**Unit 4 – Part 2: Energy Change in Chemical Reactions**

Potential Energy:

Kinetic Energy:

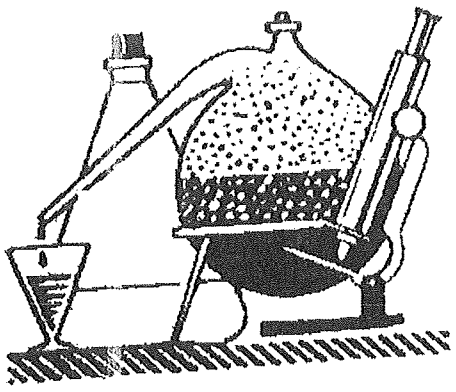
Endothermic:

Exothermic:

Enthalpy:

$\Delta H$:

Activated complex:



1. **Exothermic or Endothermic?**

- **Classify** the following reactions as: **synthesis, decomposition, combustion, single replacement, double replacement, or acid-base**
- **Classify** each reaction as exothermic or endothermic
- **Do not balance.**

| | Type of Reaction? | Exo or Endo? |
|---|---|---|
| a. $Ba + O_2 \rightarrow BaO_2 +$ energy | | |
| b. $KNO_3 +$ energy $\rightarrow KNO_2 + O_2$ | | |
| c. $PCl_3 + Cl_2 \rightarrow PCl_5 +$ 25 kJ | | |
| d. $C_3H_8 + 3O_2 \rightarrow CO_2 + H_2O$ $\Delta H = -$ 35 kJ | | |
| e. $HNO_3 + LiOH \rightarrow LiNO_3 + H_2O +$ 75 kJ | | |
| f. $Fe + CuSO_4 +$ heat $\rightarrow FeSO_4 + Cu$ | | |
| g. $NH_3 + HCl \rightarrow NH_4Cl +$ energy | | |
| h. $Mg + CrCl_3 \rightarrow MgCl_2 + Cr$ $\Delta H = +$ 90 kJ | | |

2. **Rewrite and balance** the following equations with the **energy term in the equation**.

a. $CaCO_3 \rightarrow CaO + CO_2$ (an endothermic reaction)

b. $CS_2 + O_2 \rightarrow CO_2 + SO_2$ (an exothermic reaction)

c. $Sb + I_2 \rightarrow SbI_3$ $\Delta H = +$ 40 kJ

d. $Pb(NO_3)_2 + Na_2SO_4 \rightarrow PbSO_4 + NaNO_3$ $\Delta H = -$ 140 kJ

e. $H_3PO_4 + LiOH \rightarrow Li_3PO_4 + H_2O$ $\Delta H = +$ 50 kJ

f. $C_6H_{14} + O_2 \rightarrow CO_2 + H_2O$ $\Delta H = -$ 100 kJ

3. Which of the equations in # 1 are considered to be spontaneous?

Which of the equations in # 2 are considered to be spontaneous?

4.8 Endothermic and Exothermic Reactions Chemistry 11 – Mrs. Dildy

1. $\Delta H = -25$ kJ for the reaction: A → B. Re-write this equation including the energy term. Sketch and label a PE graph for this reaction. State whether the surroundings feel warmer or cooler as the reaction occurs. (label $\Delta H$ and Ea)

2. If a reaction absorbs 40 kJ of heat, what is the $\Delta H$ for the reaction?

3. What is the $\Delta H$ for the reaction C + 30 kJ → D? Sketch and label a PE graph for this reaction showing an activation energy of 70 kJ. Will the surroundings feel warmer or cooler as the reaction occurs? (label $\Delta H$ and Ea)

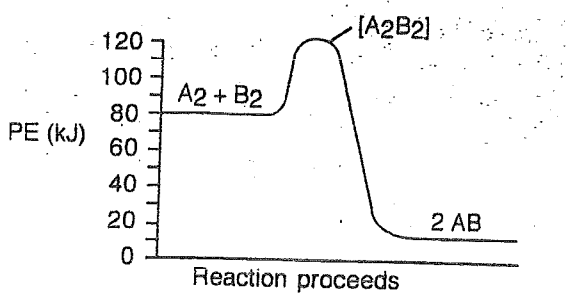
4. What is the $\Delta H$ for the reaction, R → T + 10 kJ? Which would have more energy, the reactants or the products? Sketch and label a PE graph for this reaction showing an activation energy of 40 kJ. State whether the surroundings feel warmer or cooler as the reaction occurs. (label $\Delta H$ and Ea)

5. When HCl reacts with NaOH to produce NaCl and $H_2O$, 60 kJ of heat is released to the surroundings. Sketch and label a PE graph for this reaction showing an activation energy of 20 kJ. State whether the surroundings feel warmer or cooler as the reaction occurs. (label $\Delta H$ and Ea)

4.9 Exothermic & Endothermic Reactions Chemistry 11

1. Draw PE diagrams for an exothermic reaction & endothermic reaction.

2. The following is a PE diagram for a collision between molecules $A_2$ and $B_2$. The molecules collide with favorable geometry.




a. Is the overall reaction exothermic and endothermic? _____

b. Write a balanced equation for the reaction, including the value for enthalphy

_____

c. What is the value of the activation energy in the above reaction? _____

4.Draw and label a PE diagram for the reaction: $2\ NOBr \rightarrow 2\ NO + Br_2 + 50\ kJ$.

5. Draw and label a PE diagram to show the enthalpy change and activation energies for a reaction in which: $R + 25\ kJ \rightarrow P$. The activation energy is 50 kJ.