UNIT 9 ATOMIC STRUCTURE

1. What is the distance of closest approach for $5.5MeV$ α particles in a head on collision with a gold nucleus [Z= 79].

2. Explain the structure of h alpha line on the line basis of vector model of atom. [6] [2055]

3. explain the structure Hα line on the line basis of vector model of atom. [3] [2056]

4. what could not be explained by Bohr's theory of hydrogen atom? write does the modification introduced by Sommerfeld. [3] [2058]

5. What are general, characteristics of Sommerfield elliptical orbits? Show that the total ene:oy cf. an electron of hydrogen atom in a Sommerfield orbits is the same as that in Bohr's orbit. [10] [2059]

6. A5 Mev alpha-particle a gold nucleus [z 79] with an impact parameter of $2.6x^{10-13}$m. Through what angle will it be scattered2 [6] [2059]

7. when the hydrogen was bombarded in Frank-Hartz experiment by 10.21 ev and 12.10 ev. electron, emission of the three spectral line were obserVed. calculate the wavelength. Given:h = $6.62x^{10-34}$ js, e = $1.6x10^{-19}$C [6] [2060]

8. Explain the limitations of Bohr's model of atoms.[3 [2061]

9. When hydrogen was bombarded in Frank-Hertz experiment by 10 21 cv a ev electrons, emission of three spectral lies observed, - Calulate their wavelength. Assume, h = 6.6 x $^{10-34}$ C.= 3.0 x 108 rriSel Ground state Of hydrogen = -13.6ev.[6] [206]

10. Describe the differences between atomic model due to Rutherford, Bohr and Summerfield. Describe 'Frank-Heart experiment and write its conck;son. [3+6] [2063]

11. Describe Franck-Hertz experiment and write its conclusions. [6] [265]

12. Ah hydrogen atom is in the ground state. What is the quantum number of which it will be excited by absorbing a photon of energy 12.75 eV? [6] [2065]

13. What are the general characteristics of Sommerfield elliptical orbits? Show that the energy of the electron of hydrogen atom in Sommerfield orbits is the. same as that in Bohr's orbit. [9] [2067]

14. write down the conclusion of Frank-hertz experiment. [3] [2067,o.c]

15. why are spectral lines of deuterium shifted to shorter wavelengths than those of ordinary hydrogen? explain. [3] [2069]

    Explain Frank-hertz experiment. hence, discuss it's conclusion. Also discuss the limitation of Bohr's model. [3+3+3] [2069,O.c]

16. A 5 Mev α-particle approaches a gold nucleus[Z=79] with an impact parameter of $2.6x10^{-13}$ M. Through what angle will it be scattered. [6] [2069,O.c]

17. calculate the distance of closest approach of an α-particle of velocity $1.6x107$m/s to copper nucleus. Given atomic number of copper to be 29 and mass of proton to be $1.6x10^{-27}$ kg. [6] [2070,O.c]

18. Give brief account of Rutherford scattering. [3] [2071]

19. Derive a formula for the speed of an electron in the n^{th} orbitof a hydrogen atom according to the Bohr's model. Hence, campare the speed in n=1 and n=2 orbits. [7+3] [2072]

20. Describe Frank-hertz experiment and discuss the advantages and limitation of Bohr's model. How sommerfield modified Bohr's model? Explain. [4+2+4] [2073]

21. In the spectrum of hydrogen atom, what will be the ratio the longest wavelength in Lyman series to the longest wavelength in the Balmer series? [10] [2075]

22. Write down the conclusion of Rutherford scattering experiment. [6] [2073,O.c]

UNIT 10 MANY ELECTRON ATOM

1. Describe Stem-Gerlach experiment with necessary theory. Discuss the significance of the result obtained. [3+3] [2065]

2. Give an account of various quantum numbers to specify completely the state of an electron in an atom. [6] [2058]

3. Describe vector model of the atom and explain the different quantum numbers associated with it's. Give two important application of this model. [9] [206]

4. Describe with necessary theory Stem-Gerlach experiment. What conclusion can be drawn from the result of the experiment. [9] [2062]

5. Explain Pauli's exclusion principle as applied to electrons in atoms. [3] [2062]

6. Find the ionization potentials of the hydrigen atoms. Given h=6.62x^{10-34} J.S, e=1.6x^{10-19}C, Me=$9.1x^{10-31}$Kg [6] [2063]

7. Describe Stem-Gerlach experiment. Why is an in homogeneous magnetic field is required? What conclusion can be drawn from the result of the experiment? [4+2+3] [2064]

8. What is vector model? Explain the significance of different quantum numbers associated with this model. [9] [2065]

9. stae and explain pauli's exclusion principle.[3] [2066]

10. Describe Stem-Gerlach experiment with nessary theory and important conclusion.[6] [2067,o.c]
11. Explain the significance of different quantum numbers associated with vector atom model. Present two important applications of this model.[3+6] [2068]
12. Discuss vector atom with reference to the significance of different quantum numbers associated with the model. [9] [2070]
13. write down the conclusions of stem-Gerlach experiment.[3] [2070]
14. Explain the significance of different quantum numbers associated with a vector atom.[9] [2070,O.c]
15. Explain the hyperfine structure of hydrogen atom. [3] [2070]
16. What do you understand by find structure of hydrogen atom.[3] [2071,o.c]
17. Describe vector model of the atom and explain the different quantum numbers associated with it.[8] [2071]
18. State and explain pauli's exclusion principle.[3]

2071

19. Explain shells and sub-shells of an electrons.[3] [2071]
20. Describe ls coupling.[3] [2073]
21. Describe Stem-Gerlach experiment. How the result of Stem-Gerlach experiment help to explain spain of an electron? Explain quantum associated with spain.[5+2+3] [2074]
22. Describe Stem-Gerlach experiment with necessary theory. Also discuss the significance of the experiment.[10] [2074,O.c]

UNIT 11 ATOMIC SPECTRA

1. What is zeeman effect? discuss anomalous zeeman effect and hence explain the periodic table of the elements. [3+6] [2055]
2. The zeeman component of 5000A spectral lines are0.0116nm apart in a magnetic field of 1.00 T. find the ratio of e/m. [6] [2056]
3. what do you understand by zeeman effect? discuss normal zeeman effect. How would you determine the value of e/m? Why does the normal zeeman effect occurs only in the even numbers of the electrons? [6] [2057]
4. What is the fine structure of sodium D-line due to? [3] [2057]
5. Calculate line of wavelength 4226A exhibits normal zeeman splitting when placed in a uniform magnetic field of 0.4T. Calculate the wavelength of three components of normal zeeman pattern and separation between them.[6] [2058]
6. What is Zeeman effect?[3] [2059]

7. distinguish between normal and anomalous zeeman effect.Obtain an expression for normal zeeman shift.[3+6] [2060]

8. How will you explain the D1 and D2 double of sodium spectrum on the basis of vector model of the atom? [6] [2060]

9. A sample of certain element is placed in a magnetic field of fluid density of 0.2T. How far apart are the zeeman components of wavelength of light A? Also find the wavelength of the three components. [6] [2061]

10. Explain the fine structure of Sodium-D line. [6] [2062]

11. In a normal zeeman experiment, the spectral line of wavelength 4500A splits into 3 lines separated by 0.25 A in a magnetic field of 3T. Determine e/m for the electron from these data. [6] [2062]

12. The reactor is producing nuclear 4226.75A exhibits normal zeeman splitting which are 0.33A apart in a magnetic field of 4 Tesla. Find the value of e/m. [6] [2064]

13. on the basis of vector model of atom explain the origin of D1 and D2 double of sodium spectrum. [3] [2064]

14. Explain what do you understand by fine structure of hydrogen lines. [3]

15. How is the total angular momentum quantum number of the electron calculated? Derive an expression for Lande's splitting factors and explain the anomalous zeeman effect. [9] [2066]

16. What do you understand by the fine structure of hydrogen lines? Explain [3] [2067]

17. In a normal zeeman experiment the spectral line of wavelength 500nm splits onto three spectral lines separated by 0.28A in magnetic field of 3T. Calculate the value of the specific charges of electron from these data. [6] [2067]O.C

18. Discuss in brief, the difference between normal and anomalous zeeman effects and obtain the expression for normal zeeman shift. [3+3] [2068]

19. What do you understand by the fine structure of hydrogen lines. Explain. [3] [2068]

20. Calculate the wavelength separation of fine structure resulting from the spin-orbit interaction within the Hydrogen atom. [6] [2069]

21. Explain the fine structure of sodium D line. [3] [2069]O.C

22. What do you mean by zeeman effect? [3] [2069]O.C

23. Explain normal and anomolous zeeman effect with their physical significance. [6] [2070]

24. How would you conclude by estimation that α particle is more stable than He3 nucleus? [3] [2070]

25. A sorce of light of wavelength 4226A exhibits normal zeeman effect when placed in a uniform magnetic field of 4T. Calculate the wavelength of three components of normal zeeman pattern and the seperation between them. [6] [2070]

26. Explain normal and anomolous zeeman effect with their physical significance. [6] [2070]O.C

27. What is zeeman effect? [3] [2072]

28. What is zeeman effect? Discuss anamolous zeeman effect and hence, explain the splitting of sodium line? [2073]

29. What do you mean by Stark effect? [2.5] [2074]

30. What do you mean by fine structure? Explain the fine structure off H, He, Na and Hg. Explain normal and anomolous zeeman effecs in this regard. [2+6+2] [2075]

31. What do mean by Stark effect? [2.5] [2075]

32. a sample of certain element is placed in a 0.5T magnetic field and suitably excited. How far apart are the Zeeman components of 350nm spectral line of this element.[6] [2075]

33. A sample of a certain element is placed in a 0.30 T magnetic field and suitably excited. How far apart are the zeeman components of the 450nm spectral line of this element?[5] [2075]

34. A sample of a certain element is placed in a 0.30T magnetic field and suitably excited. How far apart are the zeeman componens of the 450nm spectral lines of this elements? [10] [2075]

Unit 12 PARTICLE PROPERTIES OF WAVES

1.] what is compton effect? show that the change in wavelength between scattered wave and incident wave is directly proportional to sin square $(\theta/2)$ where θ is the angle made by the scattered photon with direction of the incident photon. [9] [2058

2. What is Compton effect? Deduce an expression for the change in wavelength of the scattered wave. [9] [2062]

3. What is Compton effect?Deduce an expression for the change in wavelength of the scattered wave. Show that the change in wavelength is independent of the wavelength of the incident ray but depend on the the scattering angle. [2+6+2] [2064]

4. What do you understand by pair production in gamma ray intersection with matter? [3] [2065]

5. explain the process of pair production. [3] [2066]

6. what are the ways through which electromagnetic radiation interact with matter? explain it. [6+4] [2071]

7. explain the phenomenon of pair production. [3] [2072]

8. Find the expression for the wavelength change if energetic electromagnetic radiation is scattered by an electron which is at rest. Discuss this process. [6+2] [2074]

UNIT 13 X-RAY SPECTRUM

1. What are emission and absorption X-ray spectra? Describe Mosley law to explain the periodic table of the elements. [2055]

2. NaCl has principal planes paced at 2.820 A. The first order Bragg reflection is observed at 10^o C. Calculate a. the wavelength of the x-ray and b. the angle for the second order Bragg Reflection. [6] [2056]

3. What is Bragg's law? How would you determine the wavelength of x-ray light using Bragg' spectrometer? [6] [2057]

4. What are X-rays? Show that X-rays different through crystals only if the spacing between two crystals planes is the order of X-rays different wavelength. Describe and explain X-rays spectrometer method of determining the wavelength of X-rays.[6] [2059]

5. Explain the origin of characteristics X-rays. Derive Mosley's law. Discuss the conclusion drawn by him.[9] [2060]

6. Explain how characteristic X-rays are produced. Discuss Mosley's law. [6] [2061]

7. What are the important conclusion of Mosley's law?[3] [2062]

8. Explain Mosley's law with its importance in physics. [3] [2063]

9. State importance concluSion of Mosley's law. [3] [2064]

10. find the mass absorption coefficient a of copper of density 8930 kg/m if 1.05 mm of copper reduces the intensity of a beam of X-rays to 0.075 if its original intensity. [6] [2065]

11. What are characteristics X-rays and how are they produced? What is Moseley's law? Write down the Importance of this law. [9] [2066]

12. NaCI has its principal planes spaced at 2.8 A. If the wavelength of X-ray used is 0.979A. Calculate the angles for first and second order Bragg's reflection.[9] [2061]

13. State Bragg's and Mosley's law and explain their significances. [6] [2067]

14. Write down the characteristics similarities and dissimilarities between X-ray 8 and gamma rays. Also obtain an expression for the variations of intensity of gamma rays falling on an absorber. What does the term "half value thickness" signify? [10] [2068]

15. An X-ray is found to have its wavelength 0.124 Angstrom undergoes Compton effect from a carbon block. Calcukate the wavelength when it is stattered through 180^o. [6] [2068]

16. the wavelength of the Lα line of X-rays in the cause of Platinum [Z= 78] is 1.321 A. An unknown substance emits Lα of wavelength 4.174 A. Calculate the atomic number of the unknown substance. Given b -7.4 for Lα lines. [6] [2069]

17. Describe and explain X-rays spectrometer method of determining the wavelength of X-rays. [6] [2069,0.C.]

18. Explain the conceptual difference between X-rays and y'-rays with matter. [3+6] [2070]

19. Explain how characteristics X-ray are produced. Explain Mosley's law. [6] [20 71]

20. The first order Bragg reflection occurs at an angle of 10^o when X-ray of 9.8 nm is used in NaCl crystal. What is the spacing between principal planes of the crystal. [6] [2071]

21. Explain the fine structure of X-rays. [2.5] [2072]

22. What is characteristics X-ray? Explain fine structure of X-ray transitions. [2+5] [2073]

23. Find the atomic number of the element that has Kα X-ray of delivery? [5] [2074]

24. What are X-rays? Show that X-rays diffract through crystals only if the spacing between two crystal planes is of the order of X-ray wavelength. Also discuss to X-ray spectrometer method to determine the wave length of X-rays [10] [2075,0.C.]

UNIT 14 NUCLEAR STRUCTURE

1. Explain mass defect and binding energy in a nucleus.[3] [2061]

2. A reactor is producing nuclear energy at a rate of 30,000 kw. How many atoms of U^{235} would be used up in 1000 hours of operations? Avogadro number N_A= 6x10^{-26} atoms per kg. [6] [2064]

3. What is mass defect? HOW is it related to the binding energy of nucleus? Explain the significance of binding energy of understand the nuclear stability. [6] [2067]

4. Are the nuclear densities of O_5^{16} and H_1^2 same? Present the justification of your answer. [3] [2067]

5. A photon of wavelength 1500 A is absorbed by cold mercury vapour and two other photons are omitted. If one of them has the wavelength 1800 A what is the wavelength of the other photon? [6] [2067]

6. find the Q-value of a [Be_4^9 C_6^{12}] in reaction if the masses of a $Be_4^9C_6^{12}$ and neutron are repectively 4.003870 amu, 9.01536 amu, 12,003316 amu and 1.008986 amu. [6] [2067]

7. How can one estimate the binding energy per nucleon of the nucleus X? Explain. [3] [2067,0.C.]

8. Present a theoretical justification in finding the density of a nucleus $X^{A_1}/_{Z_1}$ if the density A2 of an another nucleus $Z^{A_2}/_{Z_2}$ is known. [3] [2068]

9. Discuss the electric and magnetic properties of nucleus. [3] [2069]

10. What are mass defect and binding energy of a nucleus?[3] [2069,0.C.]

11. What do you mean by mirror nuclei? Give an example.[3] [2070,0,C]

UNIT 15

1. How long does it take for 60.0 percent of a sample radon to decay? [Half life of radon=3.8 days] [2075
2. Mention the biological effect of ionizing radiation. [2075]
3. Explain the meaning of half life of a radioactive substance. [2075]
4. Explain neutrino hypothesis of beta-decay. [2075]
5. Ra-226 which is often used as a radiation source in medicine,has a half-life of 103 years.How long after a new sample has been delivered will its activity have reduced to 1/8th of its value on delivery?[5] [2074]
6. Describe the law of successive disintegrating. How this law explain to natural radioactive series? Describe it.[4+3+2] [2074]
7. A sample containing 50 gram of Radium 226' has 6.5 gram after 5000 years determine the half life of radium 226.[5] [2073]
8. How long does it take 80 percent of a sample of radon to decay?[Half life of radon=3.8 days].[5] [2072]
9. Explain the mean life of radioactive substance.[3] [2072]
10. Mention the properties of α β and γ ray. Also discuss the theory of successive disintegration of radioactive substances.[4+4] [2072]
11. What do you mean by internal conversion?[2.5] [2071]
12. The half life of cesium-137 is 30.2 years. If the initial amount of a sample of cesium-137 is of mass 1kg how much cesium-137 left after 151 years.[5] [2071]
13. What is the neutrino theory of beta decay? How does it explain the continuous spectrum of beta decay?[4+4] [2071]
14. An old piece of wood was found to leave C14 activity of 6 disintegration per minute per gram of its carbon content. The C14 activity of living wood is 15 disintegration per minute per gram. Estimate the age of wood.Half life of C14 is 5760 years.[6] [2070]
15. What amount of Ra-226 of half life 1570 year will have the activity of one micro curie?[6] [2069]
16. How the γ rays interact with matter? Discuss.[3] [2069]
17. What happen when γ ray are expose to photocell?[3] [2069]
18. Explain the spectra of α, β and γ rays.[6] [2069]
19. Estimate the mass of RW26 if its activity is 50000 Rutherford and half life is 1620 years.[6] [2068]

20. What are the range, straggling, and stopping power of alpha particle? Explain the significance of i Geiger law ii Geiger-Nuttal law.[6] [2067]

21. Write down the process by which gamma ray interacts with matter with respect to their energies and present the theoretical details of compton effect.[4+5] [2067]

22. What do you mean by range of α-particle? How is it determine experimentally?[6] [2062]

23. Discuss the energy spectrum of β-ray. How is the continuous nature of such a spectrum accounted for?[9] [2061]

24. What is beta ray spectrum and how it is studied? Describe qualitatively type of spectra observed.[6] [2058]

25. Why there is no change in atomic mass and atomic number when nucleus emit γ-ray?[3] [2055]

26. What is neutrino theory of β-decay? How does it explain the continuous spectrum of β-decay?[3+3] [2055]

27. What do you understand by natural radioactive series? Explain the meaning of range, straggling and stopping power of alpha particle.[6] [2063]

28. Discuss different possible process involved in the interaction of gamma rays with matter.[6] [2063]

29. What amount of Ra-226 of half life 1570 years will have the activity of 1 microcurine?[6] [2063]

30. Explain the meaning of range, straggling and stopping power of alpha particle. Also discuss the significance of Geiger-Nattal law.[9] [2065]

31. One gram of a radioactive substance disintegrate at the rate of $3.7 * 10^10$ disintegration per second.If atomic weight of the substance is 226.Calculate the mean life.[6] [2066]

UNIT 16

1. Describe the construction and working of a cyclotron.[6] [2055]

2. Give the working principle of a cyclotron.[6] [2056]

3. In a G.M tube,the number of counts remains fairly constant over a wide range of voltage applied between the cathode and the anode. Explain why?[3] [2057]

4. What do you mean by particle accelerator?Describe the principle and working of a linear accelerator.[6] [2058]

5. Describe the working of linear accelerator.[3] [2059]

6. In cyclotron the maximum magnetic field of orbit was 0.4T operating at 50 Hz with stable diameter of 1.524 m. calculate the average energy gained per revolution by an electron.[6] [2059]

7. Describe a G.M counter and explain its working as a particle director.[6] [2060]

8. Deuterons in a cyclotron describe a circle of radius 0.32 m just before emerging from the lees.The frequency of the applied emf is 10MHz. Find the flux density of the magnetic field and the velocity of deuterons emerging out of the cyclotron.Given mass of deuteron= $3.32 \times 10^{-27} kg$[6] [2060]

9. Describe the working principle of G.M. counter.[6] [2061]

10. A cyclotron of-extreme radius 1m has a magnetic field of 2T. Determine the maximum energy of the emergent deuterons. Through what p.d would they have to be accelerated to attain the same energy?[6] [2062]

11. Discuss the working of a linear accelerator with necessary theory.[6] [2063]

12. Describe the construction and the principle of working of cyclotron.[6] [2064]

13. Explain the working of GM detector. What do you understand by quenching and dead time of GM counter?[6] [2065]

14. A cyclotron with lees of radius 90 cm has a transverse magnetic field of 0.8 T. Calculate the energies to which i.a proton and ii.deuteron are accelerated. [6] [2067,O.C]

15. Explain the working principle of Geiger Muller counter.[6] [2068]

16. Why is the study of accelerator important in nuclear physics? Discuss their working principle of linear accelerator.[6] [2070]

17. Describe with a sketch and necessary theory the working of a cyclotron[9] [2070,O.C]

18. Explain the working of a G.M counter.What are its limitation?[6] [2070,O.C]

19. Explain what do you mean by "plateau curve" and "working voltage" in G.M. detection method [6] [2071]

20. 0.55 MeV electrons are injected into a 55 MeV linear accelerator powered by a 200 MHz radio frequency supply. Find the approximate length of the last drift tube.[5] [2071]

21. Explain the working of bubble chamber.[2.5] [2071]

22. Discuss the LHC project and its achievements.[8] [2072]

23. Briefly describe the motives of Large Hardon Collider.[2.5] [2073]

24. In the betatron the maximum magnetic field at orbit was 0.4 Wb/m^2 operating at 50Hz with a stable orbit diameter of 1.524 m. Calculate the average energy gained per revolution and the final energy of the electrons.[5] [2073]

25. What is LHC project?[3] [2074]

26. What is Cernekov Detector?[2.5] [2074,2075]

27. What do you mean by particle accelerator? Describe the principle and working of a linear accelerator.[6] [2075,O.C]