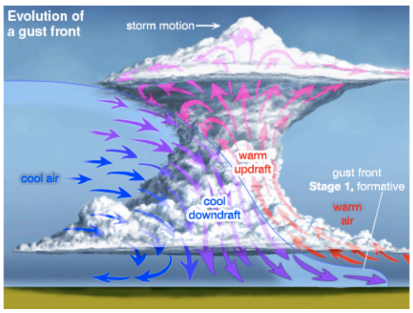
Homework–Module 4 **Name:** Key

1) We learned in Module 3 that adiabatic compression always works to warm sinking air. Yet the thunderstorm downdraft beneath the base of the cloud is usually much colder than the air surrounding it. Explain the apparent paradox using concepts in Chapter 11 of H&P and material in Module 3.

   There is a 600-character limit for all questions.



   Schematic of the cool downdraft in a severe thunderstorm. Figure Credit: Encyclopedia Briannica.[1]

Thought process:

The cooling effect of evaporation of falling raindrops exceeds the warming from adiabatic compr
ession. Hence, evaporation can produce a cold downdraft.

[1] https://media1.britannica.com/eb-media/32/24032-004-75D4F911.jpg

2) Describe four meteorological factors that frequently occur together during summer and early fall over the Los Angeles Basin that set the stage from a major buildup of photochemical smog, being certain to explain how each factor would contribute to a buildup. You can neglect seasonal differences in the input of primary pollutants that are the ultimate cause of photochemical smog.

Los Angeles Basin shrouded by smog.
Photo: Robert S. Donovan

The four, primary meteorological factors are:

Sunny, dry climate - Sun is essential to photochemical smog.
Warm/hot temperatures -
The rate of photochemical reactions maximizes creation of ozone with warm daytime temperatures.
Persistent inversion - Traps pollutants near the surface.
Weak winds - Weak winds prevent dispersion of pollutants.

3) Paleoclimate data reveal that recent ice ages in the northern hemisphere coincide with climate regimes having colder summers in high latitudes. Explain why periods of glacial advance in the higher latitudes of the Northern Hemisphere tend to occur with colder summers, but not necessarily with colder winters.

Glacial maximum 15,000 years ago

Thought process:

Colder summers would reduce the melting of snow and ice.

Colder winters would have lower snowfall totals since the saturation vapor pressure would be smaller. In fact, warmer winters would produce more intense snow storms.