Using Learn Chemistry's 'Challenging Plants' Resources

Links to the curriculum

The Challenging Plants resources can be used as stand-alone resources or combined to provide support for a very wide variety of curriculum topics. They provide a rich bank of information, ideas and instruction sheets relevant to many commonly studied topics in chemistry and biology.

- Individual resources may be used to enrich topics by providing alternatives to traditional experiments in familiar topic areas. These experiments, chosen from the contexts of fertilisers, soil or plant science, provide new and different examples that illustrate commonly studied topics in chemistry and biology.

- Resources may also be used together to provide greater breadth to the study of plant related topics. Student experiment sheets, teacher presentations and information sheets are interconnected and used together they can provide a coherent picture of a topic.

- Resources can be used by learners to support independent research or group work when they are given a plant related task or project to complete. Learners can choose from the interlinked resources to create their own portfolio of work, including their own experiments, in the context of plant related topics.

- Resources can be used to support cross curricula projects where the distinction between traditional chemistry and biology topics is blurred. This approach can break down barriers between traditional scientific disciplines and allow for a greater flexibility in approach in which plant related topics are at the centre of study.

- Specific examples of the uses of the Challenging Plants resources within the curriculum and in enrichment sessions are described below.

Using experiments and investigations

(i) Preparation of salts

As an alternative to the preparation of an inorganic salt such as copper(II) sulphate, a range of salts can be prepared that are used as fertilisers. Examples include ammonium sulphate, magnesium sulphate, zinc sulphate, calcium nitrate, ammonium dihydrogen phosphate, diammonium hydrogen phosphate, potassium phosphate, copper(II) citrate and copper(II) ethanoate. Many of the experiments produce a good yield of attractive crystals.

(ii) Preparing and investigating inorganic complexes

To widen the study of *d*-block complexes beyond the commonly prepared ammonia and chloro complexes more unusual complexes such as iron(III) EDTA complex, a mixed metal EDTA complex and cis and trans copper(II) aminoethanoate complexes can be prepared. These are also used as fertilisers. Students can also investigate complexes by comparing chelated and non-chelated micronutrients.

(iii) Analysing solutions using colorimetric measurements

The resource includes a range of examples of the use of colorimeter or spectrophotometer to analyse coloured solutions in the context of fertilisers, nutrients and contaminants in soil and water that can be used to extend the more conventional colorimetric experiments. Examples include finding the concentrations of manganese in a fertilizer, iron(III) ions using thiocyanate ions, thiocyanate ions using iron(III) ions, iron(II) ions using 1,10-phenanthroline, phosphate using molybdate and zinc using zincon.

(iv) Rates of reaction

To add to more traditional rates of reaction experiments details are provided of how to measure the rate of hydrolysis of urea

(v) Chemistry investigations

Where an extended period is available to carry out practical investigations a range of student projects are suggested. These include the determination of thiocyanate ions in waste water, investigating the uptake of zinc by plants, the rate of release of nutrients by fertilisers, measuring the soil exchange capacity of soil, measuring the soil/water distribution coefficient of zinc ions and the effect of pH and temperature on this coefficient.

(vi) Plant chemistry/biology experiments

Experiments that focus on plant science and are particularly suitable for horticultural courses or science clubs in schools and colleges include the uptake of water by plants, passive transport of glucose and starch, passive transport of starch and chloride ions, rate of passive transport, rate of osmosis, effect of nutrient solutions on the rate of plant growth in floating culture, hydroponics and soil culture.

Use of support material about plants, agriculture and the environment

(i) Fertilisers

Students can use the resource to find out how ammonia is manufactured. They can also find much more information about fertilisers that they could use if asked to carry out their own research into the use of fertilisers. Topics include nutrients and fertilisers, fertilisers providing primary, secondary and micronutrients, applying fertilisers and fertilisers and the environment.

(ii) Plants and the environment

Some interesting applications of plants are included in the resource that can be used in lessons that cover chemistry and the environment. These include the use of phytomediation to clean contaminated land, treatment of water from coke ovens and phytoextraction and mining.

(iii) Plant and soil science

Information is available in the resource about a large number of plant and soil science topics. Each topic is covers in short engaging sections that link to practical applications in horticulture and agriculture. These mini-studies are particularly suitable for students studying horticulture, agriculture and modules of applied science that have a focus on plants and they provide a wealth of information for individual student study.

Topics covered in worksheets and presentations include useful products from plants, why plants need nutrients, signs of nutrient deficiencies, nutrient cycles including carbon, nitrogen and sulphur cycles, making compost, transport through plants, plant cells and in flowering plants, why passive diffusion happens due to entropy and free energy considerations, rate of passive diffusion, photosynthesis, soil and other growing media, soil structure, soil water, nutrients and soil and soil test kits.