



Mavinay

Avinashilingam Institute for Home Science and Higher Education for Women

(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956)

Re-accredited with 'A+' Grade by NAAC. Recognised by UGC Under Section 12B

Coimbatore - 641 043, Tamil Nadu, India

Bachelor's Degree Examination – June 2021 VI Semester

Class : III UG
Major : Physics

Time : 3 Hours
Max. Marks: 100

18BPHC22 Nuclear and Particle Physics

Part A

10 x 1 = 10

Choose the Correct Answer

- _____ are atoms of the same element having the same atomic number Z but different mass number A. CO1 K 2
 - Isotopes
 - Isobars
 - Isotones
 - Isomers
- An isotope with a high binding energy per nucleon: CO1 K 3
 - will decay in short period
 - is unstable
 - is very stable
 - has very few electrons
- Cyclotron cannot accelerate CO2 K3
 - Electrons
 - Neutron
 - Positive ions
 - Both (a) and (b)
- Which of the following is preferred for accelerating electrons? CO2 K2
 - Betatron
 - Cyclotron
 - Synchrotron
 - Van de Graft Generator
- The atomic number is not changed by which type of radioactive decay? CO3 K3
 - Alpha
 - Beta
 - Gamma
 - Atomic number is changed in all the three cases
- Helium nuclei particles are called CO3 K1
 - Gamma particles
 - Beta particles
 - Alpha particles
 - Photon
- When two atomic nuclei combine it is called as CO4 K1
 - Chain reaction
 - Nuclear fusion
 - Nuclear decay
 - Nuclear fission
- Complete the following nuclear reaction: ${}^{16}_8\text{O} + {}^4_2\text{He} \rightarrow \text{_____} + {}^{19}_{10}\text{Ne}$ CO4 K4
 - ${}^1_1\text{p}$
 - ${}^1_0\text{n}$
 - ${}^2_1\text{H}$
 - ${}^3_1\text{H}$
- Particles that participate in the strong nuclear interaction are called CO5 K1
 - neutrinos
 - hadrons
 - leptons
 - electrons
- How many quarks are there? CO5 K1
 - 2
 - 4
 - 6
 - 8

Part B
Answer ALL questions

5 x 6 = 30

Each answer should not exceed 400 words or two pages

- 11.a. Binding energy per nucleon of ${}_{29}^{64}\text{Cu}$ nucleus is 8.73 MeV per nucleon. Masses of proton and neutron are 1.007825 amu and 1.008665 amu respectively. Calculate the mass of copper ${}^{64}\text{Cu}$ nucleus in amu. CO1 K6
- (or)
- 11.b. What are mesons? Explain in brief Meson theory of nuclear forces. CO1 K3
- 12.a. Explain the construction and working of Geiger- Muller counter CO2 K4
- (or)
- 12.b. Explain the working principle of synchrotron CO2 K4
- 13.a. State the law of radioactive disintegration and deduce the expression for the half-life period. CO3 K4
- (or)
- 13.b. Define and explain the term nuclear isomerism CO3 K2
- 14.a. State the different types of nuclear reactions. CO4 K2
- (or)
- 14.b. What are endoergic reactions? Explain the threshold energy of an endoergic reaction. CO4 K3
- 15.a. What are cosmic rays. How are they classified as primary and secondary cosmic rays? CO5 K2
- (or)
- 15.b. Explain in detail the classification of elementary particles CO5 K4

Part C

5 x 12 = 60

Answer all questions

Each answer should not exceed 800 words or four pages

- 16.a. Give the theory of liquid drop model of a nucleus and discuss it. CO1 K5
- (or)
- 16.b. Describe the shell model of nuclear structure with references to assumption and evidences. What are the limitations of Shell model? CO1 K5
- 17.a. What is linear accelerator? Describe with neat diagram principle and working of linear accelerator CO2 K4
- (or)
- 17.b. Why are accelerators needed? Discuss the construction, working and application of cyclotron. CO2 K4
- 18.a. Explain the different types of radioactive decay processes with examples. CO3 K2
- (or)
- 18.b. Describe Gamow's theory of α -decay. Hence deduce Geiger-Nuttall law. CO3 K5
- 19.a. What is meant by Q-value of nuclear reaction? Obtain an expression for it. Write the laws of nuclear reactions. CO4 K4
- (or)
- 19.b. Give theory of successive disintegration of radioactive substance. Explain what is a radioactive equilibrium. CO4 K5
- 20.a. Discuss the four interactions among elementary particles. CO5 K3
- (or)
- 20.b. How are the cosmic rays originated? Discuss in detail the effect of earth's magnetic field on the cosmic rays. CO5 K3
