

SEAT No. _____

[13]

SARDAR PATEL UNIVERSITY
 B. Sc., 6th Semester
 Saturday, 1st October 2022
 Time: 03:30 to 05:30 pm
 Subject Code: (PHYSICS) US06CPHY03
 Subject Title: Nuclear Physics



Max Marks: 70

Que: 1 Write correct answer for each of the following MCQs. [10]

- 1 Nuclei having same number of neutrons but different number of protons are called as _____.
 - a) Isotones
 - b) Isotopes
 - c) Isomers
 - d) Isobars
- 2 The deviation of a nucleus from a spherically symmetric shape is expressed by the term _____.
 - a) nuclear magnetic moment
 - b) magnetic quadrupole moment
 - c) electric quadrupole moment
 - d) nuclear angular momentum
- 3 Mirror nuclei method is used to estimate ____ of nucleus.
 - a) magnetic moment
 - b) spin
 - c) radius
 - d) electric quadrupole moment
- 4 Life span of a compound nucleus is _____ sec.
 - e) 10^{-16}
 - f) 10^{-6}
 - g) 10^{-36}
 - h) 10^{-26}
- 5 If Q value is positive then nuclear reaction is _____.
 - a) endoergic
 - b) exoergic
 - c) stripping
 - d) both exoergic and endoergic
- 6 The value of G-factor for proton is _____.
 - a) 5.56
 - b) 5.65
 - c) 5.76
 - d) 5.46
- 7 The value of K for an assembly of sub critical size is _____.
 - a) > 1
 - b) 0
 - c) 1
 - d) < 1
- 8 _____ consists of a stack of parallel plates with a gap of about 8mm.
 - a) Spark chamber
 - b) GM counter
 - c) Cerenkov detector
 - d) Ionization chamber
- 9 _____ is not a type of an accelerator.
 - a) cyclotron
 - b) betatron
 - c) LINACS
 - d) bubble chamber
- 10 Spark chamber is _____.
 - a) a detector
 - b) an accelerator
 - c) a comparator
 - d) a counter

Que-2 Fill in the blank. Also answer whether the remaining statements are TRUE or FALSE. [08]

- 1 The formula for nuclear radius is _____.
- 2 Parity is a wave mechanical property of a nucleus. [True / False]
- 3 The Q-Value equation represents binding energy of a nucleus. [True / False]
- 4 In a liquid drop model, nucleus is regarded like a drop of liquid. [True / False]
- 5 Type of disintegration in which a heavy nucleus splits into two medium size nuclei is called _____.
- 6 In a _____ process, nuclear process electron emission takes place.
- 7 Ionization chamber is an accelerator. [True / False]
- 8 Linear accelerators consist of number of hollow cylindrical electrodes of increasing length. [True / False]

Que-3 Write answers of any ten questions in brief. [20]

- 1 Draw the graph of binding energy per nucleon versus mass number.
- 2 Define: Isotopes and Isobars.
- 3 Explain mirror nuclei method to know about nuclear radius.
- 4 Give the classification of nuclear reactions.
- 5 Explain elastic scattering and inelastic scattering nuclear reactions.
- 6 With example define pick up nuclear reaction process.
- 7 Draw diagram for experimental setup of NMR.
- 8 Give difference between prompt and delayed neutron.
- 9 What do you mean by fission chain reaction?
- 10 Differentiate between nuclear accelerator and detectors.
- 11 Define (i) dead time and (ii) recovery time of GM counter.
- 12 Give the schematic diagram of a betatron.

Que -4 Answer questions. Attempt any 4 out of 8. [32]

- 1 Obtain the formula to find mass of an ion using Aston mass spectrograph.
- 2 Explain any two reasons for nonexistence of electrons in a nucleus.
- 3 With the help of liquid drop model obtain an expression for volume energy, surface energy and coulomb energy of a nucleus.
- 4 Derive Q value equation for two body nuclear reaction in two dimensions.
- 5 Giving definition of NMR, explain experimental setup for it.
- 6 Explain use of radio isotopes in archaeology.
- 7 With neat diagram, explain principle, construction and working of Van de Graff accelerator.
- 8 Write working principle of detectors and explain cloud chamber in detail.

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