

ATSC 201 **Midterm Exam**
 Prof. Stull (open books, notes, calculator)
 Fall 2018 (50 points \approx 1 minute/point)

Name: _____
 Student Number: _____

Use the attached "bubble sheet" to indicate your answers IN PENCIL. Be sure to put your name and student number on all sheets. You will turn in ALL sheets. If you make a mistake and change your answer on the bubble sheet, please thoroughly and cleanly erase the old wrong answer (or else draw an "X" through the wrong answer.

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Write your name on the enclosed thermo diagram, and plot the following environmental sounding on it. Use this sounding for the next 7 questions. Assume the environment is dry.

P (kPa)	T (°C)
20	-40
30	-40
50	-20
65	0
70	0
85	7
100	20

Answer ALL the following questions on the bubble sheet.

- (3 points) The static stability at $P = 90$ kPa is: A) stable B) neutral C) unstable D) unable to determine
- (2 points) The tropopause is at P (kPa) \approx A) 85 B) 70 C) 65 D) 50 E) 30
- (3 points) At $P = 65$ kPa, the potential temperature of the environmental air is θ (°C) \approx
 A) 0 B) 6 C) 16 D) 35 E) 65

Suppose that there is an air parcel near the ground of $(P, T, T_d) = (100 \text{ kPa}, 28^\circ\text{C}, 6^\circ\text{C})$. Plot this air parcel on the thermo diagram. Use this parcel for the next 4 questions.

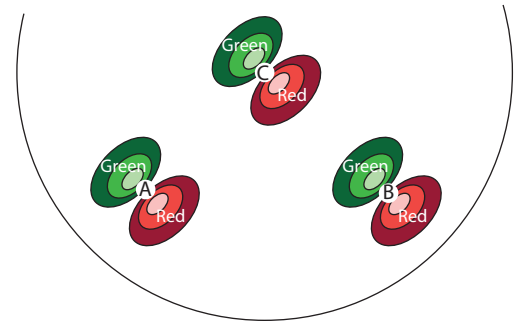
- (2 points) For this air parcel, its mixing ratio r (g/kg) \approx A) 0.15 B) 0.6 C) 6 D) 16 E) 24
- (2 points) For this air parcel, its wet-bulb temperature is T_w (°C) \approx A) 2 B) 6 C) 15 D) 23 E)
- (2 points) The LCL for this air parcel is at P (kPa) \approx A) 73 B) 65 C) 58 D) 50 E) 43
- (2 points) Assume the air parcel and the sounding you already plotted to answer the next few questions. The equilibrium level (EL) for this parcel is at P (kPa) \approx A) 73 B) 65 C) 58 D) 50 E) 43
- (3 points) Suppose that a pre-storm atmospheric sounding indicates that the $\text{CAPE} = 197 \text{ J/kg}$. If a trigger mechanism exists, then the type of thunderstorm that is expected is:
 A) thunderstorm is unlikely B) weak C) moderate D) supercell (without tornado) E) tornadic supercell

9. (4 points) The Coriolis parameter at 30°S latitude is f_c (s^{-1}) \approx
 A) 0.73×10^{-4} B) 1.1×10^{-4} C) 1.46×10^{-4} D) -1.1×10^{-4} E) -0.73×10^{-4}

10. (4 points) At the same location as exercise 11, suppose that at sea level the isobars are oriented east-west, with a spacing $\Delta d = \Delta y$ such that the pressure gradient is $\Delta P / \Delta y = 2 \text{ kPa} / 1000 \text{ km}$. The geostrophic wind $G \approx$
 A) 10 m/s from the east B) 20 m/s from the east C) 30 m/s from the north
 D) 20 m/s from the west E) 10 m/s from the west

11. (3 points) For the Doppler radar image at right, the radar is located at point C. Which statement is correct?

- A) Point A shows a tornado rotating clockwise
- B) Point A shows a tornado rotating counter-clockwise
- C) Point A shows a downburst
- D) Point C shows a downburst
- E) Point B shows a tornado rotating counter-clockwise



12. (4 points) Which statement is correct?

- A) Most of our weather & storms are in the stratosphere.
- B) If the swirl ratio is 0.1, then multiple-vortex tornadoes are likely.
- C) Tornado diameters larger than 1 km correspond to tornadoes of strength EF 3 or greater.
- D) Lightning "side strokes" are survivable because the lightning first passes through a tree.
- E) A line connecting points of equal cloudiness on a weather map is called an isoneph.

13. (4 points) At 30°N latitude a 10 km thick column of air rotates counter-clockwise as a solid body with tangential speed $M = 10 \text{ m/s}$ at a radial distance of $R = 100 \text{ km}$ from the center of rotation. If this column maintains its 10 km thickness as it moves to 10°N latitude, then its relative vorticity will:
 A) increase
 B) stay constant because the thickness is constant
 C) stay constant because it is in solid-body rotation
 D) decrease but retain the same sign
 E) decrease and change sign

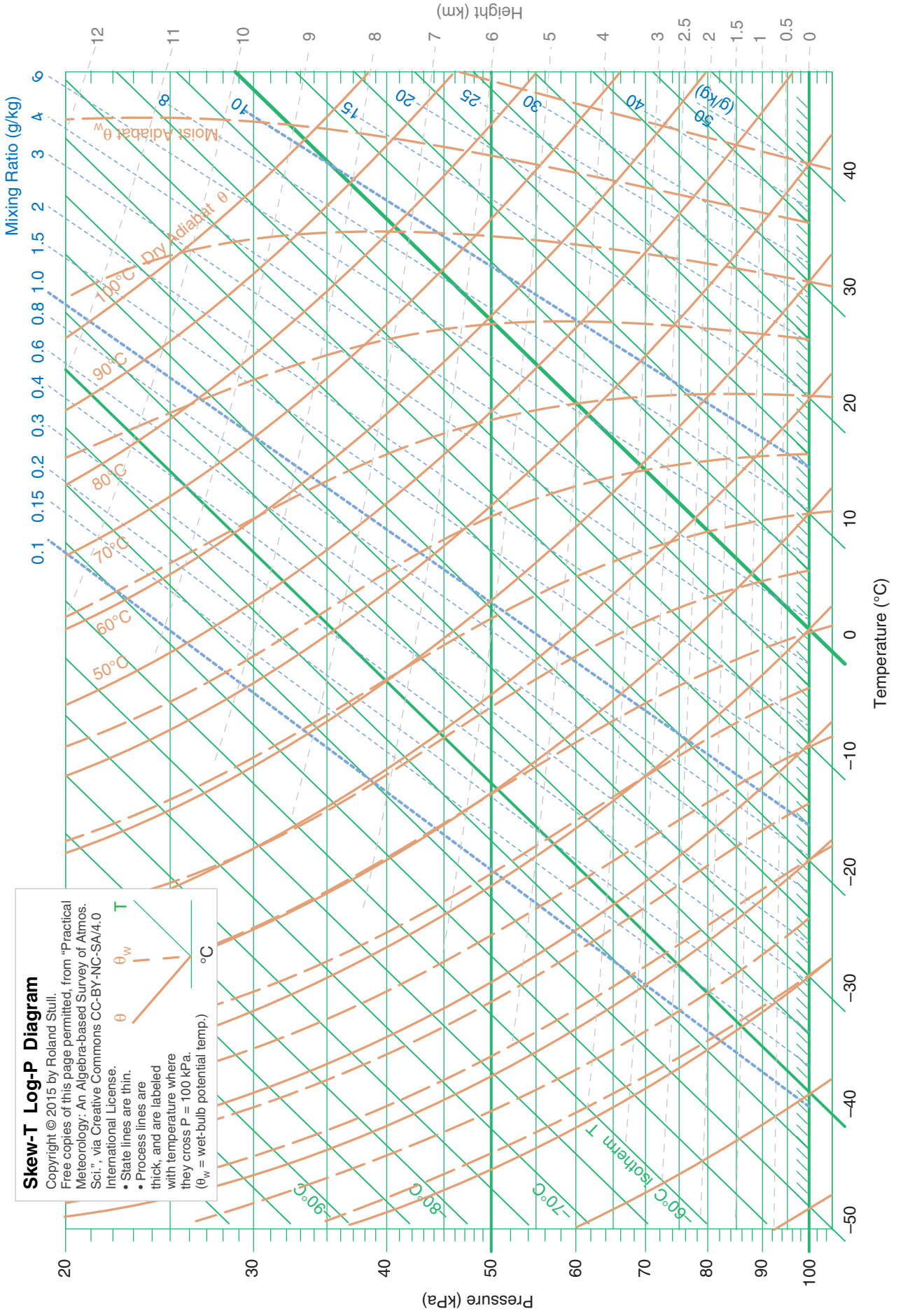
14. (4 points) Air of temperature $T \approx 27^\circ\text{C}$ contains humidity with mixing ratio $r \approx 20 \text{ g/kg}$. Its virtual temperature T_v ($^\circ\text{C}$) \approx A) 3962 B) 356.4 C) 303.8 D) 30.7 E) 27.3

15. (4 points) The (U, V) components of wind are (10, -5) m/s. The corresponding wind direction is
 A) 117° B) 153° C) 270° D) 297° E) 333°

16. (3 points) Suppose that at the bottom of the atmosphere at UBC, $\Delta T / \Delta x = -5 \cdot \text{C} / 100 \text{ km}$ and $\Delta T / \Delta y = -5 \cdot \text{C} / 100 \text{ km}$. If (U, V) = (10, 0) m/s, then the advection term would give ____ at UBC.
 A) decreasing temperature B) steady temperature C) increasing temperature

--end of exam--

Attachments: skew-T and bubble page. (Write your name & SN on ALL pages & submit.)



Skew-T Log-P Diagram
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 Free copies of this page permitted, from "Practical Meteorology: An Algebra-based Survey of Atmos. Sci.," via Creative Commons CC-BY-NC-SA/4.0 International License.
 • State lines are thin.
 • Process lines are thick, and are labeled with temperature where they cross $P = 100$ kPa. (θ_w = wet-bulb potential temp.)

