1. The radius of Ho^{165} is 7.731 fm. Deduce the radius of He^4 (Ans: 2.226 fm)

2. What is Binding energy of a nucleus? Calculate the binding energy of an α particle and express the result both in MeV and Joule.
Given: $m_p = 1.007276$ amu. Ans.: 28.29 MeV and 45.32×10^{-13} J.
$m_N = 1.008665$ amu.
$m_\alpha = 4.001506$ amu.

3. Given the following isotope masses;
$_3Li^7 = 7.016004$; $_3Li^6 = 6.015125$ and $_0n^1 = 1.008665$ u
Calculate the binding energy of a neutron in the $_3Li^7$ nucleus. Ans: 7.35 MeV

4. What is mass defect and packing fraction?

5. Explain the reasons for the absence of electrons inside the nucleus.

6. Derive Bethe-Weizsacker semi-empirical mass formula.

7. Given the following isotope masses:-
$_3Li^7 = 7.016004$; $_3Li^6 = 6.015125$ u and $_0n^1 = 1.008665$ u.
Calculate the B.E. of a neutron in the $_3Li^7$ nucleus. Express the result in a.m.u.
Ans:- 0.007786 a.m.u.

8. What are the similarities between Liquid drop and nucleus?

9. Calculate the atomic number of the most stable nucleus for a given mass number A.

10. Obtain an expression for energy released (Q) in symmetric fission, from the mass formula.

11. What is mirror nuclei? Give example.

12. As one moves along the line of stability from $_{56}Fe$ to ^{235}U nucleus, the nuclear B.E/nucleon decreases from about 8.8 MeV to 7.6 MeV. What is the reason behind it?

13. Write the properties of α, β and γ rays.

14. What is range of α particle? State Geiger Nuttal Law and explain

15. What is end-pt energy in β spectrum?

16. Explain the reason of secondary peak in β spectrum.

17. Explain the existence of continuous spectrum of β particles. Describe neutrino theory of β decay.

18. What is nuclear isomerism? Give example.

19. Explain internal conversion.

20. What is Mossbauer effect?

21. What is half-life in Radioactive decay?

22. The half life of radium is 1590 years. In how many years will one gram of pure element loose one centigram? Ans:- 23.25 yr.

23. 1 gram of radium is reduced by 2.1 mg in 5 years by α-decay. Calculate the half life period of radium Ans:- 1672 yr.

24. Calculate the time required for 10% of a sample of Thorium to disintegrate. Assume the half-life of Thorium to be 1.4×10^{10} years. Ans:- $t = 2.1 \times 10^9$ yr.

25. 1 gram of a radioactive substance disintegrates at the rate of 3.7×10^{10} disintegrations per second. The atomic weight of the substance is 226. Calculate its mean life.

26. Po^{212} emits α particles whose K.E. is 10.54 MeV. Determine the α disintegration energy. Ans 10.74 MeV.

27. Find the distance of closest approach of 2 Mev. proton incident on Gold nuclei ($Z = 79$). Ans. 5.69575×10^{-14} mt

28. Is the K.E of the emitted alpha particle from a nucleus equals to the disintegration energy?

29. Explain graphically. how the B.E/nucleon varies with mass no. on an average. and explain from this curve the release of energy in fusion of light nuclei and fission of heavy nuclei.

30. What is Kurie plot?

31. Consider the process $Co^{60}(5^+) \rightarrow Ni^{60}(4^+) + e^- + \bar{\nu}$
Explain whether it is a Fermi or G-T transition.

32. Show that in β transformation. ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + \beta^- + \bar{\nu}_e$, the K.E of the recoil nucleus is given by $E_Y = \dfrac{(Q + 2m_0c^2) E_m}{2M_Y c^2}$.

33. Write down ground state spin parity of ${}^{27}_{13}Al$, using extreme single particle shell model.

34. Calculate, for an α-particle of energy 5 MeV, the order of magnitude of probability of leakage through a potential barrier of width 10^{-12} cm and height 10 MeV.

35. What are the expected types of gamma ray transitions between the following states of odd A nuclei $g_{9/2} \rightarrow p_{1/2}$.