



Science for You: Weather

Week 1: Clouds

How to identify and name clouds

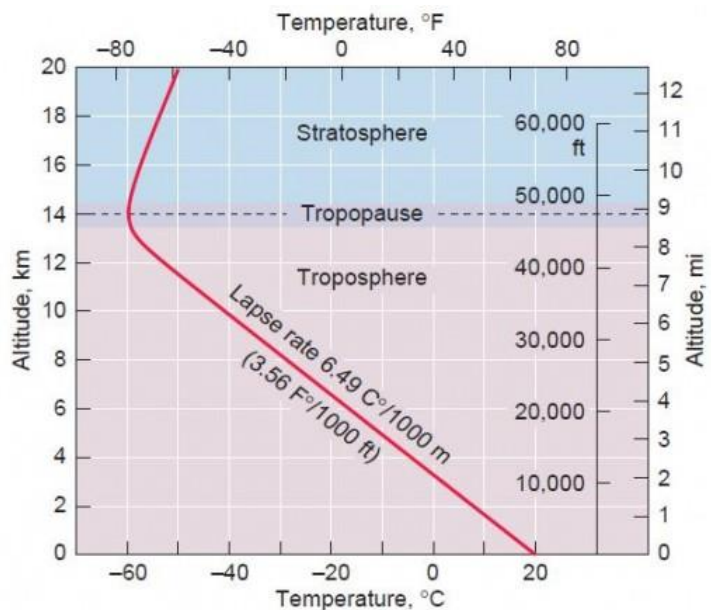
Two things are the basis of cloud names: shape and height/altitude. The cloud classification system was published in 1802 by Luke Howard, an amateur English meteorologist.

Shapes:

- **cumuloform** (puffy, “heap clouds”, cauliflower, cottony)
 - Have a puffy edge.
- **stratoform** (layered, grey sky, “blankets”)
 - Don’t usually see a lot of features or edges.
- **cirroform** (wispy, curly, hairy)

Height/altitude refer to a cloud’s location in the **troposphere**:

- **Tropopause**: the point at which air stops cooling with altitude and starts warming. Its average altitude is 36,000 feet or 6.8 miles. This is the boundary between the troposphere and the stratosphere.



- High clouds have the prefix “cirro”—**cirrocumulus, cirrostratus**.
- Mid clouds have the prefix “alto”—**altocumulus, altostratus**.
- Low clouds do not have a prefix—**cumulus, stratus**.

Identifying clouds:

- **Cumulus:** Low cumulus are the most iconic clouds and are larger and more randomly spaced than higher clouds; **altocumulus** are smaller (not just because they’re farther away), often form a patchwork pattern, look more 3-dimensional than cirrocumulus; **cirrocumulus** are tiny and somewhat transparent, often form patterns, more 2-dimensional than altocumulus.
- **Cumulonimbus** can exist at all heights at the same time. “Nimbus” means precipitation, and often have lightning and thunder. The top of a cumulonimbus (the **anvil**) is wispy if it contains ice or smoother if it contains liquid water. You can also usually see the boundary of the precipitation.
- **Stratocumulus** are shoulder-to-shoulder low cumulus. Most common cloud type on Earth; mostly occurs over the ocean.
- **Stratus:** are low solid clouds; they’re so solid that you can’t tell where the Sun is. If a stratus cloud is producing precipitation, it’s a **nimbostratus**. You usually can’t see where the storm ends: it’s gray and stormy as far as you can see.
- **Altostratus** are thinner than stratus, so you can see the fuzzy ball of the Sun through the clouds.
- **Cirrostratus** are still thinner than altostratus. They’re entirely made of ice crystals because they are so high and are characterized by a ring around the Sun or moon.
- **Cirrus** clouds have only one type, so no prefixes (all are very high).
- **Lenticular** clouds form as caps above mountains and are often disk shaped.
- **Mammatus** clouds are formed by blobs of sinking cold air at the bottom of a cumulonimbus.

How to make a cloud in a jar (with discussion)

1. Fill a jar 1/3 to 1/2 full of very warm water.
2. Put a lid on the jar.
3. Set the jar aside and wait until condensation forms on the inside of the jar.

Meanwhile, some answers to questions about clouds:

- What is a cloud?
 - They aren't made of water vapor, because water vapor is invisible.
 - Clouds are made of microscopic droplets of liquid water or ice crystals.
- If clouds are made of water droplets, why are they white and not clear?
 - White light gets scattered by the water droplets; some light penetrates to the cloud base.
- What is the difference between a white cloud and a dark cloud?
 - The dark part of the cloud is in the shade.

Back to the jar:

- Some condensation has formed inside of the jar. Why?
- Water molecules are coming and going from the surface of the liquid.
 - The amount of water vapor that can exist in the air is limited by temperature:
 - The colder the air, the fewer water molecules can exist as a vapor, and they condense out and form liquid drops. (On grass, this is dew.)
 - Any time water vapor in the atmosphere is cooled to the dew point, a cloud is formed.
 - So... if you put the jar in the refrigerator, would you get a cloud? No, because the glass and lid cool more than the air, so you'd just get more condensation.
- To form a cloud, the water molecules need a surface to condense on ("cloud condensation nuclei"), for example, some smoke. So...

To form the cloud in the jar:

4. Remove the lid.
5. Light the match, blow it out, and put the smoking match into the jar.
6. Place the bag of ice on top of the jar. Voilà: a cloud in the jar!

Other clouds in jars:

- Dry ice drastically cools the air in the jar and makes more of the vapor condense.
- 99% isopropyl alcohol in a 2-liter bottle; pressurize the air in the bottle; quickly release the pressure—the air expands and cools; the cooling vapor forms a cloud.