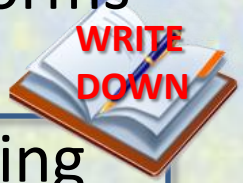
Vapor Pressure

The Nature of Vapor Pressure

- An open glass of water left standing around will eventually evaporate even with out being heated.
  - This is because occasional high energy molecules at the water's surface escape.
- When water evaporates, it changes from a liquid to a gas called water vapor.
- Water vapor takes up more space than an equal mass of liquid water.
- As a result, in a closed container, the vapor that forms can exert a significant amount of pressure.
- The pressure exerted by the gas over an evaporating liquid in a closed container is known as *vapor pressure*.

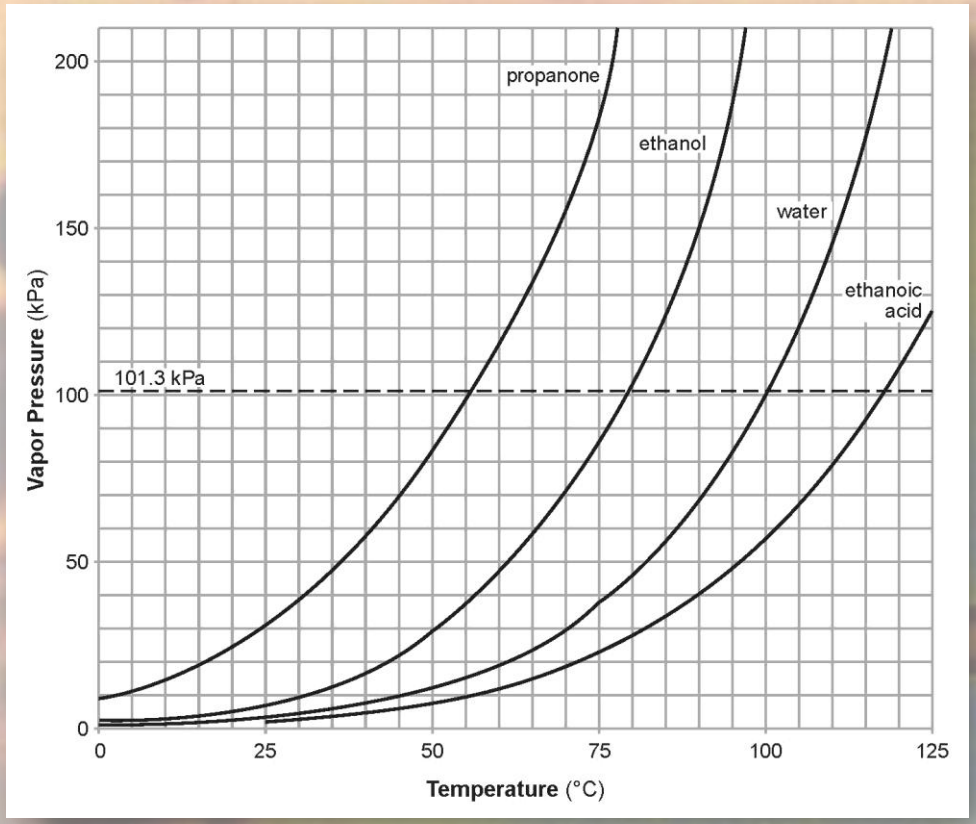


Vapor Pressure in an Open Container

- Even in an open container, the vapor is confined by the air pressing down on it.
- Some of it collects at the surface and exerts pressure.

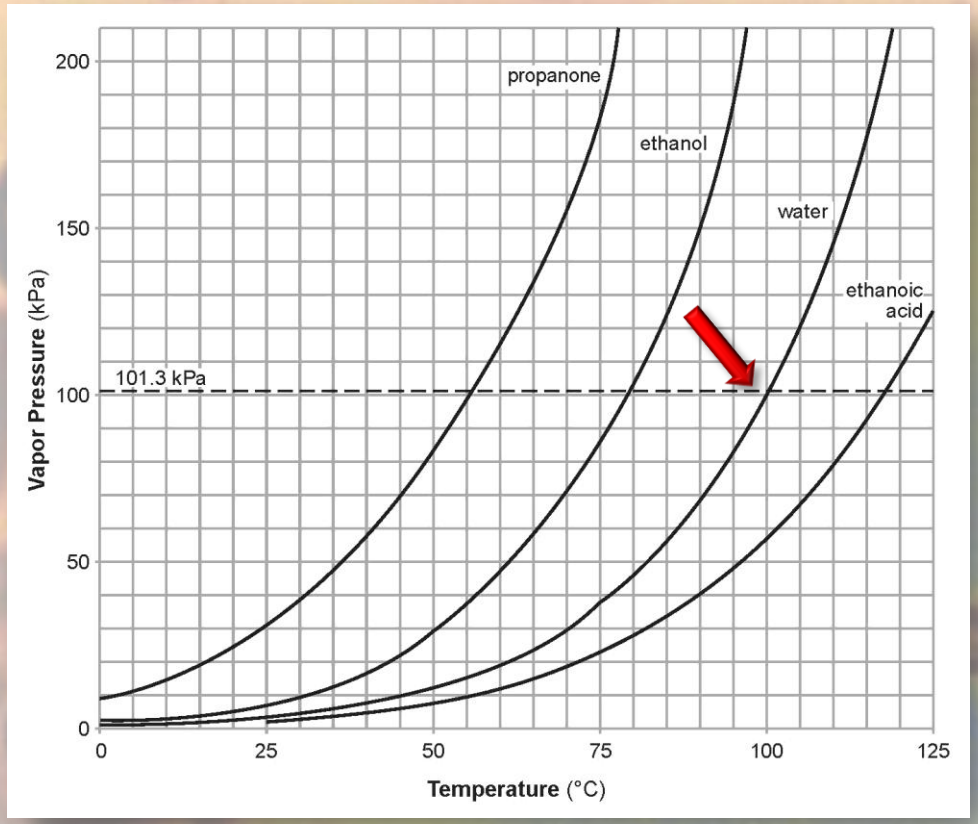
Vapor Pressure and Temperature

- As the temperature increases, so does the rate of evaporation.
- As a result, as the temperature increases, so does the vapor pressure.
- See the graph to the right.



Vapor Pressure and Boiling

- What is the temperature of water when the vapor pressure is at normal atmospheric pressure (101.3 kPa)? **100°C**
- Note that this is the boiling point of water.
- In order for a water to expand and form vapor bubbles throughout the liquid as it does when it boils, the vapor has to exert as much pressure as the blanket of air confining it.
- A liquid boils when the vapor pressure reaches atmospheric pressure.



Working with Vapor Pressure

- What is the boiling point of ethanol?
  79°C
- What is the vapor pressure of propanone at 45°C?
  70 kPa
- At what temperature does ethanoic acid have a vapor pressure of 40 kPa? **90°C**