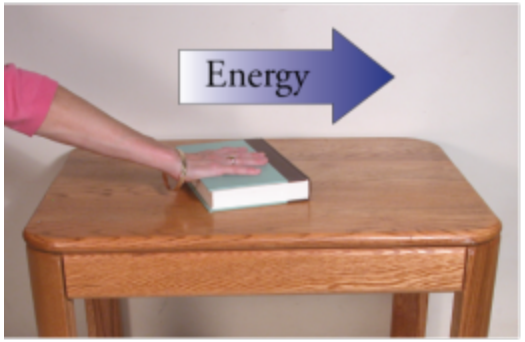
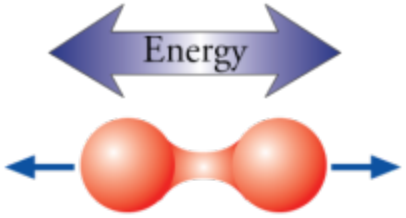
Energy Terms

- **Energy** = the capacity to do work
- **Work**, in this context, may be defined as what is done to move an object against some sort of resistance.



Energy is required to push a book across a table and overcome the resistance to movement due to friction.

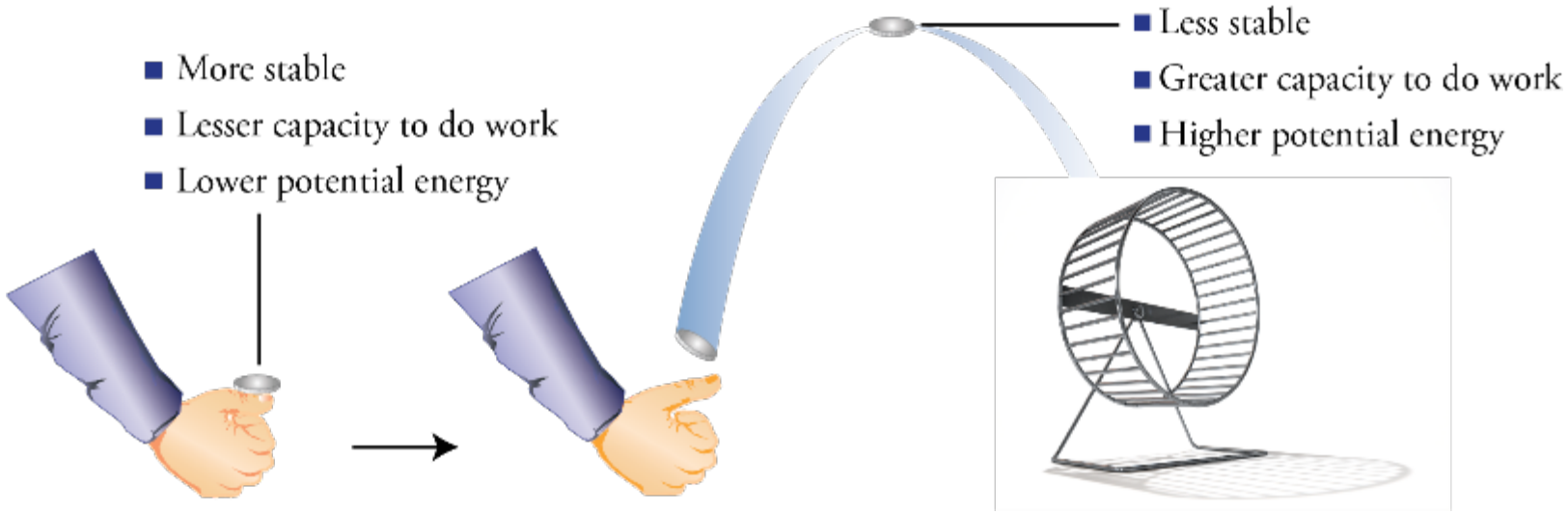
Energy is required to lift a book and overcome the resistance to movement due to gravity.



Energy is required to separate two atoms in a molecule and overcome the resistance to movement due to the chemical bond between them.

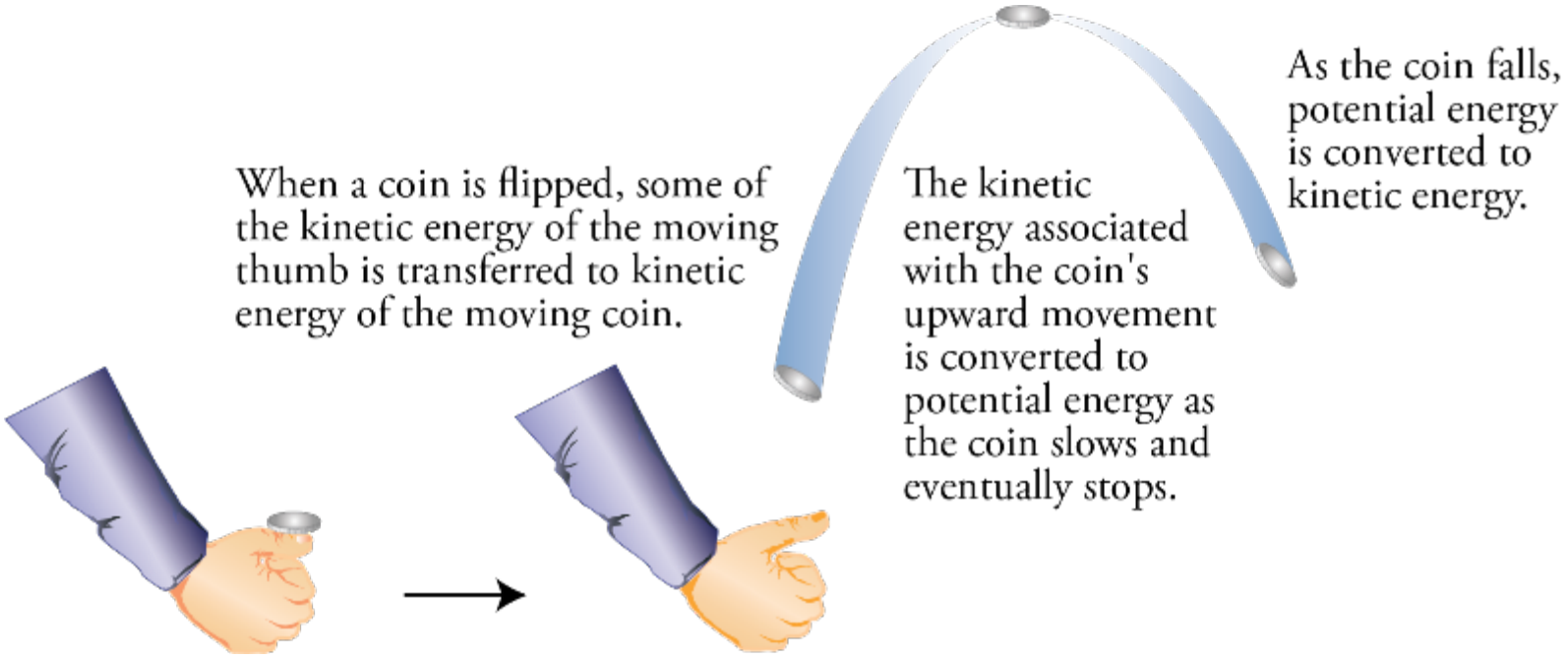
Coin and Potential Energy

- **Potential Energy** = energy by virtue of position or state



Law of Conservation of Energy

- Energy can be neither created nor destroyed, but it can be transferred from one system to another and changed from one form to another.



Endergonic Change

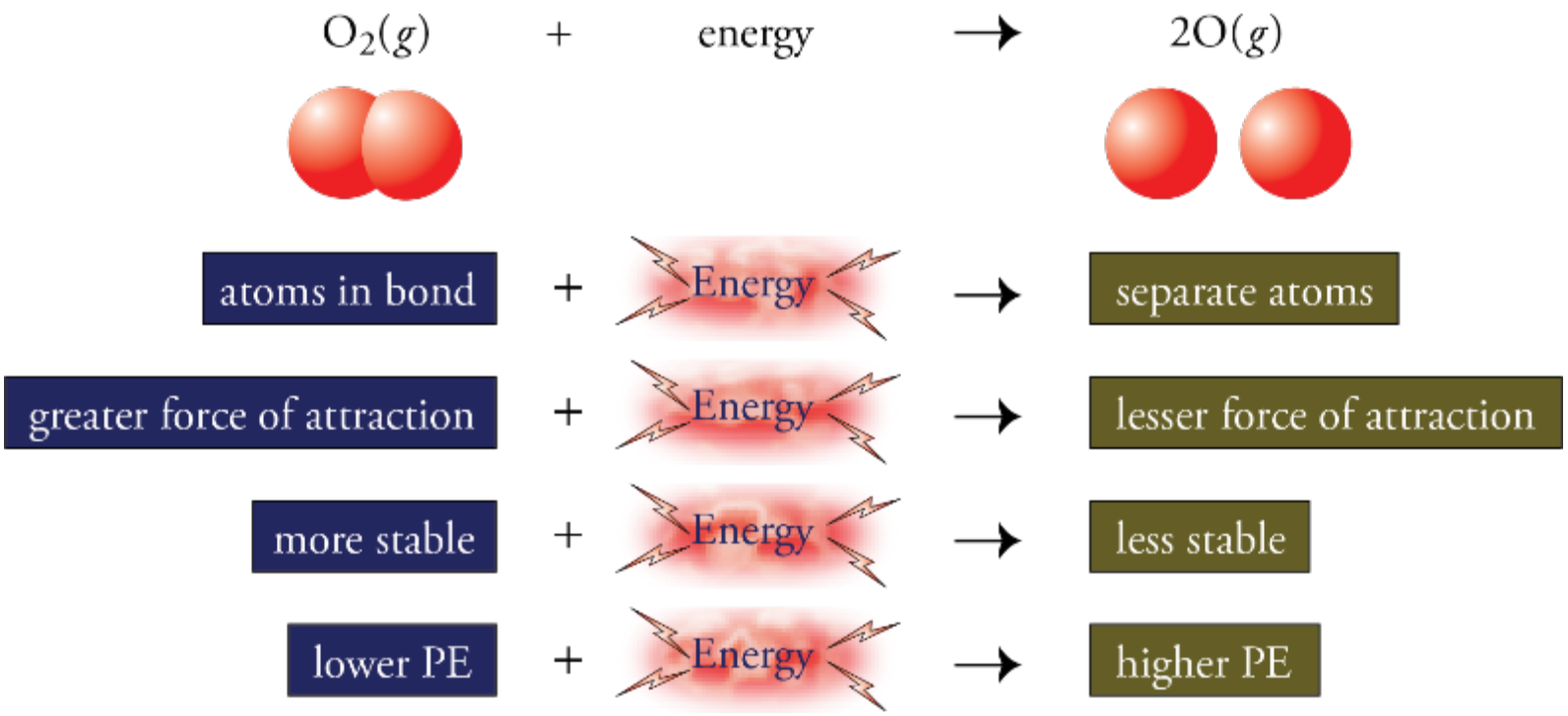
coin in hand $\rightarrow$ coin in air above hand

more stable $\rightarrow$ less stable system

lesser capacity to do work $\rightarrow$ greater capacity to do work

lower PE + energy $\rightarrow$ higher PE

Bond Breaking and Potential Energy



Exergonic Change

coin in air above hand → coin on ground

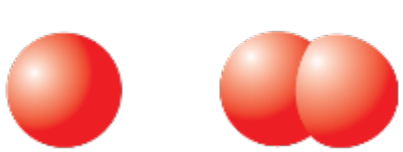
less stable system → more stable

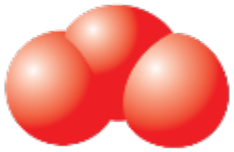
greater capacity to do work → lesser capacity to do work

higher PE → lower PE + energy

Bond Making and Potential Energy

$O(g) + O_2(g) \rightarrow O_3(g) + \text{energy}$





separate atoms → atoms in bond + Energy

lesser force of attraction → greater force of attraction + Energy

less stable → more stable + Energy

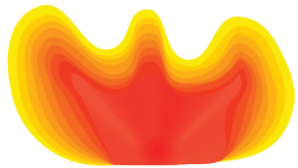
higher PE → lower PE + Energy

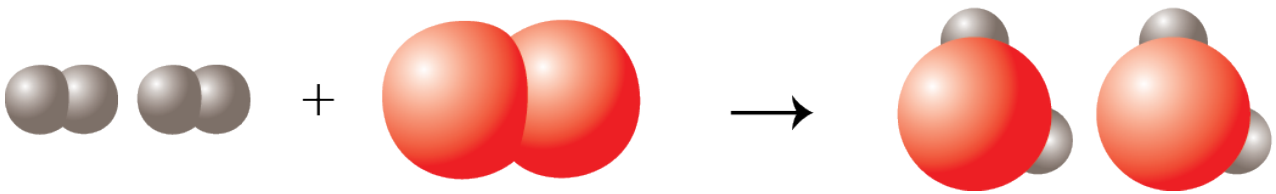
Exergonic (Exothermic) Reaction

weaker bonds → stronger bonds + energy

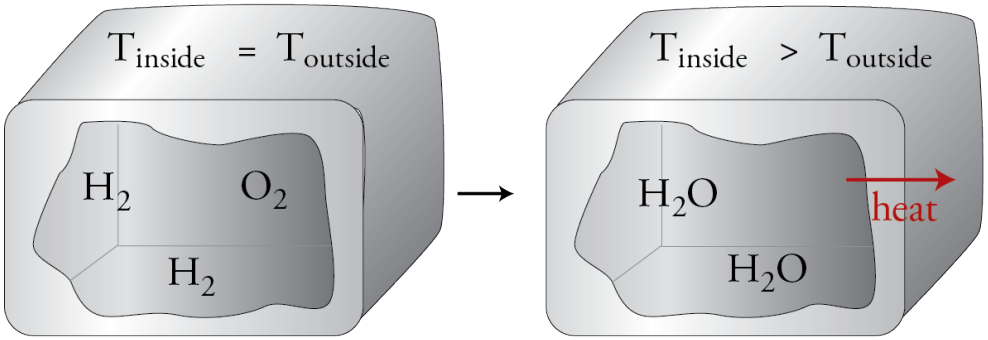
less stable → more stable + energy

higher PE → lower PE + energy

$2H_2(g) + O_2(g) \longrightarrow 2H_2O(l) +$ 

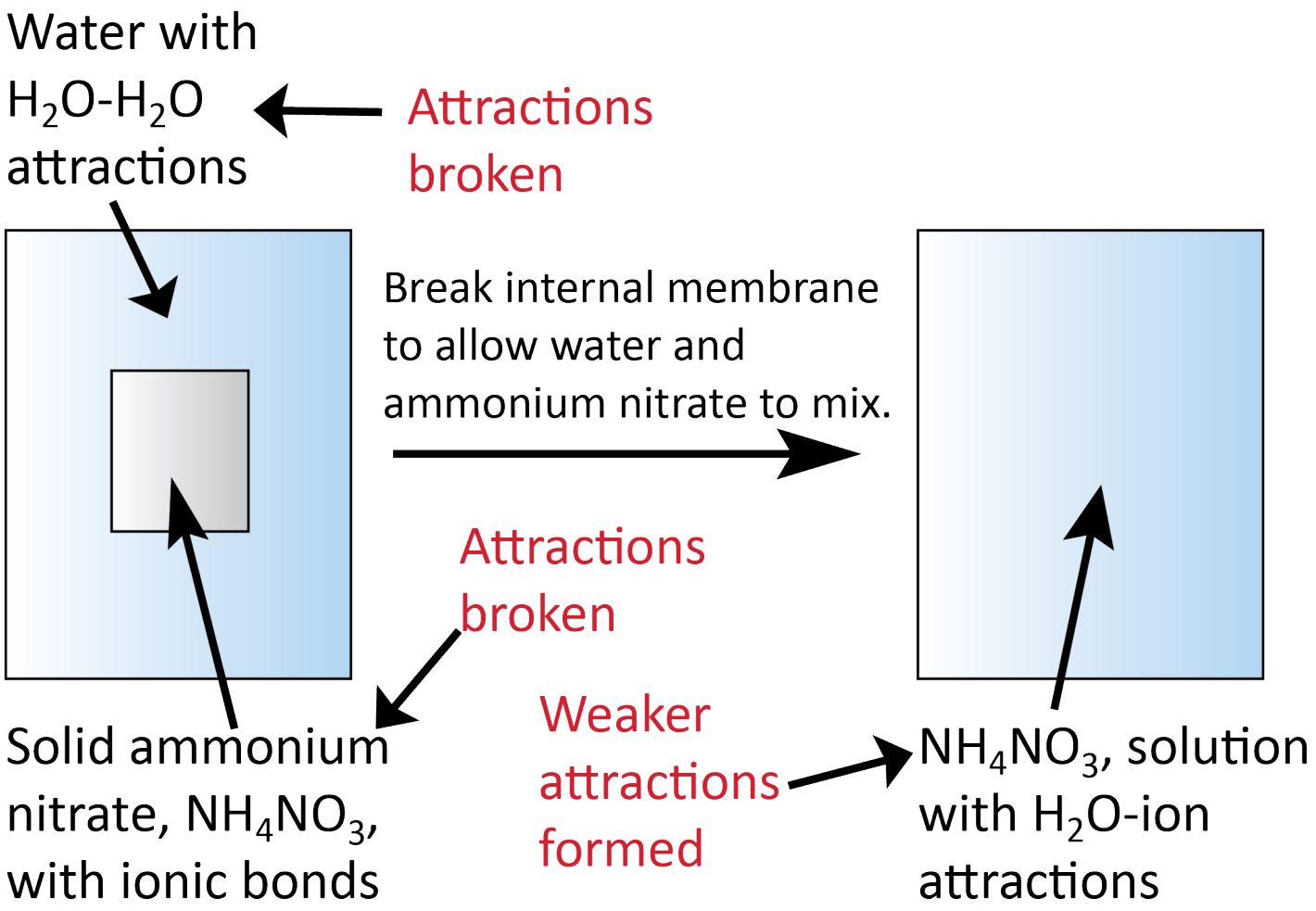


Exothermic Reaction



Stronger bonds → More stable
↓
Energy released ← Lower PE
↓
Increases KE_{ave} of product particles
↓
Increased T → $T_{inside} > T_{outside}$
↓
Heat transferred to surroundings
↓
Exothermic

Endothermic and Cold Packs



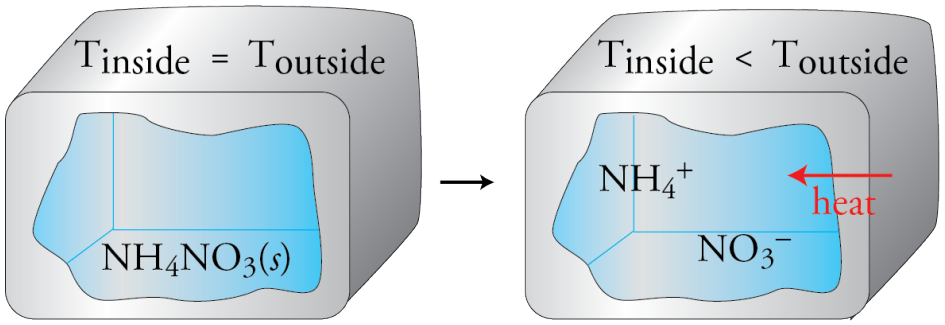
Endothermic Reaction

stronger bonds + energy → weaker bonds

more stable + energy → less stable

lower PE + energy → higher PE

$NH_4NO_3(s)$ + energy → $NH_4^+(aq)$ + $NO_3^-(aq)$



Weaker bonds → Less stable

↓

Energy absorbed ← Higher PE

↓

Decreases KE_{ave} of product particles

↓

Decreased T → T_{inside} < $T_{outside}$

↓

Heat transferred to system → Endothermic

Energy and Chemical Reactions