

## Answers to problems in page 314

### Answers to Practice Problems E

1.  $\text{PCl}_3$  is excess,  $\text{H}_2\text{O}$  is limiting, theoretical yield is 109 g HCl
2.  $\text{H}_2\text{O}$  is excess,  $\text{PCl}_3$  is limiting, theoretical yield is 59.7 g HCl
3.  $\text{PCl}_3$  is excess,  $\text{H}_2\text{O}$  is limiting, theoretical yield is 101 g HCl

### Homework

GENERAL

**Additional Practice** Write a balanced chemical equation for each of the following problems, and then determine the excess reactant, the limiting reactant, and the theoretical yield (in grams) of the first product mentioned.

1. Zinc citrate,  $\text{Zn}_3(\text{C}_6\text{H}_5\text{O}_7)_2$ , an ingredient in toothpaste, is made by reacting zinc carbonate and citric acid,  $\text{C}_6\text{H}_8\text{O}_7$ . The other products are  $\text{H}_2\text{O}$  and  $\text{CO}_2$ . There are 6.00 mol  $\text{ZnCO}_3$  and 10.0 mol  $\text{C}_6\text{H}_8\text{O}_7$ . **Ans.**  $3\text{ZnCO}_3 + 2\text{C}_6\text{H}_8\text{O}_7 \rightarrow \text{Zn}_3(\text{C}_6\text{H}_5\text{O}_7)_2 + 3\text{H}_2\text{O} + 3\text{CO}_2$ ;  $\text{C}_6\text{H}_8\text{O}_7$  is in excess,  $\text{ZnCO}_3$  is limiting, and the theoretical yield is  $1.15 \times 10^3$  g  $\text{Zn}_3(\text{C}_6\text{H}_5\text{O}_7)_2$ .
2. Hydrogen sulfide gas is formed when HCl reacts with FeS.  $\text{FeCl}_2$  is the other product. 130.5 g of FeS is mixed with 70.4 g of HCl in solution. **Ans.**  $\text{FeS} + 2\text{HCl} \rightarrow \text{H}_2\text{S} + \text{FeCl}_2$ ; FeS is in excess, HCl is limiting, and the theoretical yield is 32.91 g  $\text{H}_2\text{S}$ .

 Logical