Menoufia University

Nuclear Physics (P 253)

Faculty of Science

Date: Jan. 2019

Physics Department

Time: 2 hrs

الامتحان من صفحتين (الصفحة الاولى)

Answer the following questions:

Q-1 Which of the following statements are true ($\sqrt{}$) and which are false (X); correct the false ones: [36 Marks]

- 1-Activity is reduced to 0.125 A₀ after 3T.
- 2-Neutrions and gammas are having the same origin.
- 3-Positive ions are produced in the EC process.
- 4-Both of nuclear mass and nuclear volume proportional to A.
- 5-AL is a good shield for gamma rays.
- 6-Saturation property is found in the proportional counter.
- 7-Exposure to neutrinos are not hazardous.
- 8-In pairs annihilation e and e are resulted.
- 9-The relativistic kinetic energy $K = \sqrt{C^2P^2 + m_0C^2} m_0C^2$.
- 10-IC process is a source of monoenergetic electrons.
- 11-The function of the PMT is to enlarge the energy of gamma ray.
- Q-2 Why are the following statements correct?

[42 Marks]

- 1-Nuclear densities are much greater than Bulk densities.
- 2-In magnetic spectrograph K_α α r (radius of curvature).
- 3-Rate of energy loss of α > that of β of same velocities.
- 4-Atoms are considered as empty objects.
- 5-Free neutrons can decay while free protons can not.
- 6-Nuclear force is of a saturation property.
- 7-Ratio of nuclear radii of ²⁴Na to ³He is 2.
- 8-Growth curve can be represented by N_0 (1-e^{- λt}).



9-Radioactive nuclei of low N/Z tend to go β^+ decay.

10-Nuclear force is a charge independent.

11-1amu is equivalent to 931.5/C2.

12-K_D in EC process can not equal to zero.

13-The shield for fast neutrons is made of hydrogenous material.

14- μ_m and μ_L are simply related.

Q-3 Give short note on the following items.

[52 Marks]

1-The variation of ε with A.

2-Proportional counter.

3-Neutron-shielding materials.

4-Inverse beta decay.

5-Need for NaI (TI) crystal in scintillation counter

6-The IC process.

Q-4 Solve the following problems:

[50 Marks]

1-From the decay process

$$^{47}_{20}Ca~(46.954543) \rightarrow ^{0}_{-1}e~(0.000549) + ^{47}_{21}Sc~(46.952409) + \overline{v} + Q~(\beta^-)$$

Find the energy of \overline{v} in cases:

(a) K
$$(\beta^-)$$
 = Q (β^-)

(b) K
$$(\beta^{-})$$
 / K (\overline{v}) = 2.24

2-The excitation nuclear energy of $^{113}_{50}Sn$ (392 keV) is internally converted into its electron system. Find the potential energies φ^K_e and φ^L_e given that $K^k_e=363~keV$ and $K^L_e=387~keV$

3-Consider the reaction ${}^{188}_{76}Os \rightarrow {}^{1}_{0}n + {}^{187}_{76}Os$,

given that
$$BE(^{188}_{76}Os) = 1499.1 \,MeV$$

$$S_n = 7.999 \text{ MeV}$$

Find the mass of $^{187}_{76}Os$.

$$m_H = 1.007825 u$$

$$m_n = 1.008665$$

GOOD LUCK

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