

QUESTION BANK

Faculty of Science

Examination M.Sc. II

Year - 2022

Subject: Physics (Nanophysics)

Class: M.Sc. II Sem.-IV

Title of the Paper: HCT- 4.2: Nuclear and Particle Physics

Q.1) Answer the following: (4 marks)

1. Define binding energy of nucleus. Explain binding energy curve.
2. Explain electric quadrupole moment.
3. What is meant by mass defect?
4. Explain liquid drop model of nucleus.
5. What is threshold energy? Find the equation of threshold energy.
6. Write a note on magic numbers.
7. Write a note on Breit-Wigner one level dispersion formula
8. Explain Pauli's neutrino hypothesis.
9. Define Alpha-disintegration energy.
10. Explain continuous nature of Beta-ray spectrum.
11. What is Q-value of a nuclear reaction? Explain its significance.
12. Explain short range nuclear forces.
13. Give a short account of the shell model of nucleus.
14. Explain spin-orbit interaction of nucleus.
15. What are types of interactions?
16. Write a note on phase stable orbits.

Q.2) Answer the following: Long answer type: (8/10 marks)

1. What is radioactivity? Give an account of laws of radioactivity. Explain radioactive dating.
2. Explain the conservation laws of nuclear reactions. Give an account of Nuclear fusion and Nuclear fission with examples of nuclear reactions.
3. Explain mass, shape, size and spin of nucleus. Write a note on nuclear binding energy. Explain nuclear stability using nuclear binding energy curve
4. Give an account of meson theory of nuclear force. Explain Yukawa's hypothesis.

5. What are Cosmic rays? Give an account of origin of Cosmic rays. Explain the properties of primary Cosmic rays.
6. What are particle accelerators? Explain the principle and working of Synchrotron.
7. Give an account of Scintillation counter
8. Give an account of elementary particles. Explain the classification of elementary particles based on symmetry.
9. What are Quarks? Explain the types of quarks. Give an account of CPT theorem
10. Explain the construction and working of cyclotron. What are its disadvantages?
11. Discuss the nuclear reaction kinematics.
12. Explain the compound nucleus reaction process in detail.
13. Show that deuteron cannot exist in excited states.
14. Discuss p-p scattering at high energy.
15. State and explain Pauli exclusion principle.
16. What is the evidence for shell structure of a nucleus? Explain the shell model of nucleus.
17. What are types of nucleus reactions and discuss the nuclear reaction kinematics.
18. Discuss n-n scattering at high energy.
19. How are the disadvantages of shell model removed in collective nuclear mode.
20. Explain Beta-ray spectrometer to determine the kinetic energy of Beta-particle.
21. Explain the fine structure of Alpha-line spectra and long range alpha-particle spectrum.
22. What are elementary particles? Give a brief history of elementary particles.
23. Explain the working of a gas-filled detector. Give an example.
24. Give a short account of semiconductor detector.
25. Give a brief description of superconductivity model.
26. Explain Yukawa's hypothesis.
27. Give a brief account of Large Hadron Collider (LHC)
28. Explain the construction and working of cyclotron. Find the condition of resonance.
29. What is mass defect? Define binding energy and explain its characteristic nature of the curve.
30. What is packing fraction of a nucleus? Explain the variation of packing fraction with atomic mass number

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty : Science Subject- Physics (Nano Physics)

Paper- SCT-4.1: Material Characterization Techniques

Class : M. Sc. II SEM-IV (CBCS) pattern

Question Bank

Q. Short answer type question

- 1) Write a short note on SEE.
- 2) What is nano material and nano technology?
- 3) What are the limitations of STM?
- 4) What are medical applications of nano material?
- 5) What is qualitative and quantitative analysis in AES?
- 6) Write a short note on SEM
- 7) What are the properties of nuclear spins?
- 8) Write a short note on optical spectrometer.
- 9) Write a note on bright field microscope.
- 10) Write a short note on TEM.
- 11) What is the principal of AFM?
- 12) What are the properties of X-ray?
- 13) Write a short note on auger transition.
- 14) Write a short note on AFM.
- 15) What is resonance condition in ESR and NMR?
- 16) What is Bragg's condition of diffraction?
- 17) What are advantages of electron microscope?
- 18) Write a short note on electron detector.
- 19) What is relaxation time?
- 20) Write a note on Rayleigh Criteria.

Q. Long answer type questions

- 1) What are contact and noncontact modes in AFM?
- 2) What is principal, construction and working of Scanning electron microscope?
- 3) Explain SEM in detail with neat diagram.
- 4) What is dark field image? Explain in detail with neat diagram.
- 5) What are different types of an optical spectrometer? Explain any one in detail with neat diagram.
- 6) What are different types of sample preparation methods?
- 7) What is the AFM? Obtain the equation of force curves.
- 8) Obtain the relation for theoretical resolving power.
- 9) What are secondary and backscattered electrons? Explain SEM in detail with neat diagram.
- 10) Write the applicability of Transmission electron microscope?

- 11) What is the principle of TEM? Explain the construction and working of TEM with neat diagram.
- 12) What is the use of back scattered electron detector?
- 13) Draw the block diagram of AFM and describe each part of microscope.
- 14) What is the role of magnetic lenses and optical column microscope?
- 15) Explain the construction and working of TEM with neat diagram.
- 16) Explain electronics image analysis and size histogram.
- 17) What is the principle of XPS? Explain construction and working of XPS with neat Diagram.
- 18) Which lens systems are used in TEM?
- 19) What is resonance condition in EPR and NMR? Explain principle and working of NMR in detail.
- 20) How the STM is implemented in instruments?
- 21) What is the principle of diffraction of light? Obtain Rayleigh criteria of diffraction.
- 22) Obtain the relation of frequency modulation in AFM.
- 23) What is the principle of STM? Explain construction and working of STM with diagram.
- 24) What is electron tunnelling in STM?
- 25) What is CP-MAS experiment? Explain high resolution solid state NMR methods.
- 26) What is vibration isolation? And explain data acquisition.
- 27) What is the principle of Auger electron spectroscopy? How it is used as electron energy analyser and electron detector?
- 28) What is practical application of AFM?
- 29) What is the principle of STM? How STM is applicable to imaging of surfaces?
- 30) Explain high vacuum and photoelectron emission.
- 31) What is EPR? Write the different applications of EPR.
- 32) What is X-ray beam effect?
- 33) Explain high resolution solid state NMR methods in detail.
- 34) What is nuclear spin interaction in solid?
- 35) What is resonance condition in EPR and NMR? Explain principle and working of EPR in detail.
- 36) What is magic angle spinning?
- 37) What is cross polarization? Explain CP-MAS experiment in detail.
- 38) Explain nuclear reaction and hyperfine structure.
- 39) What is electron diffraction? Obtain Bragg's condition of diffraction.
- 40) Obtain the relation for kinetic energy of auger electron.