Chemistry 141 Name

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Quiz 10 (20 points) November 23, 2010

All work must be shown to receive credit.

$$ln\left(\frac{P\_{2}}{P\_{1}}\right)=\frac{-∆H\_{vap}}{R}\left(\frac{1}{T\_{2}}-\frac{1}{T\_{1}}\right)=\frac{∆H\_{vap}}{R}\left(\frac{T\_{2}-T\_{1}}{T\_{1}T\_{2}}\right)$$

$$log\left(\frac{P\_{2}}{P\_{1}}\right)=\frac{-∆H\_{vap}}{2.303 R}\left(\frac{1}{T\_{2}}-\frac{1}{T\_{1}}\right)=\frac{∆H\_{vap}}{2.303R}\left(\frac{T\_{2}-T \_{1}}{T\_{1}T\_{2}}\right)$$

R=0.0821 L atm/mol K = 62.4 L torr/mol K = 8.31 J/mol K

1. (12 points) Propane has a heat of vaporization of 19.04 kJ/mol and a normal boiling point of -42.0oC.
	1. What is the vapor pressure of propane at 25oC?

$$ln\frac{P\_{2}}{P\_{1}}=\frac{∆H\_{vap}}{R}\left(\frac{T\_{2}-T\_{1}}{T\_{1}T\_{2}}\right)$$

$$ln\frac{\left(760 torr\right)}{P\_{1}}=\frac{19040\frac{J}{mol}}{8.31\frac{J}{mol K}}\left(\frac{231 K-298K}{\left(231 K\right)\left(298 K\right)}\right)=-2.23$$

$$\frac{\left(760 torr\right)}{P\_{1}}=e^{-2.23}=0.1075$$

$$P\\_1=(760 torr)/(0.1075)=7070 torr (9.30 atm)$$

* 1. What is the boiling point of propane under the ocean where the atmospheric pressure is 36.0 atmospheres?

$$ln\frac{\left(36.0 atm\right)}{\left(1 atm\right)}=\frac{19040\frac{J}{mol}}{8.31\frac{J}{mol K}}\left(\frac{T\_{2}-231 K}{\left(T\_{2}\right)\left(231 K\right)}\right)$$

$$3.58=\frac{19040\frac{J}{mol}}{8.31\frac{J}{mol K}}\left(\frac{T\_{2}-231 K}{\left(T\_{2}\right)\left(231 K\right)}\right)=\left(9.92\right)\left(\frac{T\_{2}-231 K}{\left(T\_{2}\right)}\right)$$

$$0.361=\left(\frac{T\_{2}-231 K}{\left(T\_{2}\right)}\right)$$

$$0.361 T\_{2}= T\_{2}-231 K $$

$$-0.639 T\_{1}=-231 K$$

$$T\_{1}=361 K or 88 ℃$$

1. (8 points) Carbon tetrachloride has a normal boiling point of 350 K and a melting point (at 1 atm) of 250.3 K. Its critical temperature is 556 K and critical pressure is 44.4 atm. It has a triple point at 249.0 K and 0.85 atm. Sketch the phase diagram of carbon tetrachloride. Which has the greater density, solid carbon tetrachloride or liquid carbon tetrachloride?

7302

Pressure (torr)

Which is more dense for this substance, the liquid or the solid state? Explain how you arrived at this answer.

liquid

Critical point

The solid is more dense because the liquid converts to a solid when pressure is applied.

solid

760

556

350

 249 250

Temperature (K)

gas

Triple point

460