**P4 Learning Journey**

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| 1C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\AABC820.tmp | The current model of the Atom is of a central **nucleus** which contains **neutrons** (mass 1, no charge) and **protons** (mass 1, + charge) surrounded by **electrons** in **orbits** in **shells** (mass is **negligible**, - charge).  **Mass number = protons + neutrons, Mr.**  **Number electrons = number protons = Atomic Number Ar.**  **Electrons** can absorb **radiation** and move to a higher energy level.  An **isotope** is **same** number of **protons** but **different** number of **neutrons** – so same chemistry but heavier.  An **ion** is a **charged particle** that has **gained electrons** (**-**) or **lost electrons** (**+**). |
| 2C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\AABC820.tmp | Current ideas of the Atom have changed over time…  **Dalton** said they were tiny **indivisible spheres**.  **Thomson** – **Plum Pudding** – all of positive charge with **negative** charge **embedded** in it.  **Nuclear model** – **Rutherford**, **Ernst** and **Mayer** – based on evidence from the **Alpha scattering experiment** – central positive nucleus with a **cloud** of negative **electrons** in **orbit**.  **Bohr** adapted this – **electrons** in shells at set distances/**energy levels**.  Then **protons** in the **nucleus** made the positive charge.  **Chadwick** discovered the **neutron** which explained the **imbalance** between Atomic and mass numbers. |
| 3C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\AABC820.tmp | **Unstable atoms** can **decay** and spit out one or more of the three types of **ionising radiation** in the process.  **Alpha** – He nucleus, mass 4, charge +2, **least penetrating**, travels shortest distance, **most ionising**, stopped by few cm’s air or paper. Equation shows **mass number-4 and Atomic number -2**.  **Beta** – electron, formed from neutron converting to a proton, mass **negligible**, charge -1, **mid ionising**, mid distance, stopped by thin sheet metal or Perspex. Equation shows **no change in mass number and atomic number +1**.  **Gamma** – **electromagnetic wave**, energy released from decay, no mass, no charge, **most penetrating**, **least ionising**, longest distance, stopped by metres of concrete or thick sheet lead. |
| 4C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\AABC820.tmp | **Radioactive decay is random** and unaffected by physical conditions. It is measured with a **Geiger-Muller tube** which records the count rate in **becquerels** (1 Bq = 1 decay per second)  The **half-life** is the time taken for the number of **radioactive nuclei** in an isotope to halve and certain materials have a particular half-life.  It can be found using a graph; x-axis = time, y-axis = Activity. |
| 5C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\AABC820.tmp | **Background radiation** comes from many sources (food, rocks, **Radon** gas, **cosmic** sources, X-rays, Nuclear industry) and is all around us all of the time. The **exposure** varies depending on our jobs and where we live.  **Irradiation** is exposure from being **near to a source**. Prevented by standing behind barriers, lead lined boxes etc.  **Contamination** is where radiative particles **get into an object**. Prevented by wearing protective gloves and suits etc.  **Gamma and Beta** are most **dangerous outside** the body as they can get in (irradiation).  **Alpha** is most **dangerous inside** the body as it is so ionising nd does a lot of damage in one area (contamination). |
| 6C:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\AABC820.tmp | **Low doses** of radiation can **ionise atoms** in cells without killing them but causing **mutations** which can cause **cancer**.  **Higher doses** of radiation can kill cells = **radiation sickness**.  Radiation is used in **Medical Tracers** (Gamma) and **Radiotherapy** (Gamma rays and Beta emitters) which kill cancer cells.  There has to be a **balance** between how **ionising** (how much damage it will do) and the **half-life** (how long it will last) and the risk of causing the patient to become ill. |
| 7TC:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\AABC820.tmp | **Fission** is the process where a large unstable atom **splits into two smaller** ones releasing a huge amount of energy, two smaller atoms (radioactive waste) and several neutrons.  These **neutrons** can cause further fission reactions = **chain reaction** which controlled using **carbon rod** is nuclear energy generation and uncontrolled is a nuclear bomb.    **Spontaneous** fission rarely happens. |
| 8 TC:\Users\rca\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\AABC820.tmp | **Fusion** is where **two smaller nuclei join** to make one larger nucleus releasing incredibly large amounts of energy.  It is occurring **in stars** like our sun where **Hydrogen** and **Deuterium** slam together to produce **Helium**.  If we could harness this we could have an **infinite** source of energy which produces a non-radioactive waste product. |