

Understanding Concepts

- In your notebook, write the word(s) needed to complete each statement below.
 - In a(n) _____ change, a new substance is produced.
 - A(n) _____ is a mixture of metals.
 - A solid produced when two solutions are mixed together is a(n) _____.
 - A(n) _____ is a sample of matter containing only one type of atom.
 - _____ are shiny, malleable, and conduct electricity.
 - The _____ is the number of protons in the atom.
 - An electrically charged atom is a(n) _____.
 - The _____ is the core of the atom, containing most of its mass.
 - The size of an atom is described by its atomic _____.
 - _____ materials are made by humans, rather than naturally.
 - Elements can be arranged in a(n) _____ table.
- Indicate whether each of the statements is true or false. If you think the statement is false, rewrite it to make it true.
 - Combustion is the chemical reaction between a fuel and hydrogen.
 - Colour and hardness are examples of chemical properties.
 - The measure of how easily a liquid flows is called viscosity.
 - A molecule is a combination of atoms.
 - The chemical symbol for calcium is Cal.
 - The modern periodic table organizes elements by atomic mass.
 - A Bohr diagram shows electrons in orbits around the nucleus.
 - A neutron is positive and located in the nucleus.
- What is the difference between a physical property and a chemical property?
 - Give an example of one physical property and one chemical property for each of the following: wood, gasoline, and baking soda.
- For each of the following, replace the description with one or two words:
 - the measure of resistance of a solid to being scratched or dented.
 - the chemical property that describes the ability of a substance to burn
 - a change in which a new substance is produced
 - a change in which no new substance is produced
 - able to dissolve in a solvent
 - substances invented by people
- The sentences below contain mistakes or are incomplete. Write complete, correct versions.
 - A physical change produces a new substance.
 - The formation of frost is a chemical change.
 - A new colour indicates a physical change.
 - The ability to react with an acid is an example of a physical property.
 - It is safe to taste some substances in the lab.
 - A chemical change is a change of state or form.
 - Corrosion is the reaction of a metal with nitrogen in the air.
 - Goggles may be taken off if you have finished your experiment.
 - Elements are made up of compounds.
 - Nonmetals are shiny and good conductors.
 - Protons are negative particles in orbits around the nucleus.

- (l) The mass number is the number of neutrons.
- (m) A Bohr diagram shows protons in orbit.
- (n) Mendeleev's table organized elements by atomic number.
- (o) Elements in the same period have similar properties.
6. List five things you would consider before deciding whether a change is chemical or physical.
7. Indicate whether each of the following is a physical or a chemical change.
- water freezing on a pond
 - soap removing grease from hands
 - a light bulb glowing
 - a cake baking
 - wood burning
 - kitchen scraps composting
 - a paper clip bending
 - dynamite exploding
8. Describe two compounds that contain atoms of the same elements, but in different proportions.
9. State the types of atoms and the numbers of each type that are present in the following molecules: copper phosphate (Cu_3PO_4) and sodium nitrate (NaNO_3).
10. Describe the similarities and/or differences between each pair of terms.
- physical property, chemical property
 - combustion, corrosion
 - element, compound
 - atom, molecule
 - metal, nonmetal
 - mineral, ore
 - natural material, synthetic material
11. In a Bohr-Rutherford model of the atom,
- Where are the protons found?
 - Where are the neutrons found?
 - Where are the electrons found?
- Which particles make up most of the mass of the atom?
 - Which particles take up most of the space in the atom?
12. State Mendeleev's periodic law.
13. How does Mendeleev's periodic law differ from the modern periodic law?
14. (a) In the periodic table, where are the metals found?
(b) Where are the nonmetals found?

Applying Skills

15. Name four materials or pieces of equipment that you used in your investigations to ensure lab safety. Explain the function of each.
16. A yellow solid is heated and is observed to change to a brown liquid. Explain whether the change is chemical or physical.
17. A white solid is heated and is observed to change to a liquid at 65°C . When the liquid is cooled, it becomes a white solid again at 65°C . Is the change chemical or physical? Explain.
18. Examine the models in **Figure 1**.

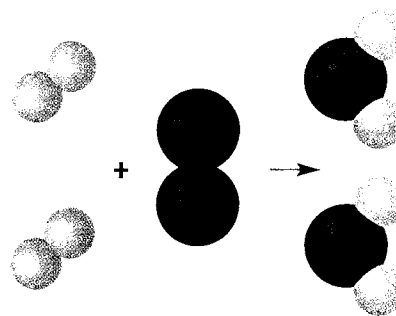


Figure 1

- What substances could the drawings represent?
 - Write a word equation for the reaction.
19. Copy **Table 1** into your notebook. Fill in the blanks with the missing numbers.

Table 1

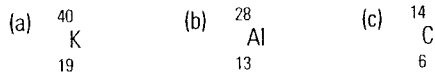
Element	Symbol	Atomic number	Mass number	No. of protons	No. of electrons	No. of neutrons
beryllium	Be	4	9	?	?	?
carbon	C	6	?	?	?	8
silicon	Si	?	?	?	14	14
potassium	K	?	?	19	?	20

20. Write the formula, name, and structural diagram for the compound formed by each of the following combinations of elements:

- (a) potassium and chlorine
- (b) calcium and oxygen
- (c) aluminum and sulfur

21. Draw Bohr-Rutherford diagrams for each of the atoms in question 20.

22. Identify the numbers of protons and neutrons in each of the atoms in **Figure 2** by interpreting their standard atomic notation.

**Figure 2**

23. Match the description on the left with the term on the right. Use each term only once.

Description	Term
A smallest particle of an element	1 element
B substance containing only one type of atom	2 synthetic
C connection between atoms	3 proton
D particle made up of two or more atoms	4 composite
E number of protons	5 molecule
F positive subatomic particle	6 polymer
G sum of protons and neutrons	7 atomic number
H uncharged subatomic particle	8 mass number
I very long molecule	9 neutron
J material formed by mixing two or more materials	10 atom
K produced by people	11 bond

24. List the four different types of materials that people have used over the centuries and give one ancient and one modern example of each.

25. Classify each of the following as a metal, polymer, ceramic, or composite.

- (a) concrete reinforced with steel bars
- (b) a pottery coffee mug
- (c) a bronze statue
- (d) a polyethylene drink bottle
- (e) a shirt that is 40% cotton and 60% nylon

26. Suppose someone tells you that a green object contains copper. You are not convinced because you have seen copper wires and jewellery that are reddish-brown. Is it possible that this green substance does contain copper? Explain.

Making Connections

27. The four Hazardous Household Product Symbols indicate products that are poisonous, flammable, explosive, and corrosive. Which labels would be on containers of

- (a) an aerosol insect spray?
- (b) a drain cleaner?
- (c) an ant powder?
- (d) furniture polish?

28. Think of a group of objects (e.g., leaves, food, animals, children's toys, or drug store products) and a way to categorize them so that, if a new one were to be discovered, it could be included in your system. Create a computer or poster display of your organization system, and explain why you chose to categorize the objects in this way.

29. Elements have been named for many reasons. Using library resources, or the Internet, research the following:
- Germanium, lutetium, and polonium were named to honour the geographic origin of their discoverers. Who were the discoverers, and where did they come from?
 - Which heavenly bodies were the following named after: mercury, uranium, neptunium, plutonium, tellurium, selenium, palladium, cerium? (Some are very easy, while others are not so obvious.)
 - Some elements were named to honour people. Which people were honoured by the following: gadolinium, curium, einsteinium, fermium, mendeleevium, lawrencium, nobelium, seaborgium? Write out their full names, and write a couple of sentences about each person.
 - Some elements were named after places. What places are the following named after: europium, hafnium, americium, berkelium, californium?
30. Carbon dioxide ejected from a fire extinguisher is so cold that it changes to snow.
- Is this a chemical or a physical change?
 - The carbon dioxide snow, when applied to a burning object, is said to smother the flame. What kind of chemical change is the carbon dioxide snow preventing? How does the carbon dioxide stop the fire?
31. Corrosion is the reaction of metals with oxygen in a chemical change.
- What kinds of changes occur in other substances over time? For example, what happens to plastic products left out in below-zero temperatures or in intense sunlight for long periods of time?
 - In what instances could the use of plastics practically replace the use of metals?
32. You have learned that models are modified as scientists gather new evidence. Has this happened with the atomic model? Explain.
33. Elements are the basic building blocks of all the substances in the world. Elements are made up of atoms. Think about the structure of the atom.
- Which part of the atom is involved in the chemical reactions that form these substances? Give reasons for your answer.
 - Identify one substance that is produced by industry, and describe its potential uses and associated risks.
34. Customs officials investigating a crate shipped from Central America wanted to know what was in the crate before allowing it into Canada. All the labels were in Spanish, but the following chemical symbols were printed on the crate: NaHCO_3 , NaNO_3 , $\text{Ca}_3(\text{PO}_4)_2$. Would you recommend that the officials allow the crate to continue, or should they call the shipping company for more information? Explain your answer.
35. Design a poster to represent an element from the periodic table. Include the following information: atomic mass, atomic number, the origin of the symbol, properties of the element, where it can be found, can it be produced, and what is it commonly used for? You may include any other information that you feel is important or relevant. Be sure to include a neat and colourful drawing of its Bohr model (including the number of protons and neutrons).
36. In general, the atomic mass of elements increases as the atomic number increases. Find three pairs of elements in the periodic table that are exceptions to this generalization. Why do you think these exceptions occur?