

## States of Matter of Phase Diagrams

- ### Phase Diagrams (States of Matter)
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- The diagram shows the phase boundaries for water. The y-axis is labeled 'Pressure' and the x-axis is labeled 'Temperature'. The 760 torr mark is indicated on the y-axis. The phase regions are labeled: Solid (Ice), Liquid (Water), and Gas (Vapor). The critical point is labeled 'Supercritical Fluid'. Two points are marked: Point 1 is on the solid-liquid boundary at 50°C, and Point 2 is on the liquid-gas boundary at 110°C. The regions are color-coded: Solid (light blue), Liquid (light green), and Gas (light orange). The critical point is marked with a red dot.
- | Point | Temperature (°C) | Pressure (torr) | Phase Transition |
|-------|------------------|-----------------|------------------|
| 1     | 50               | -               | Solid-Liquid     |
| 2     | 110              | -               | Liquid-Gas       |

a) Liquid                      b) Gas                      c) Solid                      d) Supercritical Fluid

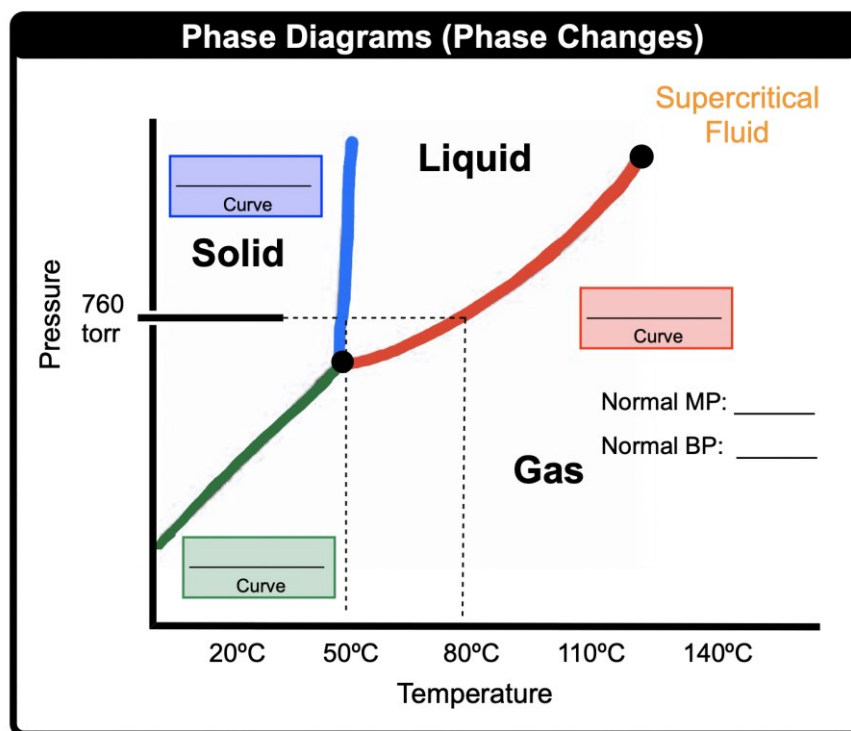
Phase diagram for water showing Solid, Liquid, and Gas regions. Key points include the triple point at 0.01 °C and 0.006 atm, the normal boiling point at 100 °C and 1 atm, and the normal melting point at 0 °C and 1 atm. A process path B is shown starting from a solid state at 1 atm and -78.5 °C, moving horizontally to the right, crossing the solid-liquid boundary at -0.01 °C, and then continuing horizontally to the right at 1 atm.

- a)  $0\text{ }^{\circ}\text{C}$       b)  $-78.5\text{ }^{\circ}\text{C}$       c)  $-56.7\text{ }^{\circ}\text{C}$       d)  $31\text{ }^{\circ}\text{C}$       e)  $100\text{ }^{\circ}\text{C}$

## CONCEPT: PHASE DIAGRAMS

### Phase Changes of a Phase Diagram

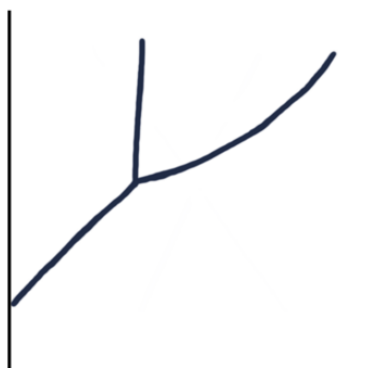
- Recall, a phase change is a \_\_\_\_\_ change that involves the transition between the 3 states of matter.
- **Phase Change Curve:** Line segment within phase diagrams that separates \_\_\_\_ states of matter from each other.



- **Normal Pressure:** Name given to the standard pressure of \_\_\_\_\_ atm or \_\_\_\_\_ mmHg or torr.
- **Normal Melting Point:** Phase transition between \_\_\_\_\_ to \_\_\_\_\_ at normal pressure.
- **Normal Boiling Point:** Phase transition between \_\_\_\_\_ to \_\_\_\_\_ at normal pressure.

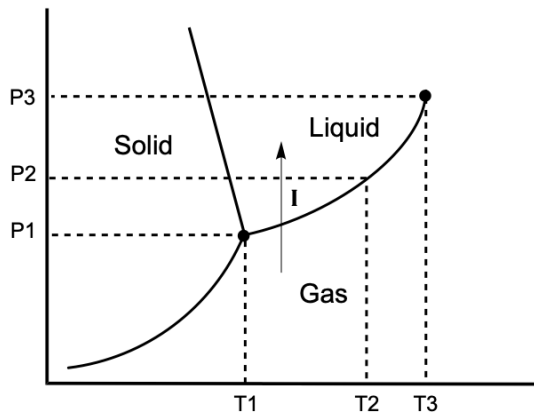
**EXAMPLE:** A substance has a triple point  $-45.0^{\circ}\text{C}$  and 500 mmHg. What is the most likely phase change to occur for a solid sample of this substance as it is heated from  $-60.0^{\circ}\text{C}$  to  $10^{\circ}\text{C}$  at a pressure of 490 mmHg?

- a) Condensation      b) Vaporization      c) Deposition      d) Melting      e) Sublimation



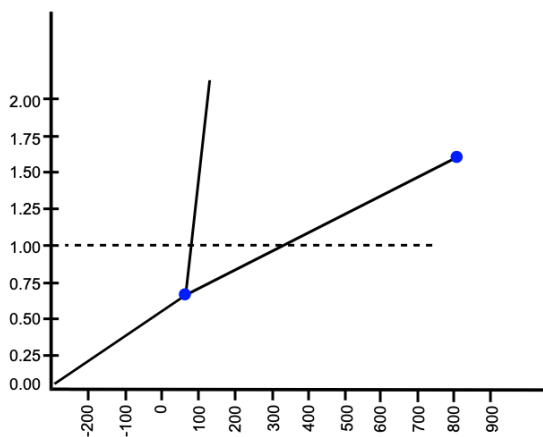
## CONCEPT: PHASE DIAGRAMS

**PRACTICE:** Arrow I corresponds to:



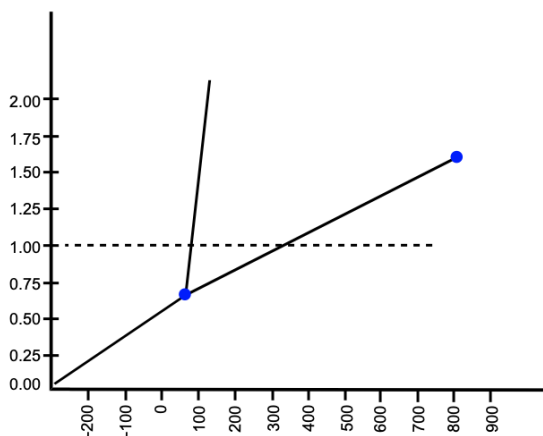
- a) Equilibrium      b) Sublimation      c) Condensation      d) Vaporization      e) Deposition

**PRACTICE:** What is the normal freezing point of this unknown substance?



- a) 0 °C      b) -200 °C      c) 200 °C      d) 400 °C      e) 100 °C

**PRACTICE:** At what temperature can we no longer tell the difference between the liquid and gas phases?



- a) 100 °C      b) 200 °C      c) 400 °C      d) 800 °C      e) 820 °C