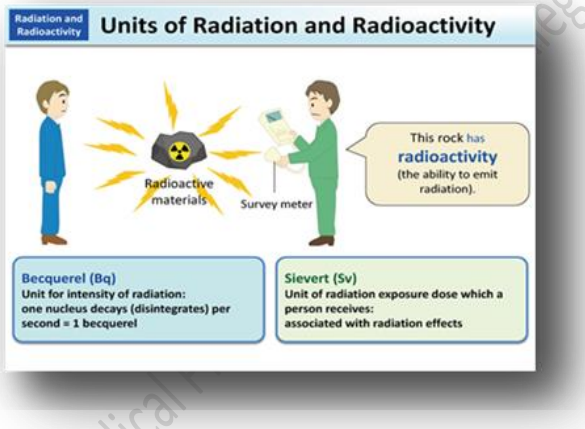
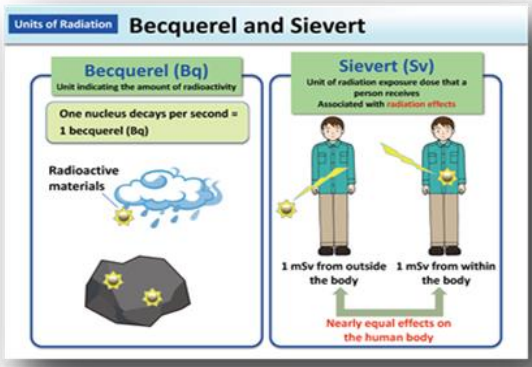
Al-Mustaqbal University
College of Science
Department of Medical Physics
The Fourth Stage
First Course

Radiation Protection

LECTURE FOUR

Units of Radiation Protection





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LECTURE FOUR: Units of Radiation Protection

One – Rad (radiation absorbed dose)

Two – Rem (Roentgen equivalent man)

Three – Gray (Gy)

Four – Sievert (Sv)

Five – Curie (Ci)

Six – Becquerel (Bq)

Seven – Disintegrations per second (dps)

❖ One – Rad (radiation absorbed dose)

1 - Rad is a unit of **absorbed dose** of radiation.

2 - Rad unit is a measure of the amount of **energy deposited in tissue**

4 - Rad unit can be used **for any type of radiation.**

5- Rad unit dose not **describe the biological effects on** the human body of the different radiations due to the weighting factor of radiation type Q.

Dose: it is a **quantity** of a radiation or drug taken or recommended to be taken at **one time.**

Radiation weighting factor: is a factor used to determine the equivalent dose from the absorbed dose averaged over a tissue or organ based on the type of radiation absorbed.

❖ Two – Rem (Roentgen equivalent man)

1- Rem unit is used to **measure biological effects** on the human body.

2- Rem unit is a unit that measures the low **levels** of different types of ionizing radiation.

3- Rem is a unit of **equivalent absorbed dose** of radiation which takes into account the biological effects.

4- The dose in **rem** equals the dose in **rad multiplied by the quality factor (Q).**

Quality Factor (Q): It is a factor used in radiation protection to **weight the absorbed dose**.

Examples

For Beta and Gamma radiation, the Q = 1 so, the rem **= rad**

For Alpha radiation, the Q = 20 so, the rem **= 20 rad**

❖ Three – Gray (Gy)

1- Gray unit represents the measured **absorbed dose** from exposure to radiation.

2- Gray is a measure of **energy deposition** in tissue.

3- A dose of one Gy is equivalent to a unit of energy (joule) deposited in a kilogram of material.

4- A Gray unit of absorbed radiation dose equal to 100 rad.

1 Gy = 100 rad = 1 joule/kg

❖ Four – Sievert (Sv)

Sievert (Sv): It is unit used to measure **dose quantities** of radiation such as;

(i) Equivalent dose

(ii) Effective dose.

Equivalent dose

- It represents the **biological effects of low levels of ionizing radiation** on the human body.
- It represents the **probability of radiation-induced cancer and genetic damage**.

Effective dose

It is a **dose quantity** in the International Commission on Radiological Protection (ICRP) system of radiological protection

❖ Five – Curie (Ci)

1- Curie (Ci) is **traditional unit** of radioactivity.

2- Curie is unit used to measure the **number of decays per second**.

3- Curie is equal to the **radioactivity of one gram (1g) of pure radium-226**.

❖ Six – Becquerel (Bq)

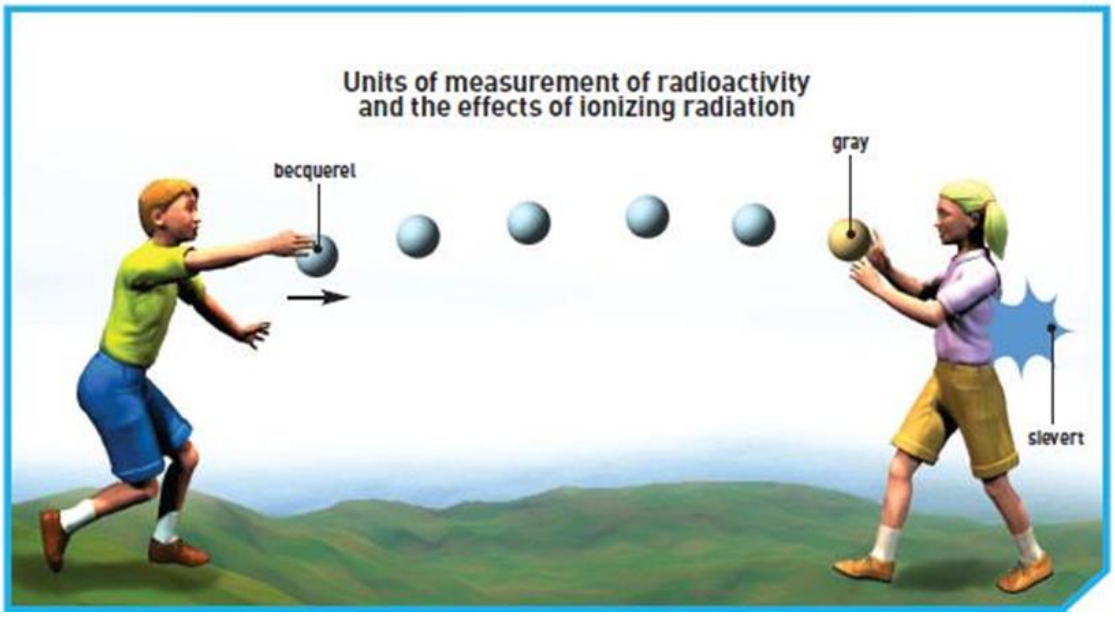
The standard international unit of radioactivity equal to **one decay per second**.

1 Becquerel (Bq) = 27 Picocurie (pCi)

❖ Seven – Disintegrations per second (dps)

Disintegrations per second (dps) : The unit represents the **number of subatomic particles** (alpha particles & Beta particles) **or photons** (gamma rays) **which released from the nucleus of a given atom over one second**.

1 dps = 1 Bq



Bubble sheet questions

Q1- Rad unit dose not describe the biological effects on the human body of the different radiations due to the ----------

A-Dose B-weighting factor C-weight the absorbed dose D-energy deposition E-none of them

Q2- Rem unit is a unit that measures the ---------- of different types of ionizing radiation.

A- measure biological effects B-low levels C-high levels D- A & B E- B & C

Q3- ---------- unit is a measure of the amount of energy deposited in tissue.

A- Rad B- rem C- Becquerel D- Sievert E- curie

Q4- Rad unit represents the absorption of ---------- for each gram.

A- 1 joule/kg B- 10^{-7} joule C- 100 ergs D- 1 Becquerel E- 27 Picocurie

Q5- The dose in rem equals the dose in rad multiplied by the ----------

A- Quality factor B- equivalent absorbed dose C- dose D- energy deposition E- number of decays per second

Q6- Sievert (Sv): It is unit used to measure dose quantities of radiation such as ----------.

A-quality factor B- biological effects C- genetic damage D- equivalent dose E- energy deposition in tissue