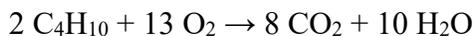
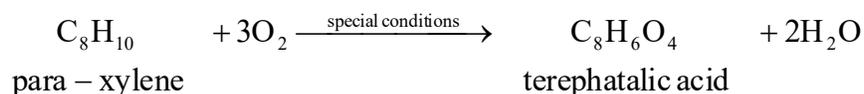


### Stoichiometry Worksheet #3

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

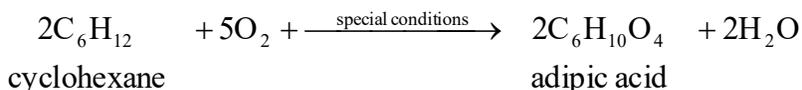


- How many moles of water formed?
  - How many moles of butane burned?
  - How many grams of butane burned?
  - How much oxygen was used up in moles? In grams
2. Terephthalic acid, an important raw material for making Dacron, a synthetic fiber, is made from para-xylene by the following reaction:



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.



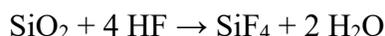
- How many moles of oxygen would be needed to make 40.0 moles of adipic acid by this reaction?
  - If 164 grams of cyclohexane is used, what is the theoretical yield of adipic acid in moles? In grams?
4. Aluminum oxide,  $Al_2O_3$ , a buffing powder, is to be made by combining 5.00 grams of aluminum 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 ( $\text{NO}_2^-$ ) in potassium nitrite is changed to the nitrate ion by the action of potassium permanganate ( $\text{KMnO}_4$ ) in sulfuric acid solution.



How many moles and how many grams of  $\text{KMnO}_4$  are needed to carry out this reaction on 11.4 grams of  $\text{KNO}_2$ ?

8. The chief component of glass is silica for which the formula  $\text{SiO}_2$  can be used. Silica is dissolved by hydrofluoric acid, HF, according to the following reaction that produces silicon tetrafluoride,  $\text{SiF}_4$ , a gas at room temperature.



How many grams and how many moles of  $\text{SiF}_4$  can be produced from 63.4 grams of HF?

9. Copper(I) iodide,  $\text{CuI}$ , is not stable enough to last long in storage, so it is generally made just prior to use. It can be prepared from copper sulphate and hydriodic acid by the following reaction:  $2 \text{CuSO}_4 + 4 \text{HI} \rightarrow 2 \text{CuI} + 2 \text{H}_2\text{SO}_4 + \text{I}_2$ .

- If 10.4 grams of  $\text{CuSO}_4$  is used, calculate the number of grams of HI needed and the number of grams of each of the products that are produced.
- 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,  $\text{Cl}_2$ , are to be used to prepare dichlorine heptoxide,  $\text{Cl}_2\text{O}_7$ , 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:  $4 \text{NH}_3 + 5 \text{O}_2 \rightarrow 4 \text{NO} + 6 \text{H}_2\text{O}$ . 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,  $\text{NaIO}_3$ , with hydriodic acid, HI. The following reaction occurs:  $\text{NaIO}_3 + 6 \text{HI} \rightarrow 3 \text{I}_2 + \text{NaI} + 3 \text{H}_2\text{O}$ . Calculate the number of moles and the number of grams of iodine that can be made this way from 16.4 grams of  $\text{NaIO}_3$ .

13. Nickel metal reacts with silver nitrate solution according to the following balanced equation:  $\text{Ni} + 2 \text{AgNO}_3 \rightarrow 2 \text{Ag} + \text{Ni}(\text{NO}_3)_2$ . 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  $\text{CO}_2$  are produced when 23 grams of  $\text{C}_2\text{H}_5\text{OH}$  are burned?

15. Given:  $3 \text{Fe}_2\text{O}_3 + \text{CO} \rightarrow 2 \text{Fe}_3\text{O}_4 + \text{CO}_2$ . How many grams of  $\text{Fe}_2\text{O}_3$  can be converted to  $\text{Fe}_3\text{O}_4$  by 14.0 grams of CO?