

ERSC 3P21 - Midterm, October 25, 2007

Answer all questions in the examination booklet provided. Mark value for each question in *italics*.
Total time allowed = 60 minutes.

1) (15) Define 5 (5) of the following:

phase rule	phase rule
basalt	perakaline
immiscible	NORM
piokilitic	batch fractional crystallization

2) (5) Give the correct mineral formula or mineral name for the following:

Albite
Forsterite
 KAlSi_2O_6
 $\text{Ca}_5(\text{PO}_4)_3(\text{F}, \text{Cl}, \text{OH})$
Diopside

3) With reference to the attached binary phase diagrams answer the following questions:

a) **Fig. 246** (10)

What are the two components that define this system?

Now many congruently melting compounds are present in this system?

How many incongruently melting compounds are present in this system?

Write the equation for the reaction that takes place for the incongruently melting compound which has the highest P_2O_5 content.

What is the composition of the lowest temperature liquid possible in this system?

b) **Fig. 508** (12)

Give the mineral names for the two components that define this system.

Label the phase fields present on this diagram.

For a composition of 40% $\text{NaAlSi}_3\text{O}_8$ and 60% SiO_2 at 1300°C answer the following questions:

What are the stable phases present?

What are their proportions?

What are the compositions of the stable phases?

c) **Fig. 292** (5)

Given a solid mixture of 50% PbO and 50% $\text{PbO} \cdot \text{MoO}_3$, what is the composition of the first liquid produced on heating the sample to the liquidus?

Assuming that equilibrium melting occurs, what is the composition of the last solid phase to be melted?

d) **Fig 101** (10)

Assuming the equilibrium crystallization occurs, what is the composition of the last liquid produced by crystallizing a 50:50 mixture of MnO and SiO_2 .

Give the mineral names and their proportions that comprise a final solid for this mixture.

At what temperature is this liquid produced?

What is the composition of the final liquid produced?

4) (10) Define Fractionation. Discuss the role played by gravity as a fractionation mechanism.

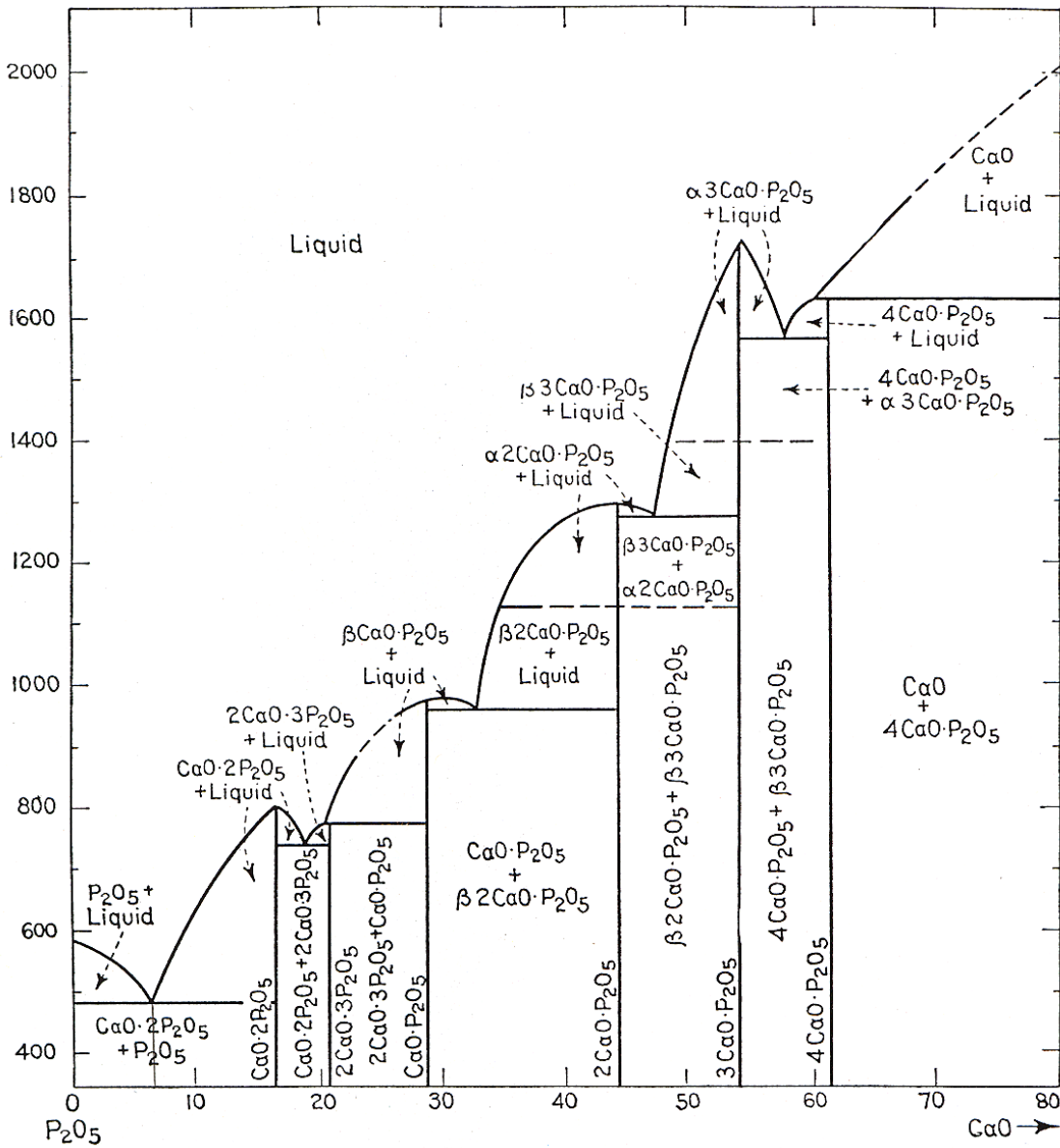


FIG. 246.—System CaO-P₂O₅.

Question 3a

Question 3b

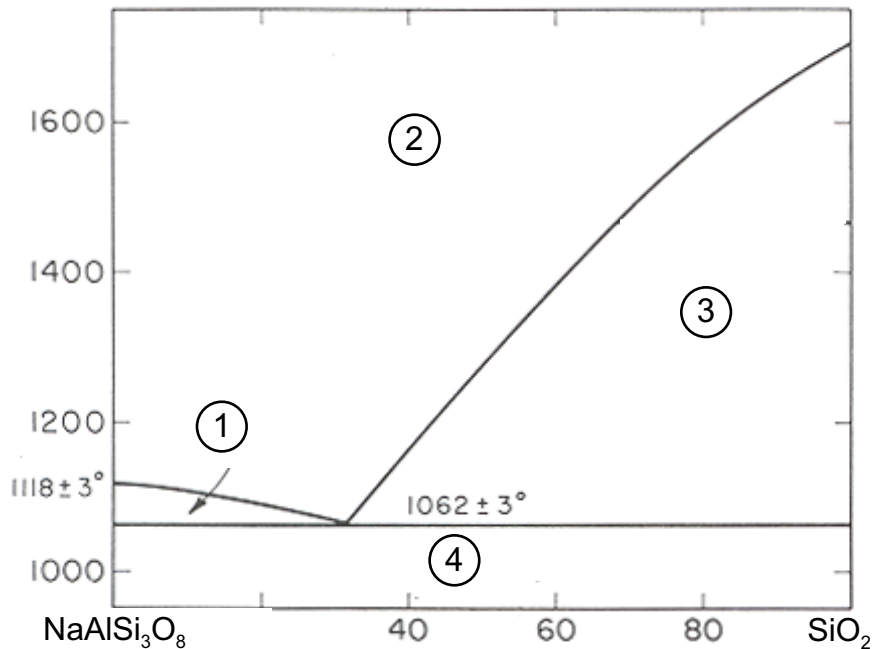


FIG. 508.—System NaAlSi₃O₈-SiO₂.

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Question 3c

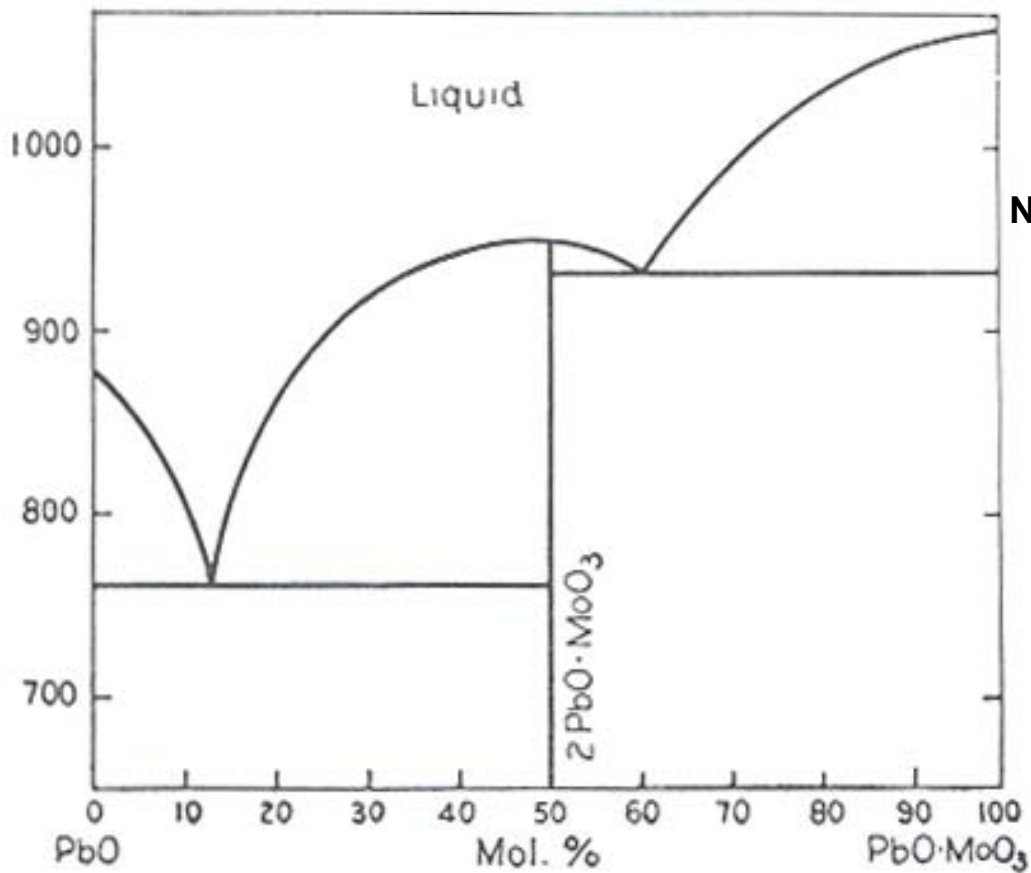


FIG. 292.—System PbO-PbO·MoO₃.

Question 3d

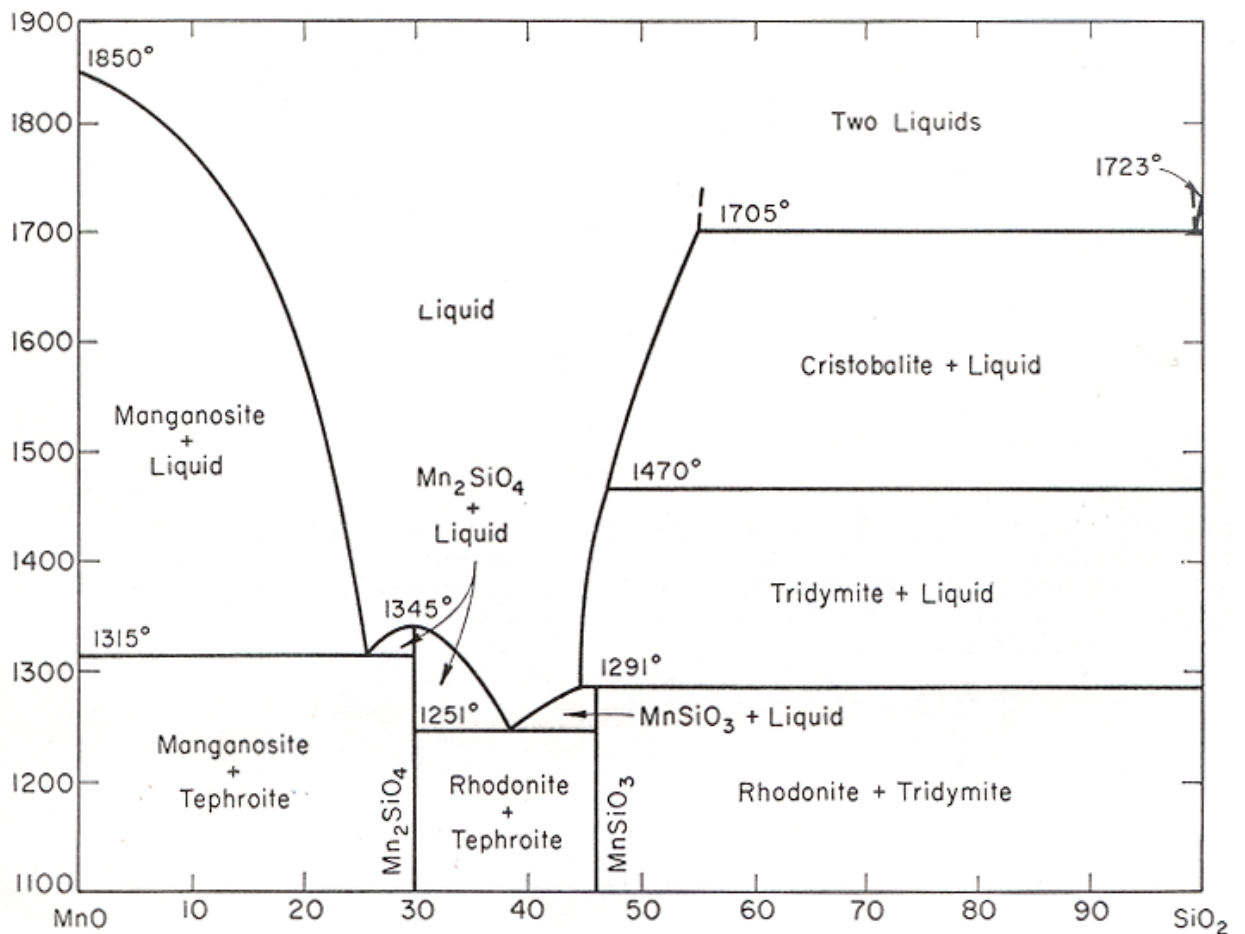


FIG. 101.—System MnO-SiO₂.