

Background Information

The basic unit of matter is the **atom**. The atom is made up of even smaller particles. Three of these **subatomic particles** are the proton, the neutron, and the electron. Both the positively charged protons and the electrically neutral neutrons form the **nucleus** of the atom. The negatively charged electrons travel around the nucleus of the atom in a series of distinct **energy levels**.

The number of protons in the nucleus of an atom, or the **atomic number**, is used to identify the atom. The total number of protons and neutrons in the nucleus is called the **mass number**.

Substances that consist entirely of only one type of atom are called **elements**. Each element is represented by a chemical **symbol**. The number of protons in an atom of an element never changes. The number of neutrons, however, may vary from one atom of an element to the next. Atoms of the same element that have different numbers of neutrons are called **isotopes**. Certain kinds of isotopes are **radioactive**.

Substances that consist of more than one type of atom are called **chemical compounds**. Most of the materials in the living world are compounds.

Procedure

1. Match the numbered terms with their definitions. Write the letter of the definition that corresponds with each term in the space provided.

_____ 1. mass number	a. atoms of the same element with different numbers of neutrons
_____ 2. chemical symbol	b. positively charged particle
_____ 3. isotopes	c. subatomic particle located outside the nucleus of the atom
_____ 4. atomic number	d. substance that contains two or more different kinds of atoms.
_____ 5. nucleus	e. number of protons in an atom
_____ 6. neutron	f. shorthand way of representing an element
_____ 7. element	g. center of the atom
_____ 8. proton	h. electrically neutral subatomic particle
_____ 9. chemical compound	i. number of protons plus the number of neutrons in an atom
_____ 10. electron	j. substance consisting of only one type of atom

Background Information

Atoms that have the same number of protons and electrons are electrically neutral. However, atoms may gain or lose electrons during chemical reactions. This creates an imbalance of negative and positive charges. Atoms may have a negative charge because they have gained extra electrons. Such atoms are called **negative ions**. Other atoms may have a positive charge because they have lost electrons. These atoms are called **positive ions**.

Procedure

2. The following table contains information about several atoms. Using what you have learned in the preceding paragraph, complete the table. Enough information has been provided for you to fill in all the blanks.

Element Name and Symbol	Atomic Number	Mass Number	Number of Protons	Number of Neutrons	Number of Electrons	Isotope, Ion, or Neutral Atom
Aluminum (Al)	13	27			13	neutral atom
Bromine (Br)			35	45	36	
Carbon (C)	6			6	6	
Carbon (C)	6	14			6	
Helium (He)	2	4				neutral atom
Hydrogen (H)	1		1	0		neutral atom
Hydrogen (H)		1			0	
Lithium (Li)	3	7			2	
Nitrogen (N)		14				neutral atom
Oxygen (O)		18	8		8	
Oxygen (O)	8	16			10	
Potassium (K)		39	19			neutral atom

3. Use the information from the attached Periodic Table to answer questions 1 through 3 and to fill in the table that follows. A small portion of a Periodic Table is shown below. A more current Periodic Table can be found at the end of this worksheet.

1 H Hydrogen 1.0079							2 He Helium 4.0026
3 Li Lithium 6.941	4 Be Beryllium 9.0122	5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.990	12 Mg Magnesium 24.305	13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948

Questions about the Periodic Table

1. What is the boldfaced letter or letters in the center of the box?
2. What is the number above a boldfaced letter or letters and what does it stand for?
3. What is the number below the name of an element and what does it stand for?

Data Table (Use the Periodic Table to fill in the missing data)

Element	# of Protons	# of Neutrons	Total # of Electrons	# of Electrons in 1 st Energy Level	# of Electrons in 2 nd Energy Level	# of Electrons in 3 rd Energy Level	Stable or Unstable
Carbon							
Chlorine							
Helium							
Hydrogen							
Sulfur							
Magnesium							
Neon							
Nitrogen							
Oxygen							
Phosphorus							
Sodium							
Argon							

Background Information

Any process in which a chemical change occurs is known as a **chemical reaction**. A chemical reaction converts elements or compounds known as **reactants** into elements or compounds known as **products**. A **chemical equation** uses symbols and formulas to describe a chemical reaction.

Energy is the most important factor in determining whether a reaction will occur. A chemical reaction that releases energy may occur **spontaneously**. A chemical reaction that requires energy, however, will not flow without a source of energy.

Describing Chemical Reactions

4. A number of chemical reactions are described below. In the spaces provided, identify the reactant(s) and the product(s). Then write an equation for each reaction.

- a) A sodium ion (Na^+) reacts with a chlorine ion (Cl^-) to form the compound sodium chloride (NaCl)

Reactant(s): _____

Product(s): _____

Equation: _____

- b) Magnesium oxide (MgO) is produced when a magnesium ion (Mg^{+2}) reacts with an oxygen ion (O^{2-})

Reactant(s): _____

Products(s): _____

Equation: _____

Background Information

Most chemical reactions and their equations are more complex than those in the two exercises you have just completed. The next few problems are a bit more tricky because you will be asked to **balance** the equations. In a balanced equation, the number of atoms of each element is the same on both sides of the equation. Here is how you balance a chemical equation.

- Write a chemical equation with correct symbols and formulas.
- Count the number of atoms of each element on each side of the arrow.
- Balance atoms by using coefficients. Coefficients are numbers that indicate how many atoms or molecules of each substance are involved in the reaction. **Note:** Only change coefficients when balancing an equation. Never change symbols or formulas.
- Check your work by counting the atoms of each element.

- c) Nitrogen (N_2) and hydrogen (H_2) form ammonia (NH_3).

Reactant(s): _____

Product(s): _____

Equation: _____

- d) Carbonic acid (H_2CO_3) breaks down to form water (H_2O) and carbon dioxide (CO_2).

Reactant(s): _____

Product(s): _____

Equation: _____

- e) When it is burned, natural gas (CH_4) combines with oxygen gas (O_2) to produce carbon dioxide (CO_2) and water (H_2O).

Reactant(s): _____

Product(s): _____

Equation: _____

the periodic table

[illegible]