Lecture 7

Homework Due Friday, September 29, 2006

Microphysics Problem set (at the end of the lecture 6)

Homework due Friday, October 6, 2006

TYU Ch 5: 1,2,5,7,11,14,17,18,20; TYPSS Ch 5: 2
TYU Ch 6: 1,5,10,11,13,14,15,18,20; TYPSS Ch 6: 1
TYU Ch 7: 1,2,6,7,12,14,15,18,20; TYPSS Ch 7: 2
What does “stability” mean?
“Air Parcel”

- Number of molecules remains constant
- Expands as it rises
- Pressure equilibrates with surroundings
- Density may or may not equal surroundings
  - Depends on temperature
  - Larger temperature than environment will make molecules move faster and the pressure higher
  - higher pressure will make parcel volume expand more, lowering density relative to the environment
Lapse Rate

- Lapse rate is the rate at which temperature decreases with height.
For stability we compare parcel lapse rate to environmental lapse rate.

**Environmental Lapse Rate**

- **Diagram A:**
  - **Height (km):** 1.0, 0.5
  - **Temperature (°C):** 10, 15, 20, 25, 30
  - **Equation:** Environmental Lapse Rate = \( \frac{15 \, ^\circ C}{1 \, \text{km}} \)

- **Diagram B:**
  - **Height (km):** 1.0, 0.5
  - **Temperature (°C):** 10, 15, 20, 25, 30
  - **Equation:** Environmental Lapse Rate = \( \frac{5 \, ^\circ C}{1 \, \text{km}} \)

©2005 Kendall/Hunt Publishing
Stability depends on a parcel’s lapse rate compared to environmental lapse rate.
Conditional Instability

Height (km)

Temperature (°C)

ELR = 8°C/km

Dry adiabatic lapse rate

Moist adiabatic lapse rate

©2005 Kendall/Hunt Publishing
Stuve Diagram

• Compare parcel to environment
LCL and LFC

- **Height (km)**
- **Temperature (°C)**

- **Environment**
- **Moist adiabatic lapse rate (6°C/km in lower troposphere)**
- **Dry adiabatic lapse rate (10°C/km)**
- **Level of free convection**
- **Lifting condensation level air cools sufficiently so that cloud forms**

©2005 Kendall/Hunt Publishing
Mechanisms to lift a parcel to LFC