

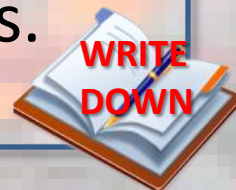
Enthalpy Change

The Role of Energy in Reactions

Energy and Reactions

- In order for a reaction to begin, energy is needed.

- The energy needed to begin the reaction is the **activation energy**.
- The activation energy comes from effective collisions.



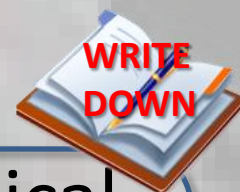
An Analogy

- The energy changes associated with a chemical change are similar to those of a tall object falling. Consider a file cabinet:
- Even when a file cabinet is falling, it needs a push in order for it to start to fall.
- This is because when you begin pushing it over, one end is actually going up! It can fall back!
- The need to push an object before it falls over is similar to activation energy.



Enthalpy Change

- During a chemical reaction, heat may be released or absorbed.



- Heat released or absorbed during a chemical reaction is called heat of reaction or enthalpy change (ΔH).
- Enthalpy change is the difference between the potential energy of the products and the reactants.

- $\Delta H = H_{\text{products}} - H_{\text{reactants}}$

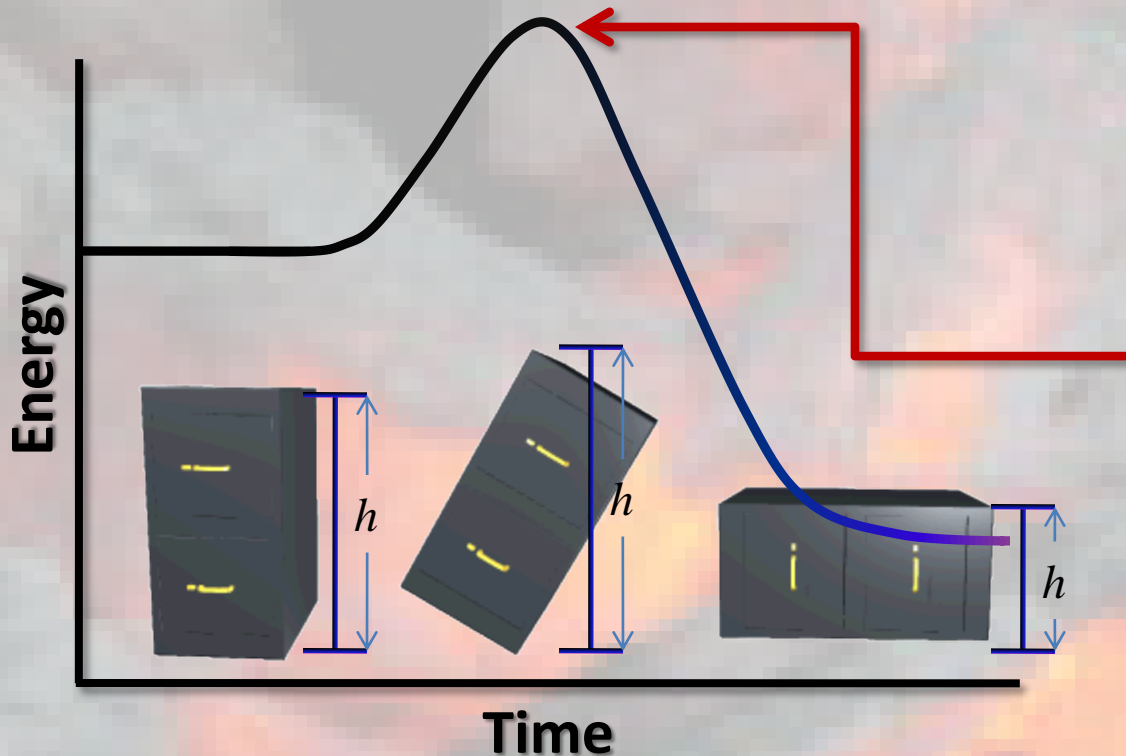
More Analogy

- Only when a tall object such as a file cabinet is pushed past its highest point, does it fall over.
- This is true whether it is falling down or being pushed back up.
- When the cabinet is falling, its potential energy is decreasing (even when it falls into standing position.)
- The difference between the energy of the standing file cabinet and the file cabinet on its side is similar to the enthalpy change.



A Graphic Analysis

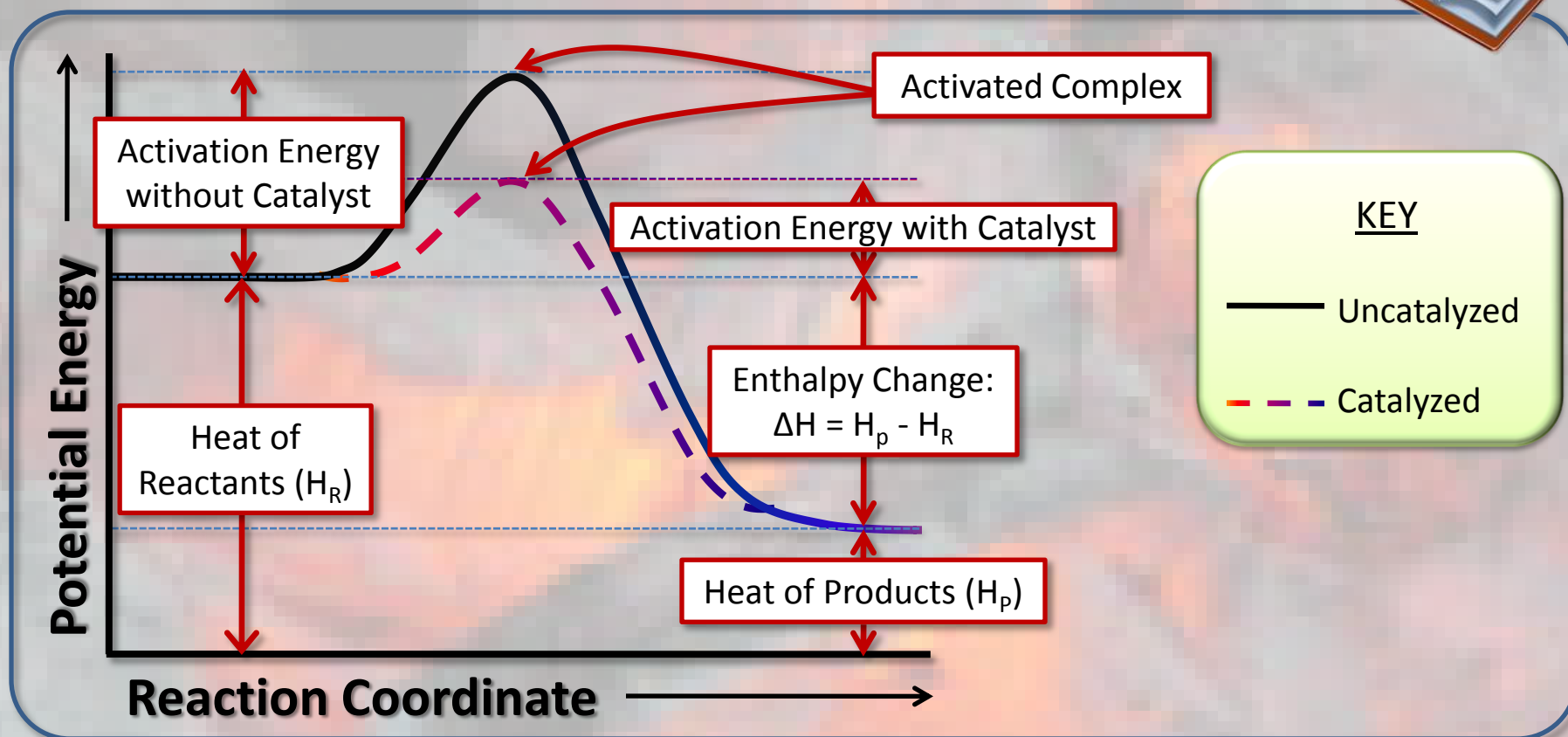
- A graph of the energy changes of a falling file cabinet would look like the one below:



The highest energy is the point just before the cabinet falls on its side (or falls back into standing position).

A Reaction Coordinate

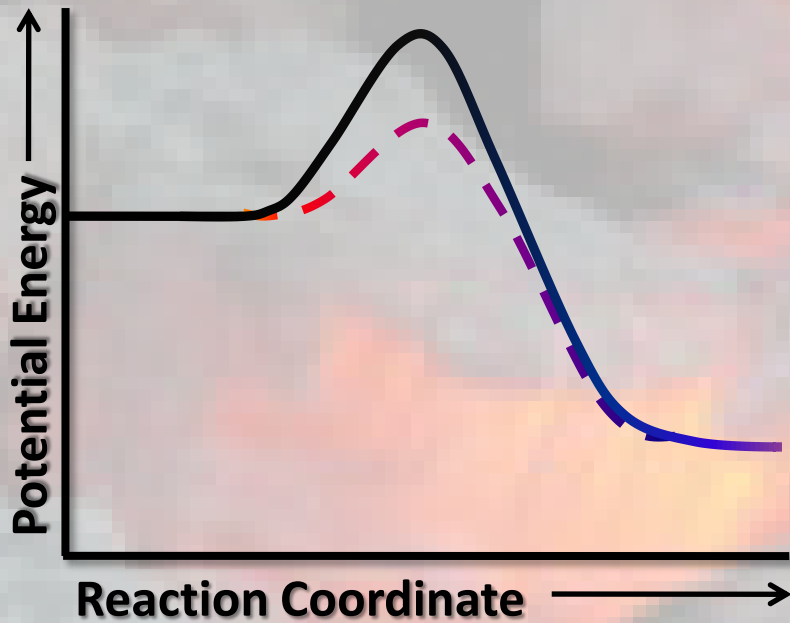
- The energy changes associated with a chemical reaction are similar. See below.



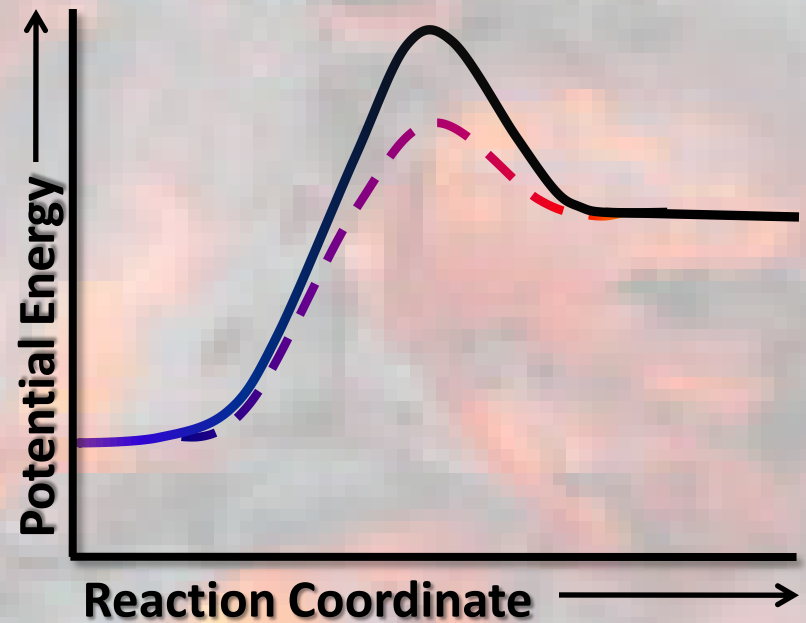
Exothermic vs. Endothermic



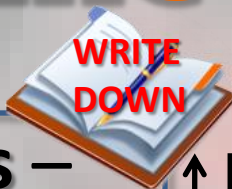
- Exothermic Reaction



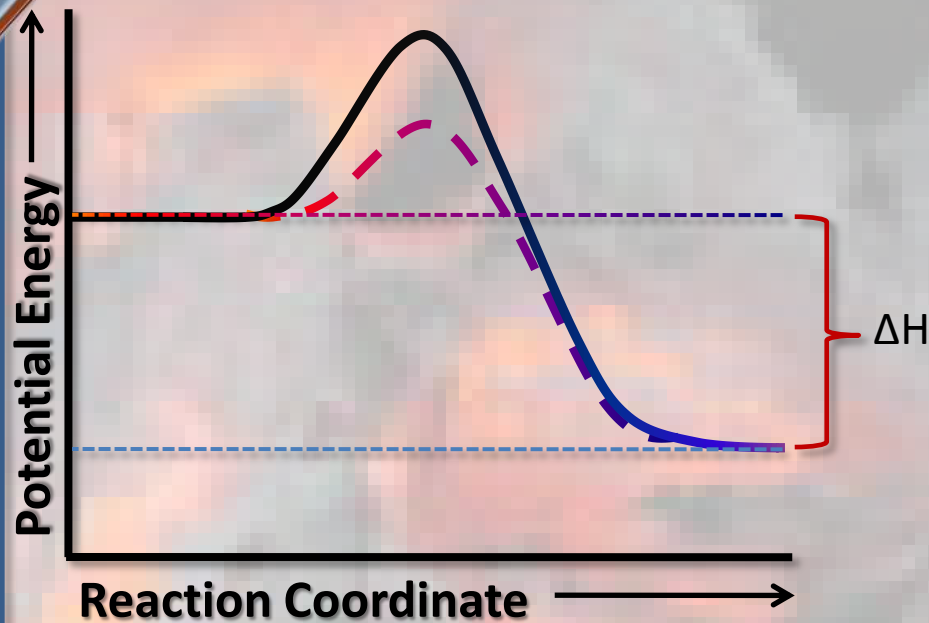
- Endothermic Reaction



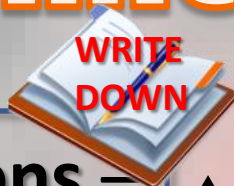
Exothermic Reactions



- **Exothermic reactions** – reactions in which energy is released.
- The potential energy of the products is lower than the potential energy of the reactants.
- ΔH is negative.
- Catalysts reduce the activation energy but have no effect on the change in enthalpy.



Endothermic Reactions



- **Endothermic reactions** – reactions in which energy is absorbed.
- The potential energy of the products is higher than the potential energy of the reactants.
- ΔH is positive.
- Catalysts reduce the activation energy but have no effect on the change in enthalpy.

