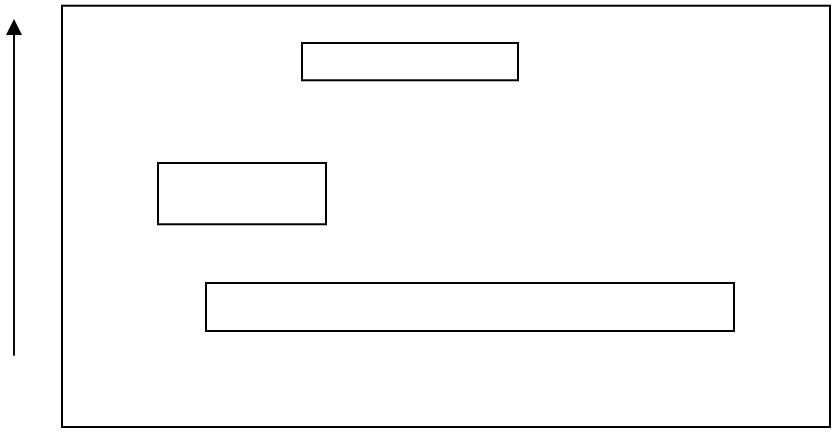
11.4 Phase Change Diagrams

Phase change diagrams show energy changes during phase changes



Heat of Fusion _____

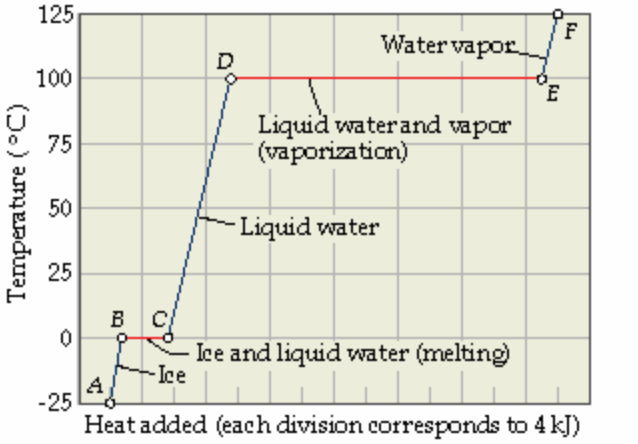
Heat of vaporization _____

Critical temperature _____

Critical Pressure _____

Heating Curves and Cooling Curves

Example: Heating Curve

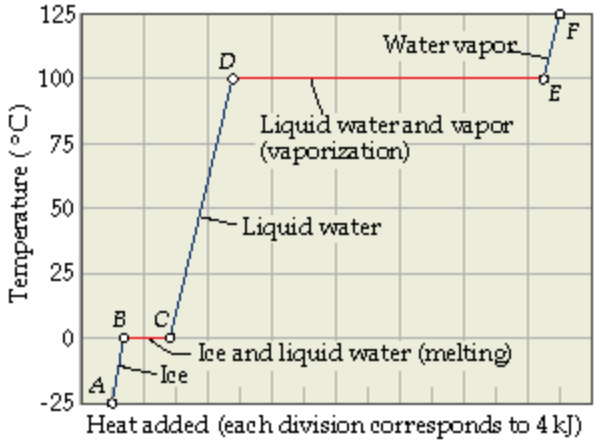


You need to be able to:

1) **Describe kinetic and potential energy changes**
2) **Understand temperature and energy relationship**
3) **Calculate the amount of energy released or absorbed using the graph and specific gram amounts**

Phase Change problem:

Calculate the enthalpy change upon converting 1.00 mol of ice at -25 °C to water vapor (steam) at 125 °C under a constant pressure of 1 atm. The specific heats of ice, water and steam are 2.09 J/g-K, 4.18 J/g-K and 1.84 J/g-K, respectively. For H_2O, ΔH_{fus} = 6.01 kJ/mol, and ΔH_{fus} = 40.67 kJ/mol.



Name _____

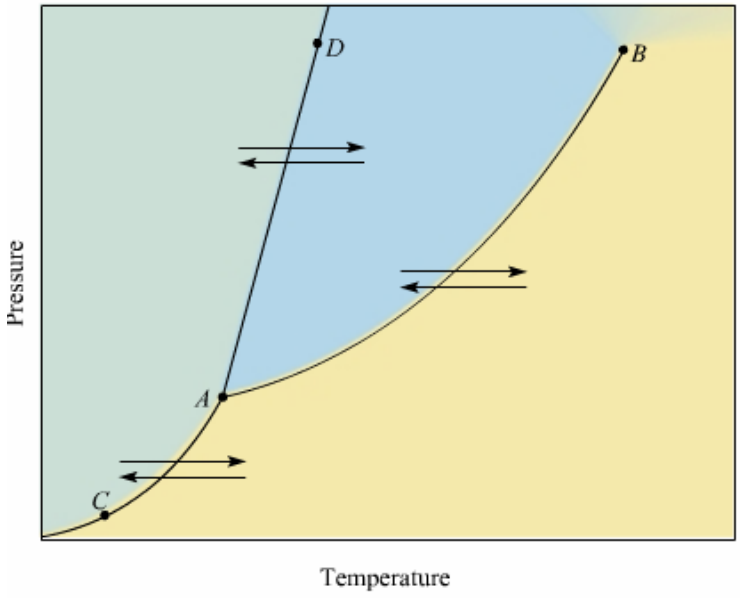
AP Chemistry

Chapter 11.6 Phase Change Diagrams

General diagram exhibits three phases

Contains three important curves, each of which represents the conditions of temperature and pressure at which the various phases can *coexist at equilibrium*

Label phases



What is the meaning of the lines on the graph? _____

Line A → B represents _____

Line A → C represents _____

Line A → D represents _____

Critical Point _____

Triple Point _____

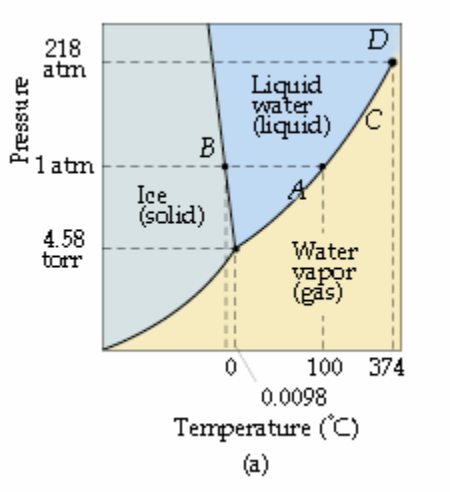
Phase Diagram Practice Problems

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. On a phase diagram why does the line that separates the gas and liquid phases end rather than go to infinite pressure and temperature?

2. What is the significance of the triple point in a phase diagram?

3. Refer to Figure 11.25(a) [text pg 413], and describe all the phase changes that would occur in each of the following cases.



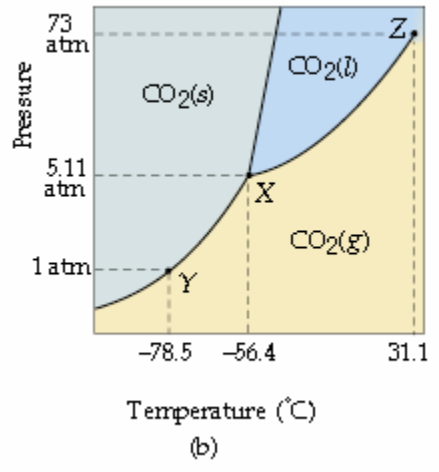
a. Water vapor originally at 1.0×10^{-3} atm and -0.10°C is slowly compressed at constant temperature until the final pressure is 10 atm.

b. Water originally at 100.0°C and 0.50 atm is cooled at constant pressure until the temperature is -10°C.

4. Refer to Figure 11.25(b), and describe the phase changes (and the temperatures at which they occur) when CO_2 is heated from -80°C to -20°C at

a. constant pressure of 3 atm;

b. a constant pressure of 6 atm.



5. The normal melting and boiling points of xenon are –112 °C and –107 °C, respectively. Its triple point is at –121 °C and 282 torr, and its critical point is at 16.6 °C and 57.6 atm.

a. Sketch the phase diagram for Xe, showing the four points given above and indicating the area in which each phase is stable.

b. Which is denser, Xe(*s*) or Xe(*l*)? Explain.

c. If Xe gas is cooled under an external pressure of 100 torr, will it undergo condensation or deposition? Explain.

3.

Hint

What is the normal boiling point of this substance?