### **Chemical Thermodynamics**

## $\Delta G$

Chemical potential

#### At equilibrium chemical potentials are equivalent.

# **Clapeyron Equation**

Liquid-gas equilibrium

#### Applies to all three equilibrium lines in phase diagram.

### Example liquid-solid

Given that  $\rho_{CO2}^{I} = 0.78 \text{ g/mL}$  and  $\rho_{CO2}^{S} = 1.53 \text{ g/mL}$ . What is the temperature of the solid – liquid equilibrium at 100 bar pressures.  $\Delta_{fus}H = 8.33$ kJ/mol

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#### Solid-liquid equilibrium line is nearly vertical

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#### Results in Clausius Clapeyron equation

### Example liquid-gas

For the liquid-gas the same assumptions can be made.

If the triple point is known,  $\Delta_{vap}H$ ,  $\Delta_{fus}H$ ,  $\rho_s$ , and  $\rho_l$  the phase diagram can be calculated

### Iclicker

The vapor pressure (in Pa) for solid and liquid UF6 are given by:

$$\ln P_s = 29.411 - 5893.5/T$$
$$\ln P_l = 22.254 - 3479.9/T$$

- What is the pressure of the triple point (units of kPa)?
  - $\circ \quad \mathsf{A} \mathsf{P} < \mathsf{0}$
  - $\circ$  B P = between 0 and 45
  - $\circ$  C P = between 45 and 95
  - D P = between 95 and 145
  - E P > 145

## Chemical potential

Calculate chemical potential at other T and P.