



Build an Atom

Content Standards Addressed in Lesson:

TEKS8.5A 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; (Reporting Category 1 – Readiness Standard)

TEKS8.5B identify that protons determine an element's identity and valence electrons determine its chemical properties, including reactivity; (Reporting Category 1 – Readiness Standard)

TEKS8.5C interpret the arrangement of the Periodic Table, including groups and periods, to explain how properties are used to classify elements (Reporting Category 1 – Readiness Standard)

NSES (1996) Grades 5-8 – Content Standard B

- Properties and changes of properties in matter

Scientific Investigation and Reasoning Skills addressed in lesson:

TEKS8.3B use models to represent aspects of the natural world such as a model of Earth's layers;

TEKS8.3C identify advantages and limitations of models such as size, scale, properties, and materials.

NSES (1996) Grades 5-8 – Content Standard A

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

I. Student Prerequisite Skills/Understandings

1. Atoms are the basic building block of matter.
2. Basic computer skills (click and drag).

II. Objectives: Students will be able to

1. Construct a model of an atom.
2. Determine the charge of an atom or ion.
3. Explain how to determine the numbers and types of subatomic particles in an atom.

III. Supplies Needed

- Engagement:
 - A cell phone
 - Hammer
 - Smashing set-up (plastic sheet and cardboard)
 - Goggles for teacher
 - Gloves for teacher

- Explore *Build-An-Atom* PhET Simulation:
 - Computer – 1 per pair of students
 - Element Cards
 - Periodic Tables

5E Organization

Engage – Introduction to Elements (5 minutes)

Content Focus: Matter, for example a cell phone, is composed of atoms.

To demonstrate that items can be made of smaller parts, the teacher performs a demo by smashing a cell phone into component parts. The teacher then asks students what sort of elements a cell phone might contain. Just as a cell phone has parts, so does an element, which is what will be explored in this lesson.

Questions to guide students' learning and thinking	Questions to gather information about students' understanding and learning
<ul style="list-style-type: none"> • How many of you have ever wondered what is in a cell phone? What do you think is in a cell phone? • What observations can you make about these pieces? • Why does breaking things into smaller pieces help a scientist figure out how things work? • How many cell phones do you think it would take to get one gram of gold? 	<ul style="list-style-type: none"> • What elements do you think are inside of a cell phone?

✓ **Checkpoint:** Students understand that matter is made up of elements.

Explore – *Build-An-Atom* PhET Simulation (30 minutes)

Content Focus: 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; Identify that protons determine an element's identity and valence electrons determine its chemical properties, including reactivity;

Investigation Skills: Use models to represent aspects of the natural world such as a model of Earth's layers.

Use the Build-an-Atom PhET simulation (<http://phet.colorado.edu/en/simulation/build-an-atom>). Pass out the element cards that go along with specific elements. Allow for 5 minutes of open play, encourage students to try all features and determine what each feature does. Have students share what they have discovered. Pass out an element card. Present the task of solving and labeling the cards. Once finished, have students complete the "Element Card Activity" half-sheet.

Questions to guide students' learning and thinking	Questions to gather information about students' understanding and learning
<ul style="list-style-type: none">• How did you know how many protons to add?• What happens when you add only protons and too few neutrons? Why?• If there are more protons than electrons, will the ion have a positive or a negative charge?• If there are more electrons than protons, will the ion have a positive or a negative charge?	<ul style="list-style-type: none">• What component of the atom determines the identity of the atom?• How many protons does your atom have?• What type of charge does a proton have? An electron? A neutron?• What is the overall charge of your atom?• How did you know how many neutrons to add?• How did you know how many electrons to add?• Is your atom neutral or does it have a charge?• What is an atom with a charge called?• Why do ions have a charge? (What makes it have a charge?)

- ✓ **Checkpoint:** Students determined their element and how many of each subatomic particle the atom contains.

Explain – *Build-An-Atom* PhET Simulation (10 minutes)

Content Focus 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; Identify that protons determine an element's identity and valence electrons determine its chemical properties, including reactivity;

Investigation Skills: Use models to represent aspects of the natural world such as a model of Earth's layers.

Teacher writes the names and charges of the subatomic particles on the board and students match each particle to its charge. Class discusses answers. The teacher then draws a Lithium atom (3 protons and neutrons in the nucleus and 3 electrons in the two shells surrounding the nucleus). Students must fill in the correct number of protons, neutrons, and electrons for the element's card (as if it were on the periodic table).

Questions to guide students' learning and thinking	Questions to gather information about students' understanding and learning
<ul style="list-style-type: none"> • What charge would an ion have if it has 3 protons and 2 electrons? • If there are more protons than electrons, will the ion have a positive or a negative charge? • If there are more electrons than protons, will the ion have a positive or a negative charge? 	<ul style="list-style-type: none"> • What happens when the number of protons and electrons are not equal? • What determines what the identity of the atom is? • What is the mass number of this Lithium atom? • Where are the protons and neutrons located in an atom? • Where are the electrons located?

- ✓ **Checkpoint:** Students can identify the location and charges of protons, neutrons, and electrons. Students can correctly fill out the element identification card.

Elaborate – Build-An-Atom PhET Simulation (10 minutes)

Content Focus: 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; Identify that protons determine an element's identity and valence electrons determine its chemical properties, including reactivity;

Reasoning Skills: Develop descriptions, explanations, predictions, and models using evidence from simulation. Communicate conclusions supported by the data gathered in the simulation.

Students are given challenge cards and must draw the provided atom, provide information about the atom, draw the symbol that would be found on the periodic table, and classify it as an ion or not. When time is up, students trade cards with another group and check each other's work.

Questions to guide students' learning and thinking	Questions to gather information about students' understanding and learning
<ul style="list-style-type: none"> • How can you determine if the atom is charged or neutral? 	<ul style="list-style-type: none"> • What is your element's atomic number? • What is your elements atomic mass? • What is your element's chemical symbol?

- ✓ **Checkpoint:** Students are able to complete their challenge card and assess another group's work.

Evaluate

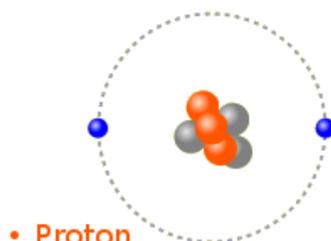
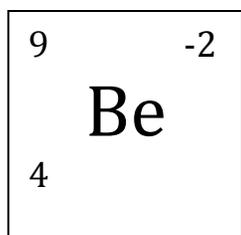
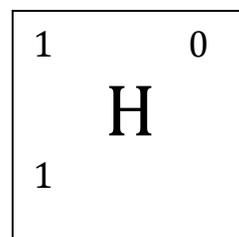
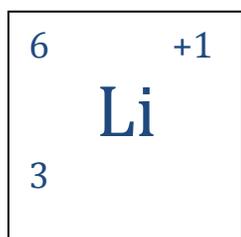
Students create challenge cards for another class. See checkpoint for challenge card requirements.

- ✓ **Checkpoint:** Students turn in completed challenge cards with the chemical symbol and atomic number for that element. The cards also have the mass number in the correct place, and a charge for the atom.

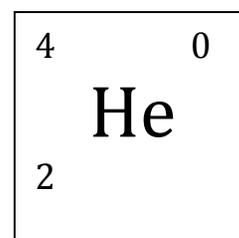
Name: _____

Show off what you know!

- Electrons do not contribute to the mass number of an atom. Why is this?
 - The mass number only counts particles which have a charge. Electrons have no charge.
 - The mass number only counts particles with no net charge. Electrons have a charge.
 - The mass number is an approximation of the mass of the atom and electrons have very little mass.
 - The mass number only represents the mass of the other particles because electrons have no mass.
- The name of an atom is determined by the number of which particle?
 - Proton
 - Electron
 - Boson
 - Neutron
- Car batteries produce hydrogen ions in the process of releasing chemical energy as electricity. The **single electron** in some **neutral** hydrogen atoms is pulled away as a result of the high current electricity. What is the **charge** on these hydrogen ions?
 - 1
 - +1
 - +2
 - 0
- Which of the following atom cards best represents the atom drawn below?



• Proton
• Neutron
• Electron



Show off what you know!

KEY

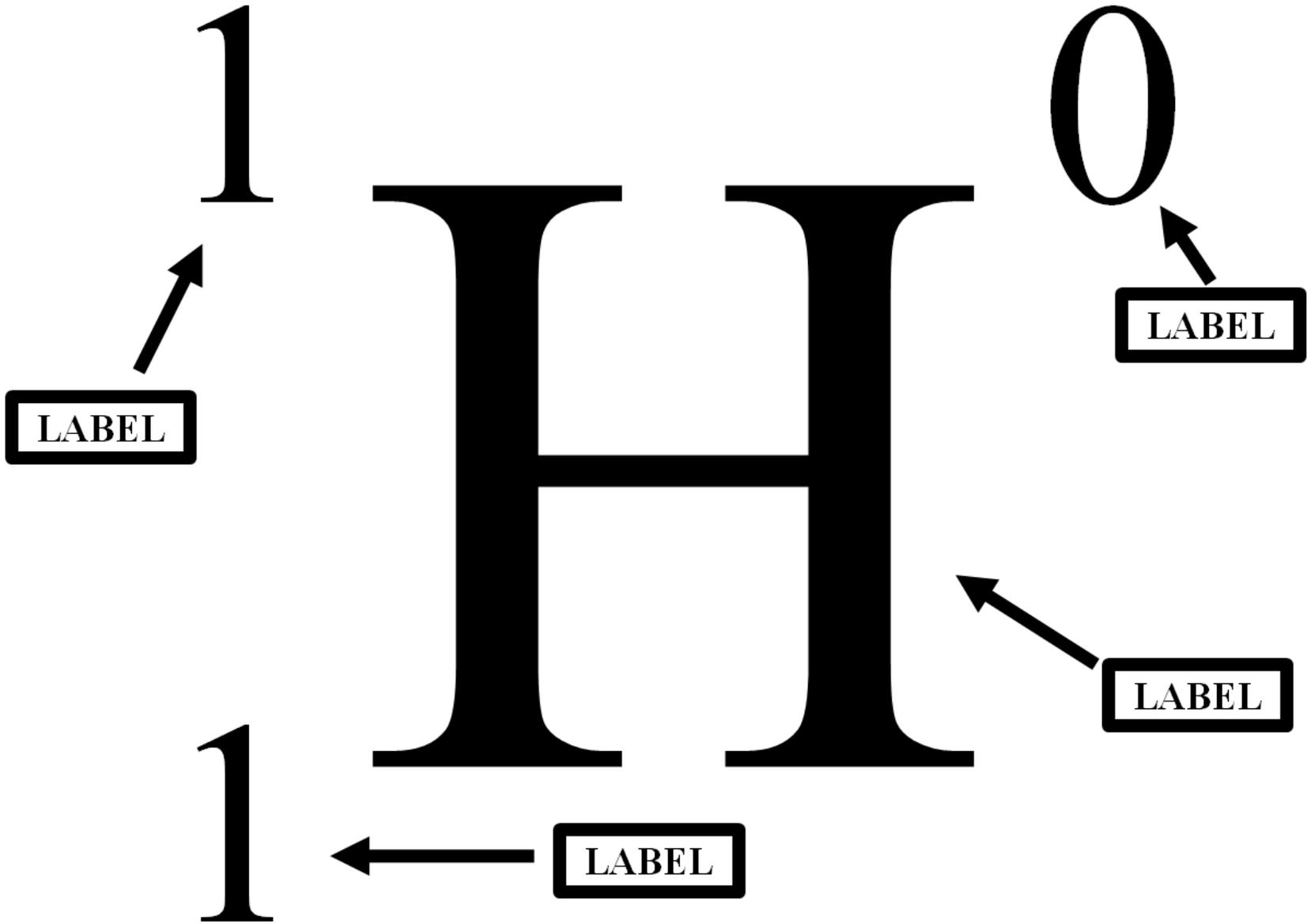
1) c

2) a

3) b

4) Li

EXAMPLE



Name: _____

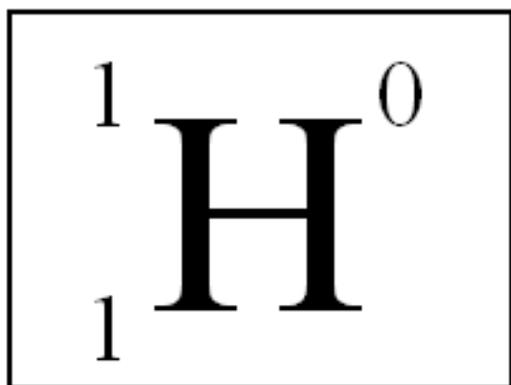
Element Card Activity:

1. Name of the element: _____
2. Atomic number: _____
3. Mass number: _____
4. Net charge of the atom: _____
5. Draw the atom as it appears in the simulation.
6. Is this a neutral atom or an ion? _____
7. # of Protons (+) = _____
of Neutrons (No Charge) = _____
of Electrons (-) = _____

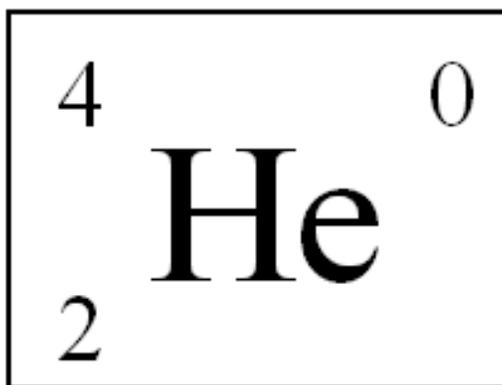
Name: _____

Element Card Activity:

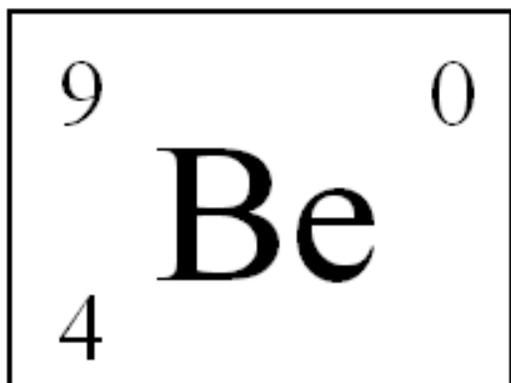
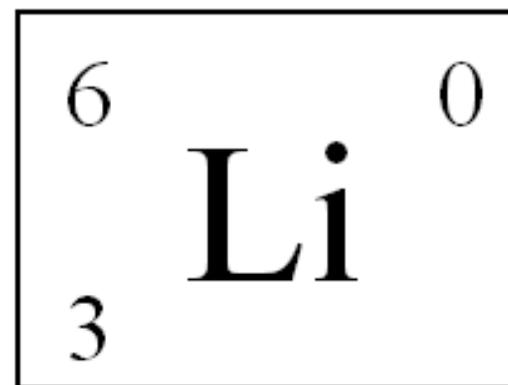
1. Name of the element: _____
2. Atomic number: _____
3. Mass number: _____
4. Net charge of the atom: _____
5. Draw the atom as it appears in the simulation.
6. Is this a neutral atom or an ion? _____
7. # of Protons (+) = _____
of Neutrons (No Charge) = _____
of Electrons (-) = _____



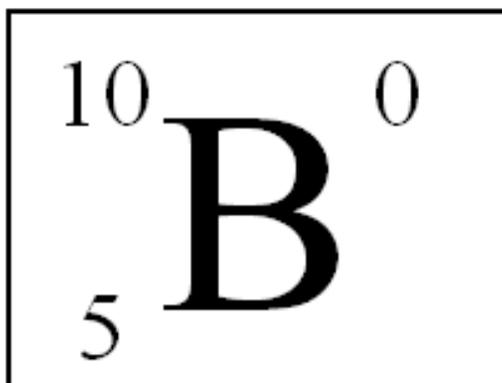
Element Cards



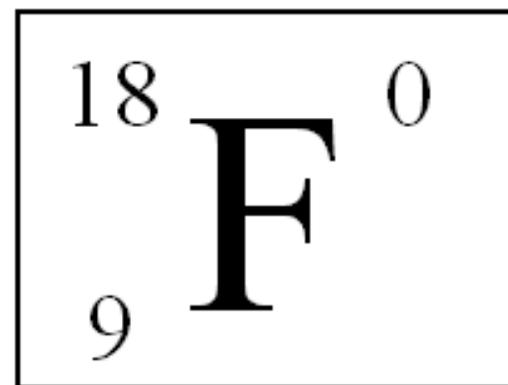
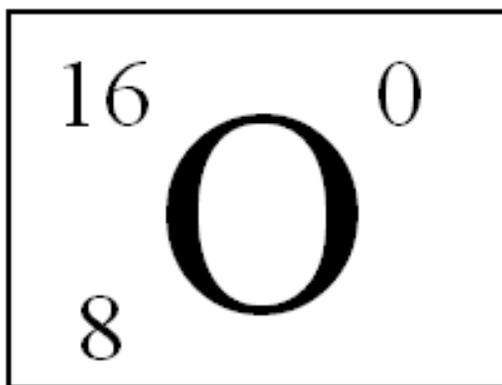
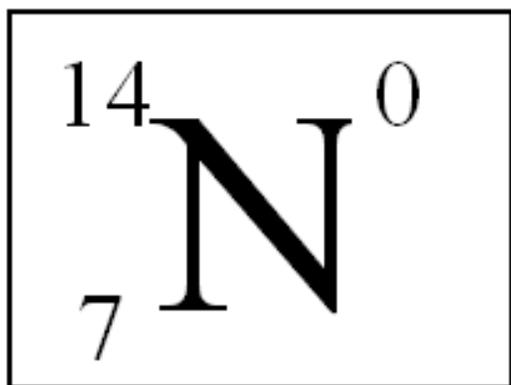
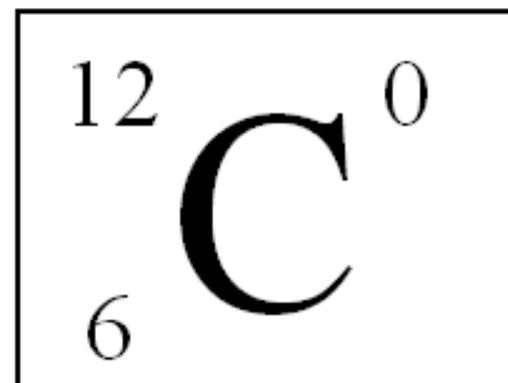
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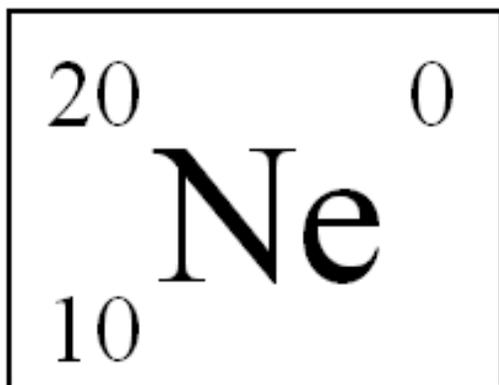


Element Cards

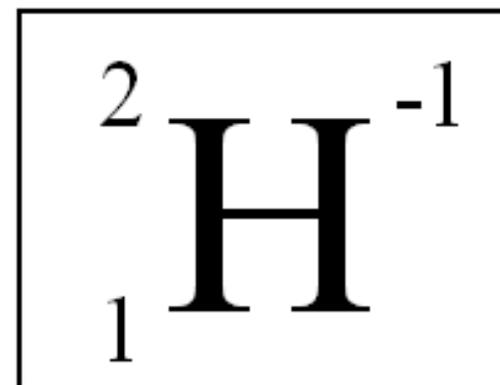
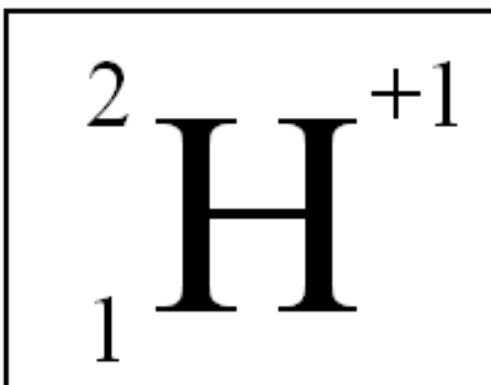


Element

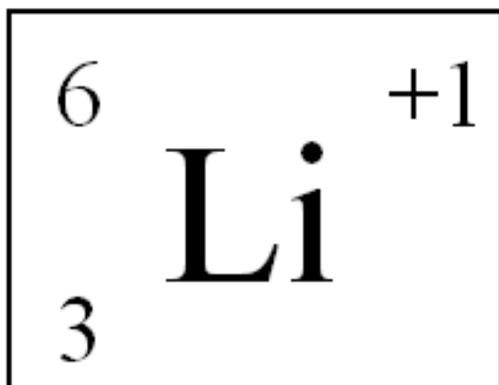




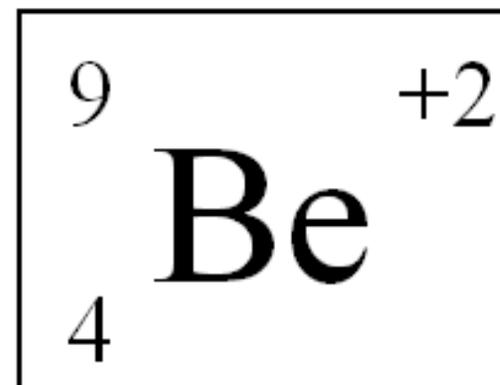
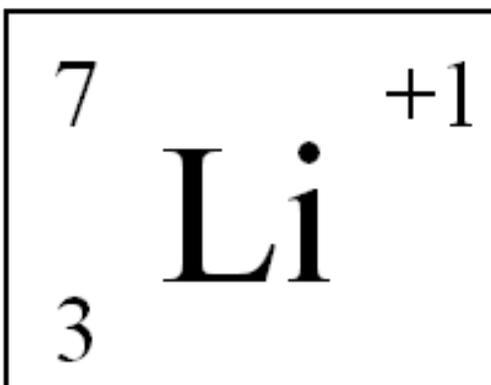
Element Cards



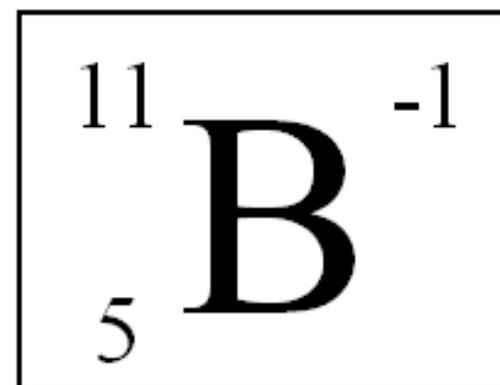
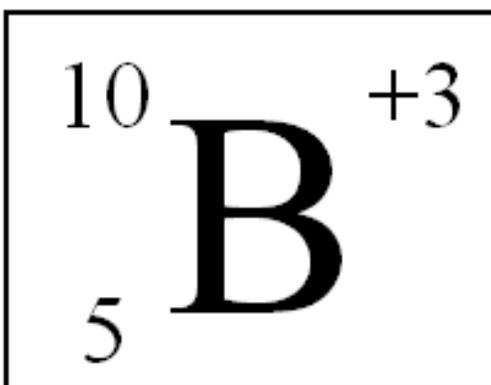
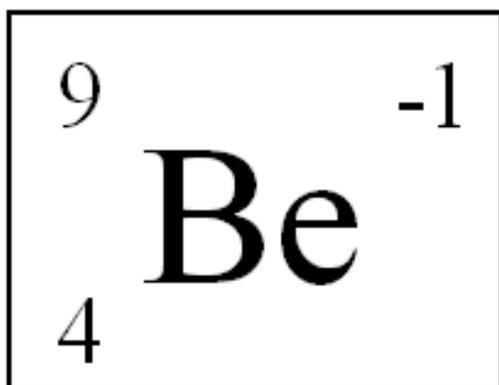
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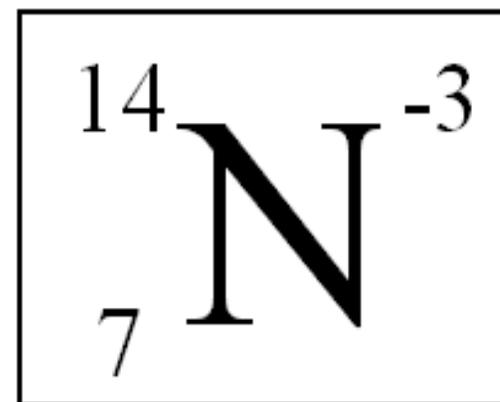
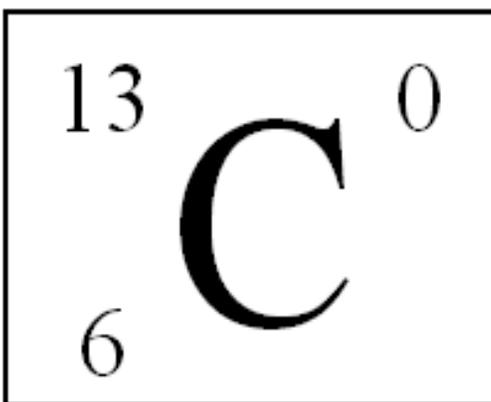
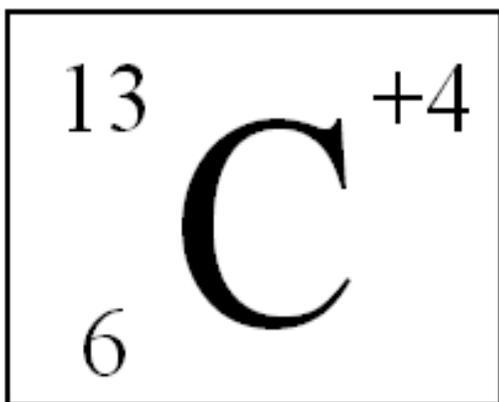


Element Cards



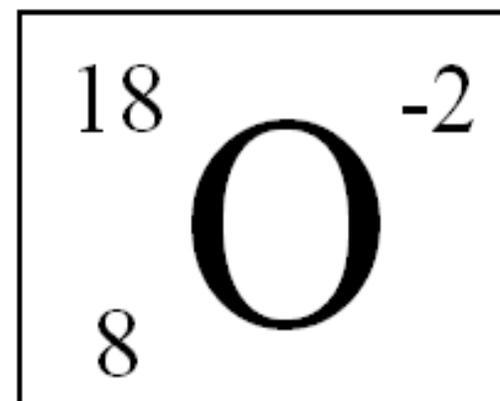
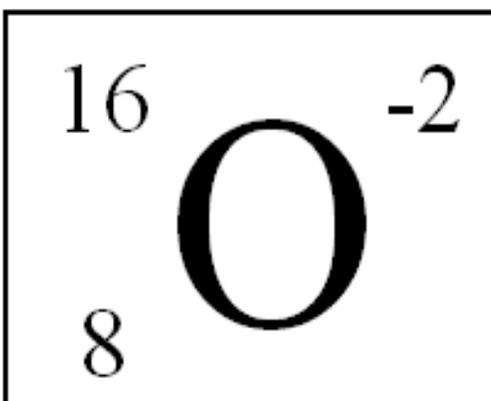
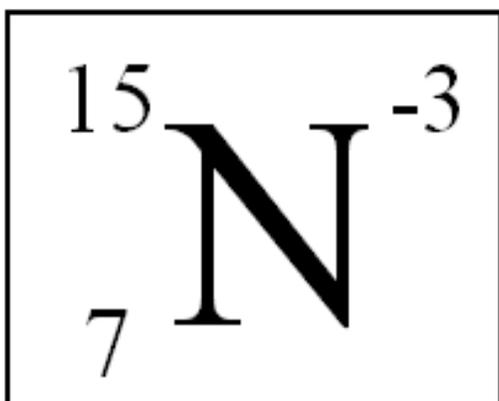
Element





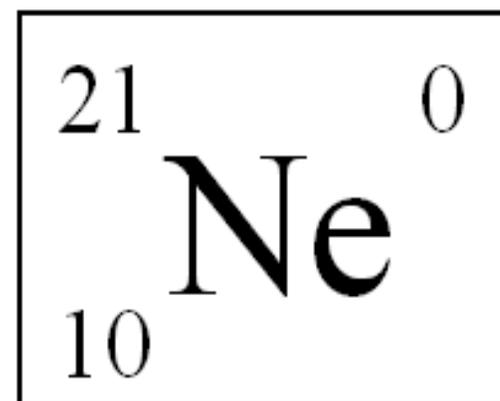
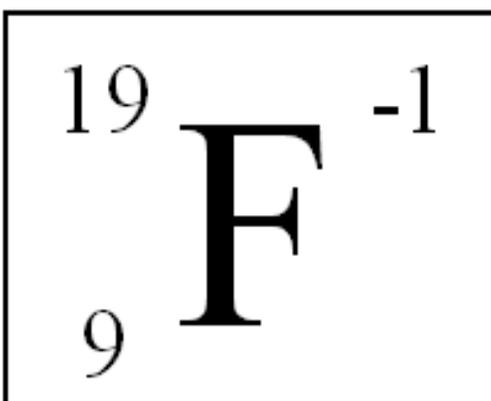
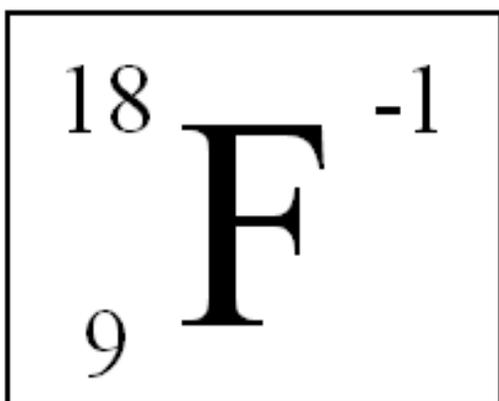
Element Cards

Element



Element Cards

Element



Challenge!

7 protons 7 neutrons 10 electrons

1) Draw the atom in the box to the right.
Label the protons, neutrons, electrons,
nucleus, and electron orbits.

2) What element is this?

3) Is it a neutral atom or an ion?

4) Atomic number: _____

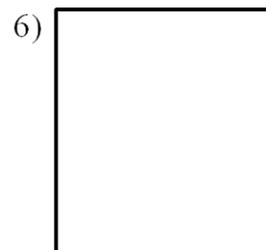
5) Mass number: _____

6) Draw the chemical symbol in the box to
the right that would be found on the
periodic table for this atom.

1)



6)



Challenge!

5 protons 5 neutrons 5 electrons

1) Draw the atom in the box to the right.
Label the protons, neutrons, electrons,
nucleus, and electron orbits.

2) What element is this?

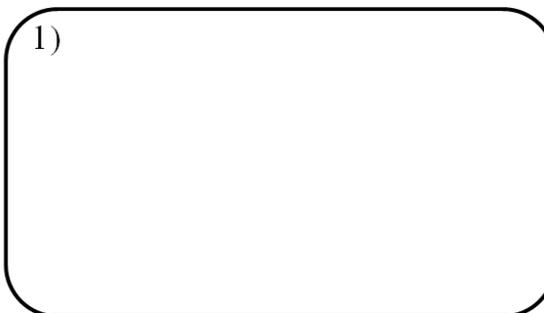
3) Is it a neutral atom or an ion?

4) Atomic number: _____

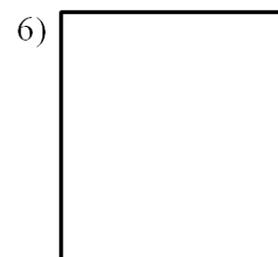
5) Mass number: _____

6) Draw the chemical symbol in the box to
the right that would be found on the
periodic table for this atom.

1)



6)



Challenge!

8 protons 9 neutrons 10 electrons

1) Draw the atom in the box to the right.
Label the protons, neutrons, electrons,
nucleus, and electron orbits.

2) What element is this?

3) Is it a neutral atom or an ion?

4) Atomic number: _____

5) Mass number: _____

6) Draw the chemical symbol in the box to
the right that would be found on the
periodic table for this atom.

1)



6)



Challenge!

3 protons 3 neutrons 2 electrons

1) Draw the atom in the box to the right.
Label the protons, neutrons, electrons,
nucleus, and electron orbits.

2) What element is this?

3) Is it a neutral atom or an ion?

4) Atomic number: _____

5) Mass number: _____

6) Draw the chemical symbol in the box to
the right that would be found on the
periodic table for this atom.

1)



6)

