SEPARATING MIXTURES

1.   Undissolved Solids / Suspensions

Decanting

- Pour the liquid (solvent) off first.
- Solid remains behind.
- Not 100 % effective - some liquid stays behind.

  e.g. Rocky soil in water.

Sieving

- Sieves have holes in them that will only let certain sized materials through.
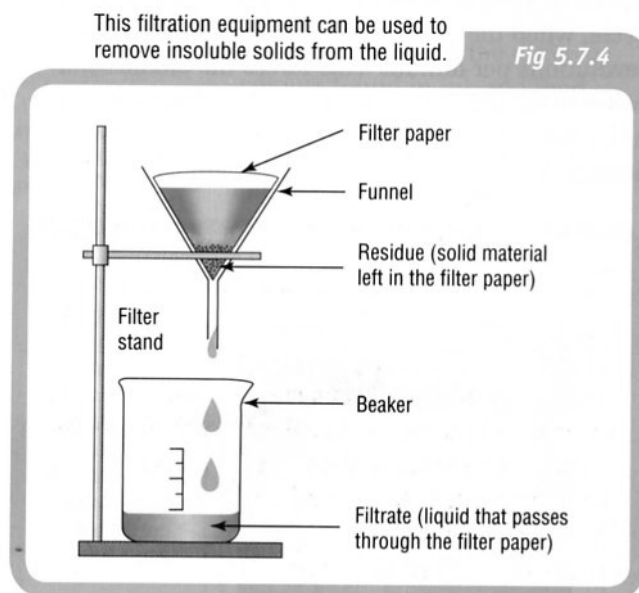
  e.g. Draining water from rice or spaghetti when cooking.
        Used in mining in a range of processes where only crushed rock of a certain size can be used.

Filtering

- 100 % effective.
- Solid remains trapped in the filter paper - called *residue*.
- Filtered liquid is called the *filtrate*.

  e.g. Sand in water.

- Many different filters - air filters in air conditioner, petrol filter in cars, swimming pools, tea bags, etc.

This filtration equipment can be used to remove insoluble solids from the liquid. *Fig 5.7.4*

Filter paper
Funnel
Residue (solid material left in the filter paper)
Filter stand
Beaker
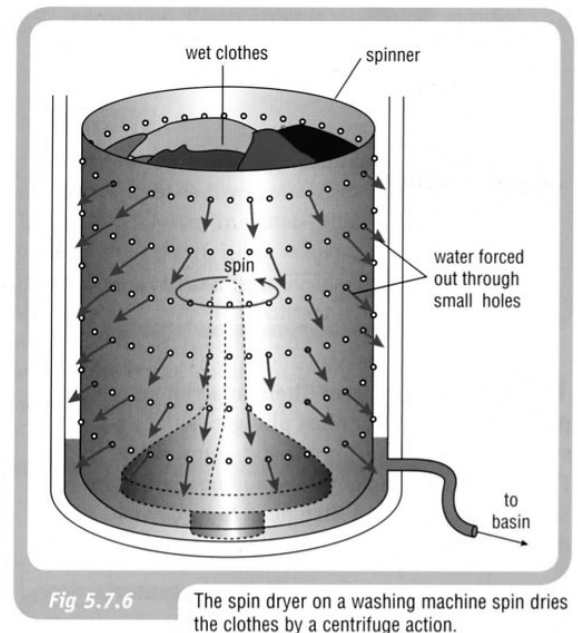Filtrate (liquid that passes through the filter paper)

Centrifuging

- Spin quickly, forcing the solids and liquids to move outwards.
- Holes allow the liquid to move through, leaving the solid behind.

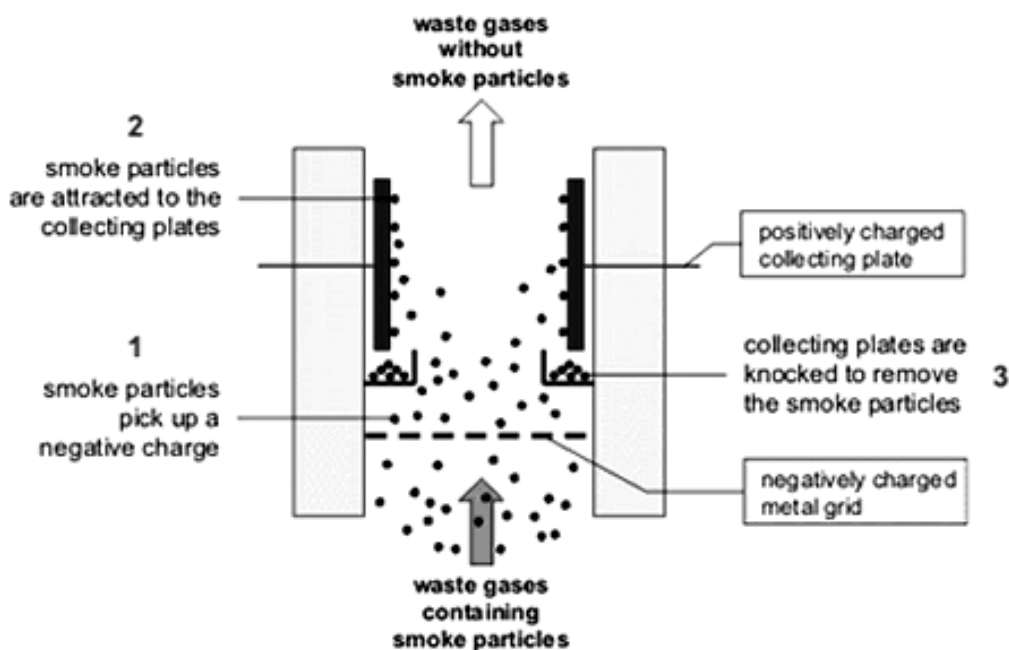   e.g. Spin dryer of a washing machine - clothes stay inside while water is forced through the holes.

Fig 5.7.6   The spin dryer on a washing machine spin dries the clothes by a centrifuge action.

- Have many applications in medicine and industry.

    e.g. In medicine they can be used to separate blood into its cells and liquid (plasma).

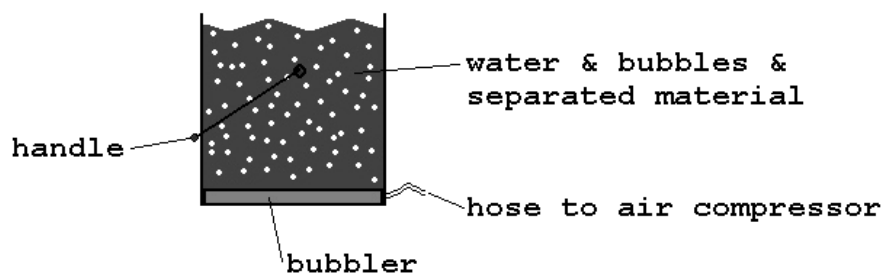## Electrostatic precipitation

- Used in industry to remove impurities from smoke released from large chimneys.
- As the smoke moves up the chimney it receives an electric charge, which attracts the particles to the collecting plates at the side of the chimney.

Froth flotation

- Used to remove metals from minerals in mining.
- The metal-containing mineral is finely crushed to release the metal and mixed with water and special chemicals called 'frothing agents'.
- When air bubbles are blown through the mixture, the metal particles cling to the bubbles and come to the surface.

Cross-section of flotation tank (not to scale)

2. Solutions
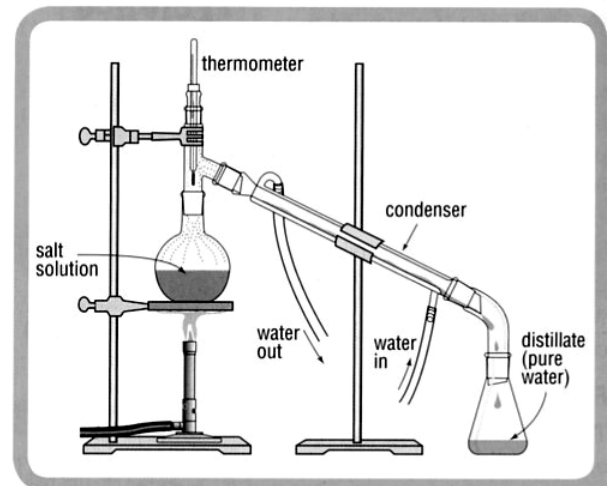
Evaporation

- Removes solvent but leaves solute behind.
- Only recovers the solute.

    e.g. Evaporate seawater to recover salt.
          Separate copper sulphate from solution.

Distillation

- Recovers solute and solvent.
- Use **condensation** to recover the solvent.

    e.g. Recover salt and water separately from a solution.

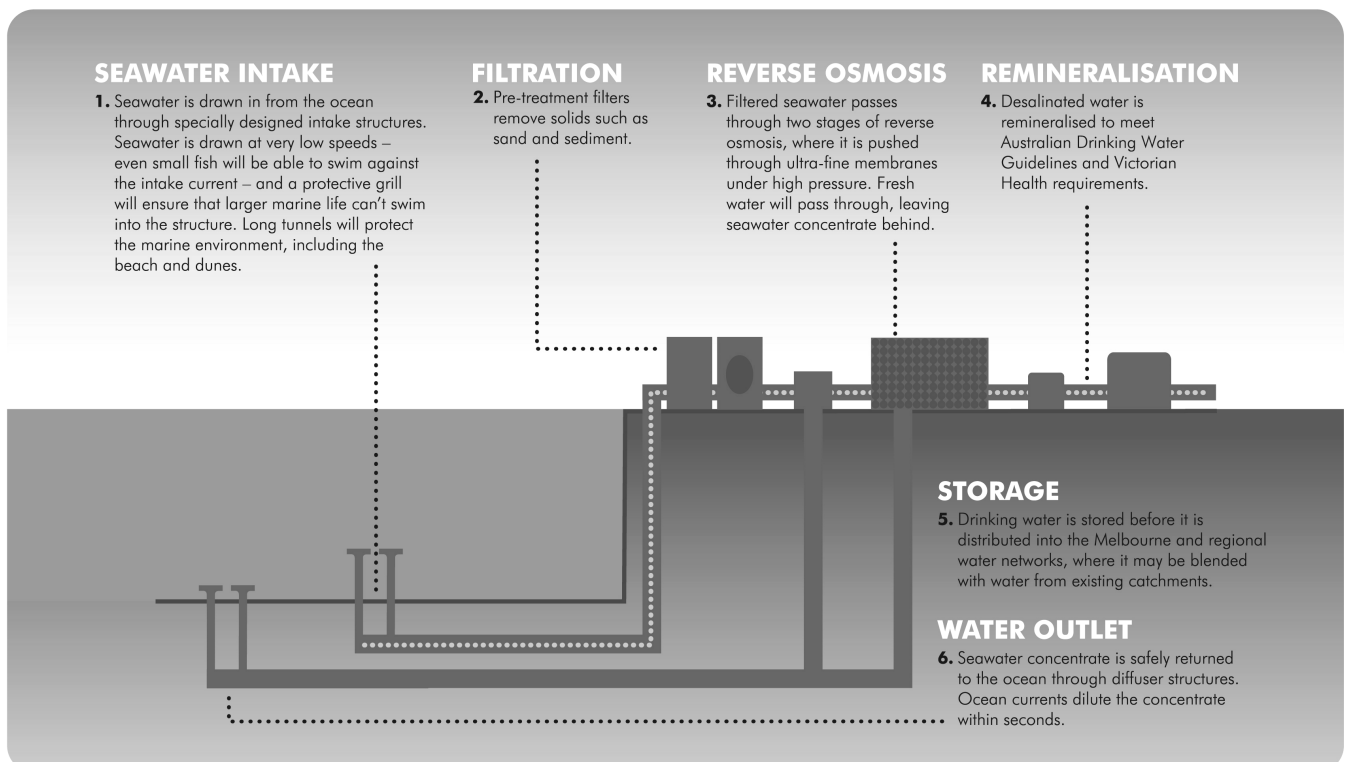- Oil is distilled to make petrol, kerosene, diesel and lubricating oils.

Laboratory distillation equipment. Cold water to cool the condenser circulates through a jacket around the condenser.
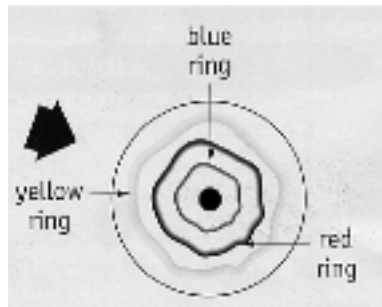
Fig 5.7.7

Desalination

- Name given to the process of removing salt and other impurities from salt water.
- There are two main desalination processes:

    1. **Thermal desalination** - same as that described above.

    2. **Reverse osmosis** - involves 'pushing' water through a special membrane, removing the salt.

SEAWATER INTAKE
1. Seawater is drawn in from the ocean through specially designed intake structures. Seawater is drawn at very low speeds – even small fish will be able to swim against the intake current – and a protective grill will ensure that larger marine life can't swim into the structure. Long tunnels will protect the marine environment, including the beach and dunes.

FILTRATION
2. Pre-treatment filters remove solids such as sand and sediment.

REVERSE OSMOSIS
3. Filtered seawater passes through two stages of reverse osmosis, where it is pushed through ultra-fine membranes under high pressure. Fresh water will pass through, leaving seawater concentrate behind.

REMINERALISATION
4. Desalinated water is remineralised to meet Australian Drinking Water Guidelines and Victorian Health requirements.

STORAGE
5. Drinking water is stored before it is distributed into the Melbourne and regional water networks, where it may be blended with water from existing catchments.

WATER OUTLET
6. Seawater concentrate is safely returned to the ocean through diffuser structures. Ocean currents dilute the concentrate within seconds.

Chromatography

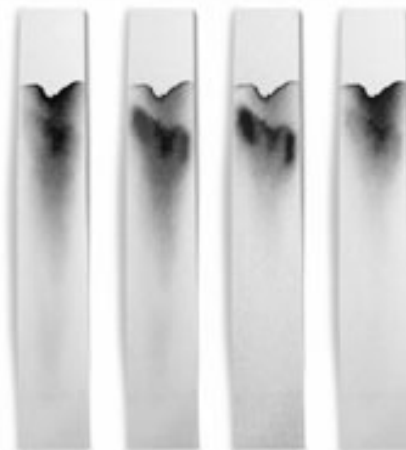•   Separates small quantities of dissolved materials

    e.g. Separates coloured inks into pigments by moving through paper.
        Used in forensic science to identify blood samples and DNA.

Chromatography

All chromatographic techniques
flow the mixture, that is to be
separated, through a material that
**retains some components more
than others**.

This causes different
components to flow through
the material at different
speeds, so they separate.

3. Separating Solids

(a) *One soluble - one insoluble.*

e.g. Copper sulphate in water.

- Add water to dissolve the soluble substance.
- Filter to recover the insoluble substance.
- Evaporate the filtrate to recover the soluble substance.

(b) *Magnetic separation.*

e.g. Iron filings in sand.

- Works only for magnetic materials (iron/steel, cobalt, nickel).
- No use for metals such as aluminium, gold, silver and copper.

(c) *Insoluble substance floats, the other sinks.*

e.g. Cork and sand.

- Skim the floating substance off.
- Filter to recover the other substance.

(d) *One solid heavier than the other.*

e.g. gold in soil

- Gold is heavier than soil and remains in the pan during "panning".