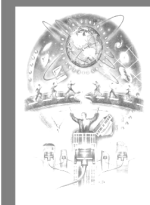


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You know that a mixture consists of two or more substances mixed together in any proportion. These substances are called components which retain their individual identities in the mixture. No new or different substance is produced as a result of mixing, though the mixture may look different in texture and appearance. Since the components retain their individual identities, it is possible to separate them by employing various methods. Some of these methods are discussed below:

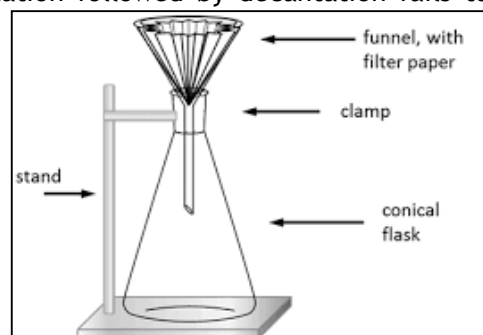
1. **Hand-picking:** Bigger and visible component of a mixture can be separated by hand-picking or by using forceps. For example, pieces of stone may be separated from rice by hand-picking.

2. **Sieving:** In some cases, bigger components of a mixture can be easily separated by the use of a sieve. A sieve is a mechanical device in which a mesh is attached to a frame. When the mixture is placed on the mesh and shaken or stirred, particles smaller than the holes of the mesh pass through but the larger ones stay on the mesh. Gram can be separated from wheat by this method.

3. **Sedimentation:** If a mixture of a liquid and an insoluble solid is allowed to stand still for some time, the solid particles settle down. This process is called sedimentation. The solid which settles down at the bottom is called sediment. Dirt particles present in muddy water can be separated by sedimentation. After the dirt particles settle down at the bottom, water is poured into another container. This process of separating a liquid from the sediment by carefully pouring it into another container is called decantation. From a mixture of two immiscible liquids, such as a mixture of oil and water, the components can also be separated by decantation.

4. **Centrifugation/Churning:** Centrifugation is a process used when the sedimentation of suspended particles in a liquid takes place very slowly. The mixture is taken in two specially designed test tubes known as the centrifuge tubes. They are placed in two separate holders. The holders are then rotated rapidly with the help of a handle. After some time the rotation is stopped, and the centrifuge tubes are taken out. It is seen that the solid particles have settled down at the bottom of the tubes. The supernatant liquid above the solid is collected by decantation. The method of centrifugation or churning is used to separate cream from milk. Since cream is lighter than milk, it comes on the surface and is skimmed off.

5. **Filtration:** Sometimes, the process of sedimentation followed by decantation fails to separate very minute solid particles from the mixture. In such cases complete separation is done by filtration. Filtration is used in laboratories to separate a liquid from a solid. The liquid is allowed to pass through a filter paper. A circular filter paper is folded into a semicircle and then into a quarter-circle. This gives a conical shape to the filter paper. The filter paper is then fitted into a conical funnel. The mixture is poured into the funnel slowly by the side of a glass rod. The liquid passes through the fine pores of the filter paper and is collected in a beaker, while the solid particles are blocked and collected on the filter paper. The filtered liquid is called filtrate and the solid particles collected on the filter paper are called residue. From a mixture of sand and water, sand can be separated by this method.



6. **Magnetic separation:** This method is used only when one of the components in a mixture is magnetic in nature. For example, from a mixture of iron filings and sulphur, iron can be separated by this method. When a magnet is brought just above the mixture, iron filings cling to the magnet. Sulphur, being nonmagnetic, does not get attracted and is

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left behind. Magnetic separation is used for separating magnetic ores from nonmagnetic impurities using huge magnets.

7. **Sublimation:** This method is used when one of the components of a mixture vaporizes without melting. On cooling, the vaporized component directly changes into solid. Ammonium chloride is separated from common salt by this method. A mixture of ammonium chloride and common salt is taken in a dish. It is covered with an inverted glass funnel. The narrow opening of the funnel is plugged with cotton. On heating ammonium chloride sublimes and collects in the cotton.

8. **Evaporation** This method is used for separating a solid dissolved in a liquid. The solution is taken in a porcelain or glass basin and heated slowly on a water bath. The solvent evaporates away and the solid is left behind as residue. Examples:

(i) Common salt may be recovered from its aqueous solution by evaporating the water. Common salt present in sea water is usually obtained by this method. Sea water is collected in large shallow ponds on the seashore and left in the sun as such for some days. Water gets vaporized slowly. White crystals of common salt are left behind in the ponds.

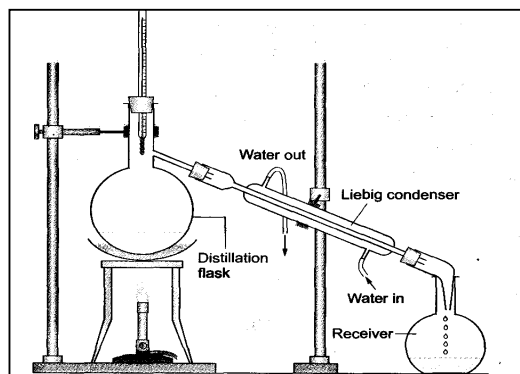
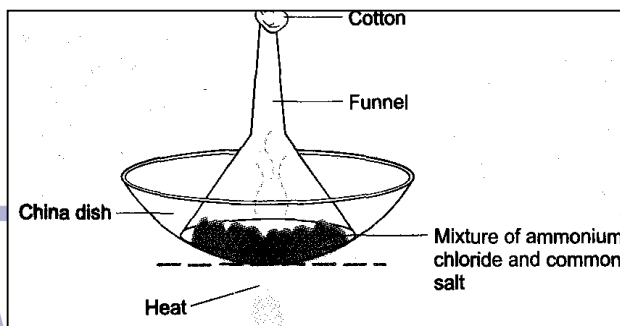
(ii) Sulphur can be recovered from its solution in carbon disulphide by evaporating the carbon disulphide.

9. **Crystallization:** The process of evaporation gives only the residue which may contain some impurities. To obtain the solid free from impurities the method of crystallization is used. For this, the solution is taken in a china dish and evaporated on a water bath till the solution becomes saturated. To check whether the saturation point has reached or not, take some solution on a glass rod and cool it. At the point of saturation, solid particles in regular and definite shape begin to appear. These particles are called crystals.

The saturated solution is removed from the flame and allowed to cool to the room temperature. The crystals of the solid separate from the solution. The process is called crystallization. The crystals are then filtered out. Thus, the process by which a pure solid in the form of crystals separates from a solution is called crystallization.

The process of crystallization is used to purify solids. For example, the salt obtained from sea water contains many impurities. These impurities can be removed by crystallization. Similarly, impure samples of potash alum (phitkari) and copper sulphate can be purified by this method.

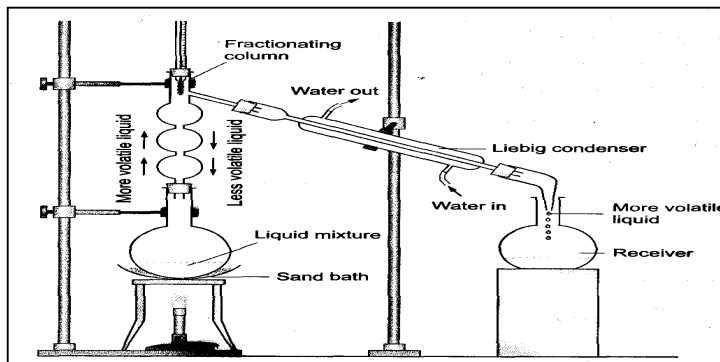
11. **Distillation:** In distillation, a liquid is heated to boiling and the vapors produced are condensed to get back the liquid. Distillation is carried out in a specially designed round-bottomed flask called distillation flask. The side-arm at the neck of the flask is attached to a cooling device called Liebig condenser. The end of the condenser is connected to a receiver. The solution is taken in the distillation flask and heated slowly to boiling. The vapour that comes out passes through the condenser where it is cooled into liquid. The liquid is collected in the receiver. The solid matter is left behind in the distillation flask. This process can be used to separate the liquid from a





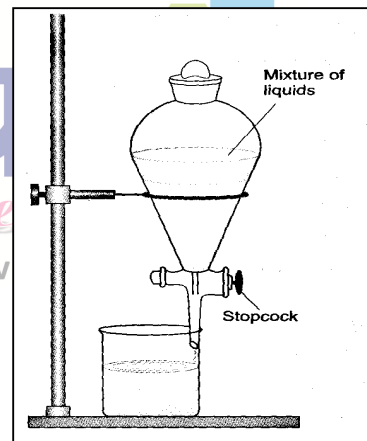
solid-liquid mixture, whether the mixture is homogeneous (like common salt dissolved in water), or heterogeneous (like a mixture of sand and water). It can also be used to separate two miscible liquids whose boiling points differ at least by 25°C.

11. Fractional distillation: This method is used to separate the components of a mixture of two or more miscible liquids whose boiling points differ by 25°C or less. For example, methyl alcohol (boiling point 65°C) can be separated from acetone (boiling point 56°C) by this method. The mixture is heated in a round-bottomed flask over a sand bath. The flask is attached to a fractionating column. The fractionating column has several traps to allow the higher boiling liquid (less volatile) to condense. The vapour of lower boiling liquid (more volatile) goes into the condenser where it is condensed and the liquid thus obtained is then collected in the receiver. The temperature remains fixed at the boiling point of the lower-boiling liquid. When this more volatile liquid is completely distilled, the temperature rises to the boiling point of the next higher-boiling liquid. This liquid is collected in another receiver. In this way, all the components of the mixture can be separated.



This method is adopted to separate the various components of petroleum.

12. Use of separating Funnel: A separating funnel consists of a glass bulb fitted with a stopcock in its stem. It is used to separate the components of a mixture of two or more immiscible liquids, i.e., the liquids which do not dissolve in each other. For example, the components of a mixture of oil and water can be separated by using a separating funnel. The mixture is taken in a separating funnel and allowed to stand still. Oil, being lighter, forms the upper layer while water forms the lower layer. The stopcock is opened and the lower layer of water is carefully drained out in a beaker.



13. Chromatography: Chromatography is a technique used to separate those solutes of a mixture which are soluble in the same solvent. This technique was first used to separate the colored components of a natural dye. In Greek, chroma means colour. Hence, this technique is called chromatography.

Separation of the Components of Some Typical Mixtures

1. Separation of the component of gunpowder: Gunpowder is a mixture of nitre (potassium nitrate), sulphur and powdered charcoal. The mixture is thoroughly shaken with water when nitre goes into solution leaving behind sulphur and charcoal undissolved. The solution is filtered out. The filtrate contains aqueous solution of nitre. On slow evaporation, the filtrate gives crystals of nitre. Undissolved residue containing sulphur and charcoal is treated with carbon disulphide. Sulphur dissolves in it but charcoal does not. On filtration, charcoal is obtained as a residue. The filtrate, which contains sulphur, on evaporation gives sulphur as the residue.

2. Separation of the components of a mixture of common salt and sand: The mixture is treated with water. Common salt dissolves in water, but sand remains undissolved. The

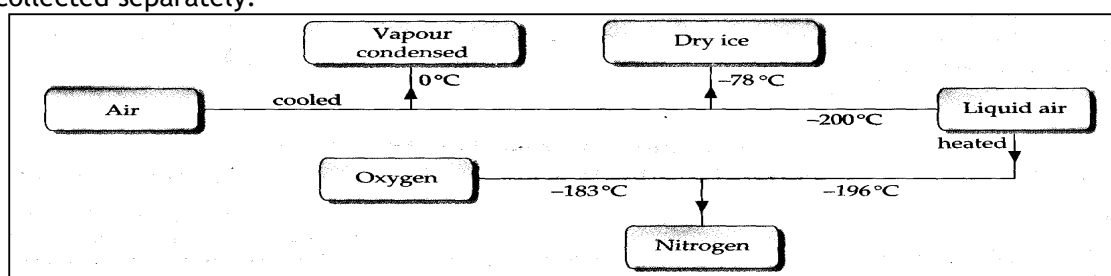


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solution is filtered. The filtrate is an aqueous solution of common salt. The solution on evaporation gives common salt as the residue.

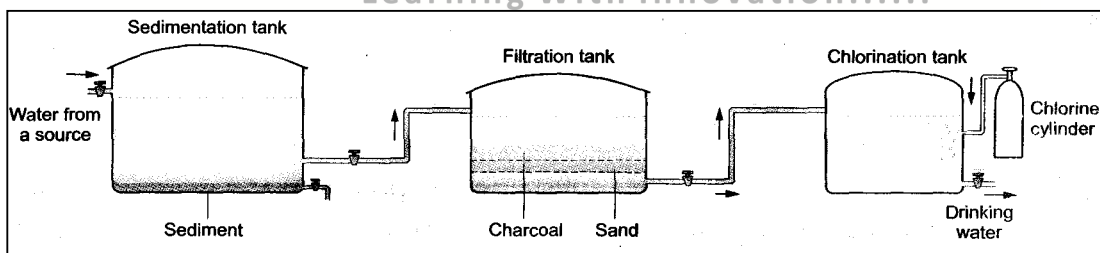
3. **Separation of the components of a mixture of sand and iodine:** The mixture is taken in a porcelain or glass basin. The basin is heated on a flame. Iodine sublimes while sand is left behind as residue.

Separation of the constituents of air: The constituents of air can be separated by fractional distillation method. You know that air is a mixture consisting mainly of nitrogen and oxygen. Carbon dioxide and other gases are also present in trace amounts. To separate the components, air is gradually cooled. Water vapour present in air condenses to water. When the temperature reaches 0°C , water freezes to ice. On further cooling, carbon dioxide separates as dry ice at about -78°C . Air is cooled further under pressure to about -200°C . At this temperature air gets liquefied. This liquid air contains mainly nitrogen and oxygen. It is now heated. Nitrogen (boiling point -196°C) is converted into vapour (gas) and is collected. Oxygen, whose boiling point is -183°C , is left behind. It is collected separately.



Purification of water: In big towns, drinking water is obtained from ponds, rivers or lakes. This water is never pure. To make it potable, the water has to pass through a series of purifying processes as described below.

1. **Sedimentation:** The water from pond, river or lake is led into a sedimentation tank. A small amount of potash alum is added and the water is allowed to stand. Muddy substances present in water settle down more easily in the presence of the alum. The clear liquid is now pumped out into a filtration tank.



2. **Filtration tank** In this tank, the water has to pass through the layers of charcoal, gravel and fine sand. Water gets filtered here and becomes free from suspended impurities. This water is then led into the chlorination tank.

3. **Chlorination tank:** in this tank, water is treated with liquid chlorine or bleaching powder. Here, bacterial germs, if any, are killed and the water becomes potable. Water is then supplied to different parts of the town through pipeline.