

QUESTION BANK

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**Chapter 1. Basic Properties Of Nucleus**

Q1 Answer in one Sentence.

1. Define mass defect and binding energy
2. Define packing fraction.
3. What is the Spectroscopic term for  $L = 1, S = 1, J = 0$

**Chapter II Radioactivity**

4. What is isobars, isomers, isotope of the molecules. ? give example of each.
- 4a. What is quadrupole moment of the nucleus ?
5. What is half life and mean life / average life of the radioactive substance. ?
6. Define specific activity of the substance.
- 6a. What is secular equilibrium ?
- 6b. Define successive disintegration ?

**Chapter III Nuclear Forces**

7. What is quarks. ?
8. What are leptons.?
9. Give the particles of baryons group.
10. What is compound nucleolus .

**Chapter IV Nuclear Reaction**

11. What is exothermic reaction.
12. What is nuclear cross section.
13. Define nuclear fusion.
14. Define nuclear fission.

**Chapter V Particle Accelerators and Detector**

15. What is heterogeneous reactor. / Linear reactor.
- 15a. What is cyclotron ?
- 15b. What is particle detector ?
- 15c. What are the types of accelerators ?

- 15d. what is dead and recovery time of the G.M. counter ?
16. What is stellar energy.
17. what is compound nucleus ?
18. what is endothermic /exothermic reaction ? example of each.
19. what is nuclear cross section ?
20. what threshold energy of the nuclear reaction ?
21. give the quantities must be conserved in nuclear reaction.

## **Chapter VI Nuclear Energy**

24. what is the function of moderator in nuclear reactor ?
25. what is critical size and critical mass in nuclear reaction ?
26. what is effective multiplication factor in nuclear reaction ?

## **Q2 Long Answer type question .**

### **Chapter 1. Basic Properties Of Nucleus**

1. Define nuclear fission. How it is differ from nuclear fusion.
2. Write short note on proton -proton cycle.
3. Derive expression for multiplication factor.
4. Explain Symmetric properties of Nucleus.

### **Chapter II Radioactivity**

5. Derive expression for half life .
6. Obtain expression for mean life in terms of decay constant.
7. Explain the Secular and transient equilibrium.
- 8 Explain the parity of nucleolus.

### **Chapter III Nuclear Forces**

9. Give the account of nuclear forces
10. Write short note on spin dependant of nuclear force
11. Describe applications of radioactivity.
12. Sketch the packing fraction curve and explain it.
13. Give the basic properties of nucleus.

### **Chapter IV Nuclear Reaction**

- 14 . Explain the symmetry of nucleolus.
- 15 What is nuclear reaction ? Explain the laws conserved with suitable examples.
- 16 What is exothermic and endothermic reaction. Give examples of each.
- 17 What is Q value of nuclear reaction. Obtain the expression of it.

### **Chapter V Particle Accelerators and Detector**

- 18 Give the important properties of deuterons.
19. Explain the working of scintillation counter.
20. Explain Working and Construction of G.M.Counter.

## Chapter VI Nuclear Energy

21. Explain LS coupling scheme for two valence electron system using neat vector diagram.
- 22 Estimate the energy liberated using binding energy and masses of fission fragments.
- 23 What is threshold energy. Obtain the expression of it.
24. Explain the sources of stellar energy.

## Q. 3 Problems

### Chapter 1. Basic Properties Of Nucleus

- 1.. Calculate the binding energy and binding energy per nucleon in case of  ${}_{29}\text{Cu}^{64}$ , whose mass is 63,9632 a.m.u.
2. Find the radius of  $\text{Pb}^{206}$
- 3 Find the activity of 1 mg of radon having half life 3.8 years

### Chapter II Radioactivity

- 3a. The half life period is 1590 years. In how many years will 1gm of pure element 1. Lose 1centigram. 2. Be reduced 1 centigram.
- 3b. Calculate time required for 10 % of a sample of thorium to disintegrate . Assume the half life of thorium is  $1.4 \times 10^{10}$  years
- 3c. Calculate the mass and number of atom in a mci of  ${}_{11}\text{Na}^{24}$  of half life 15years.

### Chapter III Nuclear Forces

4. A cyclotron with dees of radius 2m has magnetic field of 0.75 wb/ m calculate the maximum energy to which proton can be accelerated.
5. The capture cross section of  ${}^{59}\text{Co}$  for thermal neutron is 37b what % of the beam of thermal neutron will penetrate a 1mm of  ${}^{59}\text{Co}$  is 8.9 g/cm<sup>3</sup>
6. Which Conservation law violated in the reaction
1.  $\text{P} \longrightarrow \pi^0 + e^+ + e^-$
  2.  $\pi^- + p \longrightarrow n + e^+$

### Chapter IV Nuclear Reaction

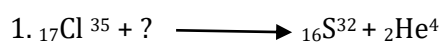
- 6a. Calculate the energy released in the reaction



- 6b. Find threshold of energy of the reaction  ${}_{7}\text{N}^{14} (n, \alpha) {}_{5}\text{Be}^{11}$  give n mass of

${}_{7}\text{N}^{14} = 14.003034$  amu.,  $n = 1.008665$  amu.,  ${}_{5}\text{Be}^{11} = 11.009305$  amu.,  $\text{He}^4 = 4.002603$  amu. The Q value is - 0.16 MeV.

- 6c. Complete the reaction:

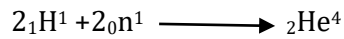


## Chapter V Particle Accelerators and Detector

7. If the frequency of oscillator to dees of cyclotron is 8 MHz. . What must be the magnetic flux density to accelerated alpha particles.?
- 8.A. Cyclatron with dees of radoius 3m.has magnetic field of 0.75Wb./m.Calculate max. energy of proton to witch it accelerate.
- 9.G.M.Counter operates at 1000 volts and anode diameter 0.2 m. The radious of cathode is 0.4m. What is maximum radial field

## Chapter VI Nuclear Energy.

- 10 Energy released per fission of  $U^{235}$  atom is 200MeV. Calculate the energy released during the fission of 1gm. Of  $U^{235}$ .
11. Calculate the energy released during following fission reaction.



- 12.Two neutrons and two protons combine to form the helium nucleus , calculate the energy liberated , if the masses of proton, neutron, and helium are  $1.675 * 10^{-27}$  kg.,  $1.673* 10^{-27}$  kg ,and  $6.665* 10^{-27}$  kg.