

2010 – 2011
B.Sc. (HONS.) (PART – III) EXAMINATION
(PHYSICS)
NUCLEAR PRACTICE AND ASTROPHYSICS
(PH – 316)

Maximum Marks : 40

Duration : Three Hours

Note: Answer all questions.

1.(a) What are the important components of a mass spectrograph? Discuss the working principle of Bainbridge mass spectrograph. [4]

(b) Draw a typical binding energy per nucleon curve for nuclei existing in nature and hence explain how the energy is released in the process of fission. [3]

OR

1'.(a) Discuss the high energy electron scattering experiment to determine the size of the nucleus. [4]

(b) On the basis of uncertainty principle show that electrons cannot be constituent of the nucleus. [3]

2. Answer any two of the following: [3+3]

(a) What are the basic differences between the energy spectrum of alpha and beta particles obtained in natural radioactive decay? Discuss the reason(s) for the typical nature of alpha particle spectrum.

$$p v = m v^2$$

(b) Discuss the energetics of positron decay.

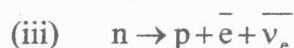
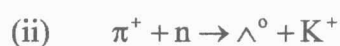
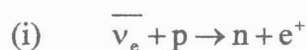
(c) Define Q-value of a nuclear reaction. Calculate the Q-value for the reaction $^{14}\text{N} (\alpha, p)^{17}\text{O}$, in MeV. Given, Mass of $^4\text{He} = 4.002603 \text{ u}$, $^{14}\text{N} = 14.003074 \text{ u}$, $^1\text{H} = 1.007825 \text{ u}$ and $^{17}\text{O} = 16.999131 \text{ u}$.

3.(a) Discuss the interaction processes by which 10 MeV gamma ray loses energy while passing through matter. [4]

(b) Draw the block diagram of a NaI(Tl) scintillation gamma ray spectrometer. Discuss briefly the function of each block. Also draw a typical gamma ray spectrum of ^{137}Cs gamma ray source, obtained using such spectrometer. [3]

4.(a) Distinguish between Fermions and Bosons. [2]

(b) Apply conservation laws to find whether the following reactions are allowed or forbidden. Give the quantum numbers which are not conserved for the forbidden reactions. [3]



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(c) Name various quark flavours. Write their quantum numbers.

[2]

OR

4'. Explain the difference between even and odd parity. Show that the pion parity is odd.

[7]

5(a) What are secondary cosmic rays? Explain the development of electromagnetic cascade shower.

[4]

(b) Plot the energy spectrum of primary cosmic rays and discuss its important features.

[3]

6. Write notes on any two of the following:

[3+3]

(a) Hydrostatic and Thermal equilibrium in stars.

(b) Hertzsprung – Russel diagram

(c) Black holes.

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