ScienceCube

Principle of Cloud Formation

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1. **Understanding the principles of adiabatic expansion and adiabatic compression through experiments.**
2. **Comparing the changes in temperature and pressure before and after cloud formation and explaining the principle of cloud formation.**

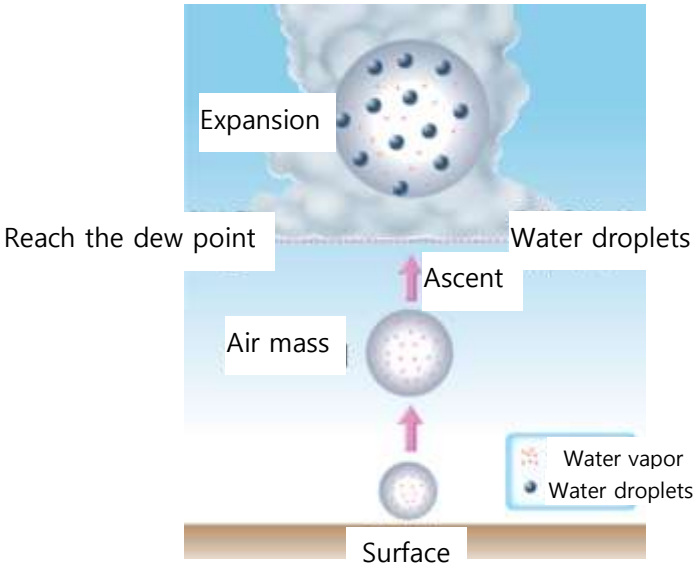
Fundamental Concept

1. **Clouds**

   Small droplets of water or ice particles formed by the condensation of water vapor, floating in the sky..

2. **Cloud Formation Process**

   Air rises → Pressure decreases → Adiabatic expansion → Temperature decreases → Dew point reached → Water vapor condenses → Clouds form



3. **Conditions for Cloud Formation**

① When air rises along the slope of a mountain

② When the surface is heated unevenly

③ When air converges towards a low-pressure center

④ When cold air meets warm air

4. Classification of Clouds

<table>
<tr><td>Category</td><td colspan="2">Cumuliform Clouds</td><td colspan="2">Stratiform Clouds</td></tr>
<tr><td>Shape</td><td colspan="2">Tall shape when updraft is strong</td><td colspan="2">Spread out shape when updraft is weak</td></tr>
<tr><td>Features</td><td>Showers</td><td rowspan="2">  </td><td>Drizzle</td><td rowspan="2">  </td></tr>
<tr><td>Examples</td><td>Cumulus, Cumulonimbus</td><td>Stratus, Altostratus, Nimbostratus</td></tr>
</table>

Experiment

Materials Needed

Interface, Science# Program, Pt temperature sensor, gas pressure sensor B, 500 mL flask with a side arm, rubber stopper (with a hole), Y-tube, air pump, rubber tube, incense, water

Preparation of Experimental Apparatus

1. Insert the temperature sensor into the rubber stopper (with a hole).
2. Add about 10 mL of warm water to the flask and seal the entrance with the rubber stopper containing the temperature sensor.
3. Connect the side arm of the flask to the Y-tube using a rubber tube.

4. Connect the air pump to one side of the Y-tube and the gas pressure sensor to the other side.

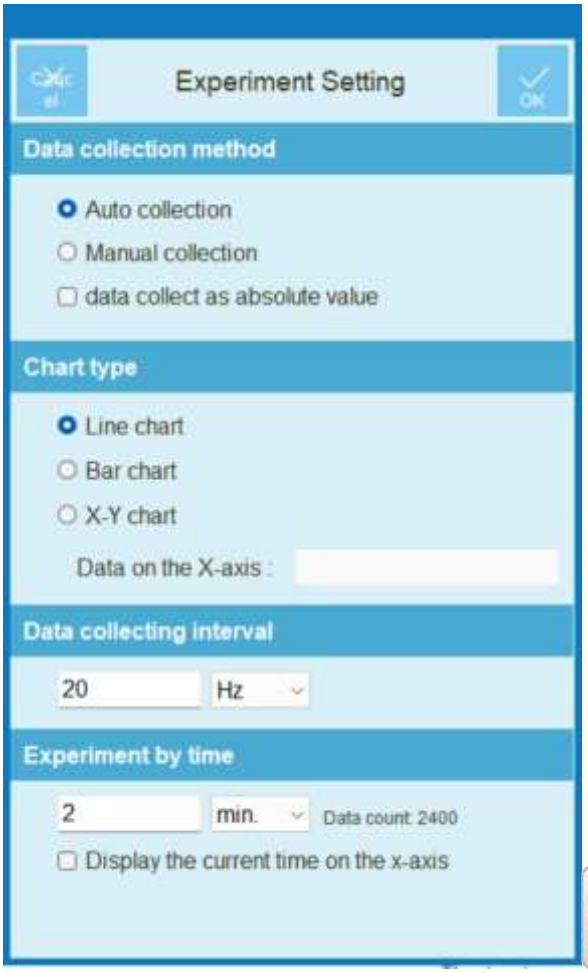
5. Open the rubber stopper of the flask, insert the incense smoke, and seal it tightly to prevent air leakage.

Interface Setup

1.  Run the Science# program.

2. Connect the temperature sensor and gas pressure sensor to the interface.

3. Click  to set up the experimental environment as shown below or click  to automatically set up.




[automatically set up]

Data Collection

1. Click  to start collecting data and compress the air pump several times..
2. When the pressure inside the flask has increased as much as possible, quickly open the valve of the air pump.
3. Observe what happens inside the flask at this moment.
4. Measure and collect data on the pressure and temperature inside the flask over a certain period.

Data Analysis

Recording Data

1. Plot the changes in temperature and pressure inside the flask over time on a graph.

2. Compare the changes in gas pressure inside the flask before and after opening the air pump valve, and compare the changes in temperature according to the change in gas volume inside the flask.

3. Describe the observable phenomena inside the flask before and after opening the air pump valve..

Data Application and Extended Activities

1. Describe the roles of warm water and incense in the flask.

2. The following illustration shows conditions in nature where clouds can form. Using the terms below, explain the process of cloud formation in the correct order

Volume Expansion Air Rising Water Vapor Condensation Temperature Decrease Cloud Formation

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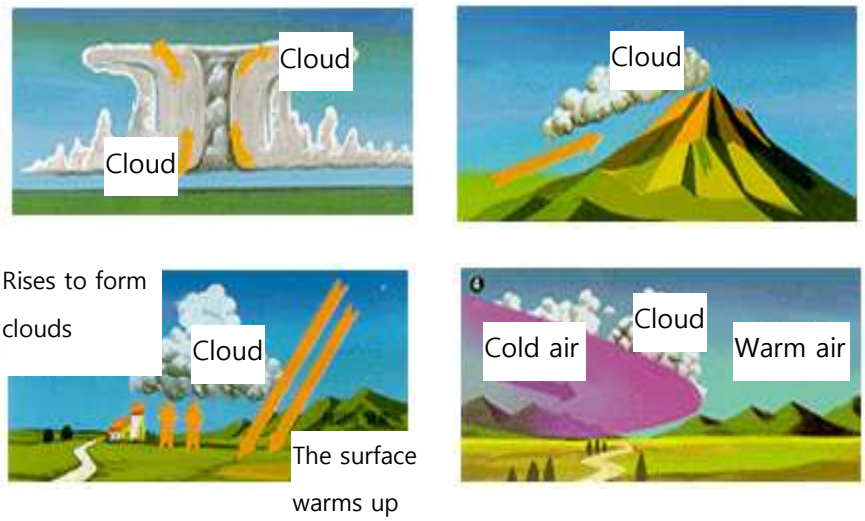

3. Find and describe phenomena around us that involve the same principle as cloud formation.

4. When a parcel of air descends, how do its volume and internal temperature change? Refer to the following illustration and explain with reasons..