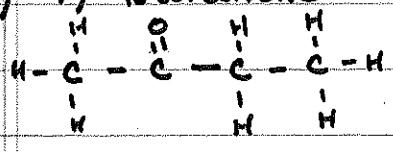
AP Chem - Unit 7 - NMSI Super Problem

A) i) Butanone



Molecules of Butanone are polar due to the dipole moment created by the unequal distribution of electron density.

1pt ∴ The molecules exhibit dipole-dipole forces as well as London dispersion forces

ii) n-Butane

1pt molecules of Butane are NONpolar ∴ They only have Londispersion forces

B) Butanone is much more soluble in H_2O than n-Butane, why?

+1pt Butanone is polar allowing it to form dipole-dipole intermolecular interactions w/ water

1pt This dipole-dipole interaction does not exist btwn NON-polar Butane molecules & water, ∴ Butane is not very soluble in H_2O

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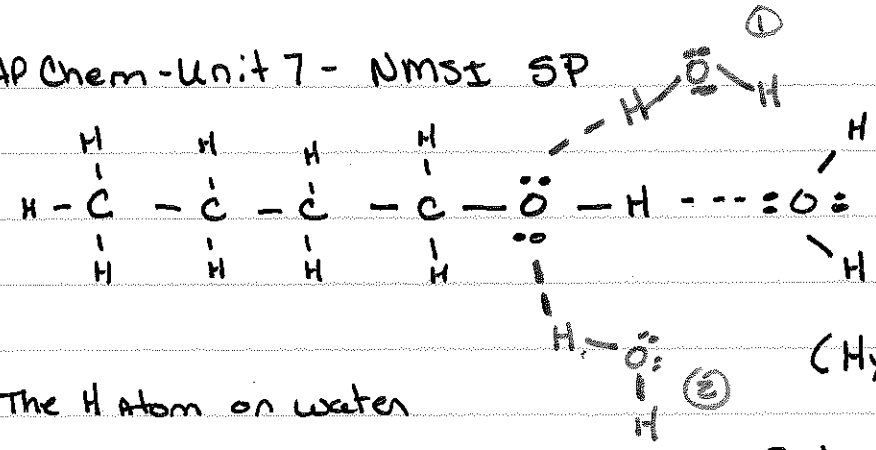
c) 

1pt

(Hydrogen Bonds)

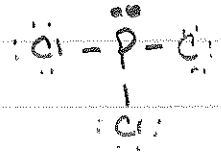
The H atom on water must be aligned to the oxygen on the Butanol

D) Butane is nonpolar + London dispersion forces $\Delta H_{vap} = 21.0$ KJ/mole

Butanone is polar + dipole-dipole forces $\Delta H_{vap} = 32.2$ KJ/mole

n-Butanol is polar + will have dipole-dipole forces + it ~~is a~~ also is a larger molecule (Bigger MM) causing more polarizability (↑ # electrons) the $\Delta^\circ H_{vap}$ will be higher for Butanol ∴ greater than 32.2 KJ/mol

1pt

e) PCl_3 

P 5 = 5
Cl 3x7 = 21
26
38 24

PCl_3 molecules is polar + its molecules are Attracted to each other ← By Dipole-Dipole forces

1pt

KCl K^+ Cl^- Are Ionic Bonds + held together

NaCl Na^+ Cl^- By electrostatic forces

1pt Ionic Bonds are stronger than dipole-dipole Interactions ∴ more energy to over come IB ∴ high temp to melt NaCl + KCl

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e) cont:

NaCl & KCl — Both have same charges but Na^+ has a smaller Radius than K^+ which makes the lattice energy of NaCl greater than KCl

1pt

∴ more energy need to overcome the forces in NaCl than KCl

∴ NaCl ↑ MP

F) Neon has a much lower BP than Xenon. Explain

1pt Ne & Xe Both only have London dispersion forces

Ne has fewer electrons than Xe; the fewer electrons ∴

1pt less polarizable the cloud, ⇒ weaker attractive forces

∴ Ne has ~~smaller~~ lower BP

G) Xenon is much more soluble in H_2O than Neon. Explain

Xe has more electrons, so it's cloud is more

1pt Polarizable ∴ Xe can Better interact with H_2O

attractive forces ∴ more soluble in H_2O

1pt

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H) Argon's solubility in H_2O be greater than or less than Xe?

1pt Argons solubility is <u>less</u> than Xe

* The greater the polarizable the cloud the Better the Substance can Interact w/ H_2O Attractive forces, ∴ more Soluble the substance.

Both Xe & Ar only have London dispersion forces.

1pt Ar has less electrons than Xe, ∴ Ar less polarizable ∴ less soluble

I) Greater Vp liquid Ar or Xe?

1pt Argon will have the larger Vapor Pressure

Both Ar + Xe have only London dispersion forces. Argon (less electrons) has a less polarizable Cloud ∴ less

1pt Attractive forces with H_2O. This lower Attractive force (compared to Xe) will allow Ar to escape easier & enter the vapor phase ∴ ↑ Vp