

ATSC 201
Prof. Stull
Fall 2009

Final Exam
(open book)
(100 points)

Name: _____

Student Number: _____

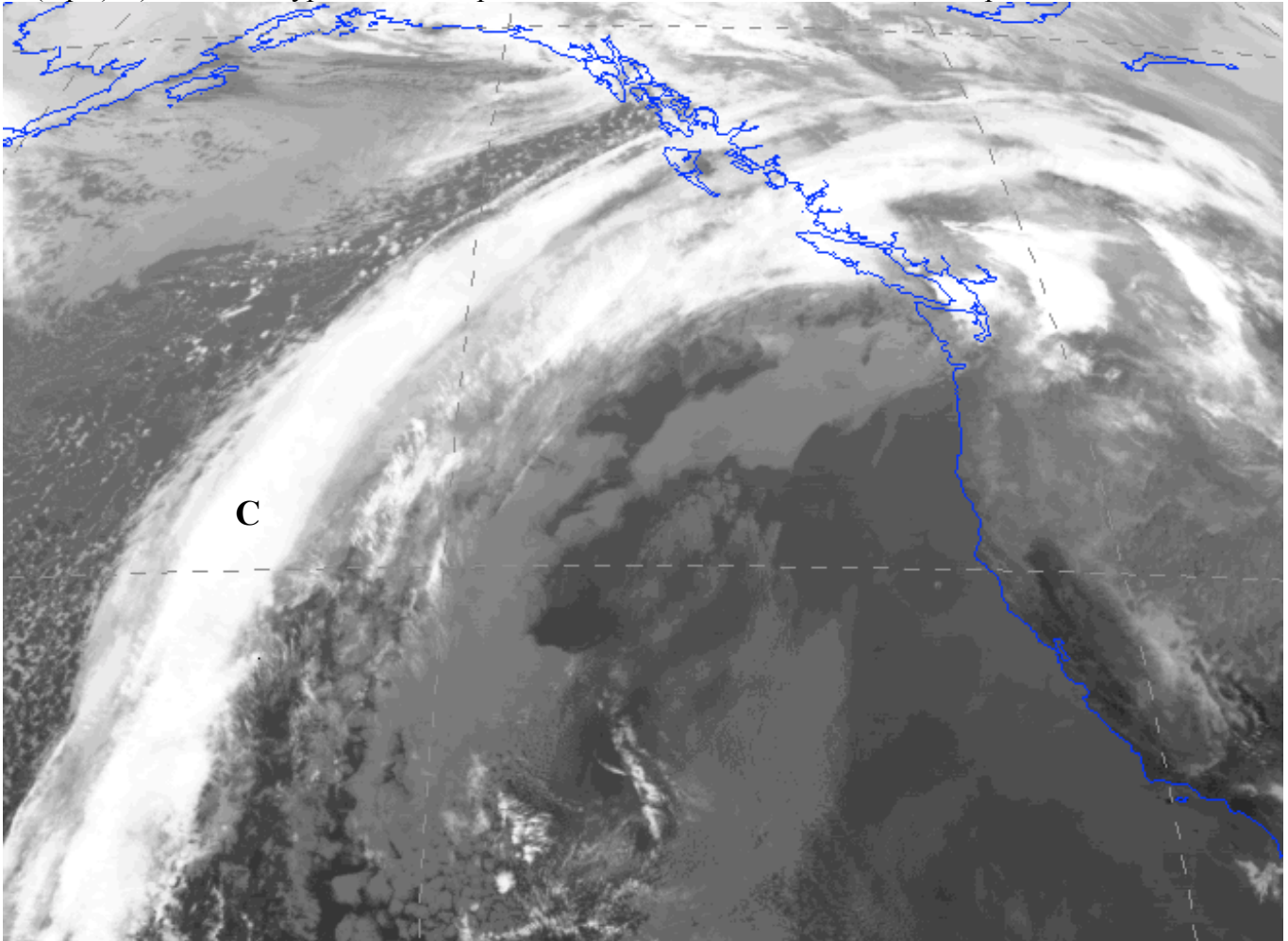
1. (2 points) The name of the clouds over UBC today at the start of this exam were _____

2. (5 pts) Given: Pressure is falling. Southeast winds. Overcast altostratus clouds. N. Hemisphere.

a) Briefly describe the likely synoptic patterns that are over or approaching this location.

b) Your local forecast for the next 12 hours:

3. (3 pts) a) Circle the type of satellite photo: visible IR Water Vapour



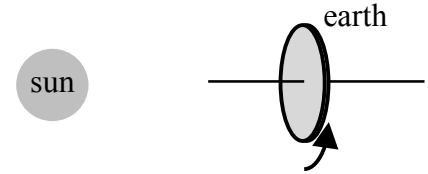
b) Draw on this photo any fronts that might exist.

c) At location C in the photo above, assume that all 3 satellite images (visible, IR, water vapour) show bright white. You interpret the cloud type at location C to be:

4. (2 pts) A satellite measures a radiance of $10^{-25} \text{ W} \cdot \text{m}^{-2} \cdot \mu\text{m}^{-1} \cdot \text{sr}^{-1}$ at wavelength $2 \mu\text{m}$. The brightness temperature is: _____ K.

Name: _____

5. Suppose the earth was shaped like a disk, with its rotational axis always pointed toward the sun. For the sunny side of the disk, describe the general circulation, and explain what processes drive it. Assume there is an atmosphere similar to our real atmosphere.



(13 pts)

(Key points. Be brief.)

6. For Rossby waves: (6 pts)

What are they? (Be brief.)

Where do you find them? (Be brief.)

Why are they important for cyclogenesis? (Be brief.)

7. (20 pts) Suppose a horizontal temperature gradient of $\Delta T/\Delta y = -20^\circ\text{C}/1000 \text{ km}$ exists throughout the depth of a 10 km thick troposphere.

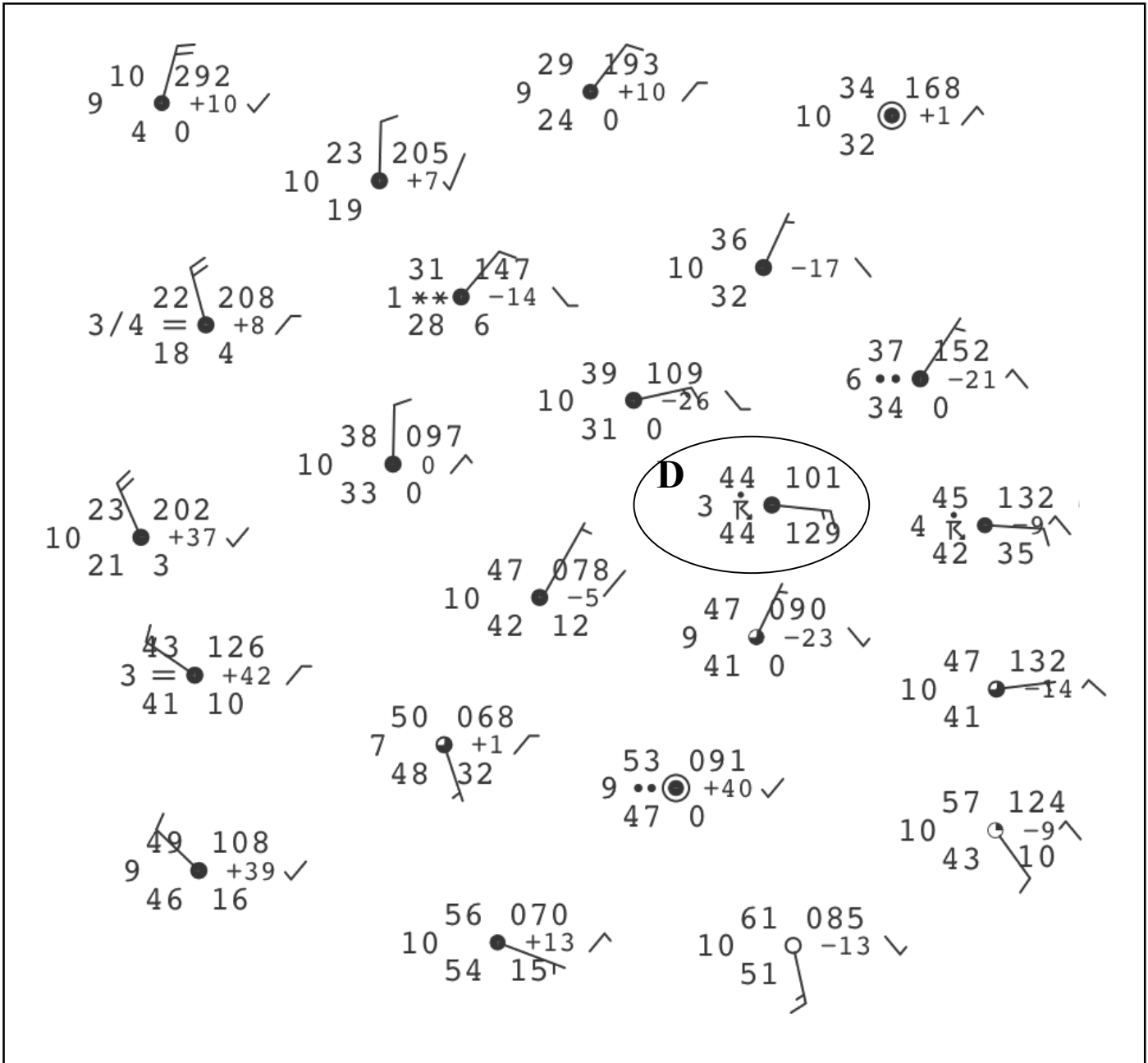
Find the geostrophic wind speed _____ (m/s) and direction _____ at the top of the troposphere. Assume: 50°N latitude, average $T_v = 0^\circ\text{C}$, and geostrophic wind = 0 at the ground.

(show your calculations)

Name: _____

- 8. a.(8 pts) Using one colour ink or pencil, draw the isotherms every 5°F. (e.g., 10, 15, 20, 25, etc.)
- b. (8 pts) Using another colour, draw isobars every 0.5 kPa. (e.g., 102.5, 102.0, 101.5, 101.0, etc.)
- c. (4 pts) Find any frontal zones and label the fronts, if any.
- d. (2 pts) At location D (circled), the current weather is _____

the cloud coverage is _____ and the wind direction and speed is _____ kts .



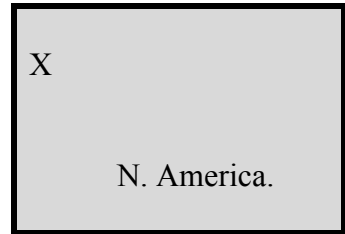
9. (3 Pts)

Suppose that on Planet X the jet stream still has Rossby waves, but that the wind is slower than geostrophic around ridges and faster around troughs. Draw a Rossby wave in the box at right, and write the letter "L" where cyclogenesis is likely.



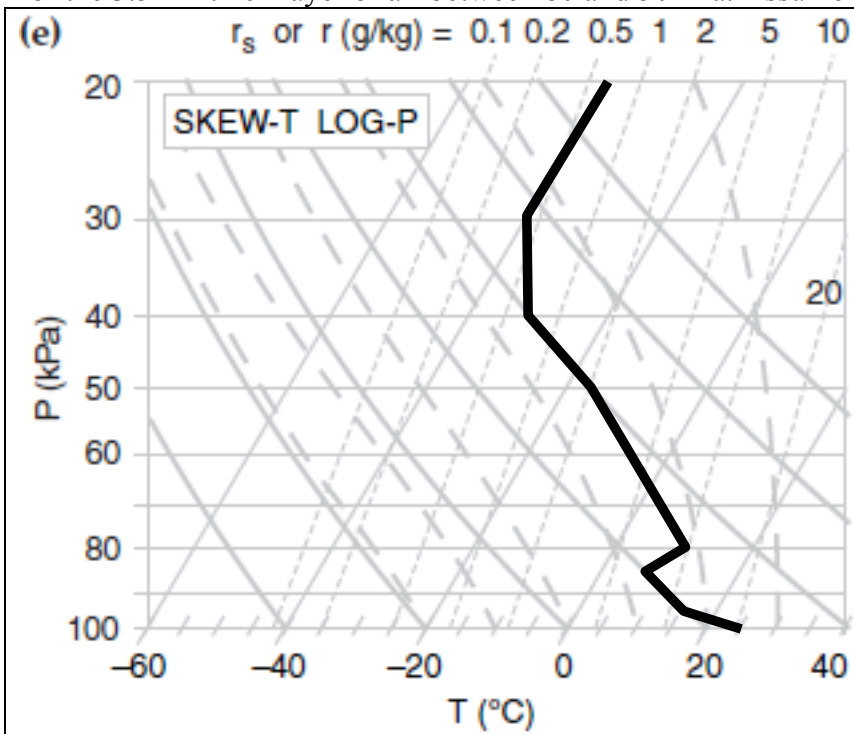
10. (3 pts) Given the sketch at right showing the Pacific Ocean (white) and North America (grey box). Use your knowledge of global circulation to draw a sketch of the likely location for monsoon high (H) and low (L) pressure centers in summer time, and the associated winds. Based on your sketch, show with an arrow the likely wind direction at Vancouver (where the "X" is).

Pacific Ocean



11. Given the temperature sounding below. Assume dry air.

- a. (6 pts) In the box at left, indicate which pressure height ranges are statically stable, neutral, & unstable.
 b. (10 pts) Showing your calculations in the box at right, find the natural wavelength of a mountain wave for the 3.5 km thick layer of air between 80 and 50 kPa. Assume mean wind speed is 20 m/s in that layer.



12. (5 pts) Suppose a strong hurricane in the N. Hemisphere moves over the equator. We know that it will die. Your job is to briefly explain how and why it dies.

13. (3 BONUS pts). For the following phenomena, name the corresponding atmospheric scale of horizontal motion (e.g., planetary, synoptic, mesoscale, microscale):

Phenomenon	Name of scale of motion
tornado	
hurricane	
monsoon circulation	

14. (1 BONUS pt) Survey Q: You prefer the textbook to be looseleaf (as it was this term) or bound (please circle one).