Name: ___________________________________

- **Please hand in the lab as ONE PDF document on Moodle.**
- **Please make sure the pages are in order**
- **Please make sure it's legible (open your PDF file to double check 😊)**
- **Thank you**

CRANDALL UNIVERSITY
GEOGRAPHY 1023
Lab 5: Weather

Reference: *Chapters 7 and 8, text and notes.*

This lab looks at weather – the short-term, day-to-day condition of the atmosphere. In this lab we will be considering some of the principles of ***meteorology*** – the scientific study of weather.

I. Atmospheric Lifting Mechanisms and Weather

A. Convectional Lifting

For this section you will find your notes and 4CE p. 210 (3CE p.201), very helpful.

In regions, like the Prairies (and other inland areas such as Ontario, and Quebec), where intense heating of the land frequently occurs during summer months, convectional lifting is common. Through the course of a day, land becomes warmer and warmer. This hot land warms the air above it. This warmed air rises. As the air rises it cools at the DAR (10°C/1000m) until it reaches the dew point temperature. Then, as the air continues to rise, it cools at the MAR (6°C/1000m).

See 4CE Figure 8.4, p. 212 (3CE Figure 8.6, p. 202), "Convectional activity in unstable conditions," and the online notes.

In this exercise, you get to draw a "typical" summer day in an inland area like Saskatoon (just for fun!)! Using the hints (questions in *italics*) below, you should be able to work through this logically …

1. At 6 a.m.:
   - the ***surface temperature*** is 7°C (a cool night indeed).
   - The temperature *at* **500 m** is 9°C.
   - Above 500 m the air warms – it is *12°C at 1000 m* – then begins to cool – it is 11*°C at 2000 m*.
   - The **dew point temperature** of the air is **9°C**.

   a. What will the weather conditions be ***<u>between the surface and 500 m</u>***? Why? *(Think! – is the air above or below the dew point temperature? What are the implications of this? If the air is above the dew point temperature, will there be condensation? What would the air conditions be like? If the air is below the dew point temperature, will there be condensation? If so, what would the conditions be?)* Will it be… (check one)

      ___ clear, because the air temperature is above the dew point temperature
      ___ foggy (cloudy), because the air temperature is above the dew point temperature
      ___ clear, because the air temperature is below the dew point temperature
      ___ foggy (cloudy), because the air temperature is below the dew point temperature

What will the sky conditions be ***above 500 m***? Why? *(Ask yourself the same questions you did in 1.a.)* Will it be… (check one)

___ clear, because the air temperature is above the dew point temperature
___ foggy (cloudy), because the air temperature is above the dew point temperature
___ clear, because the air temperature is below the dew point temperature
___ foggy (cloudy), because the air temperature is below the dew point temperature

2. At 9 a.m., the ground has warmed to 10°C; the rest of the air is still at its original temperatures. The dew point temperature is still 9°C.

   a. What are the weather conditions like now, ***between the surface and 500 m?*** Why? *(Think! – is the air above or below the dew point temperature? What are the implications of this? If the air is above the dew point temperature, will there be condensation? What would the air conditions be like? If the air is below the dew point temperature, will there be condensation? If so, what would the conditions be?)* Will it be… (check one)

   ___ clear, because the air temperature is above the dew point temperature
   ___ foggy (cloudy), because the air temperature is above the dew point temperature
   ___ clear, because the air temperature is below the dew point temperature
   ___ foggy (cloudy), because the air temperature is below the dew point temperature

   b. What are the conditions like at 9 a.m., ***above 500 m***? Why? Will it be… (check one)

   ___ clear, because the air temperature is above the dew point temperature
   ___ foggy (cloudy), because the air temperature is above the dew point temperature
   ___ clear, because the air temperature is below the dew point temperature
   ___ foggy (cloudy), because the air temperature is below the dew point temperature

3. At 3 p.m., convection currents, caused by the ground becoming warmer and warmer, are causing the **air to *RISE*** (the air temperature will cool with altitude at the DAR – 10°C per 1000 m – before condensation/dew point temperature; at the MAR – 6°C per 1000 m – after condensation/dew point temperature). The surface temperature is now a toasty 27°C. The dew point temperature is still 9°C. Small cumulus clouds are beginning to form at 2000 m. Why?

   ____ The clouds are forming because the air is always above the dew point temperature
   ____ The clouds are forming because as the air rises it reaches the dew point temperature
   ____ The clouds are forming because the air is all below the dew point temperature

4. At 6 p.m., **the air is still *RISING***. Those nice little clouds have now become ominous thunderheads! Evaporation from lakes, rivers, and reservoirs has increased the water vapour content in the air, ***changing the dew point temperature to 12°C***. If the air temperature at the surface is still 27°C, at what elevation will these thunderheads be formed? *(The air is cooling at the DAR [10°C per 1000 m,* ***or*** *1°C per 100 m]. Think – how many °C does the air have to cool to go from the surface temperature of 27°C to the* ***new*** *dew point temperature of* ***12***°*C? At a rate of 1°C per 100 m, how many metres up would you have to go to cool this many °C?)*

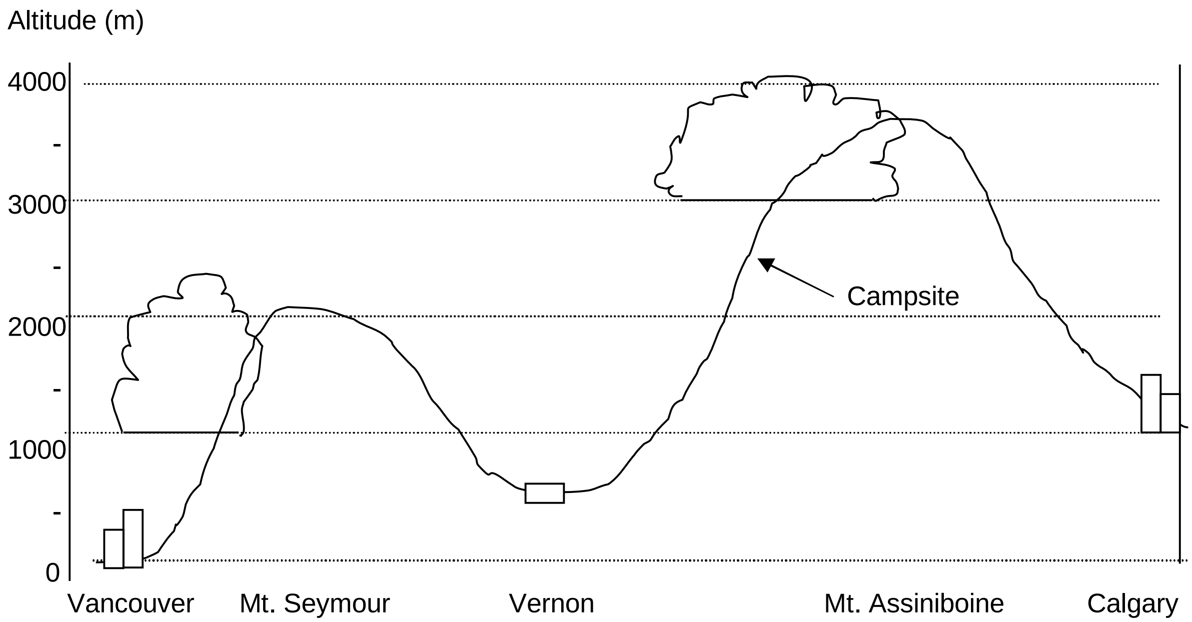
The clouds will form at an altitude of: ____________ m because at this altitude the air reaches the dew point temperature.

B. Orographic Precipitation

For this section you will find 4CE, pp.211-213 (3CE, pp. 201-202) very helpful. In particular, study 4CE Figure 8.6, p. 213 (3CE Figure 8.8 p.204) “Orographic precipitation” and my notes.

Orographic precipitation can occur when moist air is lifted upslope when it is pushed against a mountain. As the air is forced to rise over the mountain, *it will cool at the DAR* ***until it reaches the dew point temperature.*** *After that point, it will cool at the MAR.*

The diagram below (not to scale!) shows the basic topography from Vancouver to Calgary.



- Note that the windward (west) slope of mountains tends to warm and moist.
- Note that the leeward (east) side tends to be hotter and drier. On this side air is descending and warming. *It will heat at the* ***DAR on the leeward side***.

1. Find the *condensation level* (the altitude at which condensation occurs and clouds form … at what altitude do the clouds begin to form … what is the elevation of the bottom of the clouds?) on both windward slopes.

   a. What is the condensation level on Mt. Seymour? _____________ m

   b. What is the condensation level on Mt. Assiniboine? _____________ m

– *On the windward slopes, air will cool at the DAR* ***until it reaches the dew point temperature*** *(the point where condensation occurs/clouds form). Air will warm at the DAR when it descends leeward slopes.*
– *Rising air on windward slopes,* ***cooler than the dew point (above where condensation occurs/clouds form) will cool at the MAR.*** *Descending air on leeward slopes never warms at MAR, always at DAR.*

2. The original air, in Vancouver (sea level, 0 m) was at 20°C. What is the dew point temperature of this air? *(Think – the air is rising and cooling at the* ***DAR*** *[see your notes … the air cools ________*° ***every 1000m*** *–* ***yes fill in the blank!****]) You know the condensation level/elevation on Mt. Seymour. How many °C did the air cool as it rose that distance from sea level (0 m)? Therefore, what is the dew point temperature of the air? Use this calculation:*

20°C (starting temperature at sea level)
– *the temperature decrease between 0 m and the condensation/cloud level [use DAR]*

= *dew point temperature*

Dew point temperature: _______________ °C

3. What would the temperature of the air be when it reaches the summit of Mt. Seymour (approximately 2000 m)? *(In question 2, you figured out the air temperature at 1000 m. From there, the air cools at the **MAR** [see your notes … the air cools _____ ° every 1000m]) to 2000 m. What will its temperature be at 2000 m?)*

Dew point temperature (your answer from 2)
– *temperature drop over 1000 m (from an elevation of 1000 m to 2000 m)*

= *temperature at the summit* *Temperature at the summit: ___________°C*

4. What is the weather like in Vancouver, nestled on the western slopes of Mt. Seymour?

Temperature: ___________________°C

Sky conditions (clear/cloudy/other?): ________________________

Precipitation (none/rain/snow?): _________________________

5. What would the temperature of the air be in Vernon (approximately 500 m elevation) in the B.C. interior. *(In 3., you figured out the temperature at the summit of Mt. Seymour, 2000 m. As the air descends to Vernon, it will warm from that temperature: at the **DAR**. Using this rate, calculate how many °C the air will warm as it drops the 1500 m into Vernon. By adding this change in temperature to the original air temperature as 2000 m, you can find the temperature in Vernon!)*

Temperature from 3 (at summit of Mt. Seymour): _________
+ Temperature increase as air drops 1500 m: ______________ (use DAR)

= Temperature in Vernon *Temperature in Vernon is _______________°C*

6. What would the weather be like in Vernon?

Temperature: ___________________°C

Sky conditions (clear/cloudy/other?): _________________________

Precipitation (none/rain/snow?): _________________________

7. The original air has been modified by the time it reaches Vernon: much of the moisture has been removed in heavy rains in the Coast Mountains. What is the dew point temperature of the air now? (*You know the air temperature in Vernon. You know the condensation level on Mt. Assiniboine. Using the **DAR**, you can figure out the air temperature at the condensation level on Mt. Assiniboine. The air temperature at the condensation level is by definition the dew point temperature: the temperature at which the air is 100% saturated and condensation occurs).*

Next page ….

Temp (from 5)
– *Temp decrease (DAR)*

= *Dew point temperature in Vernon*

Vernon dew point temperature _____________°C

8. What would the temperature of the air be when it reaches the summit of Mt. Assiniboine (approximately 3500 m), in the Rocky Mountains? *(In 7, you figured out the air temperature at 3000 m – the air cools above that at the **MAR**. What will the temperature be at 3500 m?)*

Temp (from 7)
– *Temp decrease (MAR)*

= *Temp @ summit of Mt. Assiniboine*

Temp @ summit of Mt. Assiniboine _____________°C

C. Frontal Lifting

For this section you will find 4CE, pp. 212-216 (3CE, p. 203-207), very helpful. The leading edges of air masses are cold fronts (from a cold air mass) or warm fronts (from a warm air mass).

1. Imagine lounging in your 3 m aluminum boat in the middle of Lake Woebegone, supposedly waiting for the big one (a fish!) to bite – but really reflecting upon the wonders of the Creator. During your twelve hours on the lake, a warm front moved from the west, right past you.

Fill in this table:

	Before the warm front arrives …	After the warm front arrives …
The air temperature is … (specify **relatively cool OR relatively warm**)		
The cloud cover is … (specify, for example, **none, stratus, cirrus, OR cumulus**)		
Precipitation is like this … (specify, for example, **none, light rain, OR heavy rain**)		

2. Imagine you are on the same lake several days later – taking time to reflect upon life, the universe, and God! What a life! Only this time a cold front passes right over you. BRRR!

Fill in this table:

	Before the cold front arrives …	As the cold front passes …
The air temperature is …(specify **relatively cool OR relatively warm**)		
The cloud cover is … (specify, for example, **none, stratus, cirrus, OR cumulus**)		
Precipitation is like this … (specify for example **none, light rain, OR heavy rain**)		