OCR 21st Century Science (2012 spec)

**Unit P6 a and b Statements**

Radioactive materials

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **1** | In some atoms the nucleus is unstable. The atom decays to become more stable. It emits energetic… |  | Collide with particles, so the radiation is **very penetrating** but only has a **weak ionising effect**. |  |
| **2** | Hans Geiger and Ernest Marsden fired a beam of alpha particles (helium nuclei) at layers of gold leaf only a few atoms thick. They found that around 1 in 8000 alpha particles were deflected by very large angles (over 90°), while the rest … |  | …made up of 2 protons and 2 neutrons. This is basically the nucleus of a helium atom. They gain electrons and become atoms of helium. This means they are the **least penetrating,** but also the **most strongly ionising radiation**. They are stopped most easily. |  |
| **3** | The emission of either an alpha or beta particle from an unstable nucleus produces an atom of a different element, called a ‘daughter product’ or ‘decay product’. The daughter… |  | Radiation and the nucleus changes. Three types of radiation is emitted, called alpha, beta, and gamma. |  |
| **4** | Alpha particles are much heavier than beta particles and they quickly collide with air molecules and slow down. They are… |  | …damage DNA and can cause the cell to behave abnormally or be killed. Cells that behave abnormally can cause cancer. |  |
| **5** | Beta particles are fast moving electrons. They are much smaller than the alpha particles so are less likely to collide with other… |  | …product itself maybe unstable. There may be a series of changes but eventually a stable end-element is produced. |  |
| **6** | Sometimes after a nucleus emits a beta particle, the protons and neutrons remaining in the new nucleus rearrange themselves to a lower energy state. When this happens the nucleus emits a photon of electromagnetic radiation called a gamma ray. This does not cause a change of element. The photons have more energy and rarely collide… |  | …passed straight through with little or no deflection. From this, Rutherford concluded that the majority of the mass was concentrated in a minute, positively charged region surrounded by electrons. When a (positive) alpha particle approached close to the nucleus, it was repelled strongly enough to rebound at high angles. The small size of the nucleus explained the small number of alpha particles that were repelled in this way. |  |
| **7** | Ionising radiation can kill bacteria; gamma radiation is used for sterilising surgical instruments. Food can be treated in the… |  | …there would be half the amount of the original C-14 atoms. The shorter the half-life, the greater the activity for the same amount of material. |  |
| **8** | Ionising radiation has the energy to break up molecules in the cells in into ions. These ions than can… |  | …particles. This means they **travel further** in air and other materials and are **less ionising**. |  |
| **9** | Caron-14 has a half-life of 5700 years. After 11400 years… |  | …trace where the radiation goes. The benefit for medical imaging is that if there is a problem discovered they can be treated. |  |
| **10** | Medical imaging uses gamma radiation. The gamma radiation escapes from the body and a gamma camera can… |  | …same way. Irradiation is permitted for herbs and spices and it kills the bacteria that could spoil the products. |  |

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