Department of Earth & Climate Sciences Name_____
San Francisco State University Spring 2018

ERTH 260 Quiz #5

150 pts

Answer in spaces provided or on the rear of the exam.

1. Definitions. (Choose 3 to answer) (4 points each for a total of **12 points** in this section).

(a) downburst --

(b) mesocyclone --

(c) vertical wind shear --

(d) convective temperature –

(e) outflow boundary –

2. Units. Provide the conventional **metric unit** for each (2 pts each for a total of **8 pts**)

Example **Acceleration of gravity** m/s^2 or $m\ s^{-2}$

Vertical Acceleration _____

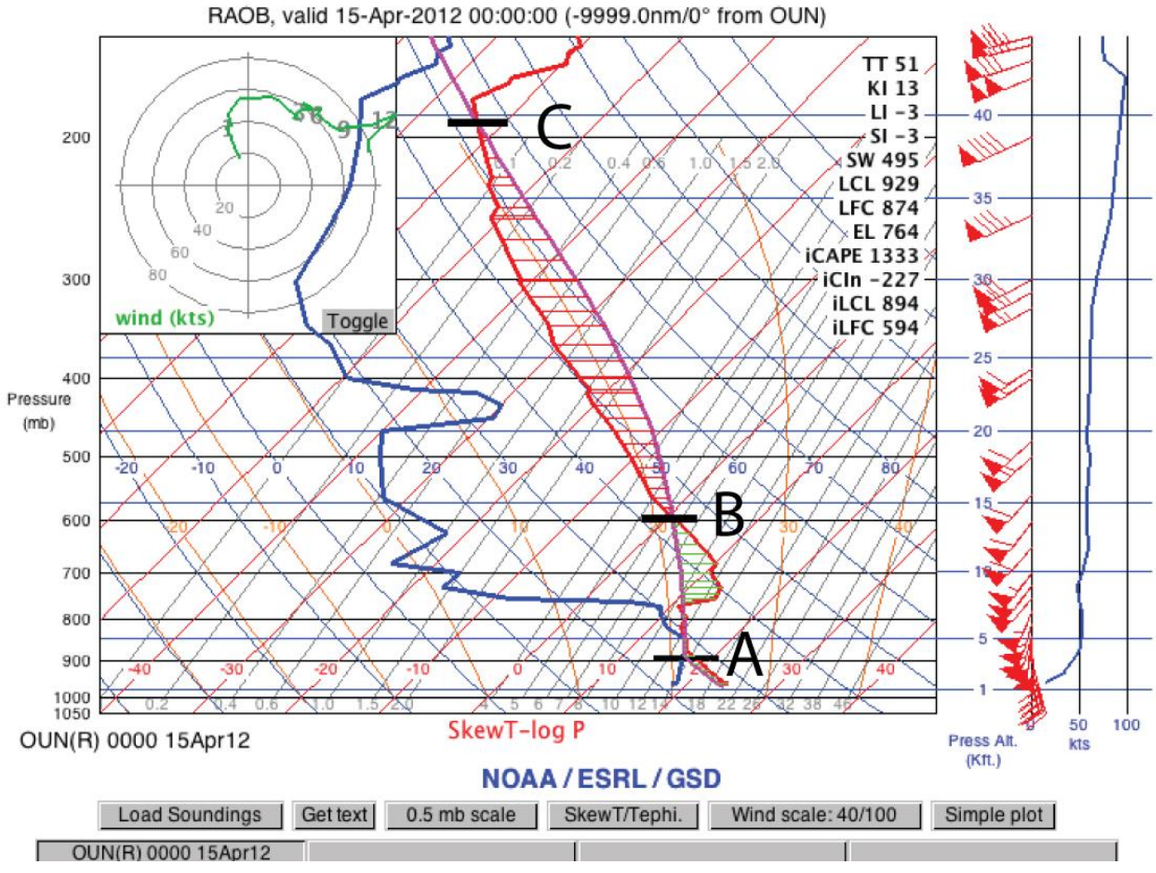
CAPE _____

CIN _____

Heights on an upper air chart _____

3. Sounding Interpretation **(70 pts)**

. A. Figure 1 is the sounding for Oklahoma City at 0000 UTC 15 April 2012. Three levels on the parcel ascent curve are shown. **(24 pts)**



1. Level A on Fig. 3 corresponds to the _____.(5 pts)

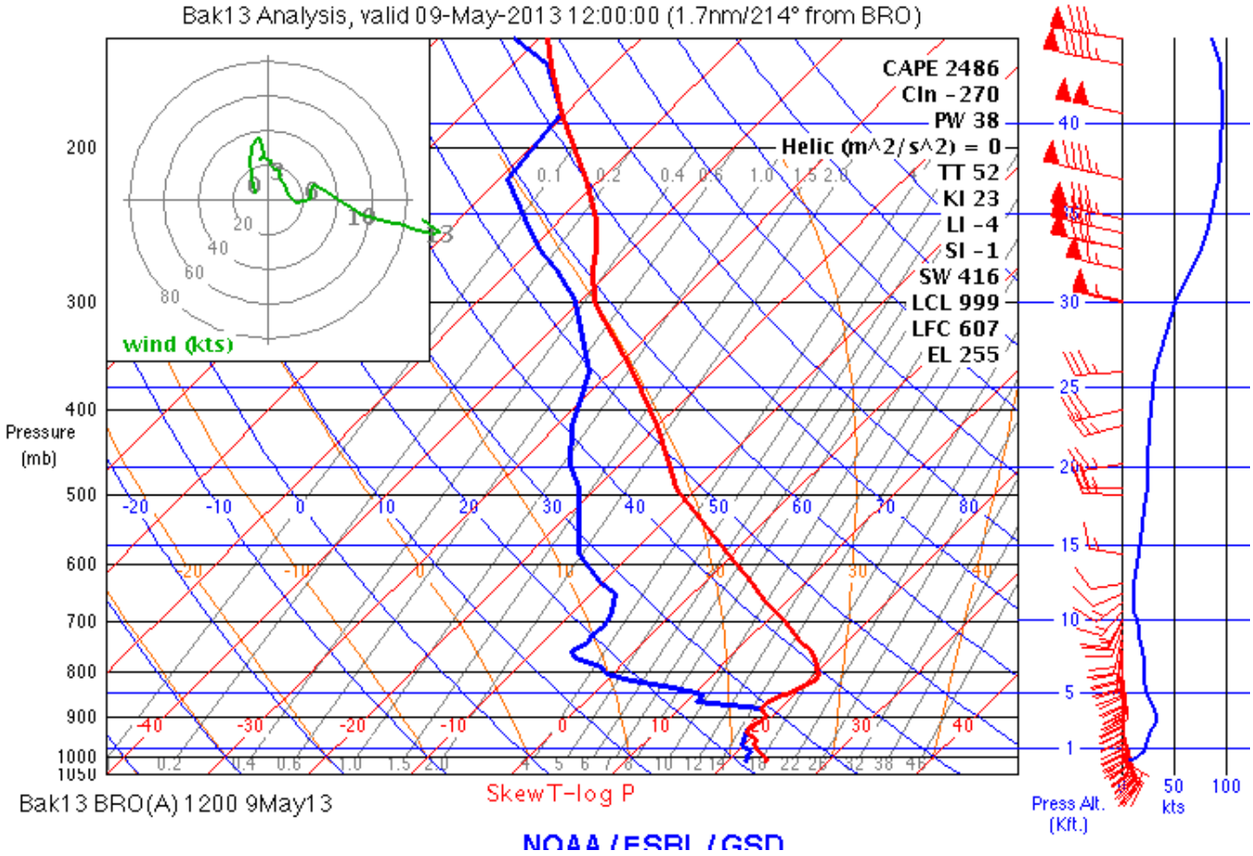
2. Level B on Fig. 3 corresponds to the _____.(5 pts)

3. Level C on Fig. 3 corresponds to the _____.(5 pts)

4. State whether the sounding is (a) absolutely stable; (b) conditionally unstable; or (c) absolutely unstable. (Circle correct choice).(4 pts)

5. Discuss the likelihood of thunderstorms **occurring at the time of the sounding**? (5 pts)

B. Figure 2 is the sounding for Brownsville TX at 12 UTC 9 May 2013. **(30 pts)**



Your task is to transform the sounding to one that estimates conditions for afternoon heating. On this skew-T log p diagram, the saturation mixing ratio lines are dark grey and slope from left (at the bottom) to right (at the top) and are labeled at the bottom in g/kg. (30 pts)

a. Find the Convective Condensation Level, and the Convective Temperature (indicate on the diagram) (10 pts)

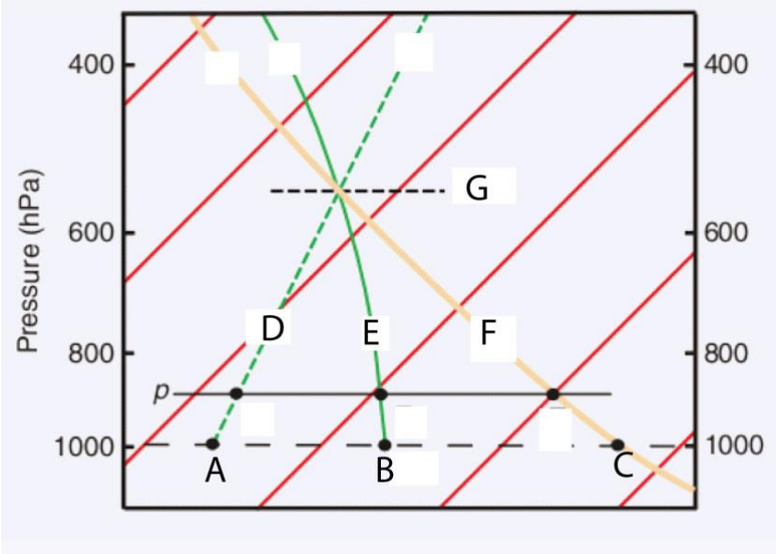
b. Draw the parcel ascent curve that would occur if the afternoon temperature achieves the Convective Temperature. (5 pts)

c. Shade in the CAPE for the ascent curve that results. (5 pts)

d. What is the physical interpretation (concept of) the Convective Temperature? (5 pts)

e. What is one simple way to judge whether the Convective Temperature is "achievable" (not just this one, but any Convective Temperature you get from analyzing any morning sounding)? (5 pts)

C. The diagram below, Fig. 3, is one we used to illustrate Normand's Rule. **(16 pts)**



Assume the surface pressure is shown by the dashed line at 1000 mb. For the given letter on the left, indicate the proper answer or answers from the choices 1 through 8 on the right. More than one choice may occur at the location of a letter and not all the choices need be used. Hint: A, B, and C are temperatures of some sort, D, E, and F are lines of some sort; and G is a level of some sort.

A _____ B _____ C _____ D _____ E _____ F _____ G _____	1. Surface Temperature 2. LCL 3. Isentrope 4. Dry Adiabat 5. Equilibrium Level 6. Wet Adiabat 7. Surface Wet Bulb Temperature 8. Surface Dew Point Temperature 9. Isohume 10. LFC 11. Saturation Vapor Pressure 12. Sea surface Temperature 13. Tropopause

4. Calculations**. (10 pts each for a total of 40 pts)**

   1. The CAPE for the sounding given in Fig. 1 is 1333 m^2s^{-2}. Calculate the value of the maximum convective vertical motion at the EL for this sounding (5 pts)? (Show all steps).

   2. What is the physical interpretation of $\Delta u/\Delta z$?

   3. What is the expression (as in $\Delta u/\Delta z$ above) for the variation of the horizontal wind along a streamline in natural coordinates?

4. The temperature change experienced by a vertically moving saturated air parcel is given by

$$\frac{\Delta T}{\Delta t} = w\Gamma_m$$

where Γ_m , the moist adiabatic lapse rate, is -0.6^{0}C/100 m. Updraft strength in severe thunderstorms in the mid troposphere is around 30 m s^{-1}. What is the cooling rate (**in units of degrees C/minute**) for such air parcels. (Show all steps).

5. Supercell Radar Features **(20 pts)**

A. Fig. 3 is the ½ degree radar reflectivity plot for Tulsa, OK for 2026 UTC 16 April 2012 Note the locations indicated by A, B, C, and D. **(20 points).**

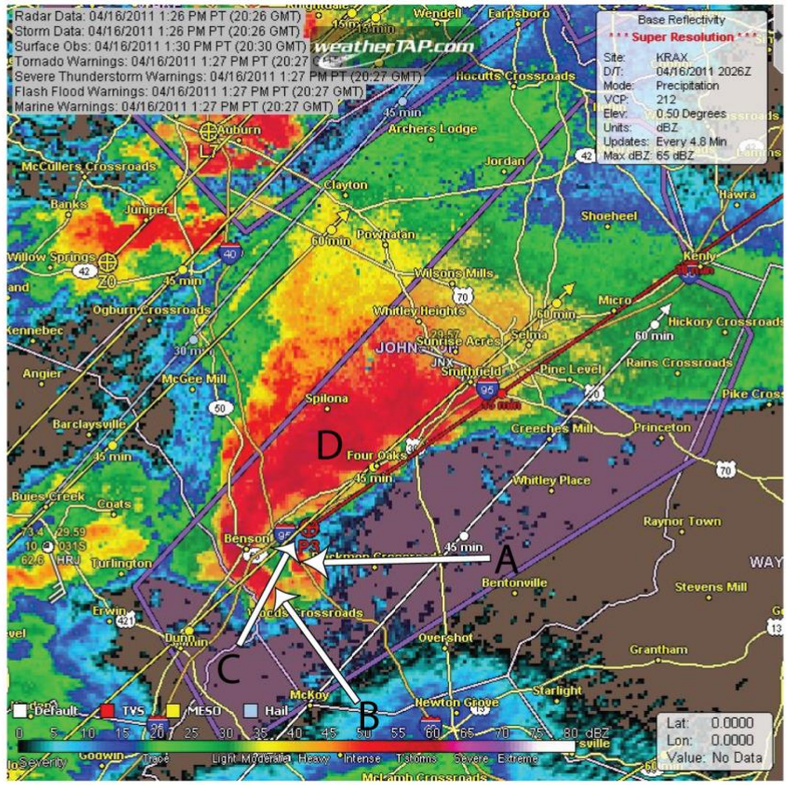


Figure 4: ½ deg reflectivity plot from Tulsa Oklahoma, 2026 UTC 16 April 2012

1. Which letter indicates a possible debris ball? _____. (5 pts)
2. The precipitation-free area to the left of the tornado and to the right of the largest hail is known as _____. (5 pts)
3. Which letter indicates the area referred to in (2)? _____(5 pts)
4. Which letter refers to the forward flank rain area?
   _____ (5 points)