

Booklet to accompany slide order #6

- slide 1      Radiation is energy that exists in different forms. X-radiation is energy in waveform that acts like a particle but has no mass. One of the properties of x-radiation is its ability to ionize substances with which it comes in contact. (It is effective to review the Bohr atomic theory and explain ionization.) X-radiation is one type of ionizing
- slide 2      radiation. X-radiation is a part of the electromagnetic spectrum of radiation; a group of differing wavelengths of energy. Particulate
- slide 3      radiation is the other type of ionizing radiation of concern here. Particulate radiation exists as bits of matter, i.e. alpha and beta particles. Due to the particulate nature of this radiation, it is more destructive than the ionizing x-radiation of the electromagnetic spectrum. Both particulate and electromagnetic radiations<sup>1</sup> are naturally occurring and can be man-made. Both of these forms of radiations interact with matter to cause an imbalance in the atomic structure of such matter.
- slide 4      This slide illustrates some of the imbalance that can result when ionizing radiation strikes an atom.
- slide 4      Photoelectric effect:  
up. left
- x-ray wave imparts all of its energy to an orbital electron
  - electron is ejected from shell producing an ion
  - associated with low energy photons
- slide 4      Compton's effect:  
up. right
- scattering effect: x-ray gives part of its energy to the electron and continues on with, less energy and in "a different direction
  - electron that was ejected can produce secondary ionization
    - less energetic wavelength continues on until it loses more energy

either by another Compton's or photoelectric interaction associated with intermediary energy levels

slide 4  
low. left

Pair production:

- x-ray disappears in the vicinity of the nucleus
- a pair of particles, one a negative electron and one a positron are ejected from the nucleus
  - nucleus was the store house for transfer of energy from wavelength to the particles
  - particles resulted as a means to conserve the charge
  - both particles continue on producing secondary ion-pairs associated with high energy levels

slide 4  
up. right

Excitation:

- addition of energy to a molecule taking it from a ground state to an active (excited) state

This illustration served in discussing the ionization processes on one or a small group of atoms. Relate now to the human body, which is composed of millions of atoms. What can happen when the human body is exposed to ionizing radiation? There are a number of ways that ionizing radiation can effect the body:

slide 5

Mechanism of biological damage: involves two theories

- direct mechanism
  - those effects in a specific area that result from ionizing radiation to that area
  - the damage was caused by the radiation itself
  - examples: reddening of the skin, cessation of cell division

slide 6

- indirect mechanism
  - those effects which result when ionization alters substances within the body making them incompatible and/or injurious and ineffective to the rest of the body