SI Biology - Full Discipline Demo

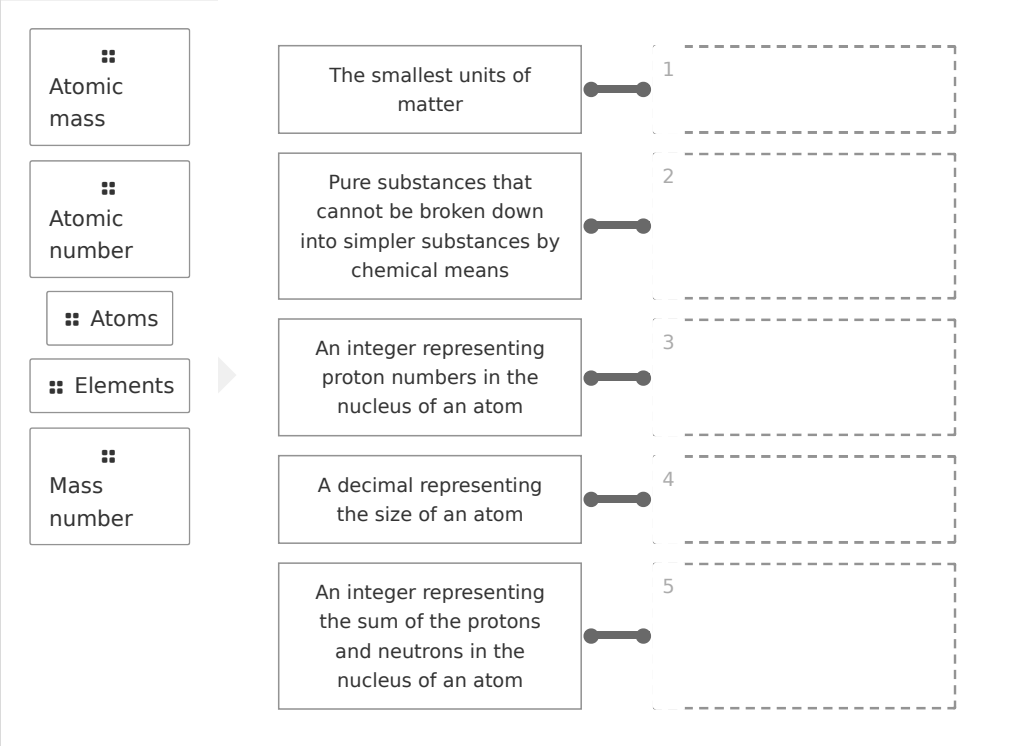
Chemistry Fundamentals

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Biology - Full Discipline Demo
Course	SI Biology - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Match each term with the best description.

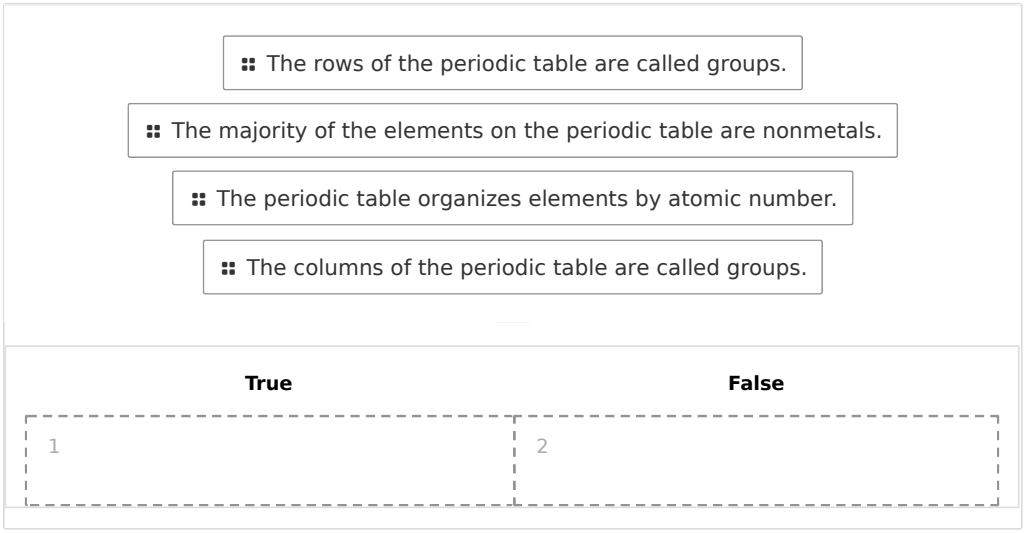


Correct answers:

1 Atoms 2 Elements 3 Atomic number 4 Atomic mass

5 Mass number

Categorize each statement as true or false.



Correct answers:

1 The periodic table organizes elements by atomic number.

The columns of the periodic table are called groups.

2 The rows of the periodic table are called groups.

The majority of the elements on the periodic table are nonmetals.

Exploration

The mass of an atom is determined by the mass of its electrons.

- True
- False ✔

Elements are classified by their ____.

- atomic number
- atomic mass
- oxidation state
- All of the above ✔

Group 1 of the periodic table consists of _____.

- alkali metals ✔
- noble gases
- transition metals
- halogens

Atoms of an element may differ in mass, but they always have the same number of _____.

- electrons
- isotopes
- neutrons
- protons ✔

Exercise 1

What are isotopes? How does the naming of the carbon isotopes reflect their composition?

Isotopes are forms of an element that contain the same number or protons, but contain different numbers of neutrons, and thus have different atomic masses. Each isotope of carbon is named after the number of particles (mass number) in their nuclei: 12 for carbon-12, 13 for carbon-13, and 14 for carbon-14.

How do your calculated atomic masses of oxygen and sulfur recorded in Data Table 2 compare to the atomic masses listed in the period table: oxygen = 15.999 amu, sulfur = 32.065 amu? If your answers differed, explain where the error may have been incurred.

Student answers will vary. Both calculated atomic masses are within 0.001 of published values which vary by this degree in different versions of the periodic

table. Otherwise, differences could be due to rounding or calculation errors.

Data Table 1: Isotope Information
(SAMPLE ANSWER BELOW)

	Isotope A	Isotope B	Isotope C
Number of Protons	6	6	6
Number of Neutrons	6	7	8
Atomic Number	6	6	6
Mass Number	12	13	14
Isotope Name	Carbon-12	Carbon-13	Carbon-14

Photo 1: Isotope B Diagram
(SAMPLE ANSWER BELOW)

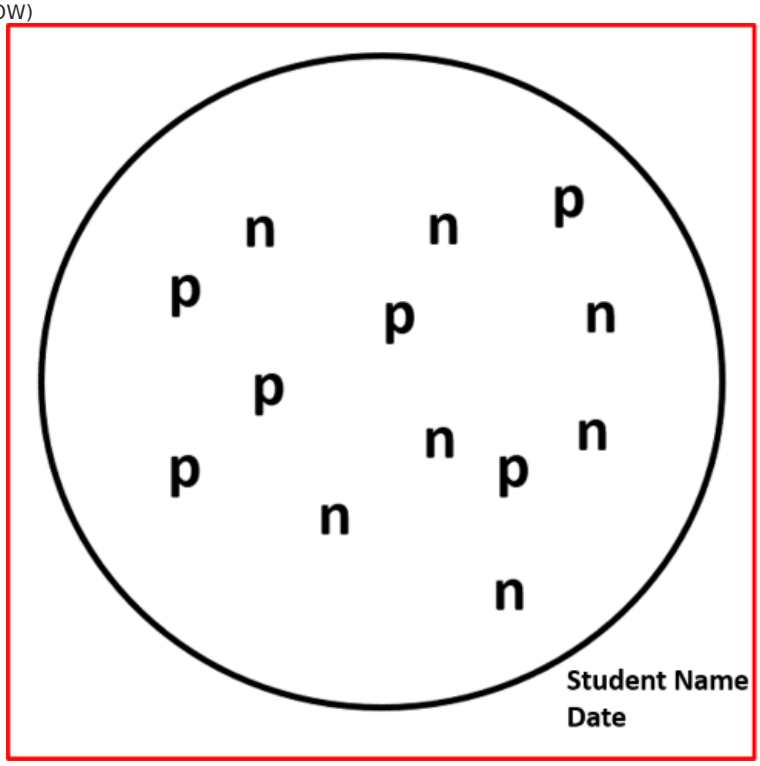
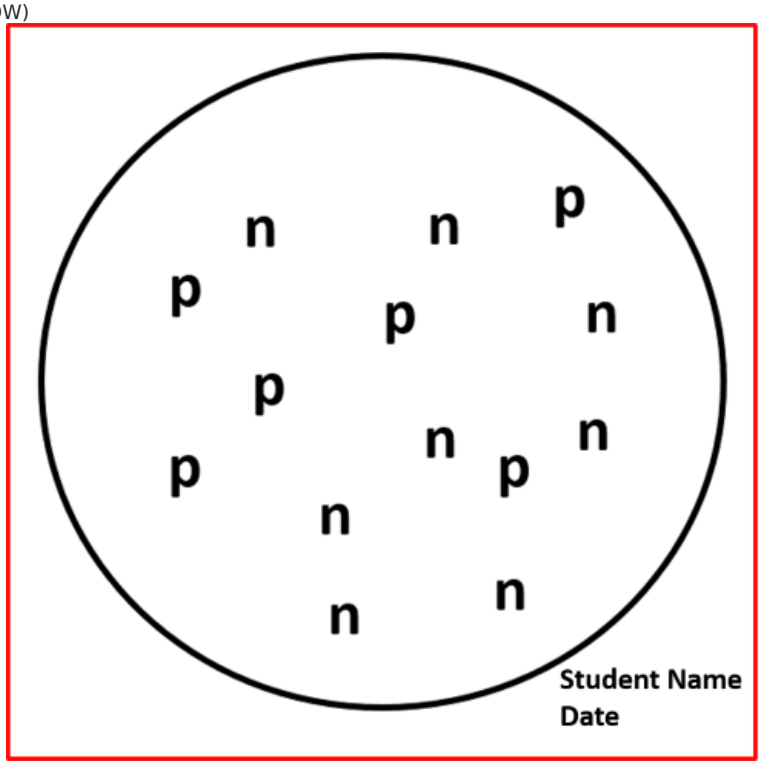


Photo 2: Isotope C Diagram
(SAMPLE ANSWER BELOW)



Data Table 2: Isotope and Atomic Masses for Oxygen and Sulfur
(SAMPLE ANSWER BELOW)

Element	Naturally Occurring Isotope	Natural Abundance of Isotope (%)	Mass of Isotope (amu)	Calculated Mass of Element (amu)
Oxygen	Oxygen-16	99.757	15.994915	15.999
	Oxygen-17	0.038	16.999132	
	Oxygen-18	0.205	17.999160	
Sulfur	Sulfur-32	94.99	31.972071	32.065
	Sulfur-33	0.75	32.971459	
	Sulfur-34	4.25	33.967867	
	Sulfur-36	0.01	35.967081	

Photo 3: Atomic Mass Calculations
(SAMPLE ANSWER BELOW)

$$O = 15.999 \text{ amu} = \frac{[(15.994915 \text{ amu} \times 99.757\ \%) + (16.999132 \text{ amu} \times 0.038\ \%) + (17.999160 \text{ amu} \times 0.205\ \%)]}{100\%}$$

$$S = 32.065 \text{ amu} = \frac{[(31.972071 \text{ amu} \times 94.99\ \%) + (32.971459 \text{ amu} \times 0.75\ \%) + (33.967867 \text{ amu} \times 4.25\ \%) + (35.967081 \text{ amu} \times 0.01\ \%)]}{100\%}$$

Student Name
Date

Exercise 2

What is the difference between the atomic number and atomic weight of an element? Which of these values is used to order elements in the periodic table? Reference Photo 4 in your explanation.

The atomic number of an element represents the number of protons in the nucleus of each atom, and the atomic weight of an element represents the size of the atom. Elements are ordered in the periodic table by their atomic numbers and shown in Photo 4.

Are most elements solids, liquids, or gases at STP? Explain your answer by referencing the periodic table uploaded in Photo 5.

Most of the 118 elements are solids at STP as illustrated in the shaded periodic table in Photo 5. Only the noble gases, hydrogen, chlorine, oxygen, fluorine, and nitrogen are gases. Only bromine and mercury are liquids at STP.

What are alkaline earth metals? Which of the elements of Data Table 3 are included in this category?

Alkaline earth metals are silver-colored and soft, and have relatively low densities, melting points, and boiling points. In chemical terms, the alkaline earth metals react with the halogens to form the alkaline earth metal halides. Beryllium from Data Table 3 is an alkaline earth metal.

Photo 4: Subcategories of the Periodic Table
(SAMPLE ANSWER BELOW)

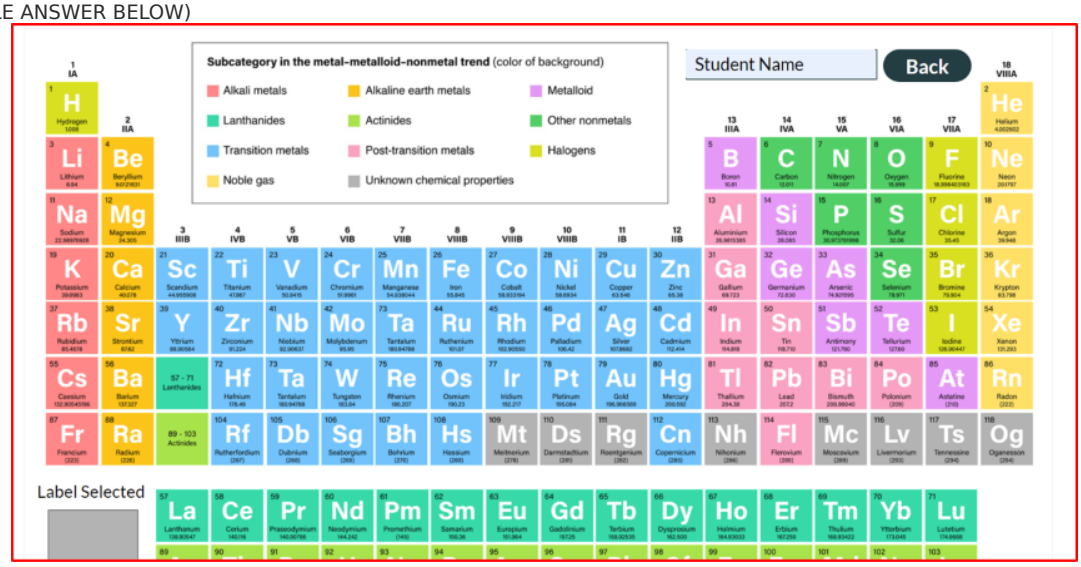
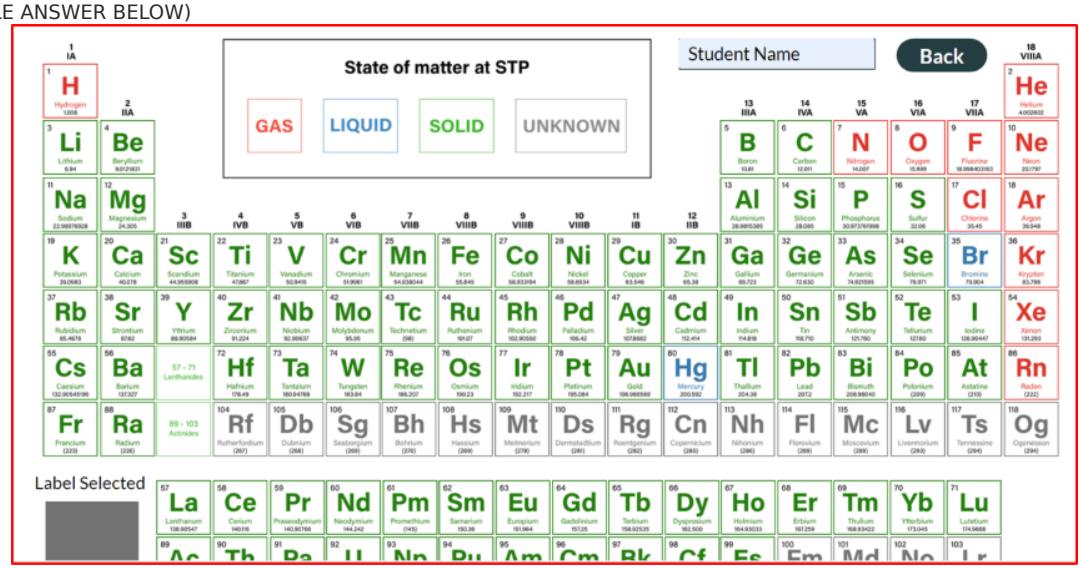


Photo 5: States of Matter on Periodic Table

(SAMPLE ANSWER BELOW)



Data Table 3: Element Groups and Descriptions
(SAMPLE ANSWER BELOW)

Element	Atomic Number	Group Number	Metal/ Nonmetal/ Metalloid	State of Matter	Atomic Weight
Neon	10	18	Nonmetal	Gas	20.1797
Bromine	35	17	Nonmetal	Liquid	79.904
Beryllium	4	2	Metal	Solid	9.0121831
Platinum	78	10	Metal	Solid	195.0844
Potassium	19	1	Metal	Solid	39.0983
Silicon	14	14	Metalloid	Solid	28.085
Sulfur	16	16	Nonmetal	Solid	32.06

Competency Review

The number of protons plus _____ of an atom is called the mass number.

- electrons
- neutrons ✔
- isotopes
- elements

Each element is composed of atoms with the same number of _____.

- protons ✔
- neutrons
- electrons
- isotopes

Atomic mass is a decimal number representing the mass of an atom.

- True ✔
- False

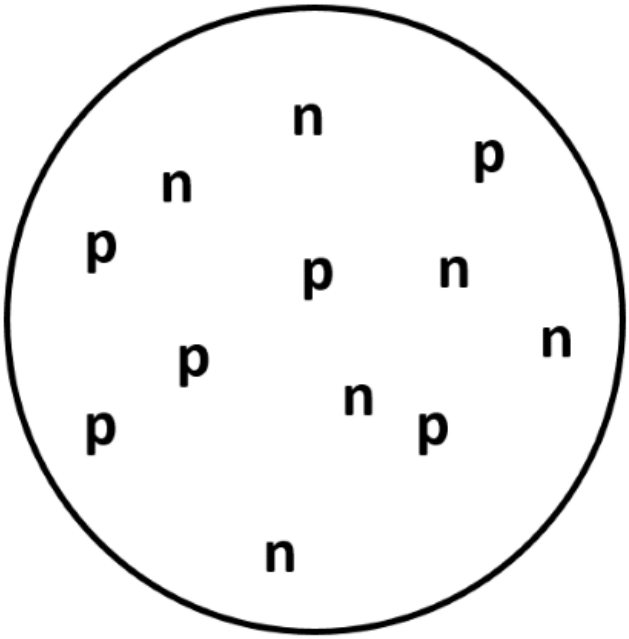
Isotopes are forms of elements with differing numbers of _____.

- protons
- electrons
- neutrons ✔
- atoms

Nonmetals are located toward the _____ of the periodic table.

- lower left
- upper left
- center
- upper right ✔

The carbon _____ isotope is represented by the diagram below.



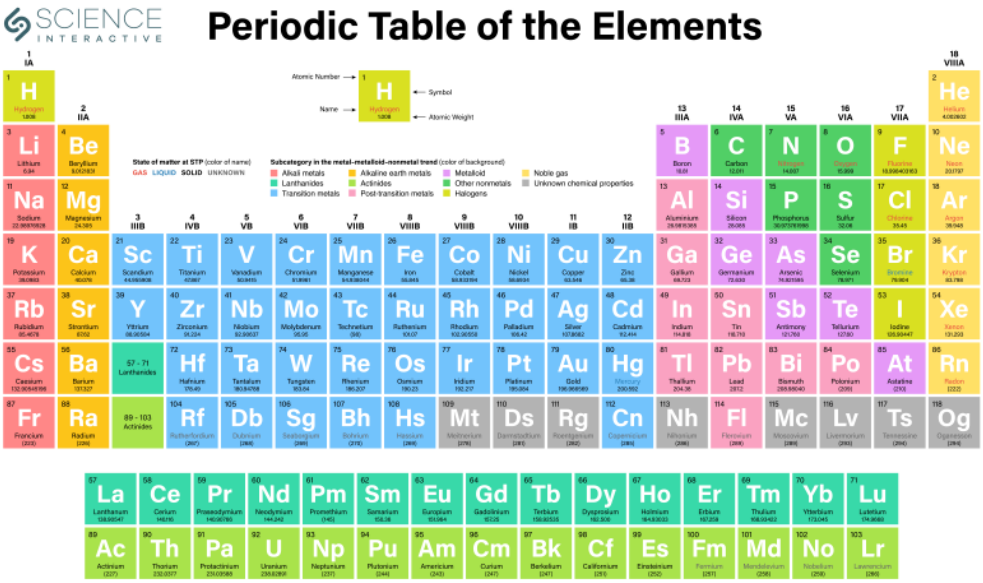
- 11
- 12 ✔
- 13
- 14

The atomic mass of oxygen is calculated as _____ amu when using the isotope mass and abundance data below.

Isotope	Abundance (%)	Mass (amu)
Oxygen 16	99.757	15.994915
Oxygen 17	0.038	16.999132
Oxygen 18	0.205	17.999160

- 15.999 ✔
- 32.065
- 99.757
- 17.999

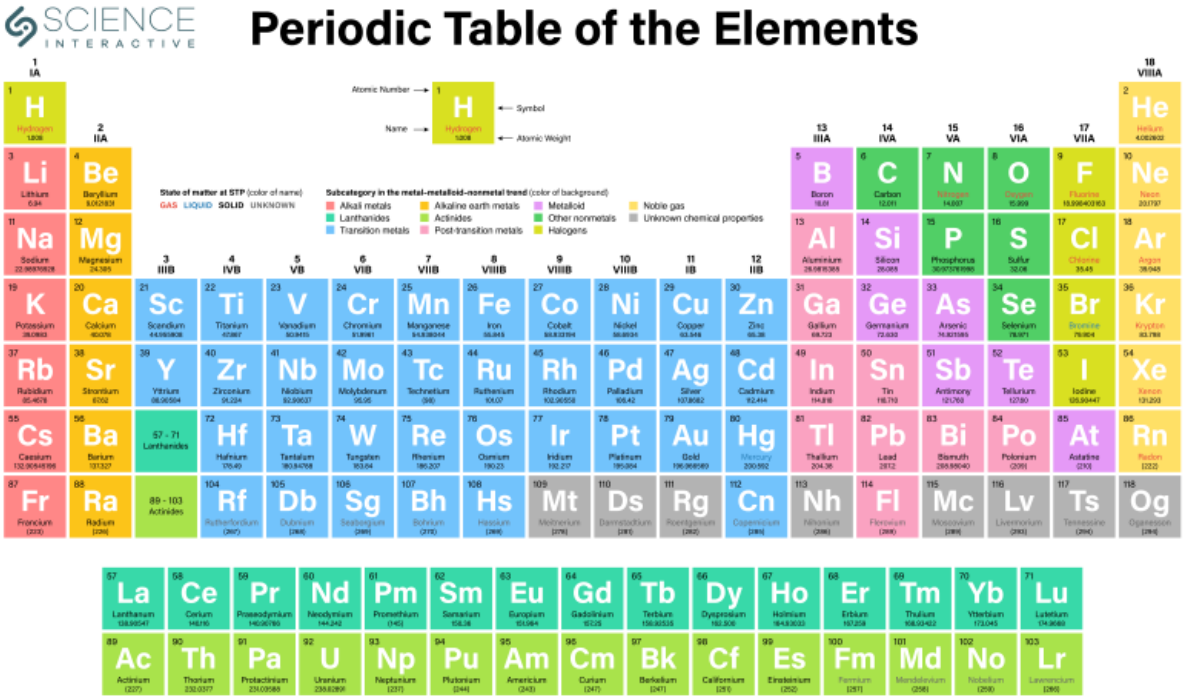
Using the shaded periodic table below, the element argon is classified as a(n) _____ .



- alkali metal
- metalloid
- transition metal
- noble gas ✔

Extension Questions

Lithium naturally exists as two isotopes. Li-6 has an atomic mass of 6.015 amu and Li-7 has an atomic mass of 7.016 amu. Apply your knowledge of isotopes, atomic mass, and the periodic table to predict which isotope is most abundant and the physical appearance and properties of the isotope.



(SAMPLE ANSWER BELOW)

Li-7 would be more abundant because the mass of this isotope is closer to the listed mass for Li in the periodic table of 6.94 amu. Lithium is located in Group 1 of the periodic table and is classified as an alkali metal. For these reasons the isotope would be expected to appear as a shiny, soft, highly reactive metal at standard temperature and pressure and readily lose the outermost electron to form a cation with charge +1. It can also be cut easily with a knife due to softness, exposing a shiny surface that tarnishes rapidly in air due to oxidation by atmospheric moisture.