Al-Mustaqbal University
College of Science
Department of Medical Physics
The Fourth Stage
First Course

Radiation Protection

LECTURE one

Introduction of Radiation

Assist. Prof. Dr Forat Alsultany

Pof. Dr Anees Al-jubouri

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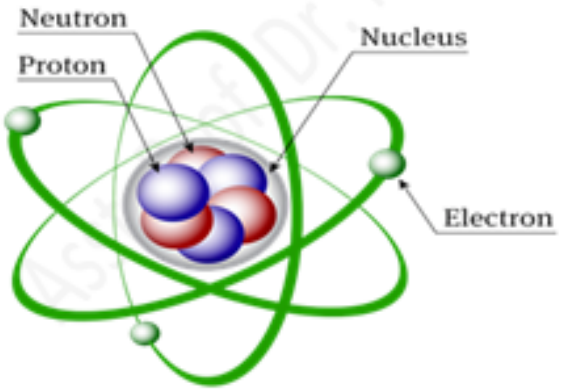
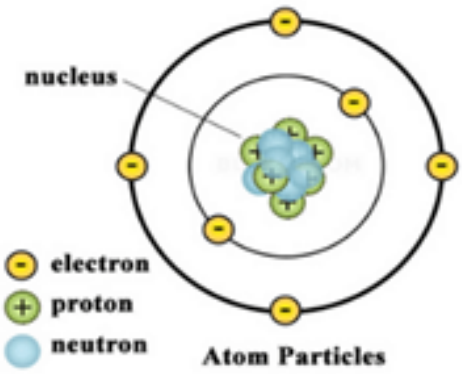
Introduction of Radiation

➢ Atom Structure:

- **An atom** is the smallest unit of matter that forms a chemical element.
- All matter is composed of atoms.
- Every solid, liquid, gas, and plasma is composed of neutral or ionized atoms.
- An atom is composed of a positively charged **nucleus** (+), with a cloud of negatively charged **electrons** (−) surrounding it, bound together by electrostatic force.
- A **nucleus** have a **protons** (positive (+) charge) and **neutron** (neutral charge). So, the nucleus have positive charge
- The electron (negative (−) charge) travels in circular orbits around the nucleus
- Thus, the total electric charge of the atom is therefore zero (the atom is neutral).





Atom Structure

➢ Radiation and Radioactive materials

✓ **Radiation** is energy that moves through space or matter at a very high speed. This energy can be in the form of **(i) particles** (alpha or beta particles), or **(ii) waves** (light, heat, radio-waves, micro-waves, x-rays and gamma rays).

✓ **Radioactive materials** (radionuclides or radioisotopes) **are atoms that are unstable**. Unstable atoms try to transform into a stable form. This process releases radiation.

✓ **Radiation** comes from both **(i) cosmic radiations** that product in outer space, and **(ii) radioactive materials** that occur naturally in the earth and in our own bodies. Together, these are known as background radiation. Everyone is exposed to background radiation daily. In addition, radiation and radioactive materials are produced by many human activities. Radiation is produced by x-ray equipment and by particle accelerators used in research and medicine. Radioactive materials are produced in nuclear reactors and particle accelerators.

✓ All natural and artificial radiation has benefits in different areas of life and harms, so there is an urgent need to study radiation and radiation protection to avoid exposure to high doses.

➢ A Brief History of Radiation

- ✓ Radiation was discovered for the first time in **1895** by Wilhelm **Roentgen**, which called **X-rays**, which could be used to look into the human body.

- ✓ When **Henri** Becquerel investigated the discovered X-rays in **1896**, it led to studies of how uranium salts are affected by light, where he discovered that **uranium salts spontaneously emit a penetrating radiation** that can be registered on a photographic plate.

- ✓ **In 1898**, **Marie Curie** and her husband discovered that **uranium emits radiation**, and it turned into other elements and another they called **radium**.

Wilhelm Roentgen

Henri Becquerel

Marie Curie and her husband

➢ Radiation Applications or Uses

Radiation is used (applications) in various fields such as;

- Medical imaging
- Treat diseases such as cancer
- Airport security
- Biological research
- Industry (produces heat that is used to generate electricity in nuclear power reactors)
- Farming
- Geology
- Number of consumer product
- Gas detectors (sensors)
- Kill harmful bacteria
- Extend the life of fresh produce.

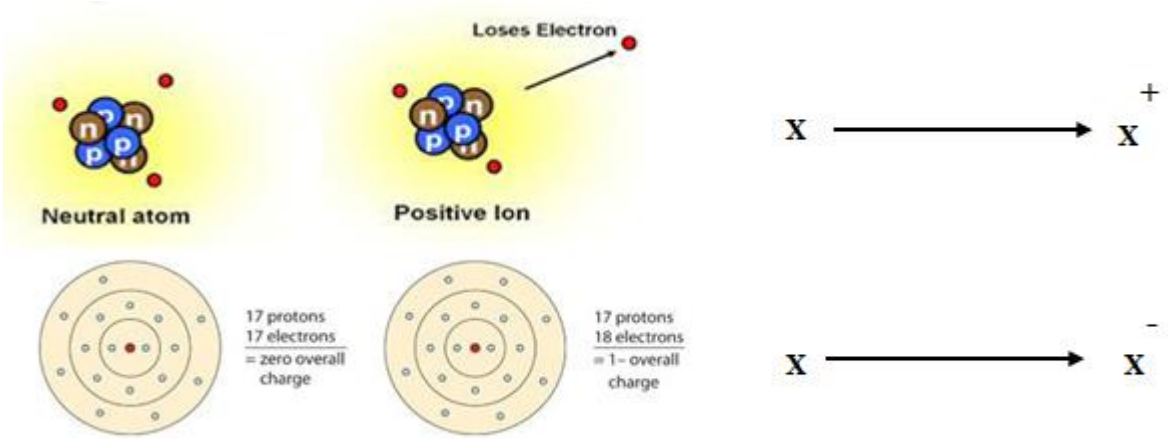
➢ Types of Radiation

✓ According to ability or inability to events the ionization process, the radiation can be divided into ionizing radiation and nonionizing radiation.

✓ **Ionization process:** It is the gaining or losing process an electron from an atom or a molecule, which will turn into a negative or positive charge.

✓ **Non-ionizing radiation:** It is the radiation that is cannot carry enough energy to produce ions.

- ✓ **Non-ionizing radiation** includes visible, infrared, ultraviolet light; microwaves; radio waves; and radiofrequency energy from cell phones. Most types of non-ionizing radiation have not been found to cause cancer.
- ✓ **Ionizing radiation:** It is the radiation that is carries enough energy to produce ions. Alpha particles, beta particles, x-rays and gamma rays are forms of ionizing radiation.



- ➢ **Biological Effect of Radiation & Protection**

- ✓ **The biological effect of ionizing radiation depends on several factors, including:**

(i) Type of radiation
(ii) Method of exposure to the body (external or internal)
(iii) Person's age
(vi) Type of organ
(v) The body's ability to store radiation.

- ✓ **Radiation protection** is the science and practice of protecting people and the environment from the harmful effects of ionizing radiation.

Bubble sheet questions

Q1- The total electric charge of the atom is ----------

A- positively charged B- negatively charged C- neutral charge D- two positively charged E- two negatively charged

Q2- ---------- materials are atoms that are unstable

A- Non-ionizing B- element C- molecule D- ionizing E- radioactive

Q3- ---------- is the gaining or losing process an electron from an atom or a molecule.

A- Ionization process B- ionizing radiation C- non-ionizing radiation D- radioactive material E- radioactive gases

Q4- ---------- is the science of protecting people and the environment from the harmful effects of ionizing radiation.

A- radiation B- radiation protection C- ionization process D- biological effect E- radioactive

Q5- ---------- radiation are charged particles that have enough kinetic energy to produce ionization by collision.

A- directly ionizing B- in-directly ionizing C- ionizing D- non-ionizing radiation E- none of them