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Class: XII
Subject: Physics
Topic: Atoms And Nuclei
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

1. If the binding energy per nucleon in Li_3^7 and He_2^4 nuclei are 5.60MeV and 7.60 respectively, then in their action, energy of proton must be $p + Li_3^7 \longrightarrow 2\ He_2^4$
   a. 17.28 MeV
   b. 1.46 MeV
   c. 39.2 MeV
   d. 28.24 MeV

   Ans. A
   Solution:
   Energy of proton (8* 7.06 – 7* 5.60)
   =56.48 - 39.2 17.28 MeV
2. The element x in the reaction $_3^7$Li (p, a) x is
   a. $_2^4$He
   b. $_6^{12}$C
   c. $_4^6$B
   d. $_4^{17}$N

   Ans. A
3. Atomic mass number of an element is 235 & its atomic number is 92. The end product of this radioactive element is an isotope of lead having atomic mass 203 & atomic number 82. The number of á & â particles emitted is
   a. $\alpha = 8$ &$\beta = 6$
   b. $\alpha = 6$ &$\beta = 4$
   c. $\alpha = 6$ &$\beta = 0$
   d. $\alpha = 3$ &$\beta = 3$

   Ans. A

4. According to Yukawa, the nuclear force arises through the exchange of between the nucleons
   a. protons
   b. positrons
   c. photons
   d. mesons
   Ans. D

5. What percentage of original radioactive atoms is left after five half lives?
   a. 5%
   b. 3%
   c. 10%
   d. 20%
   Ans. B
   Solution:
   $$\frac{M}{M_o}=\frac{1}{2^n}\Rightarrow\frac{M}{M_o}\times 100=\frac{1}{2^5}\times 100=\frac{100}{32}=3\%$$

6. Amount of energy required to separate nucleons from the nucleus is called
   a. binding energy
   b. packing fraction
   c. reaction energy
   d. splitting energy
   Ans. A

7. When a fundamental particle decays leading to the formation of other particles
   a. the total mass of the products must be equal to the rest mass of the initial particle
   b. the total mass of the products must be less than the rest mass of the initial particle
   c. the total mass of the products must be greater than the rest mass of the initial particle
   d. any one of the above depending on conditions

   Ans. B

8. Difference between total mass of two neutrons, two protons and the mass of helium nucleus is 0.031 amu. If this mass is completely converted into energy, the energy is equivalent to
   a. 4.60×10^{-12} J
   b. 15.3×10^{-11} J
   c. 9×10^{13} J
   d. 2.7×10^{12} J
   Ans. A
   Solution:
   $$\text{Energy released} = \Delta m \times 931\ \text{MeV}$$
   $$= 0.031 \times 931 \times 1.6 \times 10^{-13}\ \text{J} = 4.60 \times 10^{-12}\ \text{J}$$

9. The particle with the smallest non zero rest mass, spin and electric charge among the following is
   a. Photon
   b. Proton
   c. Negatron
   d. Pion

   Ans. C

10. Mass number A of a nucleus whose radius is 3.9 fermi is
   a. 10
   b. 47
   c. 27
   d. 17

   Ans. C
   Solution:
   $R = R_o \ A^{1/3}$
   $3.9 \times 10^{-15} = 1.3 \times 10^{-15} \times A^{1/3} \Rightarrow 3 = A^{1/3}, A = 27$

11. A count rate shows a count of 240 per minute from a given radioactive sources. One hour later the meter shows a count rate of 30 per minute. The half-life of the source is___
   a. 80 min
   b. 120 min
   c. 20 min
   d. 30 min

   Ans. C
   Solution:
   $\frac{A}{Ao} = \frac{1}{2_n}$ where n is number of half lives present in one hour
   $\frac{30}{240} = \frac{1}{2_n} \Rightarrow \frac{1}{8} = \frac{1}{2_n} \therefore n = 3$
   $\therefore$ Half life $= \frac{60}{3} = 20$ min.

12. Which one of the following conversion can be done in a breeder reactor?
   a. $^{238}_{92}U$ into $^{239}_{94}Pu$
   b. $^{232}_{90}Th$ into $^{233}_{92}U$
   c. $^{2}_{1}H$ into $^{4}_{2}He$
   d. Either (1) or (2)

   Ans. D

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13. If the multiplication factor is greater than unity in a nuclear fission reaction involving neutron capture, then
    a. chain reaction will continue in normal way
    b. an explosion may result
    c. process will stop after sometime
    d. explosion cannot occur

    Ans. B

14. stokes lines have frequencies
    a. always lower than incident light
    b. higher than incident light
    c. no definite relation exists
    d. same as the incident light

    Ans. A

15. Any nuclear fission process is always accompanied by emission of
    a. Positron
    b. Neutron
    c. Electrons
    d. Mesons

    Ans. B

16. The radius of the element with mass number 216 is
    a. 1.2 fermi
    b. 0.2 fermi
    c. 7.2 fermi
    d. 6 fermi

    Ans. C
    Solution:

$$R = R_{\circ} A^{1/3}$$

$$= 1.2 \times 10^{-15} \times (216)^{1/3} = 1.2 \times 6 \times 10^{-15} = 7.2 \text{ fermi}$$

17. Fusion reactions takes place at high temperature because
    a. molecules break up at high temperature
    b. nuclei break up at high temperature
    c. K. E is high enough to overcome repulsion between nuclei
    d. atoms are ionised at high temperature

    Ans. C

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18. When a neutron decays the resulting
    a. proton and electron move in the same direction
    b. proton and electron move in the opposite directions
    c. proton and electron do not move along the same straight line
    d. particles do not obey the law of conservation

    Ans. C

19. The half - life of 215 At is 100ms. The time taken for the activity of the sample to decay to $\frac{4}{16}$th its initial value is
    a. 400 ìs
    b. 8.3 ìs
    c. 40 ìs
    d. 300 ìs

    Ans. A

20. The probability of a radioactive atom to survive 5 times longer than its T1/2 is
    a. 2/5
    b. 2 x 5
    c. 2^{-5}
    d. 2^{5}

    Ans. C
    Solution:
    $t = 5T_{1/2}$

    $\frac{M}{M_o}$ = Probabilit y of M atoms surviving out of M_o atoms

    But $\frac{M}{M_o} = \frac{1}{2^n}; n = \frac{5T_{1/2}}{T_{1/2}} = 5, \qquad \therefore \frac{M}{M_o} = \frac{1}{2^5} = 2^{-5}$