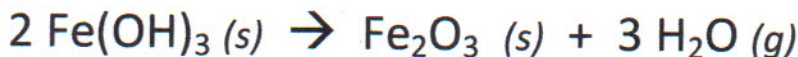


Name: _____

1. How many moles of the products (Fe_2O_3 and H_2O) form in a complete reaction of 1.00 mol $\text{Fe}(\text{OH})_3$?

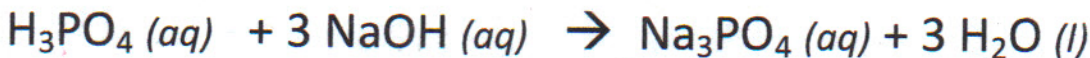


1.00 mol $\text{Fe}(\text{OH})_3$? mol ? mol

$$1.00 \text{ mol Fe}(\text{OH})_3 \left(\frac{1 \text{ mol Fe}_2\text{O}_3}{2 \text{ mol Fe}(\text{OH})_3} \right) = 0.500 \text{ mol Fe}_2\text{O}_3 \quad (3 \text{ s.f.})$$

$$1.00 \text{ mol Fe}(\text{OH})_3 \left(\frac{3 \text{ mol H}_2\text{O}}{2 \text{ mol Fe}(\text{OH})_3} \right) = \frac{1.50}{\cancel{3.00}} \text{ mol H}_2\text{O}$$

2. How many moles of product form when 0.0050 mol of H_3PO_4 reacts completely with NaOH ? And how many moles of NaOH are consumed?



0.0050 mol H_3PO_4 ? mol ? mol ? mol

$$0.0050 \text{ mol H}_3\text{PO}_4 \left(\frac{3 \text{ mol NaOH}}{1 \text{ mol H}_3\text{PO}_4} \right) = \cancel{0.0150} \quad 0.015 \text{ mol NaOH} \quad (2 \text{ s.f.})$$

$$0.0050 \text{ mol H}_3\text{PO}_4 \left(\frac{1 \text{ mol Na}_3\text{PO}_4}{1 \text{ mol H}_3\text{PO}_4} \right) = 0.0050 \text{ mol Na}_3\text{PO}_4$$

$$0.0050 \text{ mol H}_3\text{PO}_4 \left(\frac{3 \text{ mol H}_2\text{O}}{1 \text{ mol H}_3\text{PO}_4} \right) = 0.015 \text{ mol H}_2\text{O}$$

3. How many moles of reactants (C_2H_6 and O_2) are required to form 6.25 moles of CO_2 ? How many moles of water are formed?



? mol ? mol 6.25 mol CO_2 ? mol

$$(6.25 \text{ mol CO}_2) \left(\frac{2 \text{ mol C}_2\text{H}_6}{4 \text{ mol CO}_2} \right) = 3.13 \text{ mol C}_2\text{H}_6 \quad (3 \text{ s.f.})$$

$$(6.25 \text{ mol CO}_2) \left(\frac{7 \text{ mol O}_2}{4 \text{ mol CO}_2} \right) = 10.9 \text{ mol O}_2$$

$$(6.25 \text{ mol CO}_2) \left(\frac{6 \text{ mol H}_2\text{O}}{4 \text{ mol CO}_2} \right) = 9.38 \text{ mol H}_2\text{O}$$

Name: _____

4. Provide molar masses for the following, with units.

NaCl	<u>58.44 g/mol</u>	C ₃ H ₈	<u>44.094 g/mol</u>
O ₂	<u>32.00 g/mol</u>	(NH ₄) ₂ SO ₄	<u>132.154 g/mol</u>
N ₂ O ₅	<u>108.02 g/mol</u>	Na ⁺	<u>22.99 g/mol</u>

↳ same as Na, because an electron has no mass.

5. a. How many moles of P₄O₁₀ in 10.08 grams?

$$(10.08 \text{ g P}_4\text{O}_{10}) \left(\frac{\text{mol P}_4\text{O}_{10}}{283.89 \text{ g P}_4\text{O}_{10}} \right) = 0.03551 \text{ mol P}_4\text{O}_{10}$$

b. How many moles of H₂ (hydrogen gas) in 10.08 grams?

$$(10.08 \text{ g H}_2) \left(\frac{\text{mol H}_2}{2.016 \text{ g H}_2} \right) = 5.000 \text{ mol H}_2 \text{ (4sf.)}$$

c. How many moles of O₂ (diatomic oxygen gas) in 1.432 g?

$$(1.432 \text{ g O}_2) \left(\frac{\text{mol O}_2}{32.00 \text{ g O}_2} \right) = 0.04475 \text{ mol O}_2$$

d. How many moles of O (oxygen atoms) in 1.432 g?

$$(1.432 \text{ g O}) \left(\frac{\text{mol O}}{16.00 \text{ g O}} \right) = 0.08950 \text{ mol O} \text{ (4sf.)}$$

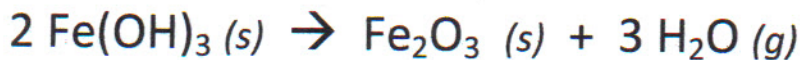
e. How many molecules of water (H₂O) in 1.0 g?

$$(1.0 \text{ g H}_2\text{O}) \left(\frac{\text{mol H}_2\text{O}}{18.016 \text{ g H}_2\text{O}} \right) \left(\frac{6.022 \times 10^{23} \text{ molecules H}_2\text{O}}{\text{mol H}_2\text{O}} \right) = 3.343 \times 10^{22} \text{ molecules H}_2\text{O}$$

Argento II

Name: _____

6. How many grams of the products (Fe_2O_3 and H_2O) form in a complete reaction of 10.00 grams $\text{Fe}(\text{OH})_3$?



10.00 g $\text{Fe}(\text{OH})_3$? g ? g

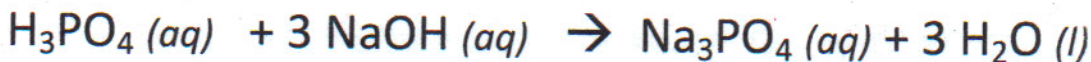
$$\left(10.00 \text{ g Fe}(\text{OH})_3 \right) \left(\frac{1 \text{ mol Fe}(\text{OH})_3}{106.87 \text{ g Fe}(\text{OH})_3} \right) \left(\frac{1 \text{ mol Fe}_2\text{O}_3}{2 \text{ mol Fe}(\text{OH})_3} \right) \left(\frac{159.69 \text{ g Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} \right)$$

$$= 7.471 \text{ g Fe}_2\text{O}_3$$

$$\left(10.00 \text{ g Fe}(\text{OH})_3 \right) \left(\frac{1 \text{ mol Fe}(\text{OH})_3}{106.87 \text{ g Fe}(\text{OH})_3} \right) \left(\frac{3 \text{ mol H}_2\text{O}}{2 \text{ mol Fe}(\text{OH})_3} \right) \left(\frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} \right)$$

$$= 2.529 \text{ g H}_2\text{O}$$

7. How many grams of product form when 25.3 grams of H_3PO_4 reacts completely with NaOH ? And how many grams of NaOH are consumed?



25.3 g H_3PO_4 ? g ? g ? g

$$\text{NaOH} = \left(25.3 \text{ g H}_3\text{PO}_4 \right) \left(\frac{1 \text{ mol H}_3\text{PO}_4}{98.00 \text{ g H}_3\text{PO}_4} \right) \left(\frac{3 \text{ mol NaOH}}{1 \text{ mol H}_3\text{PO}_4} \right) \left(\frac{40.00 \text{ g NaOH}}{1 \text{ mol NaOH}} \right)$$

$$= 31.0 \text{ g NaOH}$$

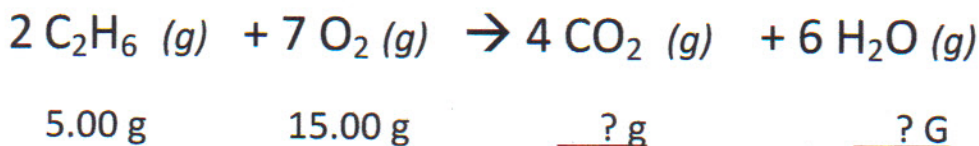
$$\text{Na}_3\text{PO}_4 = \left(25.3 \text{ g H}_3\text{PO}_4 \right) \left(\frac{1 \text{ mol H}_3\text{PO}_4}{98.00 \text{ g H}_3\text{PO}_4} \right) \left(\frac{1 \text{ mol Na}_3\text{PO}_4}{1 \text{ mol H}_3\text{PO}_4} \right) \left(\frac{163.94 \text{ g Na}_3\text{PO}_4}{1 \text{ mol Na}_3\text{PO}_4} \right)$$

$$= 42.3 \text{ g Na}_3\text{PO}_4$$

How by balance: # grams product = # grams reactant = 31.0g + 25.3g = 56.3g
~~56.3g - 42.3g = 14.0g~~
 # grams H_2O = ~~14.0g~~ 56.3g - 42.3g = 14.0g H_2O

Name: _____

8. Which is the limiting reactant when 5.00 g of C_2H_6 and 15.00 g O_2 are combusted? What is the theoretical yield for CO_2 and water, in grams?



$$C_2H_6: (5.00 \text{ g } C_2H_6) \left(\frac{\text{mol } C_2H_6}{30.07 \text{ g } C_2H_6} \right) \left(\frac{4 \text{ mol } CO_2}{2 \text{ mol } C_2H_6} \right) \left(\frac{44.01 \text{ g } CO_2}{\text{mol } CO_2} \right)$$

$$= 14.60 \text{ g } CO_2$$

$$O_2: (15.00 \text{ g } O_2) \left(\frac{\text{mol } O_2}{32.00 \text{ g } O_2} \right) \left(\frac{4 \text{ mol } CO_2}{7 \text{ mol } O_2} \right) \left(\frac{44.01 \text{ g } CO_2}{\text{mol } CO_2} \right)$$

$$= 11.79 \text{ g } CO_2$$

theoretical yield \rightarrow start w/ LIMITING REACTANT
 (O_2)

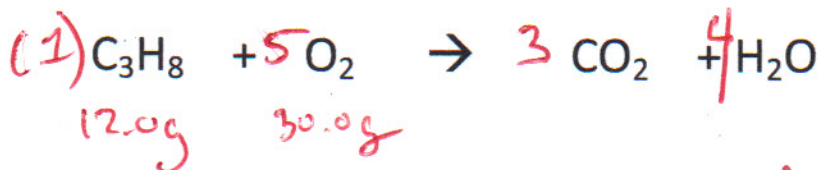
$$(15.00 \text{ g } O_2) \left(\frac{\text{mol } O_2}{32.00 \text{ g } O_2} \right) \left(\frac{6 \text{ mol } H_2O}{7 \text{ mol } O_2} \right) \left(\frac{18.02 \text{ g } H_2O}{\text{mol } H_2O} \right)$$

$$= 7.240 \text{ g } H_2O$$

Limiting reactant:

Name: _____

9. **Balance** the below equation. What is the **limiting reactant** when 12.0g of propane (C_3H_8) reacts with 30.0 g oxygen? What is the **theoretical yield for CO_2** ? ~~How many grams of excess reactant remain?~~



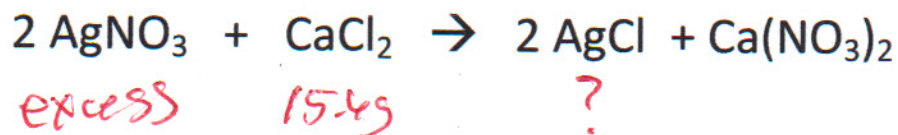
$$C_3H_8: (12.0 \text{ g } C_3H_8) \left(\frac{1 \text{ mol } C_3H_8}{44.09 \text{ g } C_3H_8} \right) \left(\frac{3 \text{ mol } CO_2}{1 \text{ mol } C_3H_8} \right) \left(\frac{44.01 \text{ g } CO_2}{1 \text{ mol } CO_2} \right)$$
$$= 35.9 \text{ g } CO_2$$

$$O_2: (30.0 \text{ g } O_2) \left(\frac{1 \text{ mol } O_2}{32.00 \text{ g } O_2} \right) \left(\frac{3 \text{ mol } CO_2}{5 \text{ mol } O_2} \right) \left(\frac{44.01 \text{ g } CO_2}{1 \text{ mol } CO_2} \right)$$
$$= \boxed{24.8 \text{ g } CO_2}$$

Limiting reactant: O_2
CO₂ theoretical yield: 24.8 g CO₂
Excess reactant: ~~_____~~

Name: _____

9. Calculate the **theoretical yield for AgCl** given 15.6 grams of ~~NaCl~~ ^{CaCl₂} react with excess AgNO₃. What is the **percent yield** if an experiment produces 23.3 grams of AgCl?



$$(15.6 \text{ g CaCl}_2) \left(\frac{1 \text{ mol CaCl}_2}{110.98 \text{ g CaCl}_2} \right) \left(\frac{2 \text{ mol AgCl}}{1 \text{ mol CaCl}_2} \right) \left(\frac{143.32 \text{ g AgCl}}{1 \text{ mol AgCl}} \right) = 40.3 \text{ g AgCl}$$

$$\% \text{ yield} = \frac{\text{actual}}{\text{theoretical}} \times 100\%$$
$$= \frac{23.3 \text{ g}}{40.3 \text{ g}} \times 100\% = 57.8\%$$

AgCl theoretical yield: 40.3g AgCl
AgCl percent yield: 57.8%