

What is a chemical?

Can you name some chemicals?

Water
Oxygen
Sand
DNA
Ammonia
Sugar
You

Handwritten notes: "air", helium, oxygen, lithium, CO₂, water, coal, gasoline

Are all chemicals harmful?
- Why are some chemicals safe and others not? Some chemicals react in ways that are harmful.

Everything in the world involves chemistry because everything in the world is made of chemicals.

Household Chemicals

At each table, there are some common household products. Product labels contain lots of information. The information presented on the label can be qualitative (e.g., a list of ingredients) or quantitative (e.g., the percentage concentration of an ingredient). Note that product labels list the most abundant material first and the least abundant last.

- For each product, use the information on the label to answer the following questions.
 - Record the name of the product. Describe the product.
 - Record the number of substances in the product.
 - What is the major ingredient?
 - Is there an "active ingredient" identified on the label? If so, what is it?
 - List any safety information or safety symbols that the labels provided. For example, was there a reference to daily use if the substance was a food? Were there any warnings, such as suggestions not to add the product to certain other materials?
 - Identify whether each observation is quantitative or qualitative.
- Once you've made observations for 7-8 products, describe any patterns in the amount and type of information you noticed in certain groups of products: for example, were there similarities in the cleaning products?
- Organize your observations in a table. At this point there is no right or wrong way to do this. After the activity, we'll discuss the best way to build a table. Be prepared to share your table with the class. As a group, we are going to determine the criteria of an effective and functional data table.

Who Cares About Chemistry?

Household Chemicals

How to Make a Table

- Title
The title must relate to the data in the table. Write the title at the top of the table.
- Columns and rows
Figure out how many columns and rows you need. HOW? The left column is for your independent variable (the thing you changed). The dependent variable (the thing that changes because of what you changed) goes to the right.
e.g., imagine you're researching how much rain fell in each month last year.
Independent variable: months of the year
Dependent variable: the amount of rainfall
- Using a ruler, draw a large box with the necessary number of columns and rows. Don't forget to include an extra blank row at the top. This is where you will label your columns.
- Label all your columns.
- Record your observation in the appropriate columns.

Month	Rainfall

Table Quiz

If you are sitting on the left answer question 1. If you are sitting on the right answer question 2.

- Some students collected information about a few countries and recorded everything they found. Construct a table to help them organize their information. China has a population of 1.3 billion (B) and covers an area of 9.6 million (M) km². The predominant language spoken there is Mandarin. In France, the main language is French and it has 65 M inhabitants. The country covers 0.7 M km². Although Canada is officially bilingual, more people speak English than French. The country is 10 M km² and has 37 M citizens. The US has 326 M people who mostly speak English. The country is 9.5 M km². The main language in Mexico is Spanish and there are 130 M people living there. The students were unable to find the area of the country.
- Imagine Mr. Reid is collecting information about Jessica, a student here at KV. He has asked you to make a table to show the details he discovered. In period 1 Jessica is in a Science class with 29 students and the class average is 78%. In period 2 she has Math with 25 students. The average is 72%. Jessica has English period 3. The teacher did not provide the average for the 22 students in the class. In Jessica's period 4 Music class there are 25 students and the class average is 86%. Finally, Jessica takes Social Studies in period 5. The class average among the 27 students in the class is 74%.

Scoring Guidelines

How to Make a Table

Quiz - Table

Matter and Atomic Structure

Chemistry is the study of matter and reactions between types of matter.

What, exactly, is matter?
Matter is anything that has mass and occupies space.

The world contains lots of different kinds of matter.
Basically, all matter is either a pure substance or a mixture.

Classification of Matter

- Pure Substance**
 - All the particles that make up the substance are the same.
 - The substance has constant properties.

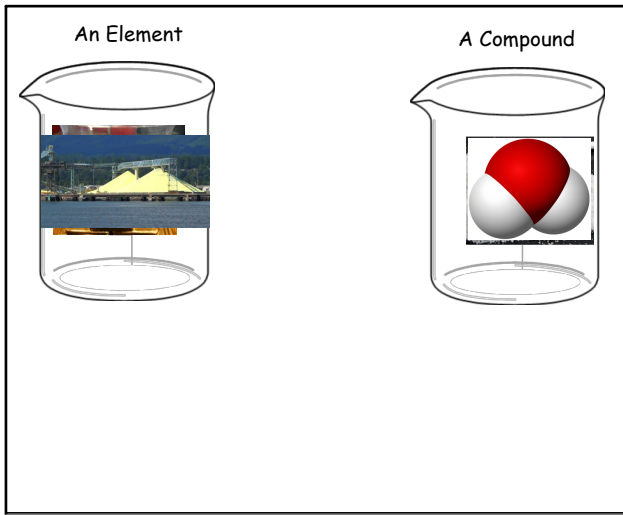
Water. Freezes at 0°C and boils at 100°C
- Elements**
 - Cannot be broken down into different substances (types of atoms).
 - They only contain one type of atom.
 - e.g., iron, mercury
 - Each has its own **chemical symbol**
 - e.g., Fe, Hg
- Compounds**
 - Contain two or more different elements (different types of atoms) bonded together.
 - e.g., carbon dioxide, water
 - Identified by a **chemical formula**
 - e.g., CO₂, H₂O

Handwritten: C₆H₁₂O₆ glucose

The formula tells us what the compound is made of.
Carbon dioxide (CO₂) is a compound.
Each molecule of carbon dioxide is composed of one carbon atom and two oxygen atoms.

What is a molecule of water (H₂O) made of?
- two atoms of hydrogen and one atom of oxygen

Pure Substances



Sort Them

5. **Mixtures**
 - Contain two or more pure substances that can be separated by physical means.

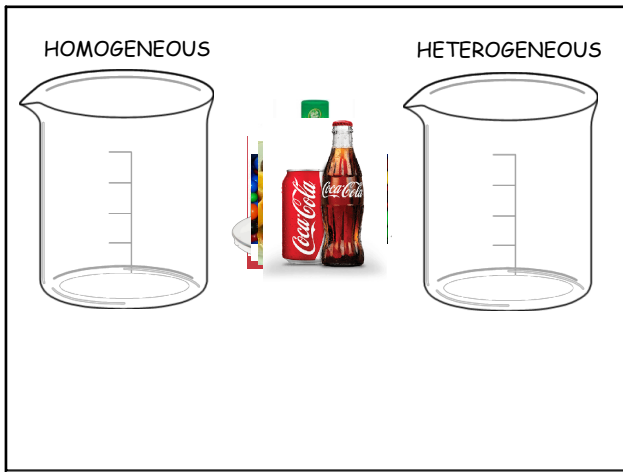
6. **Homogeneous Mixtures (or solutions)**
 - Have only one visible component
 - the same everywhere

e.g., coffee, air

7. **Heterogeneous Mixtures**
 - Contain two or more visible components
 - Not the same everywhere
 - Can be separated

e.g., Can you think of an example?

Mixtures



Sort Them

PROPERTIES OF MATTER

All matter has chemical and physical properties.

Physical property
 - a characteristic of a substance
 - state of matter (solid, liquid, or gas) at room temperature
 - colour
 - shape
 - viscosity
 - malleability
 - ductility
 - hardness
 - density
 - solubility
 - melting point and boiling point

e.g., baking soda
 white
 solid at room temp
 dissolves in water to form a solution

e.g., water
 transparent and odorless
 liquid at room temperature
 colorless in small quantities
 boiling point is 100°C

Physical change
 - a change in the size or form of a substance that does not change the chemical properties

e.g., ice melts with acid, reacts with water, reacts with oxygen

Chemical property
 - a characteristic behavior that occurs when a substance changes to a new substance

e.g., rusting, burning, mass burning

Chemical change
 - the actual change in the substance itself
 - this happens during a chemical reaction

- still has some substance

Properties of Matter

How can we tell a chemical reaction has occurred?

1. A new color appears
2. Heat or light is given off
3. Bubbles of gas form
4. A precipitate forms in a liquid

Chemical reactions are represented this way:

What we start with What we get
Reactants **Products**
 $A + B \rightarrow C + D$

Remember in a chemical reaction new substances are formed.

Chemical Reactions

Properties of Matter and Mixtures Questions

1. Replace each of the following descriptions with one or two words.
 - a) A sample of matter that contains only one kind of atom.
 - b) A characteristic of matter that involves the formation of a new substance.
 - c) A family of elements that includes sodium and potassium.
2. Classify each of the following as a pure substance or a mixture.

Substance	Pure substance or mixture	Element, compound, solution, heterogeneous mixture
Sloppy water		
Water (H ₂ O)		
Sodium chloride		
Water		
Magnesium (Mg)		
Trail mix		
Kool-Aid		
Helium (He)		
3. Classify each of the following as a physical property or a chemical property.

	Physical or chemical property
Gasoline is a clear pink solution	
Propane burns in air	
Water boils at 100°C	
Electric current can split water into hydrogen and oxygen gases	
Ice melts at 0°C	
Diamond is an extremely hard substance	
Sodium burns when placed in water	
4. The sentences below contain errors or are incomplete. Write complete, correct versions.
 - Elements and solutions are examples of pure substances.
 - The melting point of a substance is an example of a chemical property.
 - Fluorine, chlorine, and sodium are members of the alkaline earth metals family.
5. When aluminum metal is added to hydrobromic acid, hydrogen gas and an aluminum bromide solution are formed.
 - What kind of change has occurred? How do you know?
 - Which substances are the reactants and which are the products?
6. When sodium carbonate is added to water, the sodium carbonate dissolves. When hydrochloric acid is added to the solution, the solution fizzes. What kinds of changes have occurred? How do you know?

Properties of Matter Questions

If you're sitting on the left, answer the odd numbered questions. If you're sitting on the right, answer the even numbered questions.

1. Sodium, hydrogen and chlorine are all examples of which type of matter?
2. Carbon monoxide and sodium chloride are examples of which type of matter?
3. What do we call the substances after a chemical reaction?
4. Titanium is a hard, lustrous substance. Are these physical or chemical properties?
5. What is one way to tell if a chemical change occurred?
6. Is a chocolate chip cookie a homogeneous or heterogeneous mixture?
7. Cleaning products containing ammonia should never be mixed with bleach because they form chlorine gas. Is this a chemical or physical change?
8. At a gravel pit, rocks are crushed into small gravel. Is this a chemical or physical change?
9. Hydrogen burns in oxygen. Is this a physical or chemical property?
10. What do we call the substances before a chemical reaction?
11. You're about to drink some delicious Kool-Aid. Is it a solution or heterogeneous mixture?
12. Carbon is an example of what type of matter?

Quiz

5.2 Case Study: Hazardous Household Chemicals (pp 176-9)

- answer questions a-j
- answer questions 1-5

Case Study

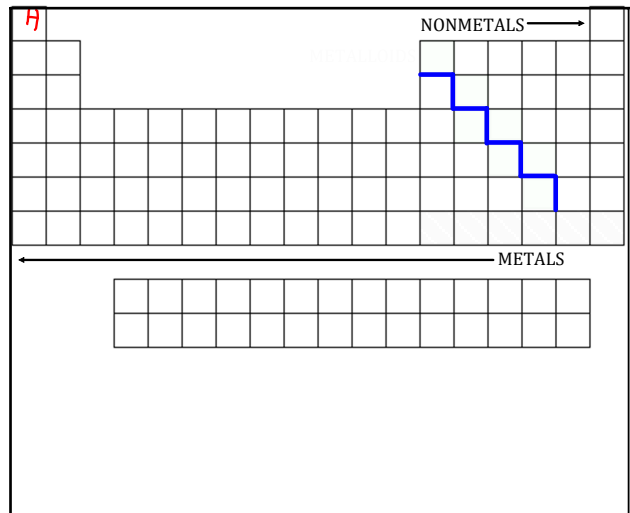
THE PERIODIC TABLE OF ELEMENTS

- Displays chemical and physical properties of each element
- It is a way of organizing all of the elements
 - **Metals** are to the left of the staircase.
 - **Nonmetals** are on the right of the staircase.
- Hydrogen is unique because it exhibits properties of both metals and nonmetals.
 - some tables have it shown in group 1 and group 18

Properties of metals and nonmetals

Property	Metals	Nonmetals
lustre	shiny	dull
malleability	malleable	brittle
conductivity	conductors	mostly insulators
reactivity with acid	mostly yes	no
state at room temperature	mostly solids	solids, liquids, and gases

Periodic Table



Families

- groups of elements in the same column
- have similar physical and chemical characteristics

Groups or Families

Periods

- the rows are called periods

Families and Periods

1. Alkali metals

2. Alkaline earth metals

3. Transition metals

4. Post-transitional metals and metalloids

5. Non-metals

5a. Halogens

5b. Noble gases

6. Lanthanide

7. Actinide

Naming Groups and Periods

If you're sitting on the left, answer the odd numbered questions. If you're sitting on the right, answer the even numbered questions.

1. On which side of the table are the metals found?
2. Would you expect a metal or a nonmetal to be lustrous?
3. If you had to guess the state of a metal you didn't know, would you guess solid or gas?
4. Arsenic is a nonmetal, on which of the table would it be found?
5. What do we call elements in the same column?
6. What is unique about the position of hydrogen on the table?
7. Would you expect a metal or a nonmetal to be malleable?
8. If elements are in the same column on the table, what do you know about them?
9. Which is more likely to conduct electricity, a metal or a nonmetal?
10. If you wanted to build a suit to protect you from acid would you make it out of a metal or a nonmetal?

Quiz

1 H Hydrogen 1.008	Atomic Number Symbol Name Atomic Mass		
3 Li Lithium 6.941	4 Be Beryllium 9.012		
11 Na Sodium 22.990	12 Mg Magnesium 24.305		
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867

Periodic table

What is an atom made of?

Rutherford's model of the atom shows atoms are composed of three subatomic particles:
Proton - heavy and positively charged
Neutron - about the same mass as protons, but neutral in charge
Electron - almost no mass and negatively charged

- Protons and neutrons are located at the dense core of the atom (the nucleus).
- Electrons are found circling the nucleus like planets orbiting the sun.
- Atoms are electrically neutral because they have the same number of protons and electrons.
- # of positive = # of negative
- The **atomic number** of an element indicates the number of protons in each atom.
- The **atomic weight** of an atom indicates the sum of protons and neutrons.

(Mass)

electron
proton
neutron

Try these:
For each element:
1. State the atomic number.
2. Give the number of protons, neutrons, and electrons.
3. State the atomic mass.

How do you find atomic mass?
#p = atomic mass - #e

Element	Atomic number	# of			Atomic mass
		protons	neutrons	electrons	
Sulfur (S)	16	16	16	16	32.06
Calcium (Ca)	20	20	20	20	40.078
Aluminum (Al)	13	13	14	13	26.982
Gold (Au)	79	79	118	79	196.97

Atomic Structure 1

Bohr Diagrams

- chemical reactions involve electrons
- understanding how electrons are arranged in an atom helps us understand reactions
- we use Bohr diagrams to show the arrangement of electrons around the nucleus
- electrons in the outer orbit (called valence electrons) are involved in chemical reactions
- each orbit has a definite number of electrons
 - the first orbit can have a maximum of two electrons
 - the second and third orbits can have no more than eight electrons

Bohr diagrams

Element	# electrons in				Bohr diagram	
	atom	first level	second level	third level		
Lithium	3	2	1			1e 2e Li
Fluorine	9	2	7			1e 2e F
Sulfur	16	2	8	6		2e 8e 6e S
Calcium	20	2	8	8	2	2e 8e 8e 2e Ca

Try these with your partner:
1. Oxygen
2. Carbon
3. Magnesium
4. Aluminum

5. Draw the Bohr diagram for neon, a noble gas. What does your diagram tell you about why noble gases don't react with other elements?
 - noble gases have full orbits.
 - they don't have any spare electrons they're willing to lose
 - they don't need to borrow any electrons
 - so they don't react

Bohr practice

For your element, provide each of the following:

12 Mg Magnesium 24.305	15 P Phosphorus 30.974
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Left Right

1. Symbol
2. Atomic #
3. Family #
4. Period #
5. Atomic mass
6. # of protons
7. # of neutrons
8. # of electrons
9. Metal or nonmetal
10. Ionic charge
11. Explain why the ion has this charge.
12. Draw the Bohr diagram for the ion formed by your element.

Quiz

Attachments



Rust Time Lapse on Steel.mp4



Magnesium ribbon is burned in air.mp4



Reaction (Explosion) of Alkali Metals with Water.mp4