Introduction to Phase Equilibria

On the triangular diagram below, plot each of the following mineral compositions. Show locations with dots:
- grossular $\text{Ca}_3\text{Al}_2\text{Si}_3\text{O}_{12}$
- quartz $\text{SiO}_2$
- anorthite $\text{CaAl}_2\text{Si}_2\text{O}_8$
- wollastonite $\text{CaSiO}_3$
- kyanite $\text{Al}_2\text{SiO}_5$
- larnite $\text{Ca}_2\text{SiO}_4$
- corundum $\text{Al}_2\text{O}_3$
- lime $\text{CaO}$
- gehlenite $\text{Ca}_2\text{Al}_2\text{SiO}_7$
This figure shows a phase diagram involving minerals in the CASH (CaO-Al₂O₃-SiO₂-H₂O) system. It includes some of the same phases you considered above, plus a couple of new ones.

There are six reactions (numbered 1 through 6) which divide PT space into seven fields (A through G).

Note, this is a 4 component system. Fill in the following table:

<table>
<thead>
<tr>
<th>degrees of freedom</th>
<th># of phases that may coexist</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

For each of the following 15 assemblages, tell in what zones or on what reactions it is stable. Some may be stable nowhere, some everywhere.

Co everywhere  Gr-An-Co-H₂O E
Zo left of 4    An-Ge-Wo-Zo nowhere
Ge everywhere  Zo-Ky-Co-Gr-H₂O nowhere
Zo-An left of 4 Gr-An-Zo-Q-H₂O 2
An-Ge FG        An-Co-Gr-Ge-H₂O nowhere
Zo-An-Ge nowhere An-Co-Gr-Q-H₂O nowhere
Gr-An-H₂O CDEF
An-Wo-Q right of 3
Gr-Co-An-Ge 5

What general observation can you make about the stability field (range of PT space where something is stable) and the number of minerals in an assemblage? The more minerals that are together in an assemblage, the smaller the stability field.