
FISICA PARA BIOLOGIA F107 A : AULA 11

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Pagina do curso: <https://sites.ifi.unicamp.br/orlando/ensino/f-107-fisica-para-biologia/>

Moodle: <https://www.ggte.unicamp.br/ea/>

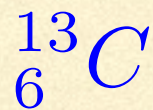
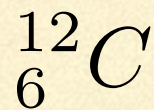
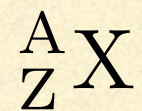
FISICA NUCLEAR E RADIOATIVIDADE:

Física Nuclear: descrição do comportamento do núcleo atômico.

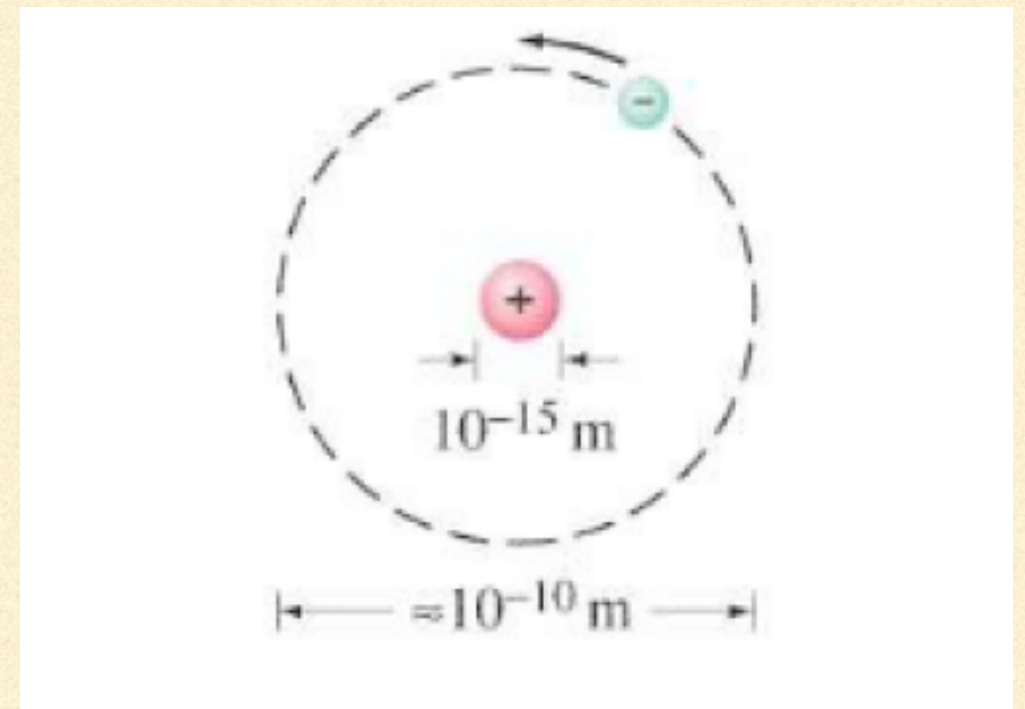
Núcleo: prótons e nêutrons

Numero atômico Z : numero de prótons

Numero de massa A : prótons+nêutrons



Mesmo Z , diferente N : isótopos



NUCLEO

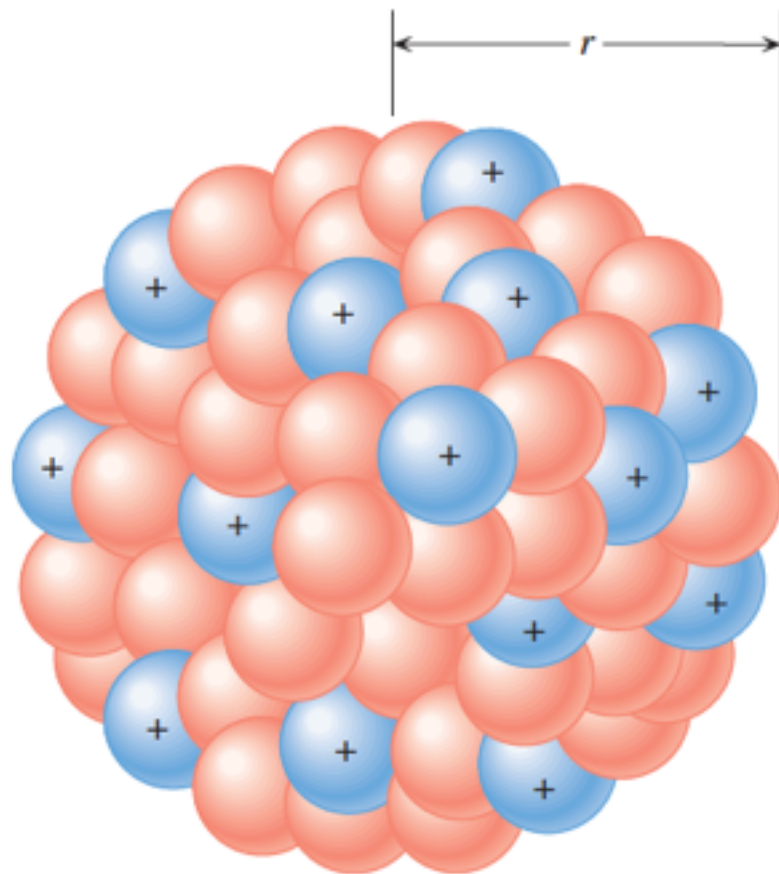
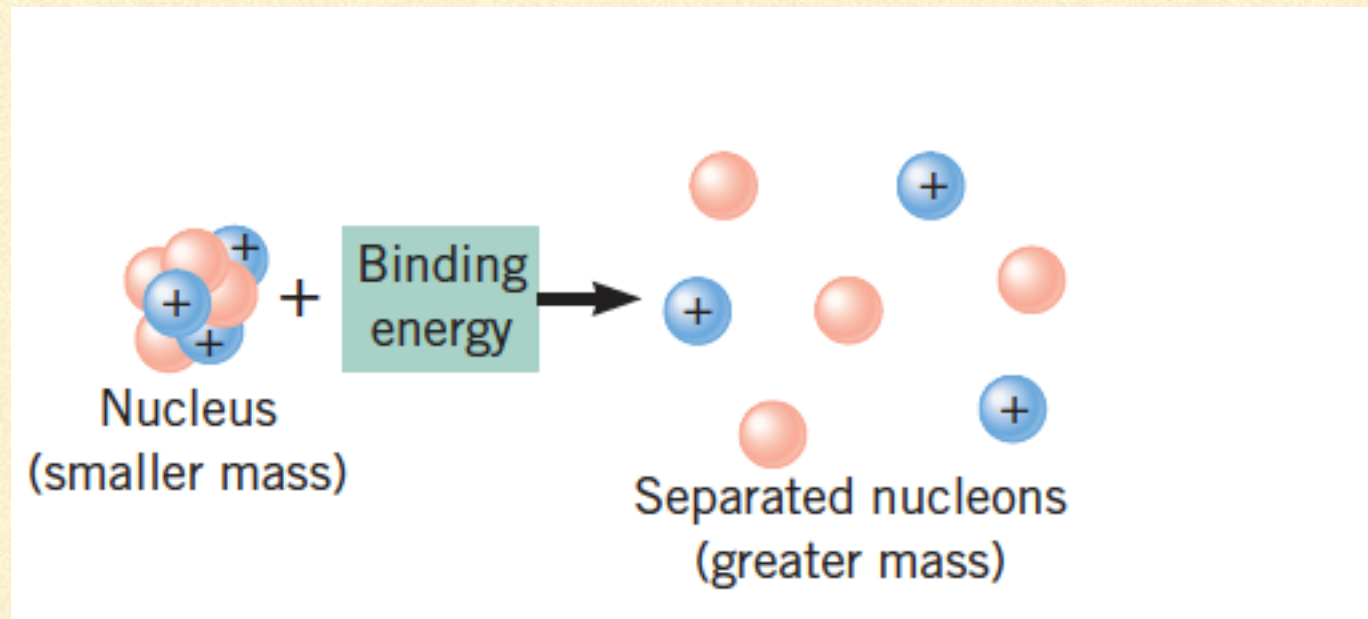


Figure 31.1 The nucleus in an atom is approximately spherical (radius = r) and contains protons (\oplus) clustered closely together with neutrons (\ominus).

Qualquer núcleo com $Z > 83$ não é estável.

Radioatividade: instabilidade do núcleo

RADIOATIVIDADE



${}^4_2\text{He}$ < 2 protons e 2 neutrons?

Se sim, o átomo é estável.

MASSA ATOMICA

| Particle | Electric Charge (C) | Mass | |
|---------------|-------------------------|------------------------------|-----------------------------|
| | | Kilograms (kg) | Atomic Mass Units (u) |
| Electron | -1.60×10^{-19} | $9.109\ 382 \times 10^{-31}$ | $5.485\ 799 \times 10^{-4}$ |
| Proton | $+1.60 \times 10^{-19}$ | $1.672\ 622 \times 10^{-27}$ | 1.007 276 |
| Neutron | 0 | $1.674\ 927 \times 10^{-27}$ | 1.008 665 |
| Hydrogen atom | 0 | $1.673\ 534 \times 10^{-27}$ | 1.007 825 |

massa ${}^4_2\text{He}$:4,002603 u

${}^{12}_6\text{C}$ 12 unidades de massa atomica

ESTABILIDADE

Testando com ${}^4_2\text{He}$: 2p+2n

Massa Helio: 4,002603 u

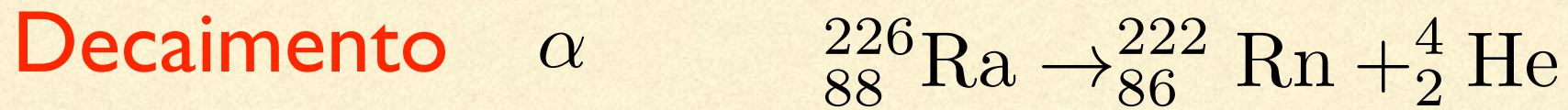
Massa proton: 1,007276 u $\times 2 = 2,017330$ u

Massa neutron: 1,008665 u $\times 2 = 2,015650$ u

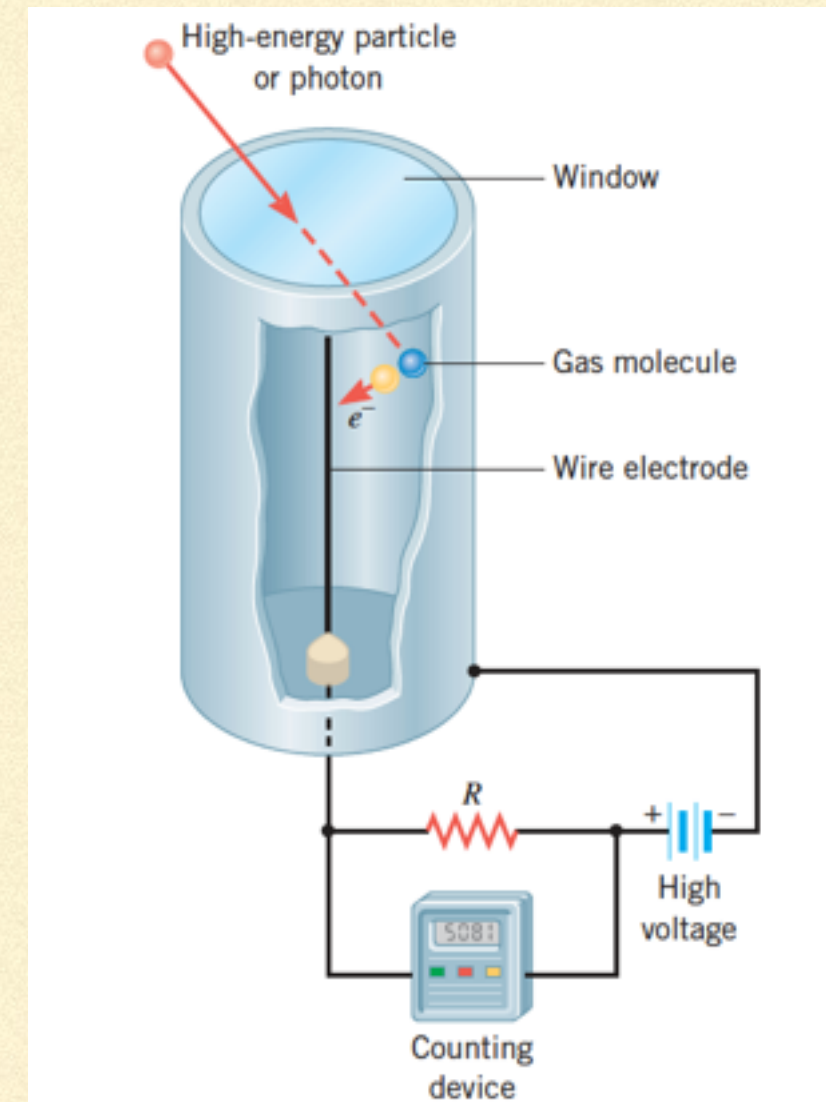
Total final: 4,032980 u > Massa Helio: 4,002603 u

Estavel !!!

RADIOATIVIDADE



Contador Geiger:



SERIE DE BALMER

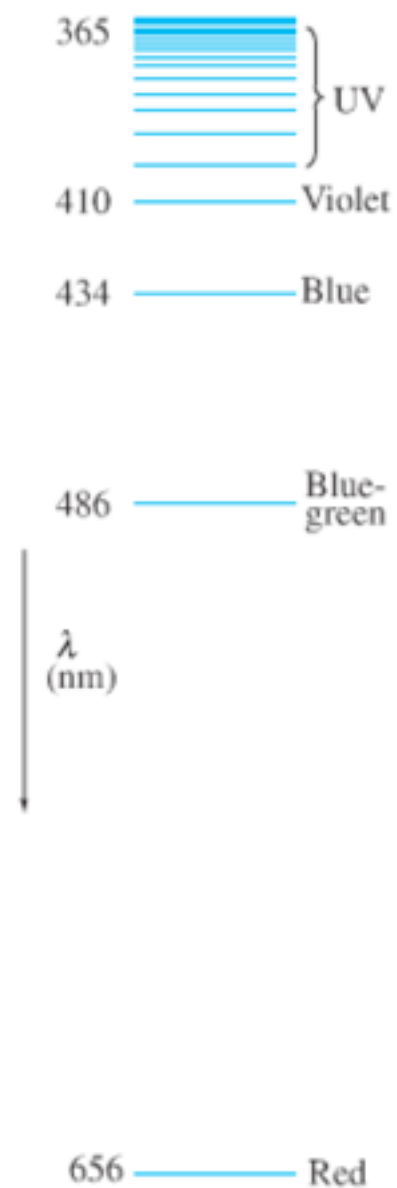


FIGURE 27-22 Balmer series of lines for hydrogen.

$$\frac{1}{\lambda} = R \left(\frac{1}{2^2} - \frac{1}{n^2} \right)$$

λ comprimento de onda

$$R = 1,0974 \times 10^7 \text{ m}^{-1}$$

$$n = 1, 2, 3, \dots$$

QUANTIZAÇÃO A LA BOHR III E SERIE DE BALMER

$$\frac{1}{\lambda} = R \left(\frac{1}{2^2} - \frac{1}{n^2} \right)$$

Podemos transformar

Diferença da energia de um elétron

$$\frac{(hc)}{\lambda} = (hc) R \left(\frac{1}{2^2} - \frac{1}{n^2} \right)$$



energia de um foton

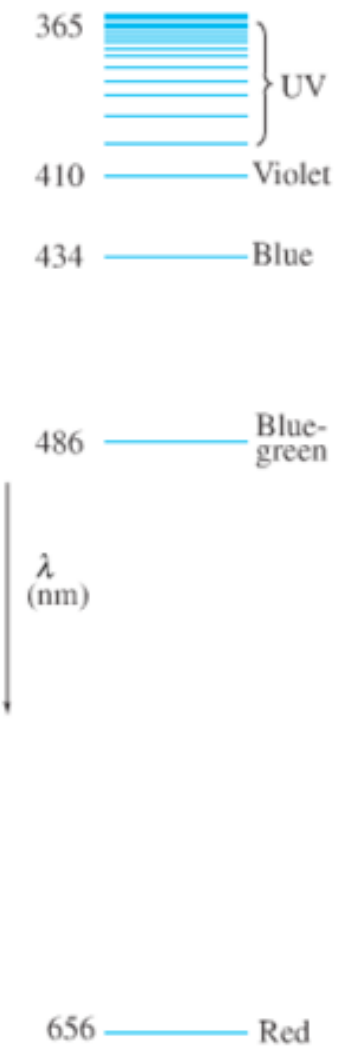
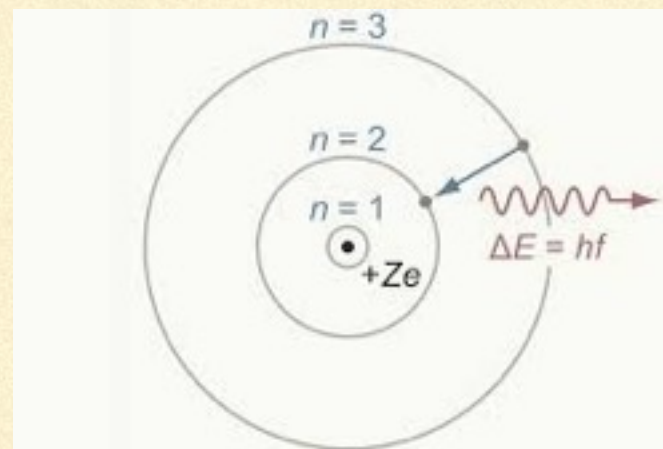
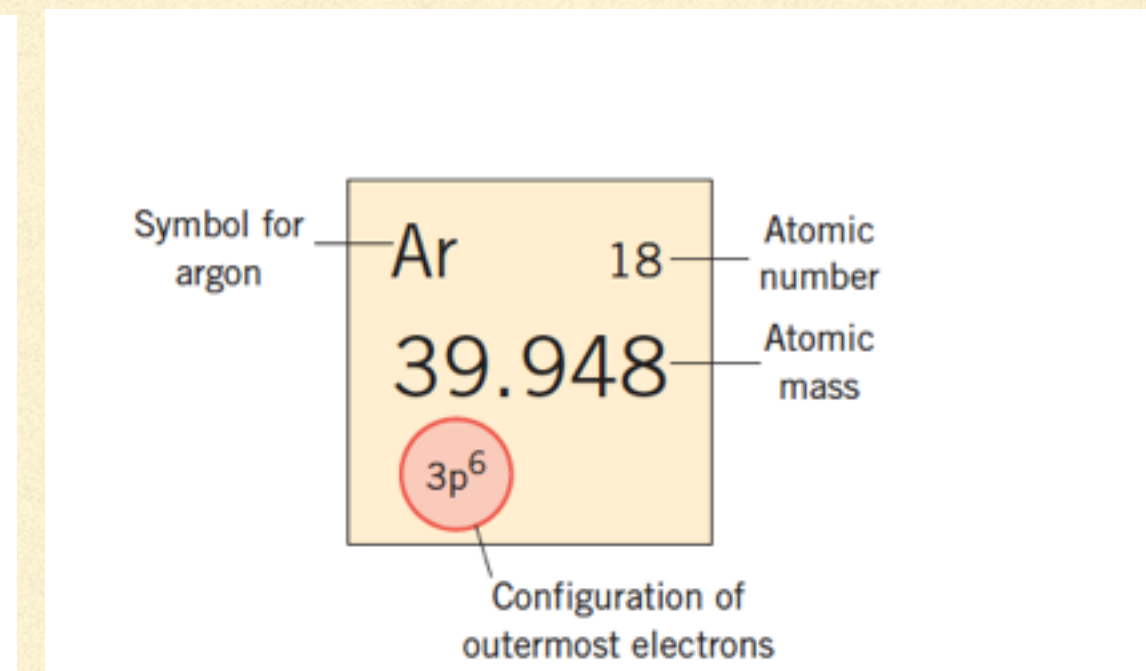


FIGURE 27-22 Balmer series of lines for hydrogen.

TRANSIÇÕES PARA OUTROS ELEMENTOS

Table 30.3 Ground-State Electronic Configurations of Atoms

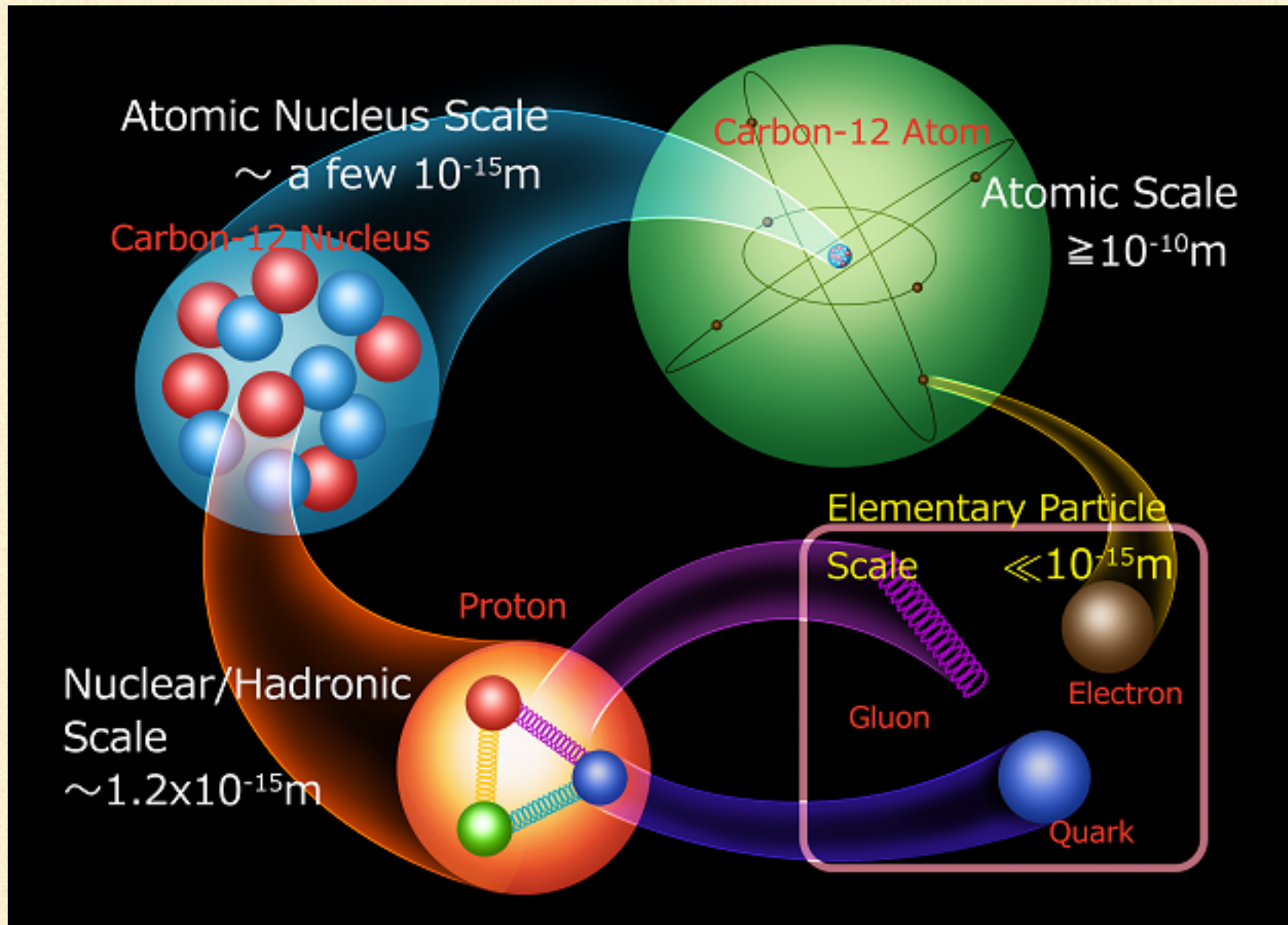
| Element | Number of Electrons | Configuration of the Electrons |
|----------------|---------------------|--------------------------------|
| Hydrogen (H) | 1 | $1s^1$ |
| Helium (He) | 2 | $1s^2$ |
| Lithium (Li) | 3 | $1s^2 2s^1$ |
| Beryllium (Be) | 4 | $1s^2 2s^2$ |
| Boron (B) | 5 | $1s^2 2s^2 2p^1$ |
| Carbon (C) | 6 | $1s^2 2s^2 2p^2$ |
| Nitrogen (N) | 7 | $1s^2 2s^2 2p^3$ |
| Oxygen (O) | 8 | $1s^2 2s^2 2p^4$ |
| Fluorine (F) | 9 | $1s^2 2s^2 2p^5$ |
| Neon (Ne) | 10 | $1s^2 2s^2 2p^6$ |
| Sodium (Na) | 11 | $1s^2 2s^2 2p^6 3s^1$ |
| Magnesium (Mg) | 12 | $1s^2 2s^2 2p^6 3s^2$ |
| Aluminum (Al) | 13 | $1s^2 2s^2 2p^6 3s^2 3p^1$ |



Dado o electron mais externo da transição deste elétron para o estado fundamental.

Qual é o λ ?

PARTICULAS ELEMENTARES



PARTICULAS ELEMENTARES II

Three generations of matter (fermions)

| | I | II | III | |
|---------|---|---|---|--------------------------------------|
| mass | $2.4 \text{ MeV}/c^2$ | $1.27 \text{ GeV}/c^2$ | $173.2 \text{ GeV}/c^2$ | 0 |
| charge | $\frac{2}{3}$ | $\frac{2}{3}$ | $\frac{2}{3}$ | 0 |
| spin | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | 1 |
| name | u up | c charm | t top | γ photon |
| Quarks | $4.8 \text{ MeV}/c^2$ | $304 \text{ MeV}/c^2$ | $4.2 \text{ GeV}/c^2$ | 0 |
| | $-\frac{1}{3}$ | $-\frac{1}{3}$ | $-\frac{1}{3}$ | 0 |
| | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | 1 |
| | d down | s strange | b bottom | g gluon |
| Leptons | $< 2.2 \text{ eV}/c^2$ | $< 0.17 \text{ MeV}/c^2$ | $< 15.5 \text{ MeV}/c^2$ | $91.2 \text{ GeV}/c^2$ |
| | 0 | 0 | 0 | 0 |
| | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | 1 |
| | ν_e electron neutrino | ν_μ muon neutrino | ν_τ tau neutrino | Z^0 Z boson |
| | $0.511 \text{ MeV}/c^2$ | $105.7 \text{ MeV}/c^2$ | $1.777 \text{ GeV}/c^2$ | $80.4 \text{ GeV}/c^2$ |
| | -1 | -1 | -1 | ± 1 |
| | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | 1 |
| | e electron | μ muon | τ tau | W^\pm W boson |

Gauge bosons