Summary for Tutorial 1

QL
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Keep in mind: You still need to read the lecture notes. My summary can’t have everything in it. If there’s an error, please email me.

Three tips: 1. Don’t memorize the equations. Understand them, and know how to use them. 2. Pay attention to the units. 3. Wikipedia

I. ENERGY LEVELS IN ATOMS

$Z$ is the proton number in an atom while $N$ is the neutron number.

A. photon

Energy of a photon with frequency $\nu$:

$$E_{\nu} = h\nu$$

(1)

$$\nu = \frac{c}{\lambda}$$

(2)

B. Hydrogen Atom

$$Z = 1$$

(3)

$$E_n = -13.6 \cdot \frac{1}{n^2} [eV]$$

(4)

C. Multi-electron Atom

$$E_n = -(Z - 1)^2 \cdot \frac{13.6}{n^2} [eV]$$

(5)

II. RADIOACTIVE DECAY LAWS

$$N(t) = N_0 \cdot e^{-\lambda t}$$

(6)

in which $N_0$ is the initial number of radioactive atoms. $N(t)$ is the number of radioactive atoms left after time $t$. $\lambda$ is the decay constant.

A. half-life $T_{1/2}$

$$\lambda = \frac{ln2}{T_{1/2}}$$

(7)

B. Dose

Amount of energy deposited into body per unit mass

$$D = \frac{E}{m}$$

(8)

The units for dose are: 1) Rad, which is 100 erg/g. 2) Gray or Gy, which is J/kg.

C. Activity

$$A(t) = \left| \frac{dN(t)}{dt} \right| = \lambda N(t)$$

(9)

$$A(t) = A_0 \cdot e^{-\lambda t}$$

(10)