

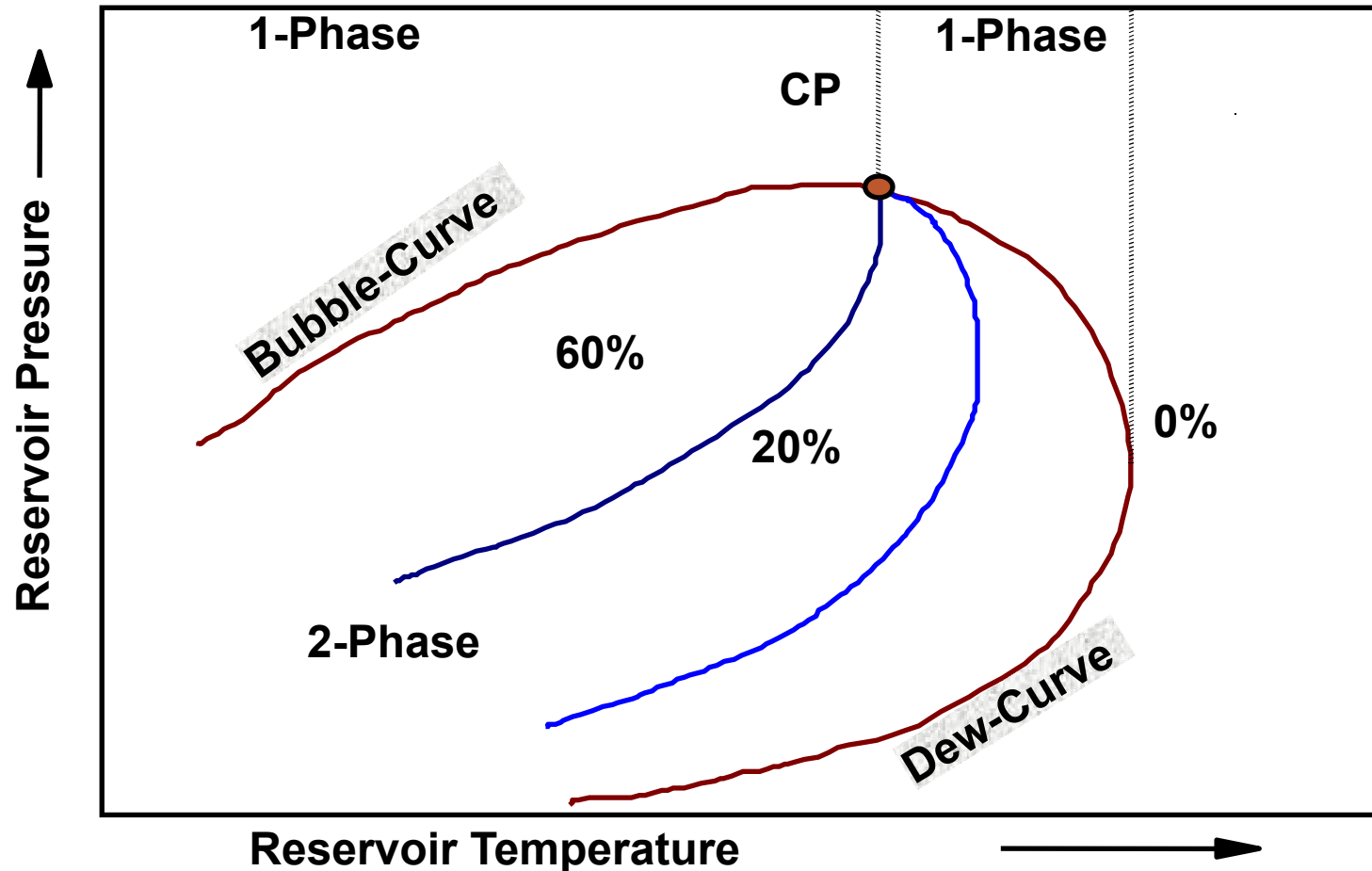


Properties of Reservoir Fluids (PGE 362)

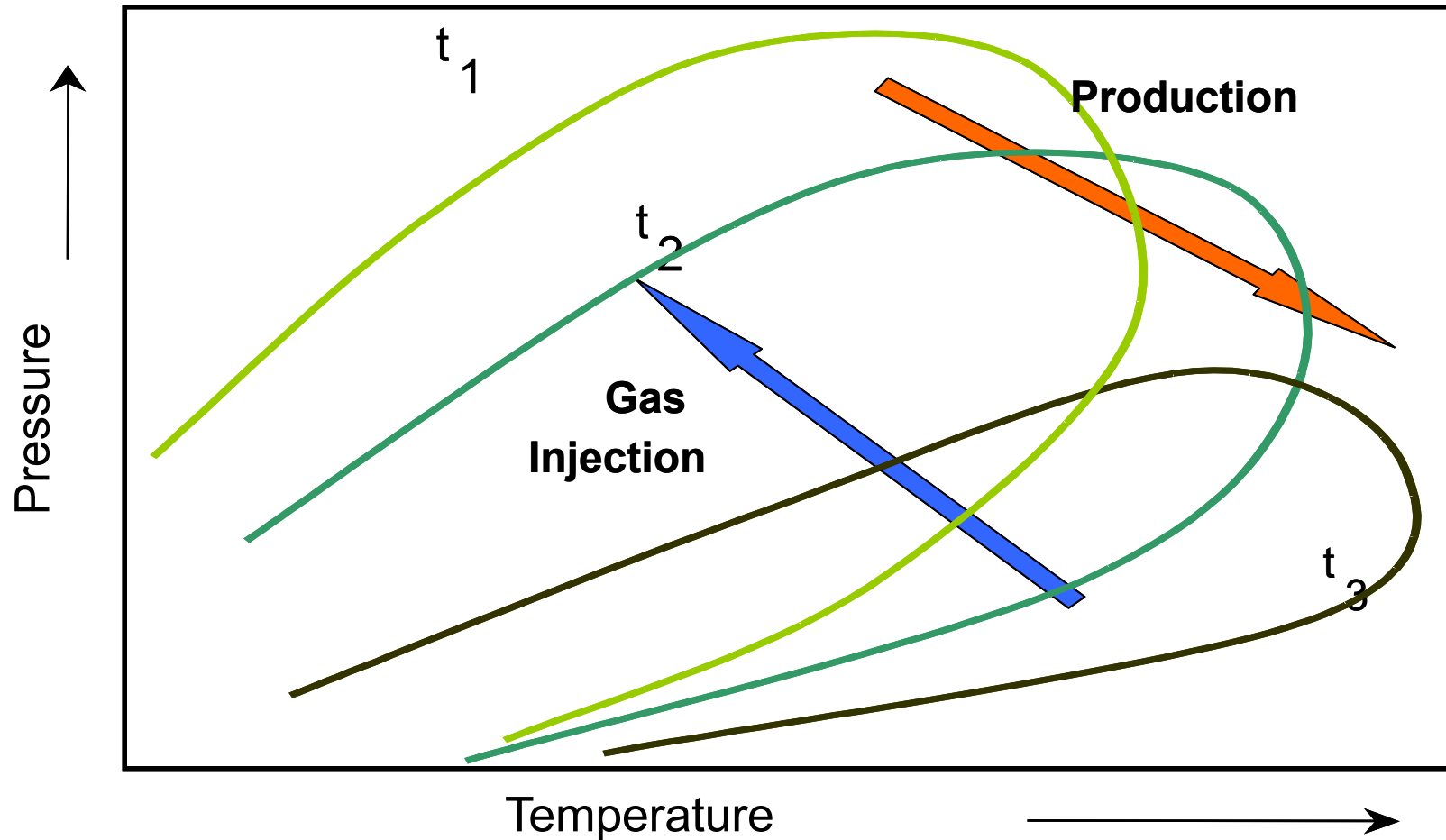
Phase Behavior of Liquids

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Pressure-Temperature Diagram for Multicomponent Systems



Importance of Pressure-Temperature Diagram



Terminologies

- **Phase**
 - A portion of the system which has homogeneous intensive properties and it is bounded by a physical surface.
- **Interface**
 - Separates two or more phases. These phases are solid, liquid(s), and gas
- **Intensive Properties**
 - Independent of system mass (i.e density)
- **Extensive Properties**
 - Dependent of system mass (i.e volume)

Terminologies

- **System**
 - A body of matter with finite boundaries (physical or virtual)
- **Closed system**
 - Does not exchange matter with surroundings but may exchange energy (heat).
- **Open system**
 - Does exchange matter and energy with surroundings.
- **Homogenous system**
 - Intensive properties change continuously and uniformly (smoothly)
- **Heterogeneous system**
 - System made up of two or more phases in which the intensive properties change abruptly at phase-contact surfaces

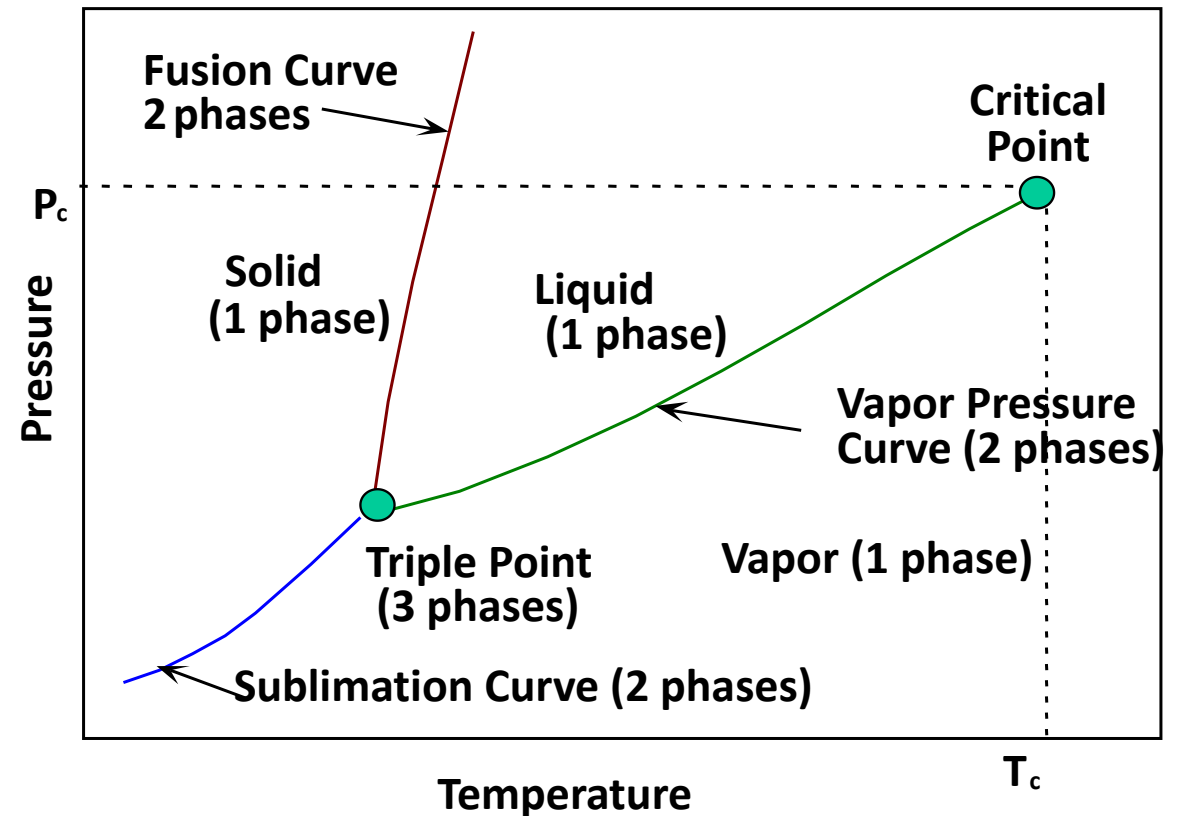
Terminologies

- **Properties**
 - Characteristics of a system (phase) that may be evaluated quantitatively. These are,
 - Phase density (liquid, gas, solid)
 - Compressibility
 - Surface tension
 - Viscosity
 - Heat capacity
 - Thermal conductivity

Phase Diagram

- **Types of phase diagrams for a single component (pure substance)**

- Pressure-Temperature (PT)
- Pressure-Volume (PV) or ($P\rho$)
- Temperature-Volume (TV) or ($T\rho$)



Phase Diagram

- **Interesting videos**

- Phase Diagrams and the States of Matter

- <http://www.youtube.com/watch?v=gbUTffUsXOM>

- Triple Point

- <http://www.youtube.com/watch?v=BLRqpJN9zeA>

- What is Supercritical fluid

- <http://www.youtube.com/watch?v=QHcqyFm0i9M#aid=P8sRLIeLU1Q>

Pressure-Volume-Temperature

- **Temperature-Volume (TV)**

- At constant pressure the volume of a liquid at any temperature can be estimated using the formula:

- $V = V_o(1 + \alpha(T - T_o))$

- V_o : initial volume at T_o

- α : average coefficient of thermal expansion (different for different liquids)

- At constant temperature the volume of a liquid at any pressure can be estimated using the formula:

- $V = V_o(1 - C(P - P_o))$

- C : average coefficient of compression (different for different liquids)