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Ionisation

The process by which nuclear radiation damages cells is known as ionisation. This is where electrons are removed from or added to an atom to leave a charged particle called an ion. If the atom gains an electron it has an overall negative charge and if it loses an electron it has an overall positive charge. Alpha radiation causes more ionisation than beta or gamma radiation.

Background radiation

Nuclear radiation is always present in our environment. This is known as **background radiation**. This can come from natural sources e.g. radon gas, cosmic rays or from man-made sources e.g. nuclear fallout from weapons testing and accidents at nuclear power stations.

Absorbed dose and equivalent dose

The amount of energy received by a substance per unit mass is known as the **absorbed dose**. This can be calculated by using the equation

$$\mathbf{D} = \frac{\mathbf{E}}{\mathbf{m}}$$

where **D** is the absorbed dose in grays (Gy)

E is the energy in joules (J)

and **m** is the mass in kilograms (kg)

This does not tell the whole story of how a person would be affected by nuclear radiation. It does not take into account the type of radiation encountered.

The **equivalent dose** allows us to take the type of radiation into account. It is calculated by using the equation $\mathbf{H = Dw_R}$

where **H** is the equivalent dose in sieverts (Sv)

D is the absorbed dose in grays (Gy)

and $\mathbf{w_R}$ is the radiation weighting factor.

Alpha radiation has a radiation weighting factor of 20, whereas beta and gamma radiation both have a radiation weighting factor of 1.