



Readiness — Knowledge and Skills

Science 8 — STAAR Review

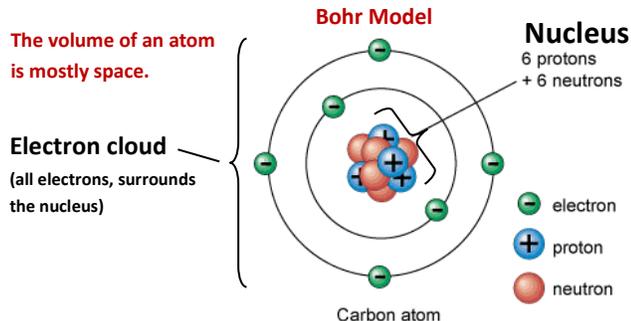
Category 1

Properties of matter and energy,
and their interactions

TEK: (8.5) The student knows that matter is composed of atoms and has chemical and physical properties: **(A) the student will describe the structure of atoms, including masses, charge, locations of protons and neutrons in the nucleus and electrons in the electron cloud.**

Vocab

- **Element:** — the simplest pure substance
- **Atom:** — smallest unit of element, has all characteristics of that element
- **Nucleus:** — dense center, (+) charge due to protons, 99.9% of mass of atom contains [protons and neutrons]
- **Electron cloud:** — surrounds nucleus, (-) charge due to [electrons]
- **Proton:** (+) charge, located in nucleus, mass = 1 amu [atomic mass unit]
- **Neutron:** no charge, located in nucleus, mass = 1 amu
- **Electron:** (-) charge (neg.), located in electron cloud on orbitals/energy levels, almost no mass



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

Vocab

- **Atomic number** = to number of protons, specific to each element
 - * identifies element (like a fingerprint),
 - * each element has a different number of protons.
 - Beryllium has 4 protons, atomic number for Beryllium is 4
 - #Protons = #electrons
- **Atomic mass** = to number of protons plus number of neutrons, in nucleus
- **Mass number** = atomic mass rounded to the nearest whole number
- **Valence electrons** — electrons on orbital farthest from nucleus determine the chemical properties and reactivity (likelihood it will react with another atom)
 - Most elements want to have **8 valence electrons**
 - Makes elements like Sodium (Na, family 1) or Fluorine (F, family 17) very reactive
 - or NOT reactive like Neon, a Nobel gas from group 18
 - Reactive atoms may combine with other reactive atoms to form compounds

Calc!

Mass of the atom? = protons + neutrons
How many neutrons? = mass # - atomic #

Key

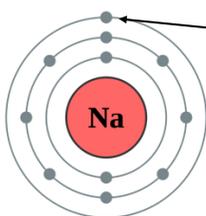
11	Atomic number
Na	Element symbol
Sodium	Element name
22.99	Average atomic mass

Each block on the periodic table gives you specific information about that element.

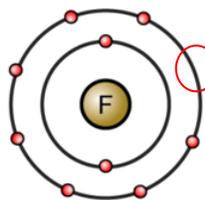
Element	mass	p	n
O	16	8	8
Be	9	4	—



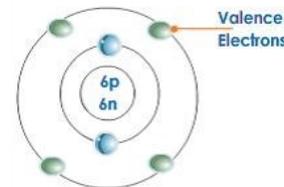
Ans: 5



Sodium, Na, has one valence electron. It will give up this electron easily to form compounds.

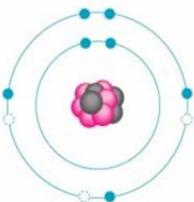


Fluorine, F, has 7 valence electrons leaving an empty space for one more. It will pick up this electron easily to form compounds.



Neon, Ne, has a full valence shell leaving no room for electrons and none to lose easily. It will not react.

On Your Own— Which statement best describes the atom on the left?



- A It has 7 Valence electrons in the electron cloud therefore it is the element fluorine.
- B It has 9 electrons in the nucleus therefore it is a Nobel gas.
- C There are 5 valence electrons in the electron cloud therefore this atom would like to gain 3 more electrons.
- D There are 5 valence electrons in the electron cloud therefore this atom is a metal.

Answer—There are 5 valence electrons. This means it is 3 short of having the 8 electrons that it would like. Letter C is correct.

Category 1 continued....

(C) The student will interpret the arrangement of the Periodic Table, including groups and periods, to explain how properties are used to classify elements.

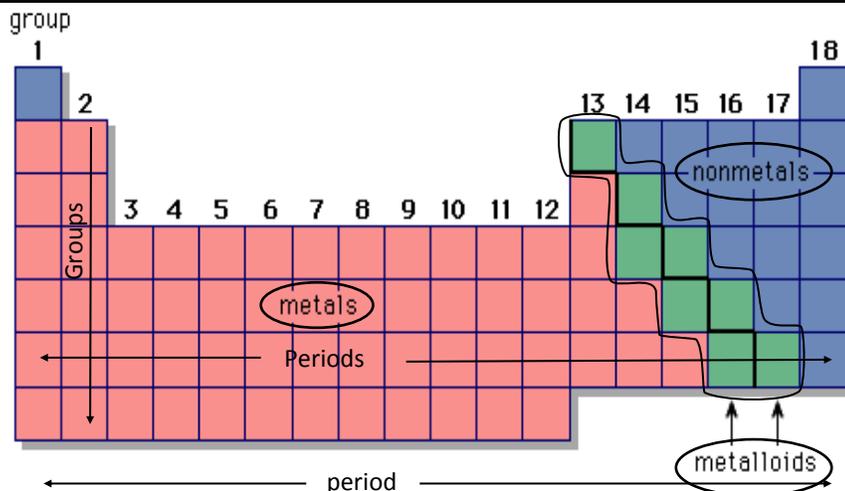
Vocab

- **Group (family)** — vertical columns of elements on Periodic Table with **similar properties**. There are 18 groups. The elements in each group/family have the **same number of valence electrons**.
- **Period** — a row on the periodic table, properties of elements change as you move across a period.

Vocab

The **periodic table** is divided into three main sections: **metals, metalloids and non-metals**.

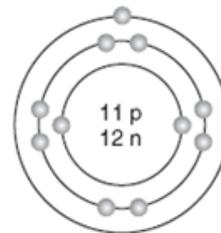
- **Metals** usually have **luster** (shine), they **conduct heat and electricity**; and can change shape when hammered or formed into a new shape. This is referred to as the property of **malleability**. When metals are turned into wire, we call this property ductile.
- **Non-metals** are on the right side of the periodic table. They are **dull** and **don't conduct** a current (electricity). Many of them are gases.
- **Metalloids** are along the diagonal and between the two main groups. These have **properties of both metals and non-metals**.
- **Organic Compounds** all contain the element **carbon**, and often may contain: **hydrogen, nitrogen, oxygen**, "**CHON**" and are found in living things.



- **Density** — elements each have a unique density (amount of mass in a given volume of a substance).

On Your Own— According to the periodic table, this element would most likely have the following properties.

- A Shiny, conducts a current, very reactive.
- B A gas that is not very reactive.
- C A substance that conducts a current but is brittle and not malleable.
- D A shiny liquid that conducts a current.

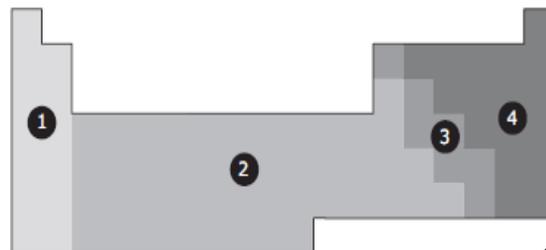


Answer: $11p = 11$ protons therefore according to the periodic table it is the element sodium. Sodium is a metal so it must be letter A, shiny, conducts a current and sodium is very reactive.

Your Turn— An element is waxy, has a low melting point and is not used for wiring in homes because it doesn't conduct a current. Which section of the periodic table is the element most likely to be found?

- Step 1**—Identify each section. (1) very reactive metals, (2) metals, (3) metalloids, and (4) non-metals.
- Step 2**—Know the properties of each section.
- Step 3**—Choose the one that matches the description best.

Answer—Section 4- The non-metals are NOT metals, melt easily and are not used for electrical wiring in our homes.



APE MAN

Category 1 continued....

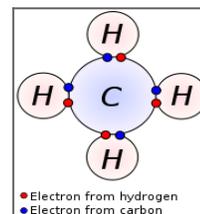
- (D) The student will recognize that chemical formulas are used to identify substances and determine the number of atoms of each element in chemical formulas containing subscripts.
- (E) investigate how evidence of chemical reactions indicate that new substances with different properties are formed; and
- (F) recognize whether a chemical equation containing coefficients is balanced or not and how that relates to the law of conservation of mass.



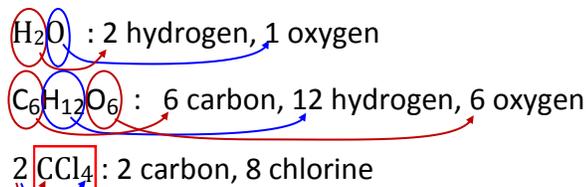
When elements combine, they form new compounds. Many metal atoms will combine with non-metals. For example a sodium (Na) will combine with chlorine (Cl) to form NaCl. Sometimes non-metals combine to make compounds such as H₂O (water), CO₂ (carbon dioxide), or C₆H₁₂O₆ (sugar).

Most elements react with other elements because they want to have 8 valence electrons in the outermost electron shell. The Carbon atom only has 4 valence electrons. The carbon bonded with hydrogen so that now it has 8.

The new compound that was formed has a chemical formula of CH₄. It is made from 5 atoms or C + H + H + H + H. It is much easier to simplify this and write the formula as CH₄ with the 4 subscript representing all four hydrogen atoms.

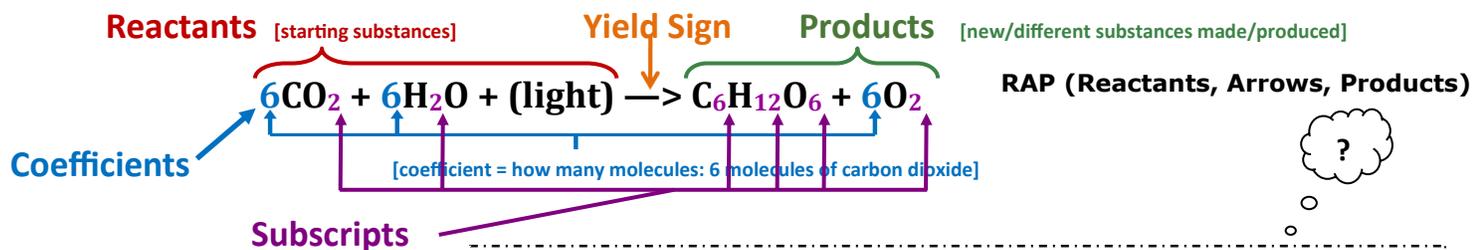


- **Substance** — matter with the same properties and composition throughout. **Compounds** contain 2 or more different elements.
 - **Chemical formula** — shorthand way to write a substance
Ex. H₂O is water, C₆H₁₂O₆ is glucose
 - **Subscript** — indicates the number of atoms of an element in a formula.
Ex. H₂O; 2 = two atoms of Hydrogen
 - **Chemical Reaction** — process that produces chemical change, results in new substances with different properties
 - **Law of Conservation of Mass** — mass can be neither created or destroyed, mass of products must equal mass of reactants.
- A balanced equation** shows that matter is only rearranged into new substances. No new atoms/elements are created or destroyed.



Propane has 3 carbon and 8 hydrogen.
Write its formula: _____

Ans: C₃H₈



Q: How many atoms of each element occur in the photosynthesis reaction? C: ___ H: ___ O: ___

Ans: C₆H₁₂O₆

YOUR TURN— How many different substances are produced in this reaction? Reactants → Products



There are two substances produced in this reaction. Substances that are produced are called the products. Can you list them?

KCl = potassium chloride, and **O₂** or oxygen.

How can you tell if this was a **chemical reaction**? The signs are: a **gas** was produced, a significant **color change**, a **change in mass**, or a **new solid** appeared that was not there before. In the reaction above, oxygen gas or O₂ was produced. In addition, two substances were formed from one.

Evidence of Chemical Change/Reaction

City/Country	Color change (new/different)
Girls/Guys	Gas production (bubbles/fizzing - not boiling)
Love	Light production (fireworks, fireflies)
Their	Temperature change (release/absorption of energy)
Phones	Precipitate formation (solid product forms and falls to bottom)