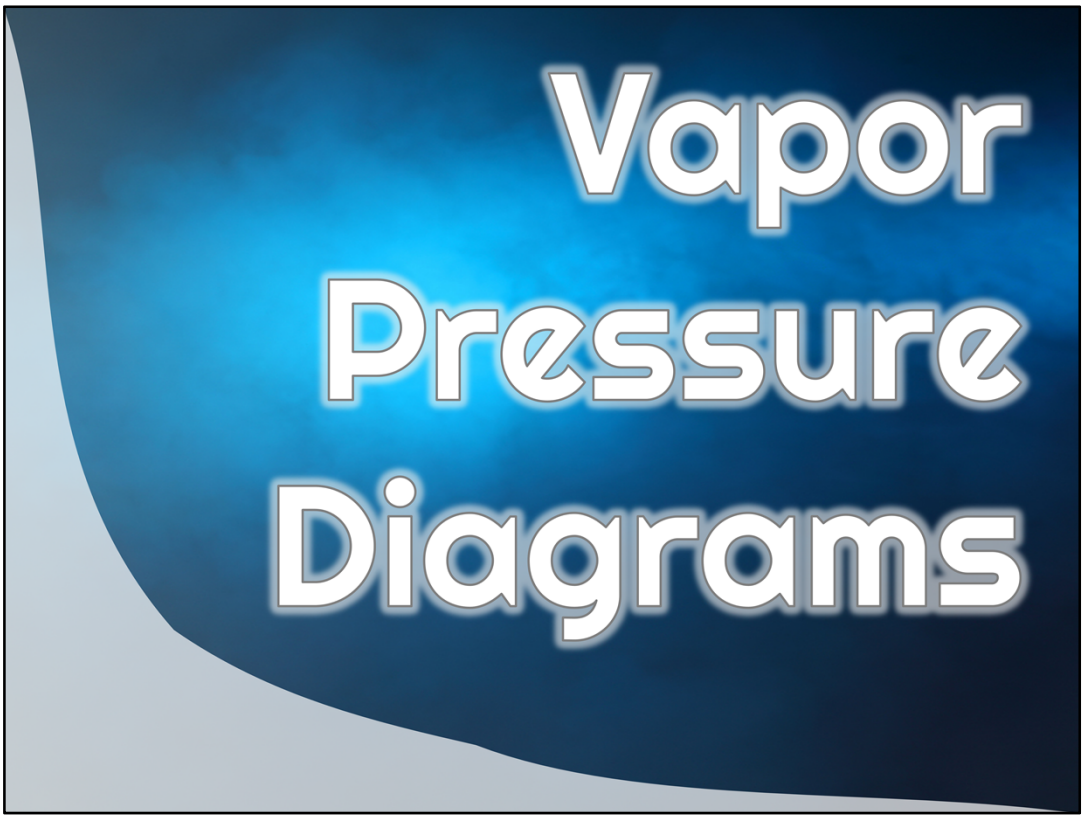
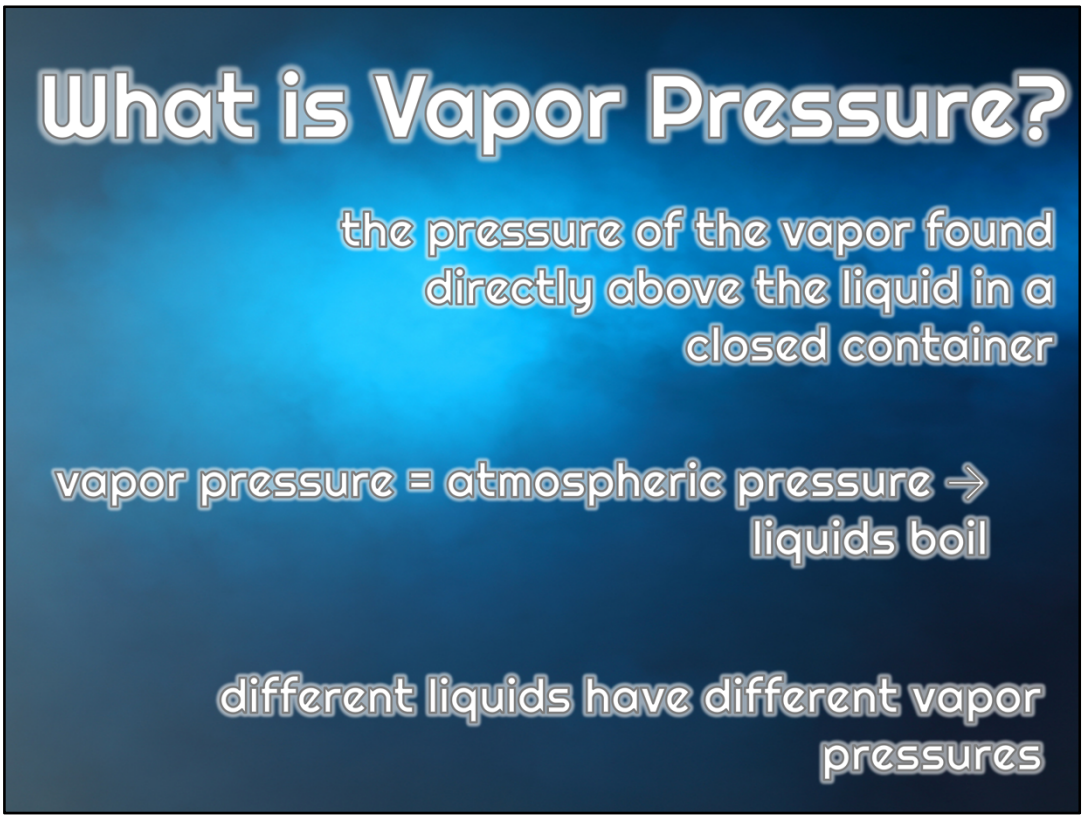
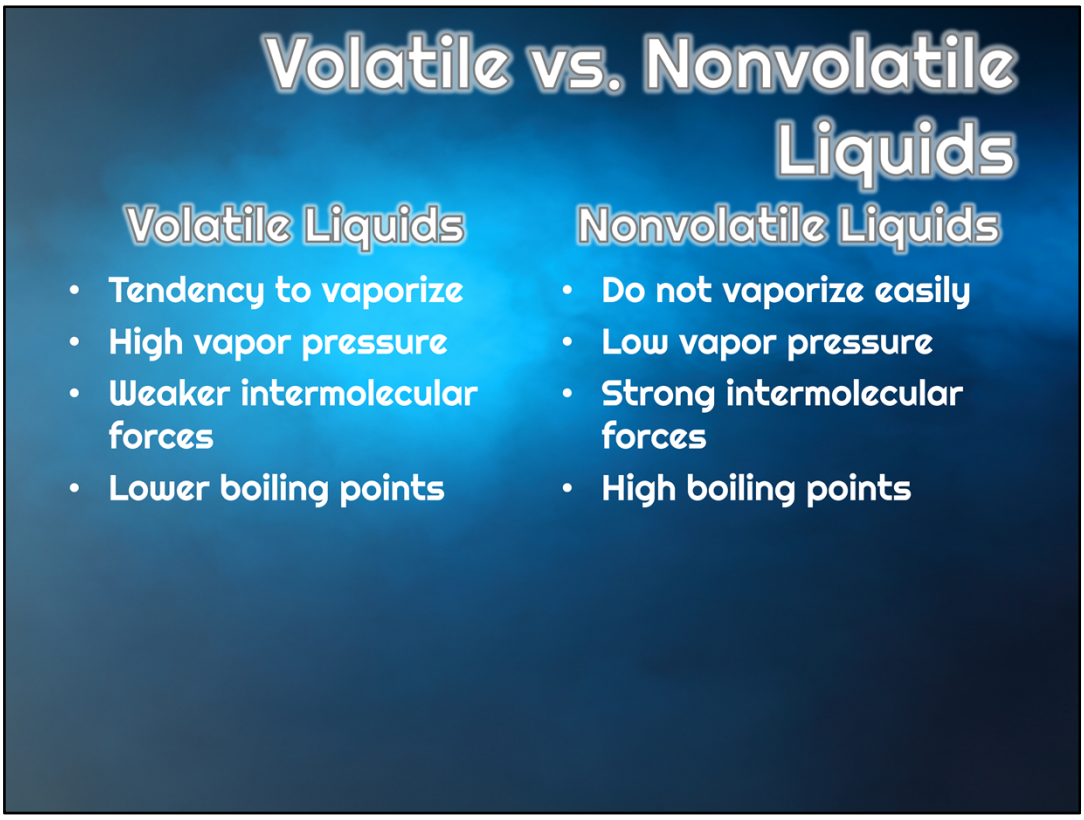
Module 9: States of Matter and Gas Laws
Topic 2 Content: Phase Diagrams and Vapor Pressure Diagrams Presentation Notes



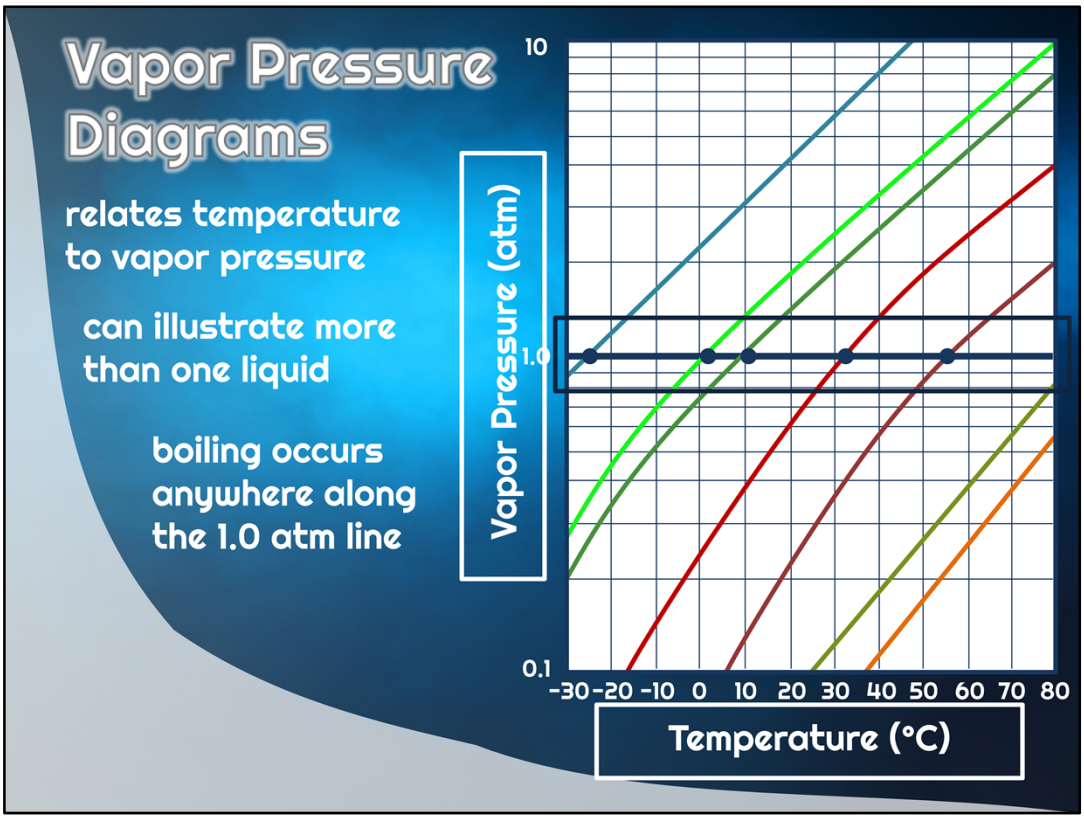
Vapor Pressure Diagrams



Vapor pressure is the pressure of the vapor found directly above the liquid in a closed container. When the vapor pressure equals the atmospheric pressure around it, a liquid will boil. Different liquids have different vapor pressures.

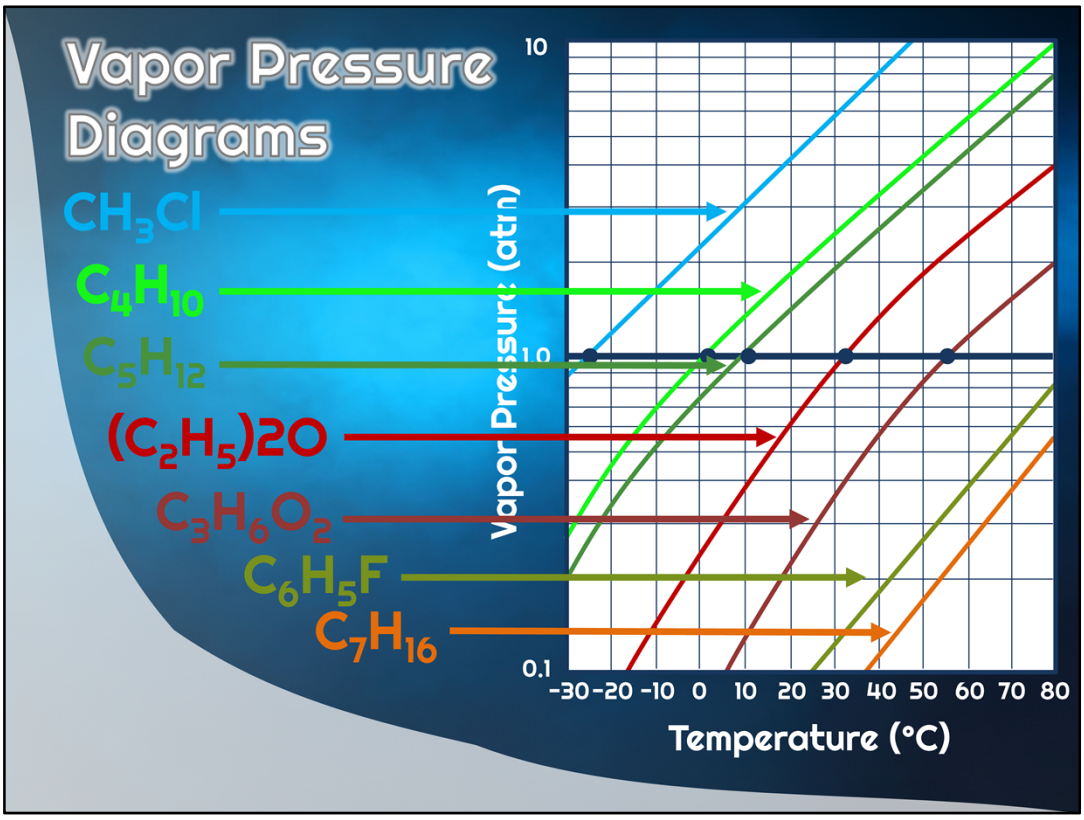


A volatile liquid has the tendency to vaporize. Volatile liquids have a high vapor pressure, weaker intermolecular forces, and lower boiling points. Nonvolatile liquids do not vaporize easily and they have low vapor pressure points, strong intermolecular forces, and high boiling points.

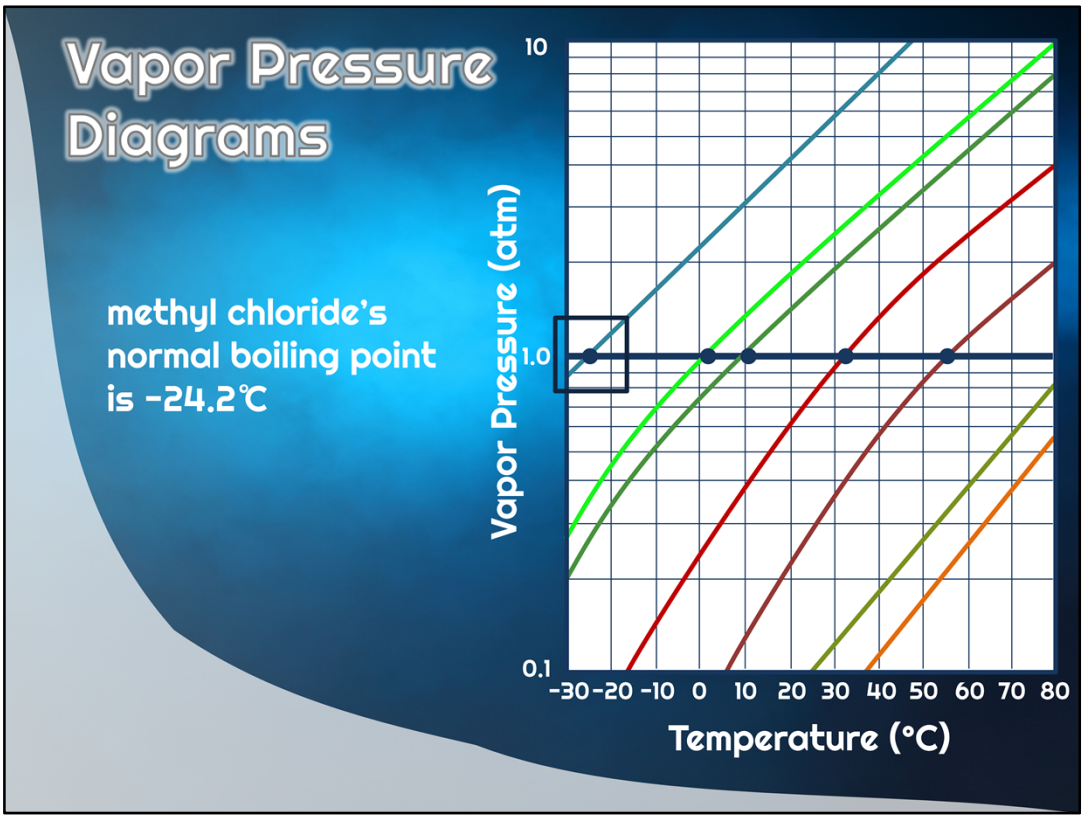


A vapor pressure diagram relates temperature to vapor pressure. Often, vapor pressure diagrams illustrate more than one liquid on a graph. For example, this graph shows seven different substances. On this graph, notice that the *y*-axis shows the vapor pressure in atm; however, pressure is also measured in kPa and mmHg, so they may also be used on the *y*-axis. The x-axis indicates temperature.

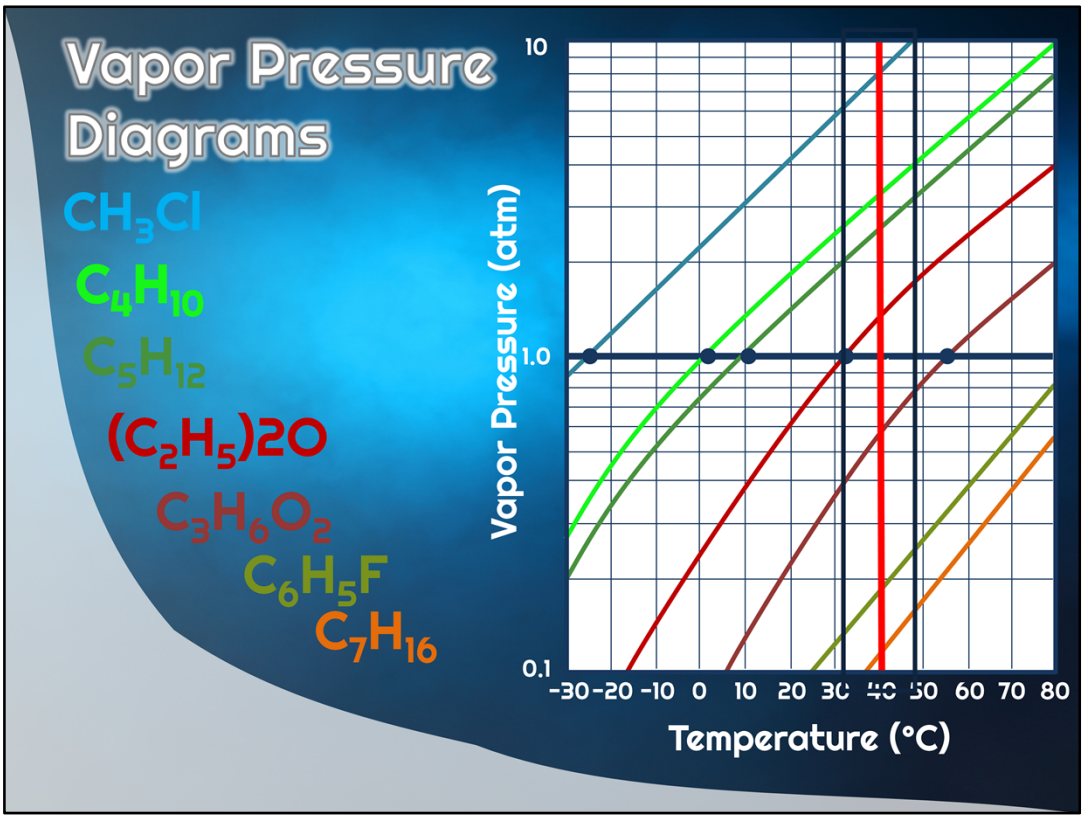
When analyzing a vapor pressure diagram, start by determining the normal boiling points of each substance. This is the temperature at which the liquid vaporizes to a gas under standard pressure conditions. The solid line at 1 atm helps to indicate normal boiling points.



The compounds shown on this vapor pressure diagram are methyl chloride in blue, butane in green, neo-Pentane in dark green, dimethyl ether in red, methyl acetate in burgundy, fluorobenzene in olive green, and heptane in orange.



At a standard pressure of 1 atm, 101.325 kpa, or 760 mmHg, methyl chloride changes from liquid to gas at -24.2°C. This is methyl chloride's normal boiling point. You can determine all of the other compounds' normal boiling points with a quick analysis of the vapor pressure diagram.



You can see that it is possible for all seven of these substances to boil at the same temperature, but they are at different pressures when this occurs. As a chemist, you could get all of the seven substances to boil at the same temperature. This temperature is indicated by the vertical red line on the graph. At 40°C, all of the substances would boil, but these substances would have to be at different amounts of pressure.