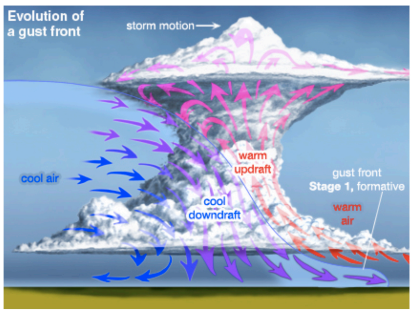
Homework–Module 4 **Name:** Key

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:
=> Entrainment of air outside into the cloud
=> Evaporation of cloud droplets
=> Evaporative cooling initiates a cool downdraft in the cloud
=> Falling hydrometeors (raindrops) in the downdraft below cloud base evaporate
=> Evaporative cooling of raindrops in rainshaft counters adiabatic warming

[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

Thought process:
Summer and early fall weather in Southern California is marked by persistent
=> Sunny skies
=> Warm afternoon temperatures that promotes development of photochemical smog
=> Modest wind speeds with a persistence PM sea breeze that impedes horizontal transport
=> Strong inversion from the combination of subsidence from the Pacific High and cool sea breeze that limits vertical dispersion

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:
=> Warmer winter temperatures that remain below freezing
=> Higher saturation vapor pressure than colder winters
=> More snowfall potential
=> More ice build up and glacial advance