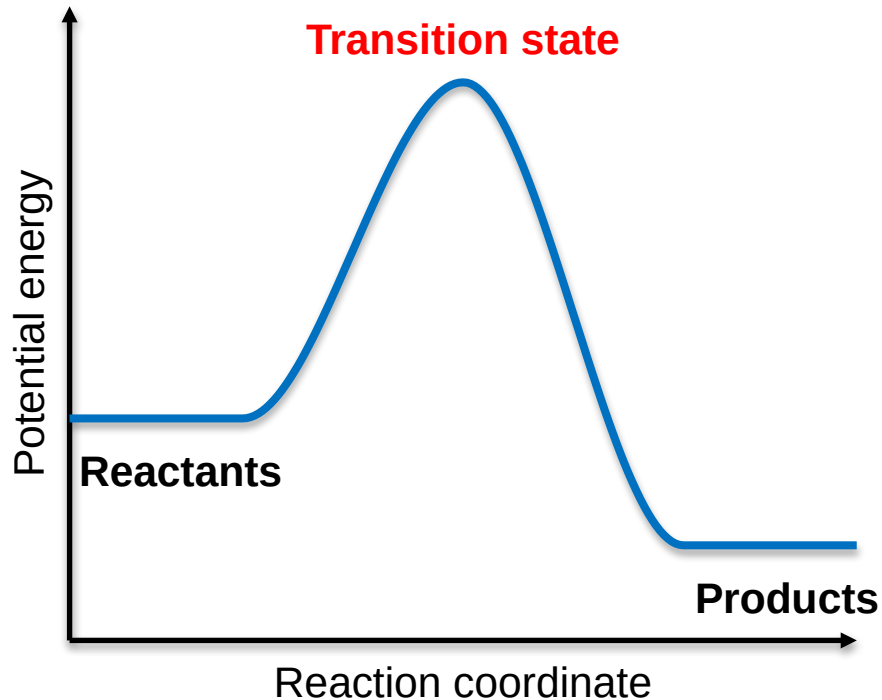


Essential Question

What does an energy hill tell us about a reaction?

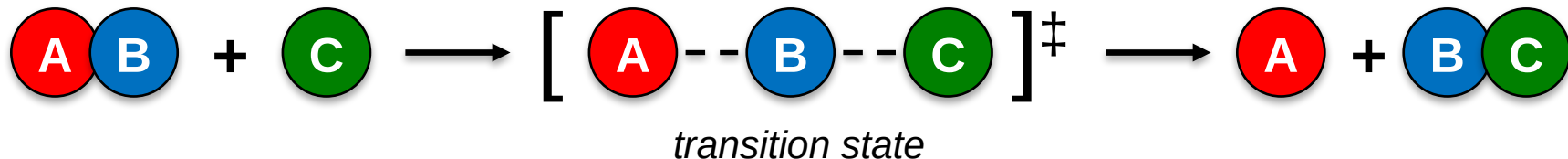
Reaction Energy Profile

- Shows energy as reactants become products
- x-axis: reaction coordinate (progress)



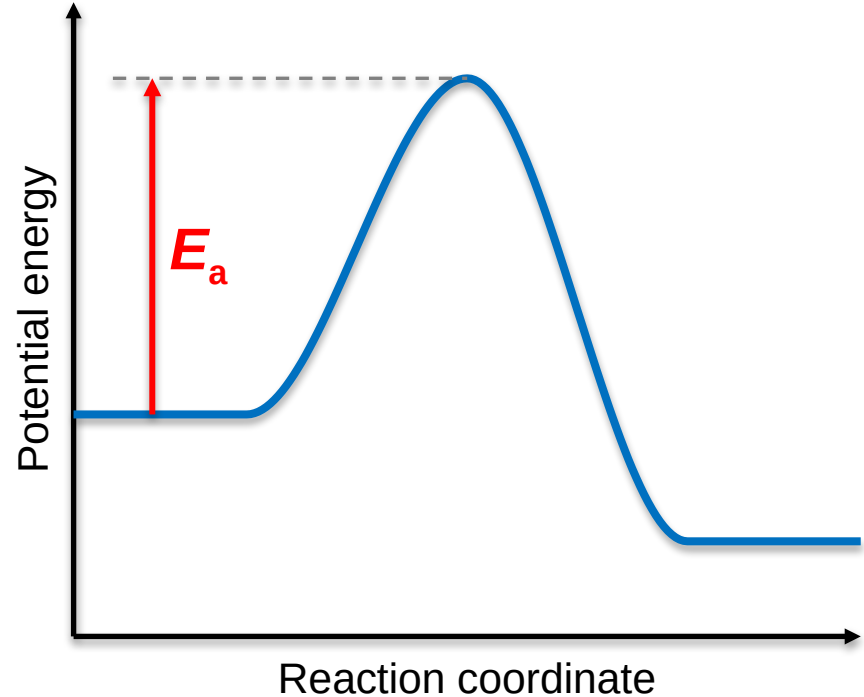
Transition State

- Highest-energy point on the path
- Bonds partly broken and partly formed
- Lasts for an instant; can't be isolated



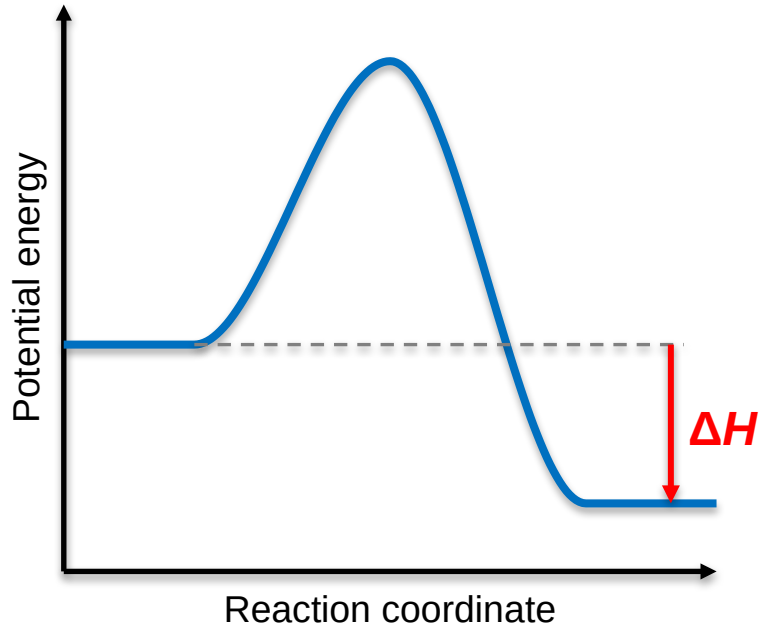
Activation Energy

- E_a = energy to reach the transition state
- Larger $E_a \rightarrow$ slower reaction

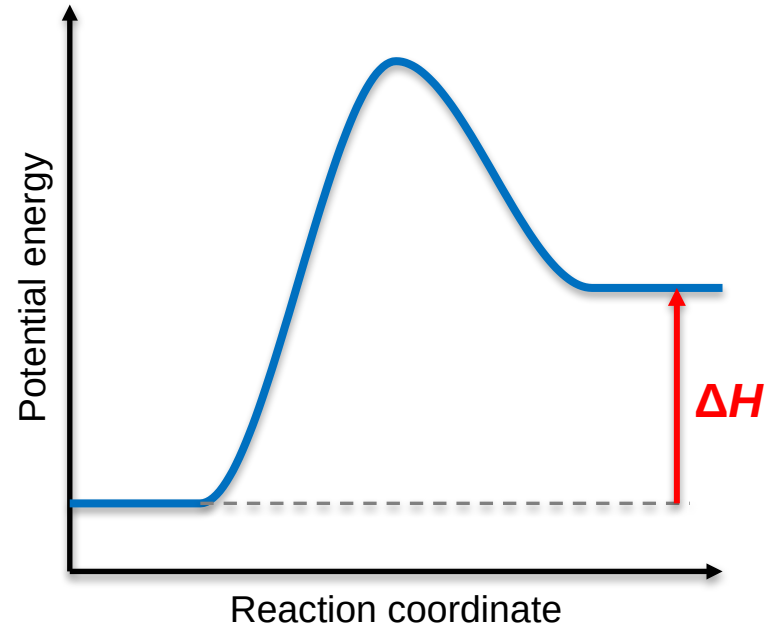


Exothermic vs. Endothermic

Exothermic: $\Delta H < 0$



Endothermic: $\Delta H > 0$



Temperature and the Rate Constant

$$k = A \exp(-E_a/RT)$$

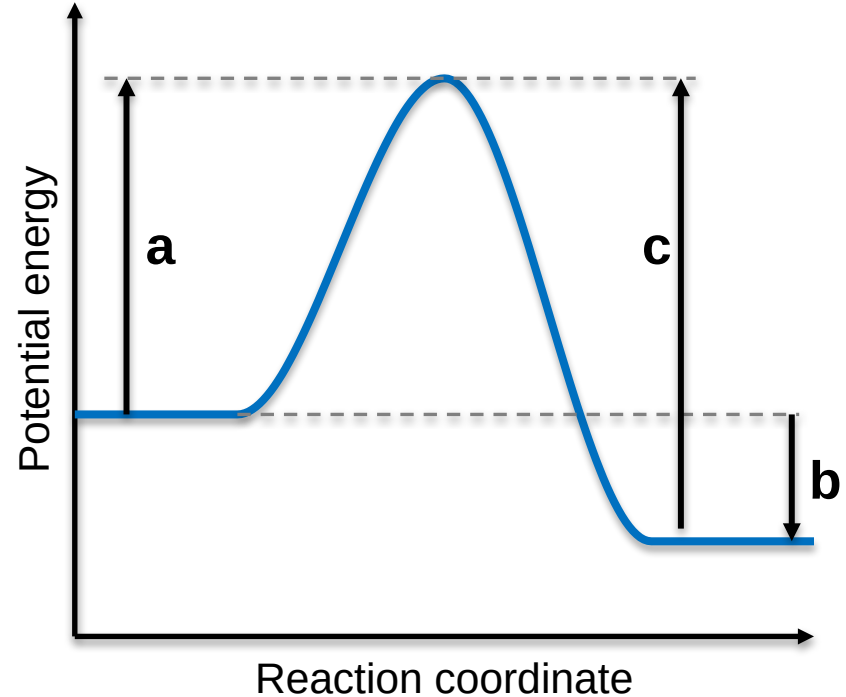
Higher T
larger k , faster

Larger E_a
smaller k , slower

- Called the Arrhenius equation
- No Arrhenius calculations on the AP exam

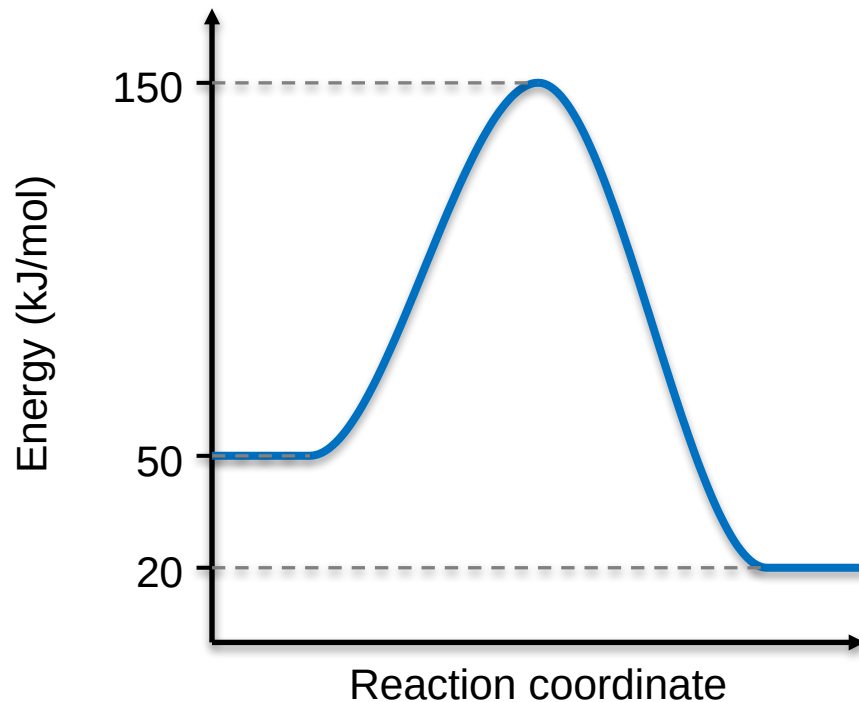
Example: Labeling a Profile

What does each arrow (a, b, c) represent? Is the reaction exothermic or endothermic?



Example: Reading Energy Values

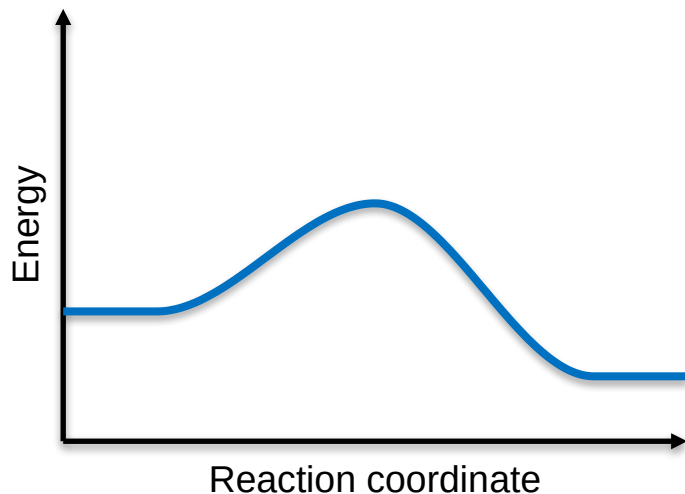
Use the energy profile to find E_a for the forward reaction and ΔH for the reaction.



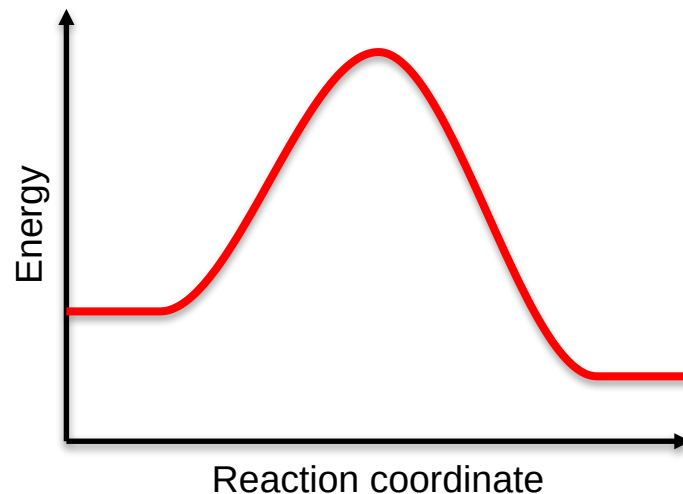
Example: Comparing Activation Energies

At the same temperature, Reaction 1 has $E_a = 40$ kJ/mol and Reaction 2 has $E_a = 90$ kJ/mol. Which reaction is faster? Explain.

Reaction 1



Reaction 2



Big Ideas

- Transition state = top of the hill
- E_a = reactants to transition state
- ΔH = products – reactants
- Higher T or lower $E_a \rightarrow$ larger k

