Discovery and Properties of anode, cathode rays neutron and Nuclear structure

1. (d) Neutrons and protons in the nucleus and electrons in the extranuclear region.

2. (a) It consists of proton and neutron and these are also known as nucleones.

3. (c) Radius of nucleus $\simeq 10^{-15} m$.

4. (c) Positive ions are formed from the neutral atom by the loss of electrons.

5. (b) The β-ray particle constitute electrons.

6. (a) James Chadwick discovered neutron $({}_0n^1)$.

7. (b) Charge/mass for

$n = 0, \alpha = \frac{2}{4}, p = \frac{1}{1}$ and $e = \frac{1}{1/1837}$

8. In the Bohr model of the hydrogen atom (or hydrogen-like atoms), the electron revolves around the nucleus under the influence of Coulomb's electrostatic force.
We want to show that:
V = -2K
Step 1: Forces acting on the electron
For an electron of charge -e revolving around a nucleus of charge +Ze:
Coulomb force provides the centripetal force:
$(Ze^2) / (4\pi\varepsilon_0 r^2) = mv^2 / r$
Multiplying both sides by r:
$(Ze^2) / (4\pi\varepsilon_0 r) = mv^2$
Step 2: Express Kinetic Energy
$K = 1/2\ mv^2$
Substituting mv^2 from above:
$K = 1/2 \times (Ze^2) / (4\pi\varepsilon_0 r)$

$K = (Ze^2) / (8\pi\varepsilon_0 r)$

Step 3: Express Potential Energy

Potential energy of attraction between charges is:

$V = -(Ze^2) / (4\pi\varepsilon_0 r)$

Step 4: Relation between V and K

Comparing the two results:

$V = -2K$

(a) Half of the potential energy

9. (d) The density of neutrons is of the order $10^{11} kg/cc$.

10. (c) This is because chargeless particles do not undergo any deflection in electric or magnetic field.

11. (b) Neutron and proton found in nucleus.

13. (b) Cathode rays are made up of negatively charged particles (electrons) which are deflected by both the electric and magnetic fields.

15. (b) Mass of neutron is greater than that of proton, meson and electron.
Mass of neutron = mass of proton + mass of electron

16. (b) Proton is 1837 (approx 1800) times heavier than an electron. Penetration power $\propto \frac{1}{\text{mass}}$

17. (c) **A sub-atomic particle** Elementary particles are the fundamental building blocks of matter, e.g., electrons, protons, neutrons (and deeper: quarks, leptons, etc.).

18. (c) Nucleus of helium is $2He^4$ mean 2 neutrons and 2 protons.

19. (c) Proton is the nucleus of H −atom (H −atom devoid of its electron).

20. (b) Cathode rays are made up of negatively charged particles (electrons, e^-)

21. (a) Goldstein

Explanation:

Anode rays, also called **canal rays**, are streams of **positive ions** moving toward the cathode in a discharge tube.

They were discovered by **Eugen Goldstein** in 1886 while studying discharge tubes with perforated cathodes.