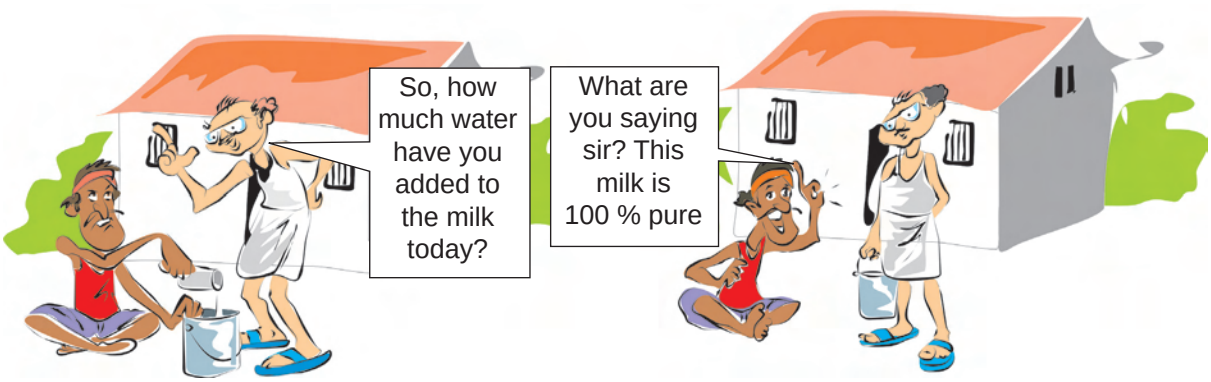
5. ELEMENTS AND COMPOUNDS AROUND US



5.1. TYPES OF PURE SUBSTANCE

Read the above conversation. How often do we use words such as 'pure milk' and 'pure water'? Have you ever wondered what 'pure' really means?

For an ordinary person, "a pure substance" means that it is free from adulteration. In that sense, the air we breathe and the milk we drink are not pure. However, there are a few cases where the matter that we encounter in ordinary experience is pure' that is, they consists of only a single substance. Distilled water, sugar, baking soda etc. are pure substances like the copper used in electric wiring.

MORE TO KNOW

Air we breathe is not a pure substance but a mixture of gases

Milk is a mixture that contains liquid fat, protein and water.

How to recognise a pure substance?

One can recognise a pure substance by its properties such as density, melting point, refractive index, electrical conductivity and viscosity. Then, how can we define a pure substance?

A pure substance has fixed composition and fixed properties which cannot be easily separated by physical methods.

For example, pure water boils at 100°C at one atmospheric pressure and ice freezes at 0°C. These are the properties of all samples of pure water, regardless of their origin. Pure water contains only two hydrogen and an oxygen which cannot be separated by physical methods.

In science, a pure substance is either an element (e.g., iron) or a compound (e.g., Sodium chloride).

ACTIVITY 5.1

List any 5 substances you consider pure:

1. _____
2. _____
3. _____
4. _____
5. _____

Fig: 1

Fig: 2

5.2. WHAT IS AN ELEMENT?

ACTIVITY 9.2

You have to unscramble the following words given in bracket:

1. Water conveying pipes are made of _____ (ONIR)
2. Electric wire contains _____ (PPERCO)
3. Ornaments are made of _____ (LDGO)
4. The air we breathe consist of _____ (YGENOX)
5. Coal contains _____ (RBONCA)

The unscrambled words such as iron, copper, gold, oxygen and carbon that we come across in our daily life are said to be elements.

Look at the pictures. What do you notice? Did you notice this. In fig.1, a boy is alone and in fig 2 two boys seem to be similar in all aspects (like twins)? Hence for analogy, we can say that both are elements.

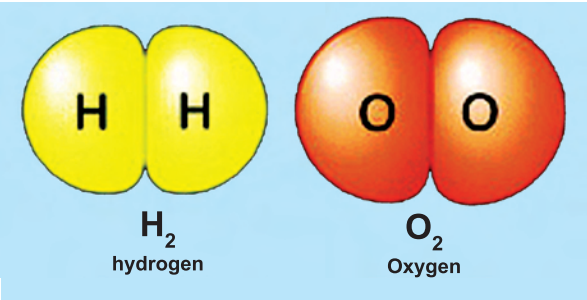
Let us see the different views of an element put forth by scientists

- An element is a pure substance that cannot be split into anything simple by physical or chemical methods. (BOYLE)
- An element is the basic form of matter that cannot be broken into a simpler substance. (LAVOISIER)
- An element is made of same kind of atoms. (Modern atomic theory)

MORE TO KNOW

An atom is the smallest particle of an element.

A molecule is made up of the same kind of atoms or different kinds of atoms



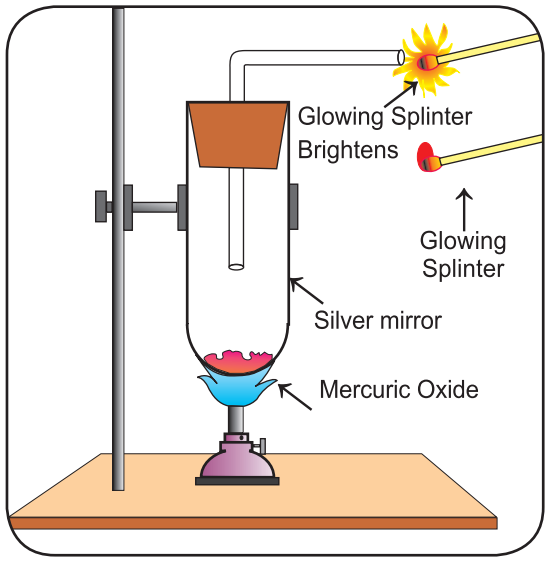
Examples of elements are hydrogen, nitrogen, oxygen, carbon, aluminium, gold, silver etc. A lump of sulphur contains sulphur atoms only. Nitrogen contains atoms of nitrogen only. Copper wires contain only copper atoms.

Thus,all elements are made up of one kind of atom only. However, atoms of different elements are not identical. For example, if we compare atoms of copper and silver, we find that they differ from each other in size and internal structure.

ACTIVITY 5.3

Take a little amount of mercuric oxide in a test tube. Heat it first gently, and then strongly in a bunsen flame. Observe the test tube. You will notice a silver mirror gradually appearing on upper part of the test tube and later, globules of mercury will be seen. Insert a glowing splinter into the test tube. The flame of splinter brightens showing the presence of oxygen. What does this tell you?

A complex substance like mercuric oxide is broken down into simpler substances, mercury and oxygen. It is not possible to split these substances any further by any other chemical method. Thus, mercury and oxygen are elements.



Mercuric oxide → Mercury + Oxygen
(element) (element)

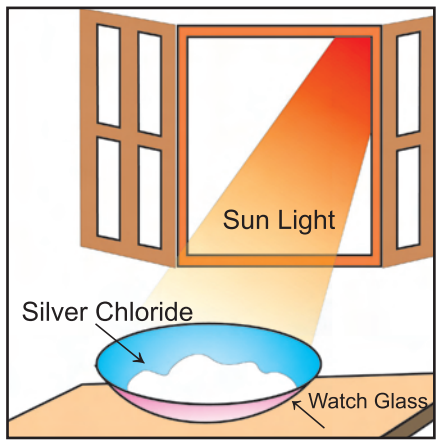
ACTIVITY 5.4

Take a small amount of crystals of silver chloride which are white in colour on a watch glass. Place the watch glass under sunlight for some time. What do you notice?

The crystal will slowly acquire grey colour. On analysis, it is found that sunlight has decomposed silver chloride into silver and chlorine(element)

Silverchloride $\xrightarrow{\text{Sunlight}}$ Silver + Chlorine
(white) (grey) Yellow green
(element) (element)

SCIENCE



you can repeat the same activity with silver bromide.

Silver bromide $\xrightarrow{\text{Sunlight}}$ silver + bromine

(light yellow) (grey) (Reddish brown)

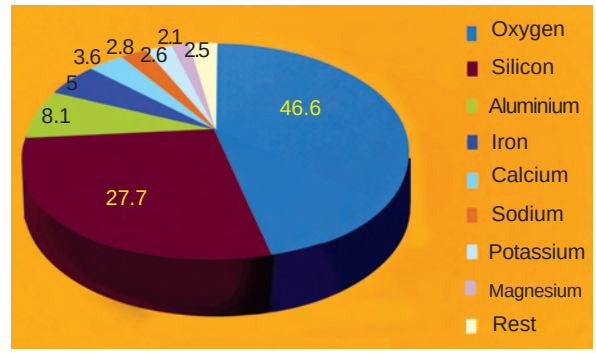
(element)(element)

5.2.1. Do you know how many elements exist in nature?

There are **118** elements known at present, out of which **92** elements occur in nature and the remaining **26** have been prepared in laboratory by artificial methods. However, only 112 elements have been authenticated by IUPAC (International Union of Pure and Applied Chemistry), and are allotted symbols.

Let us see the relative abundance of various elements in earth's crust, either in free state or in the combined state.

In earth's crust, oxygen is the most abundant element followed by silicon. Together, these make up three quarters of the earth's crust.



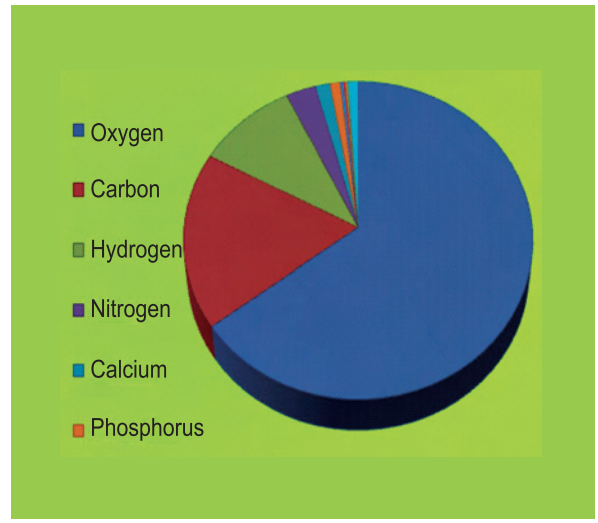
Pie Diagram - Elements present in the earth's crust

ACTIVITY 5.5

Can you find the most abundant element from the above pie diagram?

5.2.2. Have you ever thought about the elements found in our body?

About 99% of the mass of human body is made up of six elements (oxygen, carbon , hydrogen, nitrogen, calcium and phosphorus) and the rest 1% by other elements.



Pie Diagram - Elements present in the human body

All the living things, both plants and animals, are made from a few elements only. They are,

Oxygen (65%), Carbon (18%), Hydrogen (10%), Nitrogen (3%), Calcium (2%) along with some other elements.

Hydrogen and helium are the main elements in the universe and stars.

5.2.3. Classification of elements based on state

Let us classify the known elements on the basis of their state of subdivision as solids, liquids and gases.

Liquids: Mercury, bromine, (at room temperature) caesium and gallium can exist in liquids around 30° C.

Gases: Hydrogen, nitrogen, oxygen, chlorine, fluorine, helium, neon, argon, krypton, radon and xenon.

Solids: Remaining elements are solids. e.g., Carbon, silicon, copper, gold etc.,

5.2.4. Classification of elements based on properties

Now we classify the known elements on the basis of their properties as ***metals, non-metals*** *and* ***metalloids.***

Metals: Of the 92 natural elements 70 elements are metals. Metals are hard lustrous (shining in appearance), malleable(can be beaten into very thin sheet) ductile(drawn into wire), good conductors of heat and electricity, and sonorous (producing sound)

e.g., Copper, gold, silver, iron etc,.

Non-metals: Only about 16-17 elements are soft, non lustrous, non-malleable, non-ductile, bad conductors of heat and electricity, and non-sonorous.

e.g., Hydrogen, oxygen, sulphur, carbon etc,.

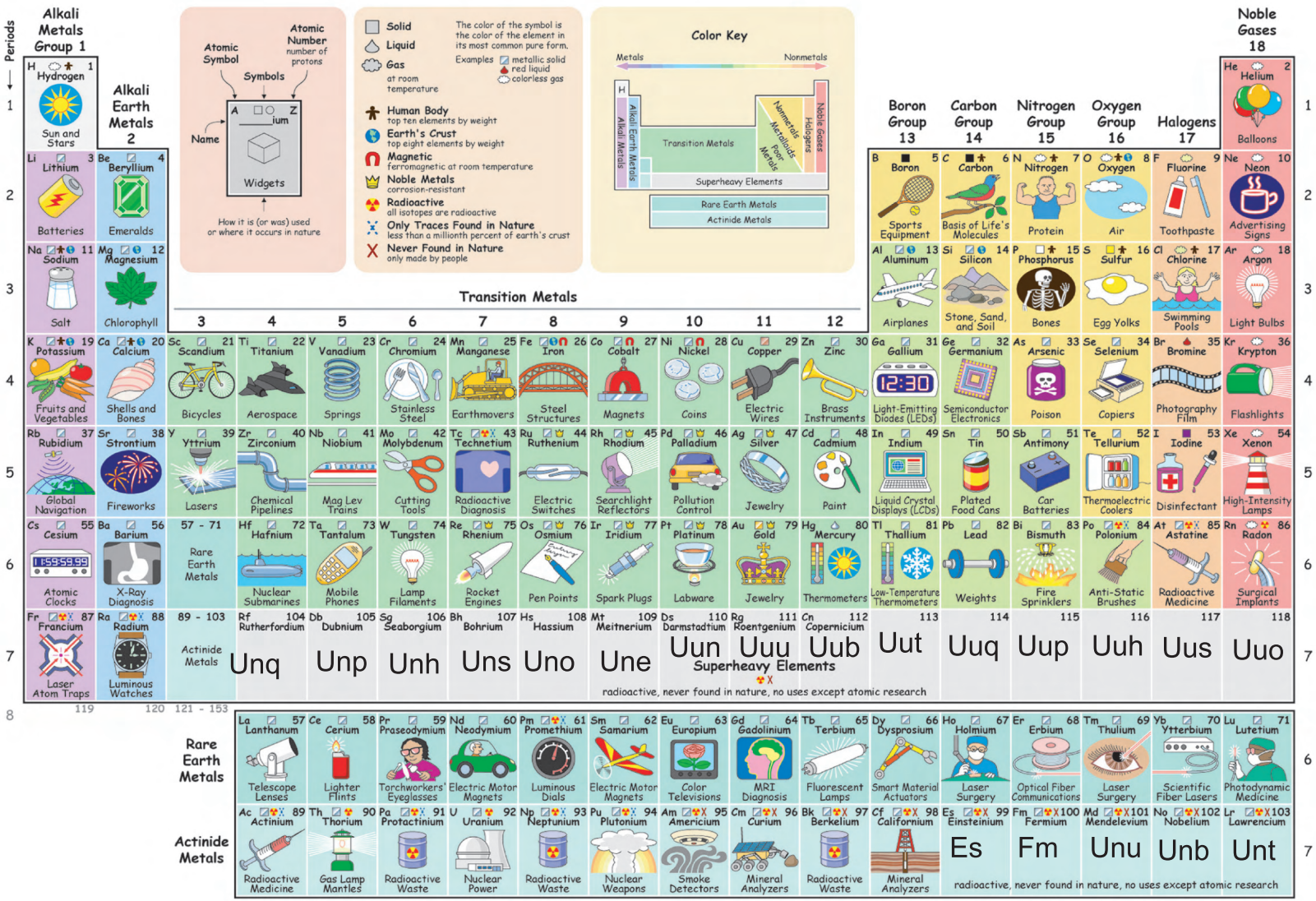
Metalloids: Very few semi-metals are known as metalloids which shows properties of metals as well as non metals.

e.g., Boron, silicon, germanium etc,.

MORE TO KNOW

- 20 % of the Earth's oxygen produced by the Amazon forest.
- An ounce of gold can be stretched into a wire of 80 kms (50 miles) long.
- The amount of carbon in the human body is enough to fill 9000 'lead' pencils.
- The noble gas xenon lasers can cut through materials that even diamond tipped blades will not cut.
- An average adult body contains 250g of salt .
- The metal with the highest melting point is tungsten. (3410° C)

How elements are used in day- to- day life - Periodic table



ACTIVITY 5.6

Learn about uses of gases with the help of the periodic table:

Fill the blanks:

1. The gas that can be used to fill party balloons is _____.
2. The gas that is used to make flash light is _____ .
3. The gas widely used in advertisement signs is _____.
4. The gas present in tungsten bulb is _____.
5. The gas present in the universe is _____.
6. The gas used in high intensity lamp is _____.
7. The gas which is used in tooth pastes to keep the teeth strong is _____.
8. The gas which helps to keep swimming pool clean is _____.
9. The radioactive gas is _____
10. About 21% of earth's atmosphere consists of_____.

5.3. WHY SYMBOLS?

Every chemical change can be conveniently represented in the form of chemical equation. This is because describing a chemical change with the names of substances becomes difficult. So, we need symbol for an element.

What is symbol?

You are familiar with the use of shortened forms of names of people, countries etc. we refer to United Kingdom as U.K., United States of America as U.S.A. and so on. It is more convenient to use the shortened forms instead of writing down long names. Similarly, in chemistry, symbols are used to represent names of elements.

A symbol is a shortened form of the name of an element.

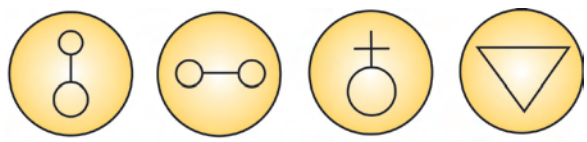
Let us learn the brief history of symbols of elements.

Greek symbols

Some earliest symbols in form of geometrical shapes were those used by the ancient Greeks to represent the four elements earth, air, fire and water.

Alchemist symbols

In the days of alchemists,the different materials that they used were represented by pictorial symbols.



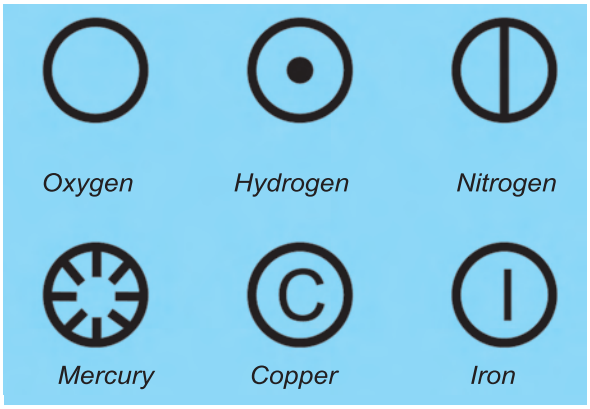
Nickel *Arsenic* *Antimony* *Water*

SCIENCE

The work of trying to change less valuable metal into gold was called **alchemy,** and the men who did this work were **alchemists.**

Dalton's symbol

In 1808, **John Dalton**, a scientist, tried to name the various elements based on these pictorial symbols.



The uses of the above symbols are difficult to draw and inconvenient to use. Hence, Dalton, symbols are not used; it is only of historical importance.

Berzelius symbols

In 1813, **Jon Jakob Berzelius** devised a system using letters of alphabet. He argued that letters should be used because they could be written more easily than other signs. The modified version of Berzelius system follows under the heading

'System for Determining Symbols of the Elements'

1. The symbols of the most common elements, mainly non-metals, use the first letter of their English name

Element	Symbol
Boron	B
Carbon	C
Fluorine	F
Hydrogen	H
Iodine	I
Nitrogen	N
Oxygen	O
Phosphorus	P
Sulphur	S
Vanadium	V
Uranium	U

2. If the name of the element has the same initial letter as another element, then symbol uses the first and second letters of their English name.

Element	Symbol
Aluminium	Al
Barium	Ba
Beryllium	Be
Bismuth	Bi
Bromine	Br
Cobalt	Co
Gallium	Ga
Helium	He
Lithium	Li
Neon	Ne
Silicon	Si

3. If the first two letters of the names of elements are the same, then the symbol consists of first letter and second or third letter of English name that they do not have in common.

Element	Symbol
Argon	Ar
Arsenic	As
Clorine	Cl
Cromium	Cr
Calcium	Ca
Cdmium	Cd
Mgnesium	Mg
Mnganese	Mn

4. Some symbols are based on the old names or Latin name of the element. There are eleven elements.

Name of element	Latin name	Symbol
Sodium	Natrium	Na
Potassium	Kalium	K
Iron	Ferrum	Fe
Copper	Cupurum	Cu
Silver	Argentum	Ag
Gold	Aurum	Au
Mercury	Hydrargyrum	Hg
Lead	Plumbum	Pb
Tin	Stannum	Sn
Antimony	Stibium	Sb
Tungsten	Wolfram	W

MORE TO KNOW

Names of some elements are derived from important country/scientist/colour/ mythological character/planet. Examples

Name	Symbol	Name derived from
Americium	Am	America (Country)
Europium	Eu	Europe(Country)
Nobelium	No	Alfred Nobel(scientist)
Iodine	I	Violet (colour, greek)
Mercury	Hg	God mercury (mythologic character)
Plutonium	Pu	Pluto (planet)
Neptunium	Np	Neptune (planet)
Uranium	U	Uranus (planet)

SCIENCE

How to write a symbol?

While writing a symbol for an element, one has to follow the method given below.

1. If the element has a single English letter as a symbol, it should be written in capital letter.
2. For elements having two letter symbols, the first letter should be in capital followed by small letter.

Significance of the symbol of an element

Symbol of an element signifies

- Name of the element
- One atom of the element

For example,

- The symbol N stands for the element of nitrogen
- One atom of nitrogen

GROUP ACTIVITY 5.7

Here is an interesting game which helps you to remember the symbols and their names. Make cards as instructed and then form a small group with your class mates to play.

INSTRUCTIONS:

Prepare 15 cards with the name of elements written on them and 15 cards with their corresponding symbols. Here is a list of names of elements (you have a freedom to choose the name of the elements)

Hydrogen	Calcium	Arsenic	Sodium	Mercury
oxygen	Argon	Chlorine	Gold	Magnesium
Copper	Helium	Chromium	Iron	Manganese

How to play

1. Shuffle the 30 cards and place the cards face down on the table .
2. Start the game. Each player will get a chance of taking 2 cards at a time to see. If a player does not get the correct pair, then he/she should keep the cards at the original position. If the name and symbol of the cards match correctly, then he/she can show to all the players and can keep the correct pairs of cards with him/her. If correct pairs are shown, players will get another chance until the player makes wrong match. Game will continue till all the cards are taken up. The winner is the one having maximum number of cards.

ACTIVITY 5.8

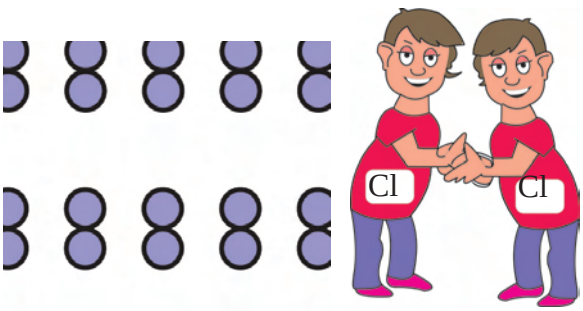
Analyse the number of elements, if any present in your name.

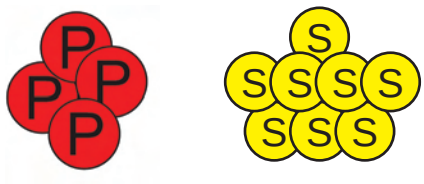
Here are few examples

Name	:	Gautam
Written as	:	GaUtAm
Elements	:	Ga-Gallium
		U-Uranium
		Am-Americium
Name	:	ARUN
Written as	:	ArUN
Elements	:	Ar- Argon
		U - U r a n i u m
		N-Nitrogen

5.4. MOLECULE OF AN ELEMENT

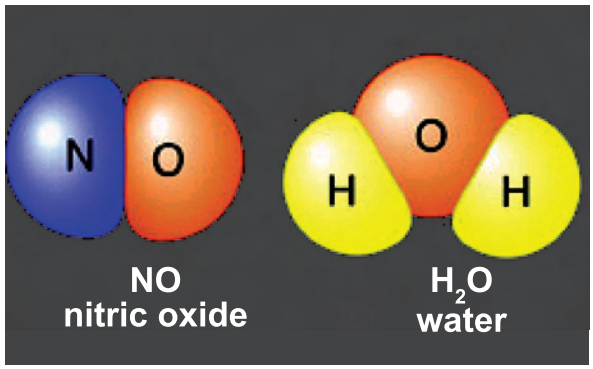
The molecule of an element contains two or more similar atoms. For example, a molecule of chlorine contains two atoms of chlorine; it is therefore written as Cl_2 (Chlorine). Similarly, a molecule of nitrogen contains two atoms of nitrogen; it is therefore written as N_2 (Nitrogen). molecules like chlorine and nitrogen which consist of two atoms of the same kind, are called diatomic molecules. A molecule of ozone consists of three atoms of oxygen and is represented as O_3. Similarly, some molecules, like phosphorus (P_4) and sulphur (S_8), consists of more than two similar atoms.

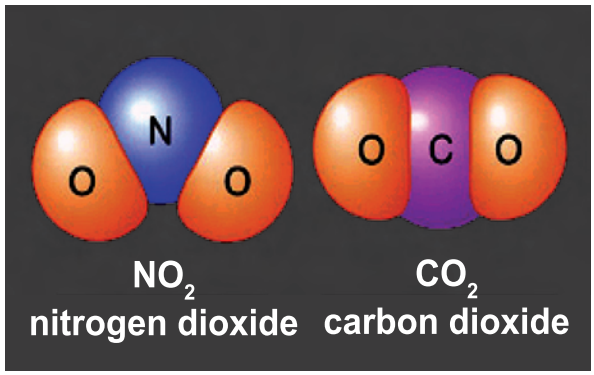




5.5. WHAT IS A COMPOUND?

Do you know that common salt, water, sugar, sand etc., which we use daily are said to be compounds? Similarly, our body is composed of hundreds of compounds. We have learnt that there is limited number of elements (<120), but number of compounds is unlimited.





SCIENCE

From the picture, can you define a compound?

When two or more elements combine in a fixed ratio by mass, they form compound.

For example, water is a compound made of two hydrogen atoms and one oxygen atom in the ratio 2 :1 by volume or 1 : 8 by mass.

A compound is a pure substance composed of two or more elements combined together chemically in a fixed ratio by mass.

Element + Element →Compound

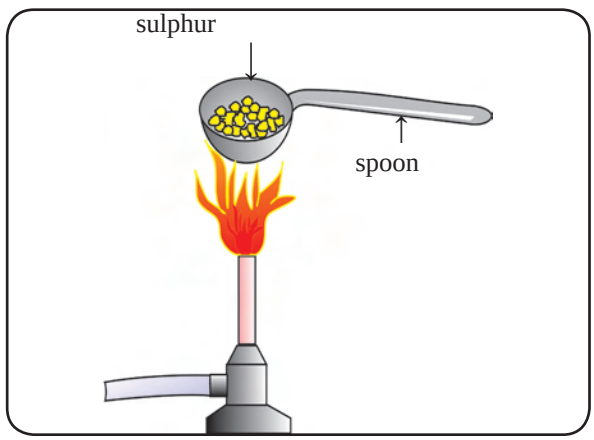
Nitrogen + Hydrogen → Ammonia

Carbon + Oxygen→ Carbondioxide

Hydrogen + Oxygen → Water

ACTIVITY 5.9

Take a little sulphur in a spoon. Heat it. It burns with a blue flame which slowly disappears. You can smell a pungent odour. what is it due to?



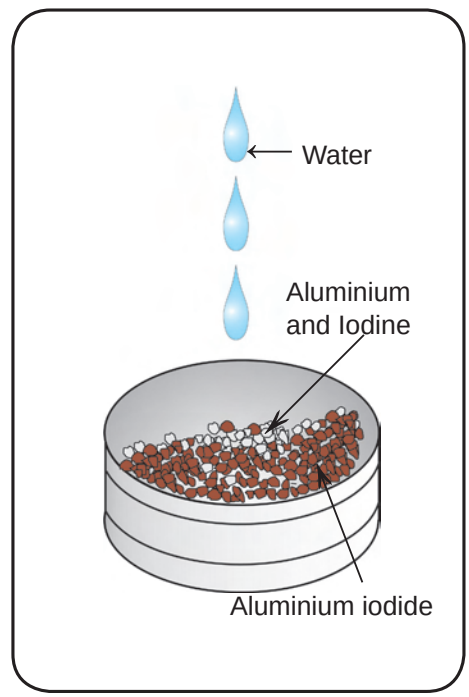
Sulphur combines with oxygen to form a colourless gas sulphur dioxide.

Sulphur + oxygen → Sulphur dioxide

(element) (element) (compound)

ACTIVITY 5.10

Take powered iodine and aluminium in a bottle lid. Add 2 to 3 drops of water to this mixture. You can see a greyish black compound formed. What is it? (Perform the experiment in outdoor).



The greyish black compound formed is aluminium iodide.

Aluminium + Iodine → Aluminium iodide

(element) (element) (compound)

ACTIVITY 5.11

Take 7g of iron powder and 4g of sulphur. Mix the two thoroughly. Take the mixture in a test tube and heat it over a flame. Remove the burner and observe. Then heat it to red hot and let it cool. What do you notice? You can see a grey brittle compound formed. What is it?

The grey brittle compound is iron sulphide

Iron + sulphur → Iron sulphide

(element) (element) (compound)

5.5.1. Characteristics of a compound

Now let us take iron sulphide and study the characteristics of a compound by performing simple experiments.

1. Iron sulphide contains iron and sulphur in the ratio 7 : 4. by mass. Hence, we can say that a chemical compound is formed by the **chemical reaction between two or more elements in a fixed proportion by mass.**
2. Iron in iron sulphide cannot be pulled away by using a magnet. Similarly sulphur present in iron sulphide cannot be separated by dissolving it in carbon disulphide because sulphur present in it does not dissolve in carbon disulphide. Hence we can conclude that the **components of the compound cannot be separated by simple physical methods.**
3. When a mixture of iron powder and sulphur is heated it glows red hot, and the glow stays for a while even when bunsen flame is removed. This shows that heat is given out. This reveals that **formation of a compound is associated with evolution or absorption of heat.**
4. Pure iron sulphide melts at a definite temperature. Hence a **compound has a fixed melting and boiling point.**
5. Iron sulphide is not attracted by magnet.When dilute sulphuric acid is added to iron sulphide, a colourless gas with rotten egg smell is produced due to hydrogen sulphide but not hydrogen. Thus iron present in the compound does not show its property. When carbon disulphide is added to sulphur does not dissolve in it. This shows that sulphur is also not able to show its characteristic property. Hence we can say **the properties of a compound are different from those of its component elements.**

6. When a sample of iron sulphide is viewed by magnifying lens, it is found to be homogenous throughout its mass. No individual particle of iron and sulphur can be seen in iron sulphide. Hence **compound is homogenous.**

Now can you to list out the characteristics of compounds?

ACTIVITY 5.12

List the characteristics of compounds

1..... .....

2..... .....

3..... .....

4.....

5.....

6.....

5.5.2. Classification of compound

Let us learn to classify the compounds based on the origin or chemical components as

1. **Inorganic compounds**
   Compounds obtained from non living sources such as rock, minerals, etc., are called inorganic compounds. eg. Chalk, marble, baking powder, etc.

2. **Organic compounds**
   Compounds obtained from living sources such as plants, animals etc., are called organic compound.eg.Protein,waxes,oil, carbohydrates, etc.

ACTIVITY 5.13

Check whether sugar is a compound or not.

- Take some sugar in a test tube.
- Heat the test tube on a flame.
- The sugar will melt and turn brown.
- On further heating it starts charring and turning black.
- Look near the rim of the test tube. You will find small droplets of water.
- Since the water droplets have formed upon heating these cannot possibly be result of condensation from air. This shows that water has formed by decomposition of sugar.
- Black residue is carbon.
- So, sugar decomposed into carbon and water. We know that water is made up of elements of hydrogen and oxygen.

This shows that sugar is a compound.

MORE TO KNOW

- Talc is the softest known substance.(talcum powder)
- Water expands by about 10% as it freezes.
- It is estimated that plastic containers can resist decomposition for 50,000 years.
- Hydrofluoric acid will dissolve glass.

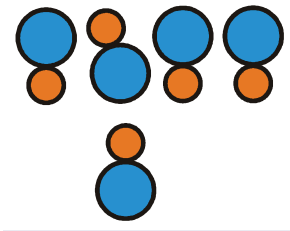
5.5.3. Uses of Compunds

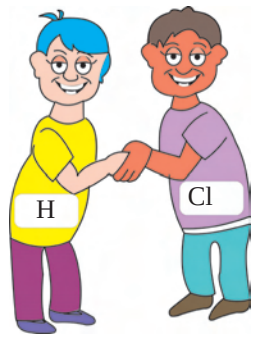
Let us tabulate the some compounds and their components that we use in our daily life.

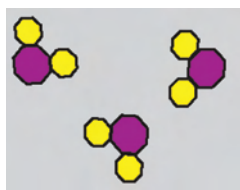
COMMON NAME	CHEMICAL NAME	COMPONENTS	USES
Water	Hydrogen Oxide	Hydrogen and oxygen	For drinking and as solvent
Table salt	Sodium chloride	Sodium and chlorine	Essential component of our daily diet, preservative for meat and fish.
Sugar	Sucrose	Carbon, hydrogen and oxygen	Preparation of sweets, toffees and fruit juices.
Baking soda	Sodium bicarbonate	Sodium, hydrogen , carbon and oxygen	Fire extinguisher, preparation of baking powder and preparation of cakes and bread.
Washing soda	Sodium carbonate	Sodium,carbon and oxygen	As cleaning agent in soap and softening of hard water.
Bleaching powder	Calcium oxy chloride	Calcium, oxygen and chlorine	As bleaching agent, disinfectant and sterilisation of drinking water.
Quick lime	Calcium oxide	Calcium and oxygen	Manufacture of cement and glass.
Slaked lime	Calcium hydroxide	Calcium , oxygen and hydrogen	White washing of walls.
Lime stone	Calcium carbonate	Calcium ,carbon and oxygen	Preparation of chalk pieces.

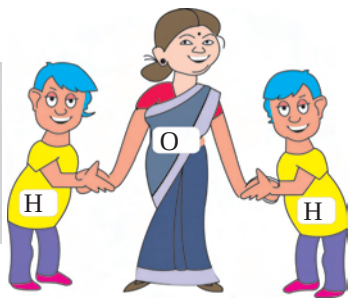
5.5.4. Molecule of compound

The molecule of a compound contains two or more different types of atoms. For example, the molecule of hydrogen chloride contains one atom of hydrogen and one atom of chlorine. Similarly, one molecule of water contains two hydrogen atoms and one atom of oxygen.









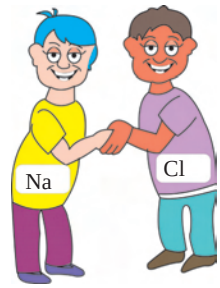
5.6. WHAT IS A FORMULA?

Just as an atom is represented by its symbol, a molecule of element or a compound is represented by means of a formula.

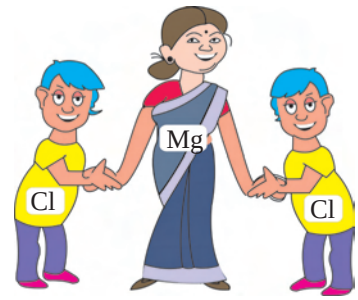
The formula represents the number of atoms of each element in the molecule. For example H_2 represents one molecule of hydrogen formed when two atoms of hydrogen combine.

The formula of water is H_2O. This indicates that two atoms of hydrogen chemically combined with one atom of oxygen to form water. The subscript " 2 " below H indicates the number of atoms of hydrogen present in one molecule of water. Notice that when only one atom is present the subscript "1" is not written.

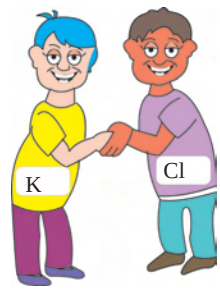
Let us learn to write formula from the following picture



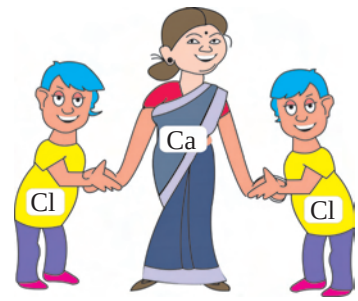
Formula is NaCl



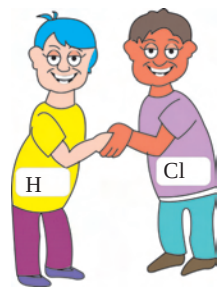
Formula is $MgCl_2$



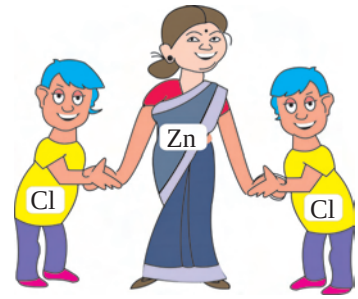
Formula is_____



Formula is _____



Formula is _____



Formula is _____

5.7. WHAT IS VALENCY?

Two atoms of hydrogen combine with one atom of oxygen to form a molecule of water. While one atom of hydrogen combines with one atom of chlorine to form a molecule of hydrogen chloride. You could say that oxygen atom has a greater capacity to combine with hydrogen than the chlorine atom. This is somewhat like some people being friendly with many people, while others are satisfied with just one friend.

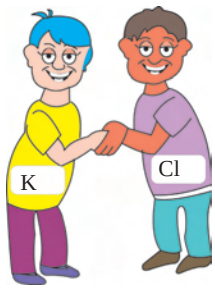
The compounds are formed by combination of atoms of different elements. During the formation of molecules of the compounds, atoms combined in a fixed proportion. This is due to the fact that different atoms have different combining capacities.

Valency can be defined as the combining capacity of an element.

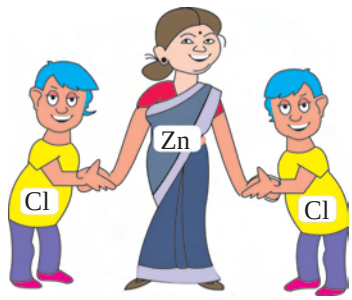
Valency with respect to hydrogen: The valency of hydrogen atom is taken as one and it is selected as the standard. Valency of other elements is expressed in terms of hydrogen. Valency of an element can also be defined as the number of hydrogen atoms which combine with one atom of the element.

Since most of the elements do not combine with hydrogen, the valency or the combining capacity of the element is also defined in terms of chlorine or oxygen.

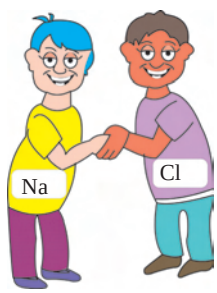
Valency With Respect to Chlorine: Since valency of chlorine is one, the number of chlorine atom with which one atom of an element can combine is called its valency.



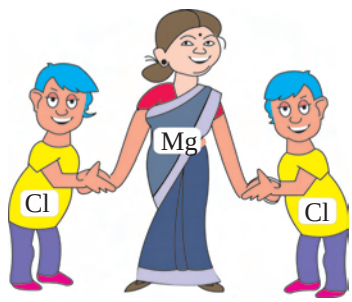
Valency of K is 1



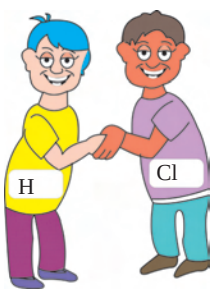
Valency of Zn is 2



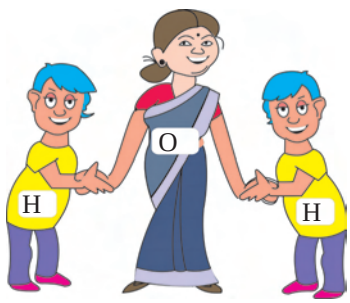
Valency of Na is ____



Valency of Mg is _____

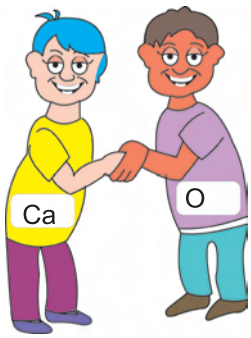


Valency of chlorine is 1

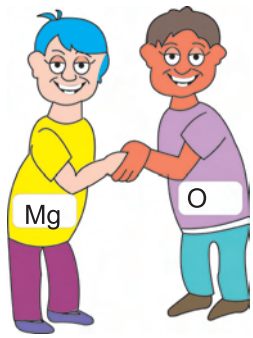


Valency of oxygen is 2

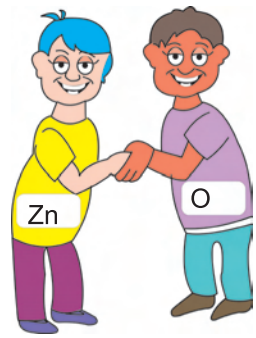
Valency with respect to Oxygen: We know that the valency of oxygen is 2. Double the number of oxygen atoms with which one atom of an element can combine is also called **valency.**



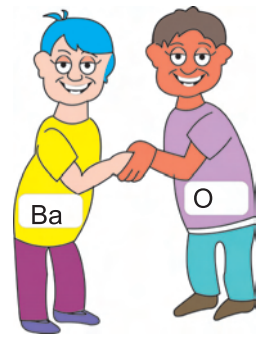
Valency of Ca is 2



Valency of Mg is 2



Valency of Zn is _____



Valency of Ba is _____

Certain elements exhibit more than one valency, are said to be variable valency.

For example,

Valency of Fe in $FeCl_2$ is 2 Valency of Fe in $FeCl_3$ is 3

Some elements, like helium and neon, do not combine with other elements. They have **zero valency**.

ACTIVITY 5.14

List out the zero valency elements from the periodic table.

EXTENDED LEARNING

New elements, till they are given permanent name, or those elements with disputed claims for discovery/synthesis, are named using three letters based on the Latin for their atomic number.

Number	0	1	2	3	4	5	6	7	8	9
symbol	n	u	b	t	q	p	h	s	o	e
Name	nil	un	bi	tri	quad	pent	hex	sept	oct	enn

The “entire symbol” name of elements must end with the suffix –ium.

To illustrate this system,

Let us assign to an element with atomic number	1	1	2
Name	Un	un	bium
Symbol	Uub		

GROUP ACTIVITY 5.15

Here is an interesting game which will help you remember the symbols and valencies of the elements you have learnt in this lesson. Make the cards as instructed and then form small groups with your classmates to play.

Instruction:

1. Prepare 3 cards each for every element given in the list. (3 X 13 =39)

Hydrogen	copper	magnesium	oxygen
Sodium	zinc	iron	sulphur
Potassium	lead	calcium	chlorine
Mercury			

2. Then prepare 3 cards each for the same elements. This time use their symbol instead of their names (3 X13=39)

   H Cu Mg O Na Zn Fe S K Pb Ca Cl Hg

3. Prepare 30 cards with '2' written on them and 12 cards with '1' written on them. The '2' and '1' cards represent the valency.

4. There should be a total 120 cards.

How to Play:

Eight players can play at a time. All the cards are distributed among the players. Each player gets 15 cards. At each turn, a player can do one of the following:

1. Make a set of three cards. One set is made of a card which has the name of an element on it, a card with its symbol and a card with its valency.

2. Draw a card from the person sitting on the left. Check if this card helps to make a set as explained above. If yes, place the set face up on the table.

A person who makes a set with a wrong symbol or valency card will have to skip next turn as a penalty. The round ends when one of the players has used up all the cards. The player who has used up all the cards or has the lowest number of cards left in hand is the winner.

EVALUATION

1. Water is made up of two elements, hydrogen and oxygen. Water is a liquid, whereas hydrogen and oxygen are gases. Hydrogen catches fire easily. Oxygen helps in burning. Water is used to put off the fire.

   From the above information, answer the following questions.

   a) What are the elements present in water?

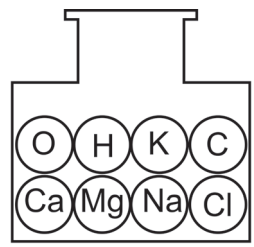
   b) In which state do these elements exist?

   c) Write the property of hydrogen.

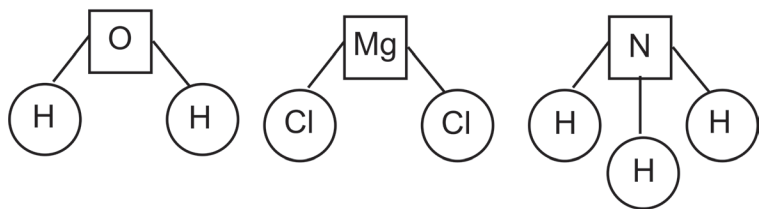
   d) Write the property of oxygen.

   e) Do the properties of water differ from hydrogen and oxygen?

2. Using the elements enclosed in the bottle, frame formulae for some compounds.



3. Find the valency for the element represented in the square box.



4. Write the names of the planets(Greek God) after which these elements are named.

   a) Plutonium b) Neptunium c) Uranium

Project Ideas

1. i. Obtain samples of the following materials.
   Sugar, Common salt, Water, Copper wire, Pencil lead, eraser, Iron

   ii. Observe each material and mention its state or appearance.

   iii. Classify the samples into element or compound.

2. List several items that are made of common elements like iron, copper and aluminium,which you find in your home or around your home.Indicate the name of the elements they are made up of and their symbols.

3. Using clay, water colour, tooth pick (small bamboo stick), make models of elements and compounds of your choice.

Experiment

Take three samples namely, iron pieces, copper wire and charcoal. Perform the following tests and tick appropriate observations. Based on the observation classify the samples into metal and non-metal.

Test	Observation		
	Iron	Copperwire	Charcoal
Addition of water	Soluble/insoluble	Soluble/insoluble	Soluble/insoluble
Drop it down	Sonorous/ nonsonorous	Sonorous/ nonsonorous	Sonorous/ nonsonorous
Conductor of electricity(using copper wire, cell and bulb)	Good/bad	Good/bad	Good/bad

Result:

The sample :

Iron is a _____. Copper wire is a _____. Charcoal is a _____

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FURTHER REFERENCE

Book

Inorganic chemistry - Puri and Sharma - Vishal publications.

Websites

www.freshney.org

www.authorstream.com

6. MEASUREMENTS

In a warm summer vacation, Aruna is eagerly waiting for her friend Swathi. Finally, Swathi came to Aruna's home with an umbrella .

Aruna: Is it raining, Swathi?

Swathi: No Aruna, but my mother asked me to take this, as it is very hot outside.

Aruna: Of course, I heard in the TV news that the temperature was 42^0C yesterday and it seems to be more than that today.

Swathi: I am confused about the unit that we use for temperature. We see people using celcius but my brother said this morning that kelvin is the unit for temperature.

Aruna: we will clear this doubt with my father (who is a teacher). (They go to Aruna's father for clarification. Aruna's father explained them clearly about units).

You know that measurement is nothing but comparing an unknown quantity with a standard quantity. The standard quantity is called unit. For example, if ,you say a distance as 300km, here 300 is its magnitude and km is its unit. we can't measure anything without a unit.

We have been following many system of units to measure physical quantities. For example kilometre, mile, foot, centimetre etc., are all units of length. Similarly kilogram, gram, pound etc., are units of mass.

Le Systeme International d' Unites (SI system of units)

To bring uniformity, the general conference on Weights and measures in 1971, decided to have a uniform system of measurement called SI system of units. In SI system, the units for all physical quantities are fixed and derived. This is logically far superior to all the other systems. It has certain features, they are based on the properties of atom. So, they do not vary with time. SI system is more convenient to practice.

There are seven fundamental quantities and twenty two derived quantities in this system of units.

We know about the units of length, mass and time in SI system. Let us learn more about other basic units.

Temperature

Kelvin is the primary unit of temperature in SI system. The Kelvin is the fraction of 1/273.16 of the thermodynamic temperature of the triple point of water. (Triple point of water is the temperature at which saturated water vapour, pure water and melting ice are all in equilibrium).

Quantity	SI Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Temperature	kelvin	K
Electric Current	ampere	A
Amount of substance	mole	mol
Luminous Intensity	candela	cd

The freezing point of water is 0ºC in celcius scale but at 0ºC, water molecules do not come to rest. Only at -273ºC, the molecules come to rest. This -273ºC is called absolute zero and it is taken as null point for kelvin scale.

Hence -273ºC = 0 K

273K = 0ºC

The usage of negative values in celcius scale can be avoided by using kelvin scale.

Electric current

Ampere is the SI unit for electric current. The ampere is the constant current which, flowing through two straight parallel infinitely long conductors of negligible cross-section and placed in vaccum 1m apart would produce between the conductors a force of 2×10^{-7} newton per unit length of the conductors

Amount of Substance

Mole is the SI unit for amount of substance. A mole is the amount which contains as many elementary entities(atoms,molecules,ions) as there are atoms in 0.012 kg of carbon-12.

Luminous intensity

Candela is the SI unit for luminous intensity. The Candela is the luminous intensity in a given direction due to a source, which emits monochromatic radiation of frequency 540×10^{12} Hz and of which the radiant intensity in that direction is 1/683 watt per steradian.

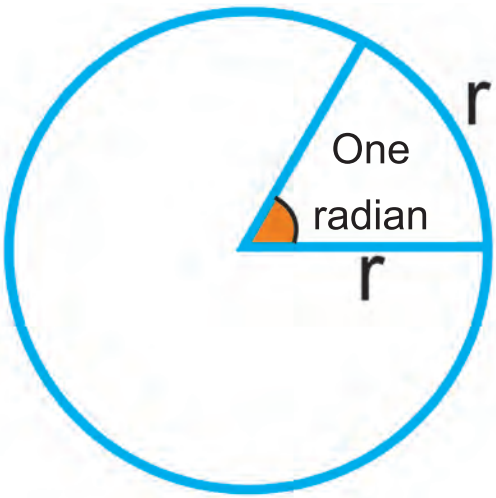
A common candle emits light with a luminous intensity roughly equal to one candela.

Plane angle and Solid angle

Plane angle and solid angle are supplementary quantities till the year 1995. Now they are derived quantities.

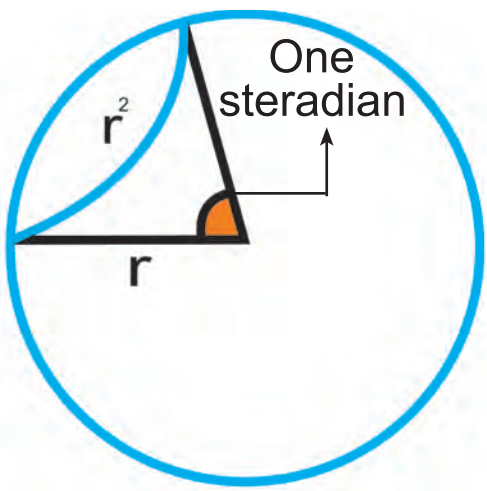
Radian is the SI unit of plane angle.

An angle of one radian results in an arc with a length equal to the radius of the circle.



Steradian is the SI unit of solid angle.

The solid angle subtended at the centre of a sphere of radius r by a portion of the surface of the sphere whose area A, equals r^2.



Conventions to be followed in writing the units in SI system

- The symbols for units should be written with a small letter
- For example: m for metre, kg for kilogram
- Units which are named after scientists should always be written with small letter.
- For example: newton, joule
- The symbols of the units named after scientist should be written by capital letter
- For example: N for newton, W for watt
- Symbols should not be written in plurals but in words,plurals are used.
- For example: 30 kg or 30 kilograms
- There should be no full stop at the end of a symbol for units
- For example: Symbol for unit of length is m(it is not m.)

MORE TO KNOW

1. The intensity of sound is measured in a logarithmic unit called decibel (dB).
2. Intensity of earthquakes are measured in Richter scale.

Units of Length

10 millimetres (mm)	= 1 centimetre (cm)
10 centimetres	= 1 decimetre (dm) = 100 millimetres
10 decimetres	= 1 meter (m) = 1000 millimetres
10 metres	= 1 decametre (dam)
10 decametres	= 1 hectometre (hm) = 100 metres
10 hectometres	= 1 kilometre (km) = 1000 metres

Units of Area

100 square millimetres (mm^2)	= 1 square centimetre (cm^2)
100 square centimetres	= 1 square decimetre (dm^2)
100 square decimetres	= 1 square metre (m^2)
100 square metres	= 1 square decametre (dam^2) = 1 are
100 square decametres	= 1 square hectometre (hm^2) = 1 hectare (ha)
100 square hectometres	= 1 square kilometre (km^2)

Units of Liquid Volume

10 millilitres (ml)	= 1 centilitre (cl)
10 centilitres	= 1 decilitre (dl) = 100 millilitres
10 decilitres	= 1 litre1 = 1000 millilitres
10 litres	= 1 decalitre (dal)
10 decalitres	= 1 hectolitre (hl) = 100 litres
10 hectolitres	= 1 kilolitre (kl) = 1000 litres

Units of Mass

10 milligrams (mg)	= 1 centigram (cg)
10 centigrams	= 1 decigram (dg) = 100 milligrams
10 decigrams	= 1 gram (g) = 1000 milligrams
10 grams	= 1 decagram (dag)
10 decagrams	= 1 hectogram (hg) = 100 grams
10 hectograms	= 1 kilogram (kg) = 1000 grams
1000 kilograms	= 1 megagram (Mg) or 1 metric ton(t)

MORE TO KNOW

Some Common measurements used in our daily life.

1 Feet = 30.48 cm

1 Sq.feet = 30.48 cm x 30.48 cm = 929.0304 sq.cm

1 Ground = 2400 sq.feet

1 Kuzhi = 145.2 sq.feet

1 Cent = 435. 60 sq.feet

1 Acre = 43560 sq.feet = 300 Kuzhi = 100 Cent

In pratice, we use only rounded off values of the above measurements.

ACTIVITY 6.1

Collect some other measurements that are used in your locality.

EVALUATION

1. Ramu and Madhu are friends. They wanted to measure the length of a room. Ramu wanted to measure it in foot. But Madhu wanted to measure it in metres. Who is right in measuring the room in the inernationally accepted system.

2. Match the following

S.No	Quantities	SI Unit
1	Temperature	Candela
2	Amount of Substance	Kelvin
3	Luminous Intensity	Kilogram
4	Mass	Radian
5	Plane angle	Mole

3. Which of the following statement is correct?
   a. The unit of force is Newton
   b. The unit of force is newton

4. Murugan measured the electric current. What unit should he use?

5. Say true or false.
   a. The symbol for units should be written with a small letter.
   b. There should be a full stop at the end of a symbol for units.
   c. We should not use plurals when we write the unit in words.
   d. The SI unit for solid angle is Radian.

Project : Collect pictures of various measuring instruments and prepare an album.

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FURTHER REFERENCE

Books:

1. Physics vol (1) and(2) - Satya Prakash - Rahul Jain V K (India) Enterprises, NewDelhi-2

2. The Physics Quick reference guide - E.Richard Cohen 1996 - American Institute of Physics.

Web sites:

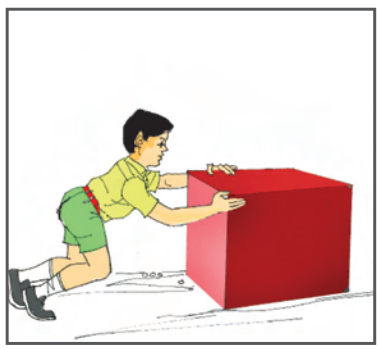
www.metrication.com
www.surfnet.org/wiki/A-level-physics
www.physics.nist.gov/cuu/unit

7. FORCE AND PRESSURE

Murugan and Nila are students of 8th standard. In their day to day life the following activities take place.







Actions like opening, lifting, kicking, pulling, pushing are some of the tasks we do every day. All these actions result in the change of position of an object.

Do you notice that each of these activities involve a push or a pull? From this we infer that to move any object, effort is needed (push or pull). This effort is called a force.

Force is a push or a pull acting on an object which changes or tends to change the state of the object.

UNIT OF FORCE

In the international system of units (SI System), the unit of force is newton (N).

Sir Issac Newton (1642 - 1727) One of the greatest scientists the world has ever seen. He was an English mathematician, physicist and astronomer. The SI unit of force is named after him.

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MORE TO KNOW

There are also other units that are used to measure force. They are dyne, kilogram weight and pound.

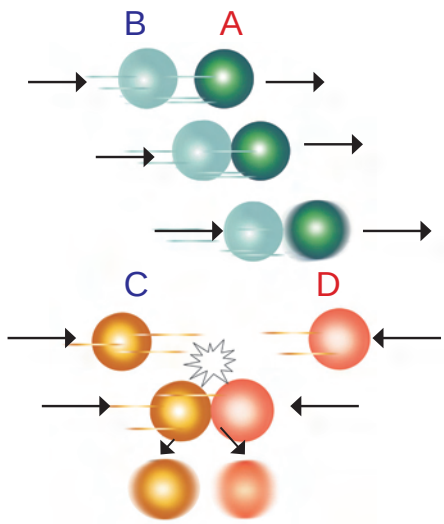
7.1. STATE OF MOTION

Let us play a game with marbles to understand what happens when force acts on an object.

Set a marble A in motion. Hit it from behind with another marble B. What do you notice?

The marble A moves faster. It is because the marble B exerted a force on A.

Take two more marbles C and D. Let them move in the opposite direction and collide with each other. After the collision, the marbles C and D change their directions of motion as shown in the figure. This is due to the exertion of force between them.



Hence a force changes either the speed of an object or its direction of motion.

A change in either the speed of an object or its direction of motion or both is described as a change in its state of motion. Thus, a force may bring a change in the state of motion of an object.

A force does not always result in a change in the state of motion. For example, the wall of a room may not move at all even if we apply the maximum force that we can exert. This does not mean that we are not applying force, but the force that we are applying is not sufficient to move the wall.

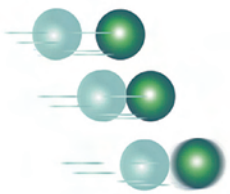
ACTIVITY 7.1

Ask your friend to bowl a cricket ball towards you. Hit the ball with a cricket bat. What happens to the state of motion of the ball?

7.2. ACTION OF FORCE AND ITS EFFECTS

ACTIVITY 7.2

Some situations have been given in the column 1 of the table; column 2 shows diagrams of some actions. Match the situation in column 1 with suitable diagram in column 2.
Table

Column 1	Column 2
Moving an object which is at rest	
Changing the speed of an already moving object.	
Changing the direction of motion of an object	
Changing the shape of an object	

From the above activity, you would have realised that a force

- can move an object from rest.
- may change the speed of an object if it is already moving.
- may change the direction of motion of an object.
- may bring about a change in the shape of an object.
- may cause some or all of these effects.

It is important to note that none of these actions is possible without the action of a force.

7.3. CONTACT FORCES

Can you lift a pot of water without holding it? Can you push this table without touching it?

Generally, to apply force on an object, we need to come in contact

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with that object. A force that can cause or change the motion of an object by touching it is called **Contact Force.**

In the above activities, the force is caused by the action of muscles. Hence this force is known as Muscular force. Do you agree that muscular force is a contact force?

Are there other types of contact forces? Come, let us find out.

A ball rolling on the play ground gradually slows down and comes to rest. If the ground is made smooth, the distance covered by the ball would be more than that what was covered earlier. Why?

The ball slows down due to the force acting between the ball and the ground. It is the force of friction which causes the ball to rest. The frictional force is always in a direction opposite to the direction of motion of the object.

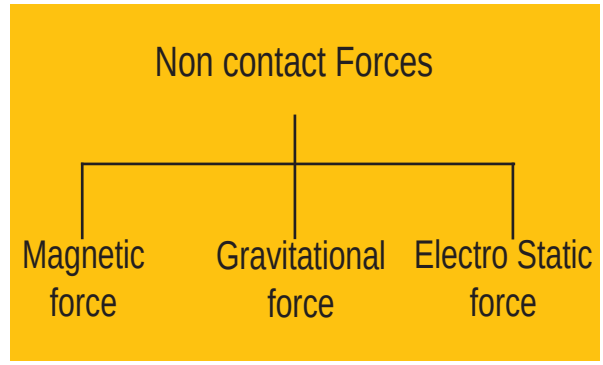
The force of friction arises due to contact between the ball and ground. It acts between any two bodies when both are in contact with each other and either any one or both are moving. Is friction also a contact force? Yes.

7.4. NON-CONTACT FORCES

A non-contact force is any force applied to an object by another body without any contact.

7.4.1. Magnetic Forces

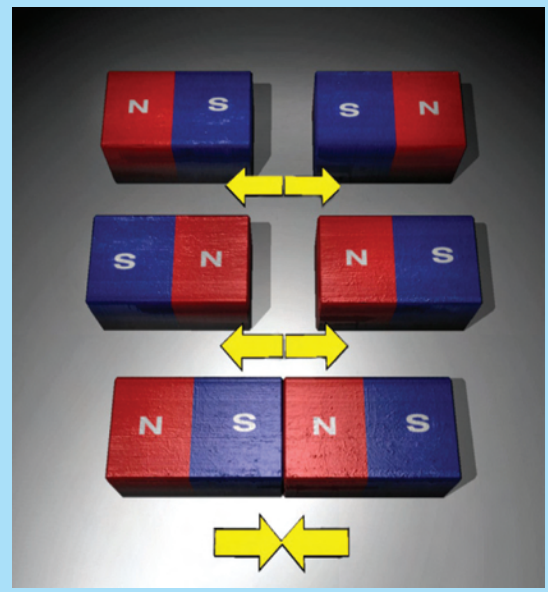
Is it necessary to bring the two magnets in contact to observe the force between them? No. A magnet can exert a force on another magnet



ACTIVITY 7.3

Take a pair of bar magnets. Place one of the magnets on a smooth surface such as a table. Now bring one end of the other magnet to one end of the magnet on the table and observe what happens.

Next, separate the two magnets, and bring the other end of the magnet you are holding to the same end of the magnet on the table. Again, watch what happens.



without touching it. Magnetic force is a non contact force.

7.4.2. Gravitational Force

Have you wondered why the ball hit for a six by a batsman comes back to the ground? Or why a mango or an apple falls to the ground? Why are objects fall towards the earth? It is because the earth pulls them down. This force is called the **force of gravity**. This is an attractive force. This is an example for non-contact force.

MORE TO KNOW

Gravity is not a property of the earth alone. In fact, every object in the universe whether small or large, exerts a force on every other object. This force is also known as the gravitational force.

7.4.3. Electrostatic Force

ACTIVITY 7.4

When you switch off the Television in your house after watching for some time, you can notice that hairs in your hands are getting attracted towards the screen. Why?

The television screen becomes electrically charged and it exerts an electrostatic force on the hair of your hand. This force is a non-contact force because, there is no contact between the screen and the hair.

The force exerted by a charged body on another charged or uncharged body is known as electrostatic force. This force acts when the bodies are not in contact. The electrostatic force is another example of non contact force.

SCIENCE

7.5. PRESSURE

ACTIVITY 7.5

Take two bags of the same size. Let the strap of one bag be narrow and that of the other broad.

Place your books in the bag with broad strap. Hang the bag on your shoulder and walk for some time. How do you feel?

Transfer the books to the other bag with narrow strap. Hang it again on your shoulder and walk for some time. How do you feel?

It is comfortable to carry the bag with broad strap. Isn't it? Why?

when you hang a bag with broad strap, the weight of the books is distributed over a larger area of the shoulders and hence the pressure on your shoulders is less.

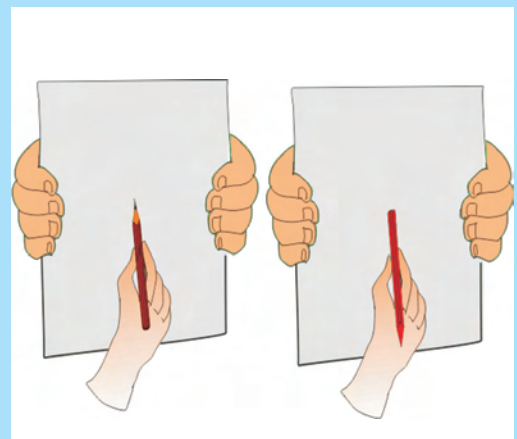
ACTIVITY 7.6

Let us take a pencil and a paper. Try to make a hole in the paper by pressing the blunt end of the pencil on the paper.

Now try to make a hole in the paper by pressing the sharp end of the pencil.

Which was easier why?

Although the force applied on the pencil is almost the same in both the cases, the sharp end of the pencil is able to make a hole. In this case the area over which the force acts on the paper is very small and its effect on the paper is much greater (it makes a hole in the paper).



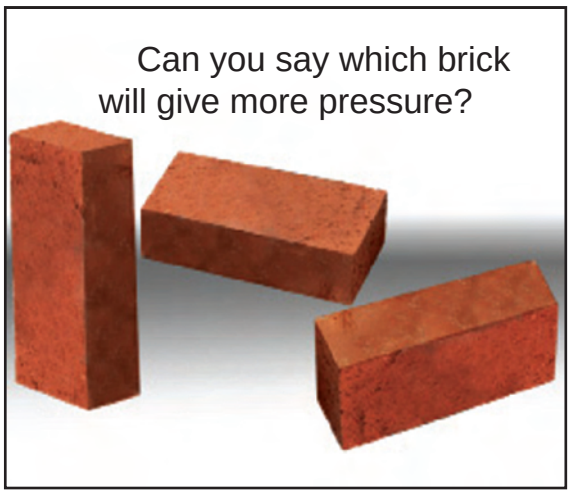
From these activities we understand that the effectiveness of the force applied depends on the area on which it is acting.

Now we will define a new physical quantity, pressure.

Pressure is defined as the force acting on a unit area

$$\text{Pressure} = \frac{\text{Force}}{\text{Area on which it acts}}$$

The SI unit of pressure is N/m^2. It is also called pascal (Pa) .



Solved Problem 1:

A liquid gives force of 100N over an area of $2m^2$. What is the pressure?

Force = 100N

Area = $2m^2$

Pressure = ?

$$\text{Pressure} = \frac{\text{Force}}{\text{Area on which it acts}}$$

Blaise Pascal (1623-1662)

One of the greatest scientists of the 17th century. He was a child prodigy. A French mathematician, physicist, inventor, writer and philosopher. The SI unit of pressure is named after him.

Substituting the values

Pressure = $100N / 2m^2$

= $50 N/m^2$

Pressure = 50 N/m^2

TRY YOURSELF

A liquid's force is acting over an area of $4m^2$. If the pressure is

25 N/m^2, what is the force?

7.6. PRESSURE EXERTED BY LIQUIDS AND GASES

You know that liquids and gases are called fluids. Solids always exert pressure downwards. But the fluids exert pressure in all directions.

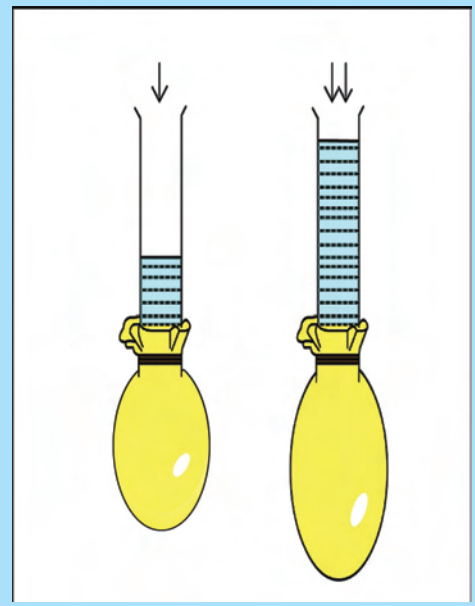
SCIENCE

Fluids exert pressure on all bodies immersed in them and also on the walls of the container that holds them.

Pressure exerted by Liquids

ACTIVITY 7.7

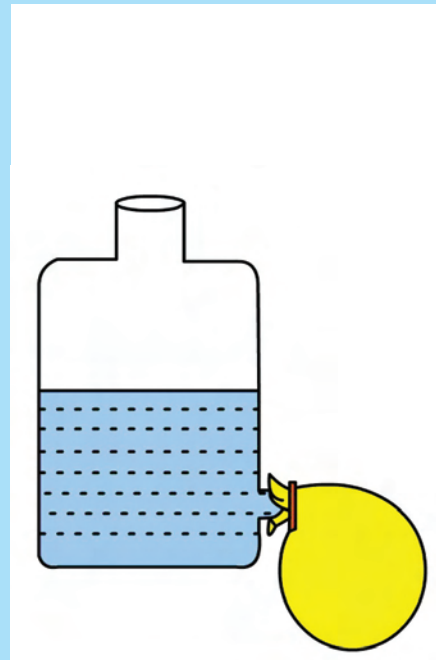
Take a transparent glass tube or a plastic pipe. Also take a piece of thin good quality of rubber (Piece of a rubber balloon). Stretch the rubber sheet tightly over one end of the pipe. Hold the pipe vertically. Ask one of your friends to pour some water in the pipe. Does the rubber balloon bulge out? Notice the height of the water column in the pipe. Pour some more water. Observe again the bulging in the rubber baloon and the height of the water column in the pipe.



This shows that the pressure exerted by liquids at the bottom depends on the height of the liquid column.

ACTIVITY 7.8

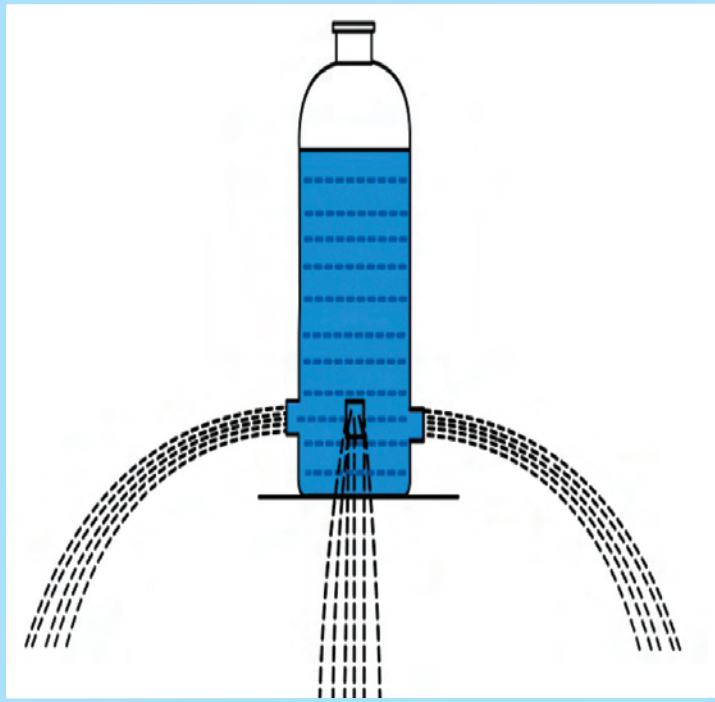
Take a discarded plastic water bottle, fit a glass tube near the bottom of the bottle. You can do so by slightly heating one end of the glass tube and then quickly inserting it. Make sure that the water does not leak from the joint. Cover the mouth of the glass tube with thin rubber baloon as you did in Activity 1. Now fill the bottle with water up to half of the bottle. What do you observe? Why does the rubber sheet bulge this time? Now pour more water and watch, what happens to the rubber sheet?



This shows that liquid exerts pressure on the walls of the container.

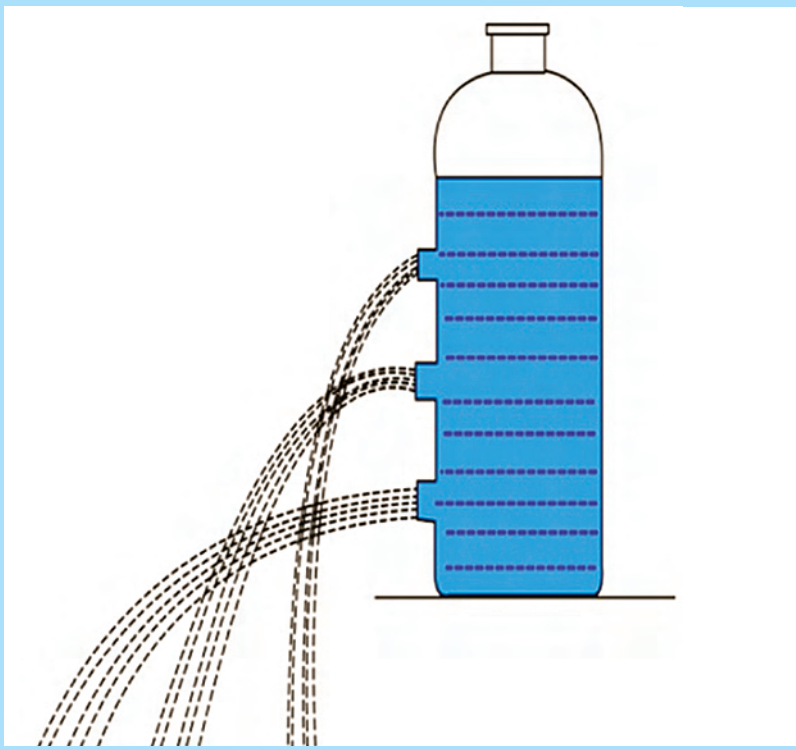
ACTIVITY 7.9

Take a plastic bottle and drill four holes all around near the bottom of the bottle. Make sure that the holes are at the same height from the bottom. Now fill the bottle with water. What do you notice? Do the different streams of water coming out of the holes fall at the same distance from the bottle?



Inference: Liquid exerts equal pressure at the same depth.

ACTIVITY 7.10



Take a plastic bottle, drill three holes at different heights from the bottom. Now fill the bottle with water. What do you observe? You can see that three different streams of water fall at different distances from the bottle.

Inference: The pressure of the liquid increases with the increase in depth.

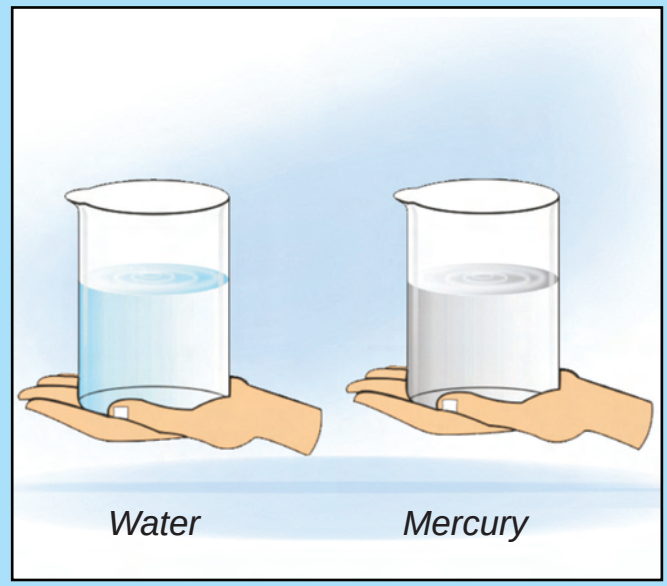
ACTIVITY 7.11

Let us take two identical glass beakers. Take some water in one beaker and an equal amount of mercury or caster oil in other beaker.

Let us approximately find out which beaker is heavier by keeping both the beakers on our palms.

Is the pressure exerted by both the beakers same?

No, the pressure is different. The pressure exerted by the beaker containing mercury or caster oil is more than that of the beaker containing water. This is because mercury or caster oil has more density than water.



Hence we can infer that pressure depends on density of a liquid.

Is the pressure exerted by a glass of water the same on the earth and the moon?

No, on the earth we have more gravitational force and hence the pressure exerted by the glass of water will be more.

On the moon, the gravitational force is less compared to our earth. Hence the pressure exerted by a glass of water is less on the moon.

So, pressure of a liquid depends on gravitational force (g).

The pressure of a liquid can also be calculated by using a formula

$p = hdg$

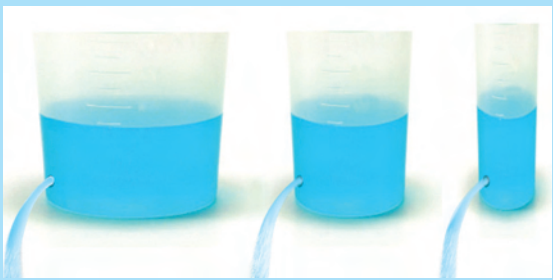
p = pressure of a liquid
h = height of the liquid column
d = density of the liquid
g = acceleration due to gravity

MORE TO KNOW

- Deep sea divers wear specially designed suits to protect them from the huge pressure of the water underneath.
- The walls of the dams are made stronger and thicker at the bottom than at the top of the dam to withstand the huge lateral pressure of water at the bottom

ACTIVITY 7.12

Take three kinds of vessels as shown in figure. Make holes in them at the same height from the bottom. Pour water into the vessels so that the height of the water level is same in all the vessels. Observe in which case the pressure is more.



7.7. PRESSURE EXERTED BY AIR

We must have walked on the road while there is a strong wind. How did we feel? Did we feel any force while walking against the wind?

What happens to the bicycle tube when it has a puncture?

From the above observations you can say that gases also exert pressure on the walls of their container.

7.8. ATMOSPHERIC PRESSURE

The earth is surrounded by air all around. This thick envelope of air is called the atmosphere. The atmospheric air extends up to many kilometers above the surface of the earth. The pressure exerted by this air column is known as the atmospheric pressure.

We know pressure is force per unit area, and if we imagine a unit area and a very long cylinder standing on it filled with air, up to the height of atmosphere, then the weight of the air in this cylinder is atmospheric pressure.

The atmospheric pressure at sea level is approximately 1,00,000 N/m^2 or (10^5 N/m^2). As we go higher and higher above the earth surface, the atmospheric pressure decreases.

MORE TO KNOW

Why do astronauts wear a special dress to go into the space?

The blood pressure inside our body would need air pressure outside to keep us safe.

When we go above the earth's atmosphere, the pressure outside is very less. But, the pressure inside our body is very high. Due to this our body will burst. So, to avoid this astronauts wear a special dress.

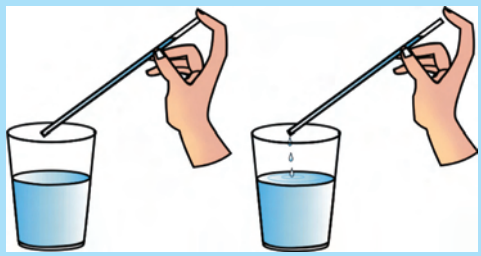
Measurement of atmospheric pressure

The atmospheric pressure is not the same at all places. It decreases as we go above the earth's surface. The instrument used to measure the atmospheric pressure is called Barometer.

In 1643, an Italian scientist named Torricelli invented the first barometer. It was a mercury barometer. Aneroid barometer and Fortein's barometer are other instruments used to measure the atmospheric pressure.

ACTIVITY 7.13

Take a glass of water. Suck a little water through a straw. Hold your finger above the straw. Pull the straw out of the water. What do you observe? Now remove your finger from the top of the straw. what happens?



ACTIVITY 7.14

Take an ink - filler. Press its bottom with your finger to Pump air out of it. Now keep its open end in water or ink and release your finger. What happens now?

ACTIVITY 7.15

Take a rubber ball and make many holes in it with a needle. Fill the ball with water. Squeeze the ball with your hand. What do you see?

Water rushes out through the holes with equal forces. What do you infer from this?

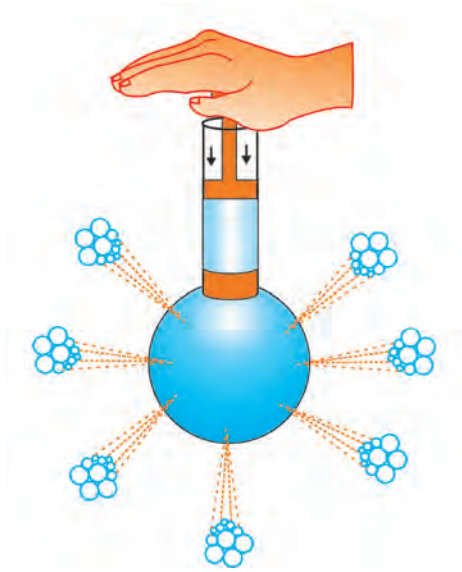
7.9. PASCAL'S LAW

The pressure applied to an enclosed liquid gets transmitted equally to every part of the liquid. This property was first demonstrated by Pascal and is called Pascal's law.

Hydraulic devices, like earth excavators (JCB) and car brakes work on the above principle.

Take a stout flask with holes of equal size at different places as shown in the figure. Fit a piston which can be moved up and down along the neck of the flask. When a force is applied on the piston, the piston moves down and the water flows

out equally in all directions through the holes. This shows pressure exerted on water is transmitted equally throughout the water so that water comes out of all the holes with equal force.



7.10. FRICTION

We must have seen children skating. These children wear shoes with wheels. Is it possible to skate on bare feet?

The force which opposes the action of sliding your foot on the floor is called 'friction'.

We saw earlier that the frictional force is a contact force.

> Friction is the force created whenever two surfaces move or try to move over each other.

Friction is caused by the irregularities on the two surfaces in contact. Even those surfaces which appear very smooth have a large number of irregularities on them. Irregularities on the two surfaces lock into one another. When we attempt to move any surface, we have to apply a force to overcome the interlocking. On rough surfaces there are larger number of irregularities. So the force of friction is greater if a rough surface is involved.

7.10.1. Factors affecting friction

The force of friction depends on two main factors

1. Mass of the body

2. Nature of the surfaces in contact

As the mass of the body increases, the force of friction also increases. A football goes farther than a cricket cork ball on a kick, since the mass of the cricket ball is more than that of a foot ball.

Friction is less when the surface is smooth. This you can

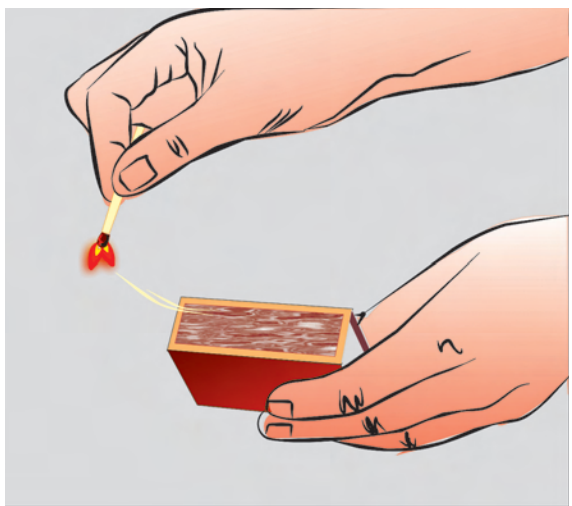
understand by rolling a stone on a tar road(rough surface) and a house floor(smooth surface).

7.10.2. Friction a necessary evil

Friction plays, an important role in our daily life. Friction opposes motion and so you may think it is an evil. But it is a necessary evil. Let us see why?

Friction is necessary

1. We are able to walk or run properly on the floor because of friction. If there is less or no friction we will slip and fall down.
2. It would not be possible to light a match stick without friction between its head and the side of the matchbox.
3. Cars and buses are able to run on the roads because of the friction between the wheels and the road.
4. We cannot write on paper without friction between the tip of a pen or a pencil and the paper.



Friction as an evil

1. Friction produces heat. This heat causes wear and tear of the machinery parts.
2. Vehicle tyres and soles of footwear wear out because of friction.

7.10.3. Increasing and reducing friction

We have seen in the earlier section that friction is desirable in some situations. Can we increase this friction?

You may have seen that the sole of shoes and footwear are grooved. Why is it so? Have you ever thought of it?

It is done to provide them better grip on the floor, so that you can move safely. This means you have increased the friction.

The treaded tyres of cars, trucks and bulldozers provide better grip with the ground.

Sand and gravel are strewn on the slippery ground during rainy season to increase the friction.

Just as we can increase the friction, we can also reduce the friction.

Friction can be reduced

1. By using suitable lubricants, friction can be reduced. eg. oil (for light machinery), grease (for heavy machinery) ,
2. If the rubbing surfaces are polished, they become smooth and in turn, reduce friction between them.
3. By the use of wheels .

4. By the use of ball bearings.

Ball bearings have small balls of steel between metal surfaces. They are placed between hubs and the axles of ceiling fans, bicycles, motor cycles etc. to reduce friction.

Ball bearing

MORE TO KNOW

Friction can never be entirely eliminated. No surface is perfectly smooth. There are always some irregularities.

SCIENCE

EVALUATION

1. Choose the correct answer.

   a) The SI unit of pressure is N/m^2.This unit is otherwise called _____ (pascal, newton, joule)

   b) Atmospheric pressure at sea level is approximately equal to _____ (10^5 N/m^2, 10^7 N/m^2, 10^3 N/m^2)

2. Fill in the blanks

   Friction is a _____ force (contact / non-contact)

3. Match the following

i) wheels and ball bearings	non-contact force
ii) grooves	based on Pascal's law
iii) earth escavators	increases friction
iv) fall of an apple from the tree	decreases friction

4. Correct the given statement.

   The gravitional force of moon is equal to the gravitational force of earth.

5. List out the following actions on the basis of contact force and non contact force

   a) lifting a chair

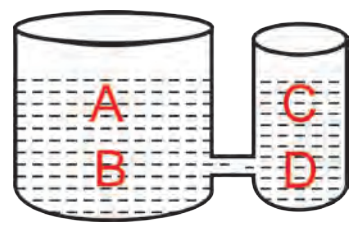
   b) the falling of a coconut from the tree

   c) friction between the road and the tyre of a car

   d) a comb attracts bits of paper

   e) attraction between two magnets

6. By observing the diagram, answer the following.



   a) How does the pressure at A differ from the pressure at B.?

   b) The pressure at B is greater than the pressure at D. Is it true?. Justify your answer.

   c) Compare the pressure at A and C.

   d) If the water is replaced with mercury, how would this affect the pressure at A and D?

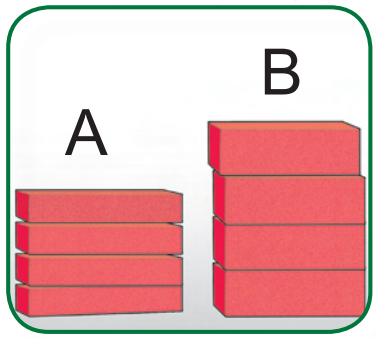
7. We know Pressure = $\frac{\text{Force}}{\text{Area}}$

If 50 N force is applied on a liquid and it experiences 25 N/m^2 pressure. Find out the area on which the force is applied?

8. Aswin and Anwar were playing with four bricks each. Aswin arranged his four bricks as shown in figure A. Anwar arranged his bricks as shown in figure B, in order to be a taller one.

Now let us complete the following sentences by choosing the right option below

(equal to, less than, more than)



a) The force of A on the ground is _____ the force of B on the ground.

b) The area that A occupies is _____ B on the ground.

c) The pressure exerted by A is _____ B

9. We know that pressure can also be calculated by using the formula p=hdg

A rectangular storage tank is filled with paraffin. The height of the tank is 2m. Density of paraffin is 800 kg/m^3, the value of g is 10 N/m^2

Calculate

a) the pressure at the bottom of the tank

b) the pressure at a depth of 1 m.

10. Swetha is wearing a sharp edged high heeled footwear. Madhu is wearing a flat footwear. If both the girls are having same weight and both are stepping over your foot, whose footwear will cause more pain to your foot? Why?

11. Swathi went by car to Ooty last week, when the car was climbing the mountain, her ears popped. She felt uneasy but after sometime she felt better. Why did her ears pop when she climbed the mountain?

12. As we go higher and higher atmospheric pressure _____ (increases / decreases)

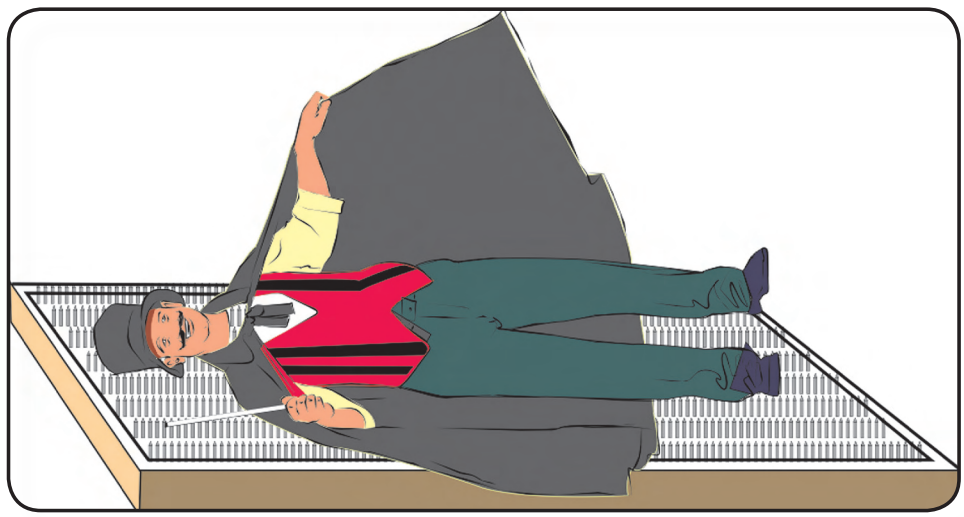
13. Kumaran went to a shop near his house on a bicycle. The bicycle made a lot of noise when he pedaled it. After coming home, he applied some oil on some parts of the bicycle. Now there is no noise, why?

14. We know that friction depends upon mass of the body when we roll down an iron ball and a football on the ground, which ball will travel more distance? Why?

15. When we “suck” on a straw, the liquid travels up in it. Explain why?

16. In a car, friction is essential in some parts but needs to be reduced in some parts. Give two examples of where friction is a) Essential and b) Needs to be reduced in a car.

17. Arasu went to an exhibition. There he saw a magician lying on a bed of nails. To his wonder, the magician was not hurt at all. help Arasu to understand the phenomenon.

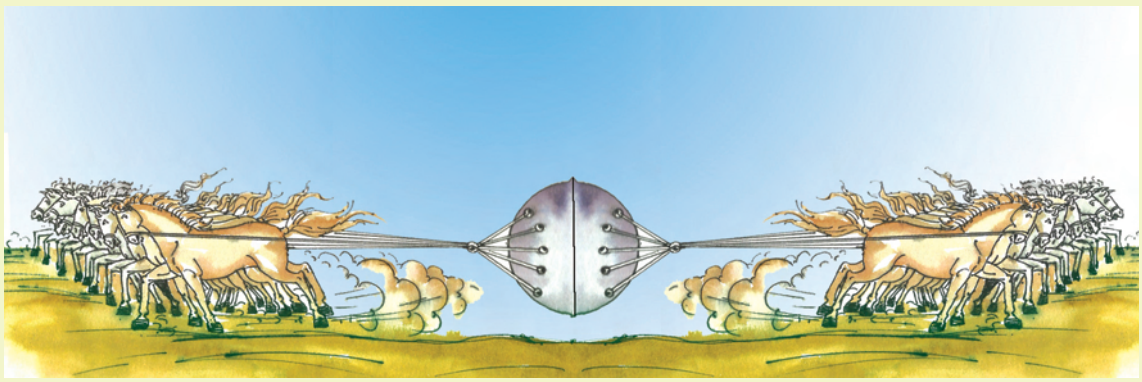


Project Work

Take a brick. Measure its length, breadth and height. Weigh the brick on a balance and note its weight. Now keep the brick on a table in various positions in turn. Find its area of contact with the table. The weight of the brick is the force applied by the brick. Now calculate the pressure applied by the brick on the table in various positions. Prepare a chart showing your observations. Similarly find the pressure exerted by a book, a wooden block, etc., and note your observations in the chart.

DO YOU KNOW?

Otto von Guericke, a german scientist of the 17th century, invented a pump to extract air out of a vessal. With the help of this pump, he demonstrated dramatically the force of the air pressure. He joined two hollow metallic hemispheres of 51cm diameter each and pumped air out of them. then he employed eight horces on each hemisphere to pull them apart. So great is the force of air pressure that the hemispheres could not be pulled apart.



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