CH 151 Summer 2024:

Problem Set #3

Instructions

Step One (all sections):

- **Learn the material** for Problem Set #3 by **reading Chapter 4** of the textbook and/or by watching the videos found on the website (https://mhchem.org/151)
- **Try the problems** for Problem Set #3 found on the next pages on your own first. Use separate paper and write out your answers, showing all of your work. If you write the answers on the problem set itself, you will receive fewer points. Include your name on your problem set!

Step Two:

Watch the recitation video for Problem Set #3:
http://mhchem.org/t/c.htm

- **Self correct *all* of the problems** while viewing the video. Mark correct problems with a star (or other similar mark), and correct all incorrect problems (show the correct answer and the steps required to achieve it.)
- **Submit Problem Set #3 via email (mike.russell@mhcc.edu) as a single PDF file** (use CamScanner (https://camscanner.com), CombinePDF (https://combinepdf.com), etc.) **by 11:59 PM Wednesday, July 10.**

If you have any questions regarding this assignment, please email (mike.russell@mhcc.edu) the instructor! Good luck on this assignment!

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* Complete problem set on separate pieces of paper showing all work, circling final answers, etc.
* Self correct your work before turning it in to the instructor.

Covering: **Chapter Four**
* *Important Tables and/or Constants:* periodic table (http://mhchem.org/pertab)

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1. What do the symbols in parentheses stand for in the following equations?
   a. $PCl_3(l) + Cl_2(g) \rightarrow PCl_5(s)$
   b. $NaCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + NaNO_3(aq)$
2. For each of the following balanced equations, indicate how many atoms of each element are present on the reactant and product sides of the chemical equation.
   a. $4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$
   b. $2\ Na + 2\ H_2O \rightarrow 2\ NaOH + H_2$
   c. $2\ Co + 3\ HgCl_2 \rightarrow 2\ CoCl_3 + 3\ Hg$
   d. $H_2SO_4 + 2\ NH_3 \rightarrow (NH_4)_2SO_4$
3. Balance the following chemical equations.
   a. $Fe + O_2 \rightarrow Fe_2O_3$
   b. $NaClO_3 \rightarrow NaCl + O_2$
   c. $Au_2S_3 + H_2 \rightarrow H_2S + Au$
   d. $NH_3 + O_2 \rightarrow N_2O + H_2O$
4. Balance the following combustion equations.
   a. $C_2H_4 + O_2 \rightarrow CO_2 + H_2O$
   b. $C_6H_{12} + O_2 \rightarrow CO_2 + H_2O$
   c. $C_3H_6O + O_2 \rightarrow CO_2 + H_2O$
   d. $C_5H_{10}O_2 + O_2 \rightarrow CO_2 + H_2O$
5. Balance the following chemical equations.
   a. $Al + Sn(NO_3)_2 \rightarrow Al(NO_3)_3 + Sn$
   b. $Na_2CO_3 + Mg(NO_3)_2 \rightarrow MgCO_3 + NaNO_3$
   c. $Al(NO_3)_3 + H_2SO_4 \rightarrow Al_2(SO_4)_3 + HNO_3$
   d. $Ba(C_2H_3O_2)_2 + (NH_4)_3PO_4 \rightarrow Ba_3(PO_4)_2 + NH_4C_2H_3O_2$
6. Classify each of the following chemical reactions as precipitation, decomposition, single-replacement, combustion, acid-base or combination.
   a. $3\ CuSO_4 + 2\ Al \rightarrow Al_2(SO_4)_3 + 3\ Cu$
   b. $K_2CO_3 \rightarrow K_2O + CO_2$
   c. $2\ AgNO_3 + K_2SO_4 \rightarrow Ag_2SO_4(s) + 2\ KNO_3$
   d. $2\ SO_2 + O_2 \rightarrow 2\ SO_3$
   e. $H_2SO_4 + 2\ KOH \rightarrow 2\ H_2O + K_2SO_4$
   f. $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$

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7. Identify the products of, and then write a balanced chemical equation for, each of the following chemical reactions.
    a. $AlCl_3 \rightarrow ? + ?$ (decomposition reaction into elements)
    b. $HNO_3 + NaOH \rightarrow ? + ?$ (acid-base reaction)
    c. $Al + Ni(NO_3)_2 \rightarrow ? + ?$ (single replacement reaction)
    d. $Be + N_2 \rightarrow ?$ (combination reaction)
8. Write a balanced chemical equation for the thermal decomposition of each of the following metal carbonates to its metal oxide and carbon dioxide.
    a. $BeCO_3$
    b. Li_2CO_3
    c. $ZnCO_3$
    d. Cs_2CO_3
9. Write a balanced chemical equation for the combustion of each of the following hydrocarbons in air.
    a. C_5H_{12}
    b. C_4H_6
    c. C_7H_8
    d. C_8H_{18}
10. Write a balanced chemical equation for the combustion of each of the following hydrocarbons in air.
    a. C_2H_4O
    b. $C_5H_{10}O$
    c. $C_2H_4O_2$
    d. $C_3H_6O_2$
11. Balance the following chemical equations.
    a. $NH_3 + O_2 + CH_4 \rightarrow HCN + H_2O$
    b. $KClO_3 + HCl \rightarrow KCl + Cl_2 + H_2O$

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