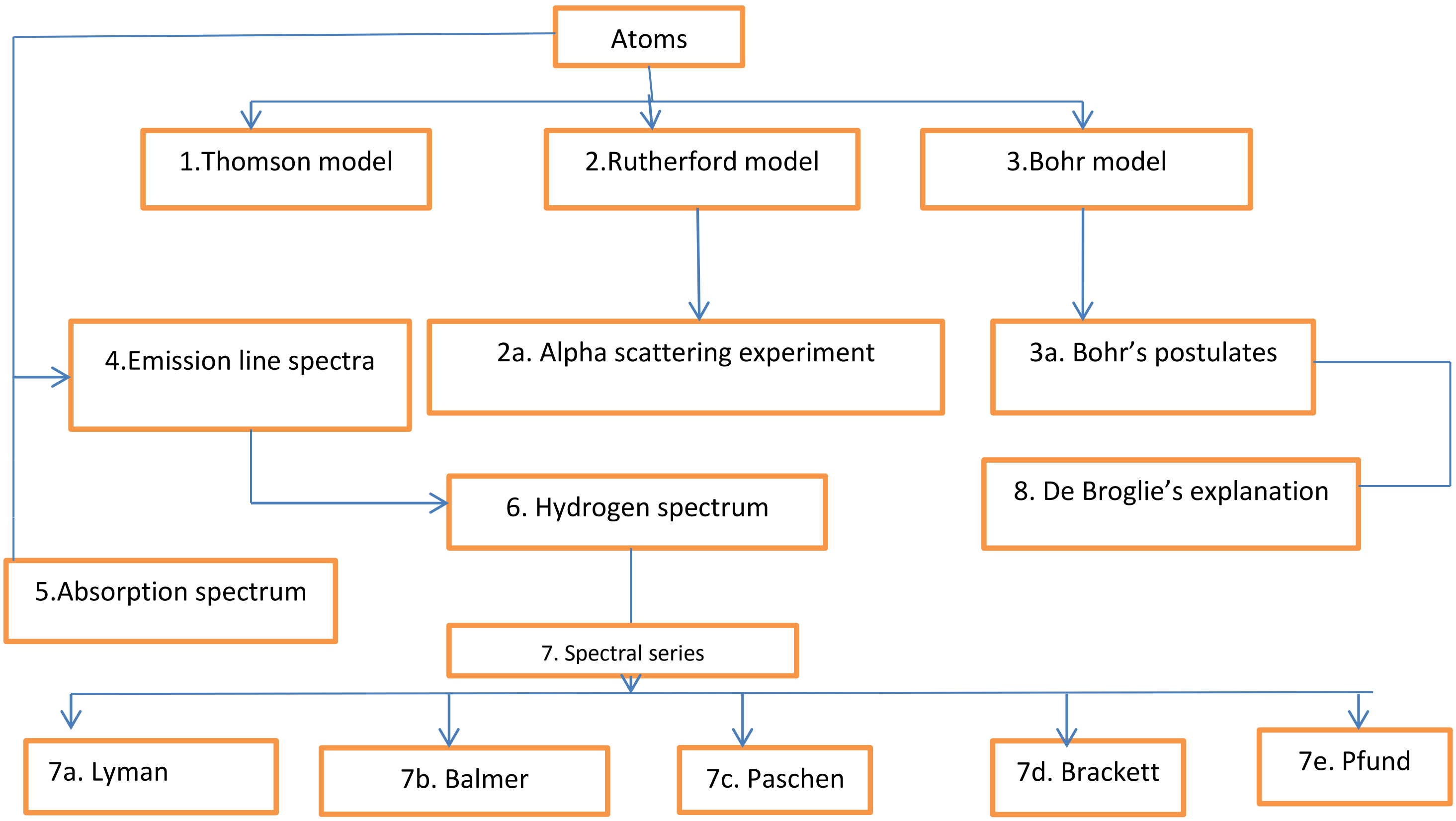
CONCEPT MAP
ATOMS



Gist of the chapter
Atoms

1. Thomson model: Positive charge is distributed throughout the volume of the atom and the negatively charged electrons are embedded like seeds in a watermelon
2. Rutherford model: Entire positive charge and most of the mass of the atom are concentrated in the nucleus and electrons revolve around the nucleus just like planets revolve around the sun

   2a. Alpha scattering experiment: Alpha particles are made to fall a thin foil of gold and the scattered alpha particles were observed through a detector consisting of zinc sulphide screen and a microscope.

   The observation and conclusions of the experiment

   1. Most of the alpha particles were un deflected and passed through the foil. It implies that most of the space in atom is empty
   2. A few alpha particles were deflected though large angles. it implies that a strong positive charge is present inside the atom
   3. A very few alpha particles retraced their path. This implies that most of the mass is concentrated in the centre and has a positive charge which is named as nucleus
3. Bohr model: Nucleus is at the centre and electrons revolve around the nucleus in stable orbits.

   3a. Bohr's postulates: 1. The electrons revolve around nucleus in stable orbits without emission of radiant energy. 2. The electrons revolve only in those orbits where the angular momentum is some integral multiple of $h/2\pi$. 3. When an electron jumps from an higher orbit to a lower orbit it emits radiant energy equal to the energy difference between the orbits.
4. When an atomic gas or vapour is excited at low pressure, it emits radiation which contains certain specific wavelengths only. This is called emission line spectrum.
5. When white light passes through a gas, the transmitted light contains some dark lines in place of bright lines which were found in the emission spectrum of the gas. This is called absorption spectrum.
6. Hydrogen spectrum is an emission line spectrum. There is no regularity in the spectral lines. The spacing between lines within certain sets decreases in a regular way. Each of these sets is called spectral series. The general expression for the wavelength of these spectral series is $1/\lambda = R\{1/ n_i^2 - 1/n_f^2 \}$
7. Spectral series:A few spectral series of hydrogen are Lyman, Balmer, Paschen, Brackett and Pfund etc.,

   7a. Lyman series: It is in the ultraviolet region. Here $n_f = 1$ and $n_i = 2,3,4….$

   7b. Balmer series: It is in the visible region. Here $n_f = 2$ and $n_i = 3,4,5….$

   7c. Paschen series: It is in the infrared region. Here $n_f = 3$ and $n_i =4,5,6….$

   7d. Brackett series: It is in the infrared region. Here $n_f = 4$ and $n_i =5,6,7….$

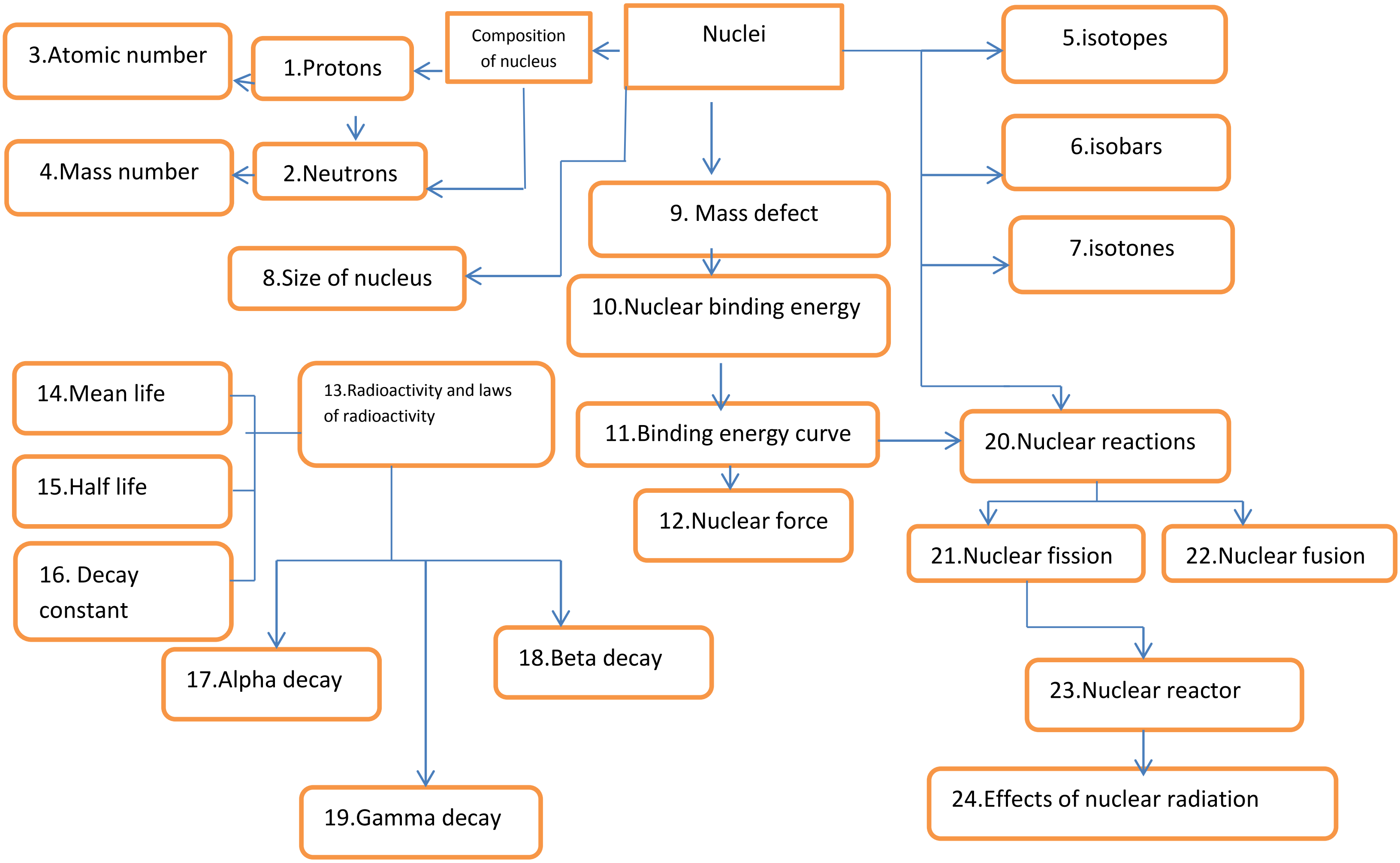
   7e. Pfund series: Here $n_f = 5$ and $n_i = 6,7,8….$

8. De Broglie explanation of Bohr's second postulate: An electron must be seen as a particle wave when revolving around the nucleus and gives rise to standing waves like stretched strings, according to de Broglie. When the electron revolves in the nth circular orbit of radius r_n, the circumference

$$2\pi r_n = n\lambda$$

where $\lambda = h/p = h/mv_n\, r_n$ (de Broglie expression)

CONCEPT MAP
NUCLEI



Gist of the chapter

Nuclei

1. Nuclei consists of positively charged particles called protons
2. Nuclei consists of uncharged particles called neutrons discovered by Chadwick
3. No of protons in the nucleus is called atomic number
4. Sum of number of protons and neutrons is called mass number
5. Nuclei of same elements having same atomic number and different mass number For ex.$^1H_1$, $^2H_1$ and $^3H_1$
6. Nucleides with same mass number are called isobars For ex., $^3H_1$ and $^3He_2$ are examples of isobars
7. Nucleides with same neutron number but different atomic number are called isotones For ex., $^{198}Hg_{80}$ and $^{197}Au_{79}$
8. The density of all nuclei is same . The radius of a nucleus of mass number A is $R = R_0 A^{1/3}$ where $R_0 = 1.2 \times 10^{-15}$ m.
9. The difference in sum of the masses of the constituents of a nucleus and the mass of the nucleus is called mass defect.
10. The energy required to separate the nucleons from a nucleus is called nuclear binding energy.
11. It is the graph between binding energy per nucleon as a function of mass number . The average binding energy per nucleon for stable nuclei is 8 MeV
12. The strong attractive force between the nucleons which overcomes the electrostatic repulsion of protons and binds the protons and neutrons in a tiny nuclear volume. It is charge independent. It falls of rapidly to zero as the distance between nucleons is more than a few femtometers.
13. It is a nuclear phenomenon in which an unstable nucleus undergoes a decay. There are three types of radioactive decay. According to the radioactive law, the number of nuclei undergoing the decay per unit time is proportional to the total number of nuclei present in the sample.
14. The average life of a nuclei is the sum of lives of all nuclei divided by number of nuclei
15. The time taken by a nuclei to reduce to half its initial value
16. The reciprocal of the time taken by a radioactive nuclei to reduce to 1/e times its initial value.
17. When a nucleus emits an alpha particle, its atomic number reduces by two and mass number by four. $^A X_z \rightarrow {}^{A-4} Y_{z-2} + {}^4 He_2$
18. When a nucleus emits a beta particle, its mass nuber remains unchanged but its atomic number increases by one if it is β^-decay and atomic number decreases by one if it is β^+ decay
19. Gamma radiation is an electromagnetic radiation emiited either during alpha decay or beta decay
20. Both heavy and light nuclei have low binding energy per nucleon so they undergo nuclear reactions to attain stability
21. A heavy nucleus like uranium when bombarded with a neutron, breaks in to two medium weight nuclei with the release of enormous energy is called fission.
22. Two light nuclei like hydrogen nuclei combine to form a heavy nucleus with the liberation of energy it is fusion. Fusion reactions are also known as thermonuclear

reactions as it occurs at a very high temperature of the order of 10^7 K. ex., energy generation in stars is due to fusion reactions

23. A device in which controlled nuclear fission reaction takes place and is used in nuclear power plants
24. The radiations emitted during fission reactions are harmful and cause damage to the tissues of human beings and cause cancer. Hence disposal of nuclear wastes are to be taken care of