DPP
DAILY PRACTICE PROBLEMS

Class : XIIth **Subject : PHYSICS**
Date : **DPP No. : 9**

Topic :-Nuclei

1. A radioactive sample of U^{238} decays to Pb through a process for which half life is 4.5×10^9 $years$. The ratio of number of nuclei of Pb to U^{238} after a time of $1.5 \times 10^9 years$ (given $2^{1/3} = 1.26$)
   a) 0.12 b) 0.26 c) 1.2 d) 0.37
2. The mass and energy equivalent to 1 amu are respectively
   a) $1.67 \times 10^{-27} gm$, 9.30 MeV b) $1.67 \times 10^{-27} kg$, 930 MeV
   c) $1.67 \times 10^{-27} kg$, 1 MeV d) $1.67 \times 10^{-34} kg$, 1 MeV
3. Hydrogen atom from excited state comes to the ground state by emitting a photon of wavelength λ. If R is the Rydberg constant, the principal quantum number n of the excited state is
   a) $\sqrt{\frac{\lambda R}{\lambda R - 1}}$ b) $\sqrt{\frac{\lambda}{\lambda R - 1}}$ c) $\sqrt{\frac{\lambda R^2}{\lambda R - 1}}$ d) $\sqrt{\frac{\lambda R}{\lambda - 1}}$
4. Energy generation in stars is mainly due to
   a) Chemical reactions b) Fission of heavy nuclei
   c) Fusion of light nuclei d) Fusion of heavy nuclei
5. A radioactive nucleus undergoes α-emission to form a stable element. What will be the recoil velocity of the daughter nucleus if V is the velocity of α-emission and A is the atomic mass of radioactive nucleus
   a) $\frac{4V}{A-4}$ b) $\frac{2V}{A-4}$ c) $\frac{4V}{A+4}$ d) $\frac{2V}{A+4}$
6. When a slow neutron goes sufficiently close to a U^{235} nucleus, then the process that takes place is
   a) Fission of U^{235} b) Fusion of neutron c) Fusion of U^{235} d) First (a) then (b)
7. The third line of Balmer series of an ion equivalent to hydrogen atom has wavelength of 108.5 nm. The ground state energy of an electron of this ion will be
   a) 3.4 eV b) 13.6 eV c) 54.4 eV d) 122.4 eV
8. A nucleus of mass 214 amu in free state decays to emit an α-particle. Kinetic energy of the α-particle emitted is 6.7 MeV. The recoil energy (in MeV) of the daughter nucleus is
   a) 1.0 b) 0.5 c) 0.25 d) 0.125
9. The binding energy of nucleus is a measure of its
   a) Charge b) Mass c) Momentum d) Stability

10. Suppose an electron is attracted towards the origin by a force $\frac{k}{r}$ where 'k' is a constant and 'r' is the distance of the electron from the origin. By applying Bohr model to this system, the radius of the n^{th} orbital of the electron is found to be 'r_n' and the kinetic energy of the electron to be 'T_n'. Then which of the following is true

a) T_n independent of n, $r_n \propto n$ b) $T_n \propto \frac{1}{n}$, $r_n \propto n$

c) $T_n \propto \frac{1}{n}$, $r_n \propto n^2$ d) $T_n \propto \frac{1}{n^2}$, $r_n \propto n^2$

11. v_1 is the frequency of the series limit of Lyman series, v_2 is the frequency of the first line of Lyman series and v_3 is the frequency of the series limit of the Balmer series. Then

a) $v_1 - v_2 = v_3$ b) $v_1 = v_2 - v_3$ c) $\frac{1}{v_2} = \frac{1}{v_1} + \frac{1}{v_3}$ d) $\frac{1}{v_1} = \frac{1}{v_2} + \frac{1}{v_3}$

12. Which of the following has the mass closest in value to that of the positron
($1\ a.m.u = 931\ MeV$)

a) Proton b) Electron c) Photon d) Neutrino

13. The set which represents the isotope, isobar and isotone respectively is

a) $({}_1H^2, {}_1H^3)$,$({}_{79}Au^{197}, {}_{80}Hg^{198})$ and $({}_2He^3, {}_1H^2)$

b) $({}_2He^3, {}_1H^1)$,$({}_{79}Au^{197}, {}_{80}Hg^{198})$ and $({}_1H^1, {}_1H^3)$

c) $({}_2He^3, {}_1H^3)$,$({}_1H^2, {}_1H^3)$ and $({}_{79}Au^{197}, {}_{80}Hg^{198})$

d) $({}_1H^2, {}_1H^3)$,$({}_2He^3, {}_1H^3)$ and $({}_{79}Au^{197}, {}_{80}Hg^{198})$

14. The nucleus ${}_6C^{12}$ absorbs an energetic neutron and emits a beta particle (β) . The resulting nucleus is

a) ${}_7N^{14}$ b) ${}_7N^{13}$ c) ${}_5B^{13}$ d) ${}_6C^{13}$

15. The mass defect in a particular nuclear reaction is 0.3 $grams$. The amount of energy liberated in kilowatt hours is
(Velocity of light $= 3 \times 10^8 m/s$)

a) 1.5×10^6 b) 2.5×10^6 c) 3×10^6 d) 7.5×10^6

16. Consider the following statements
S1 : The nuclear force is independent of the charge of nucleons
S2 : The number of nucleons in the nucleus of an atom is equal to the number of electrons in the atom
S3 : All nuclei have masses that are less than the sum of the masses of constituent nucleons
S4 : Nucleons belong to the family of leptons while electrons are members of the family of hadrons
Choose the correct statement(s) from these

a) S1 only b) S1 and S4 c) S2, S3 and S4 d) S1 and S3

17. Alpha rays emitted from a radioactive substance are
a) Negatively charged particles
b) Ionized hydrogen nuclei
c) Doubly ionized helium atom
d) Unchanged particles having the mass equal to proton

18. A radioactive sample at any instant has its disintegration rate 5000 disintegrations per minute. After 5 min, the rate is 1250 disintegrations per min. Then, the decay constant (per minute) is
    a) 0.4 In 2 b) 0.2 In 2 c) 0.1 In 2 d) 0.8 In 2
19. β-decay means emission of electron from
    a) Innermost electron orbit b) A stable nucleus
    c) Outermost electron orbit d) Radioactive nucleus
20. Excitation energy of a hydrogen like ion in its first excitation state is 40.8 eV. Energy needed to remove the electron from the ion in ground state is
    a) 54.4 eV b) 13.6 eV c) 40.8 eV d) 27.2 eV