QB365 Question Bank Software Study Materials

Atomic and Nuclear physics Important 2 Marks Questions With Answers (Book Back and Creative)

12th Standard

Physics

Total Marks : 40

2 Marks

20 x 2 = 40

1) What are cathode rays?

Answer : (i) When the pressure of the gas in discharge tube is reduced to around 0.01 mm of Hg, positive column disappears.
(ii) At this time, a dark space is formed between anode and cathode which is called Crooke's dark space.
(iii) The walls of the tube appear with green colour.
(iv) At this stage, some invisible rays emanate from cathode called cathode rays, which are beam of electrons.

2) Define the ionization energy and ionization potential.

Answer : (i) Minimum energy required to remove an electron from an atom in the ground state is known as binding energy or ionization energy.
(ii) Ionization potential is defined as ionization energy per unit charge.

3) What is isobar? Give an example.

Answer : Isobars are the atoms of different elements having the same mass number A, but different atomic number Z.
Example: ${}^{40}_{16}\mathrm{S}, {}^{40}_{17}\mathrm{Cl}, {}^{40}_{18}\mathrm{Ar}$

4) What is binding energy of a nucleus? Give its expression.

Answer : While forming a nucleus, the mass disappear is converted into energy. This energy is called binding energy of a nucleus.
$\therefore \mathrm{BE} = (\mathrm{Zm_P} + \mathrm{Nm_n} - \mathrm{M}) \times \mathrm{c}^2$
where, c - velocity of light

5) Give the physical meaning of binding energy per nucleon.

Answer : Binding energy per nucleon is defined as minimum energy required to take out either a proton or a neutron from nucleus.
$\overline{BE} = \frac{BE}{A}$

6) Define curie.

Answer : One curie was defined as number of decays per second in 1 gram of radium. 1 1 curie = 3.7 X 10^{10} decays/s.

7) In the Bohr atom model, the frequency of transitions is given by the following expression $v = Rc\left(\frac{1}{n^2} - \frac{1}{m^2}\right)$, where n < m, Consider the following transitions:

Transitions	m→n
1	3→2
2	2→1
3	3→1

Show that the frequency of these transitions obey sum rule (which is known as Ritz combination principle)

Answer : $v_{3\to2} = RC\left(\frac{1}{4} - \frac{1}{9}\right) = \frac{5}{36}RC$
$v_{2\to1} = RC\left(\frac{1}{1} - \frac{1}{4}\right) = \frac{3}{4}RC$
$v_{3\to1} = RC\left(\frac{1}{1} - \frac{1}{9}\right) = \frac{8}{9}RC$
$v_{3\to2} + v_{2\to1} = \frac{5}{36}RC + \frac{3}{4}RC = RC\left(\frac{5}{36} + \frac{3}{4}\right) = RC\left(\frac{5+27}{36}\right)$
$v_{3\to2} + v_{2\to1} = RC\left(\frac{32}{36}\right) = \frac{8}{9}RC = v_{3\to1}$

8) Characol pieces of tree is found from an archeological site. The carbon-14 content of this characol is only 17.5% that of equivalent sample of carbon from a living tree. What is the age of tree?

Answer : $\frac{N}{N_0} = \frac{17.5}{100}$, $T_{1/2} = 5730$ Years

Age of the sample (t) = ?

Age of sample, $t = \frac{2.303 \times \log\left(\frac{N_0}{N}\right) \times T_{1/2}}{0.6931}$

$t = \frac{2.303 \times \log\left(\frac{100}{17.5}\right) \times 5730}{0.6931}$

$t = \frac{2.303 \times \log(5.714) \times 5730}{0.6931}$

$t = \frac{2.303 \times 0.7570 \times 5730}{0.6931}$

t = 14410 years

t = 1.44 x 10^4 years

9) The radius of the 5th orbit of hydrogen atom is 13.25 Å. Calculate the de Broglie wavelength of the electron orbitting in the 5th orbit.

Answer : $2\pi r = n\lambda$

2 x 3.14 x 13.25Å = 5 x λ

∴ λ = 16.64 Å

10) Compute the binding energy per nucleon of ^4_2He nucleus.

Answer : From example, we found that the BE of ^4_2He = 28.33 Mev

Binding energy per nucleon = $\overline{B \cdot E}$ = $28.33\text{MeV}/4 \simeq 7\text{MeV}$.

11) A fusion reaction is more energetic than a fission reaction. Why?

Answer : In nuclear fusion reaction, the energy liberated per unit mass of the nuclei taking part in the reaction is many times larger than the energy liberated in a fission reaction.

12) What is meant by nuclear fission?

Answer : The process of breaking up of the nucleus of a heavy atom into two fragments with the release of large amount of energy is known as nuclear fission.

13) Why neutrons in the nucleus are stable?

Answer : Neutrons are stable inside the nucleus. But outside the nucleus they are unstable. If the neutron comes out of the nucleus (free neutron), it decays with the emission of proton, electron, and antineutrino with a half-life of 13 minutes.

14) What causes the sun to expand?

Answer : When the hydrogen is burnt out, the sun will enter into a new phase called the red giant where helium will fuse to become carbon. During this stage, the sun will expand greatly in size and all its planets will be engulfed in it

15) The ground state energy of hydrogen atom is -13.6 eV. What are k.E & P.E of the electron in this state?

Answer : K.E of the electron = 13.6 eV

P.E is equal to twice its K.E

P.E of the electron = -13.6 x 2 = -27.2 eV

16) Do you think electron or positron comes out from nuclei during beta decay present inside the nuclei?

Answer : It is important to note that the electron or positron which comes out from nuclei during beta decay never present inside the nuclei rather they are produced during the conversion of neutron into proton or proton into neutron inside the nucleus.

17) Classify neutron on the basis of their energy.

Answer : **Types:**

(i) Slow neutron (0eV to 1000eV)

(ii) Fast neutron (0.5MeV to 10MeV)

(iii) Thermal neutron (0.025eV)

18) What is chain reaction?

Answer : When one nucleus undergoes fission three neutrons are released. These three neutrons cause further fission in another three $^{235}_{92}U$ nuclei which in turn produce nine neutrons. These nine neutrons initiate fission in another nine $^{235}_{92}U$ nuclei and produce 27 neutrons so on. This is called a chain reaction and the number of neutrons goes on increasing almost in geometric progression.

(i) Contolled chain reaction - nuclear reactor

(ii) Uncontrolled chain reaction - atom bomb

19) Define atomic number and mass number.

Answer : (i) The number of protons in the nucdeus is called the atomic number (Z).

(ii) The total number of nucleons or the total number of protons and the neutrons in the nucleus is called the mass number (A).

20) What is carbon dating?

Answer : (i) Estimating the age of ancient object can be calculated by comparing number of $^{14}_{6}C$ and $^{12}_{6}C$.

(ii) Half life of $^{14}_{6}C$ is 5730 years.