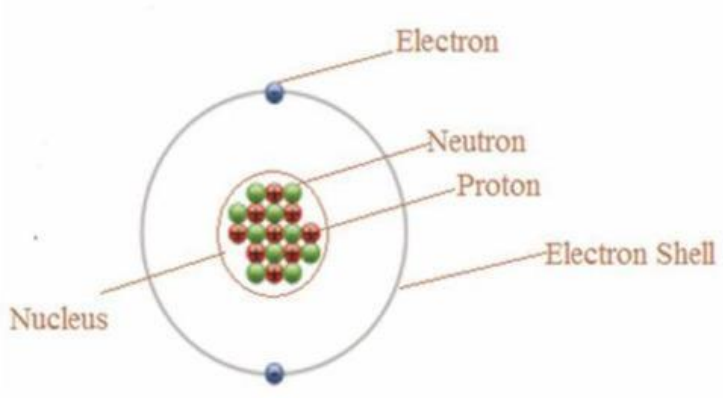
2.2 Inside an Atom

What are the two parts of atom? An atom consists of a tiny dense nucleus surrounded by electrons. The nucleus contains positively charged protons and neutral neutrons, so it is positively charged. The electrons are negatively charged. Protons and neutrons have approximately the same mass and are about 1800 times more massive than an electron. This means that most of the mass of an atom is in its nucleus. However, most of the volume of an atom is occupied by its electrons.



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The subatomic particles

Atoms possess internal structure; that is, they are made up of even smaller particles, which are called subatomic particles. A subatomic particle is a very small particle that is a building block for atoms.

An atom contains three fundamental sub atomic particles: proton, electron and neutron. An atom has a definite number of protons, electrons and neutrons. The structure of the atom describes how these particles are arranged to make an atom. The relative charge of a proton is +1. The electron is assigned a charge of −1. The neutron is assigned zero charge. Since an atom has equal number of protons and electrons, it is electrically neutral. A proton has a mass of 1.673×10^{-24} g, and a neutron has a mass of 1.675×10^{-24} g. Thus, a proton and a neutron have almost the same mass. Since the mass of an electron is very small, 9.109×10^{-28} g, its mass is assumed to be negligible or approximately zero because it is ≈ 2000 times less heavier than both the proton and neutron.

Table 2.2Nature and location of sub-atomic particles

Particle' Name	Location	Actual Mass (g)	Relative Mass (amu)	Actual Charge (C)	Relative charge (C)
Proton	Nucleus	1.673×10^{-24}	$1.00728 \approx 1$	$+1.60218\times10^{-19}$	+1
Electron	Outside nucleus (shell)	9.109×10^{-28}	$0.00055 \approx 0$	-1.60218×10^{-19}	-1
Neutron	Nucleus	1.675×10^{-24}	$1.00866 \approx 1$	0	0

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Atomic Number and Mass Number

All atoms can be identified by the number of protons and neutrons they contain. The atomic number (Z) of an atom equals the number of protons in its nucleus. The atomic number is also the number of electrons that surround the nucleus of a neutral atom. Atomic number (Z) = Number of protons= number of electrons Mass number (A) is the sum of the number of protons and the number of neutrons in the nucleus of an atom.Except for the most common form of hydrogen, which has one proton and no neutrons, all atomic nuclei contain both protons and neutrons. Mass number (A) = Number of protons + Number of neutrons. = Atomic number + Number of neutrons.

The mass and atomic numbers of a given atom are often specified using the notation:



Example: ${}^{12}_{6}C$, mass number = 12, atomic number = 6, and C is the symbol of carbon.

Determination of the electrons, protons and neutrons

- Proton is equal to the atomic number of atoms.
- Number of protons = atomic number (Z)
- Electron: The atom is neutral therefore the number of electrons is equal to the number of protons.
- Number of electrons = atomic number (Z) = number of protons

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- The number of neutrons in an atom is equal to the difference between the mass number and the atomic number or proton number.
- Number of neutrons = Mass number (A) - Number of protons

Choose the correct answer for the following questions

1) What is the center of an atom called?

A. Electron B. Neutron C. Nucleus D. Orbit

2) Which subatomic particle has a negative charge?

A. Proton B. Neutron C. Electron D. Positron

3) 15. An atom has atomic number 6 and mass number 14. How many neutrons does it have?

a) 6 b) 8 c) 14 d) 20

4) What is the charge of a neutron?

A. Positive B. Negative C. Neutral D. Variable

5) Which particles are found in the nucleus of an atom?

A. Electrons and protons
B. Neutrons and electrons
C. Protons and neutrons
D. Only electrons

6) Most of the mass of an atom is found in the:

a) Electrons
b) Nucleus
c) Electron shells
d) Empty space

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7) What determines the atomic number of an element?

A. Number of neutrons
C. Number of electrons
B. Number of protons
D. Mass number

8) If an atom has Z = 8, how many electrons does it have?

a) 4 b) 8 c) 16 d) Cannot be determined

9) What is the relative charge of a proton?

A. -1 B. 0 C. +1 D. +2

10) What keeps electrons attracted to the nucleus?

A. Gravity
C. Strong nuclear force
B. Magnetic force
D. Electrostatic force

11) Most of the volume of an atom is occupied by:

a) Protons
b) Neutrons
c) Electrons
d) The nucleus

12) Which subatomic particle has nearly the same mass as a neutron?

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

13) Which of the following is *not* a subatomic particle?

A. Proton B. Neutron C. Electron D. Molecule

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14) What is the approximate mass of a proton or a neutron?

A. 1 atomic mass unit (amu)
C. 0.5 amu
B. 0 amu
D. 2 amu

15) The number of neutrons in an atom is calculated as:

a) $Z - A$ b) $A - Z$ c) $A + Z$ d) $Z \times A$

16) Electrons are located in:

A. The nucleus
C. The electron cloud
B. The neutron cloud
D. The atomic shell

17) The mass of an electron is approximately:

a) Equal to a proton

b) Negligible compared to proton and neutron

c) Twice that of a neutron

d) Same as nucleus

18) Who proposed the nuclear model of the atom?

A. J.J. Thomson
C. Ernest Rutherford
B. Niels Bohr
D. James Chadwick

19) What is the overall charge of a neutral atom?

A. Positive
C. Zero
B. Negative
D. Cannot be determined

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20) Which of the following atoms has no neutron in its most common form?

a) Helium b) Carbon

c) Hydrogen d) Oxygen

21) What is the function of neutrons in the nucleus?

A. To give the atom its charge C. To stabilize the nucleus

B. To attract electrons D. To orbit the nucleus

22) If an atom has 6 protons, how many electrons does a neutral atom have?

A. 3 B. 6 C. 12 D. 0

23) What is the mass number of an atom?

A. Number of electrons C. Number of protons + neutrons

B. Number of protons D. Number of neutrons + electrons

24) Which of the following subatomic particles has a negative charge?

A. Proton B. Electron C. Neutron D. Nucleus

25) Why is an atom considered electrically neutral?

A. It has more protons than electrons

B. It contains only neutrons

C. It has an equal number of protons and electrons

D. Electrons have no charge

26) What is the relative charge of a neutron?

A. +1 B. –1 C. 0 D. +2

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27) What is the atomic number (Z) of an atom?

a) Number of protons

b) Number of neutrons

c) Protons + neutrons

d) Number of electrons + neutrons

28) Which subatomic particle has the least mass?

A. Proton

C. Electron

B. Neutron

D. All have equal mass

29) What is the approximate mass of a proton?

A. 1.675×10^{-24} g

C. 1.673×10^{-24} g

B. 9.109×10^{-28} g

D. 2.000×10^{-25} g

30) What is the main reason the mass of an electron is considered negligible?

A. It has no charge

B. It is located far from the nucleus

C. It is approximately 2000 times lighter than a proton

D. It moves too fast to measure

31) The mass number (A) of an atom is given by:

a) Protons only

b) Protons + neutrons

c) Neutrons only

d) Protons + electrons

32) Which two subatomic particles have almost the same mass?

A. Electron and proton

B. Proton and neutron

C. Neutron and electron

D. Proton and electron

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33) What does the structure of an atom describe?

A. The energy levels of electrons

B. The mass of an atom

C. The arrangement of protons, neutrons, and electrons

D. The chemical reactivity of an atom

34) The smallest particle into which an element can be divided and still be the same substance is called a(n) …….. .

a. Neutron b. electron c. atom ***d.*** nucleus

35) Atoms consist of which of the following? Select all that apply

A) Protons B). Molecules C) Neutrons D). Electrons

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