Background Radiation and Contamination

Forget love — radiation is all around. Don't panic too much though, it's usually a pretty small amount.

Background Radiation Comes From Many Sources

Background radiation is the low-level radiation that's around us all the time. It comes from:

1) Radioactivity of naturally occurring unstable isotopes which are all around us — in the air, in some foods, building materials and some of the rocks under our feet.
2) Radiation from space, which is known as cosmic rays. These come mostly from the Sun. Luckily, the Earth's atmosphere protects us from much of this radiation.
3) Radiation due to human activity, e.g. fallout from nuclear explosions or nuclear waste.

The amount of radiation you're exposed to (and so the amount of energy your body absorbs) is called the absorbed radiation dose. This varies depending on where you live or if you have a job that involves radiation.

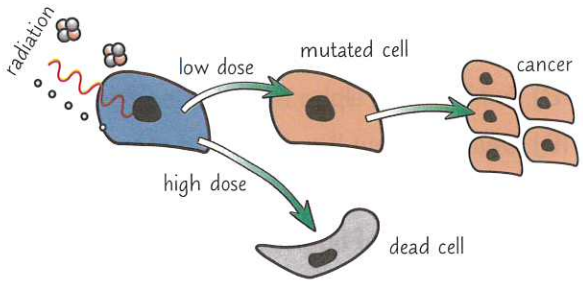
Exposure to Radiation is called Irradiation

1) Objects near a radioactive source are irradiated by it. This simply means they're exposed to it (we're always being irradiated by background radiation sources).
2) Irradiating something does not make it radioactive (and won't turn you into a superhero).
3) Keeping sources in lead-lined boxes, standing behind barriers or being in a different room and using remote-controlled arms are all ways of reducing the effects of irradiation. Medical staff who work with radiation also wear photographic film badges to monitor their exposure.

Contamination is Radioactive Particles Getting onto Objects

1) If unwanted radioactive atoms get onto an object, the object is said to be contaminated.
2) These contaminating atoms might then decay, releasing radiation which could cause you harm.
3) Contamination is especially dangerous because radioactive particles could get inside your body. Once a person is contaminated, they are at risk of harm until either the contamination is removed (which isn't always possible) or all the radioactive atoms have decayed.
4) Gloves and tongs should be used when handling sources, to avoid particles getting stuck to your skin or under your nails. Some industrial workers wear protective suits to stop them breathing in particles.

Radiation Damages Cells by Ionisation



1) Radiation can enter living cells and ionise atoms and molecules within them. This can lead to tissue damage.
2) Lower doses tend to cause minor damage without killing the cells. This can give rise to mutant cells which divide uncontrollably. This is cancer.
3) Higher doses tend to kill cells completely, causing radiation sickness (leading to vomiting, tiredness and hair loss) if a lot of cells all get blatted at once.
4) This is why places like hospitals try to limit staff and patients' exposure to radiation. E.g. shielding is used to protect staff and untreated body parts of patients, and tracers (p.171) with short half-lives are used.
5) Outside the body, beta and gamma radiation are the most dangerous, because they can penetrate the body and get to the delicate organs. Alpha is less dangerous, because it can't penetrate the skin.
6) Inside the body, alpha sources are the most dangerous. Alpha particles are strongly ionising, so they do all their damage in a very localised area. That means contamination, rather than irradiation, is the major concern when working with alpha sources.

Background radiation — the ugly wallpaper of the Universe...

Make sure you can describe how to prevent irradiation and contamination, and why it's so important that you do.

Q1 Give three sources of background radiation. [3 marks]

Background Radiation and Contamination

1 Name **two** sources of background radiation. Grade 4-6

1. .....

2. .....

[Total 2 marks]

2 A scientist is reviewing the safety procedures to be used in her lab. She is concerned about **contamination** and **irradiation**. Grade 6-7

a) Explain the difference between contamination and irradiation.

.....

.....

.....

.....

[2]

b) The scientist is using a low activity radioactive sample. Give **one** example of how she can protect herself from irradiation and **one** example of how she can protect herself from contamination.

Irradiation: .....

Contamination: .....

[2]

[Total 4 marks]

3* Radium-226 is an alpha source that was used in clocks until the 1960s to make the hands and numbers glow. Discuss whether a clockmaker should be more concerned about irradiation or contamination when repairing old clocks that contain radium. Grade 7-9

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Total 6 marks]