

ESCI 241 – Meteorology
Answers to Selected Exercises for Lesson 7

1. A dry air parcel has a temperature of 20°C. The environmental lapse rate is 5°C/km. The air parcel is forced to rise over a mountain that is 3 km high.

a. What is the temperature of the air parcel at the top of the mountain?

Answer: –10°C

b. What is the temperature of the environment at the top of the mountain?

Answer: 5°C

c. What is the buoyant acceleration of the air parcel?

Answer: –0.53 m/s² (don't forget to convert temperatures to Kelvin)

d. Is the atmosphere stable or unstable?

Answer: stable

2. A moist air parcel has a temperature of 20°C, and is forced to rise over the same mountain as in problem 1. If it reaches saturation while it is ascending, will it be warmer or colder than the dry air parcel when it reaches the top of the mountain?

Answer: warmer

3. The dry and moist air parcels from problems 1 and 2 now are forced to descend the other side of the mountain. They both descend dry adiabatically. Will their temperatures be the same once they reach the bottom? If not, which one will be warmer?

Answer: The one that was saturated will still be warmer.

4. For the following data, find the potential temperature at the two altitudes. Is the atmosphere stable or unstable?

Altitude (m)	Pressure (mb)	Temp (°C)	θ (K)
1480	850	7	293
5700	500	-15	314

Answer: Stable, because θ is increasing with height.