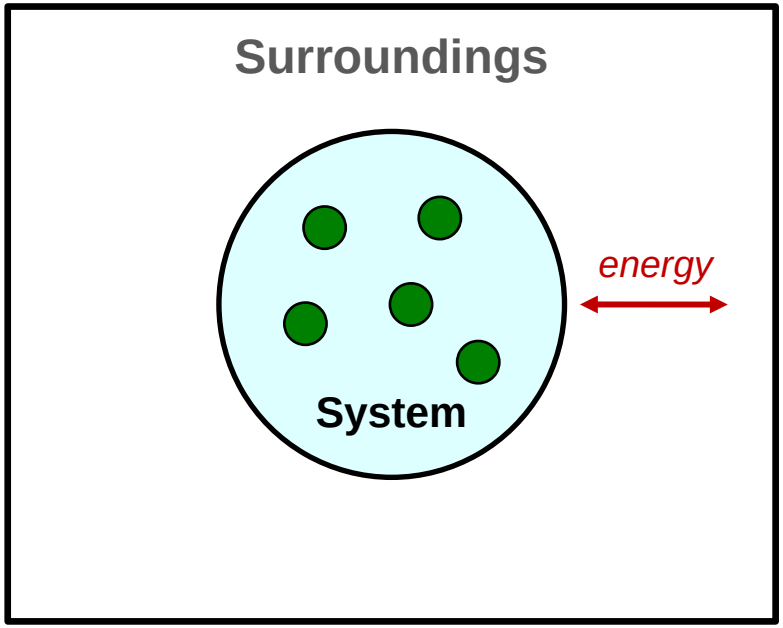
Endothermic and Exothermic Processes

Essential Question

How can we tell if a process releases or absorbs energy?

System and Surroundings

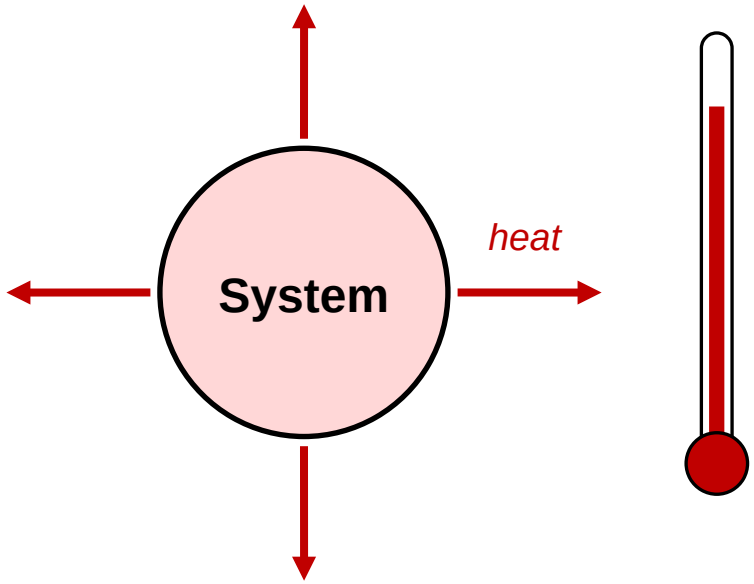
- System: the chemicals we study
- Surroundings: everything else
- Energy moves between them



System + surroundings = universe

Exothermic Processes

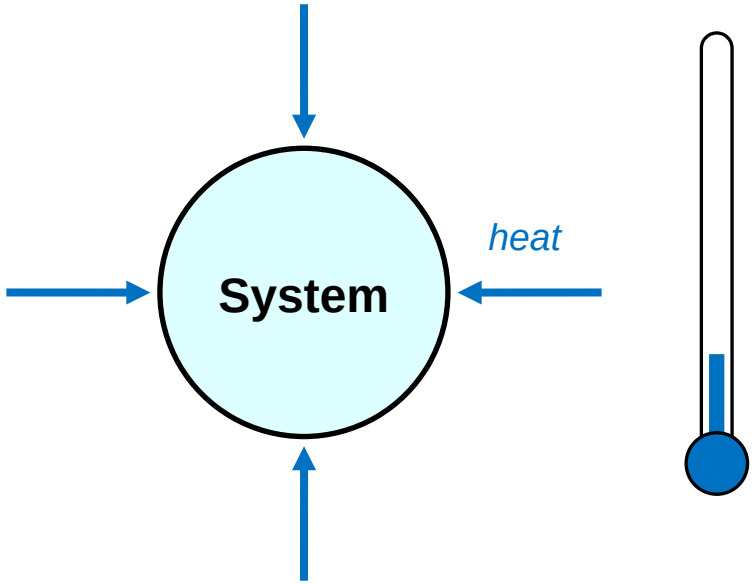
- System releases energy
- Surroundings get warmer
- Container feels hot



Energy flows OUT of the system

Endothermic Processes

- System absorbs energy
- Surroundings get cooler
- Container feels cold



Energy flows INTO the system

Temperature Is the Clue

T ↑

surroundings warm up

exothermic

T ↓

surroundings cool down

endothermic

- The thermometer measures the surroundings

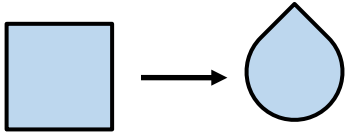
Endothermic and Exothermic Processes

Three Ways Energy Changes

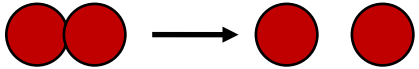
Heating / Cooling
temperature changes



Phase Changes
melt, boil, freeze, condense



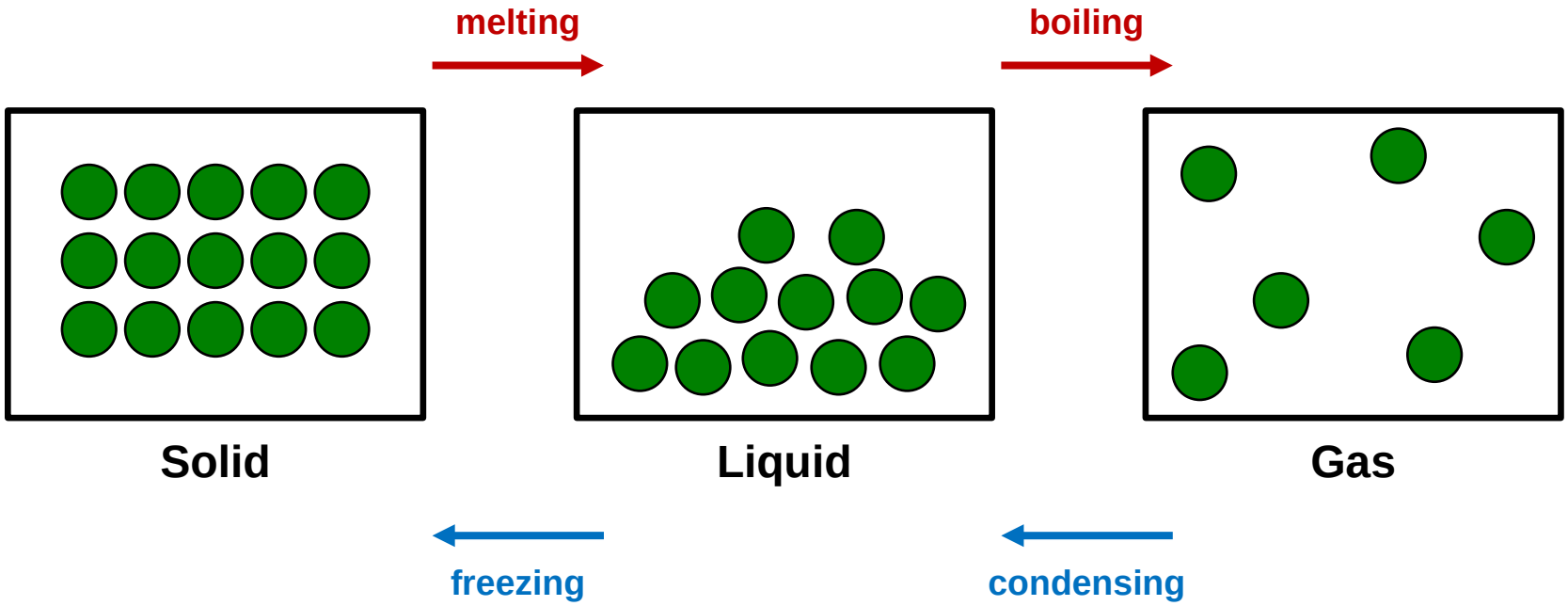
Chemical Reactions
bonds break and form



Endothermic and Exothermic Processes

Phase Changes and Energy

endothermic: absorbs energy



exothermic: releases energy

Dissolving Can Go Either Way

- More released → exothermic
- More absorbed → endothermic
- Compare the strength of the attractions

Break old attractions
absorbs energy

Form new attractions
releases energy

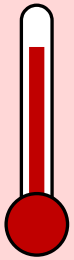
Which is bigger?

Hot Packs and Cold Packs

Hot Pack

$CaCl_2$ dissolves

Exothermic

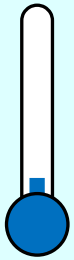


pack gets hot

Cold Pack

NH_4NO_3 dissolves

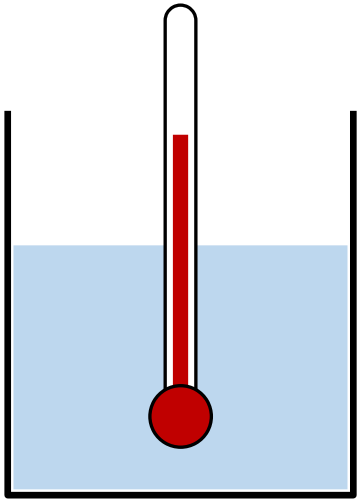
Endothermic



pack gets cold

Example: Dissolving KOH

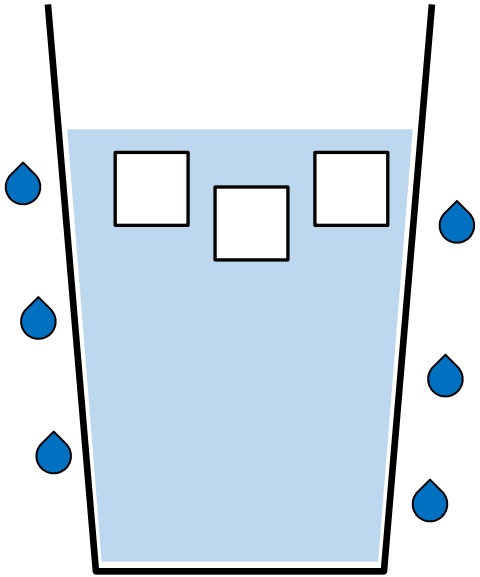
A student dissolves solid KOH in water. The temperature of the water rises from 21.0°C to 34.5°C. Is dissolving KOH endothermic or exothermic? Justify your answer.



21.0°C → 34.5°C

Example: Water on a Cold Glass

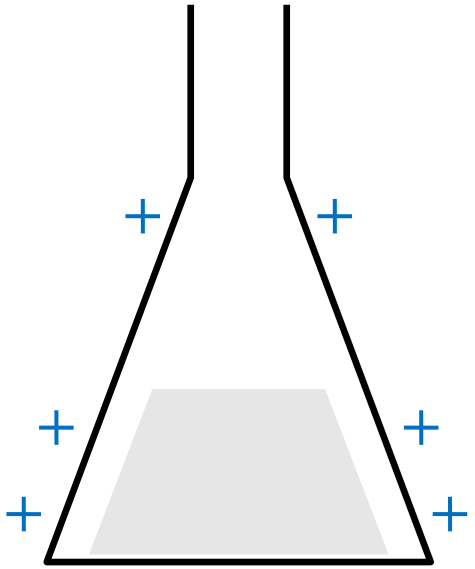
On a hot day, water droplets form on the outside of a glass of ice water. Is this process endothermic or exothermic? Which way does energy flow?



droplets form on the outside

Example: A Reaction That Freezes

Solid $Ba(OH)_2$ and solid NH_4Cl are mixed in a flask. The flask becomes so cold that frost forms on the outside. Classify the reaction and describe the energy transfer between system and surroundings.



frost on the outside

Endothermic and Exothermic Processes

Big Ideas

- Exo: system releases energy, surroundings warm
- Endo: system absorbs energy, surroundings cool
- Thermometer reads the surroundings
- Dissolving: compare attractions

