These problems are intended to ***supplement*** the problems in the textbook, not ***replace*** them.

Questions – Stoichiometry Only

I. Propane, when used as a fuel, reacts with oxygen to produce carbon dioxide and water:

$$\_\_\ C_3H_8(g) + \_\_\ O_2(g) \rightarrow \_\_\ CO_2(g) + \_\_\ H_2O(l)$$

1. Balance the equation.
2. What mass of oxygen will be required to react exactly with 96.1 grams of propane?
3. What mass of carbon dioxide is produced when 96.1 grams of propane react with oxygen?
4. Calculate the mass of water formed by 96.1 grams of propane.

II. Solid lithium hydroxide is used in space vehicles to remove exhaled carbon dioxide. The products are solid lithium carbonate and liquid water.

5. Write the balanced chemical equation for this reaction.
6. Calculate the mass of carbon dioxide absorbed by 1.00 kg of lithium hydroxide.

III. Aluminum can be oxidized by hydrochloric acid: $\_\_\ Al(s) + \_\_\ HCl(aq) \rightarrow \_\_\ AlCl_3(aq) + \_\_\ H_2(g)$

7. Balance the equation.
8. What mass of metal is needed to produce 1.00 gram of hydrogen?

Questions – Stoichiometry And Limiting Reactant

IV. Methane reacts with steam to produce hydrogen gas and carbon monoxide:

$$\_\_\ CH_4(g) + \_\_\ H_2O(g) \rightarrow \_\_\ H_2(g) + \_\_\ CO(g)$$

9. Balance the equation.
10. How much hydrogen gas is produced when 249 g of methane reacts with 249 g of steam?
11. Which reactant is limiting and which is in excess?
12. How much of the excess reactant will be left over?

V. Ammonia can be produced by the Haber process: $\_\_\ N_2(g) + \_\_\ H_2(g) \rightarrow \_\_\ NH_3(g)$

13. Balance the equation.
14. When 25.0 kg of nitrogen and 5.00 kg of hydrogen are mixed, what is the theoretical yield of ammonia, in kg?
15. How much of each reactant is left over?
16. What is the percent yield of ammonia if 21.3 kg are actually produced?

VI. **__ NH_3*(g)* + __ CuO*(s)* → __ N_2*(g)* + __ Cu*(s)* + __ H_2O*(g)***

17. Balance the equation.
18. How many grams of nitrogen are formed when 18.2 g of ammonia and 90.4 g of copper(II) oxide are combined?
19. How many grams of which reactant is left over?
20. If the actual yield of nitrogen was 9.0 g, what is the percent yield for the reaction?

VII. **__ B_2O_3*(s)* + __ CaF_2*(aq)* + __ H_2SO_4*(aq)* → __ BF_3*(g)* + __ $CaSO_4$*(aq)* + __ H_2O*(l)***

21. Balance the equation.
22. How much calcium fluoride is needed to produce 165 grams of calcium sulfate?
23. If 0.62 g of boron trifluoride is formed, how much water is also formed?
24. If 10.0 g each of the three reactants are combined, how much calcium sulfate will be produced?
25. If 10.0 g each of the three reactants are combined, how much of each reactant will be left over?

Answers

If you cannot figure out how to get the correct answer, go to your instructor, Science Tutoring Center, SI, etc.

NOTE: if your answer is different only in the last decimal place, then you probably rounded off at different points during the calculations. Don't be concerned about this.

NOTE: molar mass values were taken from the CHE 111 Lab Manual and used without rounding

1. $C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(g)$
2. 349 g O_2
3. 288 g CO_2
4. 157 g H_2O
5. $2\ LiOH(s) + CO_2(g) \rightarrow Li_2CO_3(s) + H_2O(l)$
6. 919 g CO_2
7. $2\ Al(s) + 6\ HCl(aq) \rightarrow 2\ AlCl_3(aq) + 3\ H_2(g)$
8. 8.92 g Al
9. $CH_4(g) + H_2O(g) \rightarrow 3\ H_2(g) + CO(g)$
10. 83.6 g H_2
11. steam is limiting, methane is in excess
12. 27 g CH_4
13. $N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$
14. 28.2 kg NH_3
15. 0 kg H_2 and 1.8 kg N_2
16. 75.5%
17. $2\ NH_3(g) + 3\ CuO(s) \rightarrow N_2(g) + 3\ Cu(s) + 3\ H_2O(g)$
18. 10.6 g N_2
19. 5.3 g NH_3
20. 85%
21. $B_2O_3(s) + 3\ CaF_2(aq) + 3\ H_2SO_4(aq) \rightarrow 2\ BF_3(g) + 3\ CaSO_4(aq) + 3\ H_2O(l)$
22. 94.6 g CaF_2
23. 0.25 g H_2O
24. 13.9 g $CaSO_4$
25. 0 g H_2SO_4 and 7.6 g B_2O_3 and 2.0 g CaF_2