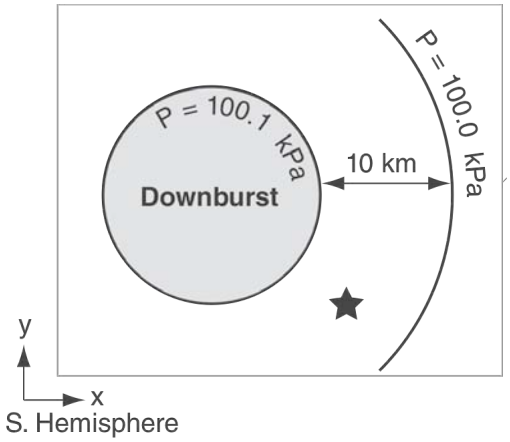
ATSC 201 **Midterm Exam** Name: _____
Prof. Stull (open book)
Fall 2010 (50 points) Student Number: _____

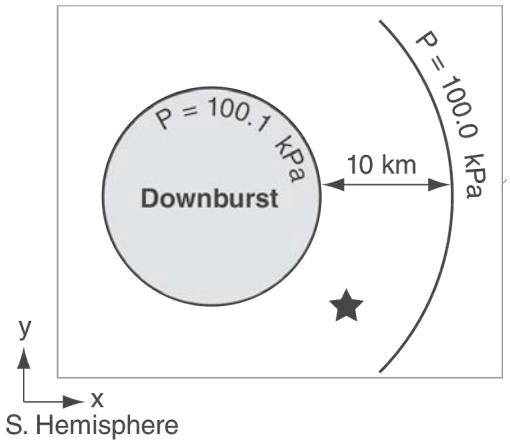
1. Given the downburst in the diagram at right. Assume zero background environmental wind.



a. (2 points) Within the rectangular domain of the grey box at right, sketch the wind vectors that you expect.

b. (2 pts) Qualitatively, describe (1 or 2 sentences) how advection would tend to alter the air temperature at the location of the star.

c. (3 pts) A Doppler radar exists at the star on the diagram. Within the whole rectangular domain of the grey box at right, sketch the shading associated with a Doppler wind display. (If you don't have coloured pens or pencils, then encircle the different colour regions and write in words what colours would be in those portions of the display).



d. (2 pts) Calculate is the magnitude of the pressure gradient (kPa/m) at the location of the star.

Also, in what direction does this pressure gradient point? _____

e. (6 pts) Calculate the theoretical geostrophic-wind magnitude (m/s) at the location of the star. Assume $|f_c| = 10^{-4}\ s^{-1}$ and $\rho = 1\ kg \cdot m^{-3}$.

Also, what is the theoretical geostrophic wind direction at the star? _____

f. (1 pt) If the actual wind speed were equal to the theoretical geostrophic wind speed, what would be the Enhanced Fujita magnitude of a tornado having the same wind speed? _____

g. (2pts) What type of damage would you expect from a tornado of that magnitude (describe as a short list)?

Name: _____

2. Use the attached thermo diagram, which show T and T_d of the environment.

a. (1 pt) What type of diagram is it? _____

b. (4 pts) Follow the movement of an air parcel from the bottom of the sounding. What are the pressure altitudes (kPa) of the

- Lifting condensation level (LCL) _____
- Level of free convection (LFC) _____
- Equilibrium level (EL) _____
- Tropopause _____

c. (1 pt) Shade the CIN region on the attached thermo diagram.

d. (1 pt) List 2 trigger mechanisms that could cause a thunderstorm to form in this environment. _____ , _____

e. (2 pts) For the environmental air at 75 kPa, what is its relative humidity? _____ %

f. (1 pt) For the air parcel rising from the surface, its relative humidity at 75 kPa is _____ %

3. Use the attached hodograph. Assume N. Hemisphere.

a. (2 pts) Circle which storm movement would dominate: [right-moving , normal , left-moving]
Justify (short answer):

b. (4 pts) Graphically estimate the speed _____ (m/s) and direction _____ of movement of the storm from part (a). (show your work on the hodograph)

c. (10 pts) Graphically estimate the 0 - 3 km storm-relative helicity value. (Show your work on hodograph).

SRH = _____ (m^2/s^2).

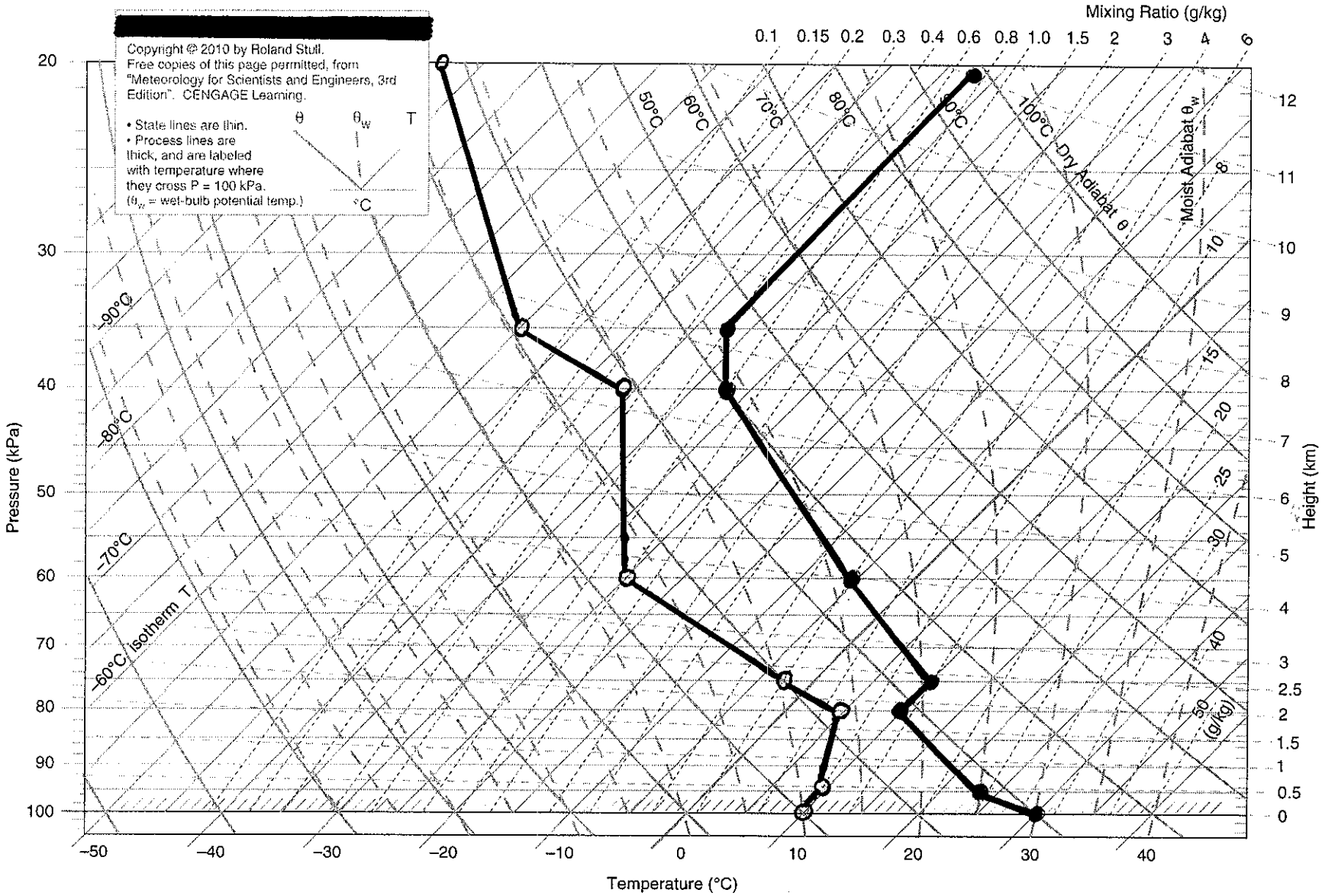
d. (1 pt) Also, why is helicity important (very short answer)?

4. (5 pts) An air column 10 km thick is initially at 60°N latitude with no relative vorticity. If this air moves to 90°N latitude and column thickness changes to 5 km, calculate its new potential vorticity (s^{-1})?

BONUS (Optional) (2 pts) Suppose a thunderstorm formed with negative electrical charges accumulating in the anvil region. What type of lightning would be most hazardous, and why? (very short answer)

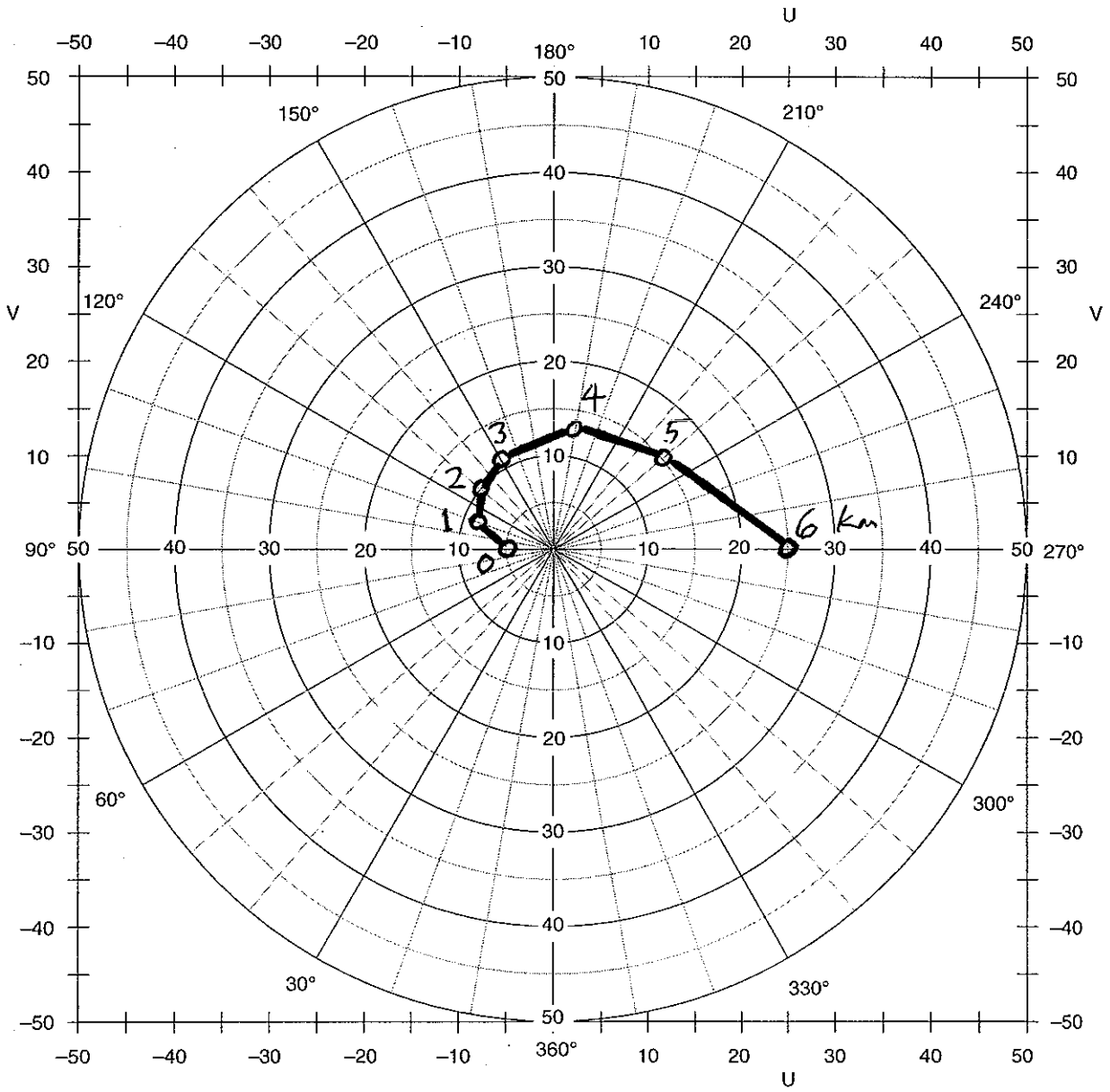
Your Name: _____

Student No. _____



Your Name: _____

Student No. _____



Winds are in m/s.

Figure 16.51
Blank hodograph for you to copy and use. Compass angles are direction winds are from. Speed-circle labels can be changed for different units or larger values, if needed.