Geology 103

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Weather Basics

I–Latent Heat and Specific Heat

Water is a substance commonly found on the Earth and in the atmosphere in all three phases of matter (solid, liquid and gas). As far as we know earth is the only planet or natural satellite where this is true. This unique condition on earth, and water's distinct properties, are major factors in determining daily weather patterns and global climates on our planet.

In this investigation you will observe the temperature changes of a volume of water as heat is added to it *at a steady rate*, as the water changes from a solid to liquid, and from a liquid to gas. You will compare the relative amounts of heat needed for each step.

Time (min.)	Time (sec.)	Temp. (°C)
0	0	
0	30	
1	0	
1	30	
2	0	
2	30	
3	0	
3	30	
4	0	
4	30	
5	0	
5	30	
6	0	
6	30	

After recording the data, graph the changes in temperature on the graph paper provided, and answer the questions below:

1. According to your graph, did the temperature increase while the ice was melting?

2. What happened to the temperature from the time the ice melted to the time the water boiled?

3. What change occurred in temperature after the water began to boil?

4. While the ice was melting, what was the heat energy being used to do?

5. While the water was boiling, what was the heat energy being used to do?

6. From the time the ice melted to the time the water boiled, what was the heat energy being used to do?

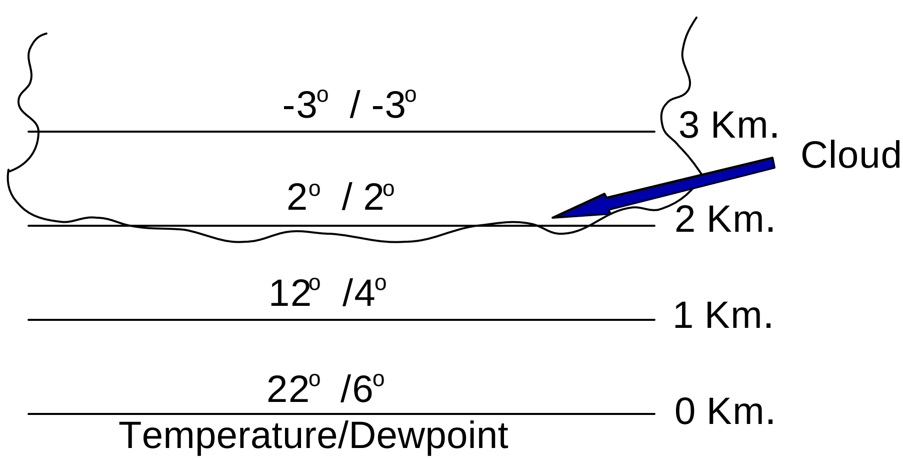
Conclusion:

7. According to the graph, which phase change required the greatest amount of energy?

II–Adiabatic Temperature Changes

As air rises, it expands. As air expands, it cools down. If air cools down to its *dewpoint*, condensation will occur, and a cloud will form. Adiabatic temperature changes are those that occur <u>without the addition or subtraction of heat energy.</u>

The adiabatic lapse rate for "dry" air (air with a Relative Humidity of under 100%) is 10°C for temperature, and 2°C for dewpoint–for every 1000 meters (1 kilometer) the air rises. When temperature=dewpoint, condensation takes place and a cloud forms.



Once the cloud base is established, if the air continues to rise, both temperature and dewpoint decrease 5°C for every gain of 1000 meters in altitude. This is known as the adiabatic lapse rate for moist air.

For each of the diagrams below, calculate the temperature and dewpoint at each labeled altitude.

______ 3 Km. ______ 2 Km. ______ 1 Km. 28^{o} /12^{o} ______ 0 Km. Temperature/Dewpoint	1. At what level will a cloud form? 2. What will the air temperature be at an elevation of 3 Km. above the surface? 3. Will precipitation from the base of this cloud be liquid (rain) or solid (snow)?
______ 3 Km. ______ 2 Km. ______ 1 Km. 22^{o} /14^{o} ______ 0 Km. Temperature/Dewpoint	4. At what level will a cloud form? 5. What will the air temperature be at an elevation of 3 Km. above the surface? 6. Will precipitation from the base of this cloud be liquid (rain) or solid (snow)?
______ 3 Km. ______ 2 Km. ______ 1 Km. 19^{o} /3^{o} ______ 0 Km. Temperature/Dewpoint	7. At what level will a cloud form? 8. What will the air temperature be at an elevation of 3 Km. above the surface? 9. Will precipitation from the base of this cloud be liquid (rain) or solid (snow)?