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READING MATERIAL

Read About Atoms & Molecules

WHAT IS ATOMIC STRUCTURE?
All atoms are made of three smaller particles called protons, neutrons and electrons.
The protons and neutrons clump together at the center of an atom and the electrons orbit far away. Atoms can be combined to form molecules through chemical reactions. To better understand atomic structure…

LET’S BREAK IT DOWN!

Atomic Structure

The center of the atom, often
referred to as the nucleus, is made
up of protons and neutrons. The
protons are positively charged, while
the neutrons don’t have a charge.
Orbiting around the outside of the
atom at a tremendous speed and
distance are electrons. Electrons are
the smallest of the three subatomic

particles and have a negative charge. Empty space is found between the atomic nucleus and electrons.

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Microscopic Atoms

Atoms are extremely small. Atoms are more than 10,000 times smaller than the width of a hair. Even a

classroom microscope would not be
able to see anything close to the size
of an atom. A specialized
microscope called a Scanning
Tunneling Microscope developed in
the 1980s can show us individual

atoms. If you were to look at some iron filings with a Scanning Tunneling Microscope, you would be able to see tiny spheres of iron atoms.

Identifying Atoms

Each element has a certain number

of protons, neutrons and electrons.
We can find this information by
referencing the Periodic Table of
Elements. For example, element
number 6 on the table is carbon,
which is notated by the letter C. The
periodic table also shows us that
carbon’s atomic number is 6. The
atomic number tells us how many protons and electrons are present in the element. From this information we know that carbon has 6 protons and 6 electrons.

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Elements and Molecules

Elements can be combined to make

molecules. Water for example is H2O. This means that 2 hydrogen atoms
are bonded to one oxygen atom.
There are endless combinations of

atoms that make up all of matter.
Some are simple like water, while
others are much more complicated
such as hemoglobin. A sucrose
molecule, what you know as table sugar, is made up of 12 atoms of carbon, 22 atoms of hydrogen, and 11 atoms of oxygen. Sucrose can be written in a shorthand notation like this:

C12H22O11.

Careers in Chemistry

The main field of science that
studies atoms and molecules is

called chemistry. Chemists use their
knowledge of atoms to create
molecules that can be used as
medicines. In order to make

molecules, they need to know which
ones react together and which order
to react them in. Other types of
scientists like biochemists study huge molecules made by nature such as proteins and DNA. The production of insulin molecules to treat diabetes was made possible by the work of biochemists.

ATOMS & MOLECULES VOCABULARY

Matter Anything that has mass and takes up space.

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Atom The basic unit of an element. All matter is made up of atoms.

Proton A positively charged subatomic particle located at the center of an atom.

Neutron A subatomic particle with no charge located at the center of an atom.

Electron A subatomic particle of an atom that is negatively charged and orbits the nucleus extremely

fast.

NucleusProtons and neutrons clump together at the center of an atom to form the nucleus of an atom.

ATOMS & MOLECULES DISCUSSION QUESTIONS

What would you see if you looked at iron filings with a Scanning Tunneling Microscope?

Since the Scanning Tunneling Microscope is so powerful, you would see tiny spheres which are iron atoms (the smallest possible unit of iron).

Describe the different particles that make up an atom.

An atom is made up of 3 particles; protons, neutrons and electrons. Protons are positively charged and are positioned in the center of an atom. Neutrons are not charged and are also located in the center of an atom. Electrons orbit the center very quickly and are negatively charged.

What are some examples of elements? How do you know they are elements?

Some examples of elements are gold, iron, copper and carbon. Anything on the periodic table is an element. All elements are pure substance made up of only one type of atom.

How can you use the Periodic Table of Elements to help you find information about specific elements?
The Periodic Table of Elements shows the names and abbreviations for each element. It also tells

you how many protons, neutrons and electrons each atom has. The atomic number of each element corresponds with how many protons and electrons an element has. We cover more details about the periodic table in our lesson called “The Periodic Table.”

How did scientists conclude that most of an atom is empty space?

In 1908, Ernest Rutherford did an experiment where he shot beams of radiation through gold foil which is made up of gold atoms. Most of the radiation went right through the gold foil, while only a tiny fraction of the beams bounced back. This supports the atomic model with most of the mass at the center with electrons orbiting far away from it.

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What are some different careers available for people that want to study atoms and molecules?

Scientists in the medical field use molecules on a regular basis to develop new medicines to help fight diseases. Specifically, biomedical scientists may be able to replicate naturally occurring molecules to help people with deficiencies.