

TEKS Cluster: Properties of Atoms

8.5 Matter and energy. The student knows that matter is composed of atoms and has chemical and physical properties.

Structure of Atoms

Readiness Standards

- 8.5(A) describe the structure of atoms, including the masses, electrical charges, and locations, of protons and neutrons in the nucleus and electrons in the electron cloud
- 8.5(B) identify that protons determine an element's identity and valence electrons determine its chemical properties, including reactivity

Periodic Table

Readiness Standards

- 8.5(C) interpret the arrangement of the Periodic Table, including groups and periods, to explain how properties are used to classify elements

Supporting Standards

- 6.6(A) compare metals, nonmetals, and metalloids using physical properties such as luster, conductivity, or malleability

Grades 6 and 7 student expectations eligible for assessment on Grade 8 STAAR included to support the review of important tested content before STAAR.

TEKS Scaffold

TEKS	Student Expectation
C.6(D)	express the arrangement of electrons in atoms of representative elements using electron configurations and Lewis valence electron dot structures (R)
I.6(B)	relate chemical properties of substances to the arrangement of their atoms (S)

8.5 Matter and energy. The student knows that matter is composed of atoms and has chemical and physical properties. The student is expected to:

8.5(A)

(A) describe the structure of atoms, including the masses, electrical charges, and locations, of protons and neutrons in the nucleus and electrons in the electron cloud

6.5(A)	know that an element is a pure substance represented by a chemical symbol and that a compound is a pure substance represented by a chemical formula (R)
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Stimulus

Investigation	Demonstration	Graph	Chart/Table
Diagram	Visual/Image/Illustration	Web/Cycle/Chain	Model*
Informational Text/List*	Map	Formula/Equation	

Academic Vocabulary

atom*	electron*	neutral (no) charge*
atomic mass*	electron cloud*	neutron*
atomic nucleus*	element*	particle*
atomic number*	mass*	positive charge*
Bohr model*	mass number*	proton*
charge*	negative charge*	

Content Builder

Describe the structure of atoms, including:

- Masses
- Electrical charges
- Location of protons and neutrons

Major concepts in this standard include:

- The nucleus contains protons and neutrons
- Electrons are found in the electron cloud which includes the area around an atomic nucleus
- Use different models to show and describe the structure of atoms (Bohr, etc.)
- The number of neutrons and electrons can vary in an atom, but the protons will not vary

Instructional Implications

Understanding the structure of atoms is foundational for understanding their classification and application. Using precise scientific language to describe atomic structure allows for further concept development. Students may struggle with the concept because it is abstract in nature, generally unobservable in the context of the classroom, and relies on relationships among parts and not just the identification of subatomic particles.

When you teach this concept, remember to:

- Create experiences beyond the exploration of a model to understand the concepts.
- Vary the models used to show atomic structure.
- Provide opportunities for calculating mass beyond application of the algorithm.
- Differentiate mass number and atomic mass.

Learning from Mistakes

Students may make the following mistakes:

- Misidentifying an atom based on subatomic particle data
- Confusing the charge of the nucleus and electron cloud
- Not recognizing subatomic particles, charges, location, or how to use an element symbol to determine these values
- Confusing the mass number of an element and an atom's atomic mass
- Not recognizing the majority of the mass of an atom is in the nucleus and that the majority of the volume is in the electron cloud
- Confusing the vocabulary for parts of an atom

Interesting Items

8.5(A) 2023 #9	8.5(A) 2015 #17
8.5(A) 2022 #32	8.5(A) 2014 #19
8.5(A) 2019 #29	8.5(A) 2013 #15
8.5(A) 2016 #17	

TEKS Scaffold

TEKS	Student Expectation
C.6(D)	express the arrangement of electrons in atoms of representative elements using electron configurations and Lewis valence electron dot structures
I.6(B)	relate chemical properties of substances to the arrangement of their atoms (S)

8.5 Matter and energy. The student knows that matter is composed of atoms and has chemical and physical properties. The student is expected to:

8.5(B)

(B) identify that protons determine an element's identity and valence electrons determine its chemical properties, including reactivity

Stimulus

Investigation	Demonstration	Graph	Chart/Table*
Diagram	Visual/Image/ Illustration	Web/Cycle/Chain	Model*
Informational Text/List*	Map	Formula/Equation	

Academic Vocabulary

chemical property
element*
proton*
reactivity (reactive*)
valence electron*

Content Builder

- Number of protons in nucleus determines atom's identity
- Valence electrons determine atom's chemical properties
- Valence electrons determine atom's reactivity

Major concepts in this standard include:

- Protons are located in the nucleus and identify the element
- Valence electrons are found in the outer most portion of the electron cloud
- Reactivity is directly related to the octet rule; i.e., eight valence electrons in the outer shell Hydrogen and Helium are the exceptions as they have two valence electrons
- Atomic number of an element provides the number of protons and electrons in one atom if the atom is neutral
- Valence electrons are directly related to representative groups

Instructional Implications

Understanding the structure of atoms and subatomic particle placement is essential to the application of element identity, chemical properties, and reactivity. Students need to use specific scientific language to describe how to identify an element's identity, determine reactivity, and infer chemical properties based on Periodic Table placement. Students may struggle with the concept because it is abstract in nature, generally unobservable in the context of the classroom, and relies on relationships among parts and not just the identification of subatomic particles.

When you teach this concept, remember to:

- Vary the models used to show atomic structure.
- Create opportunities to identify the element given subatomic particle information other than protons.
- Create opportunities for students to predict reactivity.
- Provide opportunities for students to predict chemical properties in a representative group.

Learning from Mistakes

Students may make the following mistakes:

- Not understanding what valence electrons are or how they predict reactivity
- Not recognizing that the atomic number is the number of protons and that protons determine the element's identity

Interesting Items

8.5(B) 2017 #23
8.5(B) 2015 #11
8.5(B) 2015 #39
8.5(B) 2013 #33

TEKS Scaffold

TEKS	Student Expectation
C.5(C)	interpret periodic trends, including atomic radius, electronegativity, and ionization energy, using the Periodic Table (R)
C.5(B)	identify and explain the properties of chemical families, including alkali metals, alkaline earth metals, halogens, noble gases, and transition metals, using the Periodic Table (R)
I.6(D)	relate the placement of an element on the Periodic Table to its physical and chemical behavior, including bonding and classification (S)

8.5 Matter and energy. The student knows that matter is composed of atoms and has chemical and physical properties. The student is expected to:

- 8.5(C) **(C) interpret the arrangement of the Periodic Table, including groups and periods, to explain how properties are used to classify elements**

6.6(A)	compare metals, nonmetals, and metalloids using physical properties such as luster, conductivity, or malleability (R)
6.5(A)	know that an element is a pure substance represented by a chemical symbol and that a compound is a pure substance represented by a chemical formula (R)

Stimulus

Investigation	Demonstration	Graph	Chart/Table
Diagram	Visual/Image/ Illustration*	Web/Cycle/Chain	Model*
Informational Text/List*	Map	Formula/Equation	

Content Builder

- Periodic Table is arranged by atomic number
- Periodic Table is arranged by groups (vertical) and periods (horizontal)
- Location of elements on the Periodic Table can predict their properties

Major concepts in this standard include:

- Location of metals, metalloids, and nonmetals
- Differentiation among solid, liquid, and gas on the Periodic Table
- Most reactive metals are Groups 1 & 2; least reactive nonmetals are Group 18
- Reactivity is directly related to the number of valence electrons

Instructional Implications

Understanding the arrangement of the Periodic Table is imperative to support foundational learning about the structure of the atom. Using precise language about the Periodic Table and its arrangement will support the predictive patterns that govern its arrangement. Students may struggle with predicting reactivity and chemical properties because they are abstract in nature and difficult to observe. Reactivity and chemical properties are based on elemental relationships at the atomic level.

When you teach this concept, remember to:

- Provide opportunities for students to predict elements that will have similar reactivity given another element.
- Identify the valence electrons and representative groups.
- Provide opportunities for students to infer elements that will have similar chemical properties.
- Create opportunities for students to label the Periodic Table patterns.

Learning from Mistakes

Students may make the following mistakes:

- Not understanding that groups are vertical and periods are horizontal
- Not recognizing the representative groups, metals, nonmetals, and metalloids on the Periodic Table
- Not recognizing the patterns of valence electrons on the Periodic Table
- Struggling to identify the location of elements on the Periodic Table based on characteristics of that element
- Misinterpreting the patterns on the Periodic Table
- Not understanding that atomic structures relates to an element's group and period
- Not recognizing that reactivity increases down a group, not a period

Academic Vocabulary

atomic number*	period*
chemical behavior*	Periodic Table*
chemical property*	physical property*
energy level*	property
family*	transition metal
group*	valence electron*

Interesting Items

8.5(C) 2018 #31
8.5(C) 2017 #2
8.5(C) 2016 #32
8.5(C) 2014 #46
8.5(C) 2013 #5

6.6 Matter and energy. The student knows matter has physical properties that can be used for classification. The student is expected to:

6.6(A) **(A) compare metals, nonmetals, and metalloids using physical properties such as luster, conductivity, or malleability**

Role in Concept Development

Supports 8.5(C) interpret the arrangement of the Periodic Table, including groups and periods, to explain how properties are used to classify elements

Connection/Relevance to Grade 8 and STAAR This supporting standard helps scaffold future learning of readiness standard 8.5(C).
The Periodic Table is explicitly taught in Grade 8 and builds on the basic introduction to the Periodic Table from Grade 6. Basic physical properties from 6.6(A) lay the foundation for interpreting the arrangement of the Periodic Table in 8.5(C).
6.6(A) is eligible for assessment on Grade 8 Science STAAR.

When to Review With 8.5(C) STAAR review

Instructional Implications Students should be able to look at the properties of a given atom in Grade 8 and classify it as a metal, nonmetal, or metalloid.

When you review this concept, remember to:

- Provide opportunities for students to classify elements on the Periodic Table by luster, conductivity, and malleability.
- Create situations for students to use the Periodic Table to describe the physical properties of a given element based on its placement on the Periodic Table.

Learning from Mistakes Students may make the following mistakes:

- Not recognizing that malleable and ductile are physical properties
- Struggling to classify elements as metals, nonmetals, and metalloids based on their physical properties

Stimulus

Investigation*	Demonstration	Graph	Chart/Table*
Diagram	Visual/Image/Illustration	Web/Cycle/Chain	Model
Informational Text/List*	Map	Formula/Equation	

Academic Vocabulary

brittle	electric current	metal
conductivity*	element*	metalloid
density	luster	nonmetal*
ductility	magnetism	physical property*
dull	malleability*	states of matter

Interesting Items

6.6(A) 2023 #24
6.6(A) 2015 #33