

LESSON | What are atoms?

9

What is the smallest thing you can think of? A single grain of sand? A particle of dust?

Now try to imagine something so small that you would need millions of them to make one grain of sand! Imagine something so small that you cannot see it—not even with the most powerful microscope.

There is something that small: the **atom**. All matter is made up of atoms. All solids, liquids, gases, and plasmas are made up of these tiny particles.

Atoms are matter. One atom take up space—very, very, very little space. An atom also has mass—very, very, very little mass.

How small is the atom? Atoms are so small that in just one drop of water, there are about six sextillion atoms.

That's 6,000,000,000,000,000,000 atoms!!!

If you tried to count to six sextillion it would take you about one hundred trillion years—If you counted fast!

The idea of the atom is far from new. Many years ago, before there were any “real” scientists, there were philosophers [fi-LAHS-uh-furz]—people who did mental “investigations.” They worked with ideas. Over 2,000 years ago, a Greek philosopher named Democritus [di-MAHK-ruh-tus] had the idea that all matter was made up of tiny parts. He believed that these parts could not be divided or destroyed. He named them *atoms*. In Greek, *atomos* means “indivisible” [in-di-VIS-uh-bul].

Democritus could not prove his idea. He couldn't even test it. So, it remained just an idea for many years. Today, scientists have proven that many of Democritus's ideas were correct. Everyday, more and more is discovered about the atom.

LARGE NUMBERS AND SMALL THINGS

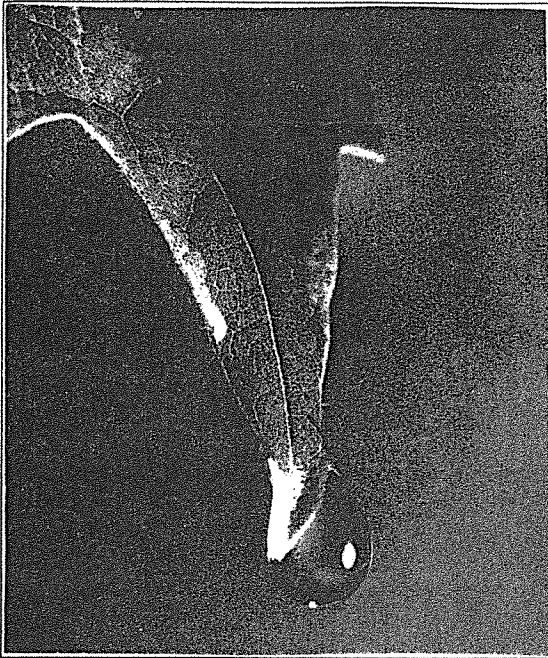


Figure A

Suppose each of those atoms were a drop of water. How much water would that be? It would be six sextillion drops of water.

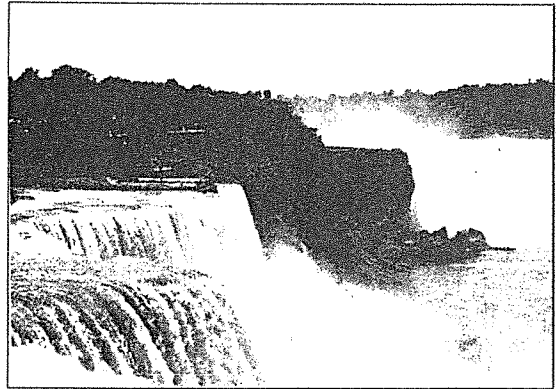


Figure B

That's more water than all the water that passes over Niagara Falls in 2000 years.



Figure C

That's enough water to fill about six billion Empire State Buildings.

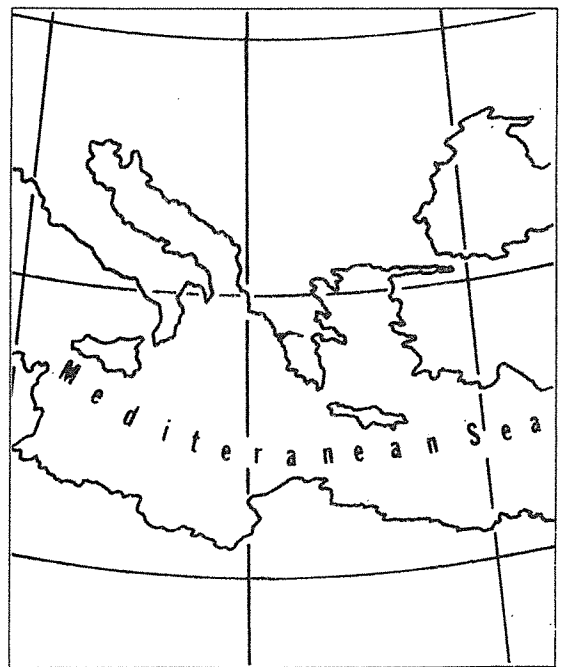


Figure D

That's almost twice as much water as there is in the Mediterranean Sea.

TRUE OR FALSE

In the space provided, write "true" if the sentence is true. Write "false" if the sentence is false.

- _____ 1. An atom is very large.
_____ 2. Democritus named the atom.
_____ 3. Solids are made of atoms.
_____ 4. Liquids are made of atoms.
_____ 5. Gases are not made of atoms.

MATCHING

Match each term in Column A with its description in Column B. Write the correct letter in the space provided.

Column A	Column B
_____ 1. Democritus	a) a very small particle
_____ 2. matter	b) Greek philosopher who named the atom
_____ 3. philosophers	c) made up of atoms
_____ 4. <i>atomos</i>	d) people who think about things
_____ 5. atom	e) Greek word for "indivisible"

WHICH IS SMALLEST? WHICH IS BIGGEST?

Each group of words or terms below can be arranged by size. Write them in the correct order in the spaces below each group.

1. a piece of dust an atom an elephant

_____ smallest _____ largest

2. the tip of a pin a dime an atom

_____ smallest _____ largest

3. an atom a rock a pebble

_____ smallest _____ largest

MODERN ATOMIC THEORY

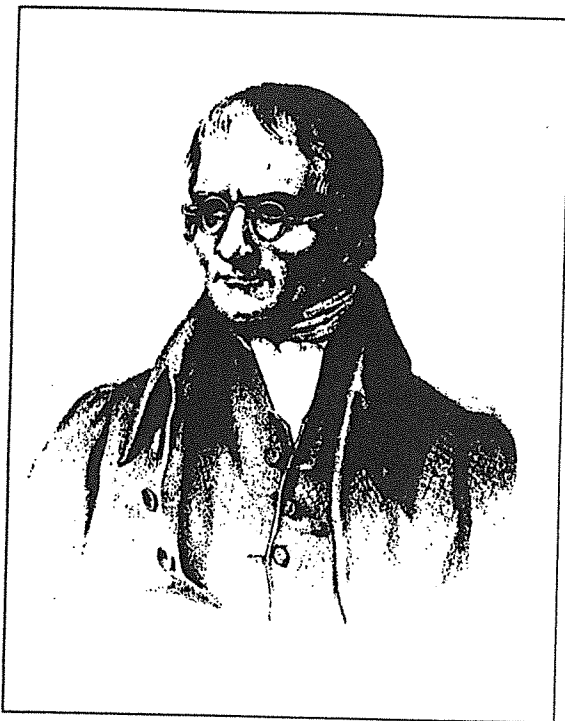


Figure E John Dalton

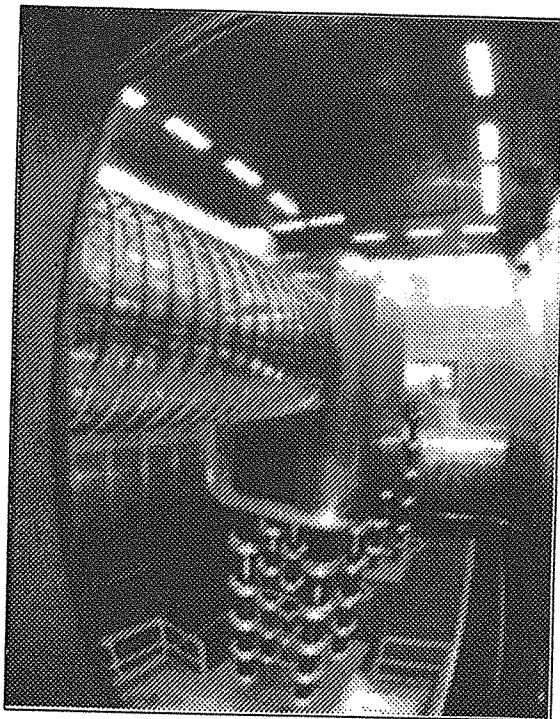


Figure F Synchrotron

In the early 1800s, an English chemist named John Dalton described his ideas about matter. Dalton's ideas were based on many scientific experiments and observations. The ideas formed a theory that led to our modern atomic theory.

You may wonder how we could know anything about a particle of matter that is too small to see and almost too small to measure. Scientists have learned how to study atoms. They study atoms by studying how matter behaves. They use very complicated equipment. However, you can learn about atoms by studying what scientists have learned.

The present atomic theory states:

1. All elements are made up of tiny particles called atoms.
2. Atoms of a given element are alike.
3. Atoms of different elements are different.
4. Chemical changes take place when atoms link up with, or separate from, one another.
5. Atoms are not created or destroyed by chemical change.

Democritus was on the right track over 2000 years ago. However, one important part of his idea has been proven wrong. Atoms *are* divisible. In fact, the "splitting" of the atom is the basis for nuclear [NEW-klee-ur] or atomic, energy.

FILL IN THE BLANK

Complete each statement using a term or terms from the list below. Write your answers in the spaces provided. Some answers may be used more than once.

alike
created
different
Democritus

John Dalton
six sextillion
small
2000

atoms
indivisible
destroyed

1. The atom was first thought of by a man named _____ more than _____ year ago.
2. In Greek, the word *atomos* means _____.
3. Matter that is indivisible cannot be _____.
4. An English chemist named _____ presented a modern atomic theory.
5. All elements are made of _____.
6. Atoms of a given element are all _____.
7. Atoms can not be _____ or _____ by chemical change.
8. Atoms of _____ elements are different.
9. Atoms are so _____ that we can not see them.
10. There are _____ atoms in a drop of water.

REACHING OUT

Why did it take 2000 years for scientist to confirm some of Democritus's ideas about atoms.
