Review Packet #3 - Random Topics

1)a) two points

carbon: 49.02 / 12.01 = 4.081 g   hydrogen: 2.743 / 1.008 = 2.722 g   chlorine: 48.23 / 35.453 = 1.360 g

mole ratios: C/Cl = 3; H/Cl = 2; Cl/Cl = 1

empirical formula = C_3H_2Cl

b) three points

[delta]$T_f = K_f\, m$

4.38 °C = (5.12) (x / 0.025)

x = 0.0214 mol

3.150 g / 0.0214 mol = 147 g / mol

Note: the scoring standards has this equation rather than the above three lines:

$$4.38 = 5.12 \times \left(\frac{\left(\frac{3.150}{MM}\right)}{25/1000} \right) = 147 \text{ g/mol}$$

The standards then show: MM = [(5.12) (3.150) (1000)] / [(4.38) (25)] = 147

c) two points

mole fraction = moles benzene / total moles

C_6H_6 = 78.108

25.00 g / 78.108 = 0.32 mol

0.32 / (0.32 + 0.0214) = 0.94

d) two points

$P_{soln} = P_{pure}$ x mole fraction P_{soln} = (150) (0.94) = 141 mm Hg

2) a) two points

The addition of a solute lowers the freezing point of water.

A mole of NaCl contains (dissociates into) 2 moles of ions/particles, whereas a mole of $CaCl_2$ contains (dissociates into) 3 moles of ions. Therefore, $CaCl_2$ is more effective.

b) two points

Hydrogen bonding is the most important intermolecular attractive force between molecules of H_2O and between molecules of NH_3.

Water is a liquid because the hydrogen-bonding forces are stronger between the adjacent H_2O molecules than between adjacent NH_3 molecules.

c) two points

Graphite's structure consists of 2-dimensional sheets of covalently bonded carbon atoms.

The attractive forces between sheets (layers) are weak London (dispersion) forces, which allow the sheets to slide easily over one another. (Note: must indicate layers and sliding to earn point.)

Diamond consists of an extended 3-dimensional covalent network of carbon atoms. This makes diamond a very hard substance.

d) two points

Vinegar, a dilute solution of acetic acid, reacts with the white solid, which contains metal carbonates, in a neutralization reaction to form gaseous CO_2.

3)a) two points
Assume a 100-gram sample of hydrocarbon
93.46 grams C x (1 mole C / 12.01 grams C) = 7.782 moles C
6.54 grams H x (1 mole H / 1.008 grams H) = 6.49 moles H
7.782 moles C / 6.49 moles H = 1.20
$C_{1.20}H_{1.00} = C_6H_5$
b) two points
Molality = moles solute per kilogram solvent
m = (2.53 grams solute / 25.86 grams solute) x (1 mole solute / 147.0 grams solute) x (1000 grams solute / 1 kg solvent) = 0.665 *m*
c) one point
Freezing point lowering = 80.2° - 75.7° = 4.5°
Molal freezing point depression constant = (4.5° / 0.665 molal solution)
= 6.8° lowering for 1 molal solution
d) three points
Freezing point lowering = 80.2° - 76.2° = 4.0°
(6.8 x kg. solvent/mole solute) x (1 / 4.0°) x (2.43 grams solute / 26.7 grams solvent) x (1000 grams solvent / kg solvent) = 154 grams solute / mole solute)
e) one point
Empirical unit weight (C_6H_5) = 77 Number of empirical units per mole= 154 / 77 = 2
molecular formula = (C_6H_5) x 2 = $C_{12}H_{10}$