PHYA1 3.1.1

Particles & radiation

AS Physics:

what you need to know

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| **Constituents of the atom** | I can do this already | Covered in class | Strength | Weakness | I have  revised this | Book references |
| I can name the particles that make up an atom. |  |  |  |  |  | AQA: 4;  APfY: 330 |
| I can recall the **relative charges** of an electron, proton and neutron |  |  |  |  |  | AQA: 4;  APfY: 330 |
| I can recall the **charges** of an electron, proton and neutron in SI units. |  |  |  |  |  | AQA: 4 |
| I understand how to calculate the **specific charge** of a charged particle (e.g. a nucleus or ion). |  |  |  |  |  | AQA: 4 |
| I understand the meaning of the term **proton number** (Z). |  |  |  |  |  | AQA: 5;  APfY: 330 |
| I understand the meaning of the term **neutron number** (A). |  |  |  |  |  | AQA: 5;  APfY: 330 |
| I understand how to describe a nucleus using **nuclide notation** (). |  |  |  |  |  | AQA: 5;  APfY: 330 |
| I understand the meaning of the term **isotope**. |  |  |  |  |  | AQA: 5;  APfY: 331 |

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| **Stable and unstable nuclei** | | | | | | |
| I can name the forces that act within an atomic nucleus. |  |  |  |  |  | AQA: 6;  APfY: 364 |
| I can explain why a very strong attractive force is needed to keep nuclei stable. |  |  |  |  |  | AQA: 6;  APfY: 338 |
| I can describe the attractive range of the **strong nuclear force**. |  |  |  |  |  | AQA: 6;  APfY: 338 |
| I can explain why the strong nuclear force is repulsive at very short range. |  |  |  |  |  | AQA: 6; APfY: 339 & 340 |
| I can describe **radioactive decay** (alpha and beta minus decay) using nuclear equations. |  |  |  |  |  | AQA: 6 & 7;  APfY: 16 & 47 |

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| **Particles and antiparticles** | | | | | | |
| I understand that every particle has an **antiparticle**. |  |  |  |  |  | AQA: 10;  APfY: 358 |
| I can name the antiparticles of the electron, proton, neutron and neutrino. |  |  |  |  |  | AQA: 10;  APfY: 358 |
| I understand the ways in which a particle and its antiparticle are i) the same, ii) different. |  |  |  |  |  | AQA: 10 |
| I can explain that, when a particle and its antiparticle collide, they **annihilate** and their masses are converted into a photon. |  |  |  |  |  | AQA: 11; APfY: 359 |
| I can explain that **pair production** is the reverse of annihilation, and involves a photon changing into a particle and its antiparticle. |  |  |  |  |  | AQA: 11; APfY: 359 |

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| **Particle interactions** | | I can do this already | | Covered in class | Strength | Weakness | I have  revised this | Book references |
| I can name the four **fundamental interactions**. |  | |  | |  |  |  | AQA: 13 - 15;  APfY: 364 |
| I understand that fundamental interactions involve the exchange of particles. |  | |  | |  |  |  | AQA: 13 - 15;  APfY: 364 |
| I can name the **exchange particles** of the four fundamental interactions. |  | |  | |  |  |  | AQA: 13 - 15;  APfY: 364 |
| I can name the interaction responsible for beta decay (β- and β+), electron capture and electron-proton collisions. |  | |  | |  |  |  | AQA: 14 & 15;  APfY: 365 |
| I can identify the exchange particles involved in beta decay (β- and β+), electron capture and electron-proton collisions. |  | |  | |  |  |  | AQA: 14 & 15; APfY: 35 |
| I can draw **Feynman diagrams** to represent beta decay (β- and β+), electron capture and electron-proton collisions. |  | |  | |  |  |  | AQA: 14 & 15; APfY: 365 |

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| **Classification of particles** | | | | | | |
| I can explain the meaning of the term **hadron**. |  |  |  |  |  | AQA: 20;  APfY: 362 |
| I recall the two main types of hadron. |  |  |  |  |  | AQA: 21, 24 & 25; APfY: 362 |
| I can name some common baryons and antibaryons. |  |  |  |  |  | AQA: 24 & 25 |
| I can describe the stability of baryons, including the proton. |  |  |  |  |  | AQA: 21 |
| I can name some common leptons. |  |  |  |  |  | AQA: 22 & 23; APfY: 362 |
| I can name the interactions felt by hadrons and leptons. |  |  |  |  |  | AQA: 20; APfY: 364 |
| I can recall the baryon numbers for different types hadron and their antiparticles. |  |  |  |  |  | AQA: 27; APfY: 363 |

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| **Quarks and antiquarks** | | | | | | |
| I can describe the **charge** of up, down and strange quarks. |  |  |  |  |  | AQA: 25; APfY: 362 |
| I can describe the **baryon number** of up, down and strange quarks. |  |  |  |  |  | APfY: 362 |
| I can describe the **strangeness** of up, down and strange quarks. |  |  |  |  |  | AQA: 25; APfY: 362 |
| I can describe how quarks combine to form **baryons** (protons and neutrons only) and their antiparticles. |  |  |  |  |  | AQA: 25; APfY: 362 |
| I can describe how quarks combine to form **mesons** (pion and kaon only). |  |  |  |  |  | AQA: 25; APfY: 362 |
| I can describe beta decay In terms of a change in quark flavour. |  |  |  |  |  | AQA: 25; APfY: 365 |
| I can use **conservation laws** (for charge, baryon number, lepton number and strangeness) to test potential particle reactions. |  |  |  |  |  | AQA: 26 & 27; APfY: 362 & 363 |

**Book references:** AQA = ***AQA Physics A*** by Breithaupt (Pub. Nelson Thornes) – the AQA endorsed textbook

APfY =***Advanced physics*** *for you* by Johnson, Hewett, Holt and Miller (Pub. Nelson Thornes)