BINARY PHASE DIAGRAMS - PERITECTIC BEHAVIOR KEY

1. Examine figure 1 on the attached sheet for the Wollastonite (CaSiO$_3$) - Walstromite (BaCa$_2$Si$_3$O$_9$) - BaSiO$_3$ system. On the attached diagram, outline each liquidus line in **green**, each solidus line in **brown**.
   
a. What is the minimum number of components necessary to describe all of the phases shown? **TWO**

b. How many phases are present in the region labeled β-CaSiO$_3$ + Walstromite (BaCa$_2$Si$_3$O$_9$)?
   **TWO**

c. How many phases are present in the region labeled α-CaSiO$_3$ + Liq?
   **TWO**

d. How many phases are there in the region labeled BaSiO$_3$ + Liq?
   **TWO**

e. How does the number of degrees of freedom change on going from α-CaSiO$_3$ + Liq to BaCa$_2$Si$_3$O$_9$ + Liq? **No change**

f. How does the number of degrees of freedom change on going from to BaCa$_2$Si$_3$O$_9$ + Liq. to BaCa$_2$Si$_3$O$_9$ + BaSiO$_3$? **No change**

g. List the phases present at the peritectic point.
   **α-CaSiO$_3$, Walstromite, Liquid**

h. How many degrees of freedom does the sample have at the peritectic point?
   **Zero**

i. List the phases present at the eutectic point.
   **BaCa$_2$Si$_3$O$_9$, BaSiO$_3$, Liquid**

j. How many degrees of freedom does the sample have at the eutectic point?
   **Zero**

k. How do your answers to g through j explain the observed cooling curve (figure 2) which could apply to either the peritectic or eutectic points?
   At the peritectic point α-CaSiO$_3$ is converted to BaCa$_2$Si$_3$O$_9$ and heat is released. At the eutectic point both BaCa$_2$Si$_3$O$_9$ and BaSiO$_3$ crystallize, releasing heat. This keeps the temperature constant. Both the peritectic and eutectic points are triple points so no degrees of freedom are present.
2. Starting with a composition of 49% BaSiO$_3$, trace the behavior of the melt from 1600°C to 1200°C. Show the path followed by the liquid in red, the path followed by the solid in blue.

a. At what temperature does the solid first appear? 1335°C

b. What is the composition of the first solid? 100% α-CaSiO$_3$

c. At 1325°C, what phases are present? α-CaSiO$_3$ + Liquid

d. What percent of each phase is present? 5% α-CaSiO$_3$ + 95% Liquid

(HINT: See Lever Rule file)

e. At 1300°C, what phases are present? BaCa$_2$Si$_3$O$_9$ + Liquid

f. At 1300°C, what percent of each phase is present? 93% BaCa$_2$Si$_3$O$_9$ + 7% Liquid

g. What phases are present at 1200°C? BaCa$_2$Si$_3$O$_9$ + BaSiO$_3$

h. At 1200°C what is the percent of each phase present? 98% BaCa$_2$Si$_3$O$_9$, 2% BaSiO$_3$

i. What temperature does the last liquid disappear? 1268°C

i. What is the composition of the last liquid? 72% BaSiO$_3$