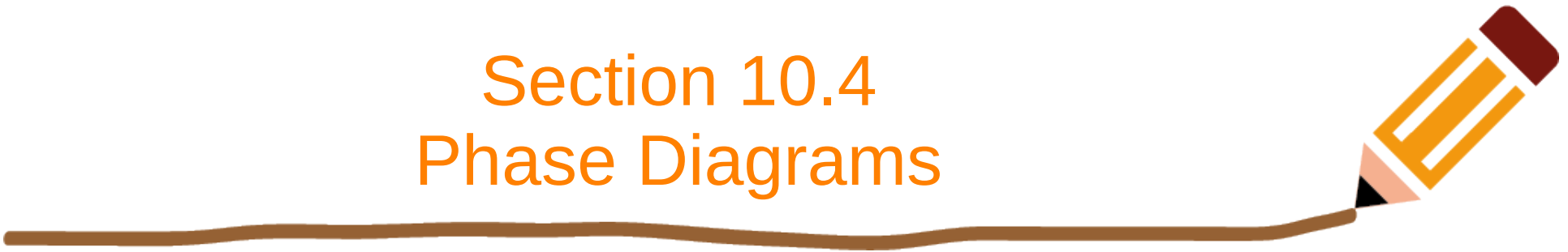
Section 10.4
Phase Diagrams



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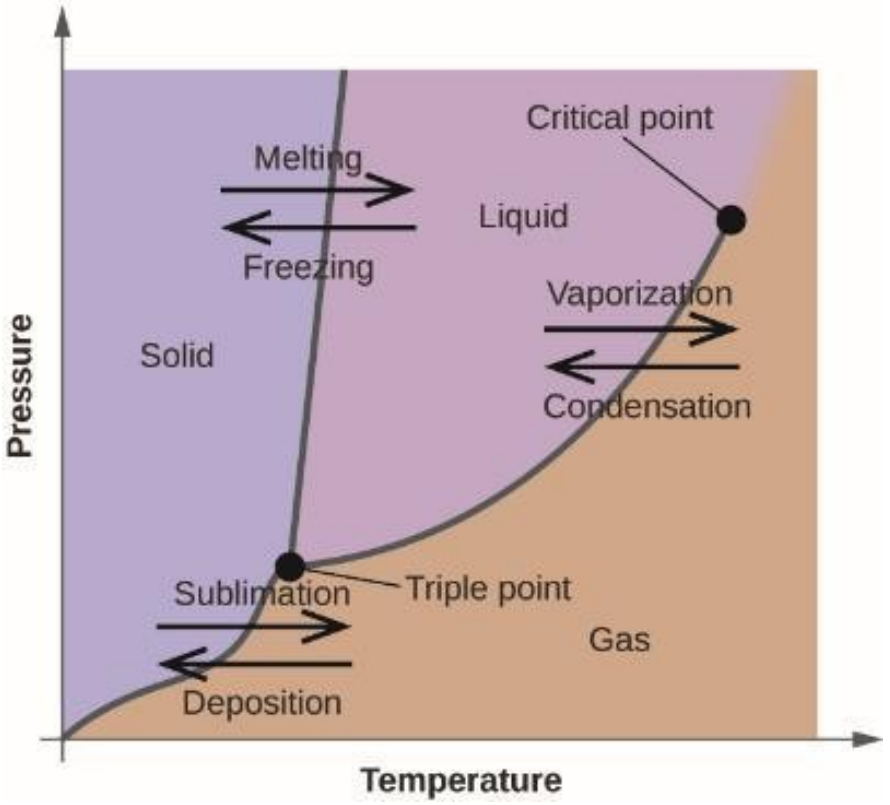
Phase Transitions and Temperature

- During phase changes, the temperature remains constant.
- If energy is being absorbed in the phase change, then all this energy is being used to break the intermolecular forces, not increase the temperature of the substance.
- If energy is being released during the phase change, then all this released energy is coming from the formation of intermolecular forces, not from the decrease in temperature of the substance.

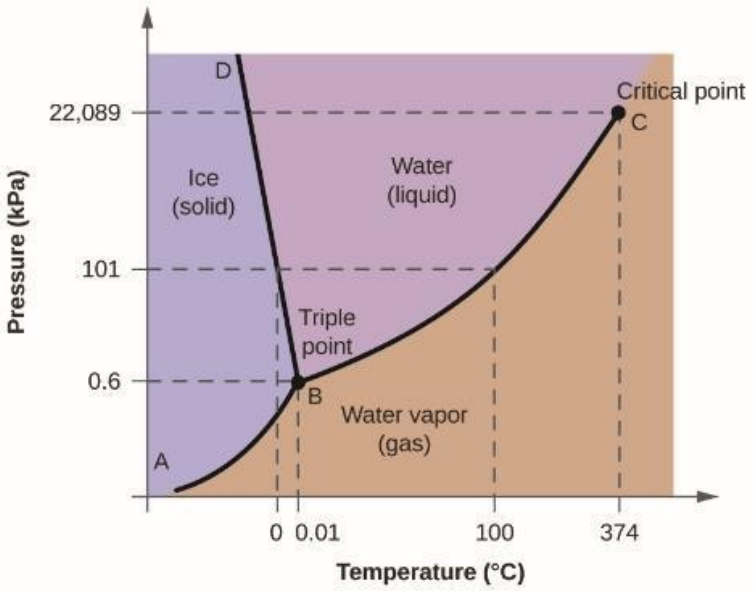
Phase Diagrams

- The physical state of a substance and its phase-transition temperatures are represented graphically in a phase diagram.



Important Points

- **Triple Point** is the temperature and pressure where solid, liquid and gas exist in equilibrium.
- **The Critical Point** is the temperature and pressure above which a substance can exist as a **Surpercritical Fluid**.
- **Supercritical Fluids** have properties similar to both a gas and a liquid.



Critical Temperature and Pressure

- Above the **Critical Temperature** a gas cannot be liquefied no matter the the pressure.
- The pressure required to liquefy a gas at its critical temperature is the **Critical Pressure.**

Substance	Critical Temperature (°C)	Critical Pressure (kPa)
hydrogen	–240.0	1300
nitrogen	–147.2	3400
oxygen	–118.9	5000
carbon dioxide	31.1	7400
ammonia	132.4	11,300
sulfur dioxide	157.2	7800
water	374.0	22,000

Supercritical Fluid Properties

- SFs expand to fill their containers.
- Their density is much greater than typical gases.
- They are capable of dissolving nonvolatile solutes.
- They have essentially no surface tension and very low viscosity
- They are extremely useful solvents for many applications.
- Other properties depend on the identity of the fluid. For instance, supercritical water has a low dielectric constant.

Conclusions

- Phase diagrams are useful representations for visualizing the phase of a substance at a specific temperature and pressure.
- The **Triple Point** and **Critical Point** can be found on a phase diagram.
- Supercritical fluids have important properties that differ from solids, liquids, and gases.