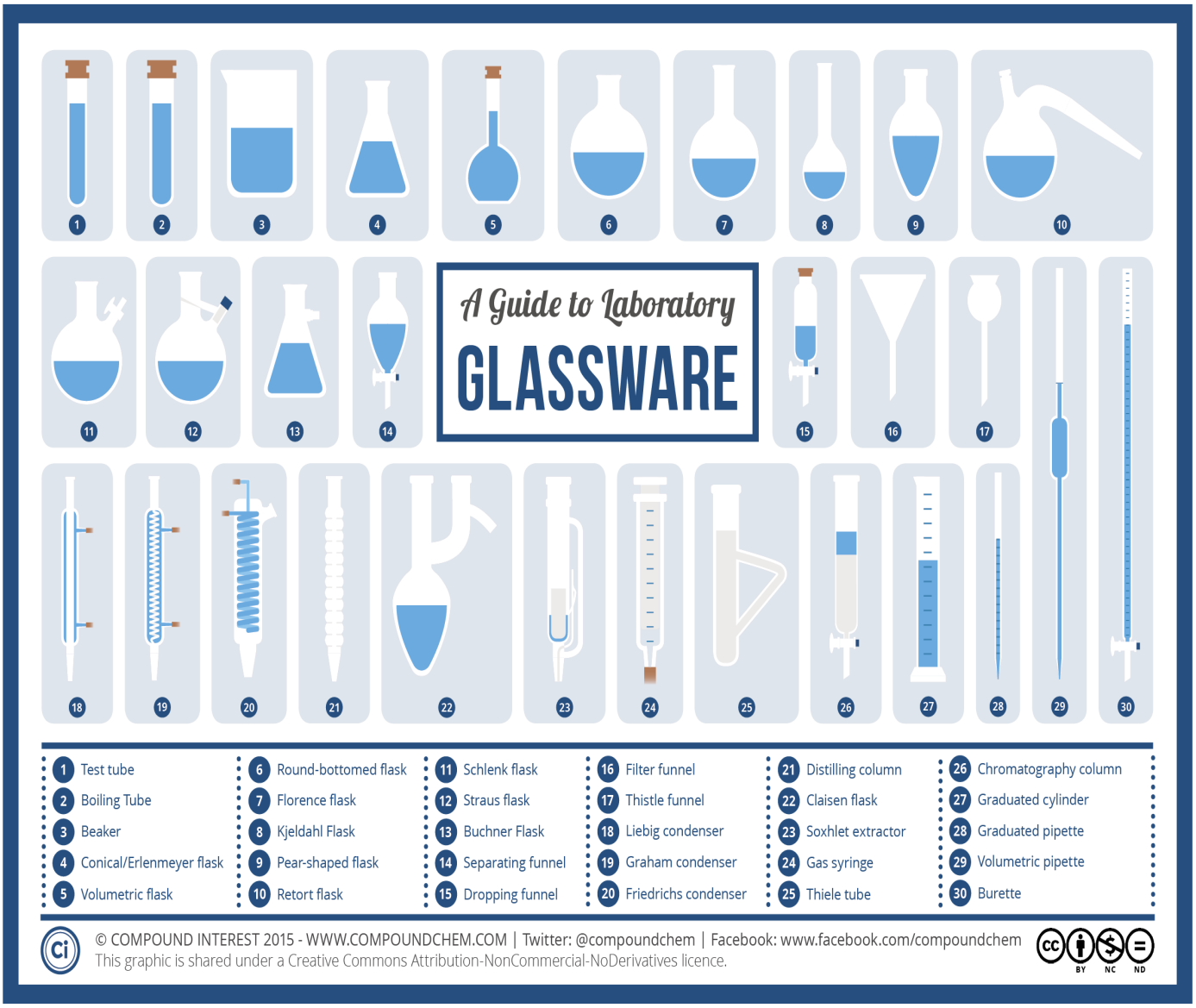
EXPERIMENTAL CHEMISTRY

Common Lab equipment



Qu: *Select the glasswares that you would use to*

(i) *filter a mixture of sand and water*

(ii) *distil a mixture of sea water*

(iii) *separate a mixture of vegetable oil and lemon juice*

(iv) *perform a Chromatography experiment*

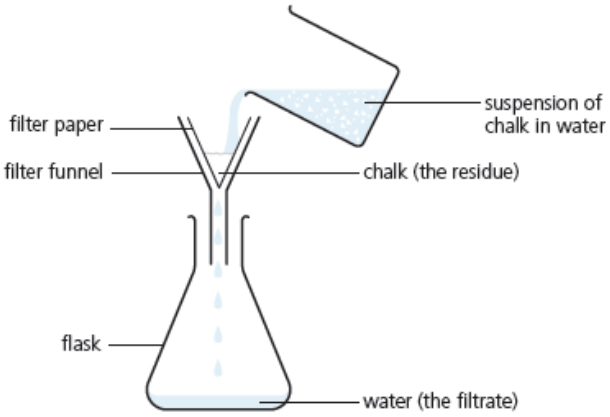
METHODS OF PURIFICATION AND ANALYSIS

Many mixtures contain useful substances mixed with unwanted material. In order to obtain these useful substances, chemists often have to separate them from the impurities.

FILTRATION

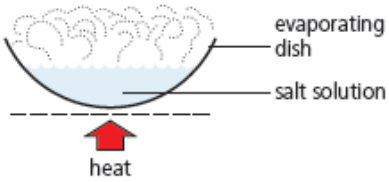
If a solid substance is added to a liquid it may **dissolve** to form a **solution**. In this case the solid is said to be **soluble** and is called the **solute**. The liquid it has dissolved in is called the **solvent**.

It is used when a solid needs to be separated from a liquid.



Qu: *Suggest the mixtures which can be separated by filtration.*

Crystallisation



To obtain salt from an aqueous solution, you need to keep heating the solution, to evaporate the water.

When there is only a little water left, the salt will start to appear. Heat carefully until it is dry.

- If a solution is heated to dryness, powdered salt is formed
- To obtain crystals of salt, the solution need to be concentrated through heating and then left to evaporate.

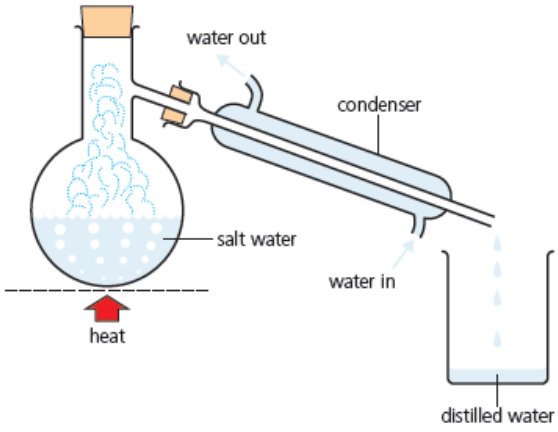
Distillation

This is a way to obtain the *solvent* from a solution. The apparatus is shown on the right. It could be used to obtain water from salt water, for example. Like this:

1 Heat the solution in the flask. As it boils, water vapour rises into the condenser, leaving salt behind.

2 The condenser is cold, so the vapour condenses to water in it.

3 The water drips into the beaker. It is called **distilled water**. It is almost pure.



Fractional Distillation

If miscible liquids are to be separated, then this can be done by **fractional distillation**. The apparatus used for this process is shown in the photo and diagram in Figure 2.22, and could be used to separate a mixture of ethanol and water.

Qu: *Name the mixtures which can be separated by*

(i) Simple distillation

(ii) Fractional distillation

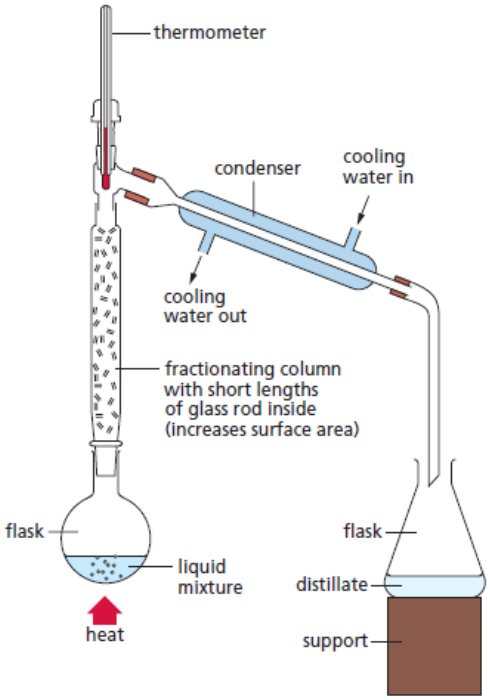
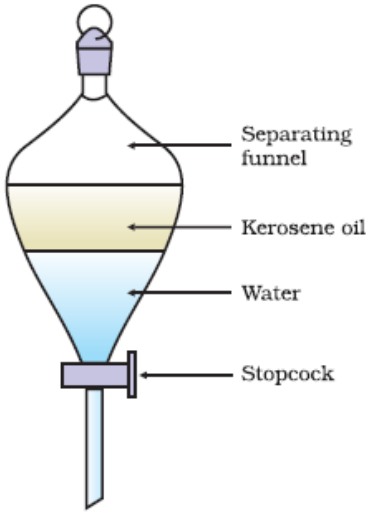


Figure 2.22 Typical fractional distillation apparatus.

Separating Immiscible Liquids

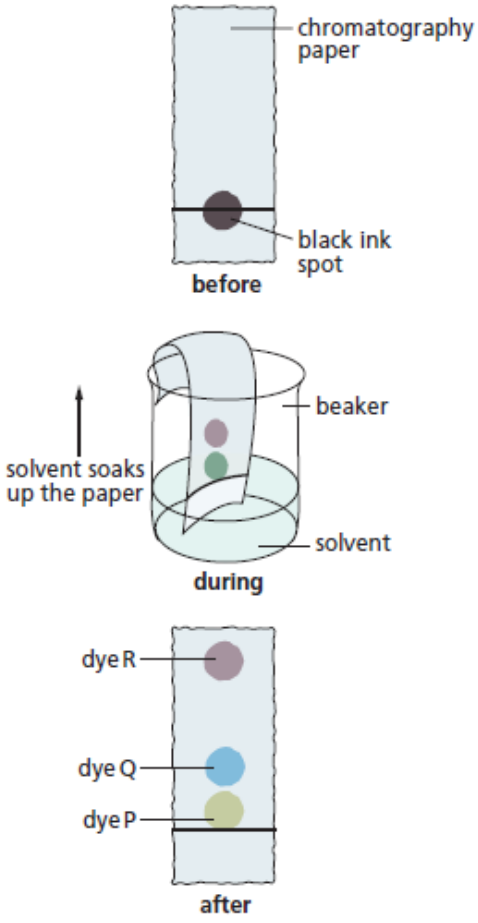
If two liquids are immiscible they can be separated using a **separating funnel**. The mixture is poured into the funnel and the layers allowed to separate.



Qu: *Suggest two different mixtures that can be separated by a separating funnel.*

Chromatography

is a technique for the separation of a mixture by passing it in solution or suspension through a medium in which the components move at different rates.



b The black ink separates into three dyes: P, Q and R.

Locating Agent

The substances to be separated do not have to be coloured. Colourless substances can be made visible by spraying the chromatogram with a **locating agent**. The locating agent will react with the colourless substances to form a coloured product. In other situations the position of the substances on the chromatogram may be located using ultraviolet light.

$$R_f \text{ value} = \frac{\text{distance moved by amino acid}}{\text{distance moved by solvent}}$$

Other uses

Chromatography can be used on a small scale in the lab, or on a very large scale in industry. For example it is used on a small scale to:

- identify substances (such as amino acids, on page 277)
- check the purity of substances
- help in crime detection (as above)
- identify pollutants in air, or in samples of river water.

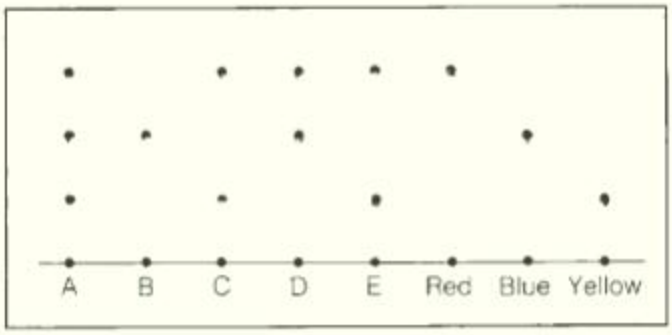
It is used on a large scale to:

- separate pure substances (for example for making medical drugs or food flavourings) from tanks of reaction mixtures, in factories
- separate individual compounds from the groups of compounds (fractions) obtained in refining petroleum.

So chromatography is a really powerful and versatile tool.

Question

7 In a chromatography experiment, eight coloured substances were spotted onto a piece of filter paper. Three were the basic colours red, blue, and yellow. The others were unknown substances, labelled A–E. This shows the resulting chromatogram:



a Which one of substances A–E contains only one basic colour?

b Which contains all three basic colours?

c The solvent was propanone. Which of the three basic colours is the most soluble in propanone?

Research Work:

- Predict how the boiling point of water would change when an impurity(*e.g salt*) is added to water.

- Suggest what difference would be seen if salt water is freezed as compared to pure water

- What do you understand by *centrifuging?*

- Research how Chromatography is used to help in crime detection

- How would you test whether a substance is pure or not?