Chem 11 **Chemical Reactions Review Assignment - Answers**

Please let me know if you have any questions or think you've found an error in the key. Study well!

1. a) $C_8H_{16} + 12\ O_2 \rightarrow 8\ CO_2 + 8\ H_2O$
   b) $Cu + 2\ H_2SO_4 \rightarrow CuSO_4 + 2\ H_2O + SO_2$ (hard to balance using "the method" – sorry! Please feel free to omit this one)
   c) $2\ Si_4H_{10} + 13\ O_2 \rightarrow 8\ SiO_2 + 10\ H_2O$
   d) $4\ NaPb + 4\ C_2H_5Cl \rightarrow Pb(C_2H_5)_4 + 3\ Pb + 4\ NaCl$
   e) $3\ LiAlH_4 + 4\ BF_3 \rightarrow 3\ LiF + 3\ AlF_3 + 2\ B_2H_6$
   f) $2\ C_{15}H_{31}NH + 46\ O_2 \rightarrow 30\ CO_2 + 32\ H_2O + N_2$

2. a) $N_2 + 3\ H_2 \rightarrow 2\ NH_3$ Synthesis
   b) $2\ CaO \rightarrow 2\ Ca + O_2$ Decomposition
   c) $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$ Single replacement
   d) $H_3PO_4 + 3\ KOH \rightarrow K_3PO_4 + 3\ H_2O$ Neutralization
   e) $2\ Fe(NO_3)_3 + 3\ MgS \rightarrow Fe_2S_3 + 3\ Mg(NO_3)_2$ Double replacement
   f) $2\ C_{11}H_{21}SH + 35\ O_2 \rightarrow 22\ CO_2 + 22\ H_2O + 2\ SO_2$ Hydrocarbon combustion

3. $Na_2S(aq) + Zn(NO_3)_2(aq) \rightarrow ZnS(s) + 2\ NaNO_3(aq)$

4. a) Acid: A substances that can release a proton when dissolve to form aqueous solutions.
   b) Base: An ionic substance containing a hydroxide group. (e.g. NaOH, $Mg(OH)_2$, NH_4OH, etc)
   c) Salt: An ionic substance that is neither an acid nor a base.
   d) Activation Energy: The amount of energy needed to start a reaction.
   e) Enthalpy: the amount of energy stored in a chemical system.
   f) Exothermic Reaction: a reaction in which the amount of energy needed to break the bonds of the reactants is less than the amount of energy released when product bonds form.

5. a) The energy term appears on the products side.
   b) The reactant enthalpy is higher than the products; the axes must be properly labeled and (unlike in the text) I expect you to draw the activation energy correctly.

6. The change in enthalpy represents the difference between the enthalpy of products (*i.e.* final conditions) and the enthalpy of the reactants (*i.e.* initial conditions). This difference is positive in endothermic reactions because there is more stored energy in the system after the reaction completes while it is negative in exothermic reactions due to less heat being stored in the system after the reaction is over.

7. Endothermic reactions draw energy in from the surroundings to break the bonds of the reactants but they do not release as much energy from the newly formed product bonds. The net result is that more energy must be taken in than is returned to the surroundings.

8. Exothermic enthalpy changes are negative due to the final enthalpy being less than the initial enthalpy. ($\Delta H = H_f - H_i$).

9. Sulfur dioxide; SO_2 dissolves in the atmosphere to produce acid rain which the damages aquatic ecosystems, food crops and numerous structures. More energy is released when product bonds form than is consumed in breaking the reactant bonds.

10. Note: The question should refer to 2 e) and not to 2 b). The reaction is taking place in the aqueous phase. This means that while the reactants are part of the system, the water in which they are dissolved is not part of the system. Ask about this if you are unsure…