



"ज्ञान, विज्ञान आणि सुसंस्कार यासाठी शिक्षण प्रसार"

शिक्षणमहर्षी- डॉ. साळुंखे बापूजी

**Shri Swami Vivekanand Shikshan Sanstha's
Dattajirao Kadam Arts, Science & Commerce
College, Ichalkaranji**



DEPARTMENT OF PHYSICS

QUESTION BANK

B.Sc. Part-III, Semester-VI, PHYSICS Paper-XIII

DSE-F1 Nuclear and Particle Physics

❖ Multiple Choice Questions

1. Cyclotron is an accelerator working on the principle of
 - a) fixed frequency magnetic resonance
 - b) variable frequency magnetic resonance
 - c) fixed frequency electric resonance
 - d) variable frequency electric resonance
2. Cyclotron mainly accelerates
 - a) positive ion
 - b) negative ion
 - c) both positive and negative ion
 - d) neutron
3. The principal of phase stability is incorporated in
 - a) cyclotron
 - b) betatron
 - c) synchrocyclotron
 - d) all of the above
4. Betatron accelerates
 - a) only electron
 - b) only protons

- c) a particles
 - d) neutrons
5. Betatron works on the principle of
- a) transformer
 - b) induction coil
 - c) phase stability
 - d) magnetic resonance
6. In synchrotron resonance condition is maintained by changing
- a) frequency of electric field
 - b) strength of magnetic field
 - c) both frequency and magnetic induction
 - d) magnetic dipole moment
7. In betatron electron is accelerated only for the
- a) first increasing magnetic induction quarter of the cycle.
 - b) first decreasing magnetic induction quarter of the cycle.
 - c) first half of the negative half of the cycle of magnetic induction.
 - d) second half of the negative half of the cycle of magnetic induction.
8. GM Counter in the GM plateau region is sensitive to particles which are
- a) positively charged
 - b) negatively charged
 - c) neutral
 - d) positively charged or negatively charged
9. In GM Counter the central electrode wire is kept at the potential which is
- a) positive
 - b) negative
 - c) zero
 - d) of any kind and value
10. GM Counter works on the principle of
- a) ion chamber
 - b) nuclear emulsion formation
 - c) light sensing

- d) photoelectric method
11. In scintillation counter the phosphor converts energy of the incoming particle into.....
- a) light
 - b) photo electric current
 - c) magnetic field
 - d) heat
12. If the pressure on a liquid is increased its boiling point
- a) rises
 - b) lowers
 - c) remains unaffected
 - d) first rises and then lowers
13. 1 a. m. u. is
- a) 1.66×10^{-27} kg
 - b) 2×10^{-20} kg
 - c) 1.66×10^{27} kg
 - d) 1×10^{-8} kg
14. ${}_1\text{H}^1, {}_1\text{H}^2, {}_1\text{H}^3$ are
- a) isomers
 - b) isobars
 - c) isotopes
 - d) Different elements.
15. Energy equivalent to 1 a. m. u. is
- a) 931 MeV
 - b) 931 BeV
 - c) 931 KeV
 - d) 931 eV
16. Packing fraction for C-12 is
- a) positive
 - b) negative
 - c) zero
 - d) -1

17. Negative packing fraction indicates
- a) greater stability
 - b) less stability
 - c) total stability
 - d) nothing about stability
18. Heavy elements with $A > 180$ have packing fraction
- a) negative
 - b) positive
 - c) zero
 - d) infinite
19. Radius of nucleus is roughly given by
- a) $R = R_0 A^{1/3}$
 - b) $R = R_0 A^{2/3}$
 - c) $R = R_0 A^2$
 - d) $R = R_0 A^{3/2}$
20. The ultimate representatives which are the building blocks of matter are called....
- a) electrons
 - b) protons
 - c) elementary particles
 - d) leptons
21. The field particle in electromagnetic forces is
- a) muon
 - b) pion
 - c) photon
 - d) positron
22. The field particle in strong nuclear forces in
- a) muon
 - b) pion
 - c) photon
 - d) hyperon
23. Leptons respond to

- a) strong interactions
 - b) weak interactions
 - c) weak and electromagnetic interactions
 - d) strong and weak interactions
24. Hadrons respond to interactions which can be
- a) only weak
 - b) only strong
 - c) strong weak or electromagnetic
 - d) only electromagnetic
25. The nuclear size is of the order of
- a) 10^{-15} m
 - b) 10^{-12} m
 - c) 10^{-10} m
 - d) 10^{-9} m
26. The nuclear charge density is over the central part of nuclei.
- a) different
 - b) same
 - c) zero
 - d) None of these.
27. In synchrocyclotron..... is/are used.
- a) one dee
 - b) two dee
 - c) three dee
 - d) ten dee
28. The energy per fission from ${}_{92}\text{U}^{238}$ is about
- a) 7.5 MeV
 - b) 8 MeV
 - c) 8.4 MeV
 - d) 200 MeV
29. As per liquid drop model, the term binding energy is analogous to
- a) heat of vaporization

- b) heat of condensation
 - c) heat of vaporization and condensation
 - d) heat of thermo couple
30. The nuclides having protons and neutrons in pair are
- a) not stable
 - b) less stable
 - c) most stable
 - d) Moderately stable.
31. Nuclear..... can be explained with the help of semi-empirical mass formula.
- a) fission
 - b) fusion
 - c) both fission and fusion
 - d) formation
32. The most stable nucleus is
- a) ${}_8\text{O}^{18}$
 - b) ${}_8\text{O}^{17}$
 - c) ${}_8\text{O}^{16}$
 - d) ${}_8\text{O}^{10}$
33. Nucleons are
- a) bosons
 - b) fermions
 - c) both bosons and fermions
 - d) neither bosons nor fermions
34. Cyclotron is suitable to accelerate ...
- a) protons
 - b) deuterons
 - c) α particles
 - d) all of the above
35. Scintillation counter detects
- a) α particles only
 - b) β particles only

- c) α and β particles only
 - d) α , β and γ particles
36. The maximum energy particles are provided by Accelerator.
- a) synchrocyclotron
 - b) proton synchrotron
 - c) betatron
 - d) cyclotron
37. As per betatron condition, the flux density at the centre should be
- a) maximum
 - b) minimum
 - c) zero
 - d) only one
38. In cyclotron, time required by particle to complete one revolution depends on
- a) applied magnetic field
 - b) mass of particle
 - c) charge on article
 - d) all of these
39. In cyclotron, the energy of the particles accelerated is Path difference between the Dees.
- a) directly proportional
 - b) inversely proportional
 - c) independent
 - d) zero
40. In synchrocyclotron, the angular velocity of particle in constant magnetic field... with the increase in the kinetic energy.
- a) increases
 - b) decreases
 - c) remains constant
 - d) none of these
41. The principle of gas ionization is not used in..... detector.
- a) ionization chamber

- b) GM counter
 - c) cloud chamber
 - d) semiconductor detector
42. In ionization chamber, the gas amplification is
- a) $\sim 10^8$
 - b) $\sim 10^3$
 - c) equal to unity
 - d) less than unity
43. In GM-tube, bromine is used as gas.
- a) working
 - b) quenching
 - c) both working and quenching
 - d) cleaning
44. The dead time in case of GM-counter is about
- a) 200 μs
 - b) 300 μs
 - c) 400 μs
 - d) 200 s
45. The counting speed of semiconductor detector is
- a) negligible
 - b) low
 - c) high
 - d) very high
46. The working principle of cloud chamber states that the super saturated vapours remains against the formation of droplets.
- a) stable
 - b) unstable
 - c) first stable and then unstable
 - d) sometime stable and sometime unstable
47. Cerenkov radiations are produced only if the particle velocity is than the phase velocity of light in the same medium.

- a) greater
 - b) lower
 - c) same
 - d) negligible
48. In case of the particle track is made visible and can be photographed.
- a) Scintillation detector
 - b) Cerenkov detector
 - c) Wilson cloud chamber
 - d) Semiconductor detector
49. The total magnification produced by photo multiplier tube is of the order of
- a) 10^3
 - b) 10^6
 - c) 10^9
 - d) 10^{12}
50. Packing fraction is
- a) always positive
 - b) always negative
 - c) zero
 - d) may be zero or have positive or negative value

❖ **Long Answer type questions**

1. Explain construction and working of a cyclotron. Derive an expression for kinetic energy attained by an ion.
2. State the principle of working of betatron and derive the betatron condition.
3. Explain the principle of electron-synchrotron with special reference to two-step acceleration.
4. Explain the construction of Geiger-Muller Counter. Explain how ionization, discharge and avalanche of electrons take place in the G. M. tube.
5. Explain construction and working of electron-synchrotron.
6. Explain construction and working of proton-synchrotron.
7. Explain the construction and working of a Scintillation counter. What are advantages of it over GM-counter?

8. What do you mean by Cerenkov radiations? How this principle can be used to detect or count fast moving charged particle?
9. Explain the theory, construction and working of semiconductor detector. Compare the maximum count rate of semiconductor detector with other counters.
10. Discuss the construction, working and advantages of synchrocyclotron.
11. Explain the principle, construction and working of ionization chamber.
12. Derive the semi-empirical binding energy formula for a nucleus on the liquid drop model.
13. Explain gravitational and electromagnetic interactions.
14. Discuss the weak and strong interactions.
15. Give the classification of the fundamental particles.

❖ Short answer type questions

1. Explain the principle of betatron.
2. Explain the Bohr-Wheeler liquid drop model of nucleus.
3. Define binding energy of nucleus. Explain characteristic nature of the curve.
4. Derive an expression for the energy gained by an electron in Betatron.
5. Explain quark model.
6. Write a short note on symmetries in elementary particles.
7. Explain construction and working of photomultiplier tube.
8. Give the construction and working of Cyclotron.
9. Explain principle of phase stability.
10. Write a note on semiconductor detector.
11. Write a note on Avalanche of electrons.
12. Write a note on Dead time.
13. Write a note on Quenching of discharge by self-quenching in G.M. counter.
14. State the similarities between a drop of liquid and the nucleus.
15. Explain construction and working of Cyclotron.
16. Obtain an expression for maximum kinetic energy acquired by ion in Cyclotron.
17. Explain construction and working of Synchrocyclotron.
18. State the uses and limitations of betatron.
19. Explain Scintillation detector and counter.

20. Write a note on Cerenkov radiation.
21. Explain ionization and discharge in G.M. counter
22. Write a note on magic numbers.
23. Discuss applications of semi-empirical mass formula.
24. What are nucleons? Explain their intrinsic properties.
25. What is shape and size of nucleus?
26. What is the need of particle accelerators?
27. Discuss the basic conservation laws.
28. Give construction and working of electron – Synchrotron.
29. Give construction and working of proton – Synchrotron.
30. Discuss different methods used to measure nuclear radius.