For questions 1-10, 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; 50 total).

1. The following are true for benzene and/or benzene toxicology:
   a. health concerns mostly center on its chronic effects
   b. can cause an increase in blood cell numbers
   c. can cause a decrease in blood cell numbers
   d. about 3% in gasoline in U.S.
   e. can cause heart attacks

2. The following are true for asbestos:
   a. currently, air samples are not required to be taken prior to abatement
   b. crocidolite is a form of amphibole asbestos
   c. serpentine is a form of chrysotile asbestos
   d. amphibole is less soluble and has a longer half-life in the lung
   e. occupational exposure to amphibole has been greater than other forms

3. The following pertain to the above compounds (a-d)
   a. compound "a" is anthracene
   b. compound "c" is more carcinogenic than compound "b"
   c. compound "c" is benzo[a]anthracene
   d. all of these compounds are proven animal carcinogens
   e. only two of these compounds have a "Bay-region"

4. The following are natural toxins:
   a. cyanide
   b. pyrethroids
   c. benzo-a-pyrene
   d. atropine
   e. strychnine
5. Regarding chemical absorption in the body:
   a. all other things being equal, a weak acid is more easily absorbed than a weak base in an acidic environment
   b. all other things being equal, a weak base is more likely to be re-absorbed from the urine than a weak acid
   c. chemicals with a higher partition coefficient have a higher lipid solubility and are therefore more able to penetrate biological membranes
   d. a fat person may be "protected" from the effects of a toxic, lipid soluble chemical
   e. chemical absorption through the eye is generally more rapid than through skin

6. The following are true regarding chemicals in the environment:
   a. a weak base usually binds better to a soil than a weak acid
   b. clay is a better adsorbent for polar organic chemicals compared to organic material
   c. adsorption of a chemical to soil is adversely related to water solubility
   d. low molecular weight halogenated hydrocarbons can be formed naturally
   e. because TCDD is degraded by sunlight, it is not an environmental problem

7. The following are correct toxin: mechanism pairs:
   a. strychnine: Renshaw cell inhibiton
   b. zinc phosphide: hemolysis
   c. fluoroacetate: *cis*-acetase inhibitor
   d. dinitrophenol: uncouples glycolysis
   e. jasmolin: Na⁺/K⁺ ATPase inhibitor

8. The following are correct toxin: antidote (or treatment) pairs:
   a. strychnine: potassium sulfide
   b. strychnine: sodium pentobarbital
   c. dinitrophenol: atropine sulfate
   d. DDT: sodium pentobarbital
   e. carbaryl: 2-PAM
   f. Arsenic: dimercaptopropanol

9. The following are true for herbicides:
   a. TCDD was a contaminant of 2,4-D
   b. diquat is much less potent than paraquat
   c. chlorophenoxy herbicides are not well absorbed dermally
   d. chlorophenoxy herbicides are better absorbed in tissues at lower pH
   e. paraquat isn’t absorbed through skin

10. A critical toxic mechanism is binding to heme proteins:
    a. hydrogen sulfide
    b. carbon monoxide
    c. amygdalin
    d. strychnine
    e. cyanide
11. Compare the two botanical pesticides, pyrethrin 1 and warfarin, with respect to the following characteristics in the table. (10)

<table>
<thead>
<tr>
<th>Pyrethrin 1</th>
<th>Warfarin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticide class</td>
<td>Pesticide class</td>
</tr>
<tr>
<td>source</td>
<td>source</td>
</tr>
<tr>
<td>Intended uses</td>
<td>Intended uses</td>
</tr>
<tr>
<td>principal site of action</td>
<td>principal site of action</td>
</tr>
<tr>
<td>mechanisms of action</td>
<td>mechanisms of action</td>
</tr>
</tbody>
</table>
12. Briefly explain (1-2 sentences) the following toxicologic phenomena (25)

VX is much more potent than parathion

Treatment of strychnine poisoning must with be carried out extremely gently

Human poisoning by warfarin rare

Some carcinogens not detected by the Ames assay

Exposure to plasticizer “bisphenol A” can cause some feminine characteristics to occur in men

In WW II, Japanese soldiers often knew when an invasion by the Marines was imminent

Alkaloids generally have a short half-life in people

eating Belladonna causes flushed face, dry mouth, dilated pupils
13. Compare the two pesticides, ethylparathion and dinitroorthocresol (DNOC): (15).

<table>
<thead>
<tr>
<th></th>
<th>Ethyl parathion</th>
<th>Dinitro-o-cresol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticide class</td>
<td></td>
<td>Pesticide class</td>
</tr>
<tr>
<td>Intended uses</td>
<td></td>
<td>Intended uses</td>
</tr>
<tr>
<td>Mechanism of action</td>
<td></td>
<td>Mechanism of action</td>
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<tr>
<td>Four distinguishing symptoms</td>
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<td>Four distinguishing symptoms</td>
</tr>
<tr>
<td>Antidote or treatment</td>
<td></td>
<td>Antidote or treatment</td>
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</tbody>
</table>
14. Heading the EPA’s “Toxic 20” list, arsenic presents a good case study of risk assessment. a) Outline the key steps in risk and hazard assessment; with respect to As, a) give the two main reasons why As tops the EPA list; b) if it is so toxic, discuss why is the Bush administration backtracking on efforts to reduce acceptable intake levels in drinking water?; c) what are the major adverse effects in people thought to be caused by As? (15)
15. Below are two pesticides, dicofol and carbaryl, along with their water solubilities. **All other factors equal, predict** their relative toxicological characteristics as listed. For each answer, use a rank order (A > B, or A < B or A=B), **then state the rationale** for your answer, in the space provided. (15)

![Chemical structures of dicofol and carbaryl.]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rank order</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermal absorption</td>
<td></td>
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<tr>
<td>Enterohepatic cycling</td>
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<tr>
<td>Evaporation from water</td>
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<tr>
<td>Biomagnification in environment</td>
<td></td>
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<tr>
<td>Environmental half-life</td>
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<tr>
<td>Henry’s Law constant</td>
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<tr>
<td>Leaching from organic soil</td>
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</tbody>
</table>

A: dicofol (0.02 mg/L)  
B: carbaryl (120 mg/L)
16. Complete the following metabolic reactions with the most likely substrate, product, enzyme, or intermediate, where prompted with "S," "P," "E," or "I," respectively. Name compounds labeled with “N?” Draw the chemical structures for substrates, products, and intermediates. (25).

- \[
\text{NH}_2 \rightarrow \text{CYP} \rightarrow \text{I?} \rightarrow \text{P?}
\]

- \[
\text{Serine} \quad + \quad \text{N?} \quad \rightarrow \quad \text{P?} + \quad \text{P?}
\]

- \[
\text{Cl} \quad \text{C} \quad \text{Cl} \quad \text{C}\text{Cl}_3 \quad \text{CYP} \rightarrow \text{P?}
\]

- \[
\text{S?} \quad \rightarrow \quad \text{C?} \quad \quad \text{F?} \quad \rightarrow \quad \text{I?} \quad \rightarrow \quad \text{CYP} \rightarrow \text{P?}
\]

- \[
\text{Cl} \quad \text{Cl} \quad \text{Cl} \quad \text{Cl} \quad \text{CYP} \rightarrow \text{I?}
\]