

2.2 Inside an atom

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: ${}^{12}_6\text{C}$, 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
- 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 question

- 1) **What does the atomic number of an element represent?**
 - A. The number of electrons
 - B. The number of protons
 - C. The number of neutrons
 - D. The total number of subatomic particles

- 2) **What is the atomic number of an atom that has 6 protons?**
 - A. 6
 - B. 12
 - C. 3
 - D. 18

- 3) **Which particle determines the identity of an element?**
 - A. Electron
 - B. Neutron
 - C. Proton
 - D. Isotope

- 4) **If an atom has 11 protons and 12 neutrons, what is its mass number?**
 - A. 12
 - B. 11
 - C. 23
 - D. 22

- 5) **The mass number of an atom is equal to the sum of:**
 - A. Protons and electrons
 - B. Electrons and neutrons
 - C. Protons and neutrons
 - D. Only neutrons

- 6) **What is the symbol for mass number?**
 - A. Z
 - B. M
 - C. A
 - D. N

- 7) **What is the atomic number of oxygen (O) if it has 8 protons?**
 - A. 7
 - B. 8
 - C. 15
 - D. 16

- 8) **Which of the following remains the same in all atoms of a particular element?**
 - A. Number of electrons
 - B. Atomic number
 - C. Number of neutrons
 - D. Mass number

- 9) If an atom has an atomic number of 17 and a mass number of 35, how many neutrons does it have?
- A. 17 B. 18 C. 35 D. 52
- 10) How is the number of neutrons calculated?
- A. Atomic number + number of electrons
- B. Mass number – atomic number
- C. Mass number + atomic number
- D. Number of protons – number of electrons
- 11) Two atoms with the same atomic number but different mass numbers are called:
- A. Ions B. Isotopes C. Electrons D. Neutrons
- 12) What is the mass number of an atom with 20 protons and 20 neutrons?
- A. 20 B. 40 C. 10 D. 0
- 13) Which of the following elements has an atomic number of 1?
- A. Oxygen C. Helium
- B. Hydrogen D. Carbon
- 14) An atom of calcium has 20 protons, 20 electrons, and 20 neutrons. What is its mass number?
- A. 20 B. 40 C. 60 D. 10
- 15) If an atom has 15 electrons and is neutral, what is its atomic number?
- A. 30 B. 14 C. 16 D. 15

- 16) Compared to the charge and mass of a proton, an electron has .**
- A) the same charge and a smaller mass
 - B) the same charge and the same mass
 - C) opposite charge and smaller mass
 - D) opposite charge and the same mass
- 17) The mass of a neutron is**
- A. about equal to the mass of a proton.
 - B. much less than the mass of a proton.
 - C. about equal to the mass of an electron.
 - D. much less than the mass of an electron.
- 18) A proton has approximately the same mass as**
- A. a neutron
 - B. an alpha particle
 - C. a beta particle
 - D. an electron
- 19) Why does the proton determine the identity of an atom?**
- A. The number of protons is also the atomic mass.
 - B. The number of protons determines chemical properties, such as reactivity.
 - C. The number of protons in an atom's nucleus determines an atom's atomic number.
 - D. The number of protons decides an atom's name.

- 20) **An atom has 17 protons and 18 neutrons. What is its mass number?**
A) 34 B) 17 C) 35 D) 18
- 21) **What is the difference between mass number and atomic number?**
A) Mass number includes only electrons
B) Atomic number includes neutrons
C) Mass number includes protons and neutrons, atomic number includes protons only
D) There is no difference
- 22) **Which of the following particles does NOT affect the mass number of an atom?**
A) Proton B) Neutron C) Electron D) Nucleon
- 23) **An element has an atomic number of 8. How many protons does it have?**
A) 4 B) 16 C) 8 D) 2
- 24) **The atomic number determines the:**
A) Number of neutrons in the nucleus B) Mass of the atom
C) Identity of the element D) Charge of the nucleus
- 25) **If an atom has an atomic number of 12 and a mass number of 24, how many neutrons does it have?**
A) 12 B) 24 C) 6 D) 36

- 26) **What are the three fundamental subatomic particles in an atom?**
- A) Proton, neutron, molecule B) Electron, nucleus, atom
C) Proton, electron, neutron D) Atom, molecule, nucleus
- 27) **What is the charge of a neutron?**
- A) +1 B) -1 C) 0 D) +2
- 28) **Why is an atom electrically neutral?**
- A) Because it has more electrons than protons
B) Because it has equal numbers of protons and electrons
C) Because neutrons cancel all charges
D) Because it has no charged particles
- 29) **What is the relative charge of a proton?**
- A) 0 B) -1 C) +1 D) +2
- 30) **Which subatomic particle has the smallest mass?**
- A) Neutron B) Proton C) Electron D) Nucleus
- 31) **The mass of a neutron is approximately:**
- A) $1.675 \times 10^{-24} \text{ g}$ B) $1.673 \times 10^{-24} \text{ g}$
C) $9.109 \times 10^{-28} \text{ g}$ D) $2.000 \times 10^{-26} \text{ g}$
- 32) **Why is the mass of the electron considered negligible?**
- A) It is the same as a proton
B) It is ≈ 2000 times lighter than proton and neutron

C) It has no charge

D) It is not inside the atom

33) **What describes how particles are arranged in an atom?**

A) Atomic theory

B) Mass number

C) Atomic structure

D) Molecular bond

34) **Which subatomic particle is negatively charged?**

A) Neutron

B) Proton

C) Electron

D) Atom

35) **Which of the following statements is true?**

A) All atoms have unequal numbers of subatomic particles

B) Neutrons are heavier than protons

C) Electrons contribute the most to atomic mass

D) Protons and neutrons have exactly the same mass

36) **Why do a proton and a neutron have almost the same mass?**

A) They are both negatively charged particles

B) They are made of the same number of electrons

C) They are both located outside the nucleus

D) They are made up of similar types of subatomic particles (quarks) and have nearly equal mass

37) What is the mass of an electron?

A) $1.675 \times 10^{-24} \text{ g}$

B) $1.673 \times 10^{-24} \text{ g}$

C) $9.109 \times 10^{-28} \text{ g}$

D) $9.109 \times 10^{-24} \text{ g}$

38) Which of the following found outside of the nucleus ?

A) Proton

B) electron

C) neutron

D) a and b

39) Which one of the following has a relative mass of 1?

A) Electron

B) Neutron

C) Proton

D) Both b and c

40) An atom is represented $^{35}_{17}\text{Cl}$. How many protons, electrons, and neutrons does this atom have?

a) 17 protons, 18 electrons, 18 neutrons

b) 17 protons, 17 electrons, 18 neutrons

c) 35 protons, 17 electrons, 18 neutrons

d) 18 protons, 17 electrons, 17 neutrons