(58/A-18) SEAT No._____

SARDAR PATEL UNIVERSITY
B. Sc, 6th Semester
Saturday, 31st March 2018
Session: Morning, Time: 10:00 to 01:00 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 Mirror nuclei method is used to estimate_____ of nucleus.
   a) Radius
   b) Magnetic moment
   c) Spin
   d) Electric quadrupole moment

2 10^{-24} cm^2 = _____ barn.
   a) 4
   b) 1
   c) 3
   d) 2

3 Nuclei having same number of neutrons but different number of protons are called ____.
   a) Isotopes
   b) Isomers
   c) Isotones
   d) Isobars

4 The physical quantity represented by nuclear magneton is _____.
   a) Nuclear mass
   b) Electric dipole moment
   c) Electric quadrupole moment
   d) Nuclear magnetic moment

5 If Q-value is positive then nuclear reaction is/are_____.
   a) Exoergic
   b) Endoergic
   c) Exoergic and Endoergic both
   d) Stripping

6 In _____ nuclear process Electron emission takes place.
   a) Positive β-decay
   b) Negative β-decay
   c) Electron capture
   d) α-decay

7 _____ is/are not the principle, used in LINACS for accelerating particles.
   a) Phase switching
   b) Phase matching
   c) Phase stability
   d) Phase matching and Phase stability both

8 Betatron accelerates electrons to _____ energies.
   a) Low
   b) High
   c) Constant
   d) Variable

9 _____ is stack of parallel plates with a gap of about 8mm.
   a) Spark chamber
   b) Cloud chamber
   c) Bubble chamber
   d) Proportional counter

10 On an average binding energy per nucleon is approximately _____.
   a) 0.8 MeV
   b) 8 MeV
   c) 8.8 MeV
   d) 0.88 MeV

(1) (P.T.O.)

Que. 2 **Write answers of any <u>ten questions</u> in brief.** **[20]**

1 Explain Masonic X-rays method to know about nuclear radius.

2 Draw a labelled diagram of Dempster's mass spectrometer.

3 Write the condition for parity of a wave function representing a nuclear state to be positive and negative.

4 Explain elastic scattering and inelastic scattering nuclear reactions.

5 For the reaction $_{92}U^{238} \rightarrow {}_{90}Th^{234} + {}_{2}He^{4}$ obtain Q-value.

6 Giving example define pick up nuclear reaction process.

7 What do you mean by fission chain reaction?

8 Calculate the amount of energy released from fission of 60 gram of $_{92}U^{235}$.

9 Define: 1. Prompt neutrons 2. Delayed neutrons.

10 Wrote a short note on bubble chamber.

11 Mention the advantages and disadvantages of photographic emulsion detector.

12 Write in brief about working of LINACS.

Que. 3 [A] Obtain the formula to find mass of an ion using Aston's mass spectrograph. **[06]**

[B] Write a short note on nuclear magnetic moment. **[04]**

OR

Que. 3 [A] Explain in detail about electric quadrupole moment of a nucleus. **[06]**

[B] For a nucleus explain Fermi-Dirac and Bose-Einstein statistics. **[04]**

Que. 4 Derive Weizsacher's semi-empirical mass formula. **[10]**

OR

Que. 4 Derive Q-value equation for two body nuclear reaction in two dimensions. **[10]**

Que. 5 [A] With the help of neutron cycle in a thermal nuclear reactor derive four factor formula. **[06]**

[B] Write a detailed note on energy released in fission of ^{235}U. **[04]**

OR

Que. 5 [A] What is Asymmetrical fission? For reaction process, **[06]**
$_{92}U^{235} + {}_{0}n^{1} \longrightarrow [{}_{92}U^{236}] \longrightarrow {}_{56}Ba^{143} + {}_{36}Kr^{90} + 3\ {}_{0}n^{1}$, mention chain reaction for $_{56}Ba^{143}$ and $_{36}Kr^{90}$ to be stable also draw the graph of fission fragments for different fission chains of $_{92}U^{235}$.

[B] Explain use of radioisotopes in archeology. **[04]**

Que. 6 [A] Write a detailed note on Van De Graaff accelerator with a neat diagram. **[06]**

[B] Elaborate one of the basic components of accelerators:"The ion sources". **[04]**

OR

Que. 6 [A] With necessary diagram elaborate principle, construction and working of cyclotron. **[06]**

[B] Write a short note on plateau of GM counter. **[04]**

(2)