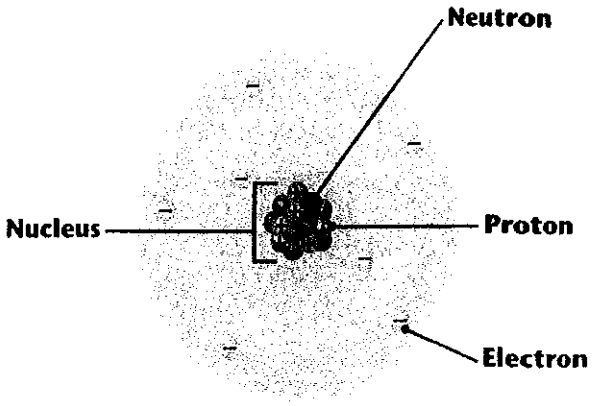
8.P.1-2.

Introduction to Atoms



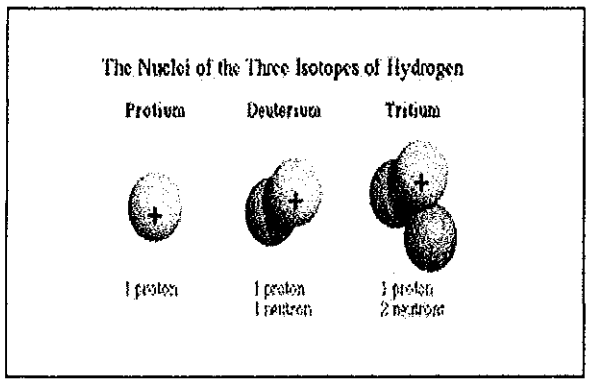
Everything around you, whether you can see it or not, is made out of matter. **Matter** is anything that has mass and takes up space (volume). Matter is made of atoms. Atoms are made of even smaller particles called **protons, neutrons, and electrons.**

An atom is made up of a **nucleus** surrounded by one or more electrons. The ***nucleus is the very small center core of an atom***. It is made up of smaller particles called **protons** and neutrons. Protons have a *positive+ electric charge*. **Neutrons** have ***NO*** charge. The **electrons** that move rapidly around the nucleus have a *negative-* electric charge. Electrons move around the nucleus in a sphere-shaped area. Scientists show this area as a cloud of negative charge. Electrons may be anywhere within the **electron cloud.**

In a neutral atom, the number of protons equals the number of electrons. So, for example, if an atom has 5 protons with positive charges and 5 electrons with negative charges, they cancel out each other, making the atom **neutral.** If an atom gains or loses electrons, the atom will now have either a negative or positive charge. An atom with a charge is called an **ion.**

One atom is different from another atom if it has a different number of protons. For example, hydrogen has only one proton in its nucleus, while carbon has 6 protons. Hydrogen and carbon are called elements. An **element is made up of all the same atoms.** Every atom of an element has the same number of protons. The number of protons in the nucleus of its atoms is called the **atomic number.** So, we would say that the atomic number of hydrogen is 1 and carbon is 6.

Atoms are so small their mass is measured in atomic mass units (amu). Protons and neutrons are about equal in mass. Each one is about 1 amu. When the mass of the protons of an element and the mass of the neutrons are combined, that combined number is called the **(atomic) mass number.** Electrons are much smaller. It takes almost 2,000 electrons to equal the mass of one proton. Electrons, however, take up much more space in the atom than the nucleus.



Although all atoms of the **same element** have the **same number** of **protons**, they may have different number of neutrons and therefore, have a different mass number. **Isotopes are atoms with the same number of protons but a different number of neutrons.** An isotope is identified by its mass number. So, if hydrogen, symbol H, normally has 1 proton and 0 neutrons, its atomic mass number is 1 (1p +0n=1amu) and it is called Hydrogen-1. An isotope of hydrogen would still have 1 proton or it wouldn't be hydrogen, A hydrogen atom with 1 proton and 1 neutron is called Hydrogen-2 (1p+1n=2amu). Hydrogen-3 is another isotope. (1p+2n=3amu). **The average mass of all the isotopes of an element is called the atomic mass.**

Name _____

Introduction to Atoms

1. What is matter? _____

2. True or False? Atoms are the smallest particles of matter.

3.Draw and label the parts of the atom below.

3. What is in the nucleus of an atom? _____

4.Match the following by writing the letter of the word on the line.

positive charge _____	A. neutron
negative charge _____	B. electron
no charge _____	C. proton

5. True or false? Most of an atom's volume is the space in which electrons move in the electron cloud.

6. Why are atoms neutral? _____

_____

7. What happens when atoms gain or lose electrons? _____

8. What are atoms that have a charge called? _____

9. A substance made up of all the same atoms is called a(n) _____.

10. How is one atom different from another? _____

11. What is the number of protons of an atom called? _____

12. What unit of measurement is used to measure the mass of a proton or neutron?

_____

13. What is (atomic) mass number? _____

14. If an atom has a mass number of 5 and it has 3 protons, how many neutrons does it have? _____

15. How many electrons are needed to equal the mass of one proton? _____

16. What are isotopes?

_____

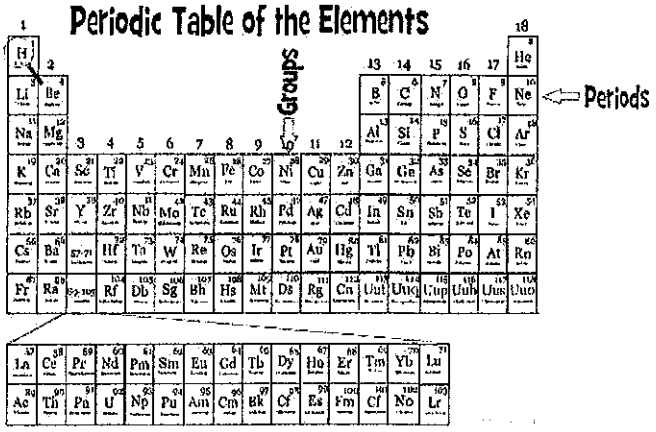
17. Hydrogen-1 has one proton and 0 neutrons. 1 p + 0 n=1 Hydrogen-1 mass number is 1 amu.
Hydrogen-2 has one proton and ___ neutron ___ p+ ___ n=2 Hydrogen-2 mass number is ___ amu.
Hydrogen-3 has one proton and ___ neutrons ___ p+ ___ n=3 Hydrogen-3 mass number is ___amu.

18. What is the average mass of all the isotopes of an element called? _____.

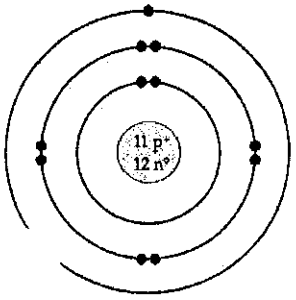
Organizing the Elements

Dmitri Mendeleev

In 1869, the Russian scientist Dmitri Mendeleev discovered a set of patterns in the properties of the elements. He noticed that a pattern of properties appeared when he arranged the elements in order of increasing atomic mass.



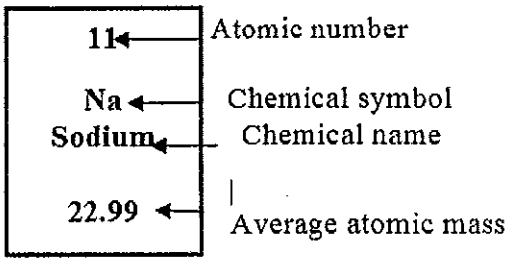
The **atomic mass** of an element is the a*verage mass of all the isotopes* of that element. Mendeleev published the first periodic table. In the periodic table, the properties of the elements ***repeat*** periodically, or in regular in intervals, in each **period**, or row, of the table. Mendeleev left three blank spaces in the table. He predicted that these spaces would be filled by elements that had not yet been discovered. He even predicted the properties of those elements. Those elements were soon discovered. Their properties are close to those predicted by Mendeleev.



Sodium

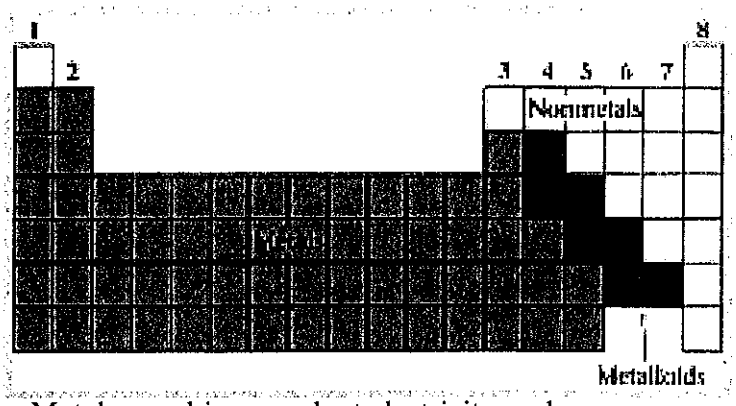
There are 3 shells surrounding 11 protons, Sodium is in period. (row) 3

There are 7 periods or rows. The **period number** tells how many energy levels an atom has. For example, elements in period 3, or the 3rd row, have 3 energy levels.



The periodic table has been updated since Mendeleev's time as scientists discovered new elements. After protons were discovered, elements were rearranged according to **atomic number,** which is the number of protons (and electrons). Some elements changed positions and the patterns of properties became more regular.

The modern periodic table contains over 100 squares, one for each element. Each square includes the element's atomic number, chemical symbol, chemical name, and the average atomic mass. Recall, that the average atomic mass is the average mass of all the isotopes of an atom. Mass number is the mass of one of those isotopes and can help determine the number of neutrons in an atom. The chemical symbol for an element usually consists of one or two letters, such as Fe, the chemical symbol for iron.



The properties of an element can be predicted from its **location** in the periodic table. As you move across a row, or period, from left to right, the properties of elements **change** in a predictable pattern.

The majority of the elements are **metals** and are on the left side of the table. Metals are shiny, conduct electricity and heat, are malleable, (can be pounded into shapes, and ductile (can be pulled into wire). The nonmetals are to the right of the zigzag line. **Nonmetals** have the opposite properties of metals. They are not shin but dull. They are not good conductors of electricity and heat. They are brittle, not malleable. They are never used to make wires. The elements along the zigzag line are **metalloid**s and can have properties of both metals and nonmetals. So, a metalloid can be a semiconductor of electricity, but it can be dull.

The elements in a column are called a **group**, or **family**. The groups are numbered from Group 1 on the left to Group 18 on the right. The family name of a group is typically the name of the first element in the column. But several groups have special names, like group 18 which is called the Nobel Gases. Elements in each group, or family, have **similar** characteristics, just like family members can have the same traits. The number on the top of columns 1, 2, 13-18, help tell how many electrons are on the outer shell (valence electrons) of the atom. Group 1 has 1 valence electron. Group 2 has 2 while groups 13-18 have 3, 4, 5, 6, 7, and 8. *Did you notice you have to drop the tens place?* This rule does not works for the transition metals which are groups 3-12. Look again at the model for sodium on the first page. How many electrons does it have on the outer shell? Sodium is in group 1. Because the elements in a group have the same number of valence electrons they act similarly.

So what can you say about an element that is in group 2 and is in period 4. Write it on the lines below. Can you name the element?

_____

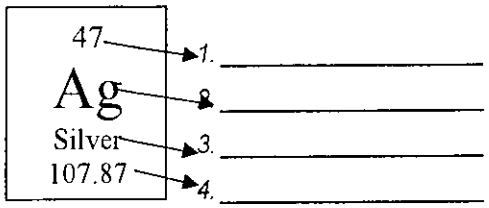
_____

_____

Name_____

Reinforce Organizing the Elements

Label the four facts shown about each element.



Answer the following on a separate sheet of paper.

5. In what order did Mendeleev arrange the elements in the periodic table?

_____

6. What do elements in the same column in the periodic table have in common?

_____

7. What can you predict about an element from its position in the periodic table?

_____

Building Vocabulary

From the list below, choose the term that best completes each sentence.

atomic mass chemical symbol periodic table period group

8. An element's _____ is its row in the periodic table.

9. Mendeleev was the first to arrange elements according to their properties in a(n) _____ .

10. Elements in a(n) _____, or family, of the periodic table have similar characteristics.

11. A(n) _____ is an abbreviation for the name of an element and has either one or two letters.

12. The _____ of an element is the average mass of all the isotopes of that element.

Name_____ Date_____ Period_____

Where Do I Belong?

Scientist Mary and Mark are trying to figure out where to put the mystery elements. They are observing their properties. Help them put the elements in the group they belong.

Mystery Element	Appearance	Melting Point	Conducts Electricity
1?	Yellow crystal	115° C	No
2?	Shiny silvery solid	1455° C	Yes
3?	Black solid	3500° C	No
4?	Greyish white solid	938° C	Semiconductor
5?	Shiny grey solid	630 ° C	No
6?	Silvery white solid	727° C	Yes

Write the number of the elements in the box that describe it best.

Metals	**Metalloids**	**Nonmetals**
Explain why you decided to put them here.	**Explain why you decided to put them here.**	**Explain why you decided to put them here.**