

The Periodic Table of Elements

Introduction

The periodic table of elements is a tabular arrangement of the chemical elements, organized on the basis of their atomic numbers, electron configurations, and recurring chemical properties. Elements are presented in order of increasing atomic number. The standard form of the table consists of a grid with rows called periods and columns called groups.

The organization of the periodic table allows scientists to identify periodic trends in element properties and to predict the properties of new, yet-to-be-discovered or synthesized elements. It also provides a useful framework for analyzing chemical behavior and is widely used in chemistry, physics, and other sciences.

Element Categories

The elements in the periodic table are organized into several categories based on their properties:

Alkali Metals

Highly reactive metals that form strong bases when combined with other elements. They have one electron in their outer shell.

Alkaline Earth Metals

Reactive metals that form strong bases and have two electrons in their outer shell.

Transition Metals

Elements that form one or more stable ions with incompletely filled d-orbitals. They typically have high melting points and are good conductors.

Post-Transition Metals

Metals that are softer and have lower melting points than transition metals. They typically have poor mechanical properties.

Metalloids

Elements with properties of both metals and non-metals. They are semiconductors and can form amphoteric oxides.

Nonmetals

Elements that are typically poor conductors of heat and electricity. They tend to gain or share electrons when reacting.

Halogens

Highly reactive nonmetals that are one electron short of a full outer shell. They readily form negative ions.

Noble Gases

Elements with completely filled outer electron shells, making them extremely stable and non-reactive.

Lanthanides

A series of elements with atomic numbers 57 through 71, part of the rare earth elements.

Actinides

A series of elements with atomic numbers 89 through 103, all of which are radioactive.

Detailed Element Information

The following section provides detailed information about each element in the periodic table, including their properties, uses, and interesting facts.

Nonmetal Elements

Hydrogen (H)

Atomic Number: 1

Atomic Mass: 1.008

Group: 1

Period: 1

Block: s

Electron Configuration: $1s^1$

Description:

Hydrogen is the lightest element and most abundant chemical substance in the universe, constituting roughly 75% of all normal matter.

Carbon (C)

Atomic Number: 6

Atomic Mass: 12.011

Group: 14

Period: 2

Block: p

Electron Configuration: $1s^2 2s^2 2p^2$

Description:

Carbon is a nonmetallic chemical element that is the basis of organic compounds and is essential to all known life on Earth.

Nitrogen (N)

Atomic Number: 7

Atomic Mass: 14.007

Group: 15

Period: 2

Block: p

Electron Configuration: $1s^2 2s^2 2p^3$

Description:

Nitrogen is a colorless, odorless, tasteless gas that makes up about 78% of Earth's atmosphere and is a constituent of all living tissues.

Oxygen (O)

Atomic Number: 8

Atomic Mass: 15.999

Group: 16

Period: 2

Block: p

Electron Configuration: $1s^2 2s^2 2p^4$

Description:

Oxygen is a highly reactive nonmetal and oxidizing agent that readily forms oxides with most elements as well as with other compounds.

Phosphorus (P)

Atomic Number: 15

Atomic Mass: 30.974

Group: 15

Period: 3

Block: p

Electron Configuration: $1s^2 2s^2 2p^6 3s^2 3p^3$

Description:

Phosphorus is a multivalent nonmetal of the nitrogen group. It exists in several forms, the most common of which is white phosphorus.

Sulfur (S)

Atomic Number: 16

Atomic Mass: 32.06

Group: 16

Period: 3

Block: p

Electron Configuration: $1s^2 2s^2 2p^6 3s^2 3p^4$

Description:

Sulfur is a chemical element with symbol S and atomic number 16. It is abundant, multivalent, and nonmetallic.

Noble Gas Elements

Helium (He)

Atomic Number: 2

Atomic Mass: 4.0026

Group: 18

Period: 1

Block: s

Electron Configuration: $1s^2$

Description:

Helium is a colorless, odorless, tasteless, non-toxic, inert, monatomic gas, the first in the noble gas group in the periodic table.

Neon (Ne)

Atomic Number: 10

Atomic Mass: 20.180

Group: 18

Period: 2

Block: p

Electron Configuration: $1s^2 2s^2 2p^6$

Description:

Neon is a colorless, odorless, inert monatomic gas under standard conditions, with about two-thirds the density of air.

Argon (Ar)

Atomic Number: 18

Atomic Mass: 39.948

Group: 18

Period: 3

Block: p

Electron Configuration: $1s^2 2s^2 2p^6 3s^2 3p^6$

Description:

Argon is the third-most abundant gas in the Earth's atmosphere. It is a noble gas and is chemically inert.

Alkali Metal Elements

Lithium (Li)

Atomic Number: 3

Atomic Mass: 6.94

Group: 1

Period: 2

Block: s

Electron Configuration: $1s^2 2s^1$

Description:

Lithium is a soft, silvery-white alkali metal. Under standard conditions, it is the lightest metal and the lightest solid element.

Sodium (Na)

Atomic Number: 11

Atomic Mass: 22.990

Group: 1

Period: 3

Block: s

Electron Configuration: $1s^2 2s^2 2p^6 3s^1$

Description:

Sodium is a soft, silvery-white, highly reactive metal. It is an alkali metal and is in group 1 of the periodic table.

Potassium (K)

Atomic Number: 19

Atomic Mass: 39.098

Group: 1

Period: 4

Block: s

Electron Configuration: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

Description:

Potassium is a silvery-white metal that is soft enough to be cut with a knife. It is one of the most reactive elements in the periodic table.

Alkaline Earth Elements

Beryllium (Be)

Atomic Number: 4

Atomic Mass: 9.0122

Group: 2

Period: 2

Block: s

Electron Configuration: $1s^2 2s^2$

Description:

Beryllium is a relatively rare element in the universe. It is a divalent element which occurs naturally only in combination with other elements.

Magnesium (Mg)

Atomic Number: 12

Atomic Mass: 24.305

Group: 2

Period: 3

Block: s

Electron Configuration: $1s^2 2s^2 2p^6 3s^2$

Description:

Magnesium is a shiny gray solid which bears a close physical resemblance to the other five elements in the second column of the periodic table.

Calcium (Ca)

Atomic Number: 20

Atomic Mass: 40.078

Group: 2

Period: 4

Block: s

Electron Configuration: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

Description:

Calcium is a reactive, soft metal that is a member of the alkaline earth elements. It is the fifth most abundant element in Earth's crust.

Metalloid Elements

Boron (B)

Atomic Number: 5

Atomic Mass: 10.81

Group: 13

Period: 2

Block: p

Electron Configuration: $1s^2 2s^2 2p^1$

Description:

Boron is a chemical element with properties between those of carbon and aluminum. It is a semiconductor rather than a metallic element.

Silicon (Si)

Atomic Number: 14

Atomic Mass: 28.085

Group: 14

Period: 3

Block: p

Electron Configuration: $1s^2 2s^2 2p^6 3s^2 3p^2$

Description:

Silicon is a hard and brittle crystalline solid with a blue-grey metallic lustre. It is a tetravalent metalloid and semiconductor.

Halogen Elements

Fluorine (F)

Atomic Number: 9

Atomic Mass: 18.998

Group: 17

Period: 2

Block: p

Electron Configuration: $1s^2 2s^2 2p^5$

Description:

Fluorine is the lightest halogen and exists as a highly toxic pale yellow diatomic gas at standard conditions. It is the most electronegative element.

Chlorine (Cl)

Atomic Number: 17

Atomic Mass: 35.45

Group: 17

Period: 3

Block: p

Electron Configuration: $1s^2 2s^2 2p^6 3s^2 3p^5$

Description:

Chlorine is a yellow-green gas at room temperature. It is an extremely reactive element and a strong oxidizing agent.

Post Transition Metal Elements

Aluminum (Al)

Atomic Number: 13

Atomic Mass: 26.982

Group: 13

Period: 3

Block: p

Electron Configuration: $1s^2 2s^2 2p^6 3s^2 3p^1$

Description:

Aluminum is a silvery-white, soft, nonmagnetic, ductile metal. It is the third most abundant element in the Earth's crust.

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Created on: April 17, 2025