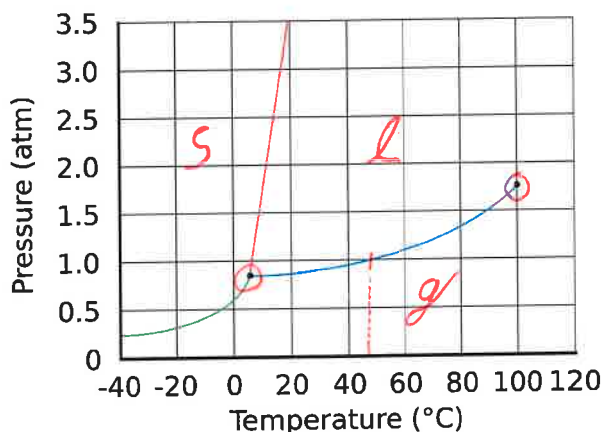


Quiz 11.3 – Vapor Pressure and Phase Diagrams

Name: Key

All questions will refer to the phase diagram for an unknown substance shown below

Unknown Substance Phase Diagram



Question 1

On the diagram, label the regions which represent each phase (solid, liquid, and gas)

Question 2

Estimate the normal boiling temperature

$$\sim 75^{\circ}\text{C} \quad (318 \text{ K})$$

Question 3

Is the liquid or solid phase more dense?

Solid (transition line has positive slope)

Question 4

Estimate the temperature and pressure at the triple point and the critical point

$$\text{T.P.: } 5^{\circ}\text{C} \quad (278 \text{ K}) \text{ and } 0.8 \text{ atm} \quad \text{C.P.: } 100^{\circ}\text{C} \quad (373 \text{ K}) \text{ and } 1.75 \text{ atm}$$

Question 5

Use your estimates to calculate ΔH_{vap}

$$\ln \left(\frac{1.75 \text{ atm}}{0.8 \text{ atm}} \right) = \frac{-\Delta H_{\text{vap}}}{8.314 \text{ J/mol}\cdot\text{K}} \left(\frac{1}{373 \text{ K}} - \frac{1}{278 \text{ K}} \right) \rightarrow \Delta H_{\text{vap}} = 7103 \text{ J/mol}$$

$$7.103 \text{ kJ/mol}$$

Question 6

Use the normal boiling point and your estimate of ΔH_{vap} to predict what the vapor pressure would be at 120°C , if there were no critical point

$$\rightarrow 393 \text{ K}$$

$$\ln \left(\frac{P_2}{1.0 \text{ atm}} \right) = \frac{-7103 \text{ J/mol}}{8.314 \text{ J/mol}\cdot\text{K}} \cdot \left(\frac{1}{T_2} - \frac{1}{318 \text{ K}} \right) \rightarrow P_2 = 1.67 \text{ atm}$$

↑
393 K

★ Note that this answer seems non-physical. This is because I sketched an unrealistic diagram