1. What is the molecular weight of HC$_2$H$_3$O$_2$

2. What is the molecular weight of Al(C$_2$H$_3$O$_2$)$_3$

3. What is the molecular weight of Sc$_2$(C$_2$O$_4$)$_3$

4. What is the molarity of a solution made from 25.0 grams of Mg(OH)$_2$ dissolved in 175.0 mL of water?

5. How many grams of HCl are required to make 105.0 mL of 2.75 M HCl?

6. Given the reaction: 2 NaOH(aq) + 1 H$_2$SO$_4$(aq) $\rightarrow$ 1 Na$_2$SO$_4$(aq) + 2 H$_2$O(l)
   how many grams of Na$_2$SO$_4$ can be produced from 25.0 grams of NaOH.

7. What is the molarity of a solution made from 25.0 grams of NaOH dissolved in 350.0 mL of water?

8. How many grams of NaOH are required to make 250.0 mL of 1.25 M NaOH?

9. 27.5 mL of 0.35M NaOH is how many grams of NaOH?

10. Jay performed a titration and noted that 225.0 mL of 0.85 M NaOH completely neutralized 175 mL of H$_2$SO$_4$. What is the Molarity of the H$_2$SO$_4$ solution? (Hint: 2NaOH(aq) + H$_2$SO$_4$(aq) $\rightarrow$ 2HOH(l) + Na$_2$SO$_4$(aq) + heat.

11. Jay performed a titration and noted that 15.0 mL of 8.0 M NaOH completely neutralized an unknown volume of 6.5 M H$_2$SO$_4$. What is the volume (in mL) of the H$_2$SO$_4$ solution? (Hint: 2NaOH(aq) + H$_2$SO$_4$(aq) $\rightarrow$ 2HOH(l) + Na$_2$SO$_4$(aq) + heat.

12. How many grams of HCl are required to make 750.0 mL of 3.000 M HCl?

13. What is the molarity of a solution made from 15.0 grams of AgNO$_3$ dissolved in 275.0 mL of water?

14. Answer the following questions about the given the reaction:
   2 H$_3$PO$_4$(aq) + 3 Mg(OH)$_2$(aq) $\rightarrow$ 1 Mg$_3$(PO$_4$)$_2$(aq) + 6 H$_2$O(l) + 12.0kJ
   (a) How many grams of Mg$_3$(PO$_4$)$_2$ can be produced from 125.0 grams of Mg(OH)$_2$.
   (14a) 

   (b) How many grams of H$_3$PO$_4$ are required to react with 11.0 grams of Mg(OH)$_2$.
   (14b) 

15. Bob performed a titration and noted that 75.0 mL of 0.65 M Mg(OH)$_2$ completely neutralized 250.0 mL of HCl. What is the Molarity of the HCl solution?
   Hint: 1 Mg(OH)$_2$(aq) + 2 HCl(aq) $\rightarrow$ 2 HOH(l) + MgCl$_2$(aq).

16. How many mL of 0.55 M NaOH are required to neutralize 195.0 mL of 1.87 M H$_2$SO$_4$?
   Hint: 1 H$_2$SO$_4$(aq) + 2 NaOH(aq) $\rightarrow$ 2 HOH(l) + 1 Na$_2$SO$_4$(aq).

17. Todd performed a titration and noted that 115.0 mL of 0.85 M Mg(OH)$_2$ completely neutralized 135.0 mL of H$_3$PO$_4$. What is the Molarity of the H$_3$PO$_4$ solution?
   Hint: 3 Mg(OH)$_2$(aq) + 2H$_3$PO$_4$(aq) $\rightarrow$ 6 HOH(l) + Mg$_3$(PO$_4$)$_2$(s).

18. How many mL of 3.25 M Mg(OH)$_2$ are required to neutralize 240.0 mL of 1.25 M H$_3$PO$_4$?
   Hint: 3 Mg(OH)$_2$(aq) + 2 H$_3$PO$_4$(aq) $\rightarrow$ 6 HOH(l) + Mg$_3$(PO$_4$)$_2$(s).

19. Jay is baking apple pies using the following recipe: 3 Apples + 2 cups sugar + 5 teaspoons Cinnamon + 4 cups Flour $\rightarrow$ 2.5 apple pies. In my cupboard I have the following: 24 apples, 10 cups of Sugar, 30 teaspoons of Cinnamon and 25 cups of Flour. Answer the following questions:

   (a) What is the limiting ingredient?

   (b) Amount of Apples left:

   (c) Amount of Sugar left:

   (d) Amount of Cinnamon left:

   (e) Amount of Flour left:

   (f) Number of pies made:

20. Given the reaction: 3 Mg(OH)$_2$(aq) + 2 H$_3$PO$_4$(aq) $\rightarrow$ Mg$_3$(PO$_4$)$_2$(aq) + 6 HOH + 543 kJ
   25.0 g of Mg(OH)$_2$ was reacted with 50.0 g of H$_3$PO$_4$. MW: Mg(OH)$_2$ = 58.3258 g/mol, H$_3$PO$_4$ = 97.9937 g/mol, Mg$_3$(PO$_4$)$_2$ = 262.87 g/mol, and HOH = 18.0158 g/mol.

   (a) What was the limiting reactant?

   (b) Moles Mg(OH)$_2$ left:

   (c) Moles H$_3$PO$_4$ left:

   (d) Moles Mg$_3$(PO$_4$)$_2$ left:

   (e) Moles HOH left:

   (f) Is the reaction Endothermic or Exothermic?

   (g) How much heat is consumed/produced in the reaction?
21. Given the reaction: \( 2 \text{Al(OH)}_3(aq) + 3 \text{H}_2\text{SO}_4(aq) \rightarrow \text{Al}_2(\text{SO}_4)_3(s) + 6 \text{HOH} + 115\text{kJ} \)

MW: \( \text{Al(OH)}_3 = 77.97 \text{ g/mol}, \text{H}_2\text{SO}_4 = 98.09 \text{ g/mol}, \text{Al}_2(\text{SO}_4)_3 = 342.11 \text{ g/mol}, \) and \( \text{H}_2\text{O} = 18.02 \text{ g/mol} \).

(a) What was the limiting reactant?  
(b) Moles \( \text{H}_2\text{SO}_4 \) left:  
(c) Moles \( \text{Al(OH)}_3 \) left:  
(d) Moles \( \text{Al}_2(\text{SO}_4)_3 \) left:  
(e) Moles \( \text{H}_2\text{O} \) left:  
(f) Is the reaction Endothermic or Exothermic?  
(g) How much heat is consumed/produced in the reaction?  

22. Given the reaction: \( 2 \text{C}_2\text{H}_6 + 7 \text{O}_2 \rightarrow 4 \text{CO}_2 + 6 \text{H}_2\text{O} + 75 \text{kJ} \)

MW: \( \text{C}_2\text{H}_6 = 30.07 \text{ g/mol}, \text{O}_2 = 32.00 \text{ g/mol}, \text{CO}_2 = 44.01 \text{ g/mol}, \) and \( \text{H}_2\text{O} = 18.02 \text{ g/mol} \).

(a) What was the limiting reactant?  
(b) Moles \( \text{O}_2 \) left:  
(c) Moles \( \text{C}_2\text{H}_6 \) left:  
(d) Moles \( \text{CO}_2 \) left:  
(e) Moles \( \text{H}_2\text{O} \) left:  
(f) Is the reaction Endothermic or Exothermic?  
(g) How much heat is consumed/produced in the reaction?  

23. Answer the following questions about the reaction below. Clearly label and show work in the space provided below, or on a separate sheet of paper.

\[ \text{Hint: } 1 \text{ Al(NO}_3)_3(aq) + 3 \text{ NaI(aq)} + 75.0\text{kJ} \rightarrow 3 \text{ NaNO}_3(aq) + 1 \text{ AlI}_3(s) \]

(a) What is the limiting reagent if you start with 15.0 grams of NaI and 10.0 grams of Al(NO\(_3\))\(_3\)?  
(b) What is the theoretical yield of AlI\(_3\) in grams?  
(c) How many grams of the excess reagent will be left over?  
(d) What is the percent yield if you performed the reaction in lab and produced 12.50 grams of AlI\(_3\)?  
(e) Is the reaction exothermic or endothermic?  
(f) How much energy (in Joules) is consumed/produced in the reaction?
24. Answer the following questions about the reaction below. Clearly label and show work in the space provided below, or on a separate sheet of paper.

\[ 3 \text{Mg(OH)}_2(\text{aq}) + 2 \text{H}_3\text{PO}_4(\text{aq}) \rightarrow 6 \text{HOH}(\text{l}) + 1 \text{Mg}_3(\text{PO}_4)_2(\text{s}) + 320. \text{kJ} \]

(a) What is the limiting reagent if you start with 25.0 grams of Mg(OH)$_2$ and 25.0 grams of H$_3$PO$_4$?  
(b) What is the theoretical yield in grams of Mg$_3$(PO$_4$)$_2$ in grams?  
(c) How many grams of the excess reagent will be left over?  
(d) What is the percent yield if you performed the reaction and produced 12.50 grams of Mg$_3$(PO$_4$)$_2$?  
(e) Is the reaction exothermic or endothermic?  
(f) How much energy (in Joules) is consumed/produced in the reaction? 

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25. Given the reaction: \[ \text{H}_2\text{SO}_4(\text{aq}) + 2 \text{NaOH}(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq}) + 2 \text{H}_2\text{O} + 784 \text{kJ} \]

34.7 g of H$_2$SO$_4$ was reacted with 75.0 g of NaOH. MW: H$_2$SO$_4$ = 98.09 g/mol, NaOH = 40.00 g/mol, Na$_2$SO$_4$ = 142.05 g/mol, and H$_2$O = 18.02 g/mol.

(a) What was the limiting reactant?  
(b) Grams H$_2$SO$_4$ left:  
(c) Grams NaOH left:  
(d) Grams Na$_2$SO$_4$ left:  
(e) Grams H$_2$O left:  
(f) Is the reaction Endothermic or Exothermic?  
(g) How much heat is consumed/produced in the reaction? 

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26. Answer the following questions about the reaction of Sodium Iodide with Barium Chloride to produce Sodium Chloride and Barium Chloride. (Clearly label and show work in the space provided below.)

\[ 2\text{NaI} + \text{BaCl}_2 + 200\text{kJ} \rightarrow 2\text{NaCl} + \text{BaI}_2(\text{s}) \]

(a) What is the limiting reagent if you start with 50.0 grams of NaI and 35.0 grams of BaCl$_2$?  
(b) What is the theoretical yield in grams of BaI$_2$ in grams?  
(c) How many grams of the excess reagent will be left over?  
(d) What is the percent yield if you performed the reaction and produced 15.0 grams of BaI$_2$?  
(e) Is the reaction exothermic or endothermic?  
(f) How much energy is consumed/produced in the reaction?