Effect of nutrients on plant growth (floating culture)
Teacher and technician sheet

The method may be used to investigate the effect of deficiencies in a number of nutrients. A full study would probably take a student or pair of students too long. Instead, students could be allocated one or two nutrients to investigate, done in a way that ensures the class as a whole investigates the effects of deficiencies in each of the essential nutrients.

It might also be modified to study the effect of pollution on plants that grow in streams, rivers and lakes.

Equipment and materials
Each student or pair of students will require:

- Ten healthy duckweed plants (*Lemna*) of similar size.
- Beaker, with plastic film to cover it
- Graph paper
- Complete-nutrient solution and nutrient-deficient solution (containing none of the nutrient you are investigating).

Nutrient solutions

- Complete-nutrient solution. Dissolve the following compounds in 1 dm³ of deionised water.
  - 0.70 g KNO₃
  - 0.25 g CaH₄(PO₄)₂·2H₂O
  - 0.25 g MgSO₄·7H₂O
  - 0.005 g FeCl₃·6H₂O
  - 0.08 g NaCl

- Nutrient-deficient solutions. Make the following changes to the complete nutrient solution formulation:
  - Deficient in:
    - Nitrogen: replace KNO₃ with 0.52 g KCl
    - Phosphorus: replace CaH₄(PO₄)₂·2H₂O with 0.16 g Ca(NO₃)₂·4H₂O
    - Potassium: replace KNO₃ with 0.59 g NaNO₃
    - Calcium: replace CaSO₄·2H₂O with 0.2 g K₂SO₄ and CaH₄(PO₄)₂·2H₂O with 0.71 g NaH₂PO₄·2H₂O
    - Sulfur: replace CaSO₄·2H₂O with 0.16 g CaCl₂ and MgSO₄·7H₂O with 0.21 g MgCl₂·6H₂O
    - Magnesium: replace MgSO₄·7H₂O with 0.17 g K₂SO₄
    - Iron: omit FeCl₃·6H₂O

Wear eye goggles, iron (III) chloride is corrosive