

# what is inside the atom

## Nucleus

Nucleus refers to the small dense region, in which positively charged protons and electrically neutral neutrons are present. Electrons revolve around the nucleus in fixed orbits.

### Definition

#### Discovery of proton by Goldstein

In 1886, E. Goldstein carried out discharge tube experiments and discovered new radiations and called them canal rays. These rays were made up of positively charged particles and led to the discovery of proton.

### Definition

#### Postulates of discovery of neutrons

The particle present in nucleus along with proton is neutral made from close combination of proton and electron.

The particle has no charge and mass almost equal to the mass of proton.

### Definition

#### Properties of neutrons

### Definition

#### Thomson's model of an atom

J.J. Thomson was the first to put forward a model to explain the structure of an atom. Thomson's atomic model is also called water melon model or Christmas pudding model. He compared the electrons with the raisins in the spherical Christmas pudding and to seeds in a watermelon. In which he describe the resin as electrons and spherical body as central body in which electrons rev

### Definition

#### Postulates of Thomson's atomic model

An atom consists of a positively charged sphere, with electrons set within the sphere.

An atom is electrically neutral as the positive and negative charges within it are equal.

### Definition

#### Postulates of Rutherford's atomic model

#### Postulates of Rutherford's nuclear model:

Positive charge is concentrated in the center of the atom, called nucleus.

Electrons revolve around the nucleus in circular paths called orbits.

The nucleus is much smaller in size than the atom.

## Uses of isotopes

An isotope of uranium is used as fuel in a nuclear reactor.

An isotope of cobalt is used in the treatment of cancer.

For treating goitre, an isotope of iodine is used.

## Drawbacks of Rutherford's atomic model

The orbital revolution of the electron is not expected to be stable. According to Rutherford's model, the electrons, while moving in their orbits, would give up energy. This would make them slow down, gradually and move towards the nucleus. The electrons will follow a spiral path and then fall into the nucleus. Ultimately, the atom would collapse. But in reality the atom is stable.

## Definition

### Rutherford's model of an atom

To study the structure of atom, Rutherford performed a thin gold foil scattering experiment. For his experiments Rutherford used a gold foil. He made a narrow beam of alpha particles to fall on the gold foil. Observations made from the alpha ray scattering experiment: Most of the alpha particles passed straight through the gold foil without getting deflected, a small fraction of the alpha particles were deflected through small angles, a few alpha particles bounced back.

## Definition

### Bohr's Model of Atom

Back in 20th century, scientists made several attempts to explain the structure of atom. Although unsuccessful, Rutherford's model of atom played a key role in discovery of a much successful model which was given by Neil Bohr in 1913. The Rutherford model had a major drawback; it could not explain why electrons do not fall into the nucleus by taking a spiral path. It was in line with the electromagnetic theory which says "if a charged particle undergoes accelerated motion, then it must radiate energy (lose) continuously". Bohr proposed the Quantum Theory of Atom. He retained some key postulates of Rutherford and added some points using Quantum Physics. Hence, his model is also known as Rutherford-Bohr model.

## Definition

### Calculate valency of an atom

The valency of hydrogen and all metals is positive. The valency of non-metals is negative. The valency of a molecule is zero.

Valency is calculated by calculating number of electrons present in outermost orbitals of atom of element.

For example : Valency of Nitrogen is 3 because outermost orbital contains 3 electrons.

## Formula

### Number of electrons in different shells

The maximum number of electrons that can be accommodated in a shell is given by  $2n^2$  where  $n$  is a positive integer.

For K shell,  $n=1$

For L shell,  $n=2$

For M shell,  $n=3$

For N shell,  $n=4$  and so on.

## Diagram

### Table of configuration of first 18 elements

## Example

### Examples of isotopes

The isotopes of hydrogen are Deuterium ( ${}^2\text{H}$ ) and Tritium ( ${}^3\text{H}$ ). The other elements whose



