Practice Test 1 Key CHEM 1451

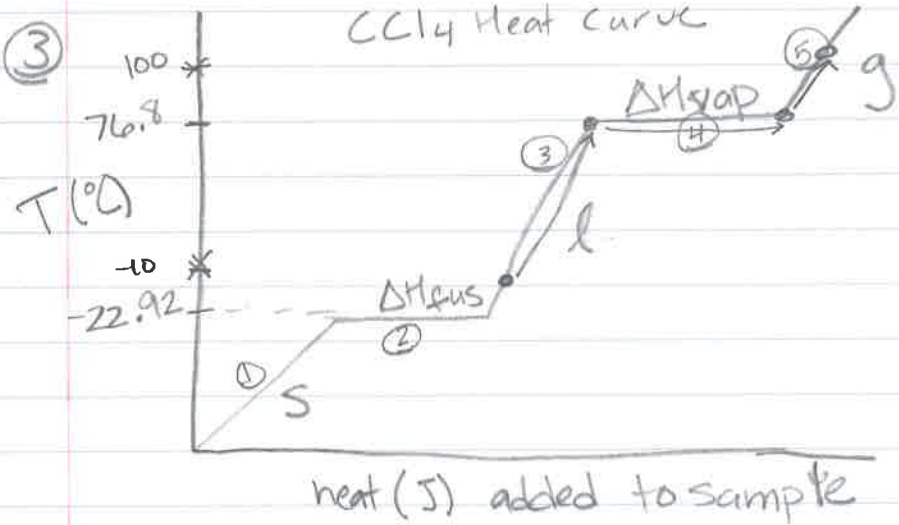
1. E (CO_2 is the ONLY non-polar molecule listed)
2. A
3. A
4. B (Higher VP means weakest IMF)
5. E
6. D (Draw the VSEPR!, SF_4 is POLAR)
7. D
8. B (CCl_4 is nonpolar, so look for a nonpolar solute)
9. B
10. C

Problems / Short Answer

① $CH_3OH(\ell) \longrightarrow CH_3OH(g)$

② When you melt (ΔH_{fus}) you do not fully overcome the IMF between molecules. When you boil (ΔH_{vap}) ALL of the IMF must be overcome so that the molecules are fully independent of each other.

③



③ cont $-10^\circ C$ to $100^\circ C$ ← gas
↑ we are already melted

③ $-10^\circ C$ to $76.8^\circ C$ liquid

$q = mC\Delta T$
$= 25.0g\,(.857\ J/^\circ C \cdot g)(76.8^\circ C - -10^\circ C)$
$= 1859.69\ J$

④ $\Delta H_{vap} \cdot mol\ CCl_4$ boil
$29.82\ \frac{kJ}{mol}\left(25.0g / 153.81\ g/mol\right)$
$= 4847\ J$

⑤ $76.8^\circ C$ to $100^\circ C$ gas

$q = mC\Delta T$
$= 25.0g\,(.423\ J/^\circ C \cdot g)(100 - 76.8)$
$= 245\ J$

Sum = 6952 J or 6.952 kJ

④ $S_{gas} = k_H \cdot P_{gas}$ (k_H: $3.4 \times 10^{-2}\ M/atm$; P_{gas}: ? atm)

S_{gas}: ? M

$2.2g\ CO_2$ in 355 mL

$M = \frac{.05\ mol\ CO_2}{.355L} = .141\ M$

$.141\ M = 3.4 \times 10^{-2}\ \frac{M}{atm} \times P_{CO_2}$

$= \boxed{4.14\ atm\ of\ CO_2}$

⑤ $T_b = 102.0°C$ $T_f = ?$

$\Delta T_b = 2.0°C = K_b \cdot m$ ($K_b = .51°C/m$, $m = ?$)

$\frac{2.0°C}{.51°C/m} = 3.92\,m$ ← find "m" first!

then, use it

$\Delta T_f = 1.86°C/m \cdot 3.92\,m$

$= 7.29°C$

$T_f = 0 - 7.29°C = \boxed{-7.29°C}$

⑥ $.150\,g\,Pb\left(\frac{100\,g\,soln}{.0011\,g\,Pb}\right)\left(\frac{1\,mL\,soln}{1.0\,g\,soln}\right) = \boxed{13636\,mL}$

⑦ $X_{H_2O_2} = \frac{mol\,H_2O_2}{mol\,H_2O_2 + mol\,H_2O}$

$32.56\,g\,H_2O_2\left(\frac{1\,mol}{34.02\,g}\right) = .957\,mol\,H_2O_2$

$275\,mL\,H_2O\left(\frac{.998\,g\,H_2O}{1\,mL\,H_2O}\right)\left(\frac{1\,mol\,H_2O}{18.02\,g\,H_2O}\right) = 15.23\,mol\,H_2O$

$X = \frac{.957\,mol}{(.957 + 15.23)\,mol} = \boxed{.059}$

⑧ 39.0% HCl ⇒ 39.0g HCl in 100g sol'n

$M = \frac{\text{mol HCl}}{\text{L sol'n}}$ ① / ②

① $39.0\text{g HCl}\left(\frac{1\text{ mol}}{36.46\text{g}}\right) = 1.07\text{mol HCl}$

② $100\text{g sol'n}\left(\frac{1\text{mL}}{1.20\text{g sol'n}}\right)\left(\frac{10^{-3}\text{L}}{1\text{mL}}\right) = .0833\text{L}$

$M = \frac{1.07\text{mol HCl}}{.0833\text{L}}$

$= \boxed{12.8\text{ M}}$

⑨ $P^\circ_{Benz} = 183\text{mmHg}$ $P^\circ_{Tol} = 59.2\text{mmHg}$

$P_{Benz} = .600 \cdot 183\text{mmHg} = 109.8\text{ mmHg}$

$P_{Tol} = .400 \cdot 59.2\text{mmHg} = 23.68\text{mmHg}$

$P_{Tot} = \boxed{133.5\text{ mmHg}}$

⑩ a + b : $\Delta H_{solute-solute} + \Delta H_{solvent-solvent}$ either order!

c : $\Delta H_{solute-solvent}$

d : ΔH_{soln}

a) Yes! This process is exothermic, so I expect to see dissolving occur

b) It MUST be exothermic if the dissolving process releases heat to the surroundings.