JUNIOR SCHOOL

GRADE 8

INTEGRATED NOTES

OSCAR MWANGI

MIXTURES ELEMENTS AND COMPOUND

PROPERTIES OF MATTER

Matter is anything that has weight and occupies space. Everything found around us is matter

♣ **Properties of Solids:**

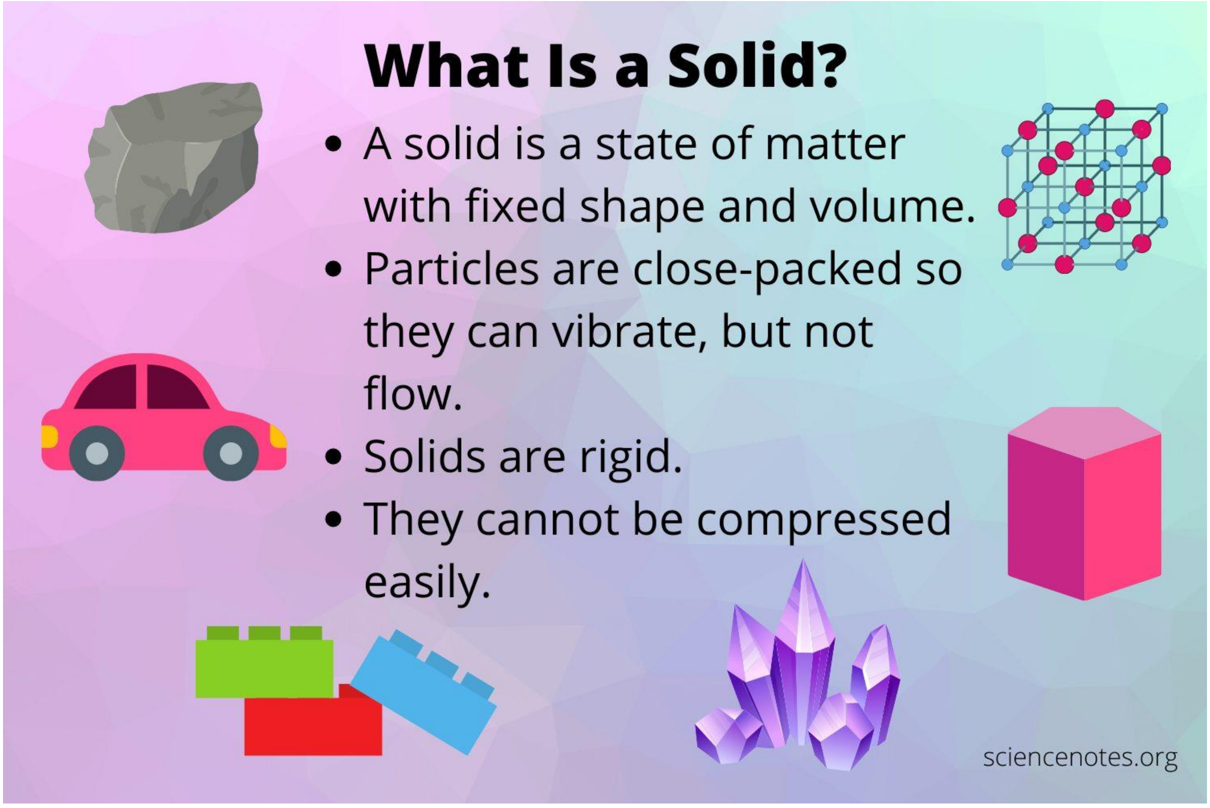
1) Solid has a fixed shape and a fixed volume.

2) Solid cannot be compressed.

3) Solids have a high density.

4) Force of attraction between the particles in a solid is very strong.

5) The space between the particles of solids is negligible.



Examples of solids

- Sand
- Timber
- Rocks
- Shoe
- Chalk dust
- Tables
- spoon

♣ **Properties of Liquids:**

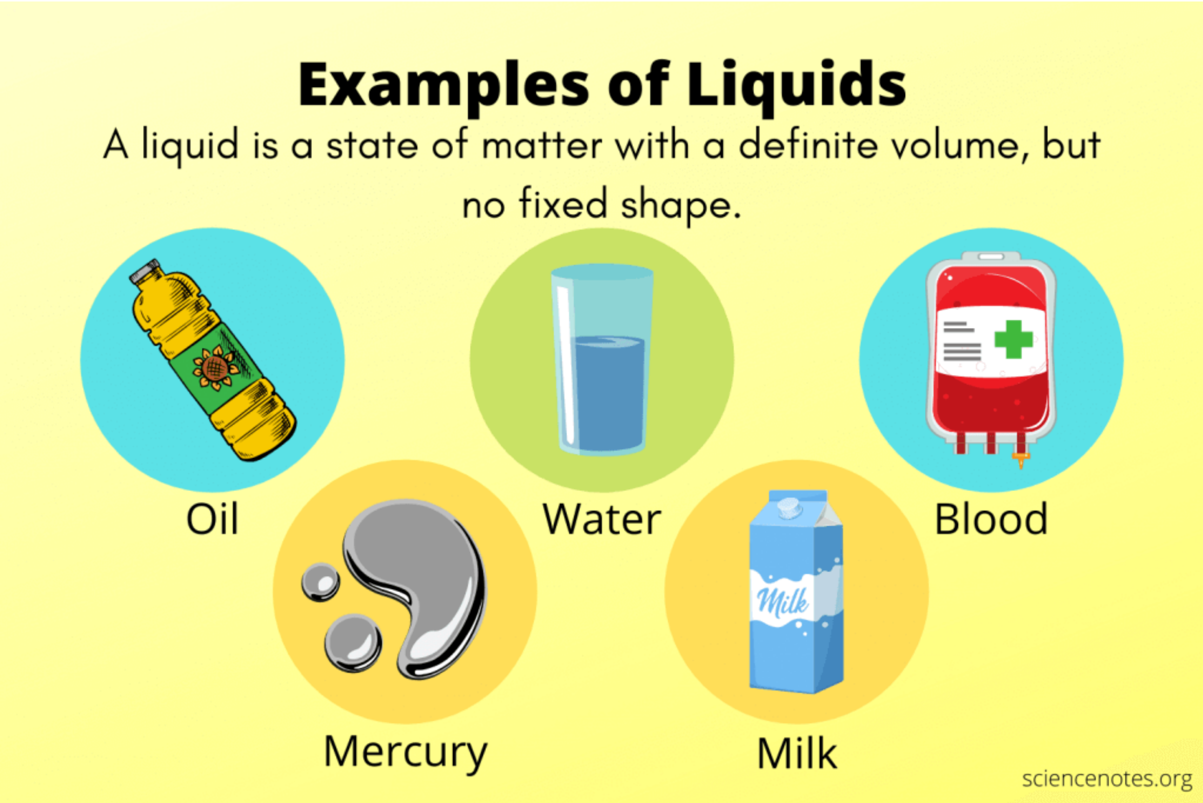
1) Liquid has a fixed volume but no fixed shape.

2) Liquids can be slightly compressed. large pressure is required to compress them.

3) Liquids have lesser densities than solids.

4) Intermolecular forces of attraction is weaker than solids.

5) They have considerable space between the particles.



♣ **Properties of Gases:**

1) Gases have neither a fixed shape nor a fixed volume.

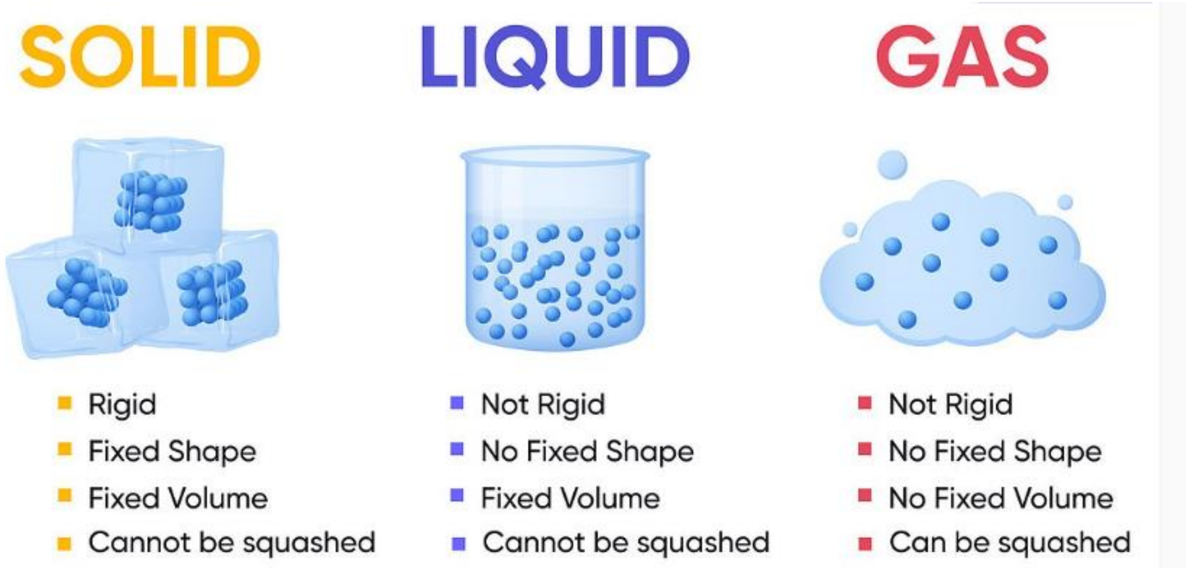
2) Gases can be compressed easily.

3) Gases have the least density among the three.

4) Intermolecular forces of attraction are weakest.

5) The space between the gas particles is large.

Summary



Diffusion in liquids

Diffusion is movement of molecules from a region of high concentration to a region of low concentration

When the crystals of potassium permanganate are kept in water, the purple-coloured crystals of potassium permanganate break further into smaller particles that occupy the space between the molecules of water imparting a purple colour to the water. So this is an example of diffusion

Watch clip on

https://www.youtube.com/watch?v=BHZZyDMeu1M&t=152

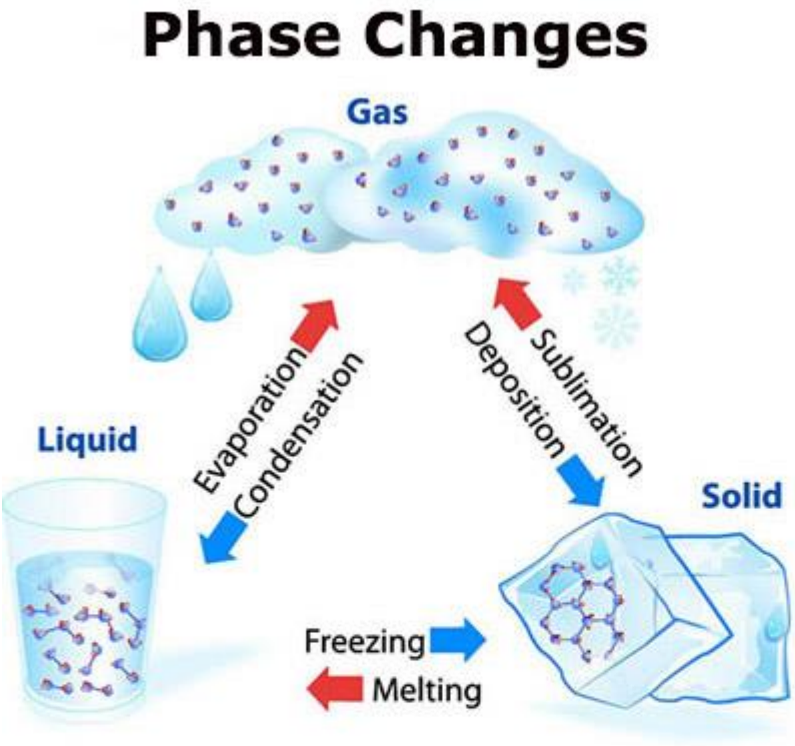
Potassium permanganate diffusion in water.

Beaker containing potassium permanganate (purple) and water, and a clock being used to time how long it takes for the purple colour to spread through the water as the potassium permanganate dissolves.

This apparatus is used to demonstrate diffusion in a liquid. Eventually, the random motion of all the potassium permanganate particles results in the purple colour being equally dispersed throughout the water. The process appears slow as the dissolved particles collide with the water molecules and each other, slowing their progress.

Changes of state of matter

A change of state is a physical change in a matter. They are reversible changes and do not involve any changes in the chemical makeup of the matter. Common changes of the state include melting, freezing, sublimation, deposition, condensation, and vaporization.



Why matter states changes

It is possible that we have seen changes in the state of matter as the ice cubes melt into liquid water, or when the water boils and turns into vapour but have we ever thought about the reason behind this?

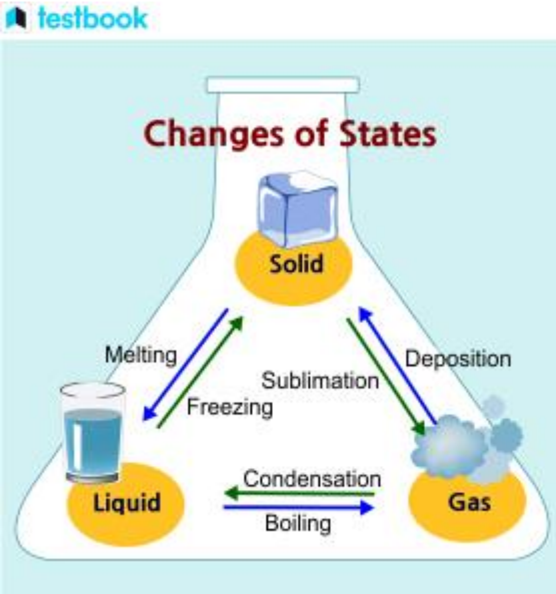
The changing states of matter occur as the matter absorbs or loses energy. When an object absorbs energy, molecules and atoms accelerate their movement and this increased energy kinetics can push particles so that they alter their state. The energy that is absorbed is typically thermal or heat energy.

Changing States of Matter

There are generally three types of matter: liquid, solid, and gas. In the solid state, the particles or molecules are tightly together which is why they possess an intense intermolecular force of attraction. The liquid states of particles, however, are apart from one another and thus have less force to attract them. In the case of gas, the particles are extremely far from one another and exhibit a negligible force of attraction.

If there are changes in the temperature or pressure of a material, the change of states of matter takes place. The state of matter can be changed by changing temperature and pressure. The impact of temperature changes on states of matter shifting will be directly related to changes in the interaction between molecules that make up the substance. If the temperature drops, particles can soften into a robust structure.

The diagram below depicts the change of states of matter through different types of processes taking place in those states:



Here to understand this phenomenon we can take an example of the conversion of ice into water. In this conversion, the ice which is a solid form of water gets changed into water which is the liquid form itself. This change in the state occurs due to a process known as melting, and in this process, when kept at a higher temperature the solid ice gets converted into liquid water. In melting, mainly the liquefaction of ice takes place.

From this example, we can understand that the change of states of matter can only occur through a certain process that takes place due to a rise or fall in its temperature or due to an increase or decrease in its pressure. Without these things, nothing can change the state of a matter. There are many processes similar to melting which are responsible for changing the state of a particular matter.

Changes Between Liquids and Solids

We have seen that changes of state take place and the compound changes from one physical form to another. One such change is between liquids and solids. To understand this we can take an example of rock which gets converted into lava when exposed to extreme heat and pressure but when it cools down the lava again converts back into a rock.

Freezing

Freezing is the process in which the liquid converts into solid. To understand this we can take an example liquids getting converted into crystals. There are many liquids which do convert into solid but they do not take the exact solid form rather they converts themselves into tiny crystals.

Melting

Melting is a process in which the solid converts into liquid by getting exposed to heat and pressure. We can understand this from the example of metal converting into molten liquids by artisans to give them different kinds of shapes.

Changes Between Liquids & Gases

Another change that takes place between different types of states is that between liquids and gases. In this change the liquids gets converted into gases or the gases into liquids and this mainly occurs by two process. An example to understand this is liquid water getting converting into water vapours which is the gaseous form of water and then the water vapour getting converted back into liquid water.

Vaporization

Vaporization is the process in which the liquid gets converter into its gaseous form. For example, if we take some water in a saucepan and heat it up then after some time the water will start to decrease in quantity. This thing happens with water as its gets converted into steam by the presence of heat and pressure on it.

Condensation

The conversion of gases into liquids takes place by the process of condensation. In this the water vapour which is present in the atmosphere into droplets of dew on grass and trees when temperature is low and pressure is also low.

Changes between Solids & Gases

One more change that take place is the solid state of matter changing into gaseous phase and then the gaseous state into the solid state. It can be understood by the example of freeze drying of water in which it gets converted from solid to gaseous in normal temperature and pressure and when the temperature and pressure is lowered it goes back to its solid form.

Sublimation

Sublimation is a process in which the solid state of matter converts directly into the gaseous state and the gaseous back into solid state without going through the liquid phase change. This process can be understood by taking the example of dry ice. Dry ice converts from solid to gas in normal temperature and pressure but when the temperature is lowered and the pressure is decreased it converts back to its solid form.

Deposition

Deposition is a phase change where gas becomes a solid without going through the liquid phase.
The forces of attraction between the solids are completely eliminated when they have absorbed enough energy. A deposition is the inverse of Sublimation and vice versa.

The most typical example of deposition is frost, which is the deposition of water vapour from humid air which converts into a solid ice.

Examples of Change of State of Matter in Everyday Life

There are several examples of changes of state of matter that occur in everyday life. Here are a few common examples:

- **Ice melting:** When ice at 0°C is heated, it changes from solid state to liquid state and starts melting.
- **Frost formation:** When the temperature drops below 0°C, water vapour in the air condenses directly into solid ice crystals.
- **Water boiling:** When water is heated, it changes from liquid state to gas state (steam).
- **Condensation of water vapour:** When water vapour in the air cools below 100°C, it changes from gas state to liquid state and condenses to form liquid water droplets.
- **Sublimation:** An example of sublimation is when solid dry ice (frozen carbon dioxide) changes into carbon dioxide gas without melting.

Causes and Effects of Changing States of Matter

The main cause of change in states of matter is due to the addition or loss of energy in the state of a substance that is altered physically.

This phenomenon is connected with the movement of molecules. Solids possess very little kinetic energy, meaning that they only vibrate and keep the bonds of chemical strength. If the energy source is placed in (e.g. heat energy, which can later be converted into kinetic energy) then the molecules begin spinning and vibrating faster, which causes the strength of the bonds to diminish.

If a certain amount of heating is applied (this is different for each substance, for example, the melting point of the water is 0°C while the boiling point is 100°C) those molecules will be moving towards the point of not remaining in their original form. When energy levels are reduced and reversed, the process begins again.

Whereas, the effects of change in the state of matter are only two which are mentioned as well as explained below:

- **Change in Temperature:** The temperature change occurs in states of a matter when it undergoes heat transfer to its surroundings. When a substance is placed in surroundings of a different temperature, heat is exchanged between the substance and the surroundings, causing both to achieve an equilibrium temperature. So when an ice cube is exposed to heat, its water molecules absorb heat energy from the surrounding atmosphere and begin to move more energetically, causing the water ice to melt into liquid water.
- **Change in Pressure:** The change in pressure occurs in states of a matter only when it undergoes liquefaction. We can understand this effect from the examples of smoke rising all over the stage at performances or parties. Dry ice is the only thing that exists (solid carbon dioxide). The solid carbon dioxide is kept at high pressure and instantly melts when pressure is reduced down to 1 bar. The space between particles of the material is what determines its physical state. In the end, when pressure is applied to the gas, it is compressed into a liquid. Then, the pressure applied to liquids becomes solid. Pressure does not affect solids. If pressure is applied to the material and the chemical state of the substance shifts from liquid to gas and after that, liquid changes to solid.

Experiments of Changing States of Matter

Below are mentioned three experiments that depict all the five processes that take place during the change of state of matter:

- If we take an ice cube and put it in a bowl then after some time it will melt into water. This depicts the conversion of a solid into liquid due to the process of melting which took place due to an increase in the temperature of the substance. Now if we put that bowl that has water in a freezer, then the water will again solidify into ice and again change its state. This phenomenon occurs due to the conversion of liquid into solid by the process of freezing. Freezing can only take place when the temperature of a substance is decreased.

- Now if you put a bowl filled with water outside your home in the sun then after some days there will be no water. Due to an increase in the temperature, the liquid water changes its form into gaseous water vapour which depicts the process of evaporation taking place. Now to depict condensation we can take a bottle and fill it with some chilled water and as time goes by we can see small droplets of water outside of the bottle which occurred due to the process of condensation taking place. Condensation occurs when the gaseous water vapours come in contact with the cold water having a decreased temperature; they start to solidify and get converted into liquid water again.

- If we take some dry ice and put it in a bowl then after some time we can see that the dry ice will disappear. This occurs due to the process of sublimation taking place in it. Sublimation converts the solid into a gaseous form and it occurs only when the temperature is increased. To reverse this process we can decrease the temperature as well as pressure and the atmospheric dry ice will again solidify.

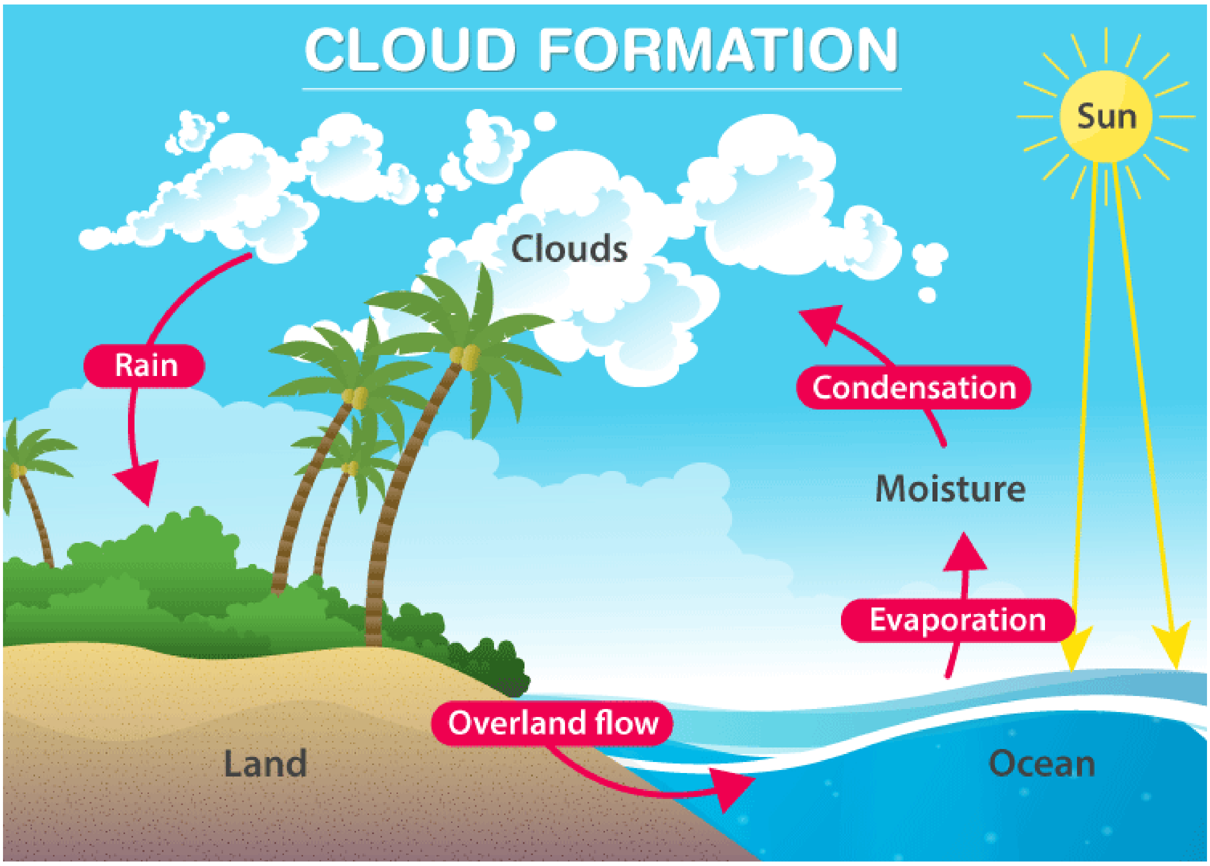
Applications of Changing States of Matter

The phenomenon of change of states of matter can be found in the following examples:

1. **Preventing ice-cream from melting by using the dry ice.**




2. **Formation of the clouds.**



Clouds form when the invisible water vapour in the air condenses into visible water droplets or ice crystals. For this to happen, the parcel of air must be saturated, i.e. unable to hold all the water it contains in vapour form, so it starts to condense into a liquid or solid form.

3. **Formation of the fog and dew.**

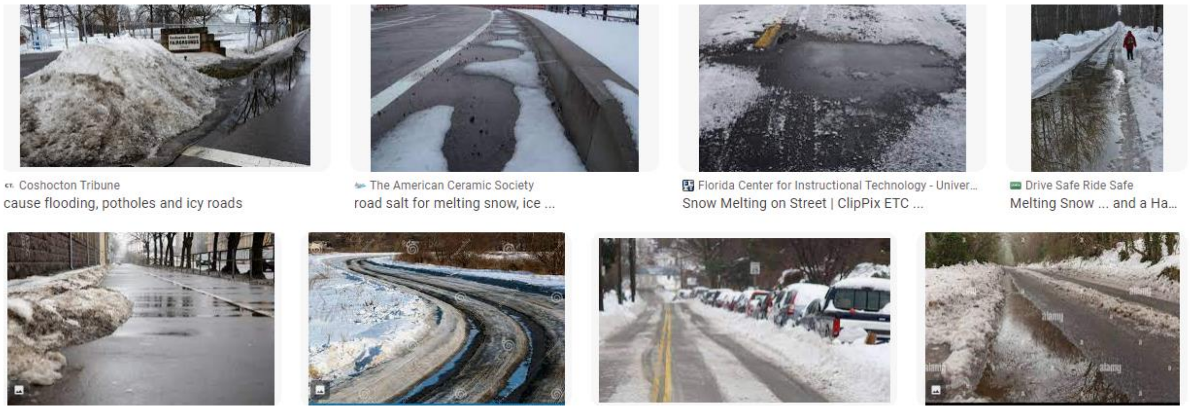
   Fog is an atmospheric condition characterised by the cloud appearing close to or at the earth's surface. Dew is the condensation that occurs due to temperature drops to the dew point. Calm winds lead to the formation of dew. When the air above the ground cools under light wind speeds, fog also forms

4. **Formation of water droplets outside of the glass.**

5. 

6. **Melting of the snow on the road.**

   Salt melts ice and snow by lowering its freezing point. Salt is best put on the roads before they freeze or before snow arrives. Then, as snow falls, the salt mixes with it, lowering its freezing point. The result is a brine solution, preventing subsequent ice forming.



7. **Refrigeration**

Refrigeration, or cooling process, is the removal of unwanted heat from a selected object, substance, or space and its transfer to another object, substance, or space. Removal of heat lowers the temperature and may be accomplished by use of ice, snow, chilled water or mechanical refrigeration

Temporary and permanent changes

Hint:

Temporary changes are also known as physical change. Temporary changes are the changes which are there only for a short period of time. Generally temporary changes are reversible.

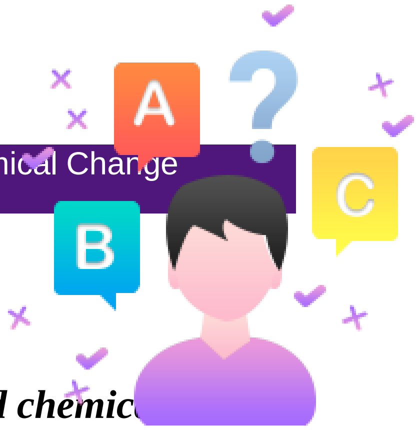
Permanent changes are the changes which remain for a longer time and are not reversible. They are also called chemical changes

There are many differences between physical and chemical changes and it is important to understand them to be able to understand these concepts clearly. The comparisons and differences between physical and chemical changes are given below along with their examples. To understand physical and chemical properties and changes better, it is important to know what they are.

Differences between Physical and Chemical Change

Physical Change	**Chemical Change**
When a substance undergoes a physical change, its composition remains the same despite its molecules being rearranged.	When a substance undergoes a chemical change, its molecular composition is changed entirely. Thus, chemical changes involve the formation of new substances.
Physical change is a temporary change.	A chemical change is a permanent change.
A Physical change affects only physical properties i.e. shape, size, etc.	Chemical change both physical and chemical properties of the substance including its composition
A physical change involves very little to no absorption of energy.	During a chemical reaction, absorption and evolution of energy take place.
Some examples of physical change are freezing of water, melting of wax, boiling of water, etc.	A few examples of chemical change are digestion of food, burning of coal, rusting, etc.
Generally, physical changes do not involve the production of energy.	Chemical changes usually involve the production of energy (which can be in the form of heat, light, sound, etc.)
In a physical change, no new substance is formed.	A chemical change is always accompanied by one or more new substance(s).
Physical change is easily reversible i.e original substance can be recovered.	Chemical changes are irreversible i.e. original substance cannot be recovered.

Thus, it can be understood that the primary difference between physical and chemical changes is that physical changes are reversible, whereas chemical changes are usually not.



QUESTIONS AND ANSWERS

Q1 How can you tell the difference between physical and chemical changes?

The appearance or form of matter changes during a physical change, but the type of matter in the substance does not. A chemical change, on the other contrary, results in the creation of at least one new substance with new properties.

Q2. Why is it important to know the difference between physical and chemical changes?

It's essential to recognise the difference between chemical and physical changes. Several changes are obvious, but there are some fundamental concepts to be aware of. Physical changes usually refer to changes in the physical state of stuff. When two or more molecules interact, chemical changes occur on a molecular level.

Q3. What are the examples of physical and chemical changes?

Examples of chemical changes would be burning, cooking, rusting, and rotting.
Examples of physical changes could be boiling, melting, freezing, and shredding.
Most physical changes can be reversed if sufficient energy is provided.

Q4. How to tell whether it's a physical or chemical change?

Check for indications that a chemical change has taken place. The following are indications of a chemical change:

- Gas is created. Bubbles can occur in liquids.
- An odour is created.
- The colour of the substance changes.
- Sound is generated.
- There is a shift in the temperature. The environment either heats up or cools down.
- Light is generated.
- A precipitate develops.

- Reversing the change is difficult or impossible.

Q5. What are three forces that can cause a physical change?

Forces such as motion, temperature, and pressure can create physical changes. Oxygen in the air reacts with sugar, and the chemical bonds are destroyed.

Elements and compounds

Elements are pure substances which are composed of only one type of atom. Compound is substances which are formed by two or more different types of elements that are united chemically in fixed proportions.

Element	Compound
Elements are such types of substances that cannot be broken down chemically.	Compounds are chemical species formed by two or more atoms together by a chemical mean.
Each element Contains a unique atomic number.	Compounds are heteroatom molecules.
Only 118 chemical elements are known in the universe.	Compounds are composed of two or more atoms of similar or dis-similar elements.
They can form different types of chemical bonding depending on stability and electron configuration.	Covalent bonds, ionic bonds, and metallic bonds can be present in compounds.
Oxygen, zinc, nitrogen, and hydrogen are common examples of elements.	Sodium Chloride, Calcium chloride, Calcium carbonate are some examples of Compounds.
Elements are always represented by symbols.	Compounds are always represented using a unique formula.
They exist on their own.	Components of elements are present in definite proportions.

Elements	Compounds
Pure substance	Impure substance
Has only one kind of atoms	Has two or more kinds of atoms
Represented by symbol	Represented by chemical formula
Smallest particle is atom	Smallest particle is molecule

Elements and Their Symbols

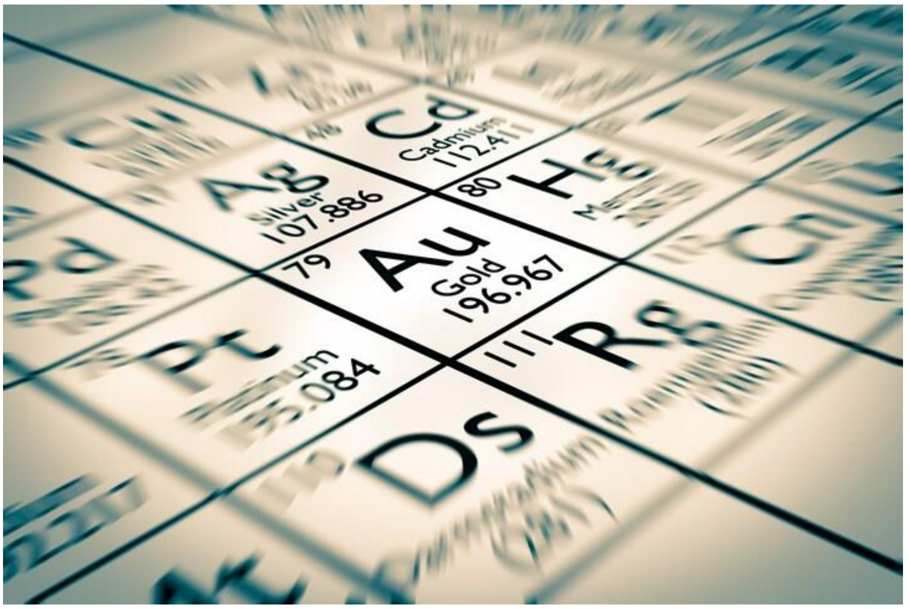
Chemical elements are the basic building blocks of matter. Elements are referred to by their names and their symbols. This makes it easier to write chemical structures and equations.

Examples

The first 20 elements of the periodic table are listed below. These elements include some of the most abundant in the universe (hydrogen, oxygen, carbon) as well as some of the most unusual (phosphorus, boron).

1. H - Hydrogen
2. He - Helium
3. Li - Lithium
4. Be - Beryllium
5. B - Boron
6. C - Carbon
7. N - Nitrogen
8. O - Oxygen
9. F - Fluorine
10. Ne - Neon
11. Na - Sodium
12. Mg - Magnesium
13. Al - Aluminum
14. Si - Silicon
15. P - Phosphorus
16. S - Sulfur
17. Cl - Chlorine
18. Ar - Argon
19. K – Potassium
20. Ca - Calcium

Notice that the symbols are one- and two-letter abbreviations for their names, with a few exceptions where symbols are based on old names. For example, potassium is K for *kalium*, not P, which is already the element symbol for phosphorus



Common Metals

- Magnesium: It has a symbol of Mg.
- Calcium: It has a symbol of Ca.
- Chromium: It has a symbol of Cr.
- Iron: It has a symbol of Fe. ...
- Zinc: It has a symbol of Zn.
- Mercurys-Hg
- Gold-Au
- Tin –Sn

Uses of elements

1. Hydrogen - Rocket propellant, chemical reagent, potential alternative fuel, coolant for electrical equipment, airship lifting gas.
2. Helium - Lifting gas for balloons/airships, coolant for superconductors. Shielding gas for welding.
3. Lithium - Batteries, psychiatric medications, constituent in light structural metals.
4. Beryllium - Light, hard, strong structural metal, x-ray transparent materials.
5. Boron - Composite materials, cleaning agents, semiconductors, chemical reagents.
6. Carbon - Structural material, jewellery (diamonds), basis for all organic compounds, adsorbent material, pencils.
7. Nitrogen - Primary component of the atmosphere, fertilizer production, rocket propellants, shielding gas for welding.

8. Oxygen - Primary active component of atmosphere, medical use, rocket propellant, steelmaking, support of combustion.
9. Fluorine - Toothpaste, pharmaceuticals, etching of glass, rocket propellant (for use outside the atmosphere).
10. Neon - Electric signs, lasers.
11. Sodium - Table salt, glassmaking, baking soda, reducing agent.
12. Magnesium - Structural material, dietary supplement, flashbulbs, fireworks.
13. Aluminium - Structural material, ceramics (aluminium oxide).
14. Silicon - Semiconductors, glassmaking, abrasives, structural material.
15. Phosphorus - Fertilizers, rust remover (phosphoric acid), matches.
16. Sulphur - Primary starting material for sulphuric acid (which has MANY uses), vulcanized rubber, detergents, odorant in natural gas, fungicide.
17. Chlorine - Bleach, swimming pool and drinking water disinfectant, chemical reagent, ingredient in salt.
18. Argon - Shielding gas for welding, inert storage of substances that react with air.
19. Potassium - Fertilizers, dietary supplements, reducing agent.
20. Calcium - Dietary supplements, fertilizers, alloying element, batteries.

Atomic Structure

H 1 Hydrogen $A_r = 1$	**The Periodic Table**						**He** 2 Helium $A_r = 4$
Li 3 Lithium $A_r = 7$	**Be** 4 Beryllium $A_r = 9$	**B** 5 Boron $A_r = 11$	**C** 6 Carbon $A_r = 12$	**N** 7 Nitrogen $A_r = 14$	**O** 8 Oxygen $A_r = 16$	**F** 9 Fluorine $A_r = 19$	**Ne** 10 Neon $A_r = 20$
Na 11 Sodium $A_r = 23$	**Mg** 12 Magnesium $A_r = 24$	**Al** 13 Aluminium $A_r = 27$	**Si** 14 Silicon $A_r = 28$	**P** 15 Phosphorus $A_r = 31$	**S** 16 Sulphur $A_r = 32$	**Cl** 17 Chlorine $A_r = 35$	**Ar** 18 Argon $A_r = 40$
K 19 Potassium $A_r = 39$	**Ca** 20 Calcium $A_r = 40$						

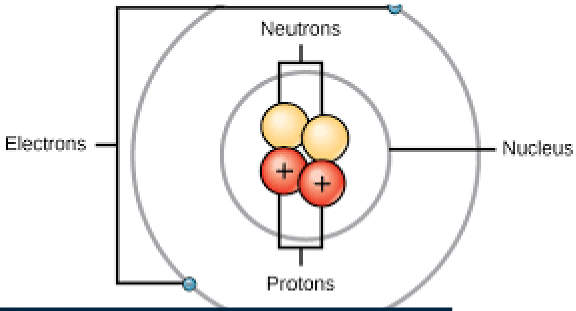
HYDROGEN 1 **H** 1.01	**PERIODIC TABLE ELEMENTS 1–20**						HELIUM 2 **He** 4.00
LITHIUM 3 **Li** 6.94	BERRYLLIUM 4 **Be** 9.01	BORON 5 **B** 10.81	CARBON 6 **C** 12.01	NITROGEN 7 **N** 14.01	OXYGEN 8 **O** 16.00	FLOURINE 9 **F** 19.00	NEON 10 **Ne** 20.18
SODIUM 11 **Na** 22.99	MAGNESIUM 12 **Mg** 24.31	ALUMINUM 13 **Al** 26.98	SILICON 14 **Si** 28.09	PHOSPHORUS 15 **P** 30.97	SULFUR 16 **S** 32.07	CHLORINE 17 **Cl** 35.45	ARGON 18 **Ar** 39.95
POTASSIUM 19 **K** 39.10	CALCIUM 20 **Ca** 40.08						

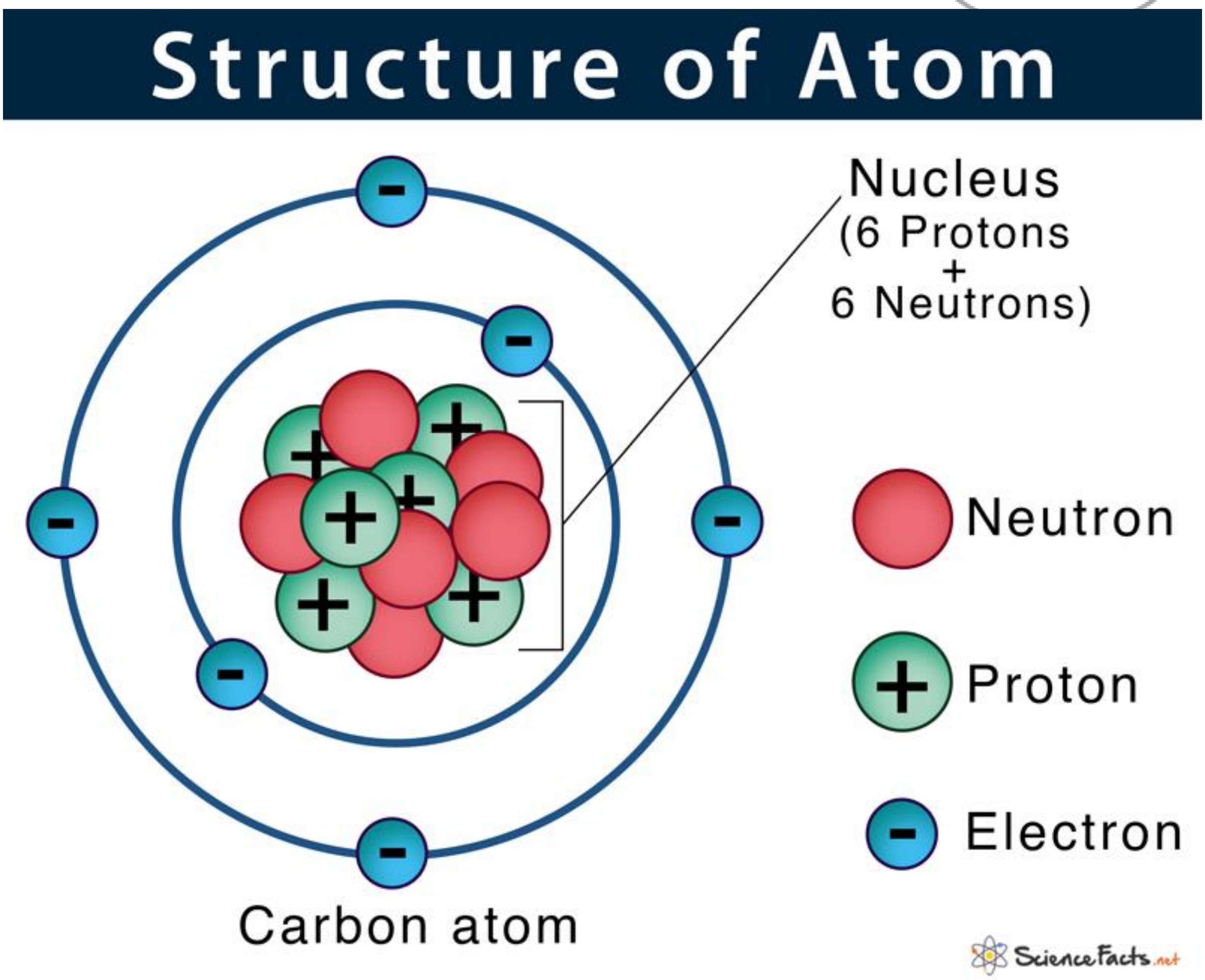
Atoms consist of an extremely small, positively charged nucleus surrounded by a cloud of negatively charged electrons.

The atomic structure of an element refers to the constitution of its nucleus and the arrangement of the electrons around it.

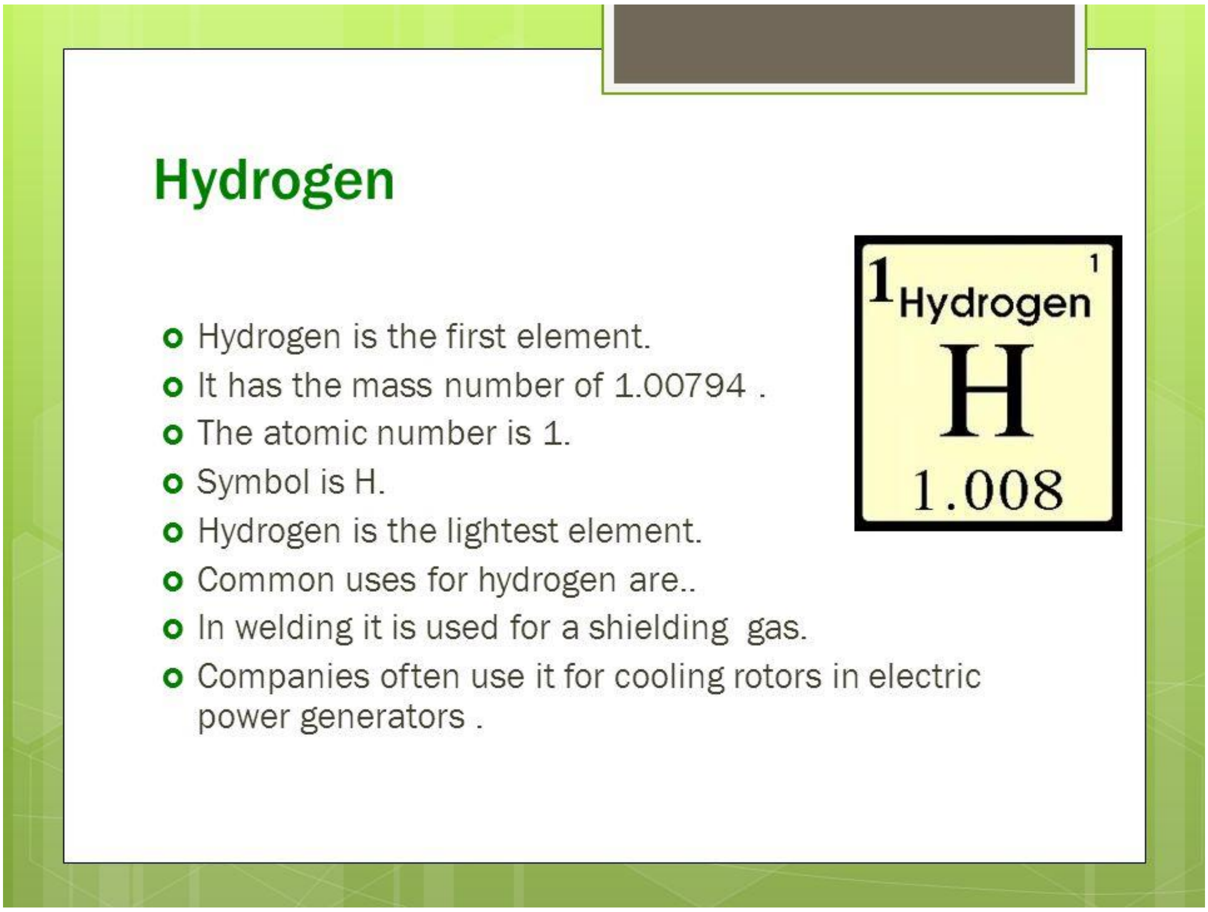
Primarily, the atomic structure of matter is made up of protons, electrons and neutrons.

The **protons and neutrons** make up the nucleus of the atom, which is surrounded by the electrons belonging to the atom. The **atomic number** of an element describes the total number of protons in its nucleus





ATOMIC NUMBER AND MASS NUMBER



The atomic number of an atom is equal to the number of protons in the nucleus of an atom or the number of electrons in an electrically neutral atom.

Atomic number = Number of protons.

Chemical symbols are the abbreviations used in chemistry for chemical elements. Element symbols for chemical elements normally consist of one or two letters from the English alphabet and are written with the first letter capitalised.

Atomic mass refers to the mass of an atom. It depicts how many times an atom of an element is heavier than one-twelfth (1/12th) the mass of one atom of carbon-12 of mass of one carbon atom. It is measured in a unit called amu (atomic mass unit).

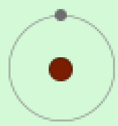
Atomic number and mass number of first 20 Elements

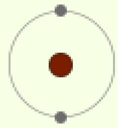
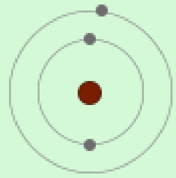
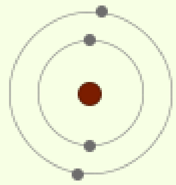
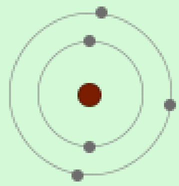
Element	Atomic number	Mass number
Hydrogen (H)	1	1
Helium(He)	2	4
Lithium(Li)	3	7
Beryllium(Be)	4	9
Boron(B)	5	11
Carbon(C)	6	12
Nitrogen(N)	7	14
Oxygen(O)	8	16
Fluorine(F)	9	19
Neon(Ne)	10	20
Sodium(Na)	11	23
Magnesium(Mg)	12	24
Aluminium(Al)	13	27
Silicon(Si)	14	28
Phosphorous(P)	15	31
Sulfur(S)	16	32
Chlorine(Cl)	17	35.5
Argon(Ar)	18	40
Potassium(K)	19	39
Calcium(Ca)	20	40

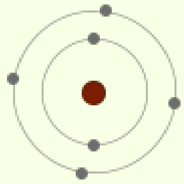
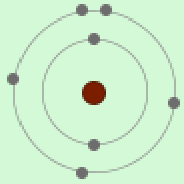
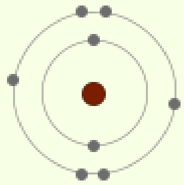
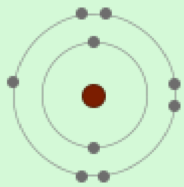
H **Hydrogen** Atomic Number: 1 Protons: 1 Atomic Mass: 1.0079	**He** **Helium** Atomic Number: 2 Protons: 2 Atomic Mass: 4.0026	**Li** **Lithium** Atomic Number: 3 Protons: 3 Atomic Mass: 6.941	**Be** **Beryllium** Atomic Number: 4 Protons: 4 Atomic Mass: 9.0122	**B** **Boron** Atomic Number: 5 Protons: 5 Atomic Mass: 10.811
C **Carbon** Atomic Number: 6 Protons: 6 Atomic Mass: 12.0107	**N** **Nitrogen** Atomic Number: 7 Protons: 7 Atomic Mass: 14.0067	**O** **Oxygen** Atomic Number: 8 Protons: 8 Atomic Mass: 15.9994	**F** **Fluorine** Atomic Number: 9 Protons: 9 Atomic Mass: 18.9984	**Ne** **Neon** Atomic Number: 10 Protons: 10 Atomic Mass: 20.1797
Na **Sodium** Atomic Number: 11 Protons: 11 Atomic Mass: 22.9897	**Mg** **Magnesium** Atomic Number: 12 Protons: 12 Atomic Mass: 24.305	**Al** **Aluminum** Atomic Number: 13 Protons: 13 Atomic Mass: 26.9815	**Si** **Silicon** Atomic Number: 14 Protons: 14 Atomic Mass: 28.0855	**P** **Phosphorus** Atomic Number: 15 Protons: 15 Atomic Mass: 30.9738
S **Sulfer** Atomic Number: 16 Protons: 16 Atomic Mass: 32.065	**Cl** **Chlorine** Atomic Number: 17 Protons: 17 Atomic Mass: 35.453	**Ar** **Argon** Atomic Number: 18 Protons: 19 Atomic Mass: 39.948	**K** **Potassium** Atomic Number: 19 Protons: 19 Atomic Mass: 39.0983	**Ca** **Calcium** Atomic Number: 20 Protons: 20 Atomic Mass: 40.078

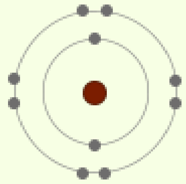
Electron arrangement of the first 20 elements

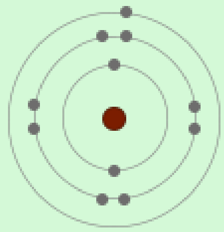
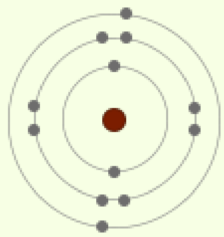
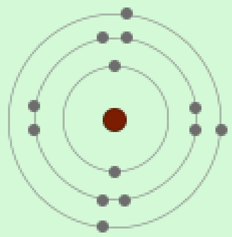
The table below shows the electron arrangement for the first 20 elements in the Periodic Table along with their Atomic number and symbols:

Element	Electrons diagram and configuration
1 **H** hydrogen	 1

2 **He** helium	 2
3 **Li** lithium	 2.1
4 **Be** beryllium	 2.2
5 **B** boron	 2.3

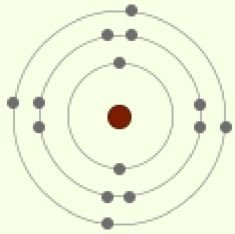
6 **C** carbon	 2.4
7 **N** nitrogen	 2.5
8 **O** oxygen	 2.6
9 **F** fluorine	 2.7

10 **Ne** neon	 2.8

11 **Na** sodium	 2.8.1
12 **Mg** magnesium	 2.8.2
13 **Al** aluminium	 2.8.3

14

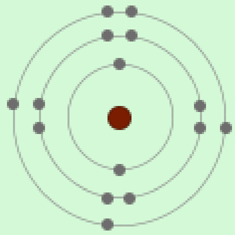
Si
silicon



2.8.4

15

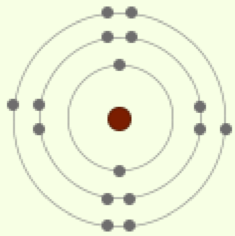
P
phosphorus



2.8.5

16

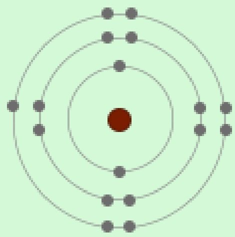
S
sulfur

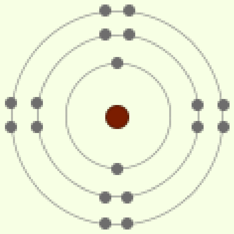
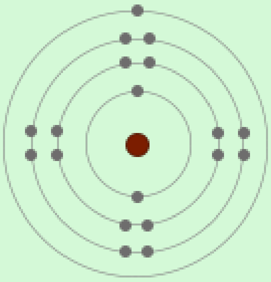
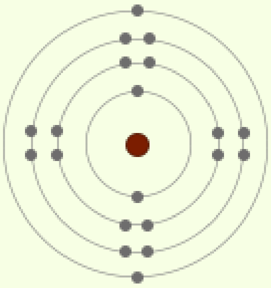


2.8.6

17

Cl
chlorine



	2.8.7
18 **Ar** argon	 2.8.8
19 **K** potassium	 2.8.8.1
20 **Ca** calcium	 2.8.8.2

TO REMEMBER

To learn the elements name:

Happy **He**nry **Li**ves **Be**side **B**oron **C**ottage **N**ear **O**ur **F**riends **Ne**lly **Na**ncy **Mg Al**len. **Si**lly **P**atrick **S**tays **Cl**ose. **Ar**thur **K**isses **Ca**rrie.

Happy. – H- Hydrogen
Henry – He- Helium
Lives – Li- Lithium
Beside – Be- Beryllium
Boron – B- Boron
Cottage – C- Carbon
Near – N- Nitrogen
Our – O- Oxygen
Friend – F- Fluorine
Nelly – Ne- Neon
Nancy – Na- Sodium
Mg – Mg- Magnesium
Allen – Al- Aluminum
Silly – Si- Silicon
Patrick – P- Phosphorus
Stays – S- Sulphur
Close – Cl- Chlorine
Arthur – Ar- Argon
Kisses – K -Potassium
Carrie – Ca -Calcium

Atomic Numbers of all these are just numbers 1 to 20, in this order.

Now for mass numbers:

Most of the time mass numbers are **Atomic number x 2** (atomic number multiplied by two), or **Atomic number x2+1**, or there is an exception, **Atomic number x 2+2**.

- **x1** => Hydrogen
- **x2** =>Helium, Carbon, Nitrogen, Oxygen, Neon, Magnesium, Silicon, Sulphur, Calcium
- **x2+2** =>Argon
- (Chlorine's atomic mass is 35.5, and this trick is not applicable here. Better to just remember it that way!)
- **x2+1** =>Everything else

A little extra info: Of the first 20 elements, Lithium, Beryllium, Sodium, Magnesium, Aluminium, Potassium and Calcium are **metals**.

If any corrections are to be made, please suggest them. I am also a student!

What is an easy way to remember the first 20 elements?

You just need to remember 2 sentences

First Sentence - Hi Hello Listen Be.B.C. News On Friday Night.

Hi-H-Hydrogen

Hello-He-Helium

Listen-Li- Lithium

B.-Be-Beryllium

B.-B-Boron

C.-C-Carbon

News-N-Nitrogen

On-O-Oxygen

Friday-F-Fluorine

Night-Ne-Neon

Second sentence - Natives Might All Sing Party Songs Clearly Arousing Kitty Cats

Natives-Na-Sodium

Might-Mg-Magnesium

All-Al-Aluminium

Sing-Si-Silicon

Party-P-Phosphorus

Songs-S-Sulfur

Clearly-Cl-Chlorine

Arousing-Ar-Argon

Kitty-K-Potassium

Cats-Ca-Calcium

OXYGEN

Preparation of oxygen

One of the most common methods for the laboratory preparation of oxygen is by the method of preparation of oxygen by simply treating hydrogen peroxide in a particular manner so that it decomposes to form water and oxygen from which then, the oxygen can be extracted.

Oxygen is one of the most important and basic elements found in the earth's atmosphere. All living animals need oxygen in the air to survive. Without oxygen, there would be no trace of life on earth. Apart from being one of the basic elements on earth for a living being to survive, it is important in a lot of other areas as well.

Oxygen is used in medical applications, commercial and industrial practices all over the world. It is very much possible to manufacture **oxygen in a laboratory**. Apart from the necessary apparatus, the main ingredients required to make **oxygen in a laboratory** are hydrogen peroxide and manganese (IV) oxide.

It must be noted that hydrogen peroxide is the main ingredient for the preparation and the manganese (IV) oxide acts as a catalyst to enhance the speed of the process.

Laboratory Preparation of Oxygen

https://www.youtube.com/watch?v=nkeniDKGs6Q

There are a lot of **laboratory processes for producing oxygen**. Among them, one of the most common ways of **preparation of oxygen** is in a laboratory by the method of **preparation of oxygen** by simply treating hydrogen peroxide in a particular manner so that it decomposes to form water and oxygen from which then, the oxygen can be extracted.

Produce oxygen by heating potassium manganate(VII), then identify it with a glowing splint

This experiment should take 30 minutes.

Equipment

Apparatus

- Eye protection
- Test tube holder
- Ceramic wool
- Test tube
- Spatula
- Bunsen burner
- Splints
- Heat-proof mat

Chemicals

- Potassium manganate (VII)

Health, safety and technical notes

- Always wear eye protection.
- When $KMnO_4$ is heated, tiny particles shoot out. (These are trapped by the ceramic wool.)
- Potassium manganate is an oxidiser and harmful,

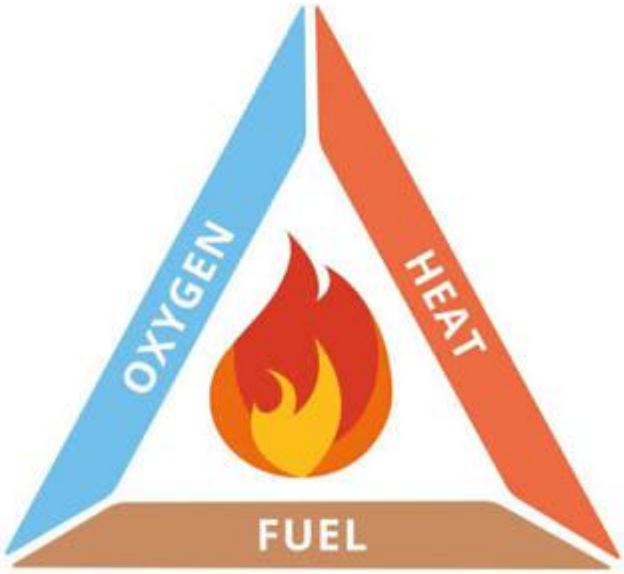
Procedure

1. Place two spatula measures of potassium manganate(VII) in a test tube.
2. Place a small piece of ceramic wool near the top of the test tube. This stops fine dust escaping.
3. Gently heat the test-tube containing the potassium manganate(VII).
4. Light a splint and extinguish it, to make a 'glowing splint'.
5. Place the glowing splint just above the top of the test tube. Keep heating the test tube. The splint should relight.
6. Scrape out the ceramic wool. Let the test tube cool to room temperature and then wash it out.
7. Notice the colours produced when the test tube is washed out.
8. Record your observations.

C***onclusion***

Oxygen is one of the most important and basic elements found in the earth's atmosphere. All living animals need oxygen in the air to survive. Without oxygen, there would be no trace of life on earth. Over the years, scientists have discovered multiple ways of **preparation of oxygen** in laboratories and also identified other diverse uses of this gas. Oxygen is used in medical applications, commercial, and industrial practices. There are a lot of different methods of preparing oxygen and different methods may have different purity rates of the concerned gas. One of the most common methods for the **laboratory preparation of oxygen** is by the method of **preparation of oxygen** by simply treating hydrogen peroxide in a particular manner so that it decomposes to form water and oxygen from which then, the oxygen can be extracted.

Oxygen and combustion Oxygen plays a very important role in combustion. It is a supporter of combustion. Combustion is the combination of fuel, an oxidizer, and an input energy source such as heat as shown by the combustion triangle. Here, oxygen works as the oxidizer.



Specifically, combustion requires three things:

1) **Fuel**: The thing that burns. This is is often a hydrocarbon, or other organic molecule. The simplest possible fuel is pure hydrogen gas.
2) **Energy**: What gets the reaction started, which is true of most chemical reactions. Note that this so-called *activation energy* is usually much less than the energy ultimately released from combustion. This is like rolling a boulder some distance in order to roll it down a hill, which releases much potential energy.
3) **Oxidizer**: The molecule that accepts electrons. It turns out that combustion requires the fuel to be *oxidized*, that is, it donates electrons. So we need something to accept the electrons, and that's the oxidizer, which is then *reduced*.

Oxygen is a great oxidizer because it is so electronegative, which means it really wants to accept electrons. Only fluorine is more electronegative, and fluorine is a superb oxidizer: blow fluorine gas at nearly any substance and it bursts into flames.

Oxygen is in many ways a perfect oxidizer for supporting life: it doesn't set things on fire like fluorine, but otherwise can oxidize very many things. When you eat, oxygen is oxidizing the food (fuel) you ingested, to generate energy you need to live.
So there is "combustion" going on inside you!

The main benefit of oxygen is that it is the most commonly available oxidizer.

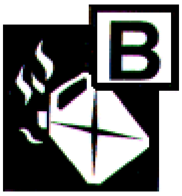
The main component of air that supports combustion is oxygen.

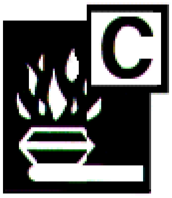
However titanium burns in nitrogen and so does lithium, and also some other active metals such as finely divided aluminium. These form nitrides. Similarly most of these active metals also burn in hydrogen forming hydrides such as lithium.

Classification of Fires

Fires are classified in six groups A, B, C, D, F and electrical:

- **Class A fires** – are fires involving organic solids like paper, wood, etc
- **Class B fires** – are fires involving flammable liquids
- **Class C fires** – are fires involving flammable gasses
- **Class D fires** – are fires involving burning metals (eg aluminium swarf)
- **Class F fires** – are fires involving fats such as used in deep fat fryers
- **Electrical fires (the letter E is not used. Instead the symbol of an electric spark is displayed)** – are fires caused by electrical equipment





Electrical Fires

Electrical fires are not given their own full class, as they can fall into any of the classifications. After all it is not the electricity burning but surrounding material that has been set alight by the electric current.

The first step when fighting a fire caused by electricity is to switch the equipment off. In addition, any water based extinguishers used on electrical equipment should be dielectrically tested and certified to ensure that you can extinguish the fire safely, even if the power supply is left on. It must be remembered that certain electrical apparatus maintain a lethal charge for some time after they have been switched off.

Colour coding of Extinguishers

The type of extinguisher is identified by a colour coding as indicated below. The old fire extinguishers standard required the whole of the body of the extinguisher to be painted the appropriate colour. You will find these extinguishers in many premises and these are still legal, you do not need to change them unless the extinguisher is defective and needs to be replaced. New extinguishers are manufactured to the standard BS EN 3.

- Water extinguishers are coloured signal red.
- Other extinguishers will be predominantly signal red with a label, band or circle covering at least 5% of the surface area of the extinguisher in a second colour indicating the contents of the extinguisher. Fire Rating

All extinguishers capable of extinguishing class A, B or F fires carry a fire rating which is indicated by a number and letter (eg 13A, 55B). The number is indicating the size of fire it can extinguish under test conditions. The larger the number, the larger the fire it can extinguish. The letter indicates the fire classification as above. Class C, D and the electrical symbol do not carry a numerical rating.

All extinguishers capable of extinguishing class F fires have a rating based on 4 benchmark tests using 5, 15, 25 and 75 litres of sunflower oil. The oil is heated to auto-ignition and allowed to pre-burn for 2 minutes. The fire is then extinguished and no re-ignition shall occur within 10 minutes of extinguishing the fire.

Chosing Fire Extinguishers

The following factors should also be considered when siting fire extinguishers:

- Extinguishers should normally be sited on escape routes on all floors at what is called ‘fire points’.
- They should be fixed in a location where the extinguisher can be reached quickly. The best place is near a door leading to a place of safety or near a specific fire risk.
- They should be fixed where they can be easily seen. Fixing them inside cupboards or behind doors will waste valuable time if a fire breaks out.
- Do not place them over cookers or heaters or in places of extreme temperatures, hot or cold.
- Extinguishers should be fixed at an elevated height, so that the carrying handle is 1m from the floor for heavier units (heavier than 4kg) and 1.5m for smaller units.
- Extinguishers should be within reasonable distance from any fire risk:

1. Class A: 30m
2. Class B: 10m
3. Class C: 30m
4. Class D: case-by-case basis, by expert advice
5. Class F: 10m

- If you have to travel through doorways, the maximum travel distances need to be reduced.
- The method of operation should be similar for all extinguishers, where possible.
- The occupiers should be capable of handling all the types and sizes recommended.
- Where different types of extinguishers for different risk types are sited together they must be properly labelled to prevent confusion.
- Extinguishers should be fitted with suitable jet or spray nozzles or flexible hoses to suit the risk involved.

Which Portable Fire Extinguishers to Use

	Water	Water Mist, dielectricall	Foam	ABC Dry Powder	Specialist Powder	CO2 Gas	Wet Chemical

		y tested					
A Fires involving freely burning materials. For example wood, paper, textiles and other carbonaceous materials.	✓	✓	✓	✓			
B Fires involving flammable liquids. For example petrol and spirits. NOT ALCOHOL OR COOKING OIL.		✓	✓	✓		✓	✓
C Fires involving flammable gasses. For example propane and butane.		✓		✓			
D Fires involving flammable metals. For example magnesium and lithium.					✓		

Fires involving electrical equipment. For example photocopiers, fax machines and computers.		✓		✓		✓	
Fires involving cooking oil and fat. For example olive oil, maize oil, lard and butter.							✓

Before you tackle a fire

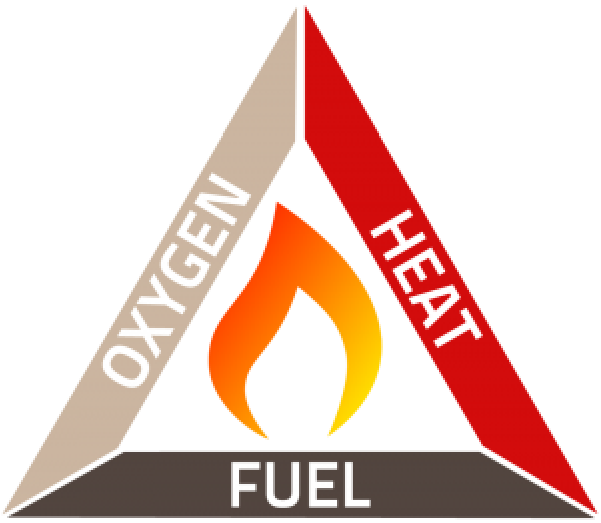
Many people put out small fires quite safely. However, some people die or are injured by tackling a fire which is beyond their capabilities. Here is a simple fire code to help you decide whether to put out or get out.

- Only tackle a fire in its very early stages
- Always put your own and other peoples safety first
- On discovering the fire, immediately raise an alarm
- Make sure you can escape if you need to and never let a fire block your exit

If you cannot put out the fire or if the extinguisher becomes empty, get out and get everyone else out of the building immediately, closing all doors behind you as you go. Then ensure the fire brigade has been called

Fire Triangle

Trying to understand the seemingly endless list of fire safety regulations can be a complex and confusing task. Whether you are attempting to identify the different types of fire extinguisher and their appropriate uses or are learning about the benefits of a fire blanket, it is vital to remember that the various stringent rules are there for a reason and this reason ultimately relates to the fire triangle.



Something usually taught in school, the fire triangle (which is also known as the combustion triangle) is a simple model for understanding the chemical reaction which must occur to create a fire. It is composed of three elements – fuel, heat and oxygen – which must all be present for a fire to ignite. It also demonstrates the interdependence of these ingredients in creating and sustaining a fire and teaches us that removing any one of these elements would prevent or extinguish the fire.

The fire triangle is often used as a basic form of fire safety training and looks at the dynamics of fire itself. By looking at and understanding this in more detail, it is much easier to grasp the need for, and details of, fundamental fire regulations – so let's get back to basics…

Fuel

In order for a fire to start there must be a material to burn – and this is referred to as the fuel. Fuel is any kind of combustible material, including paper, oils, wood, gases, fabrics, liquids, plastics and rubber. The fuel for a fire is usually characterised by its moisture content, size, shape and quantity and this will determine how easily the fuel will burn and at what temperature.

Heat

In addition to a fuel source, heat must be present in order for ignition to take place. All flammable materials give off flammable vapours which, when heat is present, combust. Heat is also responsible for the spread and maintenance of fire as it removes the moisture from nearby fuel, warming the surrounding area and pre-heating fuel in its path, enabling it to travel and develop with greater ease.

Oxygen

As well as fuel and heat, fires also need oxygen to stay alight. Ambient air is made up of approximately 21% oxygen and, as most fires only require at least 16% oxygen to burn, it acts as the oxidising agent in the chemical reaction. This means that when the fuel burns, it reacts with the oxygen to release heat and generate combustion.

Extinction of the fire

To stop a fire, one of the three elements of the fire triangle must be removed. So, if a fire runs out of fuel, it will smoulder out; if you can cool a fire down it will lose heat and go out; and if the oxygen is removed it will suffocate. Therefore, attempts at combatting a fire and also preventing a fire are based upon these principles. Fire blankets, for example, suppress a fire, removing the oxygen and, as a result, putting it out. Similarly, fire extinguishers are developed to eliminate one of the three elements – such as water fire extinguishers which cool the fire down and remove any heat.

By the same codes of practice, fire prevention methods are also developed in relation to the chemical reaction which occurs when fire takes place. Undertaking safety steps such as storing flammable liquids away and making sure piles of paper or fabric are not left near any possible heat sources are highly important.

By using this fundamental fire safety knowledge, the prevalence of fires and the damage they cause can be significantly reduced.

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