COVERING NUCLEAR CHEMISTRY BEFORE RADIOACTIVITY LAB (AFTER TEST I)

3 types of Radiation

Alpha Radiation (α) stream of particles repelled by positively charge electrode & attracted to negatively charged electrode 2 protons and 2 neutrons, charge +2 (same as He atom without electrons) (lose α, lower atomic mass by 4 and atomic mass by 2 ($^{4}_{2}He$)

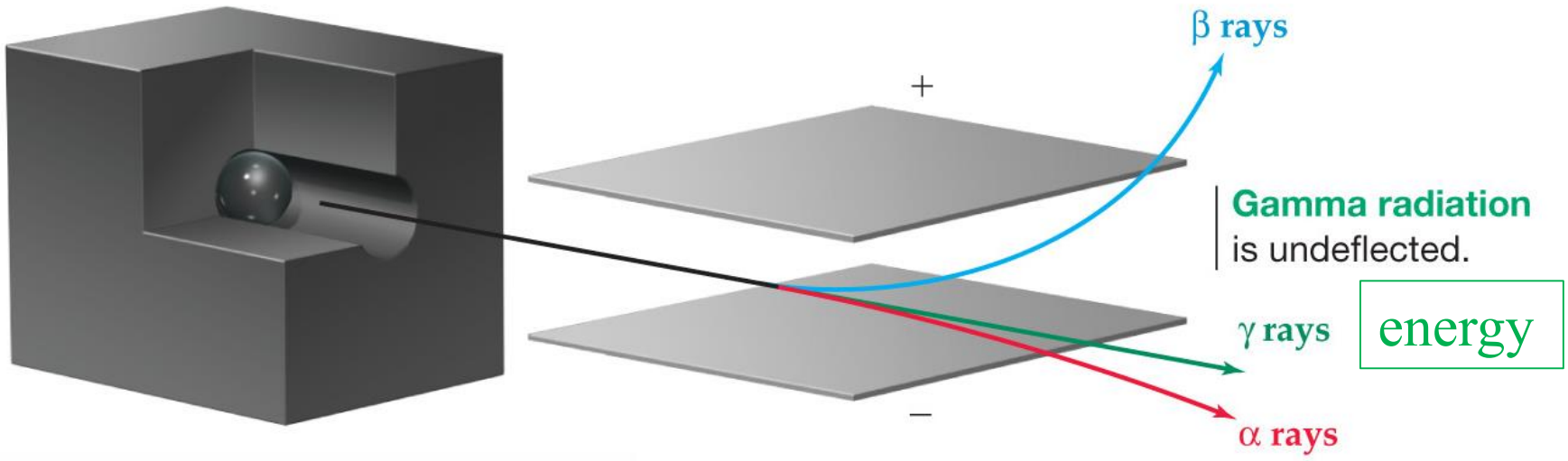
Beta Radiation (β) stream of particles attracted to positive electrode repelled by negative electrode, electron, charge -1, neutron decays into proton plus electron (β) radiation $^{0}_{-1}e$

Gamma Radiation (γ) very strong electromagnetic radiation, no mass & no charge, accompanies all α & β emission to release energy

Radioactivity – effect of electricity on α,β,γ radiation

electron

Beta radiation is strongly deflected toward the positive electrode.



The radioactive source in the shielded box emits radiation, which passes between two electrodes.

Alpha radiation is deflected toward the negative electrode.

2 protons + 2 neutrons

Radioactivity

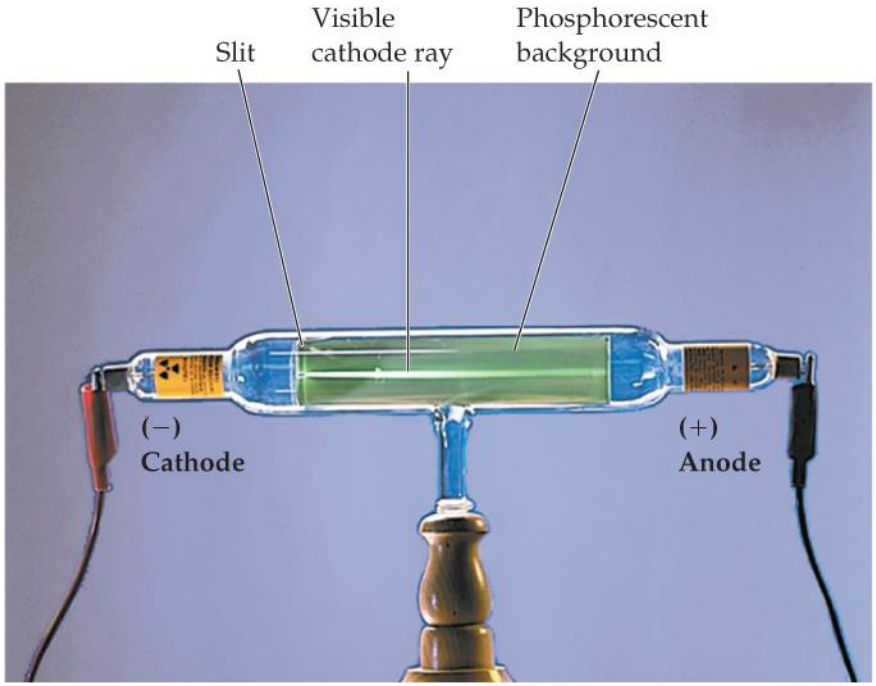
TABLE 2.2 A Summary of Radioactive Decay Processes

Process	Symbol	Change in Atomic Number	Change in Mass Number	Change in Neutron Number
Alpha emission	${}_{2}^{4}\mathrm{He}$ or α	−2	−4	−2
Beta emission	${}_{-1}^{0}\mathrm{e}$ or β^{-}	+1	0	−1
Gamma emission	${}_{0}^{0}\gamma$ or γ	0	0	0

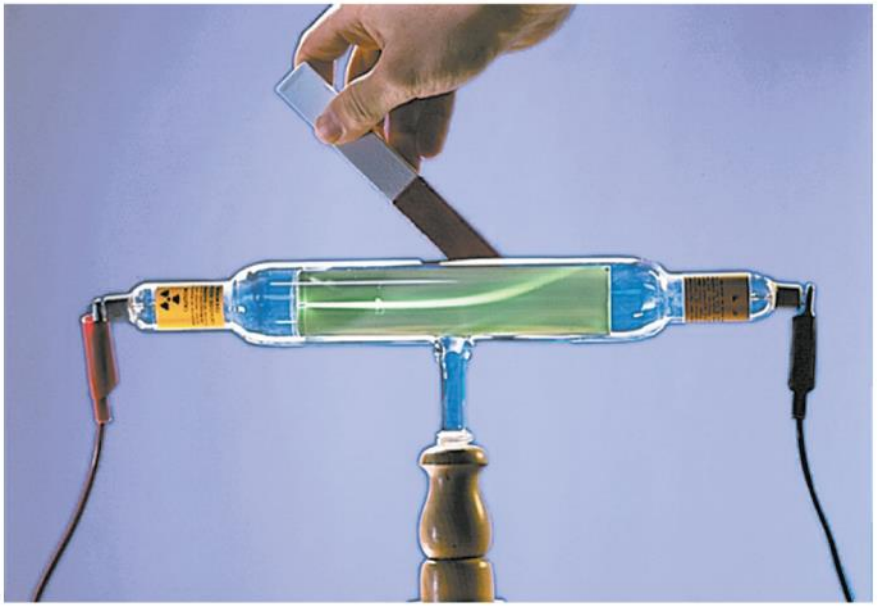
Atomic Structure: Electrons

Cathode-Ray Tubes: J. J. Thomson (1856–1940) proposed that cathode rays must consist of tiny, negatively charged particles. We now call them **electrons**. (β radiation, deflected by either magnetic or electric field)

(a) The electron beam ordinarily travels in a straight line.



(b) The beam is deflected by either a magnetic field or an electric field.



Nuclear Chemistry: The Change of One Element Into Another

Comparisons between Nuclear and Chemical Reactions

- A *nuclear* reaction changes an atom's nucleus, usually producing a different element. C*hemical* reactions only rearrange the same atoms.

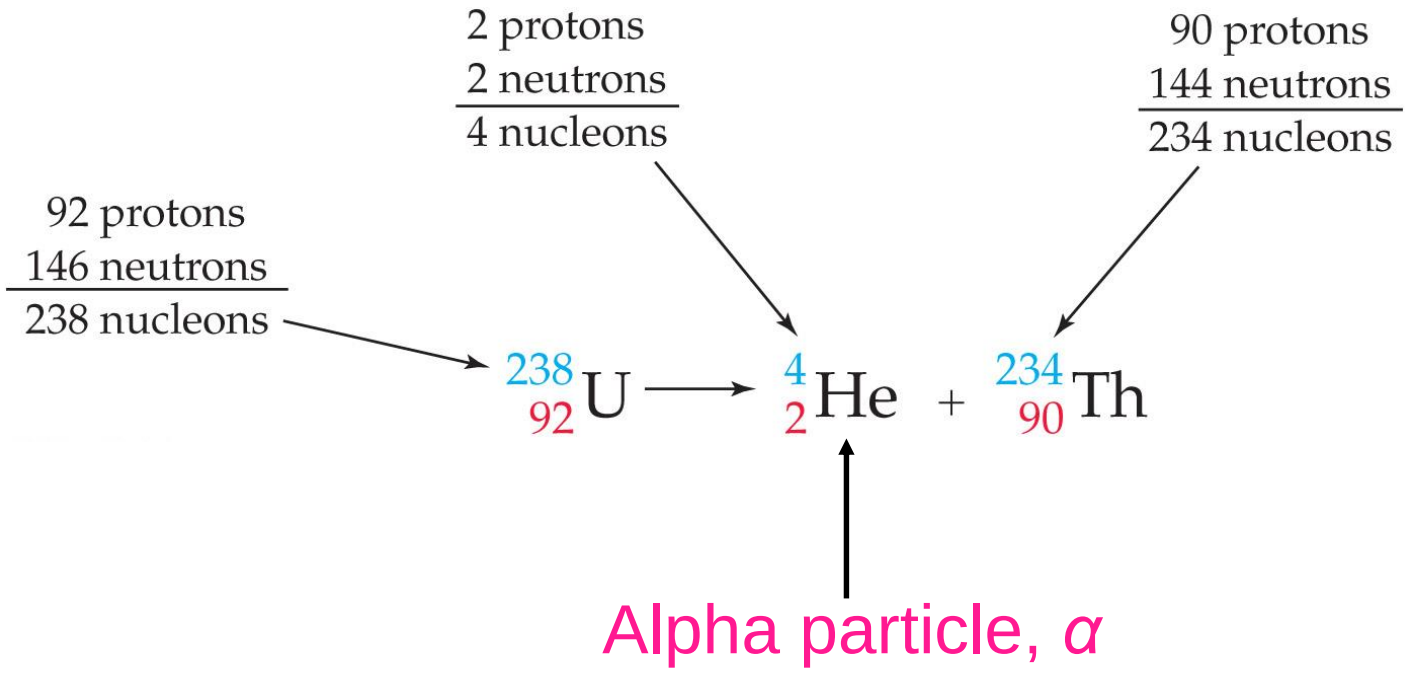
- Different isotopes of an element have essentially the same behavior in *chemical* reactions but often have a completely different behavior in *nuclear* reactions.

- *nuclear* reaction – very high energy
  c*hemical* reaction - less energy.

Radioactivity

Alpha (α) Radiation

An alpha particle is a helium-4 nucleus (2 protons and 2 neutrons).



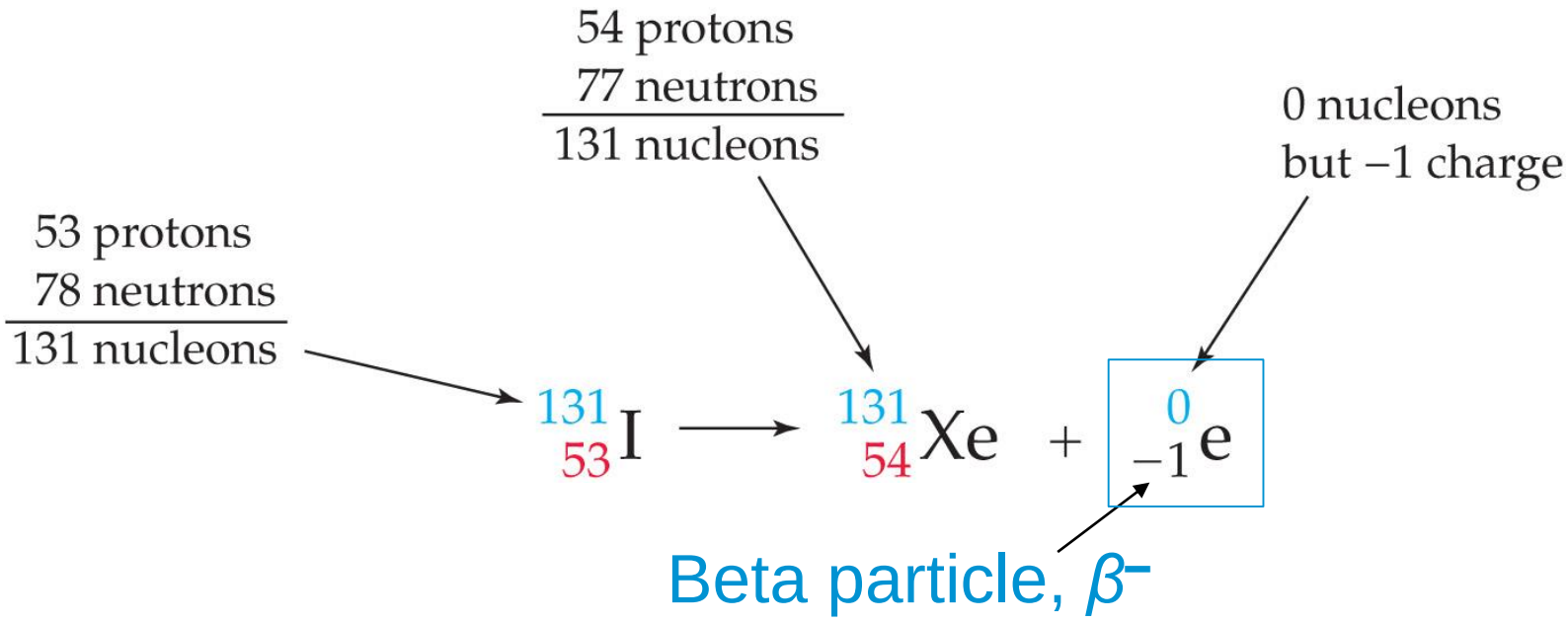
Radioactivity

53
I
126.9

54
Xe
131.3

Beta (β) Radiation

A beta particle is an electron.



convert neutron into proton & electron
electron is released as b particle

Same atomic mass bc proton & neutron have same mass

Radioactivity

Gamma (γ) Radiation

A gamma particle is a high-energy photon.

no mass & no charge

(NOT deflected by magnetic or electrical charge)

Nuclear Stability

- All isotopes **heavier than bismuth-209 are radioactive**, even though they may decay slowly and be stable enough to occur naturally.