Teacher Page

The Temperature of Clouds

Source: https://www.metlink.org/experiments-with-an-infrared-thermometer/

Click here for an introductory video you can show your students.

Time required: 30 min. - 1 hr., depending on how many concepts you choose to cover.

Materials needed for this activity:

- IR Thermometers WARNING: You may want to cover the laser pointer.
- Cloud charts / cloud wheel (See link below if you need one.)

Background: Temperature falls with height. The Sun warms the ground. The ground warms the air in contact with it (by conduction). The warm air rises, and, as it rises, the air pressure falls (air pressure is due to the weight of air above us. As you go up in the atmosphere, there is less air left above you and so the air pressure falls) and it cools (this is called adiabatic ascent and P/T=constant).
This can be related to the water cycle – as temperature falls, the rate of condensation becomes faster than the rate of evaporation and water droplets form to make clouds.
So why is the cloud base usually flat? It marks the level in the atmosphere where the temperature is just right for cloud droplets to form.
So what are high clouds made of? The highest clouds, called cirrus, are made of ice crystals which gives them their wispy appearance.
You can calculate the height of the clouds by assuming that the temperature falls by 6°C for every km of height.

Download a cloud wheel → https://www.metlink.org/wp-content/uploads/2013/08/cloudwheel.pdf

Download a cloud bookmark →
https://www.metlink.org/wp-content/uploads/2013/06/metlink-cloud-bookmark.pdf

NGSS Standards:
MS-LS2-3, MS-LS2-4, HS-ESS2-5, HS-LS2-4

PA Science & Technology Standards:
3.2.7.A3, 3.2.8.A3, 3.2.7.B3, 3.2.8.B3, 3.2.10.A3, 3.2.10.B3, 3.3.10.A5, 3.3.12.A6, 3.2.12.B3,

Student Handout Name _____

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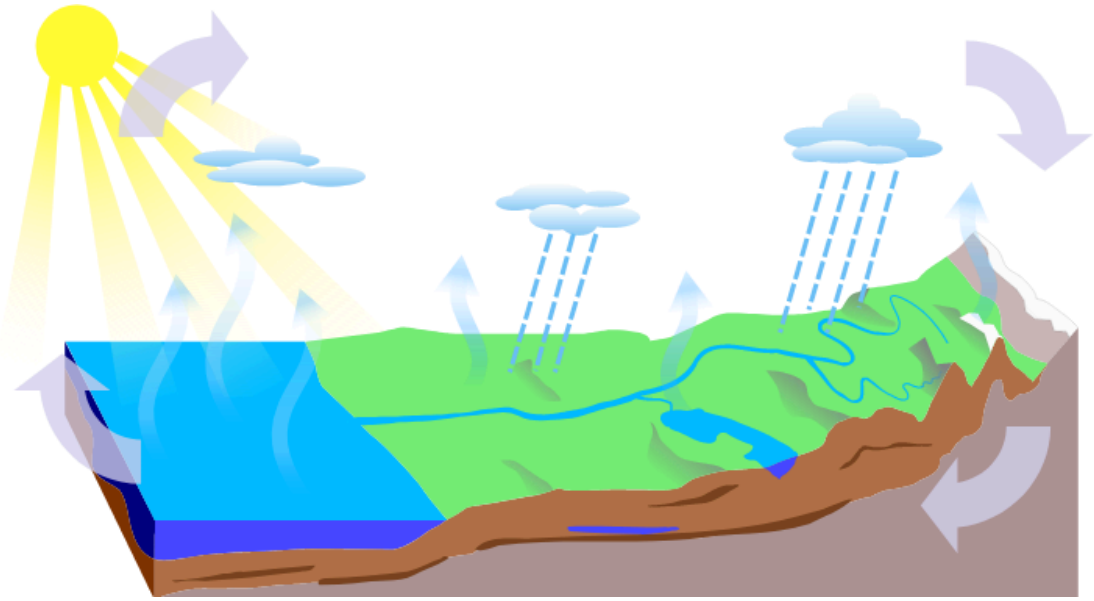
Pre-Lab Questions:

1. Label the processes in the water cycle below. What process(es) form clouds?



2. Do you think the clouds are warmer or colder than the ground? Explain your reasoning.

3. Why do you think some clouds have flat bottoms, while others, higher up, are wispy?

Let's find out!

Student Handout Name _____

→ Follow your teacher's directions for safe use of the IR thermometer! ←

Procedure:

→ First, point the thermometers at a range of objects in the shade on the ground and get an estimate for the air temperature at ground level. Record their temperature in the table below.
→ Next, point the thermometer at any cloud (there may well be several types of clouds visible, which will give different results) and measure its temperature. Use a cloud chart to determine the type of cloud, and record both the type and temperature in the table.
→ When you are finished collecting data, your teacher will share with you how to determine the height of the clouds. Calculate their height and record it in the table.

Results:

Ground object	Temperature	Cloud type	Temperature	Cloud height
Average ground temp. =				

Analysis and Conclusion:

1) Are the clouds warmer or colder than the ground? Are wispy clouds warmer or colder than flat-bottomed clouds?

2) So does air temperature rise or fall with height?

3) Refer back to the water cycle. How does this temperature change determine the height at which clouds form?