

Question Bank B.Sc. III Physics Semester VI (2021-22)

Nuclear and Particle Physics (BPT 601)

2 Marks Questions

- 1) Draw neat diagram of binding energy curve.
- 2) If the nuclear radius of Al (atomic mass number 27) is 3.6 fm, then the approximate nuclear radius of Cu (atomic mass number 64) is (in fm)?
- 3) Draw neat diagram of the synchrocyclotron.
- 4) Write any four applications of the accelerators.
- 5) If the mass defect in the nuclear reaction is 10 milligram then the energy released in that reaction is (answer must be Joule).
- 6) Write a formula for the binding energy obtained from semi-empirical mass formula.
- 7) Draw neat diagram of cyclotron.
- 8) Write any four similarities between liquid drop and nucleus.
- 9) Draw neat diagram for the packing fraction curve.
- 10) Mass defect in the nuclear reaction is 20 milligram then the energy released in that reaction is (answer must be Joule).
- 11) Draw the schematics of the betatron.
- 12) Draw the schematics of the synchrocyclotron.
- 13) Draw the schematics of the G.M. counter.
- 14) Draw the schematics of the Wilson Cloud chamber.
- 15) Write any four applications of the accelerators
- 16) The binding energy of oxygen ($A=16$) is 127.63 MeV, then average binding energy per nucleon is?
- 17) State any two advantages of the cyclotron.
- 18) State any two limitations of the cyclotron.

- 19) State any two advantages synchrocyclotron.
- 20) State any two advantages betatron
- 21) State any two advantages G.M counter.
- 22) State any two advantages scintillation counter.
- 23) State any two limitations synchrocyclotron.
- 24) State any two limitations G.M counter.
- 25) Name the particles in the lepton family.
- 26) Name the particles in the baryon family.
- 27) Name the particles in the meson family.
- 28) Name any four application of the nuclear detector.
- 29) Name the any four nuclear detectors.
- 30) Name any two nuclear accelerators.

Short Answer Questions (5 Marks)

1. Explain the terms mass defect and packing fraction.
2. What are the advantages and disadvantages of synchrocyclotron?
3. Describe construction and working of G.M. counter.
4. What is an exoergic and endoergic reaction? Give one example of each.
5. Draw the classification diagram of elementary particles.
6. Give the working of the Wilson cloud chamber.
7. Give the working of a scintillation counter.
8. What is the Q-value of a nuclear reaction? Explain its physical significance.
9. Derive an expression of the mass density of the nucleus.
10. Derive an expression for the radius of the nucleus and what is nuclear radius of ${}^{64}\text{Y}$, if the nuclear radius of the ${}^{125}\text{X}$ is 4.2 fm.
11. Draw the classification diagram of elementary particle.

12. A cyclotron with dees of radius 2 m has magnetic field of 0.75 Wb/m. calculate the maximum energies to which proton can be accelerated. (charge of proton = 1.6×10^{19} C and mass of proton = 1.67×10^{-27} kg)
13. Draw the classification diagram of elementary particles.
14. Discuss construction and working of a cyclotron.
15. Discuss the liquid drop model.
16. Explain the working of a cyclotron accelerator.
17. Write a note on the ionization chamber.
18. Discuss the working of the betatron.
19. Explain internal quenching mechanism in G.M. counter.
20. What are the advantages and limitations of G.M. tube ?

Long Answer Type Questions (10 Marks)

1. Obtain a semi-empirical mass formula for a nucleus of mass number 'A' and atomic number Z.
2. Describe the construction and working of a cyclotron? Obtain an expression for the maximum energy of an ion obtained from it.
3. Explain the term threshold energy. Obtain necessary relation for the threshold energy.
4. Explain the construction and working of betatron and derive the condition for its operation.
5. Describe the construction and working of a scintillation counter. What are the advantages of this counter in comparison with other counters?
6. What is the binding energy? Plot the binding energy curve, discuss its features.
7. Describe construction, working, advantages and disadvantages of a synchrocyclotron.
8. Discuss in detail the total angular momentum of the nucleus.
9. Explain G.M. tube with principle, construction and working. Explain avalanche and

quenching in G.M. counter.

10. What is packing fraction of the nucleus? Plot the packing fraction curve, discuss its features.

BPT-602
Solid State Physics

Two marks

1. Define unit cell and its parameters.
2. Define coordination number.
3. Define Bragg's law.
4. Write statement of Bloch theorem.
5. Define critical temperature of superconductor.
6. Sketch the planes (111), (001).
7. Define packaging friction
8. Define diffraction
9. Define critical magnetic field
10. Define critical temperature of superconductor.
11. Define packing fraction.
12. Sketch the plane (100) (010).
13. Write principle of Hall Effect .
14. Sketch the plane (200) (010).
15. Critical temperature of mercury is
16. Draw of band diagram for metals semiconductors and insulators
17. Draw a potential diagram for Kronig Penny model
18. Write approximation taken for Kronig Penny model
19. Write equation for velocity of electron of band theory
20. Write equation for effective mass of an electron
21. Write first and second property of reciprocal lattice
22. Write second and third property of reciprocal lattice
23. Write Bragg's law and its notations
24. Draw a diagram for Ewald sphere
25. Draw a diagram for single crystal X-ray diffraction .

10 mark

1. Describe in detail bravais lattices in crystal structure in three dimensions with example.
2. Describe in details experimental method of X ray diffraction by powder method.
3. Describe in detail Bravais lattices in crystal structure in two dimensions with Example.
4. Write a note on Origin of bond theory and one electron approximation.
5. Describe in details experimental method X ray diffraction by rotating crystal And Laue method.
6. Define superconductor and write a note on type I and type II superconductor With example.
7. Write a note on reciprocal lattice
8. Derive a expression first property of reciprocal lattice
9. Derive a expression second property of reciprocal lattice
10. Derive a expression third property of reciprocal lattice
11. Write a note on origin of band theory
12. Derive expression for velocity of electron in band theory and give its physical interpretation.
13. Derive expression for effective mass of electron and give its physical interpretation.
14. Write a note on Bloch theorem
15. Write a note on Kroning- penny model

5 mark

1. Write a stapes to draw a brillouin zone and draw first brillouin zone for square lattice.
2. Write a note on one electron band theory.
3. Prove that packing frication of FCC IS 0.74.
4. Write a note on Maissner effect and define critical magnetic field.
5. Write a note on Reciprocal lattice and properties of it .
6. Distinguish between metals semiconductor and insulator in terms of band theory
7. Write a note on type I superconductor and give their example
8. Write a note on type II superconductor and give their example
9. Prove that packing frication of BCC is 0.68
10. Write a stapes to draw a Brillouin zone and draw first brillouin zone for Hexagonal lattice
11. Write a note on Hall Effect

12. Define superconductivity and critical temperature
13. Write a step to draw a Brillouin zone and draw the first Brillouin zone for square lattice.
14. Write a note on Hall Effect.
15. Prove that the packing fraction of SC is 0.52.
16. Write a note on Meissner effect and critical temperature.
17. Write a note on Reciprocal lattice and properties of it.
18. Write a short note on Ewald sphere.
19. Derive expression for effective mass of electron
20. Derive expression for effective mass of electron
21. Write a physical interpretation of velocity of electron
22. Write a physical interpretation of approximate mass of electron
23. Draw and explain graph of Kronig-Penney model
24. Write approximation taken in Kronig-Penney model
25. Write a note on how the Kronig-Penney model explains conductors and insulators

Atomic, Molecular and Astrophysics. (BPT 603)

Q.1) Define following Term/Answer in one sentence

- 1) Define Pauli's exclusion principle.
- 2) What are the four quantum numbers?
- 3) What is galaxy?
- 4) Write down the formula for "multiplicity".
- 5) State the first postulate of Bohr's atomic model.
- 6) Draw the possible orientation for $l=0$.
- 7) For $l=2$, values of n and m_l are ?
- 8) What is galaxy?
- 9) Write down the formula for rotational energy of a diatomic molecule.
- 10) State the second postulate of Bohr's atomic model.
- 11) Draw the possible orientation for $l=1$.
- 12) For $l=3$, values of n and m_l are ?

- 13) What is galaxy?
- 14) Write down the expression for Lande's g factor.
- 15) State the third postulate of Bohr's atomic model.
- 16) Define the terms Nebula and Star
- 17) What is meant by interstellar medium?
- 18) What is protostar?
- 19) What is terrestrial planets?
- 20) What is the unit for measuring distance in space/
- 21) What is stokes lines?
- 22) Draw figure describing Rayleigh and Raman scattering.
- 23) What is moon?
- 24) What do you mean by Comets.
- 25) Who invented big-bang theory and in which year.

Q.2) Long Answer questions [10 Marks]

- 1) What is normal Zeeman effect? Explain it on vector atom model for one valance electron.
- 2) Derive the formula for rotational energy of a diatomic molecule.
- 3) Explain in detail classical and quantum theory of Raman Effect.
- 4) What is anomalous normal Zeeman effect? Explain it on vector atom model for one valance electron.
- 5) Derive the formula for rotational energy of a diatomic molecule.
- 6) Derive an expression for Lande's g-factor for one-valance electron system.
- 7) Discuss the spectrum of sodium and explain its doublet fine structure.
- 8) Derive the formula for rotational energy of a diatomic molecule.
- 9) Explain condensation theory and also give arguments for and against the theory.
- 10) Explain in short Rutherford's model of an atom.

- 11) Explain in details experimental setup to produce and observe Zeeman effect.
- 12) Draw energy level diagram showing transition in Zeeman effect. Hence write formulae for frequency for a spectrum with magnetic field.
- 13) Explain vibrational-rotational spectra in details.
- 14) What is electronic spectra of molecule? Hence discuss fluorescence and Phosphorescence in details.
- 15) Find the expression for total energy and hydrogen atom in electron orbit.
- 16) Discuss energy level and series transition of hydrogen atom.

Q.3) Long answer question [5 Marks]

- 1) Explain features of milky way galaxy.
- 2) Write a short note on “vector atomic Model”.
- 3) Write down difference between Raman spectra and infrared spectra..
- 4) Write a note on electron spin-orbit interaction.
- 5) Write a short note on anomalous Zeeman effect.
- 6) Write a note on Big-Bang theory.
- 7) Write a short note on “oscillating theory”.
- 8) State and explain Pauli’s exclusion principle..
- 9) Write down selection rules for fine structure doublet.
- 10) Write down characteristic properties of Raman lines.
- 11) Explain features of milky way galaxy.
- 12) Write a short note on vibrational energy levels for diatomic molecules
- 13) Write a short note on electron spin-orbit interaction
- 14) State and explain Pauli’s exclusion principle..
- 15) Write down intensity rules for fine structure doublet.
- 16) Write down characteristic properties of Raman lines.
- 17) Write a note on steady state theory.

- 18) Explain the term space quantization.
- 19) State and explain all four quantum numbers.
- 20) Explain the term space quantization.
- 21) State and explain all four quantum numbers.
- 22) What is Zeeman effect? Distinguish between normal and anomalous Zeeman effect.
- 23) Explain formation of our Solar system
- 24) Describe classical theory of Raman Effect.
- 25) Describe Quantum theory of Raman Effect
- 26) Write note on cosmological tests
- 27) Write a note on formation of galaxies
- 28) Explain the term continuous expansion of universe
- 29) Write a note on Asteroid belt.
- 30) Explain Effect of sun's temperature on formation of planets.

BPT 604 : Solar Energy, Wind and Energy Studies

1. Explain direct mode solar dryer
2. Explain indirect mode solar dryer
3. What are the advantages and disadvantages of solar dryers
4. Explain the construction and working of forced convection dryer
5. What is the basic principle of solar dryer?
6. Write short note on natural convection solar dryer
7. Explain in brief the direct mode solar dryer. Give the difference between natural convection and forced convection solar dryer
8. Explain the need of solar dryers

9. Why solar drying is superior than sun drying
10. Write short note on mixed mode solar dryer
11. Write short note on Sun vs solar drying
12. Why polycarbonate glass is used in solar dryer
13. What is the role of chimney in solar dryer?
14. Give the difference between natural convection and forced convection solar dryer
15. What are the components used in the solar dryer?
16. Write short note on overall efficiency of solar dryer
17. Write short note on pickup efficiency of solar dryer
18. What is the solar collector efficiency of solar dryer?
19. Explain how the solar dryer performs?
20. Explain the technical development of solar dryer
21. What are the factors affecting on efficiency of solar dryer?
22. What are the various types of solar dryers according to their design?
23. Explain how solar energy can be obtained from satellite through microwave to earth station. What are the difficulties in realizing it?
24. What is solar energy? By which process it formed? What are the peculiarities? How can be converted in to usable energy directly or through intermediate sources?
25. What is wind energy? How was it used in ancient time? Why was the source of energy sidetracked and focused on it? State energy chain for wind energy
26. Derive an Expression for the maximum power of wind turbine and show that $P_{\max} \propto v_1^2$

27. What are monowind and three blade HAWT? State their advantages and disadvantages.
28. Write a note on planning of wind farm
29. Write a note on applications of wind energy and wind energy quantum.
30. Explain in brief types of wind turbine generator unit.
31. Write a note on construction of horizontal axis propeller type wind turbine generator unit.
32. Write a note on India's position in the field of wind energies
33. State merits and limitations of solar PV system
34. Define power of solar PV cell and explain its variation by means of I_c vs V_c
35. Write a note on solar energy chain
36. What is solar energy plant? Explain all its components subsystems.
37. In solar PV panel there are 100 modules and 100 cells in each module if the power of each cell is 0.3 watt, find the power output of the panel if the load resistor used is 1000 ohm, find the voltage output and current delivered by the panel.
38. Define solar constant
39. Define solar insolation
40. Define clarity index
41. State any two prospects of solar PV panel system
42. What is wasted energy
43. Define wind power density.
44. What is power conversion factor
45. What is wind farm
46. How is electrical energy obtained from wind energy.

47. Define efficiency factor of wind turbine
48. State the SI unit of solar constant.
49. What is solar dryer
50. Distinguish between indirect and direct mode solar dryer.
51. Distinguish between indirect and mixed mode solar dryer.
52. Distinguish between direct and mixed mode solar dryer.
53. Explain Mixed mode solar dryer
54. What are the advantages of solar dryer.
55. What are the applications of solar dryer.
56. What are the disadvantages of solar dryer.
57. Distinguish between Sun drying vs solar drying.

Paper Title – Entrepreneurship Development

Paper Code – SECCPT607

Q.1 Define following terms/ Answer in one sentence (2 marks each)

1. Define energy management according to Cape Hart, Turner and Kennedy.
2. What is comprehensive definition of energy management?
3. What is objective of energy management?
4. Define energy audit according to Energy Conservation Act, 2001.
5. What are types of energy audit?
6. Which parameters decide type of Energy Audit to be performed?
7. What are the phases of detailed energy audit methodology?
8. What is entrepreneur?
9. What is entrepreneur according to Oxford dictionary?

10. According to Adam Smith (1776) who is entrepreneur?
11. According to Francis A. Walker (1870) who is entrepreneur?
12. On which basis entrepreneurs are classified?
13. What is individual and institutional entrepreneur?
14. What are types of entrepreneurs on size basis?
15. What are types of entrepreneurs on places basis?

Q.2 Long answer questions (6 marks each)

1. What are steps of preliminary energy audit methodology?
2. Draw process flow diagram and list process steps; identify waste streams and obvious energy wastage of Penicillin-G fermentation.
3. Describe steps of audit phase with plan of action and purpose/ results.
4. Write a note on Entrepreneur as a Risk-Bearer
5. Write a note on Entrepreneur as an Innovator.

Q.3 Short answer questions (4 marks each)

1. What is need of energy audit?
2. Describe steps of pre-audit phase with plan of action and purpose/ results.
3. Describe steps of post-audit phase with plan of action and purpose/ results.
4. Enlist characteristics of entrepreneur.
5. Write note on types of entrepreneurs.
6. Write a note on Entrepreneur as an organizer.
7. Describe Entrepreneur as an agent and a risk-taker.
8. Describe Entrepreneur as profit maker and an achievement motivator.
9. Describe Entrepreneur as a capital provider and reward receiver.
10. Describe Entrepreneur as a determinant of the nature of the business and challenge taker.

