Instructions: Please read each question carefully and begin the answer to each question on a new sheet of paper.

FOR ALL PROBLEMS, YOU ARE TO STRICTLY FOLLOW THE PROBLEM-SOLVING METHODOLOGY DESCRIBED IN THE EARLIER HANDOUT – STEP BY STEP.

1. The vertical pressure gradient force per unit mass beneath an intense wall cloud is 1.0 m s\(^{-2}\). How long (in seconds) will it take an air parcel, starting at the ground and moving vertically, to attain an updraft speed of 40 m/s?

2. Suppose an air parcel, starting at a speed of 30 m/s at Oklahoma City, comes to rest by the time it reaches Amarillo, Texas, which is 400 km away. If the parcel takes an hour and a half to travel from Oklahoma City to Amarillo, and if the pressure is 1000 mb at Oklahoma City, find the pressure (in millibars) at Amarillo. Assume that the air density is 1 kg/m\(^3\). CAUTION!!! Be sure to think about the sign of the parcel's speed in light of the direction that it's moving. Remember that the positive x coordinate is directed toward the east and the negative x coordinate is directed toward the west.

3. Consider two air parcels, A and B, that mix together as shown in class. Parcel A has the following characteristics: \(T = 12\) C, \(T_d = 8\) C, mass = 1.5 kg. Parcel B has the following characteristics: \(T = -8\) C, \(T_d = -25\) C, mass = 15 kg. If these two unsaturated parcels mix, at constant pressure (1000 mb), will the resulting mixture be saturated?

4. If the pressure increases by 10 mb to the east across a distance of 500 km, what is the geostrophic wind speed given a density of 1 kg/m\(^3\), assuming a latitude of 70 degrees north?

5. What pressure deficit in the core of a tornado (i.e., pressure change from the ambient environment to the center) would be expected if the speed of the winds blowing around the tornado is 100 m/s? Assume a density of 1 kg/m\(^3\) and neglect the effects of friction.