Chemistry – Unit 7 Review

Chemical Reaction Model
1. Describe key characteristics of all chemical reactions, including the role of energy. Explain how a balanced equation represents these features (include an example).

In chemical reactions, atoms of the reactants recombine to form new substances in the products. There is almost always some transfer between the thermal and chemical energy accounts as well as an exchange of thermal energy via heating (Q) between the system and surroundings. The balanced chemical equation represents this process symbolically, showing that the atoms in the products are the same as those in the reactants.

\[ 2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O} + \text{energy} \]
Note: there are 4 atoms of H and 2 atoms of O on each side of the equation.

Applying the Model
2. Balance the reaction below by drawing any additional reactant and/or product molecules that would be needed.

Write the balanced equation for this reaction.

\[ \text{DB}_2 + \text{CD}_3 + \text{BAC} \rightarrow \text{C}_2\text{D}_4 + \text{AB}_3 \]

Which of these molecules would be called reactants?

_____ DB₂, CD₃ and BAC are reactants
3. Balance these reactions.

a. \( 2\text{AgNO}_3(aq) + \text{CaCl}_2(aq) \rightarrow 2\text{AgCl}(s) + \text{Ca(NO}_3_2(aq) \)

b. \( 2\text{C}_2\text{H}_6(g) + 3\text{O}_2(g) \rightarrow 2\text{CH}_3\text{COOH}(g) + 2\text{H}_2\text{O}(g) \)

c. \( 2\text{HCl} (aq) + \text{Ba(OH)}_2(aq) \rightarrow \text{BaCl}_2(aq) + 2\text{H}_2\text{O}(l) \)

d. \( 2\text{Na}(s) + 2\text{H}_2\text{O}(l) \rightarrow 2\text{NaOH}(aq) + \text{H}_2(g) \)

e. When solid potassium chlorate is strongly heated in a flame it forms oxygen gas and solid potassium chloride. \(2\text{KClO}_3(s) \rightarrow 2\text{KCl}(s) + 3\text{O}_2(g) \)

f. Zinc and lead (II) nitrate react to form zinc nitrate and lead. \(\text{Zn} + \text{Pb(NO}_3_2 \rightarrow \text{Zn(NO}_3_2 + \text{Pb} \)

For the following chemical reactions, write the balanced chemical equation, including the energy term where it belongs. Also, complete the energy bar chart, the chemical potential energy graph and indicate if the reaction is exothermic or endothermic.

4. When 3M HCl is added to solid sodium carbonate, the contents of the test tube immediately starts bubbling and gets warm. Carbon dioxide gas, water vapor and sodium chloride are formed. \(2\text{HCl}(aq) + \text{Na}_2\text{CO}_3(s) \rightarrow \text{NaCl}(aq) + \text{H}_2\text{O}(g) + \text{CO}_2(g) + \text{energy} \)
5. As solid ammonium nitrate dissolves in water, the resulting solution cools.
   \[ \text{energy} + \text{NH}_4\text{Cl(s)} \rightarrow \text{NH}_4^+(aq) + \text{Cl}^-(aq) \]

6. What type of reactions are the following?
   a. \( \text{MnI}_2(s) \rightarrow \text{Mn(s)} + \text{I}_2(s) \) _____decomposition_____
   b. \( \text{C}_2\text{H}_5\text{OH(l)} + 3 \text{O}_2(g) \rightarrow 2 \text{CO}_2(g) + 3 \text{H}_2\text{O}(g) \) _____combustion_____
   c. \( \text{CaCl}_2(aq) + \text{Na}_2\text{CO}_3(aq) \rightarrow \text{CaCO}_3(s) + 2 \text{NaCl}(aq) \) _____double replacement_____
   d. \( \text{CO}(g) + \text{Cl}_2(g) \rightarrow \text{COCl}_2(g) \) _____combination or synthesis_____
   e. \( \text{Zn}(s) + \text{CuSO}_4(aq) \rightarrow \text{Cu}(s) + \text{ZnSO}_4(aq) \) _____single replacement_____