GLY 4310 Name _____

February 25, 2020

Take Home Quiz 5 KEY

Take home quizzes are due at the beginning of the following lecture. They are worth 2 points of EXAM credit. Please attach this sheet to your answers if additional sheets are used.

1. Figure 7.19 in the text shows the dry ($P_{H_2O} = 0$) and the wet ($P_{H_2O} = P_{fluid}$) cases. Use the Clapeyron equation to explain the following:

A. For the dry case, why the slope of dP/dT is positive.

B. For the wet case, why the slope of dP/dT is negative.

C. For the wet case, below P = 0.15 GPa, why the curve shows a large initial depression of the melting point.

D. For the wet case, above P = 0.15 Gpa, why the slope of the line is much less negative.

1A. The Clapeyron equation is

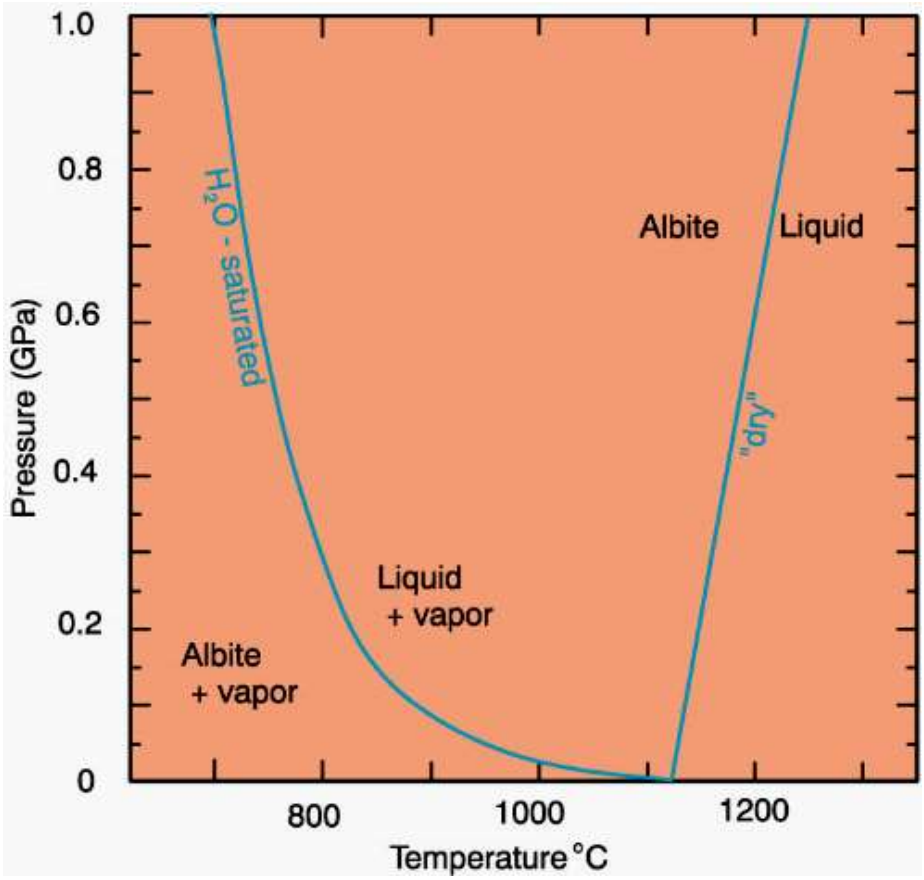
$$\frac{dP}{dT} = \frac{\Delta S}{\Delta V}$$

For the transition from solid to liquid, entropy increases, so ΔS is positive. The volume also increases on going from solid to liquid> Since both ΔS and ΔV are positive, dP/dT must be positive.

1B. For the equation,

$$H_2O_{(vapor)} + Albite = Liquid_{(aq)}$$

volume decreases on going from vapor to liquid, so ΔV is negative. This means the dP/dT is negative.



1C. Below 0.15 GPa, the gas volume decreases rapidly with increasing pressure, so ΔV is negative and large. Thus, there is a substantial depression of the melting point. It is the rate of change of ΔV with P that is important. Mathmatically,

$$\left(\frac{(\delta \Delta V)}{(\delta P)} \right)_T$$

1D. Above 0.15 GPa, the gas volume continues to shrink with increasing pressure, but at a much smaller rate. Thus, the melting point depression with increasing pressure is more gradual. ΔV is still megative, but the rate of change is smaller.