Name_____ Date_____ Block _____ **THERMO WS #1**

Part 1: Balancing, Determining if a Reaction is Endothermic or Endothermic, Determining Type of Reaction

Balance the following chemical equations using only coefficients. If you see a polyatomic ion like (NO_3) on both sides of the arrow (→) you can balance it as a whole unit. If you **do** see a polyatomic ion like (SO_4) or (NO_3) or (ClO_3) or (OH), **draw a circle around it**. After you have balanced the equation underline the word energy and then tell whether the reaction is **endo**thermic (energy is absorbed) **or exo**thermic (energy is released), by circling the word endo or exo to the right of the reaction.

1. ____$Mg_3N_{2\,(s)}$ + energy → ____$Mg_{(s)}$ + ____$N_{2\,(g)}$ **endo / exo**

Type of Reaction:_____

2. ____$K_2(CO_3)_{(aq)}$ + ____$Ag(NO_3)_{(aq)}$ → ____$Ag_2(CO_3)_{(s)}$ + ____$K(NO_3)_{(aq)}$ + energy **endo / exo**

Type of Reaction: _____

3. ____$CH_{4\,(g)}$ + ____ $O_{2\,(g)}$ → ____$CO_{2(g)}$ + ____$H_2O_{(l)}$ + energy **endo / exo**

Type of Reaction: _____

4. ____$Na(OH)_{(aq)}$ + ____ $H_2(SO_4)_{(aq)}$ → ____$Na_2(SO_4)_{(aq)}$ + ___$H(OH)_{(l)}$ + energy **endo / exo**

Type of Reaction: _____

5. ____$Al_{(s)}$ + ____$Cu(NO_3)_{2\,(aq)}$ → ____$Cu_{(s)}$ + ____$Al(NO_3)_{3\,(aq)}$ + energy **endo / exo**

Type of Reaction: _____

6. ____ $KClO_{3\,(s)}$ + energy → ____ $KCl_{(s)}$ + ____$O_{2\,(g)}$ **endo / exo**

Type of Reaction: _____

7. ____ $C_3H_{8\,(g)}$ + ____$O_{2\,(g)}$ → ____$CO_{2(g)}$ + ____ $H_2O_{(l)}$ + energy **endo / exo**

Type of Reaction: _____

8. ____$K_2(SO_4)_{(aq)}$ + ____ $Pb(OH)_{2\,(aq)}$ → ____ $Pb(SO_4)_{(s)}$ + ____$K(OH)_{(aq)}$ + energy **endo / exo**

Type of Reaction: _____

9. ____ $Li_{(s)}$ + ____$Zn_3(PO_4)_{2\,(aq)}$ → ____$Zn_{(s)}$ + ____$Li_3(PO_4)_{(aq)}$ + energy **endo / exo**

Type of Reaction: _____

10. ____$Mg(NO_3)_{2\,(s)}$ + energy → ____ $MgO_{(s)}$ + ____$NO_{2\,(g)}$ + _____ $O_{2(g)}$ **endo / exo**

Type of Reaction: _____

Part 2: Proof of Law of Conservation of Mass

Directions: Calculate the molar mass of reactants and products using the balanced equation from problem 1 and 5.

1. ____$Mg_3N_{2\,(s)}$ + energy → ____$Mg_{(s)}$ + ____$N_{2\,(g)}$

TOTAL Mass of reactants _____ TOTAL Mass of Products _____

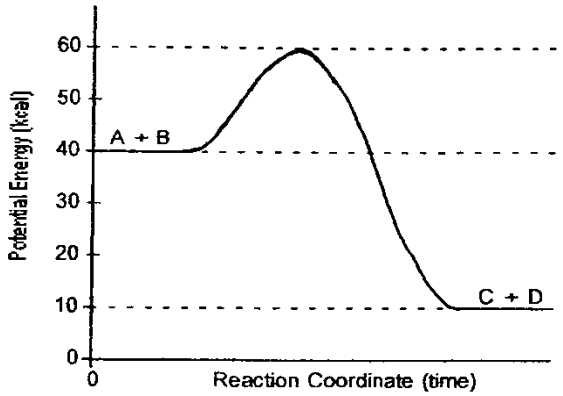
5. ____$Al_{(s)}$ + ____$Cu(NO_3)_{2\,(aq)}$ → ____$Cu_{(s)}$ + ____$Al(NO_3)_{3\,(aq)}$ + energy

TOTAL Mass of reactants _____ TOTAL Mass of Products _____

Note: If you calculate the masses correctly, the total mass of reactants = total mass of products

Potential Energy Diagrams For Reactions[1]

Figure 1



Questions 1-5 refer to Figure 1

1. Is the reaction endothermic or exothermic?

2. What is the Δ H?

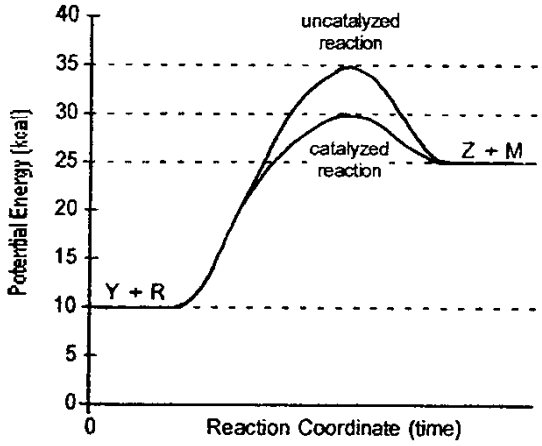
3. What is the value of the activation energy?

4. What is the potential energy of the products?

5. What is the potential energy of the activate complex?

Questions 6-10 refer to Figure 2

Figure 2



6. Is the reaction endothermic or exothermic?

7. What is the value of the activation energy of the uncatalyzed reaction?

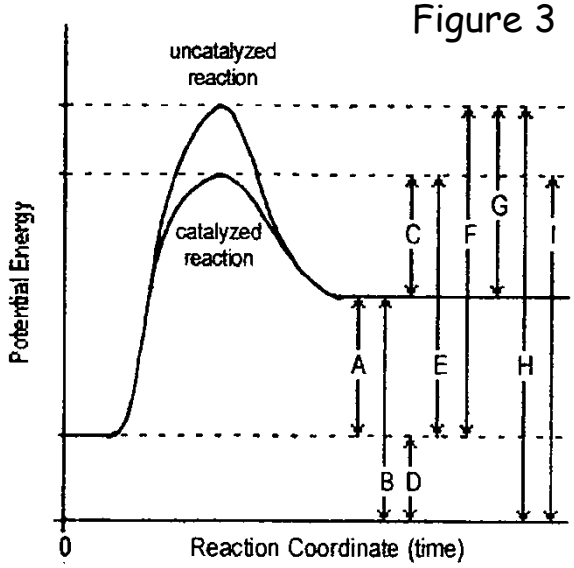
8. What is the value of the activation energy of the catalyzed reaction?

9. What is the potential energy of the activated complex of the catalyzed reaction?

10. How does ΔH for the catalyzed compare to ΔH for the uncatalyzed reaction? (same, greater or less)

Questions 11-19 refer to Figure 3. For each question, give the letter of the arrow that represents the energy described.

Figure 3



11. Potential energy of the activated complex for the uncatalyzed reaction.

12. Activation energy of the forward catalyzed reaction.

13. Potential energy of the products of the forward reaction.

14. Activation energy of the uncatalyzed reverse reaction.

15. Potential energy of the activated complex for the catalyzed reaction.

16. Activation energy of the uncatalyzed forward reaction

17. Heat of reaction (ΔH).

18. Activation energy of the catalyzed reverse reaction.

19. Potential energy of the reactants of the forward reaction.