Vapor Pressure

note that these examples have more than one species (air + liquid)

- Why does a wet sidewalk become dry on a cold day if water boils at 212°F?
  - Air is not saturated
  - Rate of mass transfer is: $\dot{m}'' = k_m\left(P_{H_2O,\infty} - P_{H_2O,surface}\right)$
  - where $\dot{m}''$ is the mass transfer rate per surface area
- Why does a 2-liter bottle of Sprite stay fizzy until you open it for the first time?
  - Gas above liquid is saturated while the cap is on, so CO_2 stays in liquid
  - When cap is removed, the liquid tries to equilibrate with the air, so the CO_2 largely comes out
  - Since the CO_2 concentration in the liquid is small, Henry's law must be used instead of Raoult's law

Vapor Pressure

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- Why is humid air so uncomfortable in the summer?
  - You body produces sweat, which takes energy to evaporate
  - The energy to evaporate your sweat cools your body
  - If the air is almost saturated with water already, your sweat cannot evaporate

$$\dot{m}'' = k_m\left(P_{H_2O,\infty} - P_{H_2O,surface}\right)$$
$$\dot{q}'' = \dot{m}''\Delta\widehat{H}_{vap,H_2O}$$

- Why do swamp coolers work in the desert but not in the swamp?
  - Water does not evaporate as much when the air is almost saturated

$$\dot{m}'' = k_m\left(P_{H_2O,\infty} - P_{H_2O,surface}\right)$$
$$\dot{q}'' = \dot{m}''\Delta\widehat{H}_{vap,H_2O}$$

Vapor Pressure

note that these examples have more than one species (air + liquid)

- Why does a wet finger dry faster when I blow on it?

  $$\dot{m}'' = k_m\left(P_{H_2O,\infty} - P_{H_2O,surface}\right)$$

  – The mass transfer coefficient k_m is proportional to velocity

- What happens to the steam plume from a power plant?
  – Evaporates in regions where the air is not saturated (a function of distance from the tower)

- How do raindrops evaporate before hitting the ground sometimes?
  – The air is not saturated at lower elevations, since the temperature is higher

  $$\dot{m}'' = k_m\left(P_{H_2O,\infty} - P_{H_2O,surface}\right)$$