

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

$$[\Delta]T_f = K_f m$$

$$4.38 \text{ }^\circ\text{C} = (5.12) (x / 0.025)$$

$$x = 0.0214 \text{ mol}$$

$$3.150 \text{ g} / 0.0214 \text{ mol} = 147 \text{ g/mol}$$

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

$$C_6H_6 = 78.108$$

$$25.00 \text{ g} / 78.108 = 0.32 \text{ mol}$$

$$0.32 / (0.32 + 0.0214) = 0.94$$

d) two points

$$P_{\text{soln}} = P_{\text{pure}} \times \text{mole fraction}$$

$$P_{\text{soln}} = (150) (0.94) = 141 \text{ mm Hg}$$

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 .

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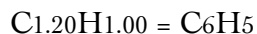
3)a) two points

Assume a 100-gram sample of hydrocarbon

$$93.46 \text{ grams C} \times (1 \text{ mole C} / 12.01 \text{ grams C}) = 7.782 \text{ moles C}$$

$$6.54 \text{ grams H} \times (1 \text{ mole H} / 1.008 \text{ grams H}) = 6.49 \text{ moles H}$$

$$7.782 \text{ moles C} / 6.49 \text{ moles H} = 1.20$$



b) two points

Molality = moles solute per kilogram solvent

$$m = (2.53 \text{ grams solute} / 25.86 \text{ grams solvent}) \times (1 \text{ mole solute} / 147.0 \text{ grams solute}) \times (1000 \text{ grams solvent} / 1 \text{ kg solvent}) = 0.665 \text{ m}$$

c) one point

$$\text{Freezing point lowering} = 80.2^\circ - 75.7^\circ = 4.5^\circ$$

$$\text{Molal freezing point depression constant} = (4.5^\circ / 0.665 \text{ molal solution})$$

$$= 6.8^\circ \text{ lowering for 1 molal solution}$$

d) three points

$$\text{Freezing point lowering} = 80.2^\circ - 76.2^\circ = 4.0^\circ$$

$$(6.8 \times \text{kg. solvent/mole solute}) \times (1 / 4.0^\circ) \times (2.43 \text{ grams solute} / 26.7 \text{ grams solvent}) \times (1000 \text{ grams solvent} / \text{kg solvent}) = 154 \text{ grams solute} / \text{mole solute}$$

e) one point

$$\text{Empirical unit weight (C}_6\text{H}_5) = 77$$

$$\text{Number of empirical units per mole} = 154 / 77 = 2$$

$$\text{molecular formula} = (\text{C}_6\text{H}_5) \times 2 = \text{C}_{12}\text{H}_{10}$$