Chem 1014
In-Class Problem Set #7
InClass October 6, 1999
Fall 1999

Name_____
TA Name _____
Lab Section #_____

1. Balance each of the following equations

   a) $\mathbf{Li(s) + Cl_2(g) \rightarrow 2LiCl(s)}$

   b) $\mathbf{3Ba(s) + N_2(g) \rightarrow Ba_3N_2(s)}$

   c) $\mathbf{2NaHCO_3(s) \xrightarrow{-\Delta} Na_2CO_3(s) + CO_2(g) + H_2O(l)}$

   d) $\mathbf{2Al(s) + 6HCl(aq) \rightarrow 2AlCl_3(aq) + 3H_2(g)}$

   e) $\mathbf{2NiS(s) + 3O_2(g) \rightarrow 2NiO(s) + 2SO_2(g)}$

   f) $\mathbf{CaH_2(s) + 2H_2O(l) \rightarrow Ca(OH)_2(s) + 2H_2(g)}$

   g) $\mathbf{2H_2(g) + CO(g) \rightarrow CH_3OH(l)}$

   h) $\mathbf{2B_2O_3(s) + 6C(s) \rightarrow B_4C_3(s) + 3CO_2(g)}$

2. Write and balance the equation for each of the following

   a) A formation equation for $MgCl_2(s)$.

   $$\mathbf{Mg(s) + Cl_2(g) \rightarrow MgCl_2(s)}$$

   b) A formation equation for $NH_3(g)$.

   $$\mathbf{N_2(g) + 3H_2(s) \rightarrow 2NH_3(g)}$$

   c) A formation equation for $Al_2O_3(s)$.

   $$\mathbf{4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)}$$

   d) The reaction for the combustion of propane ($C_3H_8(g)$).

   $$\mathbf{C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)}$$

   e) The reaction for the combustion of butane ($C_4H_{10}(g)$).

   $$\mathbf{2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(g)}$$

   f) The reaction for the combustion of ethanol ($C_2H_5OH(l)$).

   $$\mathbf{C_2H_5OH(g) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g)}$$

   g) The reaction for the combustion of methyl mercaptan ($CH_3SH(g)$). (Note: when sulfur is combusted it forms sulfur dioxide, SO_2.

   $$\mathbf{CH_3SH(g) + O_2(g) \rightarrow CO_2(g) + 2H_2O(g) + SO_2(g)}$$

3. What is the mass of a hydrogen atom in kilograms and atomic mass units? Of an oxygen atom? Of a carbon atom?

Atom	Mass in kilograms	Mass in atomic mass units
H	**1.6732×10^{-27} kg**	**1.00794 u**
O	**2.6555×10^{-26} kg**	**15.9994 u**
C	**1.99268×10^{-26} kg**	**12.011 u**

Note: The masses that are reported above are the weighted average mass (kg) and relative, weighted average mass (u). If anyone asks about that explain. The mass of 1.00794 is the relative, weighted average mass of all three isotopes of hydrogen and is not the actual atomic mass of a hydrogen atom. But it is close enough. This is a detail I expect most students will not ask about. You do not need to discuss it either.

4. Calculate the number of atoms in each of the following;

a) 3.3464×10^{-27} kg hydrogen

3.3464×10^{-27} kg $\left(\frac{\text{1 atom H}}{1.6732 \times 10^{-27}\text{ kg}}\right)$
= 2 atoms H (1 molecule)

b) 2.6555×10^{-25} kg oxygen

2.6555×10^{-25} kg $\left(\frac{\text{1 atom O}}{2.6555 \times 10^{-26}\text{ kg}}\right)$
= 10 atoms O (5 molecule)

c) 1.49451×10^{-24} kg carbon

1.49451×10^{-24} kg $\left(\frac{\text{1 atom C}}{1.99268 \times 10^{-26}\text{ kg}}\right)$
= 75 atoms C

d) 5.0397 u hydrogen

5.0397 u $\left(\frac{\text{1 atom H}}{1.0794\text{ u}}\right)$
= 5 atoms H

e) 32 u oxygen

32 u $\left(\frac{\text{1 atom O}}{15.9994\text{ u}}\right)$
= 2 atoms O

f) 72 u carbon

72 u $\left(\frac{\text{1 atom O}}{12.0111\text{ u}}\right)$
= 6 atoms C

g) 1.00794 g hydrogen

1.00794 g $\left(\frac{\text{1 atom H}}{1.6732 \times 10^{-24}\text{ kg}}\right)$
= 6.02×10^{23} atoms H

h) 16 g oxygen

32 g $\left(\frac{\text{1 atom O}}{2.6555 \times 10^{-23}\text{ kg}}\right)$
= 6.02×10^{23} atoms O

h) 12 g carbon

12 g $\left(\frac{\text{1 atom C}}{1.99268 \times 10^{-23}\text{ kg}}\right)$
= 6.02×10^{23} atoms C