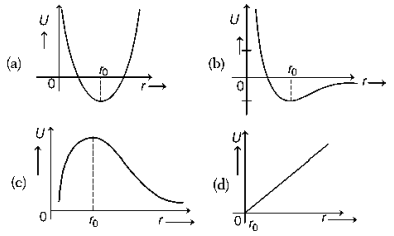
KENDRIYA VIDYALAYA SANGATHAN
ZIET CHANDIGARH
SUB :-PHYSICS CLASS XII 2022-23
REVISION PAPER UNIT- XIII–NUCLEI

Note: Q. No. 1-4 is of 01 mark each, Q. 5-6 is of 02 marks each, Q.No.7 is of 03 marks, Q. No. 8 is a case study based and is of 04 marks, Q. No. 11 is of 5 marks.

SN	Question	Marks
1	Density of a nucleus is (a) more for lighter elements and less for heavier elements (b) more for heavier elements and less for lighter elements (c) very less compared to ordinary matter (d) a constant	1
2	**Assertion (A):** Two atoms of different elements having same mass number but different atomic numbers are called isobars. **Reason (R):** Atomic number is the number of protons present and atomic number is the total number of protons and neutrons present in a nucleus (a) Both assertion and reason are correct and the reason is the correct explanation of assertion. (b) Both assertion and reason are correct and reason is not a correct explanation of assertion. (c) Assertion is correct but the reason is incorrect (d) Assertion is incorrect but the reason is correct.	1
3	Which amongst the following is a correct graph of potential energy U of a pair of nucleons as a function of their separation r ? 	1
4	F_{pp} , F_{nn} and F_{np} are the nuclear forces between proton-proton, neutron-neutron and neutron-proton, respectively. Then, relation between them is (a) $F_{pp} = F_{nn} \neq F_{np}$ (b) $F_{pp} \neq F_{nn}$ F_{np} (c) $F_{pp} = F_{nn} = F_{np}$ (d) $F_{pp} \neq F_{nn} \neq F_{np}$	1
5	State three properties of nuclear forces.	2
6	Show that the density of nucleus over a wide range of nuclei is constant and independent of mass number.	2
7	Explain the processes of nuclear fission and nuclear fusion by using the plot of binding energy per nucleon (BE/A) versus the mass number A.	3
	Case study-based questions (questions no 8- 11) NUCLEAR DENSITY The density of nuclear matter is the ratio of the mass of a nucleus to its volume. As the volume of a nucleus is directly proportional to its mass number A, so the density of nuclear matter is independent of the size of the nucleus. Thus, the nuclear matter behaves like a liquid of constant density. Different nuclei are like drops of this liquid, of different sizes but of same density. Let A be the mass number and R be the radius of a nucleus. If m is the average mass of a nucleon, then Mass of nucleus = mA Volume of nucleus = $\frac{4\pi}{3}R^3 = \frac{4\pi}{3}(R_o A^{1/3})^3 = \frac{4\pi}{3}{R_o}^3$A Nuclear density, $\rho_{nu} = \frac{Mass\ of\ nucleus}{Volume\ of\ nucleus} = \frac{mA}{\frac{4\pi}{3}{R_o}^3 A} = \frac{3m}{4\pi R_O}$	4

	Clearly, nuclear density is independent of mass number A or the size of the nucleus. The nuclear mass density is of the order 10^{17} kg m^{-3}. This density is very large as compared to the density of ordinary matter, say water for which ρ = 1.0 x 10^3 kg^{-3} 8. What is the nucleus density of hydrogen atom? 1 9. Name the factor on which nucleus density depends. 1 10. If the radius of $^{27}_{13}Al$ has a nuclear radius of about 3.6 fm, then find the radius of $^{125}_{52}Te$. 2 OR 10. If the nuclear mass of $^{56}_{26}Fe$ is 55.85 amu, then find its nuclear density. 2	
11	Draw the graph showing the variation of binding energy per nucleon with the mass number for a large number of nuclei 2< A < 240. What are the main inferences from the graph? How do you explain the constancy of binding energy in the range 30 < A < 170 using the property that the nuclear force is short-ranged? Explain with the help of this plot the release of energy in the processes of nuclear fission and fusion.	5