BIO 365 Environmental Contaminants

Review problems for test II

This test will cover the lecture material covering contaminant partitioning, fugacity, biotic/abiotic transformations, and metals. Be sure you can still balance equations, convert ppm, etc. Just because this isn't a cumulative test doesn't mean that you can forget those concepts.

My suggestions for the test: Review the notes including problems from class and work on the questions below.

Contaminant partitioning

Understand the concepts, for example, what is the significance of K_f and what can you predict with it?

I do not expect you to memorize equations (Freundlich, Henry's Law, etc.) but you should be able to apply them to a problem. When needed, you will be given the equations (the ones in bold) and it is expected that you can use that information to solve a problem.

What does the Henry's Law constant (H) tell you? How about K_{biota}? K_f? K_{OW}? K_D?

Be sure you understand how K_{OW} can be used to approximate the amount of a contaminant in lipids and soil organic matter.

Fugacity

Understand the concept of fugacity.

You will be given a table similar to the 3 that we worked out and/or you were given solutions to. Be able to complete one and answer questions related to it.

Biotic transformations of contaminants

Why is the Krebs Cycle important for the degradation of compounds that do not initially resemble commonly encountered chemicals? How can it be used to ultimately degrade aromatic compounds as well as straight chain alkanes?

Why is oxygen preferred as an electron acceptor over nitrate? Why nitrate over sulfate?

How do mineralization, degradation and detoxification differ?

Understand what makes a compound recalcitrant or biodegradable, there are a few specific examples in the notes.

What conditions make the abiotic degradation of a compound favorable? Both in terms of properties of the compounds a the environment.

How can humic acids aid in the abiotic degradation/removal of contaminants?

How can solid surfaces aid in the abiotic degradation of contaminants?

Metals

Be comfortable with the mathematics of bioaccumulation.

Understand how the oxidation state, volatility and other chemical properties influence the toxicity and distribution of metals.

You should understand how chelators may be used for sequestering metals.

How does increased pH influence metals? Specifically Cu, As. How does decreased pH influence Pb, Hg, and Cu?

List of equations you may or may not need for this test.

$K_D = (0.41)\ f_{OC}\ K_{OW}$
$C_1 = K_f\ (C_2)^n$
Henry's constant (H) = partial pressure (Pa) of compound in air / C_W
$K_{OW} = C_O / C_W$
$K_B = C_B / C_W$
$K_D = C_S / C_W$
$f = M_{total} / \Sigma Z_i V_i$
$M_i = f Z_i V_i$
$C_i = M_i / V_i$
$C_{SS} = 1.44 * R * t_{0.5}$
$K_B = f_{lipid}\ K_{OW}$

C_i = conc.
M = mass
f = fugacity
K_D = the partition coefficient between solid phases and water
C_{SOC} = conc. in soil organic carbon
f_{OC} = fraction of organic carbon in solid
C_1 = conc. in phase 1
C_2 = conc. in phase 2
K_f = partition coefficient
C_W = conc. in water
C_O = conc. in octanol
K_B = conc. in biota
C_S = conc. in solid
C_{SS} = steady state conc.
R = rate of intake
$t_{0.5}$ = half life