

1. (10 pts) The Food and Drug Administration was criticized several years ago for testing new antibiotics (drugs that kill disease-causing bacteria) on adult men only. Only those drug candidates that are shown in those tests to have few, if any, side effects and are effective in treating the disease in question are allowed on the market.

- a. Which aspect of the Unity Principle could be used to support the view that testing on men is sufficient to determine safety for all humans.

The Unity Principle states that organisms, however different they may appear, share a very large fraction of their molecules and processes. Thus a molecule, process, effect seen in one organism is likely to be seen in any other. Thus, one could argue that the effects, good or bad, of a drug in males would be the same in females and thus a test on males is sufficient.

- b. Which aspect of the Unity Principle could be used to say that testing only on men was not sufficient to determine safety for all humans.

The Unity Principle also states that the differences we see in organisms are due to the small number of differences in molecules, processes in these organisms but that, clearly, these differences can be significant. Therefore it is reasonable to think that the small number of differences between the molecules and processes in males and females could lead to different reactions (positive or negative) to a drug and thus testing in both is required.

2. (10 pts) One of the most important problems involved in using nuclear reactors to produce electricity is the safe storage of long half-life radioactive waste from the reactors.

- a. What is meant by radioactive isotope

Isotopes of a particular element have the same number of protons and electrons but different numbers of neutrons. Some isotopes are radioactive, that is their nuclei are unstable and spontaneously decay, by emitting various particles (α particles, electrons) and become either different isotopes of the same element or an isotope of a different element.

- b. What is meant by half life

Half life is the time it takes for half the atoms in a population to undergo radioactive decay

- c. It has been proposed that the waste be put in a reactor that converts it to another radioactive element. Why might help deal with the problem?

The problem lies with isotopes with very long half lives, thus they are radioactive and dangerous to health for a very long time. The new radioactive element might have a much shorter half-life, thus requiring special storage for a shorter period of time, and therefore requiring smaller storage sites.

3. (10 pts) An atom's-eye view of ice sees H and O atoms bonded to each other, extending in all directions. An atom's-eye view of a sodium chloride crystal sees Na and Cl atoms bonded to each other, extending in all directions. Are these the same types of structures in terms of bonding? Explain fully.

The O and H in the water molecule are covalently bonded. Individual water molecules are bonded to each other through hydrogen bonds. Since each water molecule can hydrogen bond with four other waters, the chain can go on in all directions. Sodium and chloride are ions, (carry a full charge) and are attracted to each other because of the attraction of opposite charges. Each can attract six ions of the other type and thus extend indefinitely. These are neither covalent nor hydrogen bonds.