

Chapter 3

Chemical Reactions / Energy

$$\begin{aligned}\Delta E &= (3 - 5) \text{ bobs} \\ &= -2 \text{ bobs}\end{aligned}$$

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Chemical Reactions / Energy

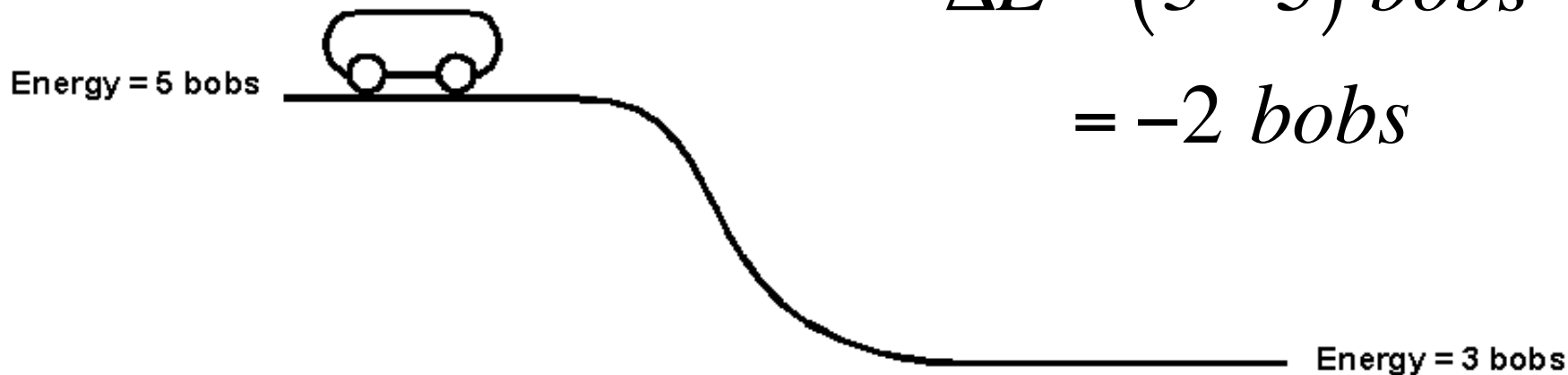
$$\Delta E = E_{after} - E_{before}$$

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Chemical Reactions / Energy

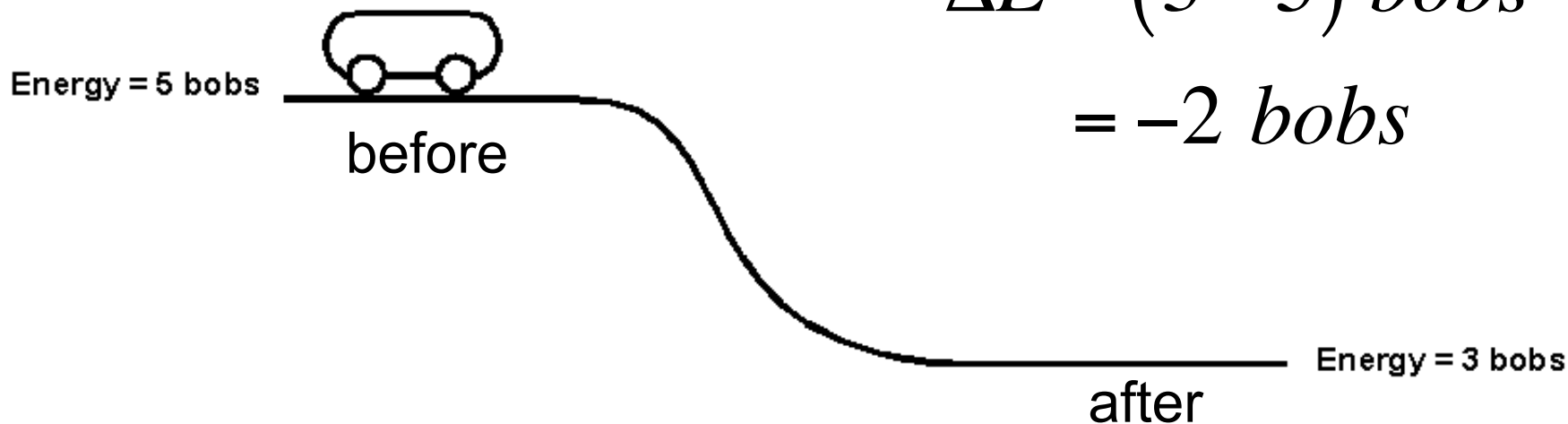
$$\Delta E = E_{after} - E_{before}$$



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Chemical Reactions / Energy

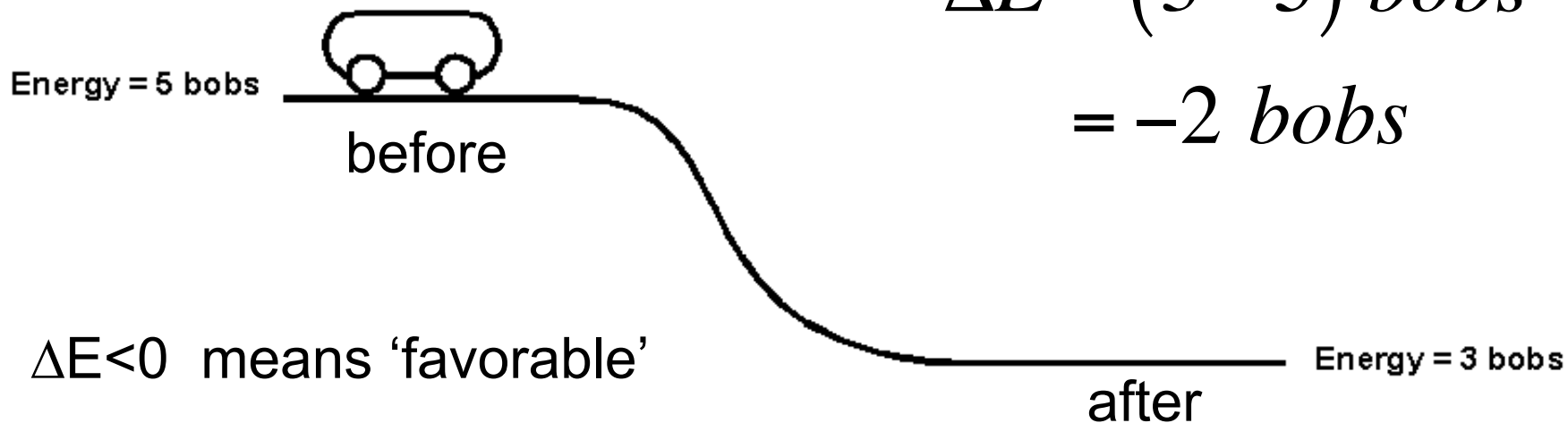
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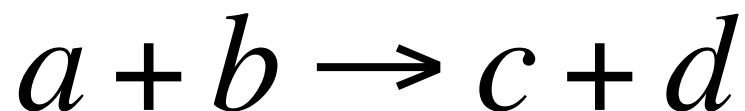
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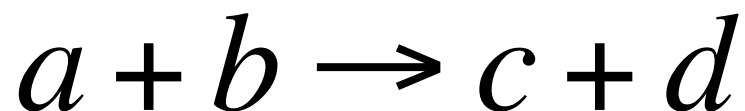
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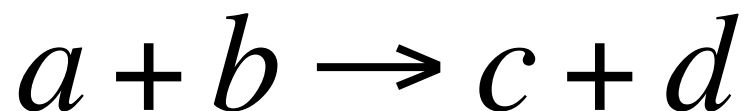


$$\Delta E = (E_c + E_d) - (E_a + E_b)$$

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Chemical Reactions / Energy

$$\Delta E = E_{after} - E_{before}$$



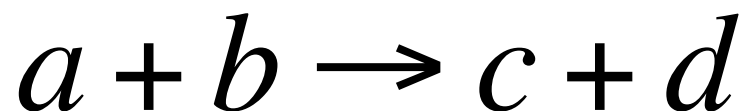
$$\Delta E = (E_c + E_d) - (E_a + E_b)$$

$$\Delta E = \sum E_{products} - \sum E_{reactants}$$

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Chemical Reactions / Energy

$$\Delta E = E_{after} - E_{before}$$



$$\Delta E = (E_c + E_d) - (E_a + E_b)$$

$$\Delta E = \sum_{(after)} E_{products} - \sum_{(before)} E_{reactants}$$

Energy Calculations

$$\Delta E = \sum E_{products} - \sum E_{reactants}$$

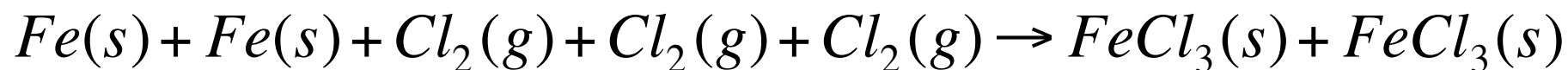
Energy Calculations

$$\Delta E = \sum E_{products} - \sum E_{reactants}$$



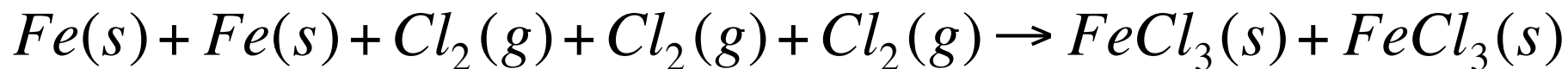
Energy Calculations

$$\Delta E = \sum E_{\text{products}} - \sum E_{\text{reactants}}$$



Energy Calculations

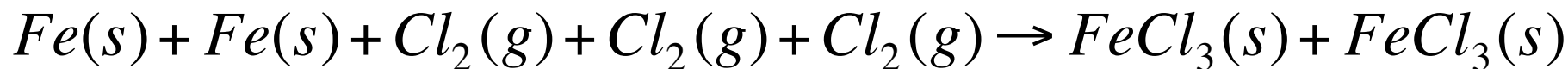
$$\Delta E = \sum E_{products} - \sum E_{reactants}$$



$$\Delta E = \left(E_{FeCl_3(s)} + E_{FeCl_3(s)} \right) - \left(E_{Fe(s)} + E_{Fe(s)} + E_{Cl_2(g)} + E_{Cl_2(g)} + E_{Cl_2(g)} \right)$$

Energy Calculations

$$\Delta E = \sum E_{products} - \sum E_{reactants}$$



$$\Delta E = \left(E_{FeCl_3(s)} + E_{FeCl_3(s)} \right) - \left(E_{Fe(s)} + E_{Fe(s)} + E_{Cl_2(g)} + E_{Cl_2(g)} + E_{Cl_2(g)} \right)$$

$$\Delta E = \left(2E_{FeCl_3(s)} \right) - \left(2E_{Fe(s)} + 3E_{Cl_2(g)} \right)$$

Energy Calculations

$$\Delta E = \sum E_{products} - \sum E_{reactants}$$



$$\Delta E = \left(2E_{FeCl_3(s)}\right) - \left(2E_{Fe(s)} + 3E_{Cl_2(g)}\right)$$

Energy Calculations

$$\Delta E = \sum E_{products} - \sum E_{reactants}$$



$$\Delta E = \underbrace{\left(2E_{FeCl_3(s)}\right)}_{(after)} - \underbrace{\left(2E_{Fe(s)} + 3E_{Cl_2(g)}\right)}_{(before)}$$

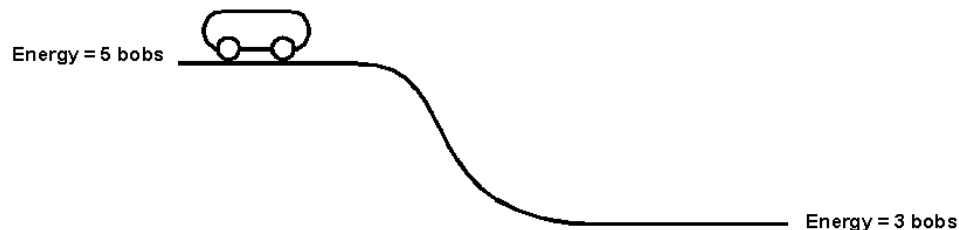
Energy Calculations

$$\Delta E = \sum E_{products} - \sum E_{reactants}$$



$$\Delta E = \underbrace{\left(2E_{FeCl_3(s)}\right)}_{(after)} - \underbrace{\left(2E_{Fe(s)} + 3E_{Cl_2(g)}\right)}_{(before)}$$

$\Delta E < 0$ means 'favorable'



Stoichiometry

$$\Delta E = \sum E_{products} - \sum E_{reactants}$$



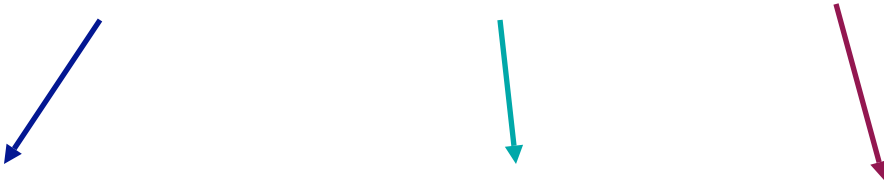
$$\Delta E = \left(2E_{FeCl_3(s)} \right) - \left(2E_{Fe(s)} + 3E_{Cl_2(g)} \right)$$

Stoichiometry

$$\Delta E = \sum E_{products} - \sum E_{reactants}$$



Stoichiometry coefficients

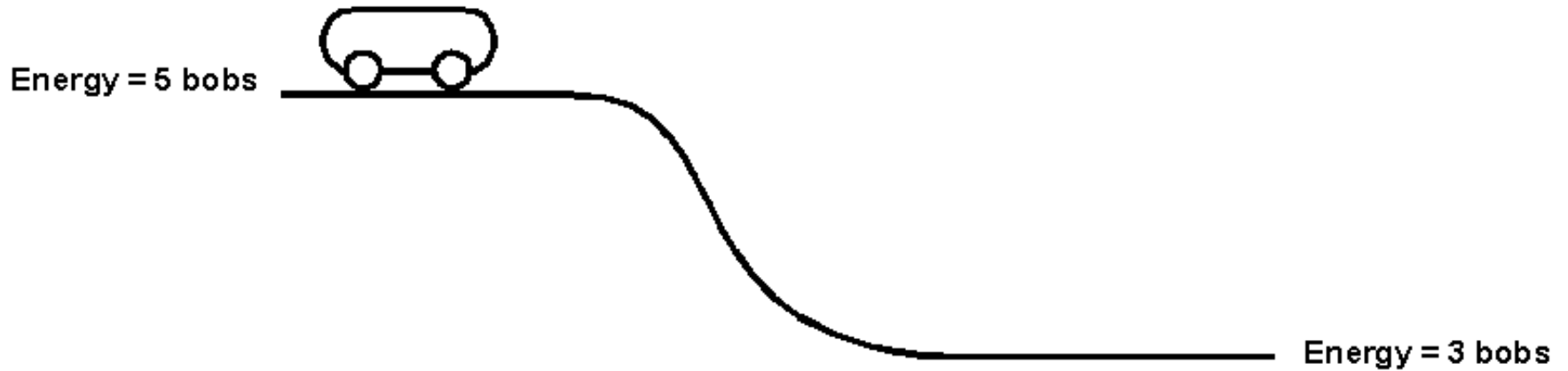


A diagram with three arrows pointing downwards from the text 'Stoichiometry coefficients' to the equation below. A blue arrow points from the '2' of 2FeCl₃(s) to the '2' of 2E_{FeCl₃(s)}. A teal arrow points from the '2' of 2Fe(s) to the '2' of 2E_{Fe(s)}. A magenta arrow points from the '3' of 3Cl₂(g) to the '3' of 3E_{Cl₂(g)}.

$$\Delta E = \left(2E_{FeCl_3(s)} \right) - \left(2E_{Fe(s)} + 3E_{Cl_2(g)} \right)$$

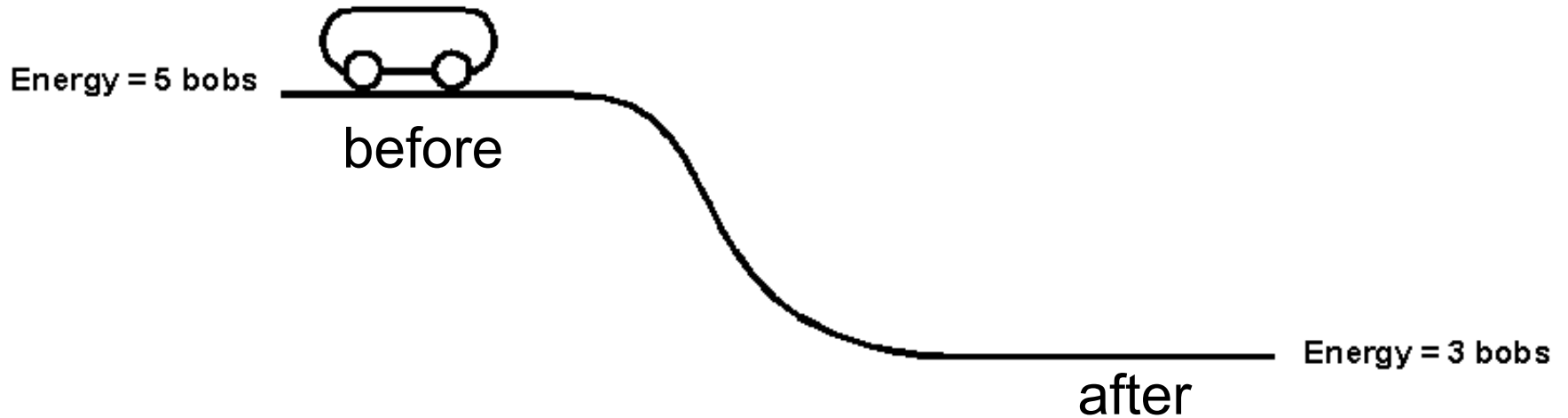
Equilibrium

$$\Delta E = E_{after} - E_{before}$$



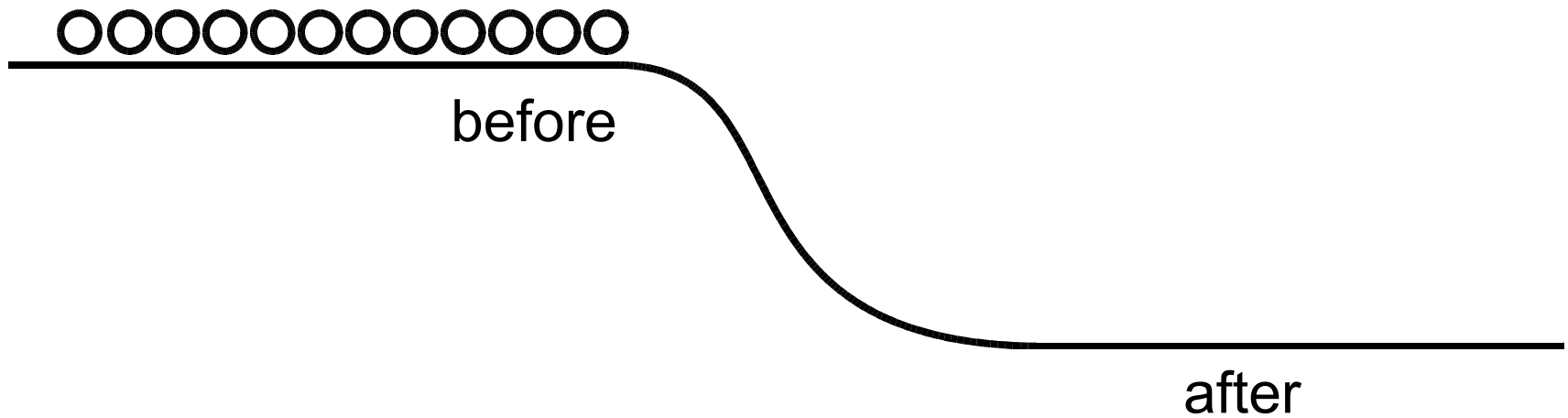
Equilibrium

$$\Delta E = E_{after} - E_{before}$$



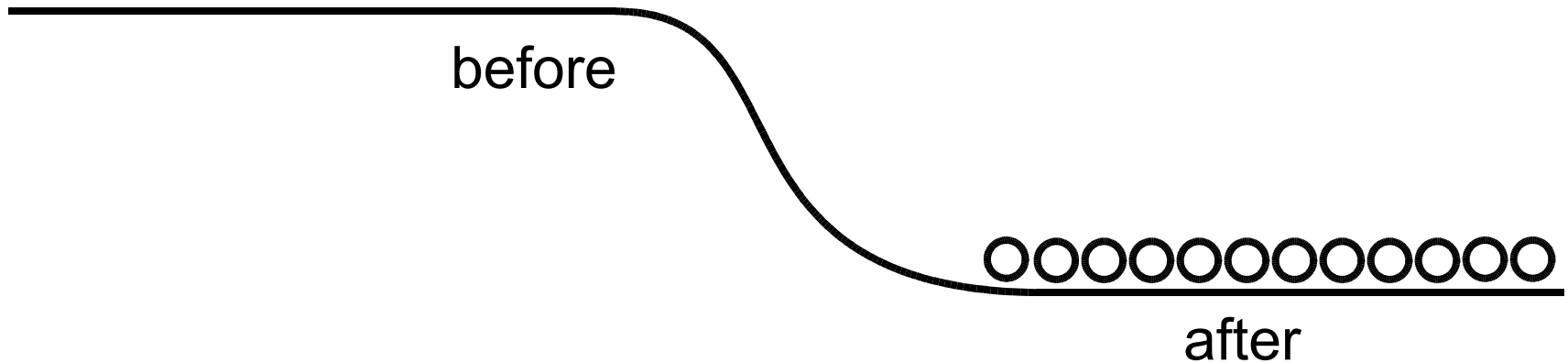
Equilibrium

$$\Delta E = E_{after} - E_{before}$$



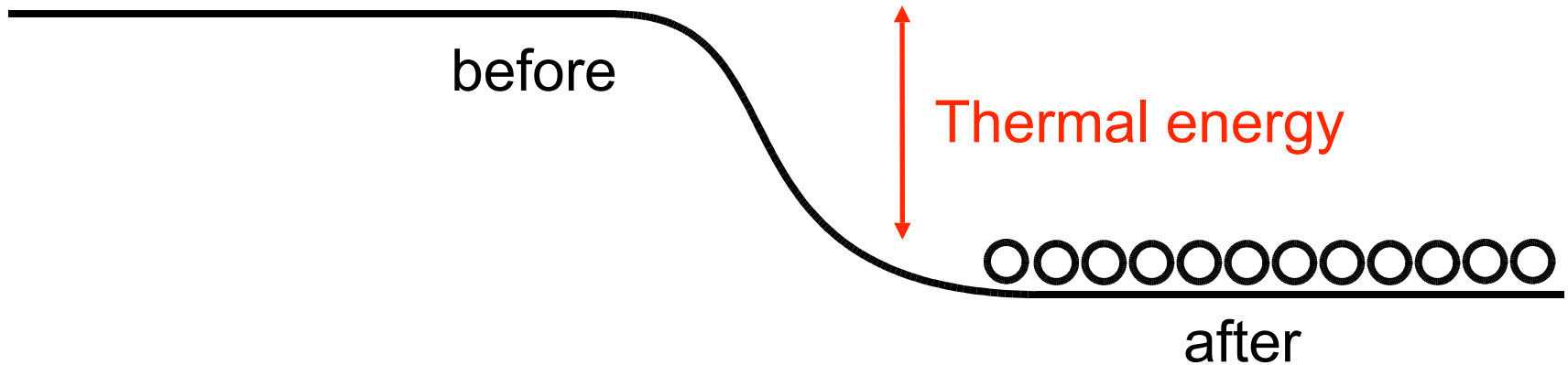
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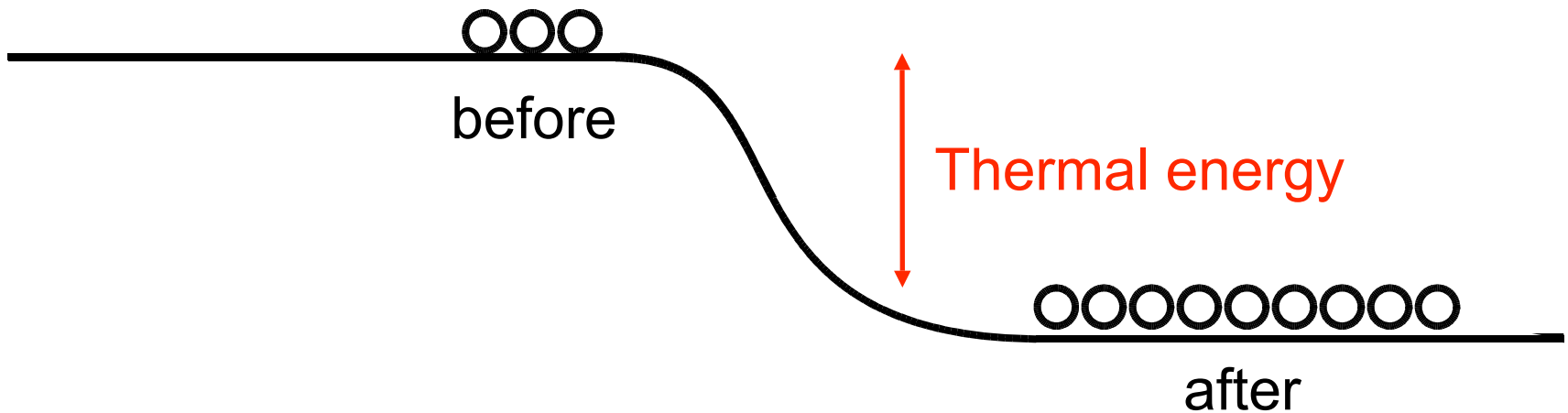
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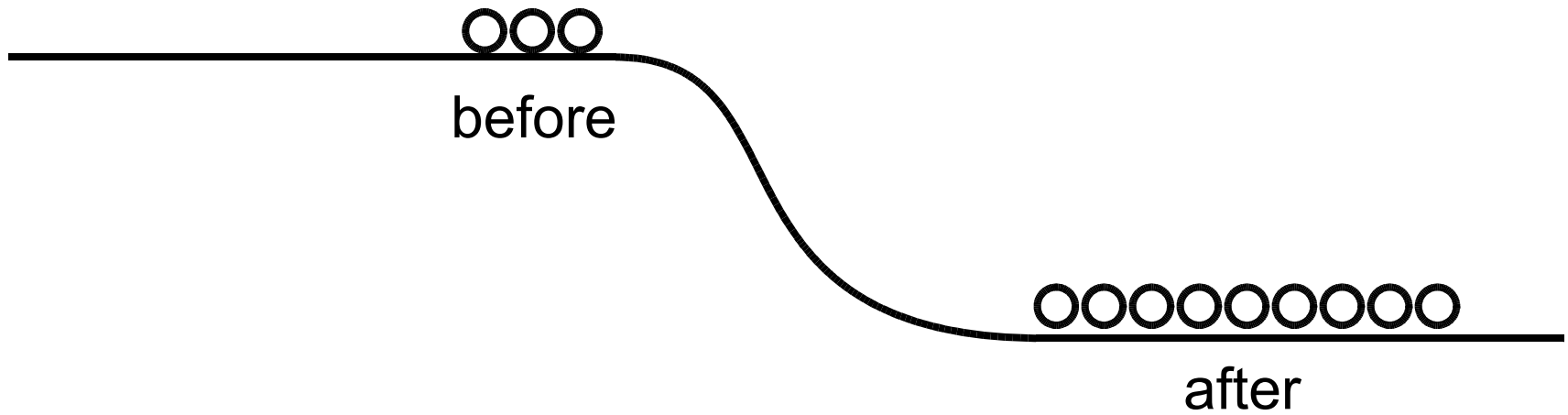
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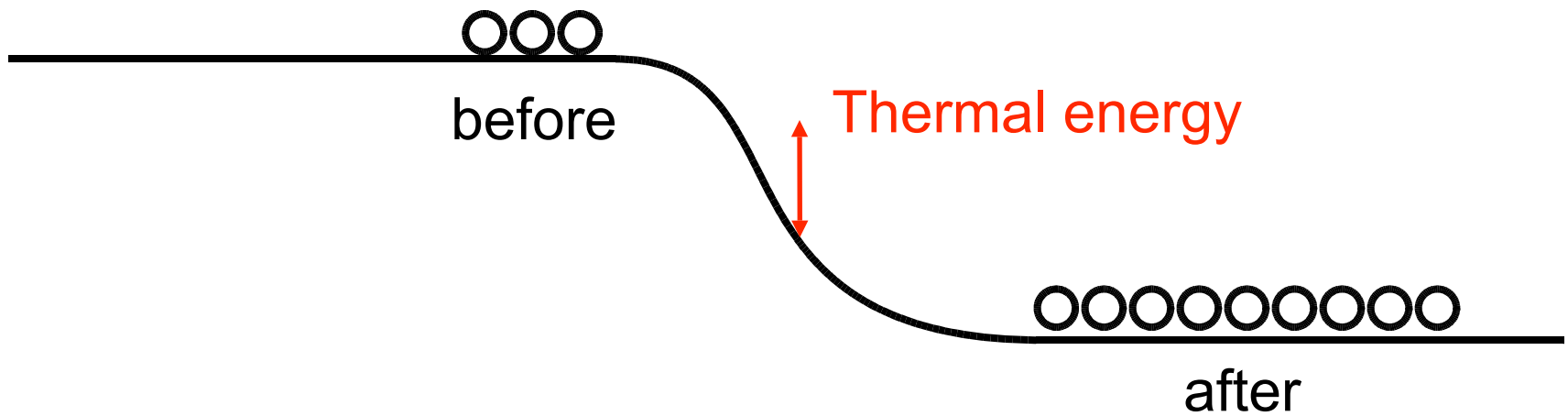
Equilibrium

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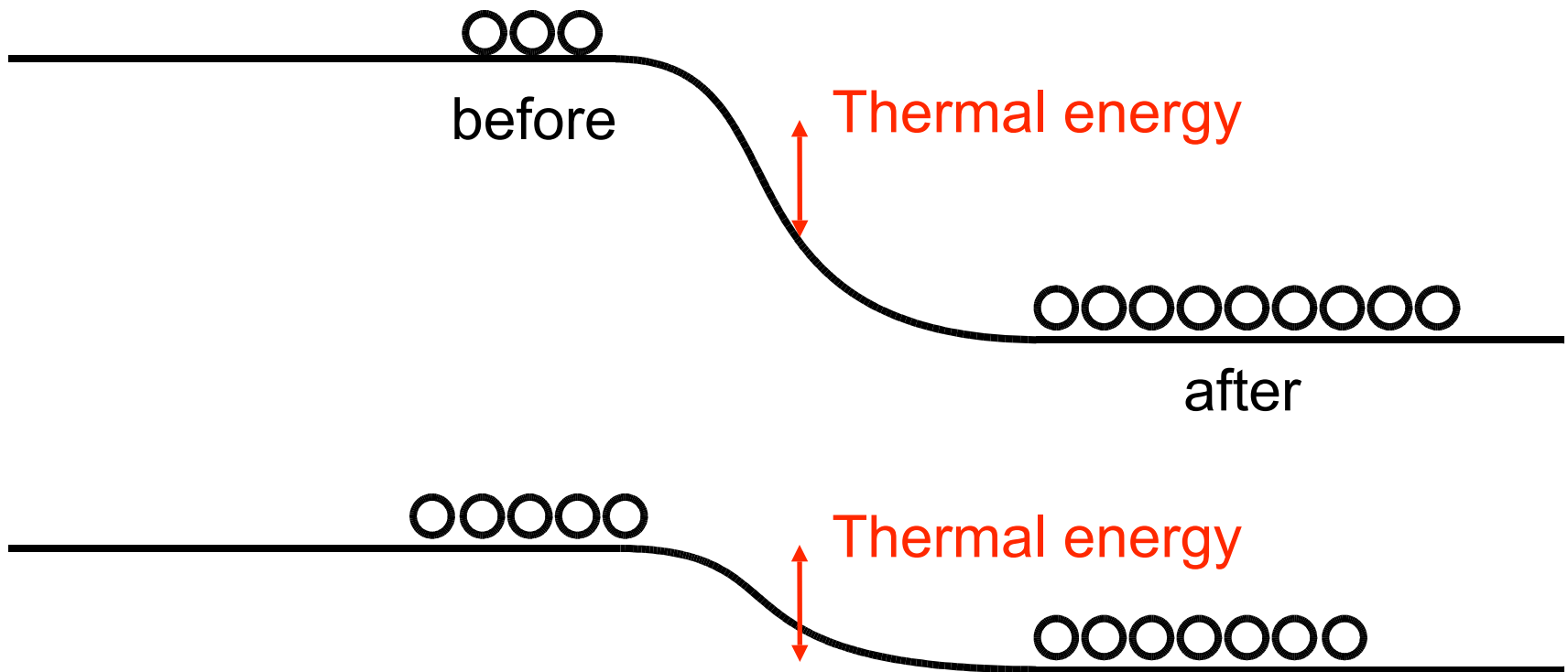
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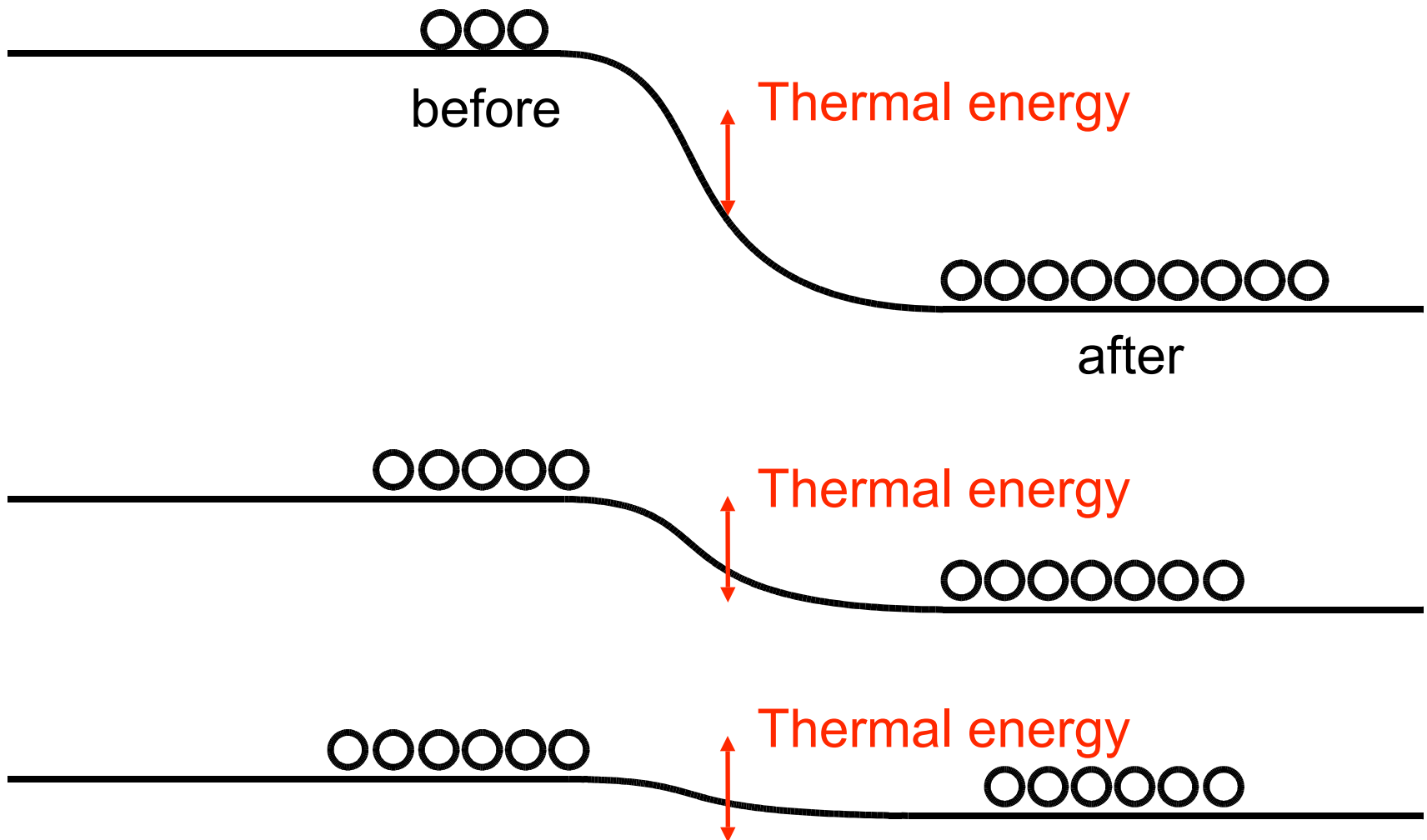
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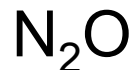
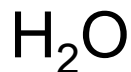


Energetics of molecules

Predicting equilibria

Chemical Reactions in Aqueous Solution

- Water is extremely unusual

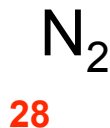
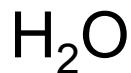
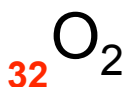


Energetics of molecules

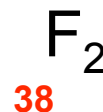
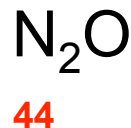
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