87) graph $\ln P_{vap}$ vs $\frac{1}{T}$ and take slope

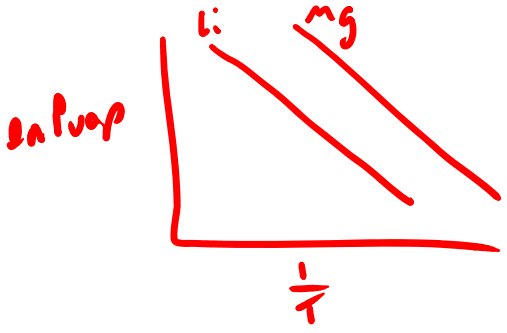
$$m = -\frac{\Delta H_{vap}}{R}$$

$$\Delta H_{vap} = -m \cdot R$$

Li: $(1.9 \times 10^4\ K)\left(8.31 \frac{J}{mol \cdot K}\right) = 1.58 \times 10^5 \frac{J}{mol} = 158 \frac{kJ}{mol}$

Mg: $(1.67 \times 10^4\ K)\left(8.31 \frac{J}{mol\ K}\right) = 1.39 \times 10^5 \frac{J}{mol} = 139 \frac{kJ}{mol}$

Li has a larger ΔH_{vap}



88) $\ln \frac{P_1}{P_2} = \frac{\Delta H_{vap}}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$

$$\ln \frac{520\ mm}{760\ mm} = \frac{40700 \frac{J}{mol}}{8.31 \frac{J}{mol\ K}}\left(\frac{1}{373K} - \frac{1}{x}\right)$$

$$-7.75 \times 10^{-3} = \left(\frac{1}{373K} - \frac{1}{x}\right)$$

$$\frac{1}{T_1} = 2.76 \times 10^{-3} \qquad T_1 = 362K \text{ or } 89°C$$

9a) $\ln \frac{P_1}{P_2} = \frac{\Delta H_{vap}}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$

$\ln \frac{836 \text{ torr}}{213 \text{ torr}} = \frac{\Delta H_{vap}}{8.31 \frac{J}{mol \cdot K}}\left(\frac{1}{313K} - \frac{1}{353K}\right)$

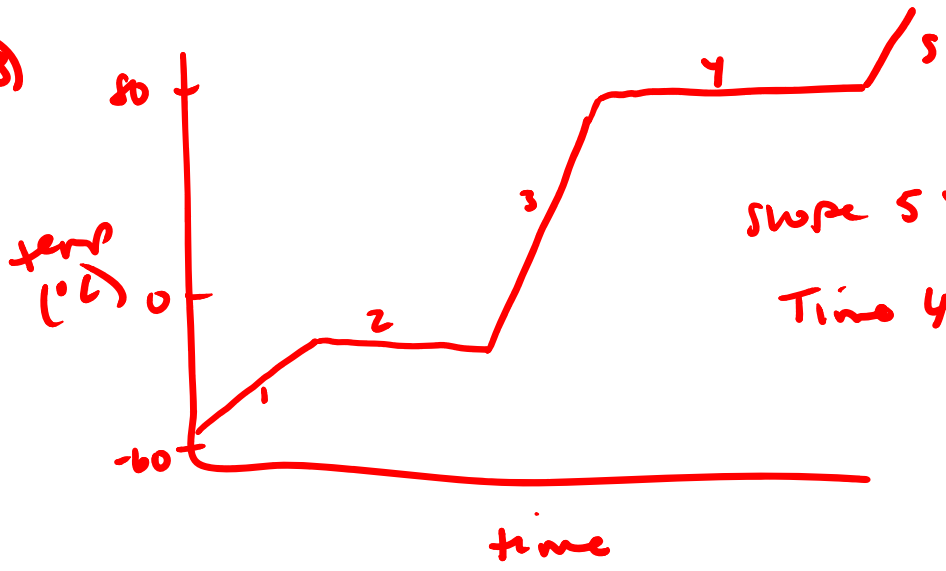
$\Delta H_{vap} = 3.1 \times 10^4 \frac{J}{mol}$

$\ln \frac{760. \text{ torr}}{213 \text{ torr}} = \frac{3.1 \times 10^4 \frac{J}{mol}}{8.31 \frac{J}{mol \cdot K}}\left(\frac{1}{313K} - \frac{1}{T_1}\right)$

$\frac{1}{313K} - \frac{1}{T_1} = 3.4 \times 10^{-4}$

$T_1 = 350. K$ or $77^\circ C$

9b)



slope 5 > slope 3 > slope 1

Time 4 : 4 × Time 2

95) a) many more intermolecular forces must be broken to convert a liquid to a solid as compared to converting a solid to liquid

$\Delta H_{vap} > \Delta H_{fus}$

b) 1.00 g Na $\quad \frac{1\ mole\ Na}{22.99\ g\ Na} \left| \frac{2.60\ kJ}{1\ mole\ Na} \right. = 0.113\ kJ$ or 113 J to melt

c) 1.00 g Na $\quad \frac{1\ mole\ Na}{22.99\ g\ Na} \left| \frac{97.0\ kJ}{1\ mole\ Na} \right. = 4.22\ kJ$ to vaporize 1.00 g Na or 4220 J

d) reverse process, opposite sign

97) $q_1 = m \Delta T C_p$

$= (5.00 \times 10^2\ g)(20.^\circ C)\left(2.03 \frac{J}{g^\circ C}\right) = 2.0 \times 10^4\ J = 20.\ kJ$

$q_2 = m \Delta H_{fus}$

$= (5.00 \times 10^2\ g)\left(\frac{1\ mole}{18.02\ g}\right)\left(\frac{6.02\ kJ}{1\ mol}\right) = 167\ kJ$

$q_3 = m \Delta T C_p$

$= (5.00 \times 10^2\ g)(100.^\circ C)\left(4.184 \frac{J}{g^\circ C}\right) = 2.1 \times 10^5\ J = 210\ kJ$

$q_4 = m \Delta H_{vap}$

$(5.00 \times 10^2\ g)\left(\frac{1\ mole}{18.02\ g}\right)\left(40.7 \frac{kJ}{mol}\right) = 1130\ kJ$

$q_5 = m \Delta T C_p$

$(5.00 \times 10^2\ g)(150.^\circ C)\left(2.0 \frac{J}{mol \cdot ^\circ C}\right) = 1.5 \times 10^5\ J = 150\ kJ$

Total = 1680 kJ

99) total mass if cube $= \frac{30.0\,g}{1\,cube} = 540.g\,H_2O \times \frac{1\,mole}{18.02\,g} = 30.0\,mole\,H_2O$

heat removed to produce ice @ -5.0°C

$q_1 = (540.g \times 22.0°C \times 4.184\,\frac{J}{g°C}) = 4.97 \times 10^4\,J$

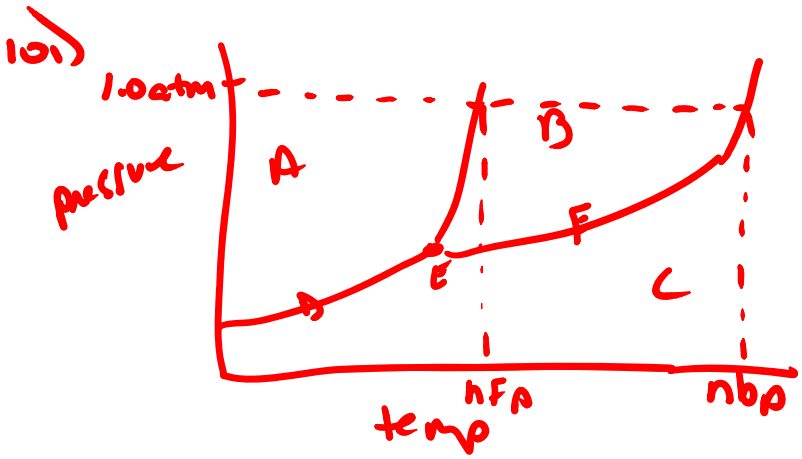
$q_2 = (30.0\,mol \times 6.02 \times 10^3\,\frac{J}{mol}) = 1.81 \times 10^5\,J$

$q_3 = (540.g \times 5.0°C \times 2.02\,\frac{J}{g°C}) = 5.5 \times 10^3\,J$

$q_{Tot} = 2.36 \times 10^5\,J$

$2.36 \times 10^5\,J \times \frac{1\,g\,CF_2Cl_2}{158\,J} = 1.49 \times 10^3\,g\,CF_2Cl_2$ must be vaporized

101)



A) solid
B) liquid
C) gas
D) solid + vapor
E) solid, liquid + vapor
F) liquid + vapor
G) liquid + vapor
H) vapor

*E) triple pt

*b) critical pt