

BOOK

J

SCIENCE BASICS

Essential



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Investigating matter

Anything that takes up space and has weight is called matter. The clothes you wear are matter, the bones and muscles of your body are matter. Air also has weight and occupies space. Air is therefore also matter.

The smallest particle of matter

A piece of iron is matter. If you break the iron piece you get smaller pieces of iron. You can go on breaking the piece of iron into smaller and smaller pieces. But this process must end somewhere. It is possible to get the smallest piece of iron. Dalton, a scientist of the 19th century called this smallest piece of iron, the iron atom. Similarly, the smallest piece of gold is the gold atom. The smallest piece of aluminium is the aluminium atom.

The smallest particle of gold, iron and aluminum is the atom. But in many cases, the smallest particle is not atom. It is the molecule. In fact, in most of the cases atoms live in a group of two or more atoms. This group of atoms is called a molecule. The smallest particle of oxygen gas is not an oxygen atom, it is the oxygen molecule. It has two atoms.



What is matter made up of?

Every matter of the world is made up of elements. There are about 110 elements in the world out of which everything has been made.

An element is made up of one kind of atoms. Oxygen gas is an element. All the atoms of oxygen are of one kind. Water is not an element because it is made up of two kinds of atoms. The atoms of hydrogen and oxygen. The smallest particle of water contains two atoms of hydrogen and one atom of oxygen. These atoms form one molecule of water.

What happens when atoms of different elements combine?

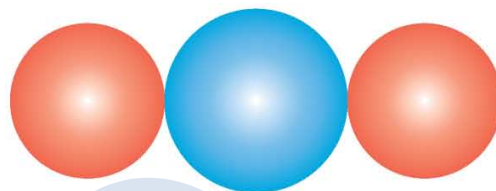
When atoms of different elements combine they form new substances. These are called compounds. Carbon dioxide gas is a compound because it contains two kinds of atoms. Its molecule (the smallest particle) has one atom of carbon and two atoms of oxygen.

Do you know?

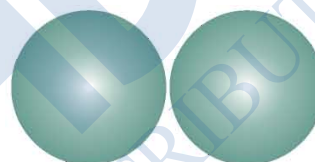
- Atoms and molecules are so small that they cannot be seen even by the most powerful microscope.
- Approximately 4 million gold atoms, placed end to end, will form a line only 1 mm long.
- Thousands of water molecules are present in a tiny drop of water.
- Atoms of one element are different from the atoms of other element. Every element has its own kind of atoms.

Elements as letters of the alphabet elements

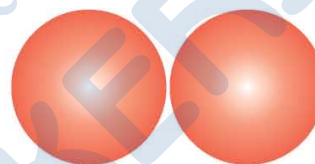
You can think of elements like letters of the alphabet. You can join different letters to make words. Thousands of words can be made from the 26 alphabets. In the same ways atoms of different elements can join together to make molecules of different matters. Millions of different kinds of molecules can be made from only about 110 different kinds of atoms. That is why there are millions of compounds around us.



a carbon dioxide molecule



a molecule of hydrogen



a molecule of nitrogen

States of matter

Most matter can be placed into one of three groups. These groups are solid, liquid and gas. This book is a solid, water is a liquid, air is a gas. Solid, liquid and gas are called states of matter. Solids are generally hard. You cannot easily change their shape. Liquids flow easily. Their shape changes when poured from one vessel into another. But they cannot escape from the vessel. Gases flow most easily. When put into a container they fill up the entire space of the container. If the container is open, they will escape out.

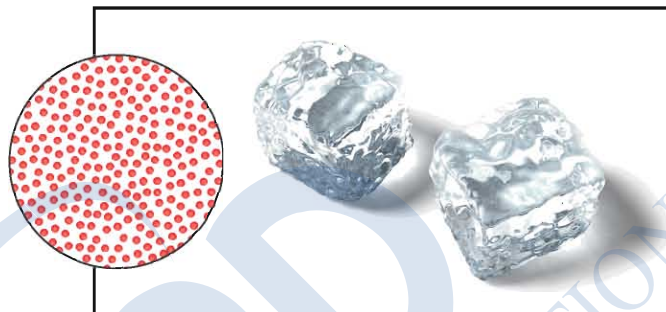
The three states of matter behave in different ways because of differences in the arrangement of molecules in them.

Examples of some common elements	Examples of some common compounds
Oxygen	Water
Hydrogen	Carbon Dioxide
Iron	Sugar
Gold	Cooking Salt
Aluminium	Chalk
Carbon	Vinegar
Silver	Baking Soda
Copper	Hydrochloric Acid

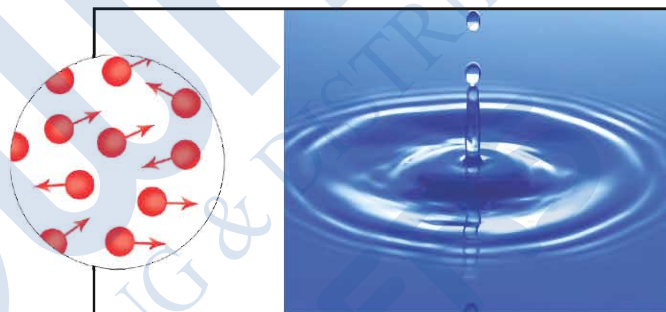
INVESTIGATE

- Can you find out the names of some other elements and compounds?
- What elements does our body need to grow?
- Can a gas be converted into liquid or solid state?
- How many gases can be prepared in your school's science lab?

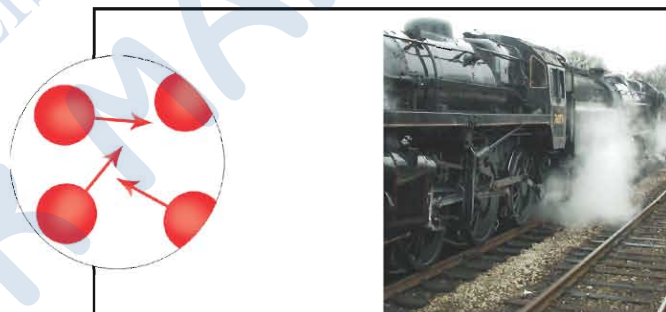
All molecules of a substance attract each other. In solids, the molecules are very tightly packed. As they are very close together, they attract each other very strongly. This keeps them firmly together. This is what makes solids hard.



In a liquid, the molecules are less tightly packed. Therefore they are farther away from each other and do not attract each other so strongly. They can move about within them. That is why liquids can flow and take the shape of the container.



In a gas the molecules are so far apart that there is hardly any attraction between them. They can move about freely in the entire space available to them. That is why they fill up entire space of a container.



Differences between a solid, liquid and gas

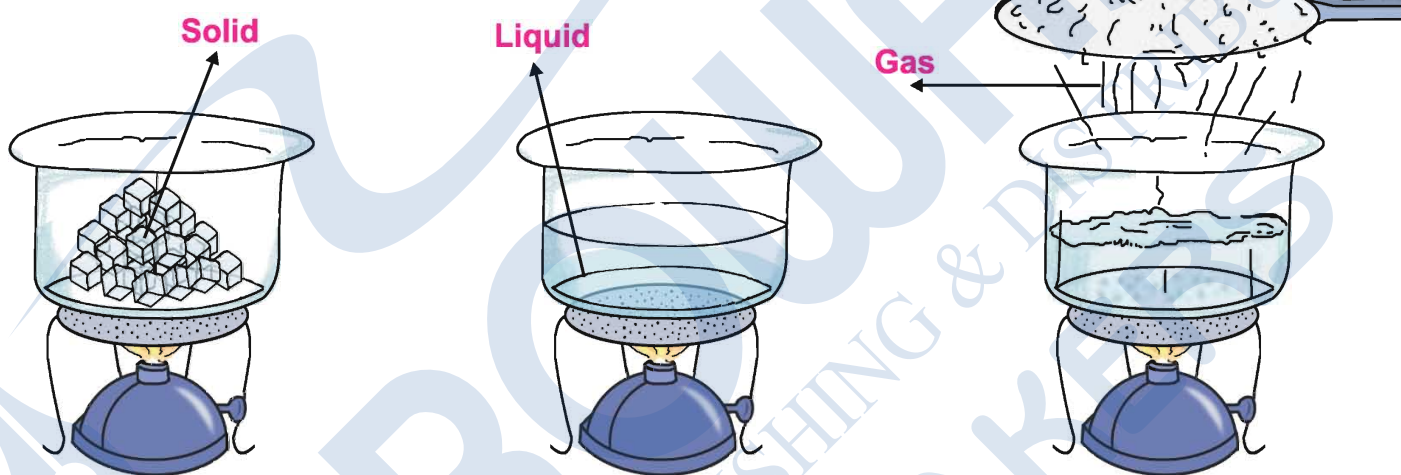
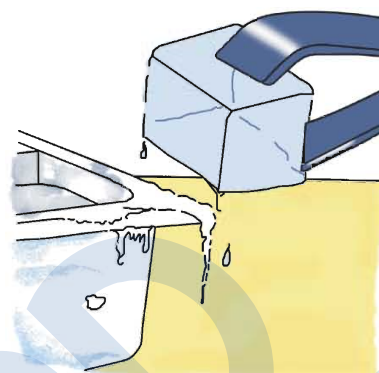
Solid	Liquid	Gas
<p>It has a definite volume.</p> <p>It has a definite shape.</p> <p>Its molecules are very tightly packed and have very strong force of attraction among them.</p>	<p>It has a definite volume.</p> <p>It does not have a definite shape. It takes the shape of the part of the container it fills.</p> <p>Its molecules are less tightly packed and have weak force of attraction among them.</p>	<p>It does not have a definite volume. It takes the volume of the container.</p> <p>It does not have a definite shape. It takes the shape of the whole container.</p> <p>Its molecules are far apart and have no force of attraction among them.</p>

Investigating matter

Change of state

Water, when kept in the freezer of a refrigerator turns into ice. Ice if heated will again change to water. Water, when steam is cooled, it changes back to water.

Ice, water and steam are the same substance. Their molecules are exactly the same. They are all made up of two atoms of hydrogen and one atom of oxygen.



Ice is the solid state of water. Water is in a liquid state. Steam is the gas state of water. Heating or cooling can change the state of water. Wax is another substance in which change of state can easily be seen by heating and cooling. Many substances can exist in the three states. But change of state is not so easy to see in other substances. Iron, for example, has to be made very very hot before it forms melted iron.

Remember

1. Anything that occupies space and has weight is matter.
2. Matter is made up of atoms and molecules.
3. The smallest particle of an element is an atom.
4. Atoms of two or more elements combine to form molecules, which are the smallest particles of a compound.
5. Solids, liquids and gases are the three states of matter. They behave in different ways because of differences in the arrangement of molecules in them.
6. In solids, molecules are very tightly packed. In liquids they are less tightly packed. In gases, they are completely free to move around.
7. Heating or cooling can change the state of matter.

1. Put a for true and a for false.

Can you give any reason why you said it true or false?

(a) All matters are made up of atoms or molecules.

Reason _____

(b) There are about 100 types of compounds.

Reason _____

(c) The smallest particle of an element is an atom.

Reason _____

(d) In all elements, atoms exist in pairs.

Reason _____

(e) The closer the molecules of a substance, the greater is the attraction between them.

Reason _____

(f) The molecules are most tightly packed in solids.

Reason _____

2. Name these:

- (a) Anything that occupies space and has weight. _____
- (b) The smallest particle of silver. _____
- (c) The smallest particle of chalk. _____
- (d) They cannot be broken up into simpler substances. _____
- (e) A combination of two or more elements. _____
- (f) Solid, liquid and gas are different. _____
- (g) Even if a small quantity of this is put into a container, it will fill the container completely.

3. Give two examples of things that are matter and two which are not.

