A. Short Answer and Definitions. (3 points each for a total of 18 points in this section).

(a) The height of a column or slab of the atmosphere between two isobaric levels (say, 1000 mb and 500 mb) is known as the ______thick______ness of the air column or slab.

(b) infrared (or atmospheric) window – the _portion of the absorption spectra of water vapor and carbon dioxide through which long wave (infrared) terrestrial radiation is allowed free passage to space._

(c) The temperature change experienced by a lofting air parcel in which no condensation is occurring is called the ______dry adiabatic lapse rate______.

(d) absorption -- the _process by which molecules take in all or a portion of the incident radiation and convert it to internal energy._

(e) An area of low atmospheric pressure not completely encircled by at least one isobar is known as a ___trough________.

(f) dry line --- _the boundary between warm dry air and warm moist air that is usually found in advancing wave cyclones in the western Great Plains._
Examine the meteogram for Sacramento CA given in Fig. 1. We discussed this meteogram in class on Wednesday 18 March 2015. Explain in a series of complete sentences why the maximum temperature occurred near sunset, while the maximum incoming solar radiation always occurs at around local noon.

**Temperatures will continue to rise as long as incoming radiation exceeds outgoing radiation.** Even though the maximum amount of energy from the sun usually is incoming at local noon time, the temperature will continue to rise until late afternoon because the amount of incoming radiation exceeds outgoing radiation. Usually, outgoing radiation exceeds incoming radiation shortly before sunset. Hence, temperatures will stop rising at that time and begin decreasing.
C. First Law of Thermodynamics (20 points in this section). The First Law of Thermodynamics, as we discussed it in class, is written out below.

\[
\frac{\Delta T}{\Delta t} = \frac{1}{c_p} \frac{\Delta q}{\Delta t} + \frac{1}{c_p \rho} \frac{\Delta p}{\Delta t}
\]

Term 1 \hspace{1cm} Term 2 \hspace{1cm} Term 3

1. Term 2 is known as the \textbf{diabatic} term. (10 points)

2. Term 3 is known as the \textbf{adiabatic} term. (10 points)

D. Short Essay. (Answer below or in complete sentences, with subject, verb and object in each sentence, please. (37 points in this section)

Figure 2 is the surface weather map for 2143 9 April 2013. Note the two stations at A and B with a temperature of 77F.

Figure 3 is a thermodynamic diagram at the same time upon which the soundings of two stations, one west and one east of the dry line are shown, but for a slightly earlier time. The red and blue lines represent the environmental lapse rate (solid) and dew point lapse rate (dashed) on either side of the dry line.

Explain why the blue curves represent the sounding taken at Station A and the red curves represent the sounding taken at Station B. In discussing this, make sure you mention how the wind, temperature, dew point and mixing ratio information is consistent with the definition of the dry line. The answer here does not need to be long.

The sounding colored blue shows a large difference between the temperature and the dew point temperature near the surface. In addition, the dew point temperature at the surface is very low. If the dry line is as is shown in Fig. 2, then this sounding must be behind (west of) the dry line. The wind direction plotted on the right is and shown on the surface weather map is also southwesterly. Station B has a much higher dew point and southeast winds at the surface. Hence, Station B must be east of the dry line and the sounding corresponding to Station B must be the one colored red on Fig. 3.
Figure 2: Surface weather map for 2143 UTC 9 April 2013
Figure 3: Soundings for two stations on either side of the dry line on April 9, 2013, 12 UTC.