**Energy in Chemical Reactions WS**

1.     Draw the potential energy (PE) diagram showing the successful collision of the exothermic reaction:

***H2    +    I2       →        2 HI   +  250 KJ***

        The PE of the reactants = 400 KJ

        The activation energy of the forward reaction =  200 KJ

2.     Draw the PE diagram showing the successful collision of the endothermic reaction:

***A   +   B   +   200 KJ   →       C***

        The PE of the reactants = 200 KJ

        The Activation Energy in the forward direction =  250 KJ

3. Write the following reaction in ΔH notation.

***A   +   B   +   200 kJ   →       C***

4. Write the following reaction in Standard Notation.

***H2    +    I2       →        2 HI     ΔH =  -250 kJ***

 5. Write in Standard Notation.

***2NI3   +   3BaCl2   →    2NCl3    +    3BaI2ΔH =   175 kJ***

6. Write in ΔH  notation.

***2AlBr3   +   3BaF2       →    2AlF3    +    3BaBr2+   276 kJ***

**Draw the potential energy diagram for reactions 7-10.**

7.                                 Potential energy of reactants =                        250 kJ

                                    Potential Energy of activated complex =         350 kJ

                                    Potential Energy of the products =                  300 kJ

a) How does the potential energy change as the reaction proceeds?   

b) How does the kinetic energy change as the reaction proceeds?      

c) Is the reaction exothermic or endothermic?

d) What is the value of   ΔH?

If a catalyst was added, what would happen to the energies of the:

e) Reactants?                                                                                       

f) Products?                                                                                         

g) Activated Complex?                                                                                   

h) If a catalyst was added what would happen to the rate?                 

8.                                 Potential energy of reactants =                        350 kJ

                                    Activation Energy =                                        100 kJ

                                    Potential Energy of the products =                  250 kJ

a) How does the potential energy change as the reaction proceeds?

b) How does the kinetic energy change as the reaction proceeds?

c) Is the reaction exothermic or endothermic?

d) What is the value of ΔH?

If the concentration of the reactants was increased, what would happen to the energies of the:

e) Reactants?

f) Products?

g) Activated Complex?

h) What would happen to the rate?

9.                                 Potential energy of reactants =                        200 kJ

                                    Potential Energy of activated complex =         400 kJ

                                    ΔH =                                                               150 kJ

a)  How does the potential energy change as the reaction proceeds?

b)  How does the kinetic energy change as the reaction proceeds?

c)  Is the reaction exothermic or endothermic?

d)  What is the value of   ΔH?

If the temperature was increased, what would happen to the energies of the:

e)  Reactants?

f)  Products?

g)  Activated Complex?

h)  What would happen to the rate?

10.                               Potential energy of products =                       50 kJ

                                    Potential Energy of activated complex =        400 kJ

                                    ΔH=                                                                -50 kJ

a) How does the potential energy change as the reaction proceeds?

b) How does the kinetic energy change as the reaction proceeds?

c) Is the reaction exothermic or endothermic?

d) What is the value of   ΔH?

If the surface area of the reactants was increased, what would happen to the energies of the:

e) Reactants?

f) Products?

g) Activated Complex?

h) What would happen to the rate?

11. What is the only thing, other than changing the reaction that will change the potential energy diagram? Describe how it will affect the diagram and the rate.

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12.  Use the energy diagram below and identify each of the following. Choose from:

*ΔH, Ea (forward, uncatalyzed), Ea (reverse, uncatalyzed), Ea (forward catalyzed),*

*Ea (reverse, catalyzed), Energy of products, Energy of reactants,*

*Energy of activated complex (catalyzed), Energy of activated complex (uncatalyzed)*

a

Energy

Reaction Progress

b

i

f

e

h

c

g

d

**Ws # 4             Potential Energy Diagrams Worksheet Answer Key**

1.     Draw the PE diagram showing the PE changes that occur during a successful collision of the exothermic reaction:

                        H2    +    I2       →        2 HI   +  250 KJ

        The PE of the reactants = 400 KJ

        The activation energy of the forward reaction =  200 KJ

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|  | http://iannonechem.com/Science/Chemistry/Iannone/kinetics/KineticsWorkbookanswers_files/image025.gif |

**Reaction path**

2.     Draw the PE diagram showing the PE changes that occur during a successful collision of the endothermic reaction:

                        A   +   B   +   200 KJ   →       C

        The PE of the reactants = 200 KJ

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| The Activation Energy in the forward direction =  250 KJ | |  | | --- | |  | |

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**Reaction path**

 3. Write the following reaction in ΔH notation.

            A   +   B   +   200 kJ   →       C

**A   +  B ----->   C       ΔH=   +200kJ**

4. Write the following reaction in Standard Notation.

            H2    +    I2       →        2 HI     ΔH =  -250 kJ

**H2   +     I2       →              2HI   +   250 kJ**

5. Write in Standard Notation.

2NI3   +   3BaCl2   →    2NCl3    +    3BaI2ΔH =   175 kJ

**2NI3**    **+   3BaCl2+  175 kJ  →    2NCl3    +   3BaI2**

6. Write in ΔH  notation.

2AlBr3   +   3BaF2       →    2AlF3    +    3BaBr2+   276 kJ

**2AlBr3   +   3BaF2      →   2AlF3   +   3BaBr2                       ΔH=  -267 kJ**

Draw the potential energy diagram for the following reactions.

7.                                 Potential energy of reactants =                        250 kJ

                                    Potential Energy of activated complex =         350 kJ

                                    Potential Energy of the products =                  300 kJ

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a) How does the potential energy change as the reaction proceeds?   **Increases**

b) How does the kinetic energy change as the reaction proceeds?      **Decreases**

c) Is the reaction exothermic or endothermic?                                                 **Endothermic**

d) What is the value of   ΔH?                                                                          **ΔH=  +50kJ**

If a catalyst was added, what would happen to the energies of the:

e) Reactants?                                                                                       **Nothing**

f) Products?                                                                                         **Nothing**

g) Activated Complex?                                                                                   **Decrease**

h) If a catalyst was added what would happen to the rate?                 **Increase**

Draw the potential energy diagram for the following reactions.

8.                                 Potential energy of reactants =                        350 kJ

                                    Activation Energy =                                        100 kJ

                                    Potential Energy of the products =                  250 kJ

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a) How does the potential energy change as the reaction proceeds?               **Decreases**

b) How does the kinetic energy change as the reaction proceeds?                  **Increases**

c) Is the reaction exothermic or endothermic?                                                 **Exothermic**

d) What is the value of ΔH?                                                         **ΔH=  -100kJ**

If the concentration of the reactants was increased, what would happen to the energies of the:

e) Reactants?        **Nothing**

f) Products?                           **Nothing**

g) Activated Complex?                      **Nothing**

h) What would happen to the rate?  **Increase**

9.                                 Potential energy of reactants =                        200 kJ

                                    Potential Energy of activated complex =         400 kJ

                                    ΔH =                                                               150 kJ

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a)  How does the potential energy change as the reaction proceeds?                          **Increases**

b)  How does the kinetic energy change as the reaction proceeds?                             **Decreases**

c)  Is the reaction exothermic or endothermic?                                                            **Endothermic**

d)  What is the value of   ΔH?                    **ΔH=  150 kJ**

If the temperature was increased, what would happen to the energies of the:

e)  Reactants?  **Nothing**

f)  Products?    **Nothing**

g)  Activated Complex?     **Nothing**

h)  What would happen to the rate? **Increase**

10.                               Potential energy of products =                                     50 kJ

                                    Potential Energy of activated complex =         400 kJ

                                    ΔH=                                                                -50 kJ

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|  | |  | | --- | | **Reaction Path** | |

a) How does the potential energy change as the reaction proceeds?             **Decreases**

b) How does the kinetic energy change as the reaction proceeds?                **Increases**

c) Is the reaction exothermic or endothermic?     **Exothermic**

d) What is the value of   ΔH?     **ΔH= -50kJ**

 If the surface area of the reactants was increased, what would happen to the energies of the:

e) Reactants?         **Nothing**

f) Products?      **Nothing**

g) Activated Complex?     **Nothing**

h) What would happen to the rate?    **Increase**

11. What is the only thing, other than changing the reaction that will change the potential energy diagram? Describe how it will effect the diagram and the rate.

**Catalyst          Lowers Ea alloys more low energy collisions to be successful and increase**

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12.  Use the energy diagram below and identify each of the following. Choose from:

*ΔH, Ea (forward, uncatalyzed), Ea (reverse, uncatalyzed), Ea (forward catalyzed),*

*Ea (reverse, catalyzed), Energy of products, Energy of reactants,*

*Energy of activated complex (catalyzed), Energy of activated complex (uncatalyzed)*

a

Energy

Reaction Progress

b

i

f

e

h

c

g

d

a. **Energy of activated complex, uncatalyzed**

b. **Energy of activated complex, catalyzed**

c. **Energy of products**

d. **Energy of reactants**

e. **Activation energy (forward, uncatalyzed)**

f. **Activation energy (reverse, uncatalyzed)**

g. **ΔH**

h. **Activation Energy (forward, catalyzed)**

i. **Activation Energy (reverse, catalyzed)**