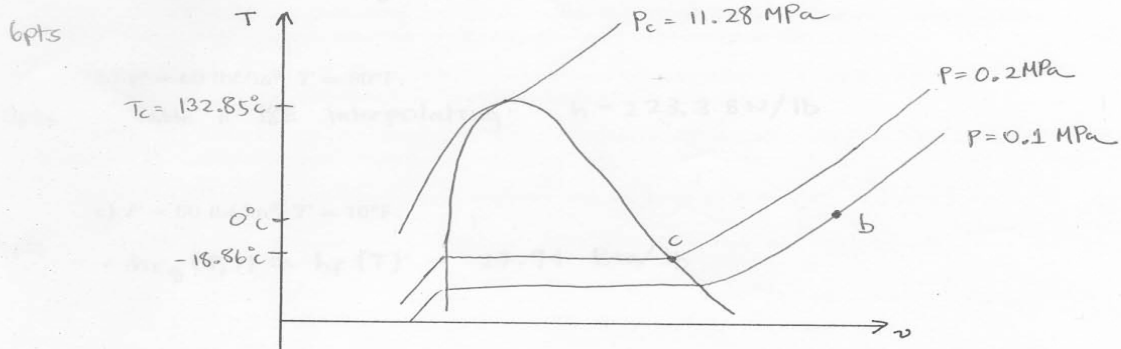


1) Phase diagrams

a) On the $T-v$ diagram below draw the liquid-vapor coexistence region and the critical isobar for ammonia. Label and indicate the values of T_c and P_c (in $^{\circ}\text{C}$ and MPa).



Determine the phase or phases in a system consisting of ammonia at the following conditions and sketch the location of each state on the $T-v$ diagram above.

b) $P = 0.1 \text{ MPa}$, $T = 0^{\circ}\text{C}$.
 Superheated vapor (Table A-15)

c) $P = 0.20 \text{ MPa}$, $v = 0.59460 \text{ m}^3/\text{kg}$.
 From Table A-15 or A-14 $v = 0.59460 \text{ m}^3/\text{kg} = v_g$
 Saturated vapor

d) Indicate on the $T-v$ diagram above the regime in which the substance behaves as an ideal gas.

2pts

$$T = (T_r / T_c) = 387.45 \text{ K}$$

approx: for $Z = 0.9$, $\omega = 1.40 \rightarrow Z = 0.9$

$$Z = \frac{Pv}{RT} \rightarrow T = \frac{Pv}{ZR} = \frac{(12988 \text{ kPa/m}^2)(0.0097 \text{ m}^3/\text{kg})(86.46 \text{ kg/kmol})}{0.9 (8.314 \text{ kJ/kmol}\cdot\text{K})}$$

2

$$T = 387.34 \text{ K}$$