Phase Rule

\[ P + F = C + 2 \]

- \( P \) = \# of phases present at equilibrium
- \( C \) = \# of components needed to describe the system
- \( F \) = \# of degrees of freedom
  (\# of thermodynamic variables - taken from T, P, compositions of components)

This “full” form of the phase rule is used when all three common physical states (s, l, g) are important.

Condensed Phase Rule

\[ P + F = C + 1 \] (instead of + 2)

- When the vapor pressure of all components is negligible, the effective number of degrees of freedom can be reduced by one.
- Pressure is not an important thermodynamic variable, leaving only two kinds variables necessary to describe the solid solution – temperature and compositions of the components.
A Boring diagram: LiF-NaF

Discuss the system in every region.

Hypothetical T-C diagram

A₄B - congruently melting - easily synthesized
e - eutectic point
a - peritectic point
AB₁ - how should it be synthesized?

Ta-S system (Exam sample)

(a) What is likely to be the best way to prepare Ta₆S?
(b) What is likely to be the best way to prepare Ta₂S?
(c) What will occur (if anything) when a sample of Ta₂S is heated from 25 to 1100 °C?
(d) What is likely to be the best way to prepare Ta₁+xS²? Explain.
The CaO-SiO$_2$ system

This is effectively a two-component system, even though there are three elements present. Why? What are the congruently melting compounds? What is compound D and how might it be prepared? Suggest structural features that may be present in A, C and D.

---

Ternary System Ca-Si-O

Binary join CaO-SiO$_2$ in the ternary system Ca-Si-O. Note the method used for labeling of phases, C = CaO, S = SiO$_2$. This type of abbreviation is widely used in oxide chemistry.

---

SiO$_2$ - a Network structure

- Idealized (cubic) structure of cristobalite form of SiO$_2$. 

---