate	ClO_3^-
Hydroxide	OH^-
Nitrate	NO_3^-
Phosphate	PO_4^{3-}
Sulfate	SO_4^{2-}

same charge as P^{3-}, S^{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

sulfate SO_4^{2-}

hydrogen sulfate HSO_4^- or (bisulfate)

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

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

$CuSO_4$ ion pair: Cu^{2+}, SO_4^{2-}
1 : 1 name: copper(II) sulfate

cobalt(II) nitrite ion pair: Co^{2+}, NO_2^- need 1:2 ratio
formula: $Co(NO_2)_2$

$Mn(PO_4)_2$ ion pair: Mn^{6+}, PO_4^{3-}
1 : 2 name: manganese(VI) phosphate

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

$CuSO_4 \cdot 5\ H_2O$ = copper(II) sulfate pentahydrate

↓ heat

$CuSO_4$ copper(II) sulfate anhydrous

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

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*) = (a 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

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!

HNO_3 (aq) H^+, NO_3^- = nitrate HNO_3 = nitric acid

HNO_2 nitrous acid

H_3PO_4 (H^+, PO_4^{3-}) phosphoric acid

$HClO_3$ Chloric acid

$HClO_2$ chlorous acid

HClO hypochlorous acid

$HClO_4$ perchloric acid

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

$Fe_2(SO_4)_3$ = 1 formula unit of iron (III) sulfate

formula mass = $2 \times Fe + 3 \times S + 12 \times O$ = formula mass

= 399.88 amu

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?

mg → g (molar mass) → mol (Av.#) → H_2O molecules

$$25 \text{ mg } H_2O \times \frac{1 \text{ g}}{1000 \text{ mg}} \times \frac{1 \text{ mol } H_2O}{18.016 \text{ g } H_2O} \times \frac{6.022 \times 10^{23} H_2O \text{ molecules}}{1 \text{ mol } H_2O}$$

molar mass of H_2O

$= 8.4 \times 10^{20}$ H_2O molecules

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}?

Molar mass C_8H_{18} = 114.224 g/mol

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

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

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