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| Bon Secours College for Women Nationally Accredited with “A” Grade by NAAC (Affiliated to Bharathidasan University, Trichy-24) Recognized by UGC Under Section 2(f) & 12 (B)    Vilar Bypass, Thanjavur-613 006. |

**DEPARTMENT OF PHYSICS**

**NUCLEAR AND PARTICLE PHYSICS**

**2 Marks**

1. What are nuclear forces? Write the properties of nuclear force.
2. Find the radius of 6C12and 8O16 nucleus.
3. Write the properties of deuteron.
4. Give the expression for semi empirical-mass formula and its significance.
5. What do you meant by binding energy?
6. List out the properties of Ground state deuteron.
7. What are Exchange forces in nuclei.
8. Give the arguments to show that the nuclear forces are charge independent.
9. Explain parity.
10. Explain nuclear size.
11. Give an account of similarity between (n,n) and (p,n) forces.
12. What is meant by scattering length?
13. What do you meant by internal conversion in gamma decay?
14. Write Gamow-Teller selection rule.
15. Compare any two properties of alpha and beta rays.
16. Mention the properties of neutrino.
17. What is nuclear isomerism?
18. Write Geiger-Nuttal law.
19. Give the principle of scintillation counter.
20. What do you meant by radioactivity?
21. Basic principle of proportional counter.
22. Explain K-electron capture.
23. Explain the difference between ionization chamber, proportional counter and GM counter.
24. Classify the nuclear reaction according to Q-value.
25. What is the significance of Nuclear models?
26. What are magic numbers and mention its significance?
27. Differentiate scattering cross reaction and reaction cross section.
28. Conservation of mass energy equation in nuclear reaction
29. Define nuclear reaction
30. Explain what is meant by nuclear resonance.
31. Write the Breit-Wigner single level formula and when the maximum cross-section is possible.
32. Discuss the limitation of liquid drop model.
33. Discuss the limitations and failure of shell model.
34. Discuss Resonance theory.
35. Write note on magic numbers.
36. Explain the magic numbers in shell model.
37. Write the expression for reaction cross section.
38. State Reciprocity theorem.
39. Compare nuclear fission and fusion.
40. What are prompt and delayed neutrons?
41. What is meant by nuclear fission? Give an example of fission reaction.
42. Give the expression for cyclotron frequency and mention its significance.
43. Mention the defects in betatron. How it is overcome in synchrotron?
44. Write a note on the energy released in nuclear fission.
45. What do you mean by critical ignition temperature?
46. What is thermonuclear fusion reaction? How does it take place?
47. Write the principle of synchrocyclotron.
48. State and explain nuclear fusion.
49. Discuss the advantages of reflectors in reactors.
50. List the different types of fission.
51. Verify the lepton number is conserved or not in the following reaction. n→P+e-ⁿ+.
52. What are Quarks? Write any two properties of Quarks.
53. What are strange particles? Give one example.
54. What are hardons? Give one example.
55. State the conservation of baryon number
56. Mention the conservation laws in elementary particle physics.
57. Give basic ideas of the theories of weak and strong interactions.
58. State CPT theorem.
59. State the conservation of Baryon number.
60. Verify the conservation of Baryon number in the following reaction n→P+ē+γ¯e.
61. Explain the term “time reversal operator”.
62. Give the properties of neutrinos.
63. Write the classification of fermions.
64. Write Gell-Mann-Okuba mass formula.
65. Write note on strong interactions in elementary particles.
66. What are the quarks responsible for the structure of baryons?

**5 Marks**

1. Discuss the significance of spin dependence of n-p forces.
2. Discuss the meson theory of nuclear forces.
3. Discuss the ground state properties of deuteron.
4. Explain parity and its importance in beta decay.
5. Define magnetic dipole moment. What is the value for a deuteron? What are the consequences?
6. Discuss the properties of nucleus.
7. Describe the types of exchange forces.
8. Define binding energy. How does the binding energy per nucleon vary with mass number?
9. Give the expression for Weizsacker’s semi-emprical mass formula. Explain each term.
10. Explain the term “tensor force”.
11. Explain neutrons scattering length.
12. List out the various properties of nuclear forces.
13. Discuss Pauli’s Hypothesis of neutrino and also write the properties of neutrino.
14. Describe the working and construction of scintillation counter.
15. Describe the construction and working of GM counters.
16. Explain how Pauli’s Hypothesis of neutrino beta particle emission solved the anomalis in the beta ray spectra.
17. Write a note on the non conservation of parity in beta decay
18. Explain the working principle of solid state detectors.
19. Discuss briefly the interaction of gamma rays with matter.
20. State and explain Geiger-Nutial law.
21. List the properties of alpha particles.
22. Discuss in detail the construction and working of semiconductor detectors.
23. Explain resonance theory briefly.
24. Discuss the theory of optical model.
25. Write a note on Reciprocity theorem.
26. Give brief account of the collective model of the nucleus. How does it help in understanding the phenomenon of nuclear fission.
27. Explain what is meant by Q-values of a nuclear reaction. Discuss the kinematics of nuclear cross section. How it is related to the threshold energy of a particle
28. Define nuclear reaction cross section and determine it
29. Write note on the optical model of nuclear.
30. Write note on collective model.
31. Explain compound nuclear reaction.
32. Write the advantages of liquid drop model.
33. Explain how the shell model is successful in predicting the ground state spin of nuclei.
34. Describe the working of Linear accelerator with neat diagram.
35. Write note on “Solar fusion”.
36. Disscuss the Bohr-Wheeler’s theory of nuclear fission.
37. Give an outline on the various parts of a nuclear fission reactor.
38. Explain what is meant by controlled fusion reactor? What are the difficulties in the design of fusion reactors?
39. Discuss the characteristics of nuclear fission.
40. Describe the basic fusion process that occur in sun.
41. Describe the working of linear accelerator with neat diagram.
42. Describe the working of nuclear fission reactor with neat diagram.
43. What are the sources of energy in sun and star?and explain it,
44. Explain the type of fuel used in nuclear reactor.
45. Explain the working of linear accelerators.
46. Describe any one of the heterogeneous type rector.
47. Explain the function of controlled fusion reactor.
48. Discuss the classification of elementary particles based on fundamental forces.
49. Explain the non conservation parity in weak interaction.
50. State and explain CPT theorem.
51. Discuss SU(3) classification scheme of elementary particles.
52. State the conservation of Baryon number and Lepton number. Discuss the same with an example.
53. What are Quarks and its types? Discuss their properties.
54. Describe an experiment illustrating violation of parity conservation.
55. Explain the fundamental forces.
56. Give the elementary theories of weak and strong interactions.
57. Explain time reversal in elementary particles.
58. Explain the conservation law regarding Baryon number.
59. Explain charge conjuction in elementary particles.
60. Write note on (i) Gellmann-Nishijima scheme (ii)Parity and isospin conservation.

**10 Marks**

1. Discuss the effective range theory of low energy n-p scattering and hence the physical significance of scattering length.
2. Explain the n-p scattering at low energies. It is possible to determine the shape of n-p potential from the experimental data?
3. For ground state deuteron obtain the relation between the range and depth of the nuclear potential.
4. Explain the semi empirical mass formula and give the two applications.
5. Explain the meson theory of nuclear forces.
6. Explain the Gamow’s theory of alpha decay. How the Geiger-Nuttal law derived from it?
7. Explain the Fermi’s theory of beta decay and obtain the expression for the emitted beta spectrum.
8. Explain the liquid drop model.Also discuss the Wizacker’s semi empirical mass formula.
9. Obtain an expression for the magnetic dipole moments of odd A nuclei on the basis of sigle particle shell model and discuss how the predictions agree with the experimental values.
10. Explain how the shell model of a nucleus accounts for existence of magic numbers.
11. Find the ground state spin and parity of 2He4 ,7N16,8O17 nuclei.
12. Explain the construction and working of Betatron.
13. Explain the construction and working of cyclotron.
14. Explain briefly about liquid drop model
15. Discuss Bohr and Wheeler’s theory of nucleus fission.
16. Explain the theory, construction and working of synchrocyclotron.
17. Write note on the followings (a) homogeneous reactors (b) thermal reactors
18. Explain the classification of elementary particles in detail and discuss the properties.
19. Explain (a) conservation laws of elementary particles (b) write notes on baryons.
20. Explain the invariance under time reversal, charge conjucation. Also discuss the CPT theorem.
21. Write a note on the quark model of nuclei.