

States of Matter (a.k.a. phases of matter)

Solid phase: Particles are locked in place, touching one another, vibrating. Hotter solids vibrate more violently.

Liquid phase: Particles are touching one another, but sliding and bumping around and changing positions; flowing. Hotter liquid particles slide and bump around faster.

Gas phase: Particles are flying free, but occasionally bumping into one another. Hotter gas particles fly faster.

1. Label the liquid water, solid water, and gaseous water (water vapor) in the diagram below.
2. Label the arrows with their names (melt, evaporate, condense, freeze).
3. Label the arrows with the required change in energy (energy gain, energy loss)

**Quick Review:**

4. What happens to the temperature of a gas when the gas is compressed?
5. What happens to the temperature of a gas when the gas is allowed to expand?

Practice: Rising Air, Sinking Air, and Weather

Part 1: Evaporation at the Equator (and other places)

The Sun shines on Earth's surface, causing the Earth's surface to heat up. If there is water on the Earth's surface, this heat gets transferred to that water and to the air near the ground. This heating causes the speed of water and air molecules to _____ (increase or decrease). Eventually, the water molecules have gained enough energy to _____ (evaporate or condense). Their state of matter turns from _____ (solid, liquid, or gas) to _____ (solid, liquid, or gas), and they leave their puddles (or their ocean, river, lake, etc.) to become an invisible part of the warm air near the ocean's surface.

Another effect of this increasing warmth near the ocean's surface is that the volume of the air that is heating at the Earth's surface begins to _____ (increase or decrease). This change in volume causes the air's density to _____ (increase or decrease). This density change causes the air (and the water that is in the air) to _____ (rise or sink).

Part 2: Rising Air

As the rising air gets higher, it encounters _____ (higher or lower) air pressure, because there is _____ (more or less) air above it. This change in air pressure causes the volume of the rising air to _____ (expand or compress). This _____ (expansion or compression) of the air causes the temperature of the air to _____ (increase or decrease). This new change in the temperature of the air causes the speed of the air molecules to _____ (increase or decrease). The change in molecular motion causes the water molecules to change phase (state) again from _____ (solid, liquid, or gas) to _____ (solid, liquid, or gas). When this happens, tiny droplets of water form around specs of dust, creating clouds. At first the droplets are too small and light to fall to the ground. They fall so slowly that even gentle updrafts keep pushing them back up. Eventually, when enough individual droplets come together, they become big enough to fall fast enough to make it to the ground as rain.

Part 3: Sinking Air

In other places, air sinks. As the sinking air gets lower, it encounters _____ (higher or lower) air pressure, because there is _____ (more or less) air above it. This change in air pressure causes the volume of the sinking air to _____ (expand or compress). This _____ (expansion or compression) of the air causes the temperature of the air to _____ (increase or decrease). This new change in the temperature of the air causes the speed of the air molecules to _____ (increase or decrease). If there are water molecules in the air, this change in molecular speed causes the water molecules to change phase (state) from _____ (solid, liquid, or gas) to _____ (solid, liquid, or gas). This is how clouds _____ (appear or disappear).

