Stoichiometry Worksheet 2
(gram/mole to gram/mole)

1. The combustion of a sample of butane, C_4H_{10} (lighter fluid), produced 2.46 grams of water.

$$2\ C_4H_{10} + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O$$
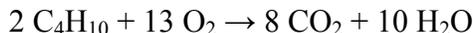
   (a) How many moles of water formed?
   (b) How many moles of butane burned?
   (c) How many grams of butane burned?
   (d) How much oxygen was used up in moles?   In grams

2. Terephthalic acid, an important raw material for making Dacron, a synthetic fiber, is made from para-xylene by the following reaction:

$$\underset{para-xylene}{C_8H_{10}} + 3O_2 \xrightarrow{\text{special conditions}} \underset{terephatalic\ acid}{C_8H_6O_4} + 2H_2O$$
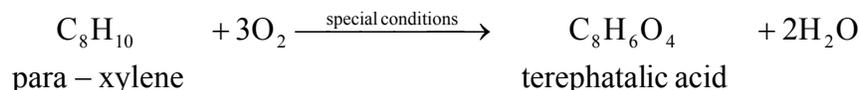
   How much terephthalic acid could be made from 154 grams of para-xylene in moles? In grams?

3. Adipic acid, a raw material for nylon, is made industrially by the oxidation of cyclohexane.

$$\underset{cyclohexane}{2C_6H_{12}} + 5O_2 + \xrightarrow{\text{special conditions}} \underset{adipic\ acid}{2C_6H_{10}O_4} + 2H_2O$$
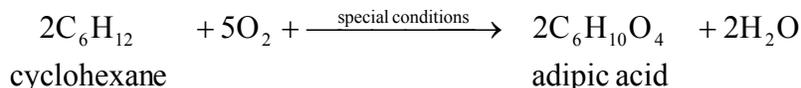
   (a) How many moles of oxygen would be needed to make 40.0 moles of adipic acid by this reaction?
   (b) If 164 grams of cyclohexane is used, what is the theoretical yield of adipic acid in moles? In grams?

4. Aluminum oxide, Al_2O_3, a buffing powder, is to be made by combining 5.00 grams of aluminum with oxygen, O_2. How much oxygen is needed in moles? In grams?

5. Calculate how many grams of iron can be made from 16.5 grams of Fe_2O_3 by the following equation: $Fe_2O_3 + 3\ H_2 \rightarrow 2\ Fe + 3\ H_2O$.

6. Iodine chloride, ICl, can be made by the following reaction between iodine, I_2, potassium iodate, KIO_3, and hydrochloric acid: $2\ I_2 + KIO_3 + 6\ HCl \rightarrow 5\ ICl + KCl + 3\ H_2O$. Calculate how many grams of iodine are needed to prepare 28.6 grams of ICl by this reaction.

7. The nitrite ion (NO_2^-) in potassium nitrite is changed to the nitrate ion by the action of potassium permanganate ($KMnO_4$) in sulphuric acid solution.

$$5\ KNO_2 + 2\ KMnO_4 + 3\ H_2SO_4 \rightarrow 5\ KNO_3 + 2\ MnSO_4 + K_2SO_4 + 3\ H_2O$$

How many moles and how many grams of $KMnO_4$ are needed to carry out this reaction on 11.4 grams of KNO_2?

8. The chief component of glass is silica for which the formula SiO_2 can be used. Silica is dissolved by hydrofluoric acid, HF, according to the following reaction that produces silicon tetrafluoride, SiF_4, a gas at room temperature.

$$SiO_2 + 4\ HF \rightarrow SiF_4 + 2\ H_2O$$
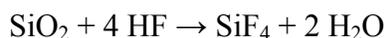
How many grams and how many moles of SiF_4 can be produced from 63.4 grams of HF?

9. Copper(I) iodide, CuI, is not stable enough to last long in storage, so it is generally made just prior to use. In can be prepared from copper sulphate and hydriodic acid by the following reaction: $2\ CuSO_4 + 4\ HI \rightarrow 2\ CuI + 2\ H_2SO_4 + I_2$.

   (a) If 10.4 grams of $CuSO_4$ is used, calculate the number of grams of HI needed and the number of grams of each of the products that are produced.
   (b) Show that the mass data are in accordance with the law of conservation of mass in chemical reactions.

10. If 2.56 grams of chlorine, Cl_2, are to be used to prepare dichlorine heptoxide, Cl_2O_7, how many moles and how many grams of oxygen are needed?

11. Under the right conditions, ammonia can be converted to nitric oxide, NO by the following reaction: $4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$. How many moles and how many grams of oxygen are needed to react with 56.8 grams of ammonia by this reaction?

12. One way to prepare iodine is to mix sodium iodate, $NaIO_3$, with hydriodic acid, HI. The following reaction occurs: $NaIO_3 + 6\ HI \rightarrow 3\ I_2 + NaI + 3\ H_2O$. Calculate the number of moles and the number of grams of iodine that can be made this way from 16.4 grams of $NaIO_3$.

13. Nickel metal reacts with silver nitrate solution according to the following balanced equation: $Ni + 2\ AgNO_3 \rightarrow 2\ Ag + Ni(NO_3)_2$. If 15.32 grams of nickel reacts with an excess of silver nitrate solution, calculate the mass of silver produced.

14. How many grams of CO_2 are produced when 23 grams of C_2H_5OH are burned?

15. Given: $3\ Fe_2O_3 + CO \rightarrow 2\ Fe_3O_4 + CO_2$. How many grams of Fe_2O_3 can be converted to Fe_3O_4 by 14.0 grams of CO?