

## *Problem set 4—due Monday, October 25*

1) (8 pts) An acute toxicity test of the new chemical Hypothetical is carried out on mice. The results are listed below:

Dose (mg/kg)	0	0.03	0.1	0.3	1	5
# animals tested	13	15	15	14	9	8
# dead	0	1	0	3	7	7

a) Calculate the LD-50 for Hypothetical. Show your calculation method clearly (graphical analysis would be OK too if clearly described).

b) You are working at the EPA over the summer, and you get a fax with these toxicity results from the manufacturer of Hypothetical. The manufacturer is trying to get an informal assessment of whether this chemical can be used in certain products.

Case 1: The manufacturer wishes to use Hypothetical in a fun new color-changing lipstick targeted at 12-14 year old girls. Each 6 g lipstick will contain 47 mg of Hypothetical. Write a response to the manufacturer.

Case 2: The manufacturer has found that Hypothetical is effective for treatment of inoperable brain cancers. At a single dose of 0.25 mg/kg, 50% of rats with brain tumors showed complete remission of cancer. In light of these very promising animal results, the manufacturer wishes to carry out Stage 3 testing on a group of about twenty humans with inoperable brain tumors. Write a response to the manufacturer.

Case 3. Low doses of Hypothetical (on the order of 0.005 mg/kg per day) were shown to reduce cholesterol in potbellied pigs by up to 30% and also produced between 10 and 20% weight loss in the tested animals. The manufacturer wishes to market it as an anti-cholesterol aid for people who are clinically obese. What further testing would the EPA insist on before approving such use?

2) (16 pts) Heavy metal research: choose either cadmium or mercury. Useful sources: Spiro pp 311-328, Medline, Lexis/Nexis, Internet (but watch out for credibility of internet sources). Please cite sources properly.

a) What are the main anthropogenic sources of the metal? Name one company which is a source of environmental contamination with the metal. Are there significant non-anthropogenic sources?

b) What chemical forms of the metal are present in the environment, and how are they formed? Does the metal bioaccumulate?

c) What is the biological/chemical basis for the toxicity of the metal?

d) Compare the toxicity for various chemical forms of the metal. Quantitative data would be nice here.

- e) How do scientists measure the amount of the metal in the environment?
- f) What are the historical trends in levels of the metal in the environment?
- g) Is there any epidemiological evidence that the metal is toxic to humans? If so, describe.
- h) Is the metal regulated by any government agency in the US? (many chemicals are regulated by multiple agencies). Give specifics if you can (Lexis/Nexis may be helpful here).

3) (6 pts) Consider the approaches to government control of environmental pollution described in Miller pp 711-714 (see the list below for a summary\*). Outline how each approach could be used to reduce environmental pollution by the metal you discuss in problem #2.

- a) regulation
- b) subsidies
- c) withdraw harmful subsidies
- d) tradable rights
- e) green taxes
- f) user fees

(\* I have not included pollution-prevention bonds, which make neither environmental nor economic sense to me)