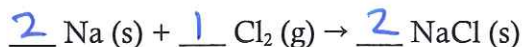## Practice Questions for Chem 60 Test 3
Not necessarily comprehensive—study your lecture notes, labs, etc. as well!

1. Sodium chloride forms by the following (unbalanced) reaction:

$$\underline{2}\ Na\ (s) + \underline{1}\ Cl_2\ (g) \rightarrow \underline{2}\ NaCl\ (s)$$

Balance the reaction above.

a) How many moles of NaCl result from the complete reaction of 3.4 mol of Cl_2?

$$3.4\ mol\ Cl_2 \times \frac{2\ mol\ NaCl}{1\ mol\ Cl_2} = \boxed{6.8\ mol\ NaCl}$$

b) How many moles of NaCl result from the complete reaction of 98.0 g of Cl_2?

$$98.0\ g\ Cl_2 \times \frac{1\ mol\ Cl_2}{70.90\ g\ Cl_2} \times \frac{2\ mol\ NaCl}{1\ mol\ Cl_2} = \boxed{2.76\ mol\ NaCl}$$
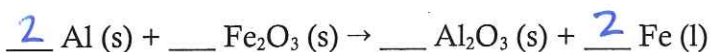
c) How many grams of NaCl results from the complete reaction of 2.5 moles of Na?

$$2.5\ mol\ Na \times \frac{1\ mol\ NaCl}{2\ mol\ Na} \times \frac{58.44\ g\ NaCl}{1\ mol\ NaCl} = \boxed{73.1\ g\ NaCl}$$

d) How many grams of NaCl results from the complete reaction of 125 g of Na?

$$125\ g\ Na \times \frac{1\ mol\ Na}{22.99\ g\ Na} \times \frac{2\ mol\ NaCl}{2\ mol\ Na} \times \frac{58.44\ g\ NaCl}{1\ mol\ NaCl}$$
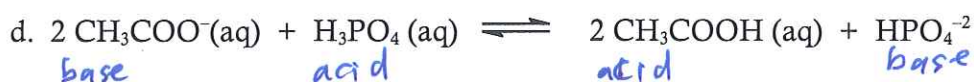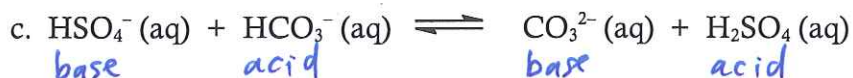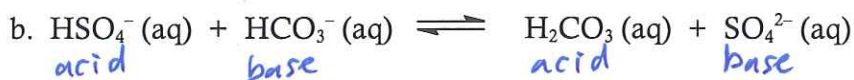$$= \boxed{318\ g\ NaCl}$$

2. Balance the following reaction:

$$\underline{2}\ Al\ (s) + \underline{\ \ \ }\ Fe_2O_3\ (s) \rightarrow \underline{\ \ \ }\ Al_2O_3\ (s) + \underline{2}\ Fe\ (l)$$

a) How many grams of Al are needed to produce 45.5 g of Al_2O_3?

$$45.5\ g\ Al_2O_3 \times \frac{1\ mol\ Al_2O_3}{101.96\ g\ Al_2O_3} \times \frac{2\ mol\ Al}{1\ mol\ Al_2O_3} \times \frac{26.98\ g\ Al}{1\ mol\ Al}$$
$$= \boxed{24.1\ g\ Al}$$

b) How many grams of Fe are produced from 4.7 g of Al?

$$4.7\ g\ Al \times \frac{1\ mol\ Al}{26.98\ g\ Al} \times \frac{2\ mol\ Fe}{2\ mol\ Al} \times \frac{55.85\ g\ Fe}{1\ mol\ Fe} = \boxed{9.73\ g\ Fe}$$

3. Identify the acid and base in each forward reaction.

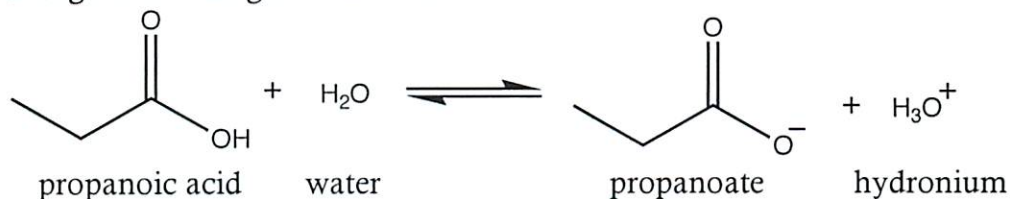   a. CH_3OH (aq) + HI (aq) $\rightleftharpoons$ $CH_3OH_2^+$ (aq) + I^- (aq)
         base   acid   acid   base

    b. HSO_4^- (aq) + HCO_3^- (aq) $\rightleftharpoons$ H_2CO_3 (aq) + SO_4^{2-} (aq)
       acid   base   acid   base

    c. HSO_4^- (aq) + HCO_3^- (aq) $\rightleftharpoons$ CO_3^{2-} (aq) + H_2SO_4 (aq)
       base   acid   base   acid

    d. $2 CH_3COO^-$(aq) + H_3PO_4 (aq) $\rightleftharpoons$ $2 CH_3COOH$ (aq) + HPO_4^{-2}
       base   acid   acid   base

4. (2 pts) Fill in the blanks (remember, conjugates differ by the presence of H^+).

Acid	$CH_3OH_2^+$	HSO_4^-	H_2CO_3	H_2SO_4
(Conjugate) Base	CH_3OH	SO_4^{2-}	HCO_3^-	HSO_4^-

5. Predict the products of the following acid-base reactions. The acid and base are marked for you.

    a. CH_3COOH (aq) + NH_3 (aq) $\rightleftharpoons$ CH_3COO^- + NH_4^+
       acid   base

    b. HNO_3 (aq) + F^- (aq) $\rightleftharpoons$ NO_3^- + HF
       acid   base

    c. CH_3COO^- (aq) + HCl (aq) $\rightleftharpoons$ CH_3COOH + Cl^-
       base   acid

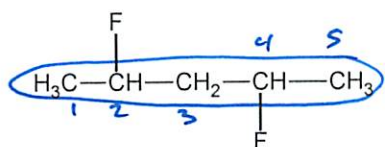   d. HCO_3^- (aq) + HSO_4^- (aq) $\rightleftharpoons$ H_2CO_3 + SO_4^{2-}
       base   acid

6. For the equilibrium below, predict how the concentrations of the different species would change under the given circumstances:
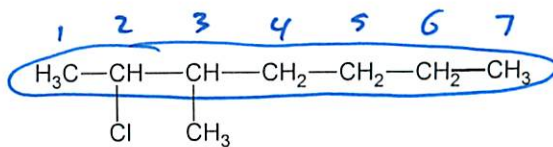

propanoic acid   water   propanoate   hydronium

a. [H$_3$O$^+$] is increased.
Eqilibrium shifts   ~~left~~   right
[propanoic acid]   ~~increases~~   decreases
[propanoate]   increases   ~~decreases~~

b. [propanoic acid] is increased.
Equilibrium shifts   left   ~~right~~
[propanoate]   ~~increases~~   decreases
[H$_3$O$^+$]   ~~increases~~   decreases

7. Name the following organic molecules:
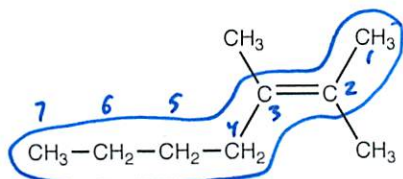

2,4-difluoropentane

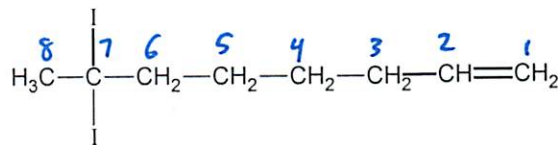

2-chloro-3-methylheptane

a benzene ring

1,4-dibromo-2-ethylbenzene
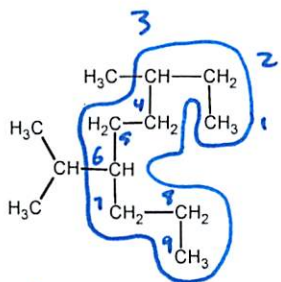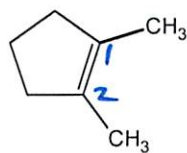

1-ethyl-2-methylcyclohexane

2,3-dimethyl-2-heptene

7,7-diiodo-1-octene

H_3C—CH—CH_2
H_2C—CH_2 CH_3
H_3C
CH—CH
H_3C
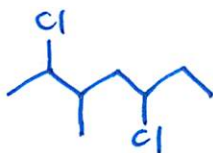CH_2—CH_2
CH_3

3-methyl-6-isopropylnonane
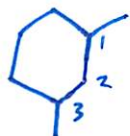

CH_3

CH_3

1,2-dimethylcyclopentene

8. Draw the following organic molecules:

2,5-dichloro-3-methylheptane

Cl

Cl

1,3-dimethylcyclohexane

4-isopropyloctane

1,2-diethylcycloheptene