

2012 APR 25

RADIOACTIVE DECAY

SOME PARTICLES ARE STABLE

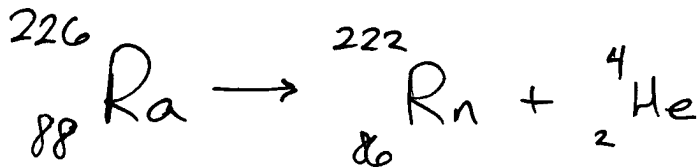
- PROTON
- ELECTRON
- HELIUM ATOM
- MANY ATOMS

SOME PARTICLES ARE NOT STABLE

- NEUTRON
- RADIUM-226
- URANIUM-232
- CARBON-14

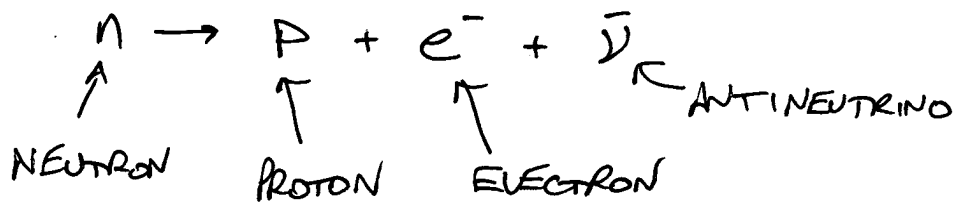
DECAY MECHANISMS

- α DECAY
EMISSION OF A ${}^4_2\text{He}$ NUCLEUS
Atomic Mass Number (# of protons + neutrons)
Atomic Number (# of protons)



- β DECAY
EMISSION OF ELECTRON OR RELATED THING

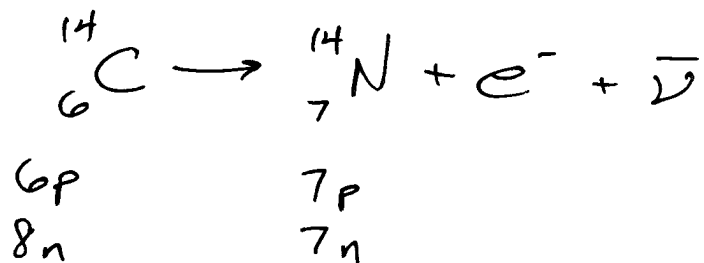
- ① β^- DECAY
EMISSION OF ELECTRON



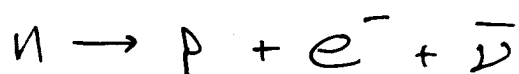
CHARGE IS CONSERVED

OF PROTON IS NOT CONSERVED

ANOTHER EXAMPLE OF β^- DECAY

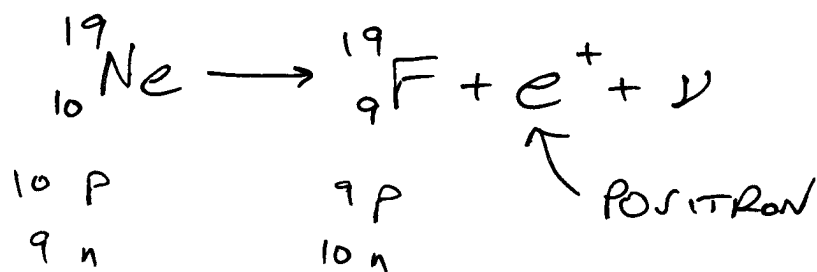


BEHIND THE SCENES,



② β^+ DECAY

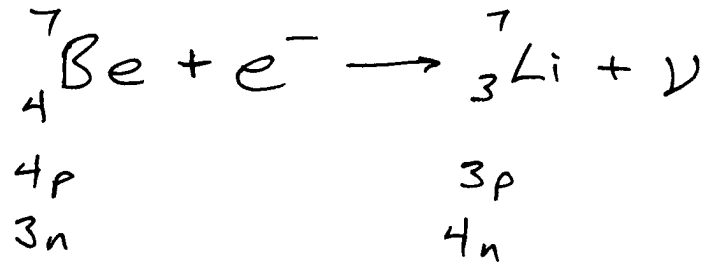
EMISSION OF A POSITRON (THE ELECTRON'S ANTI PARTICLE)



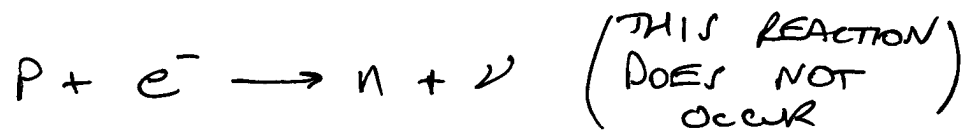
BEHIND THE SCENES



③ ELECTRON CAPTURE (EC)

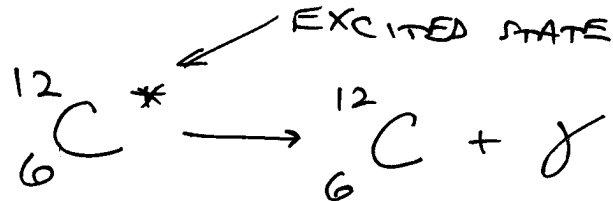


BEHIND THE SCENES



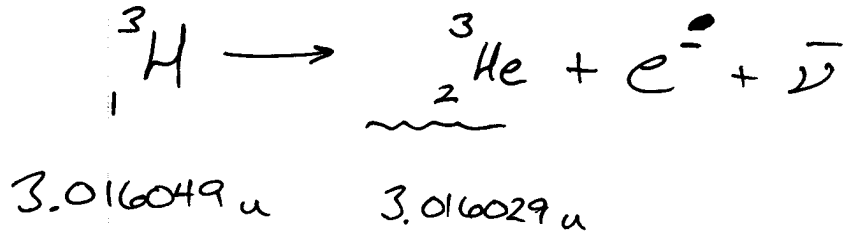
• γ DECAY

EMISSION OF A PHOTON



(GG, Ch 30, P 18)

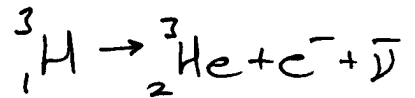
5



SHOULD BE ADD THE REST MASS OF THE e^- ON THE RIGHT? NO.

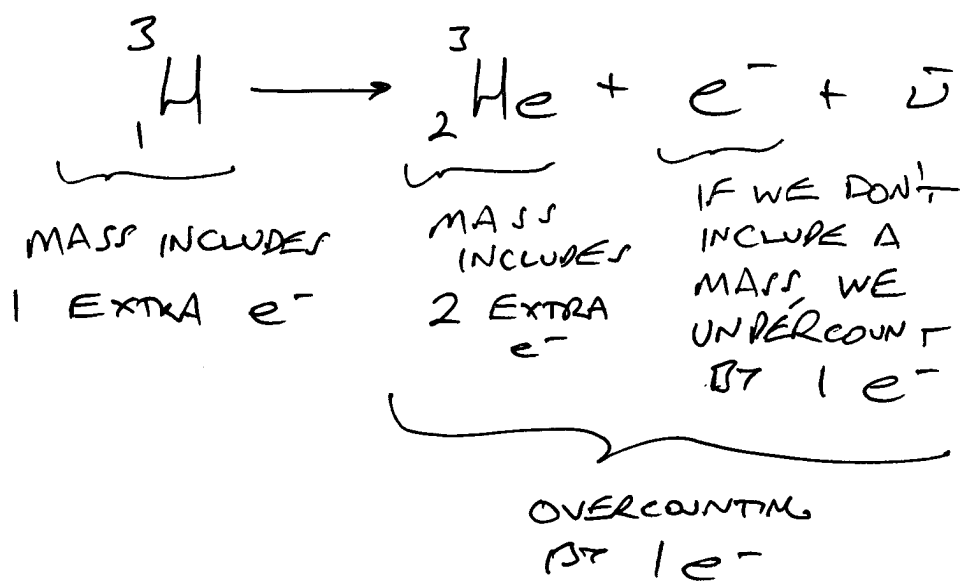
• WHEN WE WRITE ${}^3_2\text{He}$ IN A REACTION, WE MEAN THE NUCLEUS, NOT THE NEUTRAL ATOM.

• APPENDIX B GIVES MASSES FOR NEUTRAL ATOMS.



MASS FOR
NEUTRAL ${}^3_1\text{H}$
OVERCOUNTS
ELECTRONS
BY 1

MASS FOR
NEUTRAL ${}^3_2\text{He}$
OVERCOUNTS
ELECTRONS
BY 2



$$\begin{array}{r}
 3.016049 \text{ u} \\
 - 3.016029 \text{ u} \\
 \hline
 0.000020 \text{ u}
 \end{array}$$

$$\begin{aligned}
 0.000020 \text{ u} \times \frac{931.5 \text{ MeV}/c^2}{1 \text{ u}} &= 0.01863 \text{ MeV}/c^2 \\
 &= 18.63 \text{ KeV}/c^2
 \end{aligned}$$

ENERGY RELEASED IS

$$18.63 \text{ KeV}$$