

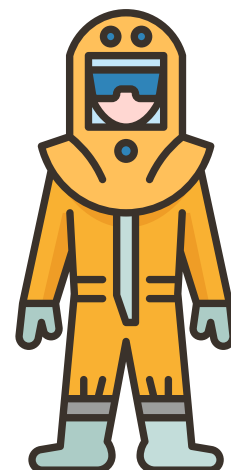
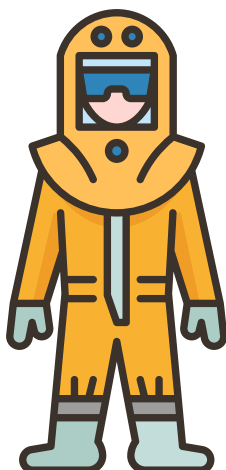
Radioactivity Dangers and Medicines

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1. Introduction

- Radioactivity means a process in which **unstable atom nuclei spontaneously emit energy in order to gain stability.**
- Radiations are primarily of three types - **Alpha(α)** Radiations, **Beta(β)** Radiations and **Gamma(γ)** Radiations.
- There are many **medicinal applications** of Radioactivity. Also, the small amount of radiation is safe, but higher exposure to radiation can damage cells and DNA, causing cancer and **serious health issues.**



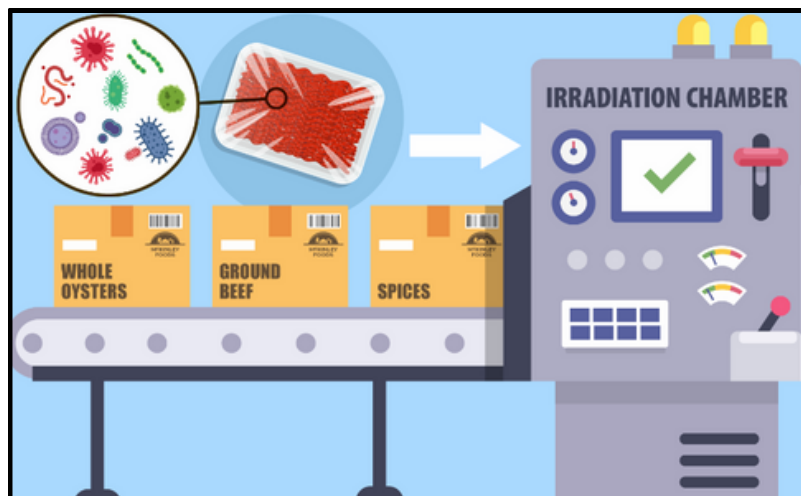
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Let us study the applications of radiation in medical treatments, and also know about the dangers of radiation

2. Uses of Radiation

1 Food Irradiation

- In our environment, some foods naturally contain radioactive substances. We know that food contains a special type of bacteria that cause it to decompose eventually. But some of those bacteria can cause food poisoning.
- To prevent food poisoning, the food is irradiated using gamma rays. Here, the microorganisms are killed.



• STEPS -

1. Food is typically packaged before irradiation.
2. Packaged food is moved through an irradiation chamber.
3. The food is exposed to a controlled dose of ionising radiation.
4. Radiation disrupts the DNA of microorganisms, preventing them from reproducing.
5. Irradiation does not heat the food or leave behind any chemical residue.

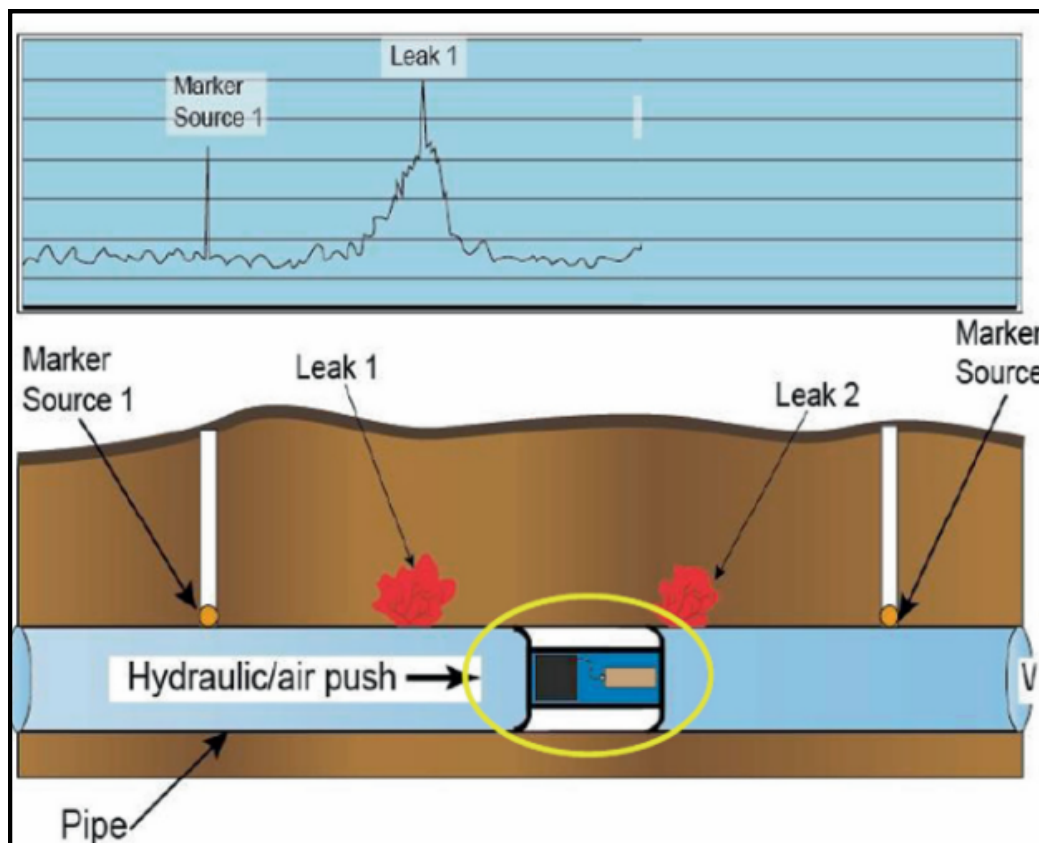
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2

Radioactivity Detecting



- Radioactive substances are used as **tracers**. For example, the underground pipe leakage detection by the Geiger-Muller Tube.
- **STEPS-**
 1. Sensitive detectors like the **Geiger-Muller tube** are used to scan the area surrounding the **underground pipe**.
 2. The radioactive tracer is **introduced into the pipe**. The tracer flows through the pipe, and where there is leakage, the tracer-containing fluid will escape.
 3. The **detectors measure the radiation levels**. Higher level of readings indicate the presence of radioactive tracers, hence **pointing to the pipe leakage location**.



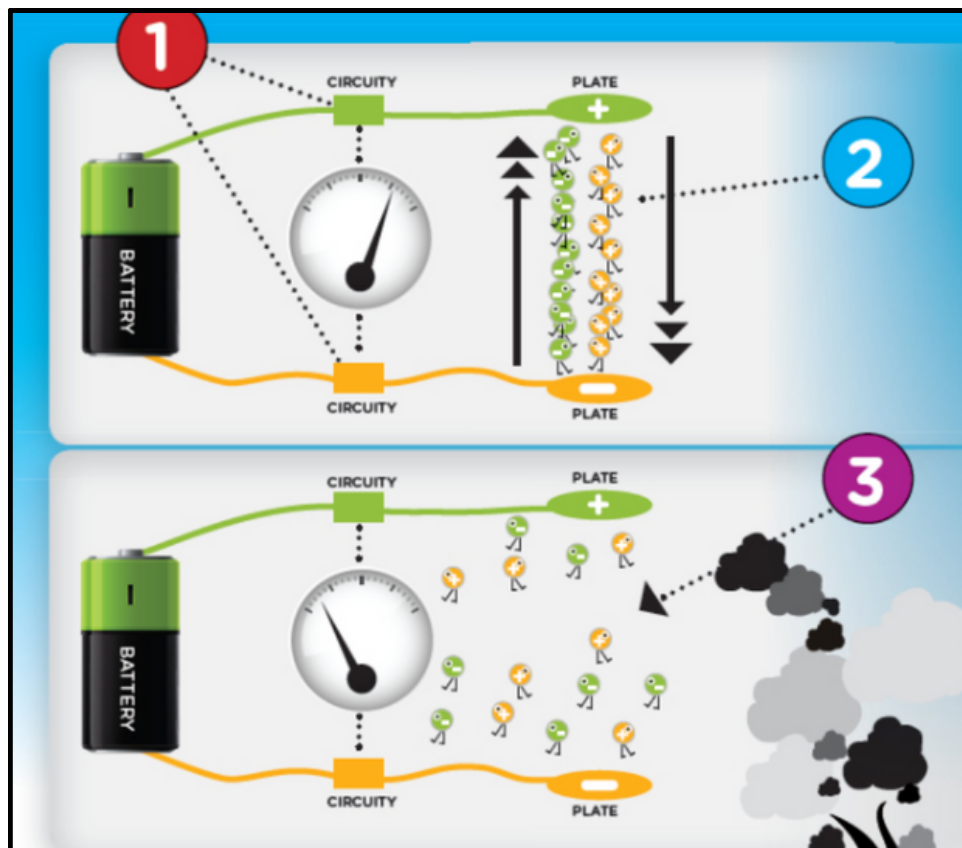
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3 Smoke Alarms

- Radioactive substances are used as smoke alarms.

STEPS-

- The **Smoke Alarm** contains an **electrical circuit**, which has two electrically charged plates with an air gap between them. **A source is connected to the plate, which releases Americium-241.**
- This Radioactive **substance will ionise the air molecules**, now they are **attracted to oppositely charged plates** of the circuit, allowing a small amount of current to flow that is measured by the detector.
- The **Smoke alarm will not sound as long as the current is flowing.** But when the **smoke gets into the gap between the plates**, the ions will slow down, **decreasing the amount of current** measured by the detector. Now, **at this point of current dropping**, the **alarm will start ringing.**



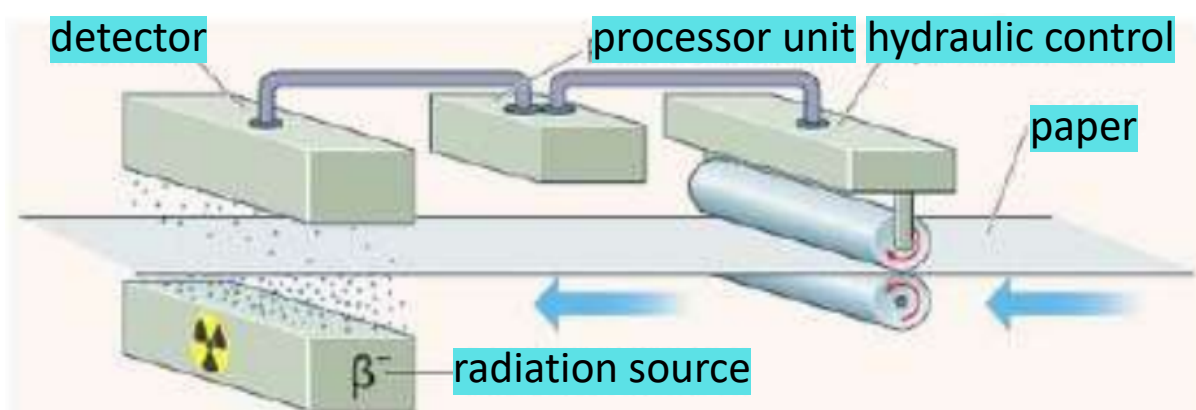
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4 Checking Thickness

- Paper is made by squeezing wood pulp between two rollers. These rollers must apply same force on wood pulp to squeeze it into the same sized paper.

STEPS -

1. The detector counts the rate at which beta particles get through the paper on one side.
2. When the paper is too thin, the count rate detected is higher. Then, a computer senses this rise in count rate and sends a signal to decrease the pressure applied by rollers to maintain the thickness of paper. Similarly, when the paper is thick, the opposite happens.

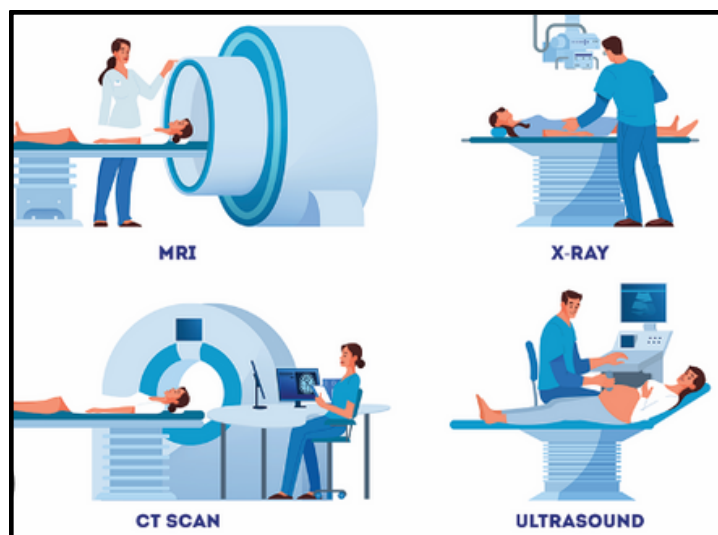
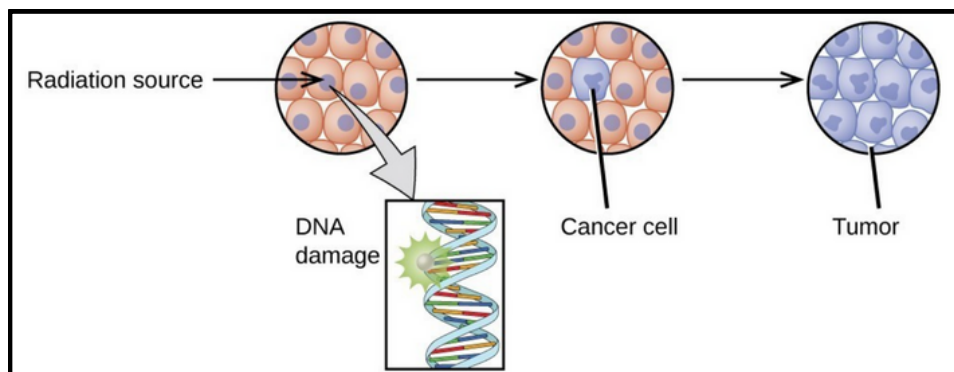


C A beta particle detector is used to control the thickness of paper during its manufacture.

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2. Dangers of Radiation

- A large amount of radiation can cause tissue damage like reddened skin and other effects that cannot be seen.
- A small amount of radiation over a long period of time can damage DNA inside a cell, a process known as **mutation**. Some mutations can cause the cell to malfunction and may cause cancer.
- Not all mutations are harmful, the cell can repair the damage itself if the radiation dose is small.
- In hospitals, radioactivity is used for various purposes. The medical staff working with radiation have limited their exposure in several ways, including increasing their distance from the source and minimising the time they spend in radiation. Staff's exposure to radiation is closely measured using Dosimeter badges.

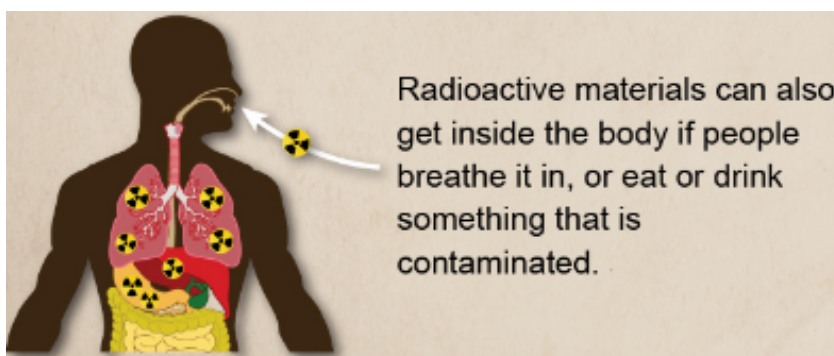


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- Nuclear Accidents allow the radioactive materials to escape into the environment. Accidents like this are harmful as they can cause people to get irradiated or contaminated.
- Food and water can also get contaminated means that it can enter the food chain. Contamination with radioactive materials of long half-lives poses a greater hazard as the effect will last longer.



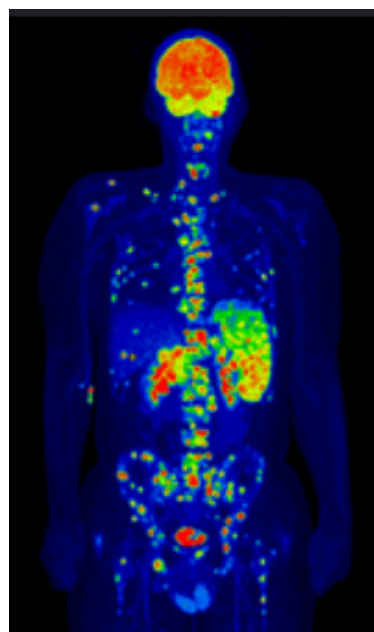
People living close to the nuclear power plant who are exposed to radiation could experience long-term health effects such as cancer.



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3. Radioactivity in Medicine

- Radioactivity materials are used to **diagnose medical issues without having to cut a patient's body.**
- Radioactivity can be used **to diagnose cancer using tracers in the body.** It can also be used to treat cancer.
- Radioactivity tracer detecting medical issue in body, **STEPS -**
 1. A radioactive tracer that emits Gamma Rays is introduced into the patient's body. The tracer is generally injected into the bloodstream. One or more Gamma cameras detect the location of the tracer.
 2. The tracer finds the location of internal bleeding. The cameras detect the highest gamma radiation, which is where the bleeding occurs.
 3. Gamma cameras are used to detect tumours, and then the tracer is made using radioactive Glucose molecule.



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4. FAQ's

(1) What is Radioactivity?

Answer: When there is spontaneous emission of energy from the unstable nucleus of an atom to become stable, the process is called Radioactivity.

(2) How is Radioactivity measured?

Answer: Radioactivity is measured using Dosimeter badges.

(3) How is Radioactivity used for diagnosis?

Answer: In diagnosis through radioactivity, doctors can find health issues without having to cut the patient's body. A radioactive substance is introduced into a human's body, and its radiation is detected/measured through cameras.

(4) How can one protect him/herself from radiation?

Answer: Distance: Maintaining a shorter distance from the source.

Time: The time spent in radiation exposure should be decreased.

Shielding: Use materials which can block radiation like lead.

(5) What are the common sources of radiation?

Answer: X-Rays, CT Scans, etc. and other techniques that involve imaging techniques are a source of radiation exposure.