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Solution 66

The mixture of common salt and ammonium chloride is taken in a china dish and placed on a tripod stand. The china dish is covered with an inverted glass funnel. A loose cotton plug is put in the upper, open end of the funnel to prevent the ammonium chloride vapours from escaping into the atmosphere. The china dish is heated by using a burner. On heating the mixture, ammonium chloride changes into white vapours. These vapours rise up and get converted into solid ammonium chloride on coming in contact with the cold, inner walls of the funnel. In this way, pure ammonium chloride collects on the inner sides of the funnel in the form of a sublimate and can be removed. Common salt does not change into vapours on heating, so it remains behind in the china dish and can be separated out.

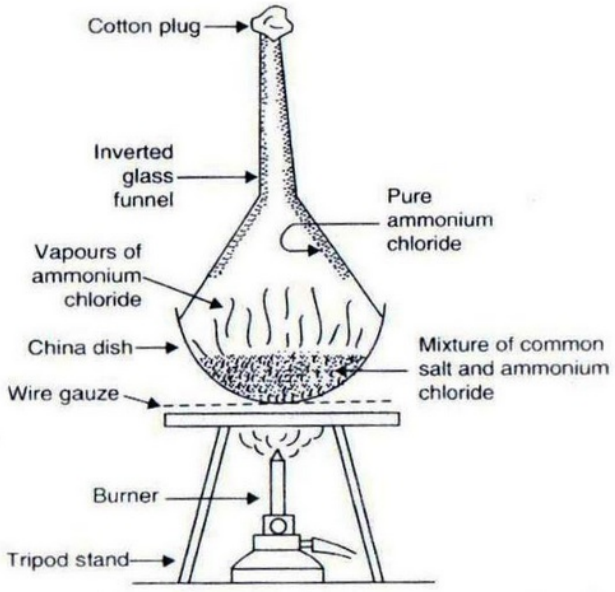

Fig. Separation of mixture of common salt and ammonium chloride by sublimation

Ammonium chloride sublimes on heating whereas common salt does not sublime on heating. So, we can separate ammonium chloride from a mixture of common salt and ammonium chloride by the process of sublimation.

Solution 67

A mixture of common salt and water can be separated completely by the process of distillation. The distillation can be used to separate a liquid from dissolved non-volatile solids.

The salt water mixture is taken in the distillation flask A and heated. Some porcelain pieces are put in the distillation flask to avoid bumping of the solution due to uneven heating. On heating, water forms vapours which rise up and come out through the side tube B of the distillation flask, and go into water condenser C. Cold water from tap is circulated through the outer tube of condenser for cooling the vapours. The hot vapours get cooled in the condenser to form pure water (i.e. distilled water) which trickles down from the condenser and collects in the beaker D. Since the salt is non-volatile, so it remains behind in the distillation flask.

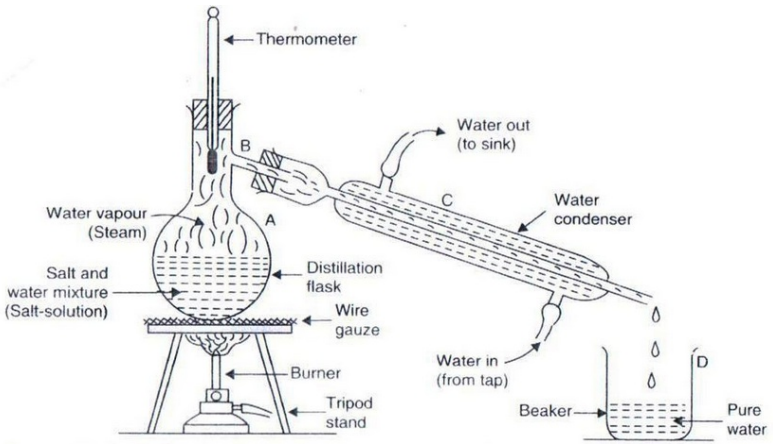

Fig. Separation of mixture of salt and water by distillation

Solution 68

In cities, drinking water is supplied from water works where river or lake water is made free from suspended solid substances and germs. In water works, the methods like sedimentation, decantation, loading, filtration and chlorination etc. are used to remove undesirable materials from water. The source of water supply in a city is either a nearby river or lake (reservoir), from there it is pumped into 'sedimentation tank'. Here it is allowed to stand for sometime so that many of insoluble substances present in water settle down at bottom of the tank. From there, it is sent to a 'loading tank' where some alum is added to water. Here suspended clay particles in water get loaded with alum particles, become heavy and settle down at the bottom of the tank. Then, it is passed through 'filtration tank'. It has three layers: fine sand layer at top, coarse sand layer in middle and gravel as the bottom layer. These act as filters and even the small suspended particles get removed when water passes through these layers. Then, the clear water is passed into a chlorination tank. Here, chlorine is added to water to kill the germs present in it. Now, the clean and disinfected water is pumped by pumping station into high storage tanks and from there, it is supplied to homes and factories through the network of big and small pipes.

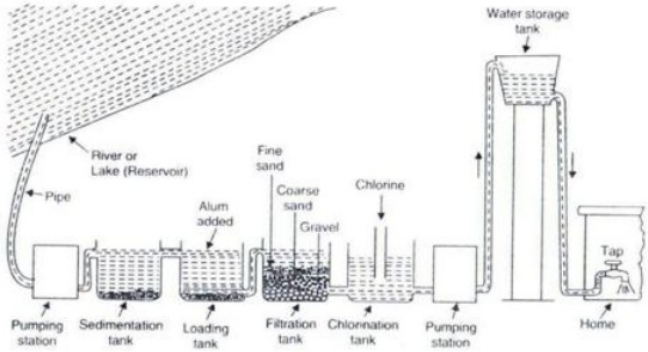

Fig. Water purification process at water works

Solution 69

(a) Fractional distillation is the process of separating two or more miscible liquids (liquids which mix together in all proportions and form a single layer) by distillation, the distillate being collected in fractions boiling at different temperatures. The separation of two liquids by fractional distillation depends on the difference in their boiling points. It is carried out by using a fractionating column. Fractionating column is a long vertical glass tube filled with glass beads. The glass beads provide a large surface area for hot vapours to cool and condens repeatedly. It provides different temperature zones inside it, the highest temperature being at the bottom of the column and the lowest temperature near its top. It is fitted in the neck of the distillation flask.

(b)

(b)

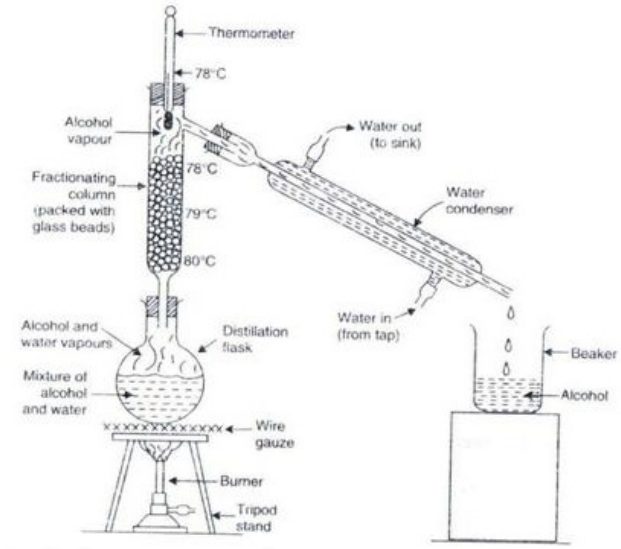

Fig. Separation of mixture of alcohol and water by fractional distillation

Solution 70

(a) Air is mixture of gases like nitrogen, oxygen, argon, carbon dioxide, helium, neon, krypton, xeon etc. The various gases of air are separated from one another by fractional distillation of liquid air. This separation is based on the fact that different gases of air have different boiling points(in liquid form).

The air is first filtered to remove dust, then water vapour and carbon dioxide are removed. Air is compressed to a high pressure and then cooled. The cooled air is then allowed to expand quickly into a chamber through a jet. This cools the air even more. This process of compression, cooling and rapid expansion of air is repeated again and again to make the air more and more cool so that it becomes liquid air. Now, the liquid air is fed into a tall fractionating column and warmed up slowly.

Liquid nitrogen has lowest boiling point of -196°C.So, on warming, it boils off first to form nitrogen gas and is collected at the upper part of the fractional distillation column. Liquid argon has a slightly higher boiling point of -186°C. So, it boils off next and collected as argon gas in the middle part of fractional distillation column. Liquid oxygen has a still higher boiling point of -183°C. So, liquid oxygen boils off last and collected as oxygen gas at the bottom of fractional distillation column.

(b)

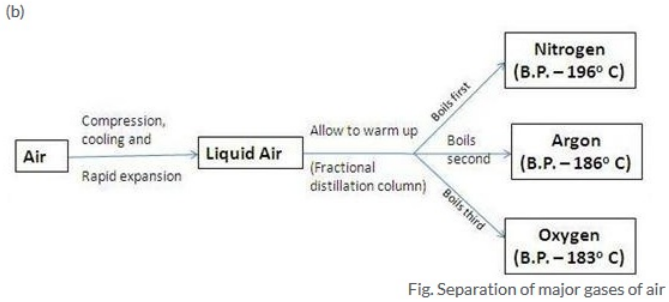

Fig. Separation of major gases of air

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Solution 86

(a) Y will be collected from near the bottom of the fractional distillation column because it has highest boiling point of -183°C.

(b) Z will be collected from the top part of the fractional distillation column because it has lowest boiling point of -196°C.

(c) X will be collected from the middle part of the fractional distillation column because it has a boiling point of -186°C which is lower than that of Y but higher than that of Z.

(d) X is liquid argon; Y is liquid oxygen; Z is liquid nitrogen.

Solution 87
(a) We will use fractional distillation to separate a mixture of A and B.
(b) We will use separating funnel to separate a mixture of B and C.
(c) (i) Alcohol would behave like A.
(ii) Water would behave like B.
(iii) Oil would behave like C.
Solution 88
(a) P is sand; Q is common salt; R is iron fillings; S is ammonium chloride.
(b) We first separate R (iron filings) by using a magnet to attract them. Then, separate S (ammonium chloride) by sublimation. Now, we shake P(sand) and Q(common salt) with water and filter. P(sand) is obtained as residue. Now, we evaporate filtrate to dryness to obtain Q(common salt).
Solution 89
(a) X is alcohol.
(b) Y is iodine.
(c) Process Z is called sublimation
(d) Process used to recover both the components alcohol and iodine from tincture of iodine is distillation.
(e) The process used to recover only component Y from tincture of iodine is evaporation.
Solution 90
(a) (i) Constituent A could be sulphur.
(ii) Liquid D could be carbon disulphide.
(b) (i) Constituent B could be copper sulphate.
(ii) Liquid E could be water.
(c) Liquid C could be vegetable oil.
(d) Filter the mixture of A, B and C. C(oil) being liquid will be obtained as a filtrate. Residue consists of A(sulphur) and B(copper sulphate). Add water to the residue mixture, shake and filter. A(sulphur) is obtained as residue. Now, evaporate filtrate to obtain B(copper sulphate).

********** END **********