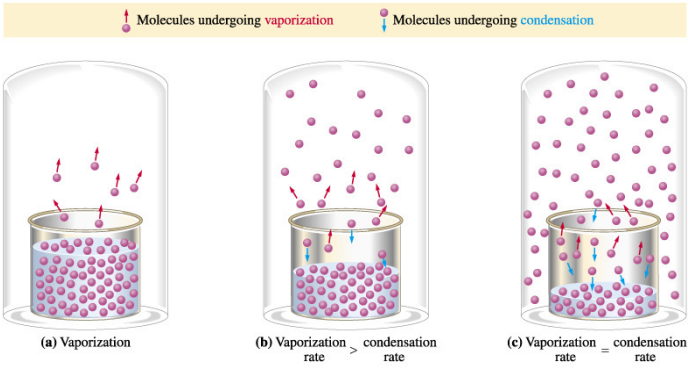
Vapor Pressure

Skills to Develop

- Define vapor pressure

Whenever we have a liquid with some space above it, some of the molecules on the surface of the liquid might escape into the space and become gaseous if they have enough kinetic energy. If the liquid is in a closed bottle, then the molecules in the gas phase can't get away completely. There will be the liquid, and above it, a gas of the same molecule. The gas particles will sometimes bump the liquid, and if they have small enough kinetic energy, they might stay in it. Thus, molecules can go back and forth between the liquid and the gas. As the amount of gas increases, it is more likely to bump the surface and get stuck, so the rates of becoming gas and becoming liquid become the same. An equilibrium will be established. The partial pressure of that gas above the liquid at equilibrium will depend on the type of molecule and the temperature. If the temperature of the liquid increases, more molecules will have enough kinetic energy to escape the liquid and be gas. If the molecule has strong intermolecular forces, it will take more kinetic energy to escape the liquid.



An example of vapor pressure in a closed container.

In an open container, a liquid like water will completely evaporate eventually, even at low temperatures (even ice will disappear eventually, because solids also have vapor pressure). This happens because when the molecules become gas, they can diffuse away instead of staying near the surface, and maybe bumping it and getting stuck again.

The vapor pressure of a liquid doesn't depend on the pressure in general (at least not much). The presence of other gas molecules won't really affect the rates of the liquid molecules leaving the surface or returning to it, because their collisions with the liquid don't matter. When we collect gases over a liquid, like in Hales' method, we should include a correction for the vapor pressure of the liquid. We can find this in a table if we know the temperature.

Some liquids have a high vapor pressure and others have low vapor pressure. This depends on the intermolecular forces, like London dispersion forces, dipole-dipole forces, and hydrogen bonds. If the intermolecular forces are strong, the vapor pressure will be low. If they are weak, it will be high. **Volatile** liquids have high vapor pressure.

Outside Links

- Khan Academy: Partial Pressure (18 min)
- CrashCourse Chemistry: Partial Pressure and Vapor Pressure (12 min)

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