

The Structure of Earth's Atmosphere

Just like the Earth's interior, Earth's atmosphere is divided into layers with different properties. Scientists discovered these layers through early experiments with balloons and, eventually, airplanes and satellites. The main property that defines these layers is *the temperature of the air*.

Normally, as you climb to higher altitudes the temperature decreases. In certain parts of the atmosphere, though, this trend reverses and the temperature increases with altitude. When warm air lies above cold air, we call it a **temperature inversion** because it seems upside-down from what we usually see!

Instructions

Below is a data table showing measurements of air temperature at different altitudes.

On the next sheet a graph is set up for you showing the Earth's surface at the bottom, and an altitude scale going up the side. Graph the temperature data and then connect the dots with a smooth, curving trend line.

Then answer the questions about your results!

YOU MAY TEAR OFF THIS FRONT SHEET. Only the second sheet needs to be turned in.

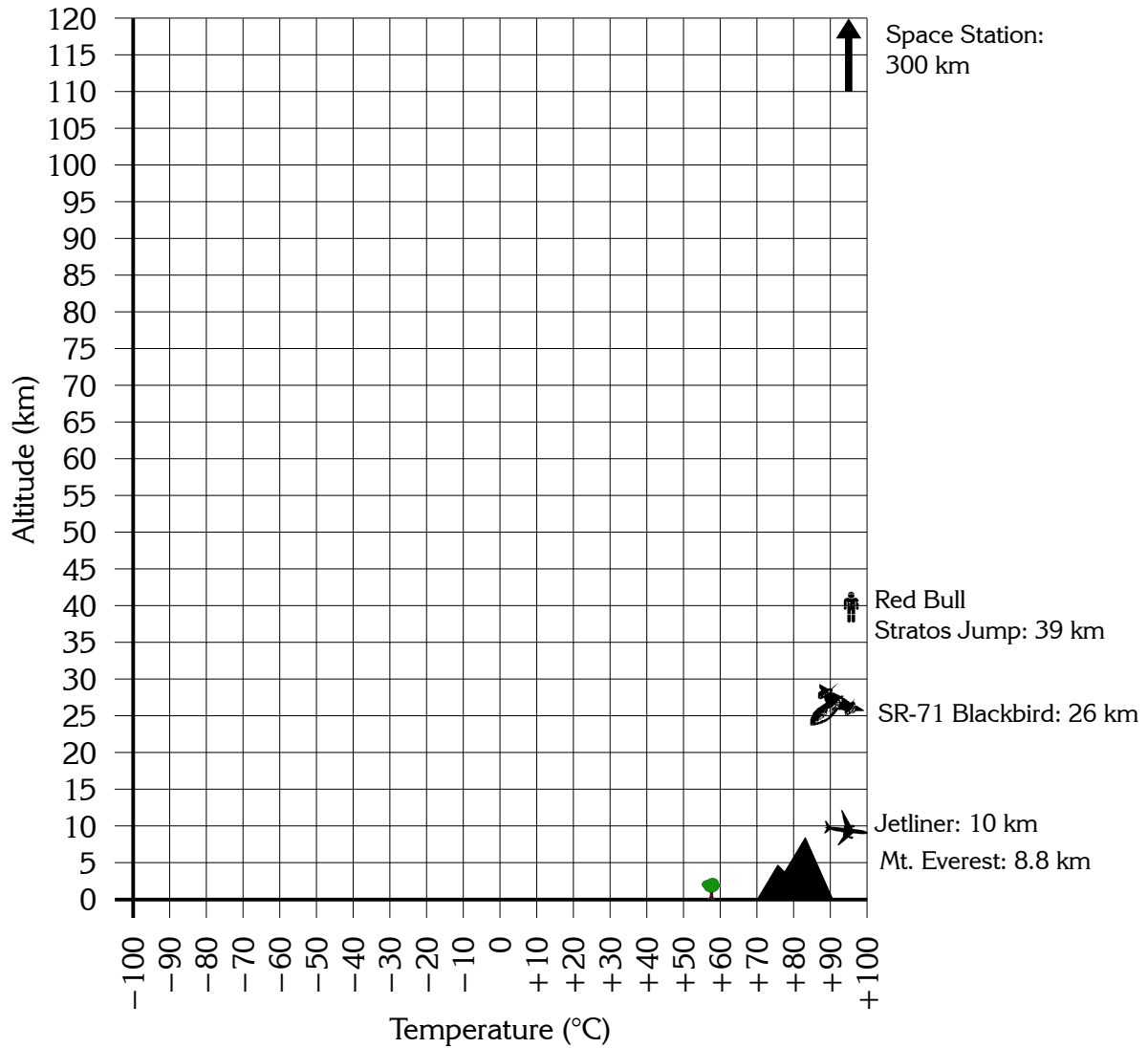
Data table

Altitude (km)	Temperature (°C)
0	+15
5	-18
10	-49
15	-56
20	-56
25	-51
30	-46
35	-37
40	-22
45	-8
50	-2
55	-2
60	-7

Altitude (km)	Temperature (°C)
65	-17
70	-33
75	-54
80	-65
85	-79
90	-86
95	-81
100	-72
105	-51
110	-30
115	+30
120	+90

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Graph



Questions

- 1) You should be able to see four “sections” to your graph based on whether the temperature is increasing or decreasing. Draw horizontal, dashed lines to separate your graph into these four sections. (Hint: Every time the graph “turns around”, that's a boundary between layers.)
- 2) Label your sections with these names:
 - Bottom layer: **Troposphere**
 - Second layer: **Stratosphere**
 - Third layer: **Mesosphere**
 - Top layer: **Thermosphere**

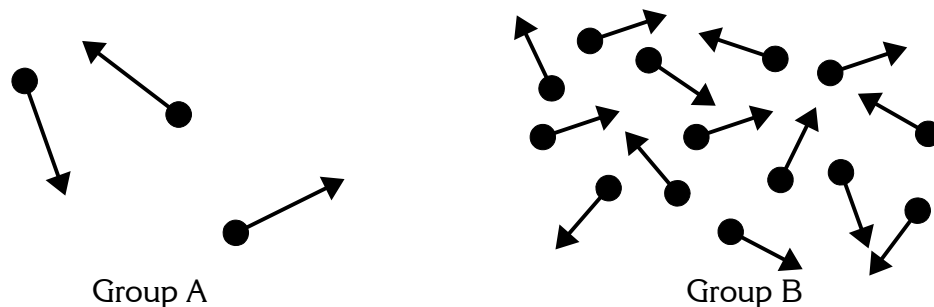
- 3) Which layer do we live in?

- 4) When air is heated, it expands to become less dense. So whenever there's warm air just below cold air, the atmosphere becomes unstable and **convection currents** can begin. In which layers would you expect convection currents to happen?

- 5) In a temperature inversion, convection currents will not occur because the denser cold air is already on the bottom. This makes the air stable and calm. Which layers show temperature inversion?

- 6) Found inside the stratosphere is Earth's **ozone layer**. Ozone is a chemical in the atmosphere that absorbs a lot of the Sun's ultraviolet light. Look at the stratosphere section of your graph. What kind of energy does it look like the ozone is transforming the Sun's radiant energy into?

- 7) Temperature is a measurement of the **AVERAGE** kinetic energy of a group of particles, but thermal energy is the **TOTAL** kinetic energy of a group of particles.



Which group of particles above has a higher temperature?
 Which group of particles above has a higher thermal energy?

- 8) Although the thermosphere has very high temperatures, the number of particles at that altitude is extremely small. What does this mean about the thermal energy contained in the thermosphere?