

Neon (Ne) - Student Datasheet

Atomic number 10 - Noble gas - Group 18 - Period 2 - p-block

Neon is a Group 18 noble gas with a closed $2s^2 2p^6$ outer shell. It is famous for its intense red-orange electrical-discharge glow, yet in Earth's atmosphere it is only a trace gas at about 18 parts per million.

Quick reference

Atomic number	10
Relative atomic mass	20.180
Electron configuration	[He] $2s^2 2p^6$
Group	18 · noble gas
Density	0.000825 g/cm ³
Melting point	24.56 K
Boiling point	27.104 K
Ordinary form	Monatomic gas

Structure & orbitals

Reference isotope: ^{20}Ne - 10 protons + 10 neutrons. Ground-state electron configuration: [He] $2s^2 2p^6$.

The occupied 2s orbital is spherical with one radial node; the occupied 2p orbitals are two-lobed with a nodal plane and selectable orientation. These are atomic probability-density teaching models for a closed-shell atom, not glowing electron tracks.

Material / molecular structure: At ordinary conditions neon is a monatomic gas; low-temperature solid neon adopts a close-packed/FCC structure

Phase / temperature context

At approximately standard pressure, neon is solid below 24.56 K, liquid only in the narrow interval from 24.56 K to 27.104 K, and gaseous above 27.104 K.

Five things to remember

1. Atomic number 10 means every neon nucleus contains 10 protons.
2. The ground state [He] $2s^2 2p^6$ closes the second shell.
3. Neon is a monatomic noble gas at ordinary conditions.
4. Natural neon is dominated by stable ^{20}Ne , with smaller ^{22}Ne and ^{21}Ne abundances.
5. Excited neon emits a characteristic red-orange glow in electrical discharge tubes.

Real-world context

Neon signs

Electrical excitation of neon produces an intense red-orange emission. Many signs casually called “neon” use other gases or phosphors for other colors.

Spectroscopy

Neon’s sharp emission lines are a classic demonstration of quantized atomic energy levels.

Lasers

Neon participates in helium-neon lasers, where neon atoms provide the familiar laser-transition emission.

Cryogenics

Liquid neon is used as a cryogenic refrigerant in specialized applications.

Atmosphere

Neon is globally mixed in dry air at only about 18.18 ppm by volume, so it is obtained from air rather than mined from deposits.

Where on Earth? / geography modes

Atmospheric neon - ≈18.18 ppm

Neon is a globally mixed trace component of dry air, so country pins would misrepresent its occurrence

Examples/context: Global atmosphere; Trace noble gas

Industrial extraction - Liquid-air separation

Commercial neon comes from air-separation streams and further purification rather than from mines

Examples/context: Air separation; Rare-gas purification; Specialty gas

Discovery geography - London · 1898

William Ramsay and Morris Travers identified neon at University College London while studying fractions from liquefied air

Examples/context: University College London; Spectroscopy

Isotopes

Isotope	Status / timescale	Why it matters
²⁰ Ne	Stable · ≈90.48% natural abundance	The dominant natural isotope; 10 protons and 10 neutrons.
²¹ Ne	Stable · ≈0.27%	A minor stable isotope useful in geochemical and cosmogenic-isotope studies.
²² Ne	Stable · ≈9.25%	The second most abundant natural isotope.

Evidence note

Atomic/isotope and phase data are measured/evaluated. Atmospheric abundance is a global composition value, so the occurrence map uses a global layer instead of invented country pins.

Review questions

What is neon's atomic number?

Answer: 10. Neon is element 10.

How many valence electrons does neon have?

Answer: 8. Its outer shell is $2s^2 2p^6$.

What color is ordinary neon gas without electrical excitation?

Answer: Colorless. The famous red-orange color is emission from excited atoms in a discharge.

Which isotope dominates natural neon?

Answer: ^{20}Ne . ^{20}Ne accounts for about 90.48% of natural neon.

How is commercial neon obtained?

Answer: Separated from air. Neon is a trace atmospheric gas recovered during industrial air separation.

Frequently asked questions

What is neon?

Neon is chemical element 10, a Group 18 noble gas.

How many valence electrons does neon have?

Eight in its outer shell: the ground-state configuration ends $2s^2 2p^6$.

How many protons, neutrons and electrons does neon have?

All neon atoms have 10 protons. A neutral atom has 10 electrons. The common isotope ^{20}Ne has 10 neutrons.

Is neon a metal?

No. Neon is a nonmetal noble gas.

Why does neon glow red-orange?

Excited neon atoms emit light at characteristic wavelengths when electrons relax between quantized energy levels. The gas itself is colorless without excitation.

Where is neon found?

It is a trace component of Earth's atmosphere at roughly 18 parts per million in dry air and is also abundant cosmically. Commercial neon is separated from air.

Sources used for this guide

- Royal Society of Chemistry - Neon
<https://periodic-table.rsc.org/element/10/neon>
- NIST - Atomic Data for Neon
<https://www.physics.nist.gov/PhysRefData/Handbook/Tables/neontable1.htm>
- NOAA - Composition of the atmosphere
<https://www.noaa.gov/jetstream/atmosphere>
- WebElements - Neon crystal structure
https://www.webelements.com/neon/crystal_structure.html

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