

1. (2 points) The two main conditions needed for downbursts to form are:

_____ and _____

2. (6 pts) For the most-used imager channels on weather satellites, ...

a) the water vapour channel, centered at wavelength _____ μm , shows a stronger signal when air within altitude range _____ (km) contains more water.

b) the IR channel, centered at wavelength _____ μm , gives what information about cloud top? _____

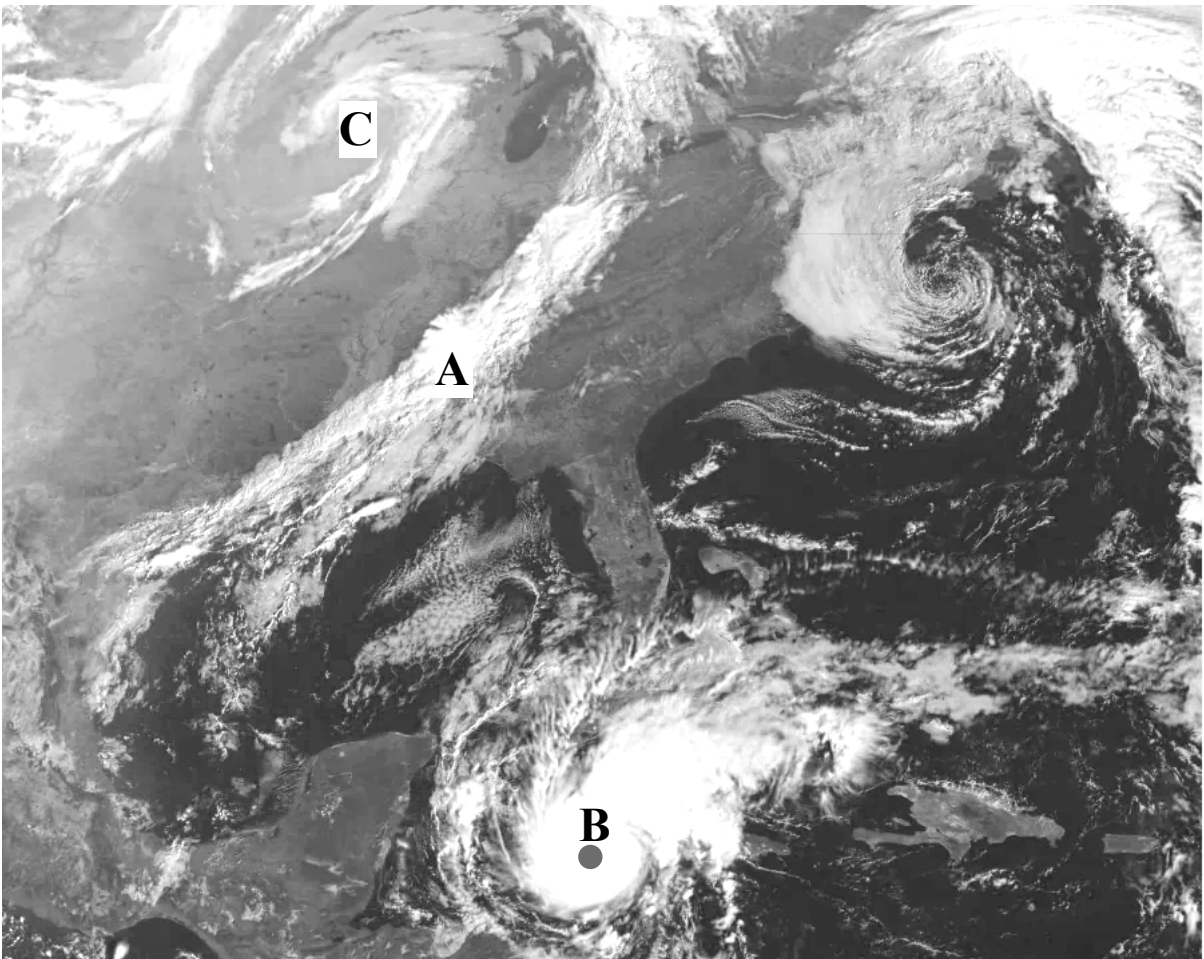
c) the visible channel, centered at wavelength _____ μm , is useless during some times at some places because _____

3. (7 pts) The picture below is a [**visible** , **IR** , **water vapour** (circle one)] satellite image. List the weather features at points A, B, C.

A: _____

B: _____

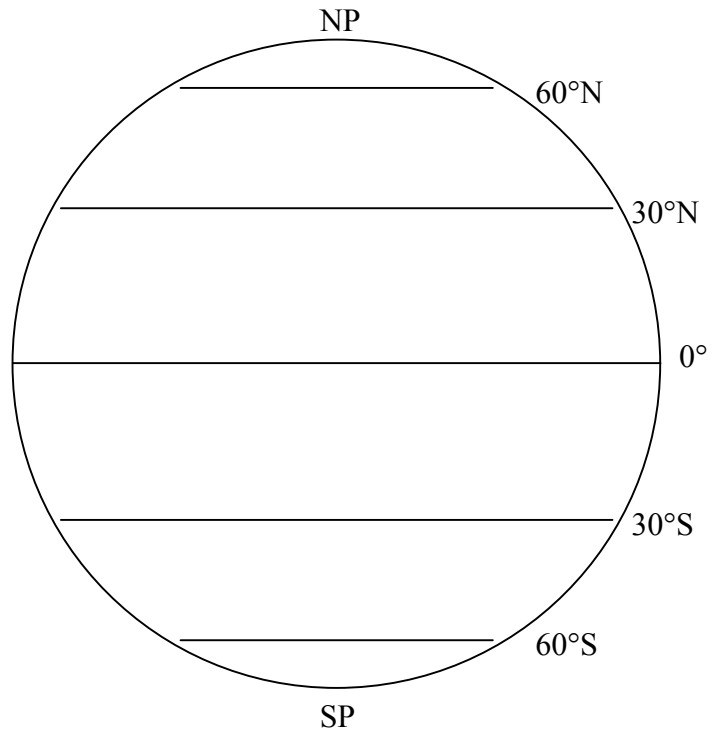
C: _____



4. (4 pts) a) Identify the clouds over the Earth & Ocean Science main building at the start of this Final Exam.

b) These clouds are often associated with what type of approaching front or other weather system?

5. (10 pts) Suppose the earth spins in the opposite direction, but with the same magnitude of angular velocity as now. Sketch the in the diagram at right the near-surface winds and pressure centers that you would expect in the global circulation (neglect continent-ocean contrasts). (Hint, first make a rough sketch on scratch paper, before you neatly copy your results to the figure at right.)



6. (6 pts) If the average air temperature in the N. Hemisphere near sea level varies smoothly from 23°C at 30° latitude to -2°C at 60° latitude, find the change of geostrophic wind speed with altitude (i.e., find the vertical gradient of geostrophic wind). Assume no other horizontal temperature variations [Hint: some useful Earth Characteristics are in Appendix B of Stull.]

$\Delta U_g / \Delta z =$ _____ (m/s)/km

$\Delta V_g / \Delta z =$ _____ (m/s)/km

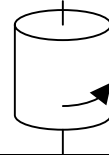
(Show your work below.)

7. (4 pts) Why is the polar jet stream stronger in winter than summer?

(very short answer or outline)

8. (10 pts) If the earth were shaped like a cylinder as sketched, with rotation about the axis as drawn, would there be Rossby waves in a polar jet stream ? [**Yes** / **No** (circle one)]

[Hint, do not consider the end disks near the N. and S. Poles.]



Justify your answer, and state any assumptions:

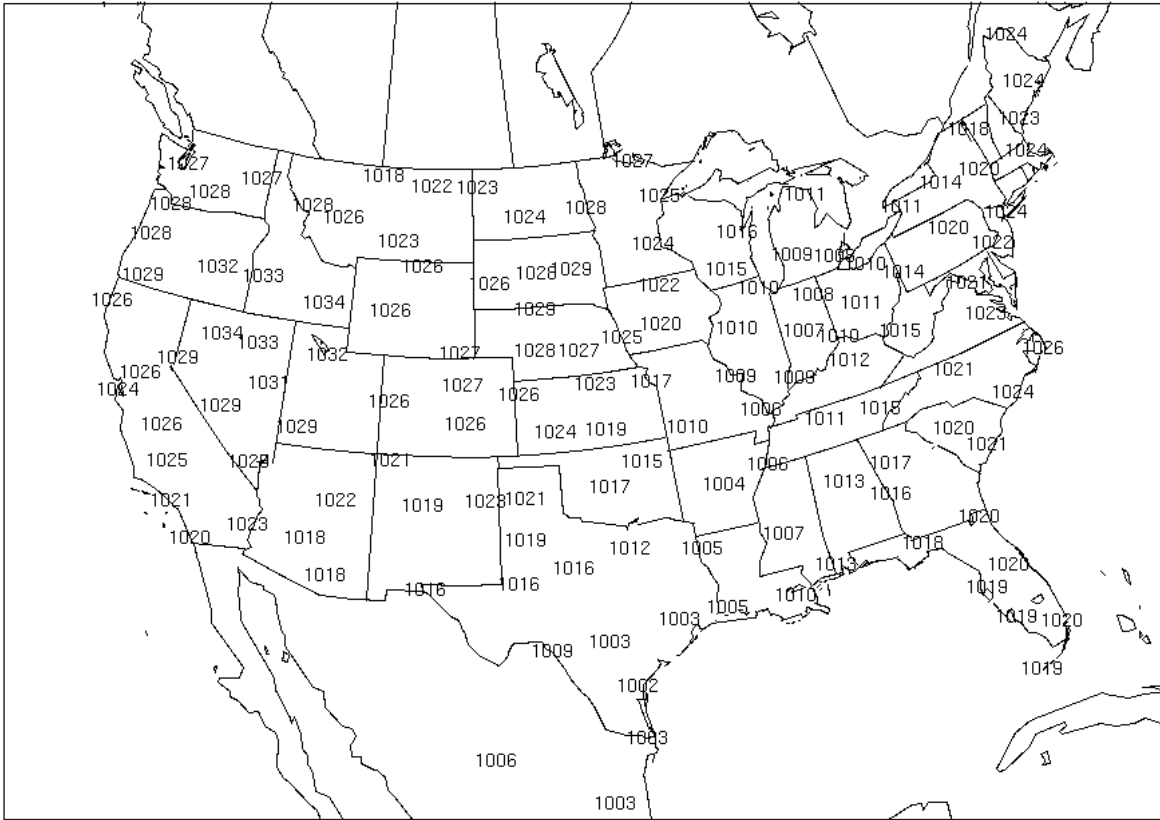
9. a) (10 pts) On the attached weather map, draw isobars every 0.4 kPa. Such as for $P = 100.4$, 100.8 , 101.2 , 101.6 , etc. Also, label any high (H) or low (L) pressure centers.

b) (6 pts) On the attached weather map (showing temperatures and isotherms, for the same weather event as in part a), draw on this map any frontal zones and fronts that are indicated by the weather data (consider the data from part (a) when you do this).

For 9a)

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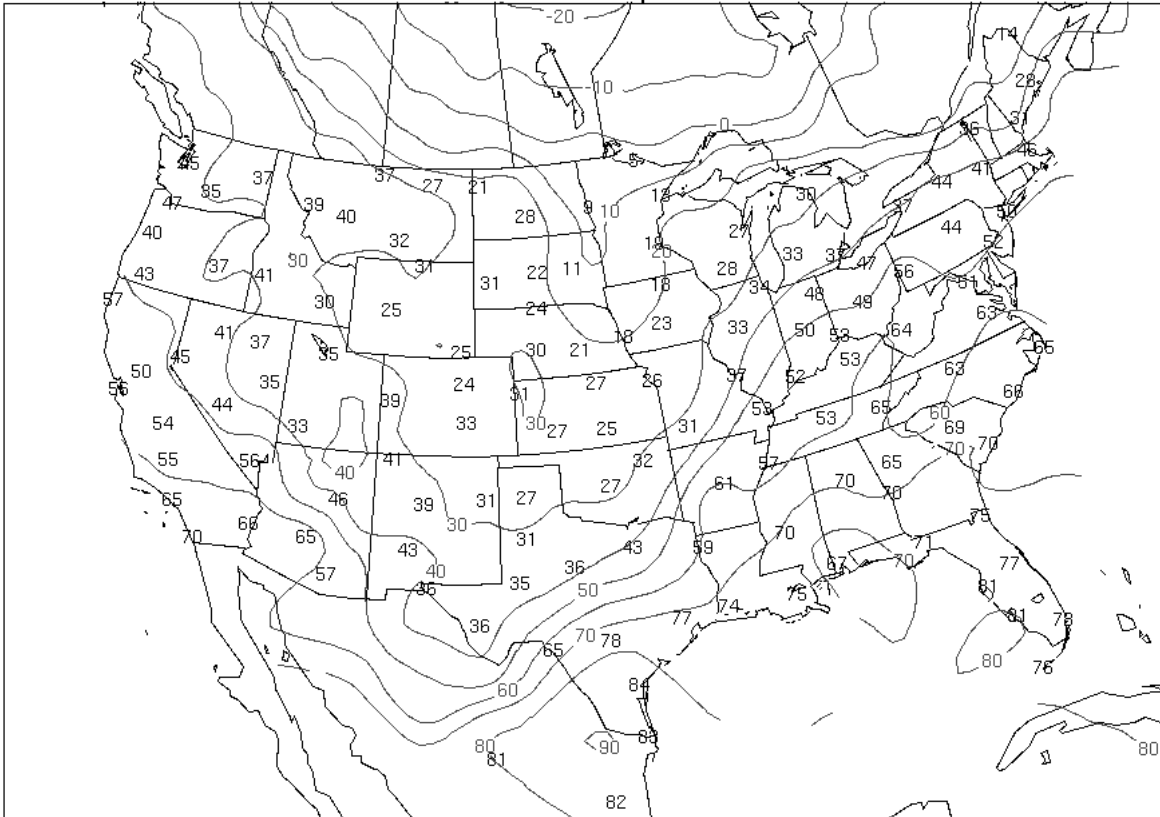
Pressures



NCEP/NWS/NOAA

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Isotherms & Temperatures



NCEP/NWS/NOAA

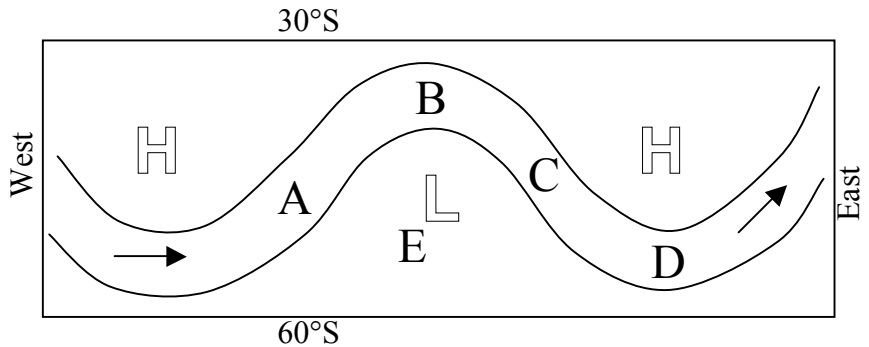
Red - Isotherms (10F)

10) (6 pts) List 3 reasons why thunderstorms are favored along cold fronts.

- (a) _____
- (b) _____
- (c) _____

11) (6 pts) Given the upper-tropospheric (30 kPa) height contours as sketched by the curved lines at right for the Southern Hemisphere mid-latitudes.

- (a) Under which location (A, B, C, D, or E, circle one) would you expect cyclogenesis to occur near the earth's surface?
- (b) Why?



(very short answer or outline)

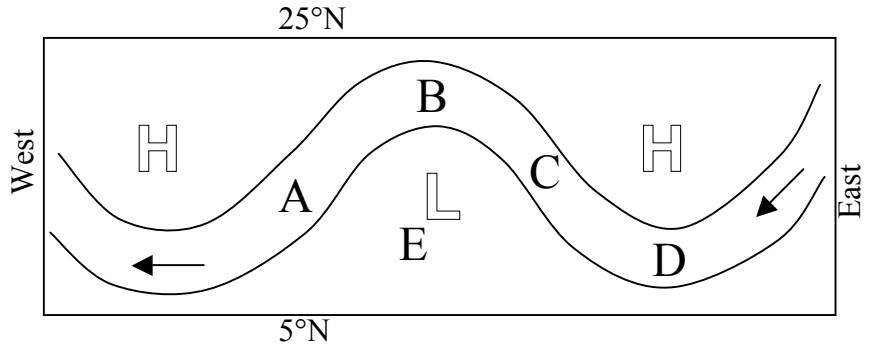
12) (5 pts) If the coast mountains in southwest British Columbia did not exist, how would the rain shadow over the Georgia Strait change, if at all? Why? [Hint: Consider the figure in the right column of Stull Chapter 14, page 48.]

(very short answer or outline)

13) (6 pts) Suppose a category 5 hurricane in the Northern hemisphere crosses the equator. What happens to the hurricane as it enters the Southern Hemisphere? Why?

(very short answer or outline)

14) (6 pts) Given the lower-tropospheric (1 km altitude) wind streamlines in the Northern Hemisphere low latitudes as sketched at right, such as might be found over the tropical N. Atlantic ocean.



(a) Which location (A, B, C, D, or E, circle one) is a favored location for the triggering of thunderstorms that develop into hurricanes?

(b) Why?

(very short answer or outline)

15) (6 pts) Compare and contrast the characteristics and formation processes of Lows (mid-latitude cyclones) that form east of the Rocky Mountains over Colorado, and Lows (mid-latitude cyclones) called Alberta Clippers that form east of the Canadian Rocky Mountains over Alberta.

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| <p>Similarities:</p> | <p>Differences:</p> |
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