

# States of Matter Simulation

Classroom worksheet · Interactive simulation: <https://lkforge.com/tools/physics/states-of-matter/>

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Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Learning objectives

- Relate temperature to the average kinetic energy of molecules.
- Describe molecular arrangement and motion in solids, liquids, and gases.
- Explain phase changes in terms of energy.

## Variables to change

- Temperature
- Substance
- Heating/cooling

## Procedure

1. Start at low temperature and observe the molecular arrangement (solid).
2. Slowly add heat and watch the transition to liquid, then to gas.
3. Cool the system back down and observe the reverse transitions.

## Observations

Sketch or describe the spacing and motion of molecules in each state and note the temperature at each transition.

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## Questions

1. How does molecular motion change as temperature rises?
2. Contrast the molecular arrangement in a solid, liquid, and gas.

3. During melting, energy is added but temperature holds steady. Where does the energy go?
4. Why does a gas exert pressure on its container?
5. What is the difference between evaporation and boiling?

### Answer key (instructors)

- **1.** Molecules move faster; higher temperature means greater average kinetic energy.
- **2.** Solid: fixed, closely packed, vibrating in place. Liquid: close but mobile, taking the container shape. Gas: far apart, fast, filling the container.
- **3.** Into breaking intermolecular bonds (latent heat), increasing potential energy rather than kinetic energy.
- **4.** Gas molecules collide with the walls; the combined force per unit area from these collisions is the pressure.
- **5.** Evaporation occurs at the surface at any temperature; boiling occurs throughout the liquid once vapor pressure equals the surrounding pressure.

*Temperature measures average molecular kinetic energy. Adding energy speeds molecules and can overcome intermolecular forces, driving phase changes; during a phase change the added energy breaks bonds instead of raising temperature.*