Homework–Module 3 **Name:** Key

1) "Drier with a chance of pouring rain" is the long-range outlook for Arizona. Research conducted at the UA[1] suggests that a warmer Arizona climate by the second half of the 21st century will feature fewer precipitating storms, but when they do occur, they would come with an increased risk of flooding. Use the concepts of the module to explain why precipitating systems in a climate that is 2˚C warmer than today would be more intense and hence more likely to produce floods. (Hint: consider the saturation vapor pressure curve of Fig. 4.5 of Ahrens to support your answer.) There is a 600 character limit.

Lake Mead at record low-levels, spring 2016.
Credit: Time.com

Thought process:
- According to Fig. 4.5, SVP increases by approximately 7% for every 1˚C of warming at the average surface temperature of earth (15˚C). So a 2˚C warming would increase the SVP near the surface by about 14% (e.g. from 16.0 mb at 15˚C to 18.2 mb at 17˚C).

- A lower-troposphere that contains more water vapor when saturated would produce heavier precipitation events and potentially more flooding, all other factors being the same when it does precipitate.

2) What changes in the weather conditions near the surface and aloft are needed to transform a stable atmosphere into one prone to produce cumulus clouds and thunderstorms? Consider the impact of changes in both the temperature and the moisture content of the air. For sake of brevity, ignore the impact of moisture changes aloft. There is 600 character limit.

Thought process:
- Warming at the surface or cooling aloft would steepen the lapse rate. With time, the process would transform a stable atmosphere to a conditionally unstable one.

- Moistening of the air near the surface aids thunderstorm formation since air parcels do not have to be lifted as far to become saturated and cool at the smaller moist adiabatic lapse rate.

3) On a calm winter night, the air temperature cooled to the dew point, at which time fog formed and thickened throughout the night. Before the formation of fog, the dew point remained constant. After the fog formed, the dew point began to decrease slowly. Use the concepts of the module to explain why the dew point would decrease once fog forms and thickens. There is a 600 character limit.

Thought process:
- If winds are calm, then only condensation can remove water vapor from the air near the surface.

- A thickening fog would require continuous condensation, which in turn would slowly decrease the water vapor concentration and lower the dew point temperature too.

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[1] Dominguez F. and C.L. Castro, "Climate Projection: Drier with chance of pouring rain." Arizona Daily Star. November 29, 2012.