

**CHEM. 250**  
**Spring, 2015**  
**Homework Set 3.4**

**Girard, Ch. 16: 1, 4, 5, 6, 7, 8, 14, 15, 16**

**1.** Define the following:

a. Toxin

*A poison of biological origin.*

b. Poison

*A toxic substance.*

c. Acute exposure

*Exposure over a relatively short time period (generally over periods of less than 1 day).*

d. Chronic exposure

*Exposure occurring over longer time periods (usually over a week).*

**4.** The weak base trimethylamine is often found in spoiling fish. When it is ingested, will it be absorbed in the stomach or in the intestine?

*A greater fraction of it will be present as a cation at low pH ( $B + H^+ \rightleftharpoons BH^+$ ). Thus more will be absorbed in the intestine where a greater fraction will be present in the neutral form.*

**5.** Citric acid is often used as a preservative in processed foods. When it is ingested, will it be absorbed in the stomach or in the intestine?

*Weak acids will be preferentially absorbed in the stomach where a greater fraction of the molecule will be in the uncharged state.*

**6.** Name the three main ways a chemical can enter the body.

*Dermal contact, inhalation, and ingestion.*

**7.** Define the following:

a. Dose

*Amount of substance an organism is exposed to.*

b. Response

*The effect observed by the organism as the result of the exposure.*

c. LD<sub>50</sub>

*A lethal dose for half of the exposed organisms to a given dose.*

d. Margin of error

*A concept for compounds that can serve as drugs and are poisons (at higher concentrations). The margin of error is the range between an effective and a toxic dose.*

**8.** A commercial pain relief medication contains 500 mg of acetaminophen per tablet.

Assume that the LD<sub>50</sub> of 338 mg/kg for mice applies to humans as well. How many tablets, taken all at once, would produce a 50% chance of a lethal dose of acetaminophen in a 154-pound (70 kg) person?

*Lethal dose = (70 kg)(338 mg/kg)(1 g/1000 mg) = 23.7 g*

*# tablets = (23.7 g)(1 tablet/0.5 g) = 47.3 tablets = 47 tablets. [I rounded down as the LD<sub>50</sub> is an estimate – not an exact value]*

**14.** What is the P-450 system? How does it participate in detoxifying water-insoluble poisons?

*.The P-450 system is an enzyme in the liver used to transform compounds by oxidation. Oxidation usually leads to more polar and water soluble compounds, allowing faster elimination from the body.*

**15.** Describe the difference between a teratogen and a mutagen.

*A teratogen is a compound that affects the development of an embryo while a mutagen leads to chromosome damage that can result in offspring with altered DNA.*

**16.** Describe the difference between a mutagen and a carcinogen.

*A mutagen leads to chromosome damage that can result in offspring with altered DNA while a carcinogen can lead to the formation of cancer (usually also through harming DNA).*