

SI Chemistry - Full Discipline Demo

Introduction to the Periodic Table

Final Report - Answer Guide

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

Test Your Knowledge

Match the scientist with his contribution to chemistry.

■ Aristotle

■ Dalton

■ Lavoisier

■ Mendeleev

The four elements that make up all substances are earth, air, fire, and water.

Elements can be organized into columns and rows based on recurring properties.

Elements are made of tiny, indivisible particles called atoms.

Elements are substances that cannot be broken down further.

1

2

3

4

Correct answers:

1 Aristotle 2 Mendeleev 3 Dalton 4 Lavoisier

Categorize each statement as true or false.

⚡ Elements in vertical columns have different properties. ⚡ Metalloids are also known as semimetals. ⚡ The horizontal rows on the periodic table are called groups. ⚡ The majority of the elements on the periodic table are nonmetals. ⚡ The periodic table arranges elements according to atomic number, not weight. ⚡ The vertical columns are known as groups.	
True	False
1	2

Correct answers:

1

The periodic table arranges elements according to atomic number, not weight.

The vertical columns are known as groups.

Metalloids are also known as semimetals.

2

Elements in vertical columns have different properties.

The horizontal rows on the periodic table are called groups.

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

Match each symbol to the correct element.

⚡ Ag	Phosphorus	1
⚡ Au	Sodium	2
⚡ Fe	Gold	3
⚡ K	Iron	4
⚡ Na	Silver	5
⚡ P	Potassium	6

Correct answers:

1 P 2 Na 3 Au 4 Fe 5 Ag 6 K

Exploration

The idea that the four basic substances, or elements, are earth, air, fire, and water was proposed by ____.

- ☐ the ancient Egyptians
- ☐ alchemists in the Middle Ages
- ☒ the ancient Greeks
- ☐ stone-age humans
- ☐ Hindu philosophers



Scientists discovered that elements sharing similar properties also have atoms containing a similar arrangement of electrons.

- ☒ True
- ☐ False



Metallic elements are found on the ____ side of the periodic table and nonmetals are found on the ____ side of the periodic table.

- ☐ lower left; upper right ✓
- ☐ lower right; upper left
- ☐ upper right; lower left
- ☐ upper left; lower right

The symbol for the element sodium is ____.

- ☐ S
- ☐ So
- ☒ Na ✓
- ☐ Ns

Exercise 1

Describe how the properties of the different types of elements (metals, nonmetals, metalloids) differ.

Metals tend to be solids at room temperature and exhibit properties such as: good conductors of heat and electricity, shiny surfaces, malleable, ductile, high melting points, high densities.

Nonmetals can be solids, liquids or gases at room temperature and are typically nonconductors or insulators. As solids, nonmetals tend to be brittle and have dull surfaces with lower melting points and densities.

Metalloids are typically solids that conduct heat and electricity only under very specific circumstances (semiconductors). They tend to be shiny and somewhat malleable with lower densities and melting points than metals but higher than those of nonmetals.

Explain what characteristics of metalloids are more like metals and which are more like nonmetals based on the research you conducted and the information recorded in Data Table 1.

Metalloids have characteristics of both metals and nonmetals. They are typically shiny solids at room temperature and can be malleable like metals but some are brittle like the nonmetal solids. They are neither conductors nor insulators but semiconductors. Their densities lie in between the high-density metals and the low-density nonmetals.

Define the term “transition.” How does this definition apply to the transition metals?

The word, transition, indicates a change between circumstances or phases. In the case of the periodic table, the transition elements are between the metals and nonmetals. We might predict that the elements become less metallic in their properties going across the periodic table toward the nonmetal elements.

Photo 1: Completed Periodic Table
(SAMPLE ANSWER BELOW)

HANDS-ON SCIENCE LABS

PERIODIC TABLE OF ELEMENTS

1A 2A 3A 4A 5A 6A 7A 8A

1 H Helium 2 He

2 Li Lithium 3 Be Beryllium 4 B Boron 5 C Carbon 6 N Nitrogen 7 O Oxygen 8 F Fluorine 9 Ne Neon

3 Na Sodium 4 Mg Magnesium 5 Al Aluminum 6 Si Silicon 7 P Phosphorus 8 S Sulfur 9 Cl Chlorine 10 Ar Argon

4 K Potassium 5 Ca Calcium 6 Sc Scandium 7 Ti Titanium 8 V Vanadium 9 Cr Chromium 10 Mn Manganese 11 Fe Iron 12 Co Cobalt 13 Ni Nickel 14 Cu Copper 15 Zn Zinc 16 Ga Gallium 17 Ge Germanium 18 As Arsenic 19 Se Selenium 20 Br Bromine 21 Kr Krypton

5 Rb Rubidium 6 Sr Strontium 7 Y Yttrium 8 Zr Zirconium 9 Nb Niobium 10 Mo Molybdenum 11 Tc Technetium 12 Ru Ruthenium 13 Rh Rhodium 14 Pd Palladium 15 Ag Silver 16 Cd Cadmium 17 In Indium 18 Sn Tin 19 Sb Antimony 20 Te Tellurium 21 I Iodine 22 Xe Xenon

6 Cs Cesium 7 Ba Barium 8 La Lanthanum 9 Hf Hafnium 10 Ta Tantalum 11 W Tungsten 12 Re Rhenium 13 Os Osmium 14 Ir Iridium 15 Pt Platinum 16 Au Gold 17 Hg Mercury 18 Tl Thallium 19 Pb Lead 20 Bi Bismuth 21 Po Polonium 22 At Astatine 23 Rn Radon

7 Fr Francium 8 Ra Radium 9 Ac Actinium 10 Rf Rutherfordium 11 Db Dubnium 12 Sg Seaborgium 13 Bh Bohrium 14 Hs Hassium 15 Mt Meitnerium 16 Ds Darmstadtium 17 Rg Roentgenium 18 Cn Copernicium 19 Nh Nihonium 20 Fl Flerovium 21 Mc Moscovium 22 Lv Livermorium 23 Ts Tennessine 24 Og Oganesson

*LANTHANIDES

**ACTINIDES

57 La Lanthanum 58 Ce Cerium 59 Pr Praseodymium 60 Nd Neodymium 61 Pm Promethium 62 Sm Samarium 63 Eu Europium 64 Gd Gadolinium 65 Tb Terbium 66 Dy Dysprosium 67 Ho Holmium 68 Er Erbium 69 Tm Thulium 70 Yb Ytterbium 71 Lu Lutetium

89 Ac Actinium 90 Th Thorium 91 Pa Protactinium 92 U Uranium 93 Np Neptunium 94 Pu Plutonium 95 Am Americium 96 Cm Curium 97 Bk Berkelium 98 Cf Californium 99 Es Einsteinium 100 Fm Fermium 101 Md Mendelevium 102 No Nobelium 103 Lr Lawrencium

ATOMIC NUMBER 82 SYMBOL Pb OXIDATION STATE +2, +4 NAME Lead ATOMIC MASS 207.2

Data Table 1: Physical and Chemical Properties of Elements
(SAMPLE ANSWER BELOW)

Group	Ductile/ Malleable	Conductivity	Melting & Boiling Points	Presence in the Environment	Reactivity	Electron Behavior
Alkali Metal - Na	Ductile and malleable	Good conductor of heat and electricity	Low melting and boiling points compared to other metals	Does not occur uncombined in nature	Highly reactive	Readily loses the 1 electron in its outer shell
Alkaline Earth Metal - Mg	Ductile and malleable	Good conductor of heat and electricity	High melting and boiling points	Does not occur uncombined in nature	Highly reactive	Loses electrons in reactions
Transition Metal - Fe	Ductile and malleable	Good conductor of heat and electricity	High melting and boiling points	Does not occur uncombined in nature	Highly reactive	Loses electrons and exhibits more than 1 oxidation state
Metalloids - Ge	Usually ductile and malleable	Semiconductor of heat and electricity	High melting and boiling points	Does not occur uncombined in nature	Intermediate reactivity	Can lose or gain electrons in reactions
Halogen - Cl	Not ductile or malleable	Poor conductor of heat and electricity	Low melting and boiling points	Does not occur uncombined in nature	Very reactive	Readily gains electrons
Noble gas - Ar	Not ductile or malleable	Poor conductor of heat and electricity	Low melting and boiling points	Occurs uncombined in nature	Unreactive	Has a complete valence electron shell so little tendency to

					gain or lose electrons
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Data Table 2: Element Groups and Descriptions
(SAMPLE ANSWER BELOW)

Element	Group Name	Group Number	Metal/Nonmetal/Metalloid	Description
Neon	Noble gas	18	Nonmetal	Colorless, tasteless, and odorless gas, unreactive, nonconductive
Bromine	Halogen	17	Nonmetal	Not found as a free element (uncombined) in nature, reddishbrown liquid that vaporizes readily at room temperature to a red gas with a strong disagreeable odor
Beryllium	Alkaline earth metal	2	Metal	Silvery white, relatively soft, low density, conductive solid that is not found as a free element in nature but commonly found combined in alloys with copper or nickel
Platinum	Transition metal	10	Metal	Silvery-white, ductile, malleable, conductive solid with a high melting point for this type of element
Potassium	Alkali metal	1	Metal	Soft, easily cut with a knife to expose a silvery surface that rapidly oxidizes in air, never found uncombined in nature
Silicon	Semimetal	14	Metalloid	Metallic luster and grayish solid, very common in rocks and gemstones such as amethyst and opal, semiconductor
Sulfur	Nonmetal	16	Nonmetal	Pale yellow, odorless, brittle solid at room temperature, nonconductor

Competency Review

_____ found that elements could be organized into columns and rows based on recurring properties.

- ☐ Antoine de Lavoisier
- ☐ John Dalton
- ☒ Dimitri Mendeleev
- ☐ Aristotle



Electronegativity is a measure of the tendency of an atom to attract a bonding pair of electrons. Describe how electronegativity is illustrated on the periodic table including trends between groups and periods and significance of atom size.

The known elements were organized into four categories (gases, nonmetals, metals, and earths) by ____.

- ☐ Antoine de Lavoisier

☐ John Dalton

☐ Dimitri Mendeleev

☐ Aristotle

✓

Today's periodic table organizes elements by ____.

- ☐ atomic weight

☒ atomic number

☐ atomic mass

☐ time of discovery

✓

The ____ include the elements in group 1 of the periodic table.

- ☐ alkaline earth metals

☒ alkali metals

☐ transition metals

☐ primary metals

✓

The atomic number represents the number of protons and neutrons in one atom of the element.

- ☐ True

☒ False

✓

_____ have low melting and boiling points compared to other metals.

- ☐ Alkaline earth metals
- ☒ Alkali metals ✓
- ☐ Transition metals
- ☐ Primary metals

_____ are highly reactive nonmetals that form strongly acidic compounds with hydrogen.

- ☐ Alkaline earth metals
- ☐ Noble gases
- ☐ Metalloids
- ☒ Halogens ✓

Electricity and heat travel more easily through metals than metalloids.

- ☒ True ✓
- ☐ False

Magnesium is a silvery-white, low density, reasonably strong element that will tarnish in air to form a thin oxide coating. Based on these characteristics, magnesium is a _____.

- ☒ metal ✓
 - ☐ metalloid
 - ☐ nonmetal
-

Astatine is an extremely radioactive element that forms salts with elements like sodium. Based on these characteristics, astatine is a(n) ____.

- ☐ alkaline earth metal
- ☐ transition metal
- ☒ halogen
- ☐ noble gas

