

**Answer the following multiple choice questions for 10 points each.
Must show complete work for full credit to be given:**

1. What happens to the chemical potential for a liquid if pressure is applied to the liquid?
A) the chemical potential is unchanged B) the chemical potential increases
C) the chemical potential decreases D) this cannot be determined
2. Assuming that Raoult's law is valid over the full range of mole fractions, calculate the mole fraction of A in the vapor if the mole fraction of A in the liquid is 0.250 and the pure vapor pressures of A and B are 125 and 525 torr respectively.
A) 0.250 B) 0.500 C) 0.750 D) 0.059 E) 0.074
3. At a temperature of 350 K the mole fraction of A in a binary A-B mixture is 0.350 in the liquid phase and 0.550 in the gas phase. If A and B are mixed in a 0.400 mole fraction ratio at 350 K, what is the percentage of the sample in the gas phase?
A) 40.0% B) 55.0% C) 35.0% D) 25.0% E) 75.0%

Choose two of the following three exercises for 30 points each:

4. The enthalpy of vaporization of water is $40.656 \text{ kJ mol}^{-1}$. What is the fraction of this enthalpy spent on expanding the vapor at 373 K and 1.00 atm?
5. In a 5.0 L compartment that is partitioned into two sides of 1.0 L and 4.0 L. In the 1.0 L compartment there is 1.0 atm of N_2 at 25°C and in the 4.0 L component there is 1.0 atm of H_2 at 25°C . Assuming ideal behavior, calculate the G° and S° of mixing when the partition is removed.
6. Draw the A-B temperature-composition phase diagram for a two-component system which forms one compound AB that melts congruently with negligible solid-solid solubility

Choose one of the following three problems for 50 points:

7. Construct the phase diagram for benzene near its triple point at 36 torr and 5.50°C using the following data: $H_{\text{fus}} = 10.6 \text{ kJ mol}^{-1}$, $H_{\text{vap}} = 30.8 \text{ kJ mol}^{-1}$, $(s) = 0.891 \text{ g cm}^{-3}$, $(l) = 0.879 \text{ g cm}^{-3}$.
8. The volume of an aqueous solution of NaCl at 25°C was measured at a series of molalities b , and it was found that the volume fitted the equation below where V is the volume of a solution formed from 1.000 kg of water and b is understood to be expressed in molality units. Calculate the partial molar volume of the components in a solution of molality $0.150 \text{ mol kg}^{-1}$.

$$V (\text{cm}^3) = 1003 + 16.62 b + 1.77 b^{3/2} + 0.12 b^2$$

9. Draw the temperature-composition phase diagram for MgO and Ni_2O_3 using the data below, where x is the mole fraction of MgO in the solid and y its mole fraction in the liquid. State the melting point of a mixture with $x = 0.30$ and the composition and proportion of the phases present when this solid is heated to 2200°C . Does this data indicate if this system has a eutectic composition?

T ($^\circ\text{C}$)	1960	2200	2400	2600	2800
x	0.000	0.350	0.600	0.830	1.000
y	0.000	0.180	0.380	0.650	1.000