

**2014**

**( 6th Semester )**

**PHYSICS**

**TENTH PAPER**

**( Nuclear Physics—II )**

**Full Marks : 75**

**Time : 3 hours**

**( PART : B—DESCRIPTIVE )**

**( Marks : 50 )**

*The figures in the margin indicate full marks  
for the questions*

- 1. Obtain the semiempirical mass formula of a nucleus. 10**

*Or*

**What is nuclear magnetic moment? Describe electrical quadrupole moment. 5+5**

- 2. Explain Pauli's neutrino hypothesis. 10**

*Or*

**Describe one method of measurement of gamma rays.**

3. What are the three models of a nucleus?  
Describe, in brief, nuclear shell model. 2+8

Or

How will you measure the  $Q$ -value of a nuclear reaction? 10

4. Describe the working principle of a betatron.  
Up to what value of energy can an electron be energized in a betatron? 9+1

Or

How does a Cerenkov counter work? 10

5. (a) What are soft and hard components of cosmic rays?

(b) Describe Bhabha's theory of electronic showers. 5+5

Or

Describe the conservation laws in nuclear reactions. 10

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**( PART : A—OBJECTIVE )**

**( Marks : 25 )**

*The figures in the margin indicate full marks for the questions*

**Answer all questions**

**SECTION—A**

**( Marks : 10 )**

Put a Tick (✓) mark against the correct answer in the brackets provided : 1×10=10

**1. Nuclei with the same atomic number  $Z$  but different mass number  $A$  are called**

(a) isobars (     )

(b) isotopes (     )

(c) isotones (     )

(d) None of the above (     )

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**SECTION—A**

**( Marks : 10 )**

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**1. Nuclei with the same atomic number  $Z$  but different mass number  $A$  are called**

(a) isobars ( )

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2. The binding energy of a nucleus is expressed in the unit

(a) MeV ( )

(b) KeV ( )

(c) GeV ( )

(d) eV ( )

3. For a radioactive element, the half-life is

(a) equal to average life ( )

(b) less than average life ( )

(c) greater than average life ( )

(d) not related to average life ( )

4. The range of an alpha particle is

(a) maximum in solids ( )

(b) maximum in liquids ( )

(c) maximum in gases ( )

(d) independent of the medium ( )

5. Outside a nucleus a neutron decays to

- (a) proton ( )
- (b) proton and electron ( )
- (c) proton, electron and neutrino ( )
- (d) electron and positron ( )

6. Nuclear fission can be brought about by

- (a) neutrons only ( )
- (b) neutrons and protons ( )
- (c) projectiles and radiations ( )
- (d) None of the above ( )

7. Where do you find Van de Graaff accelerator of output more than 5.0 MeV?

- (a) IIT, Kanpur ( )
- (b) BARC, Mumbai ( )
- (c) TIFR, Mumbai ( )
- (d) None of the above ( )

8. Cyclotrons can energies particles up to

- (a) 10–50 MeV ( )
- (b) less than 10 MeV ( )
- (c) more than 50 MeV ( )
- (d) 50–100 MeV ( )

9. Cosmic rays consist basically of

- (a) neutrons ( )
- (b) electrons ( )
- (c) protons ( )
- (d) electromagnetic radiations ( )

10. The baryon quantum number of a baryon is

- (a) +1 ( )
- (b) -1 ( )
- (c) 0 ( )
- (d) None of the above ( )

( 5 )

SECTION—B

( Marks : 15 )

Give short answers to the following questions : 3×5=15

1. Sketch the graph of binding energy per nucleon as a function of mass number.



( 6 )

**2. What is Geiger-Nuttall Law?**

3. Write the quantities, in points only, which must be conserved in nuclear reactions.

4. What are the essential components of a particle accelerator?

( 9 )

8. Write the names of strange particles. Why are they called 'strange' particles?

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