U5LM2B-WS - Stoichiometric Relations   Name: _____KEY_____

Consider the following chemical equation to answer the questions below.

$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$

1. _One_ molecules of C_3H_8 react with _five_ molecules of O_2 to produce _three_ molecules of CO_2 and _four_ molecules of H_2O. *Coefficients in the balanced chemical equation can be read in terms of molecules or moles.*

2. 20 molecules of C_3H_8 react with _100_ molecules of O_2 to produce _60_ molecules of CO_2 and _80_ molecules of H_2O. *Use stoichiometric ratios from the balanced equation.*

   Ex: $20\ \text{~~molecules of } C_3H_8\text{~~} \times \dfrac{5\ \text{molecules of } O_2}{1\ \text{molecule of } C_3H_8} = 100\ \text{molecules of } O_2$

3. $6.022\text{x}10^{23}$ molecules of C_3H_8 react with _$3.011\text{x}10^{24}$_ molecules of O_2 to produce _$1.807\text{x}10^{24}$_ molecules of CO_2 and _$2.409\ \text{x}10^{24}$_ molecules of H_2O.
   Stoichiometric ratios work here too. Ex:

   $6.022\text{x}10^{23}\ \text{molecules } C_3H_8 \times \dfrac{5\ \text{molecules } O_2}{1\ \text{molecule } C_3H_8} = 30.11\text{x}10^{23}\ \text{molecules of } O_2$
   (change to proper scientific notation)

4. 1 mole of C_3H_8 reacts with _five_ moles of O_2 to produce _three_ moles of CO_2 and _four_ moles of H_2O. *Again, read the coefficients in front of each chemical. These stoichiometric proportions may represent moles **or** molecules.*

5. 5 moles of C_3H_8 reacts with _25_ moles of O_2 to produce _15_ moles of CO_2 and _20_ moles of H_2O. *Multiply each coefficient above by the stoichiometric ratio. Example shown below.*

   Ex: $5\ \text{moles of } C_3H_8 \times \dfrac{5\ \text{moles of } O_2}{1\ \text{mole of } C_3H_8}$

6. 44 g of C_3H_8 reacts with _160_ grams of O_2 to produce _130_ grams of CO_2 and _72_ grams of H_2O. *Convert grams to moles by dividing by molar mass of propane. Use stoichiometric proportions as in problem 6. Then multiply the number of moles by the molar mass of each compound. Example shown below.*

   $44\text{g } C_3H_8 \times \dfrac{1\ \text{moles } C_3H_8}{44\ \text{g of } C_3H_8} \times \dfrac{5\ \text{mole } O_2}{1\ \text{mole } C_3H_8} \times \dfrac{32\ \text{g of } O_2}{1\ \text{mole of } O_2} = 160\text{g } O_2$

   ****Don't forget that significant figures matter! These should all have 2 sig figs!****

7. 176 g of C_3H_8 reacts with _638_ grams of O_2 to produce _528_ grams of CO_2 and _288_ grams of H_2O. *Same methods as above in number 6. Three sig figs in this case though.*

   $176\ \text{g } C_3H_8 \times \dfrac{1\ \text{moles } C_3H_8}{44.11\ \text{g of } C_3H_8} \times \dfrac{5\ \text{mole } O_2}{1\ \text{mole } C_3H_8} \times \dfrac{32.00\ \text{g of } O_2}{1\ \text{mole of } O_2} = 638.40\text{g } O_2$

8. How many moles of carbon dioxide can be produced from the reaction of 12 moles of propane? *Same methods as above in number 6. Two sig figs.*

36 moles of carbon dioxide

12 ~~moles of C_3H_8~~ x 3 moles of CO_2
1 ~~mole of C_3H_8~~

9. What mass of oxygen is needed to produce 65 grams of water? 140 g of oxygen

65 ~~g H_3O~~ x 1 ~~moles H_3O~~ x 5 ~~mole O_2~~ x 32 g of O_2 = 144g of O_2 (2 sig figs)
18 ~~g H_3O~~ 4 ~~mole H_3O~~ 1 ~~mole of O_2~~

10. How many moles of carbon dioxide can be produced from the reaction of 225 g of propane?

673 g of carbon dioxide

225 ~~g C_3H_8~~ x 1 ~~moles C_3H_8~~ x 3 ~~mole CO_2~~ x 44.0 g of CO_2 = 673.47g (3 sig figs)
44.1 ~~g of C_3H_8~~ 1 ~~mole C_3H_8~~ 1 ~~mole of CO_2~~

11. What mass of H_2O is produced from the reaction of 6.3 g of propane? 10.3 g of water

6.3 ~~g C_3H_8~~ x 1 ~~moles C_3H_8~~ x 4 ~~mole H_2O~~ x 18 g of H_2O (2 sig figs)
44 ~~g of C_3H_8~~ 1 ~~mole C_3H_8~~ 1 ~~mole of H_2O~~

12. How many molecules of H_2O are produced when 2 moles of O_2 are reacted with excess propane? *Oxygen is the limiting reagent*

1 x 10^{24} molecules of water

2 ~~mol O_3~~ x 4 ~~mole H_2O~~ x 6.022×10^{23} molec. H_2O = 9.635×10^{23} molec. (1 sig fig)
5 ~~mole O_3~~ 1 ~~mole H_2O~~