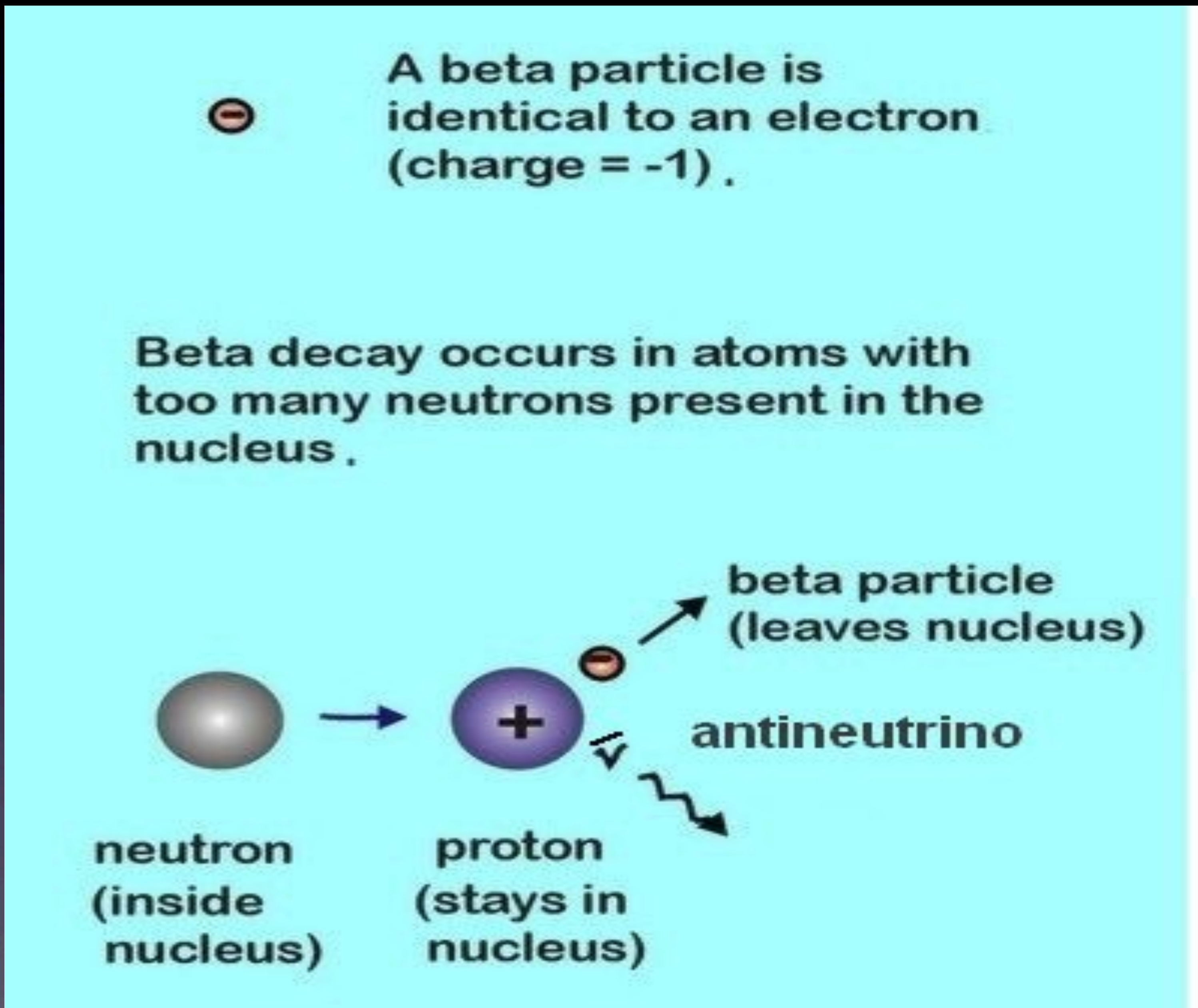
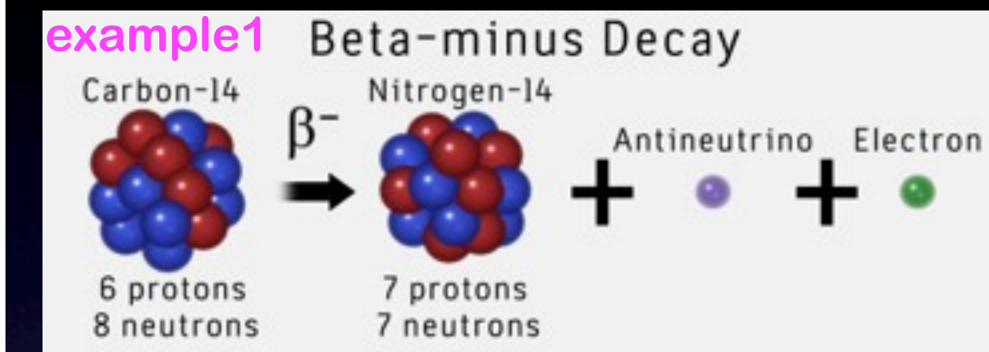
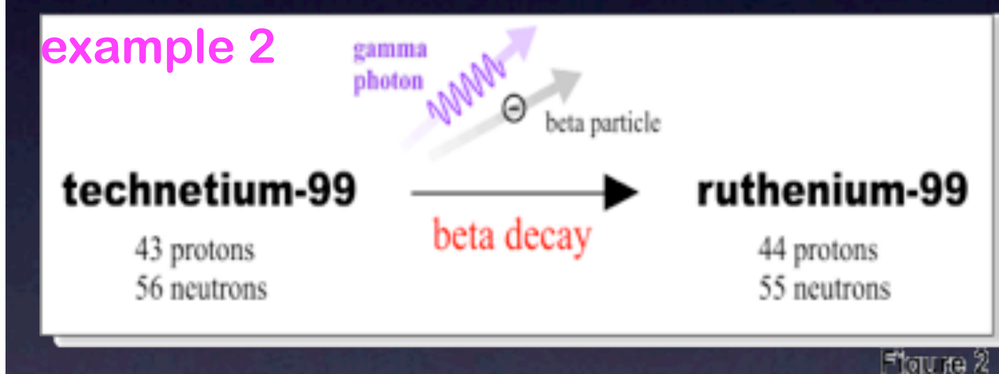
# Radioactivity: beta negative particle

Ask Mish




example 3

$$^{131}_{53}I \;\text{-->}\; ^{0}_{-1}e + ^{131}_{54}Rn$$

# Radioactivity: beta positive particle or positron

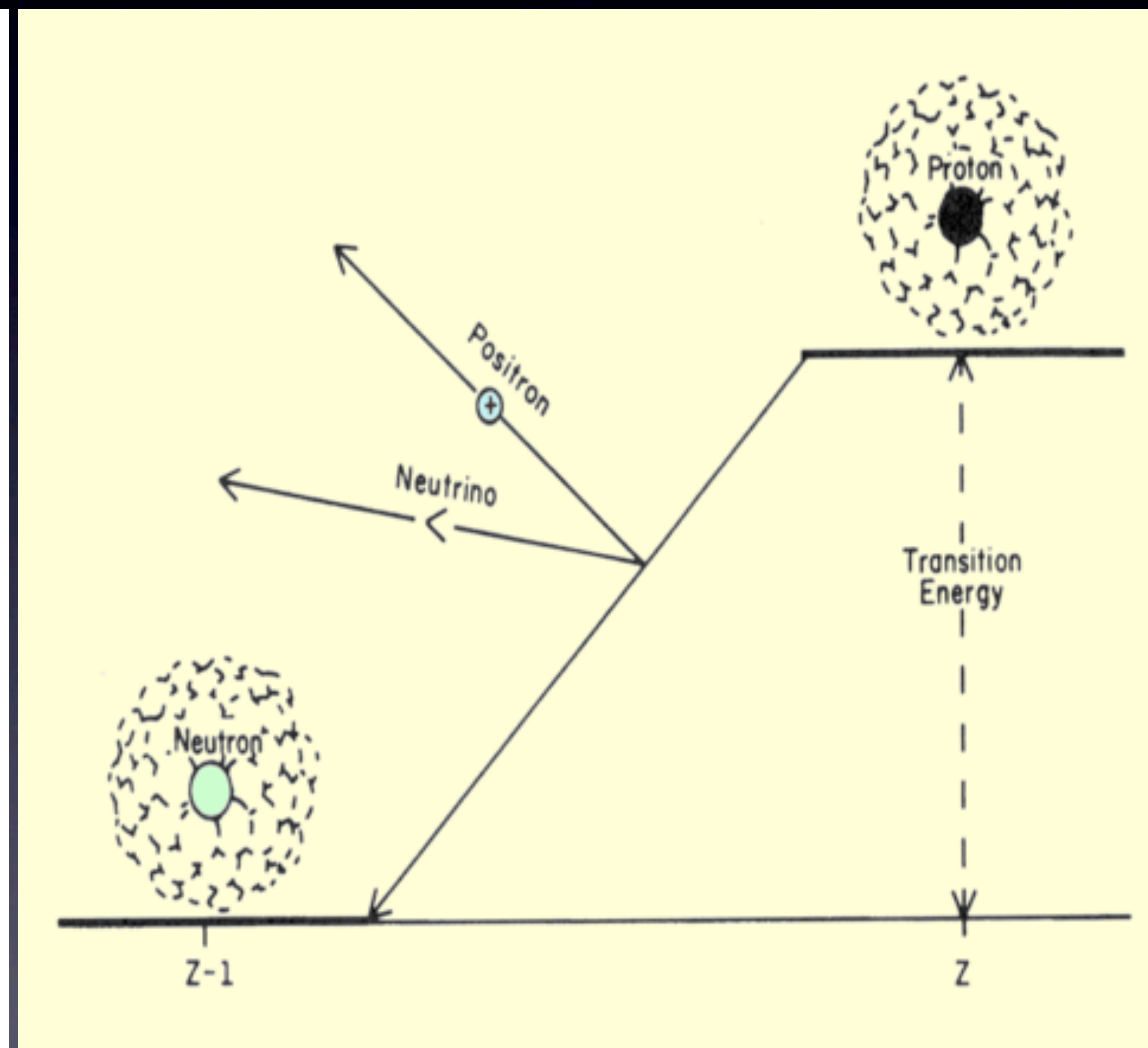
Ask Mish

## Positron Decay

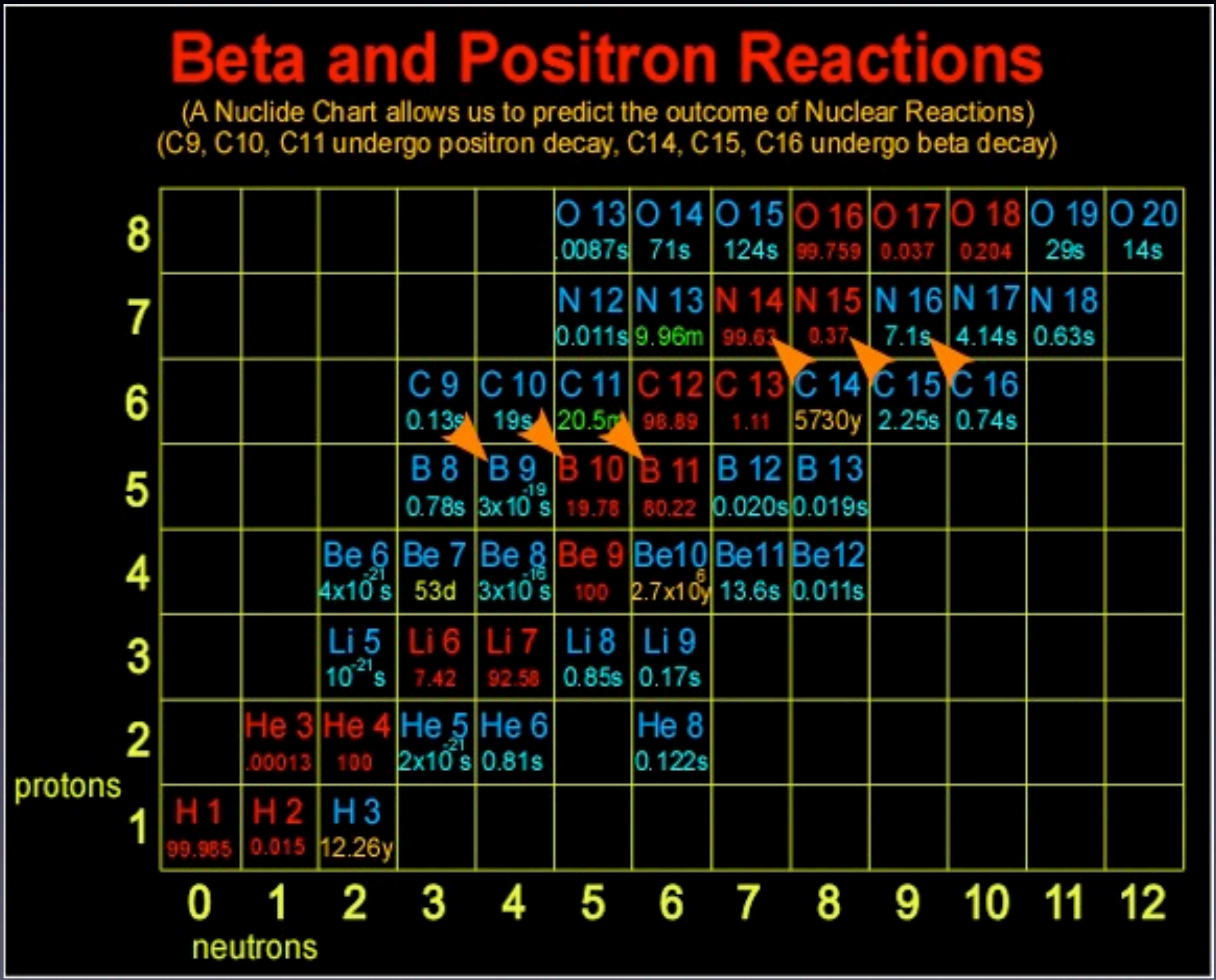
If the n/p ratio is too low, it may be increased by disintegration of a proton in the nucleus. This process is represented by the following equation:

$$^{1}_{1}p \longrightarrow {}^{1}_{0}n + {}^{0}_{+1}e + \nu + \text{Energy}$$

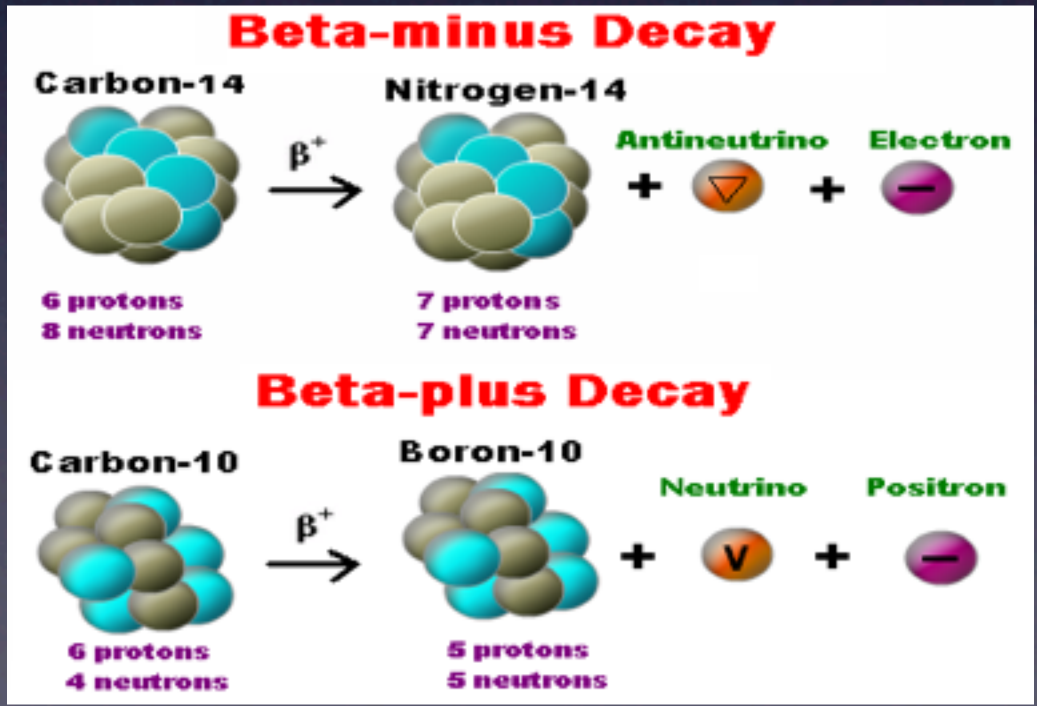
positron neutrino



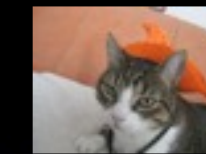
# Beta and Positron Reactions: how to predict the outcome

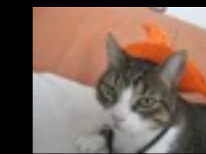

- Ratio Protons/Neutrons is determinant. Nucleus tend to lose excess particle.
- if N>P then N-> P (beta - decay) see C14, C15 and C16
- if P>N then P -> N aka beta+(positron) decay see C9,C10,C11



# BETA RADIOACTIVITY: recap

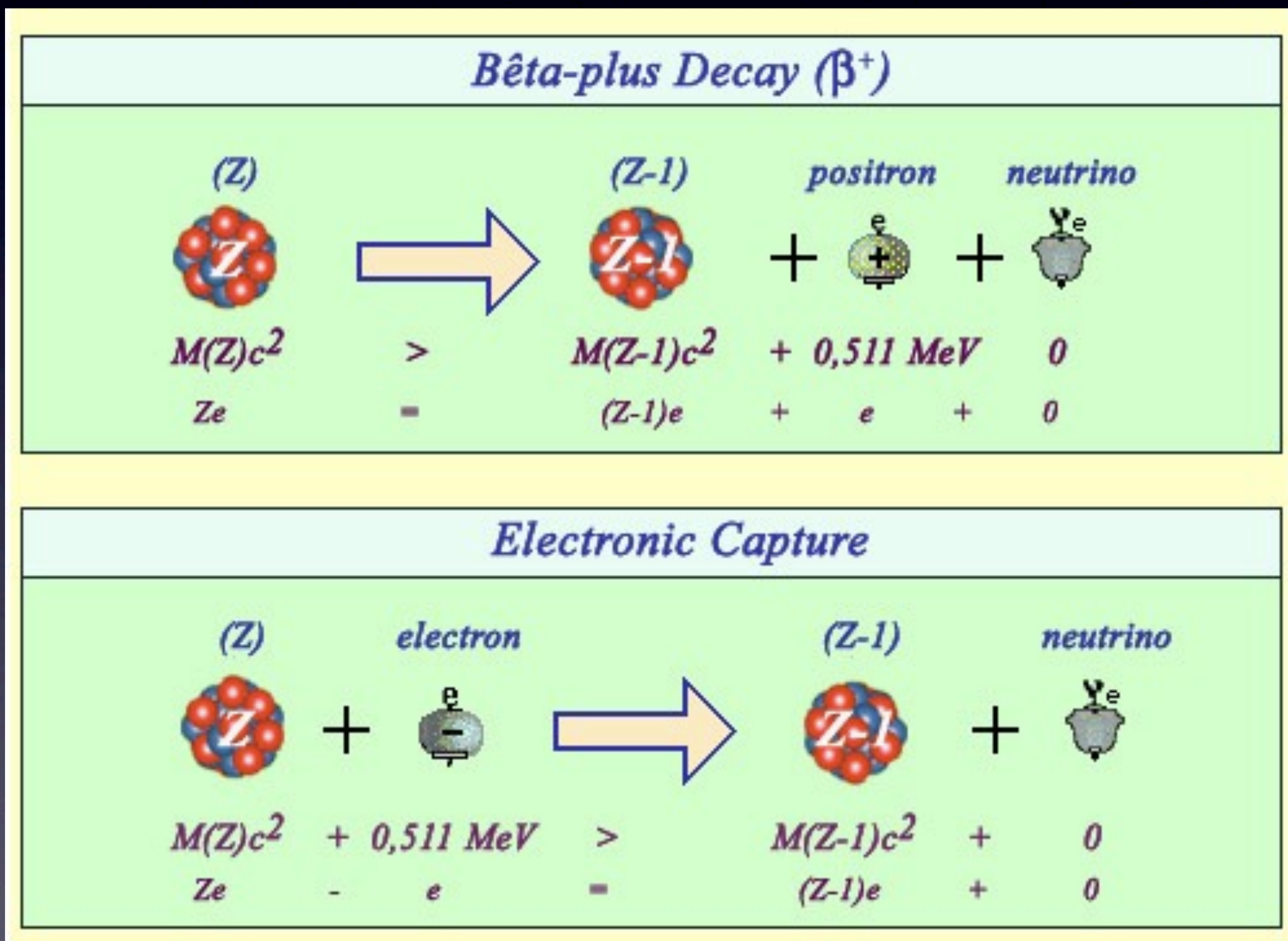

Ask Mish

| BETA + | BETA - |
|---|---|
| if excess P then P -> N | if excess N then N -> P |
| W+ boson carries weak force that produces this | W- boson |
| positron and neutrino = final products | electron and antineutrino |
| O, F used in medicine in PET | many elements<br>more common than beta+ |



Ask Mish

# Weak Force - Beta Radioactivity particularity : electron capture




- Free energy is negative, delta G<0, for spontaneous reactions to occur (thermodynamics); massive E is released when nuclear bonds are broken : E=mc2 and here delta G=delta E, so for spontaneous decay : deltaE<0, delta m<0.
- in heavier elements, delta m is small and do not generate enough energy for P->N, so nucleus capture an -e from inner (K) shell, process known as K capture/inverse beta decay, no positron just neutrino freed