Name_________________________

Environmental Toxicology (ADVS 5400/6400)
Examination I
Friday, February 21, 2003

For questions 1-5, circle the letter corresponding to the correct statement(s). None, one or more of the selections may be correct. Don’t guess—incorrect responses will be deducted from your score (5 each).

1. The most important factor that determines chemical toxicity is:
   a. potency
   b. partition coefficient
   c. whether chemical is converted to electrophilic intermediate
   d. dose
   e. pH of environment

2. The following are true statements about risk assessment:
   a. reference dose is synonymous with acceptable daily intake.
   b. people are generally less susceptible than animals to most toxins on a mg/kg body weight basis
   c. people are usually accepting of risks they can’t control
   d. in toxicity trials, NOAEL signifies the dose at which no adverse effects are observed
   e. dose levels are often corrected between species by surface area calculations.

3. The following are true statements about cytochrome P450.
   a. the “P” in cytochrome P-450 stands for “protein.”
   b. does not occur in bacteria
   c. heme iron requires reduction to the +2 state before substrate binding can occur.
   d. in mammalian cells, is bound to membranes called microsomes
   e. catalyses reactions resulting in increased toxicity

4. The following are true statements about evaporation:
   a. evaporation rate from water is directly proportional to ionization.
   b. vapor pressure increases with temperature
   c. if a compound is water-soluble, it will evaporate more slowly from water compared to a less water-soluble compound.
   d. ionized chemicals bind to water due to Brownian movement.
   e. chemicals evaporate from wet soil more slowly than from dry soil
5. The following statements about chemodynamics are true:
   a. despite a majority of chemical releases being in the air, water and soil are the ultimate sinks for all chemicals.
   b. adsorption to soil is correlated with low water solubility and high partition coefficient.
   c. the organic fraction of clay has a high anion exchange capability
   d. soil pH is an important factor in chemical binding and is at a constant pH of 7.0.
   e. a chemical’s Henry’s Law constant is proportional to it’s water solubility

6. Briefly explain why high doses of test chemicals, much higher than doses to which people are exposed in the “real world,” are commonly given to animals in long-term animal studies designed to predict the risk to humans? (5)

7. Calculate the proportion of water and lipid soluble species of phenobarbital (weak acid; pK = 5) that you would theoretically find in the urine (pH= 6) of an exposed individual. What agent could you give to the patient in the ER to increase urinary excretion? (5)

8. Explain how a chemical can be very potently toxic, yet only mildly hazardous, and how a mildly potent chemical, can be very hazardous. Use an example to illustrate each answer. (5)
9. On a hot (38ºC), dry (4% r.h.) August afternoon (14:00) just east of Henefer, UT an animal rights group derailed a train of laboratory rats bound for Weber State University. The rats quickly adapted to their new surroundings and disappeared into the wild. The derailed locomotive leaked diesel fuel onto the banks of the Weber River threatening the town and fish. There is prevailing easterly canyon wind, the riverbanks are sandy (no organic), and because of the drought and the time of the year, the stream-flow is at a 30-year low. A) Provide an environmental and toxicological assessment concerning the spilled contaminant (i.e. what happens to it? where does it go?). B) Explain how physical and environmental factors affect the situation. C) What are possible impacts to people and wildlife? D) Propose some simple steps to contain the spill. (15)
10. In the assigned reading entitled *Biologically based pesticide dose estimates for children in an agricultural community*, explain: (15)
   a. Where did the test population reside?

   b. What class of pesticides was under analysis, and what were the modes of exposure to the test population?

   c. How did the authors “back calculate” pesticide doses?

   e. Cite three assumptions the authors used to calculate pesticide doses

   f. What were two main conclusions in the paper?
11. Benzene is a recognized human carcinogen metabolized to phenol, cysteine, sulfate and glucuronyl products. Using chemical structures, arrows, enzymes, cofactors, and products), diagram the metabolic scheme of benzene. Identify detoxified, as well as some activated products and/or intermediates, and their fate in the body. Using this diagram, show how benzene causes cancer. What are two biomarkers of benzene exposure? (15)
12. In detail, and in proper sequence, identify and explain the general steps and principles commonly used to determine a reference dose for a chemical. Make liberal use of diagrams and equations in your answer. (15)