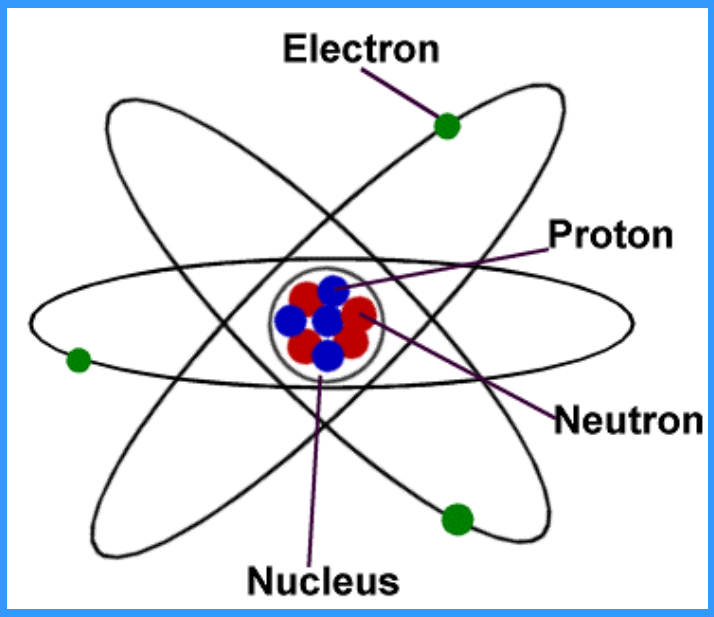
CHEM1101 (CHEMISTRY 1A)



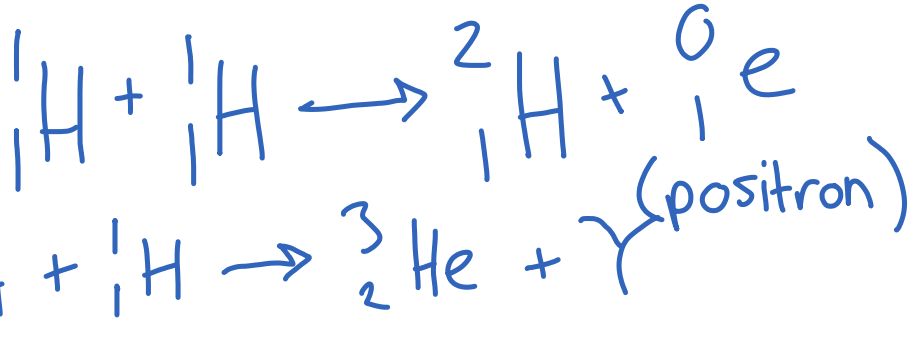
Chemistry: Lecture 1

Learning Outcomes:

- Use the appropriate notation to denote nuclides and isotopes
- Balance nuclear equations
- Recognise the proton-proton chain as the primary Nucleogenesis reaction

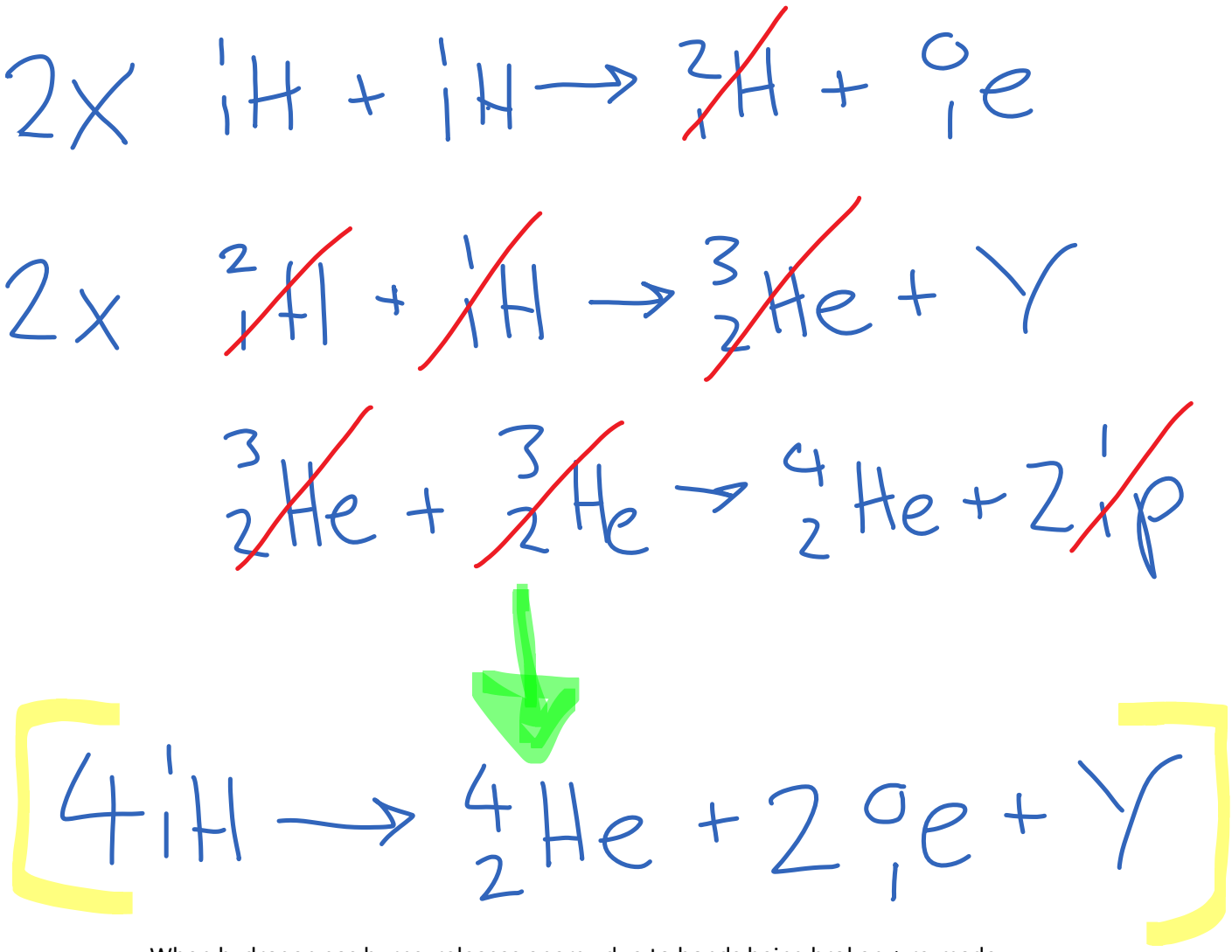
- Nucleons- protons and neutrons, found in nucleus
- Mass of neutron is subtly greater than proton
- **Proton** has +1 charge, **neutron** has a neutral charge
- **Electron**= -1 charge
- **Positron**= a positive electron, same mass different charge (+1), positrons are not present in stable atoms
- 1 atomic mass unit (amu) is approx. 1.66 x 10 (-27) kg, defined by setting mass of carbon to approx. 12amu
- Atomic number (Z)= number of protons in atomic nucleus- defines chemical nature of the atom, equal to the total charge on the atomic nucleus
- Mass number (M)= total number of nucleons (protons + neutrons)
- By changing number of neutrons, change stability and reactivity
- Nuclide= an atom with a particular mass number and atomic number
- Isotopes= nuclides with the same atomic number but different mass numbers
- E.g. carbon exists as 3 different isotopes, carbon-12 is stable, carbon-14 is a radioisotope
- Atomic mass of an element, average of the atomic masses and the abundance of each of the naturally occurring isotopes
- Nucleogenesis= formation of new nuclei from existing nucleons (protons and neutrons)- all atoms are generated from the simplest nuclide, hydrogen, by nuclear reactions
- Hydrogen-1 nucleus= a proton

- Fundamental nuclear reactions:

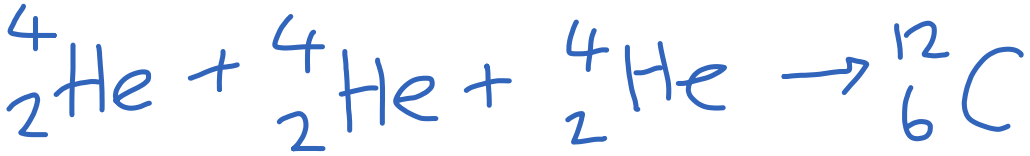


Gamma ray has energy but no mass or charge

- When balancing nuclear reactions, both the mass numbers and atomic numbers must balance
- Overall hydrogen-burning reaction- exothermic, releases heat



- When hydrogen gas burns, releases energy due to bonds being broken + re-made
- In hydrogen fusion, energy comes from a change in mass (E=mc^2)
- Overall 'hydrogen burning reaction'- releases energy unto the surroundings + radiation (also releases neutrinos (v))
- When the star exhausts its hydrogen (through hydrogen burning), begins helium burning to fuse heavier nuclei, form increasingly larger atoms e.g.



- Heavier nuclei like N-13, N-14, O-15, produced from red giant stars, still heavier nuclei in supergiants + true heavy elements form in supernovae
- New element-forming reactions=exothermic up until iron
- All elements up to iron are produced in stars
- When a star has only iron to burn, consumes energy + implodes → supernova