GLY 4200 Name_____
Homework Exercise 7

BINARY PHASE DIAGRAMS - PERITECTIC BEHAVIOR KEY

1. Examine figure 1 on the attached sheet for the Wollastonite ($CaSiO_3$) -Walstromite ($BaCa_2Si_3O_9$) - $BaSiO_3$ 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 ($BaCa_2Si_3O_9$)?

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 $BaCa_2Si_3O_9$ + Liq.? No change

f. How does the number of degrees of freedom change on going from to $BaCa_2Si_3O_9$ + Liq. to to $BaCa_2Si_3O_9$ + $BaSiO_3$? 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.

$BaCa_2Si_3O_9$, $BaSiO_3$, 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 $BaCa_2Si_3O_9$ and heat is released. At the eutectic point both $BaCa_2Si_3O_9$ and $BaSiO_3$ crystallize, releasing heat. This keeps the temperature constant. Both the pertitectic 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 ? $BaCa_2Si_3O_9$ + Liquid

f. At 1300°C, what percent of each phase is present? 93% $BaCa_2Si_3O_9$ + 7% Liquid

f. What phases are present at 1200°C? $BaCa_2Si_3O_9$ + $BaSiO_3$

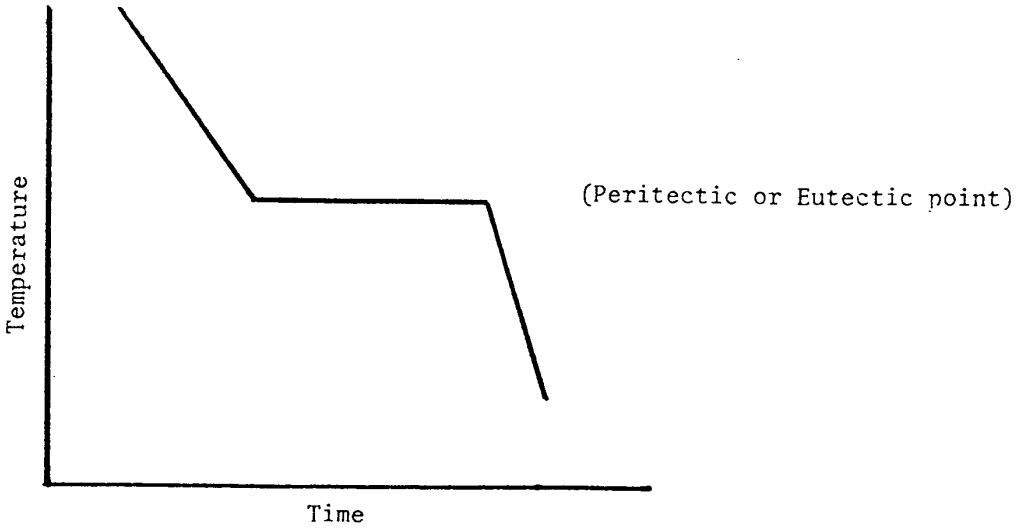
g. At 1200°C what is the percent of each phase present?

98% $BaCa_2Si_3O_9$, 2% $BaSiO_3$

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

i. What is the composition of the last liquid? 72% $BaSiO_3$

FIGURE 2



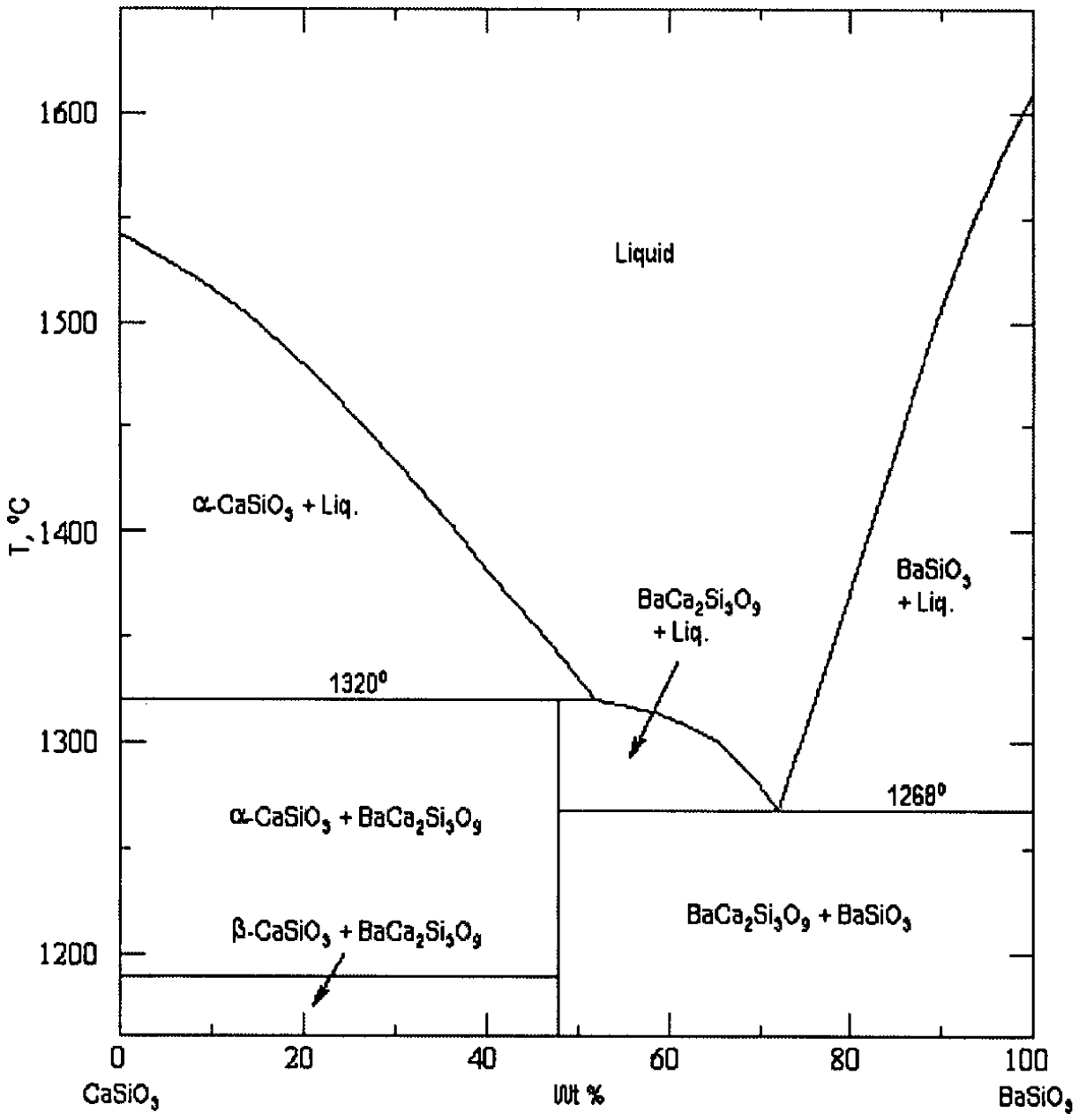

1600
1500
1400
1300
1200
T, °C
Liquid
α-CaSiO3 + Liq.
BaCa2Si3O9
+ Liq.
BaSiO3
+ Liq.
1320°
1268°
α-CaSiO3 + BaCa2Si3O9
β-CaSiO3 + BaCa2Si3O9
BaCa2Si3O9 + BaSiO3
0
20
40
60
80
100
CaSiO3
Wt %
BaSiO3

Figure 1