WJEC England GCSE Chemistry

Topic 1: Pure Substances and Mixtures

Notes

(Content in bold is for Higher Tier only)

What is a mixture?

- Consists of 2 or more elements or compounds not chemically combined together
    - Chemical properties of each substance in the mixture are unchanged
- Element = substance made from only one type of atom
- Compound = substance made from two or more elements that have reacted chemically with each other

How can you separate a mixture?

- Physical processes
    - Filtration:
        - If you have produced e.g. a precipitate (which is an insoluble salt), you would want to separate the salt/precipitate from the salt solution.
        - You would do this by filtering the solution, leaving behind the precipitate
    - Crystallisation:
        - If you were to have produced a soluble salt and you wanted to separate this salt from the solution that it was dissolved in
            - You would first warm the solution in an open container, allowing the solvent to evaporate, leaving a saturated solution
            - Allow this solution to cool
            - The solid will come out of the solution and crystals will start to grow, these can then be collected and allowed to dry
    - Simple distillation:
        - Used to separate a pure liquid from a mixture of liquids
            - Works when the liquids have different boiling points
            - Commonly used to separate ethanol from water
            - (Taking the example of ethanol...) ethanol has a lower bp than water so it evaporates first. The ethanol vapour is then cooled and condensed inside the condenser to form a pure liquid.
            - Sequence of events in distillation is as follows: heating → evaporating → cooling → condensing
    - Fractional distillation
        - e.g. crude oil
        - The oil is heated in the fractionating column and the oil evaporates and condenses at a number of different temperatures.
        - The many hydrocarbons in crude oil can be separated into fractions each of which contains molecules with a similar number of carbon atoms

- The fractionating column works continuously, heated crude oil is piped in at the bottom. The vaporised oil rises up the column and the various fractions are constantly tapped off at the different levels where they condense.
- The fractions can be processed to produce fuels and feedstock for the petrochemical industry.

- Physical processes are used, because they do not involve chemical reactions and no new substances are made

Pure substances

- A pure substance = a single element or compound, not mixed with any other substance
- They melt and boil at specific temperatures
  - Mixtures melt/boil over a range of a few degrees, so this can be used to distinguish pure substances from mixtures
- In everyday language, a pure substance = substance that has had nothing added to it, so it is unadulterated and in its natural state, e.g. pure milk

Formulations

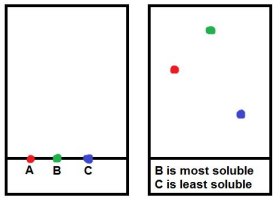
- A formulation = mixture that has been designed as a useful product
- Many products are complex mixtures in which each chemical has a particular purpose
- They are made by mixing the components in carefully measured quantities to ensure that the product has the required properties
- Examples are food and drink products, medicines, sunscreens, perfumes and paints

Chromatography

- Used to separate mixtures and give information to help identify substances
- Involves a stationary phase and a mobile phase
- Separation depends on the distribution of substances between the phases

Rf value = distance moved by substance ÷ distance moved by solvent

- Different compounds have different Rf values in different solvents, which can be used to help identify the compounds – and to distinguish pure from impure substances
- Compounds in a mixture separate into different spots but a pure compound will produce a single spot in all solvents

Paper Chromatography 	Analytical technique separating compounds by their relative speeds in a solvent as it spreads through paper. The more soluble a substance is, the further up the paper it travels. Separates different pigments in a coloured substance.
Pigment	Solid, coloured substance

Practical Assessments

what you should be prepared to do, using the above study materials...

- SP1A Determination of a melting point, e.g. for naphthalene (pure substance) or candle wax (impure substance)
- SP1B Separation of liquids by distillation, e.g. ethanol from water, and by paper chromatography