A study of water plants

[Year/Subject] 1st Year Junior High School, Science
[Course Name] Classifying Plants

Optimum Season

From June to mid November. The optimum season is between September and October, when most water plants are in full bloom.

Caution

- When conducting activities near ponds, always check the area thoroughly in advance. Safety is paramount. Take extra care against vipers.
- Ponds in the Sera area are home to many valuable species of plants. Do not collect more plants than is necessary.
- Do not take any actions that may inconvenience farmers, such as destroying irrigation ridges or water intake areas for the pond.

Items to Prepare

- White tray: to observe water plants that have been collected
- Magnifying glass: to observe the details of water plants
- Temperature gauge
- Digital camera: to photograph the conditions of water plants and the pond
[Observation of plant pores]
- Microscope observational tools
- Razor blade ■ Petri dish ■ Dropper

Common pond plants such as water chestnuts and pondweed are ideal for observation.
Take care not to collect any rare species of plants.

Observation key points

- Sketch plants accurately and in detail using lines and dots.
- When collecting and observing wild animals and plants, always have pupils record the date and time, weather, temperature and area of observation.
- If pupils notice anything while making observations, have them write the details down in the comments section.

Pond environment

- Have pupils record the overall conditions of the pond, including the level of clarity of the water, the amount of sunshine, how the pond is being used and the types of plants growing there.
- Have pupils record the conditions of the area the plant was growing, including the level of clarity of the water and the amount of sunshine in that particular location, water depth in the types of plants growing there.

Water plants

A water plant is the name given to plants that grow in water or around water found in ponds, rice paddies and rivers. There are approximately 200 different types of water plants growing in Japan alone, and approximately 400 if water plants growing in marshes and rice paddies are included.
Water plants can be classified into four different categories below depending on the way they grow:
① Emerged plants: plants with leaves and stalks that grow above the water surface
② Floating-leaved plants: plants that have leaves that float on the water surface
③ Submerged plants: the entire plant grows under water
④ Free-floating plants: plants that float on the water without attaching their roots to ground under the water

Objectives

- Allow pupils to identify the design and function of roots, stalks, leaves and flowers that water plants use to grow in or around water, and increase the pupil's awareness of different types of plants and their various lifecycles.
- Increase the pupil's awareness of local environmental conservation by observing wild natural habitats around ponds and other wetlands.

Classification of water plants

The first step in classifying water plants is to identify whether the plant is a monocotyledon or dicotyledon. Major classifications are outlined in the diagram, however many exceptions do exist.
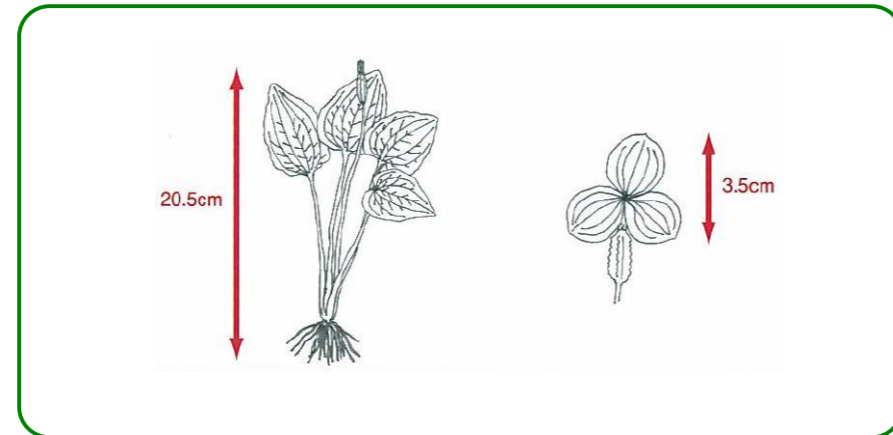
Example answers (partially entered)

A study of water plants

A number of ponds were constructed and managed many years ago in the Sera area, where rice cultivation is popular. A large number of water plants (plants that grow in water or around water) that can no longer be found in other regions, live in these ponds.

Let's have a closer look at water plants

① Sketch the overall plant, taking into consideration the structure of the roots, stalk and leaves. Be sure to include a scale too.
② Sketch the shape of veins in leaves or flowers and other parts of the plant that important for classifying the type of plant.

● **Observation date & time:** September 6, 2009 Morning   ● **Weather:** Sunny
● **Observation area:** Sera Yume Kouen, Nature Observation Field, Pond 2   ● **Temperature: 28.5°C**

20.5cm   3.5cm

Write down the conditions of the observation area.

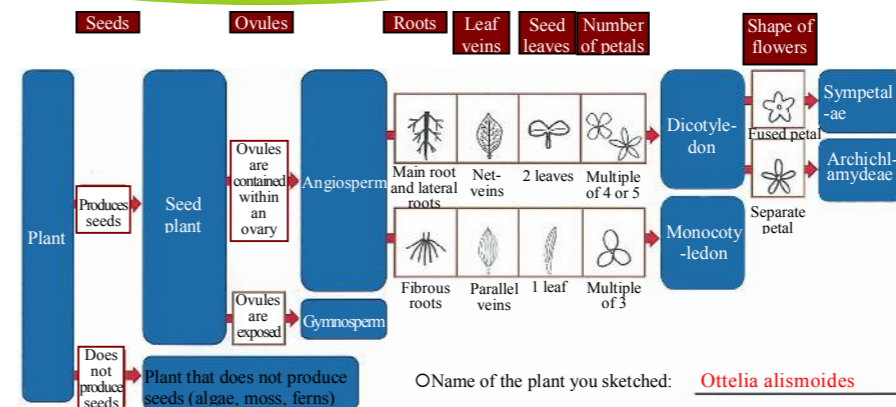|	
Overall conditions of the pond:	A sunny pond with no trees nearby. The level of clarity of the pond water was extremely high.
Conditions of the area the plant was growing:	Growing in large numbers in shallow water on the edge of the pond.

Let's classify the plants

Seeds Ovules Roots Leaf veins Seed leaves Number of petals Shape of flowers

Plant — Produces seeds — Seed plant — Ovules are contained within an ovary — Angiosperm — Main root and lateral roots — Net-veins — 2 leaves — Multiple of 4 or 5 — Dicotyle-don — fused petal — Sympetal-ae / Archichl-amydeae — Separate petal

Ovules are exposed — Gymnosperm — Fibrous roots — Parallel veins — 1 leaf — Multiple of 3 — Monocoty-ledon

Does not produce seeds — Plant that does not produce seeds (algae, moss, ferns)

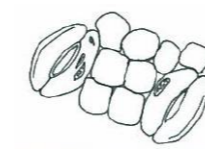○Name of the plant you sketched: Ottelia alismoides
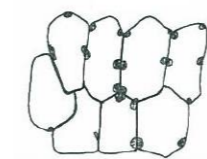
Let's have a closer look at the pores

Examine the surface of the leaves of the water plant with a microscope and sketch what you see. Compare this with the surface of the leaves of a land plant.

Plant observed: Pondweed   **Microscope zoom: 400 magnifications**

Front surface of leaf   **Rear surface of leaf**

Compare the front surface and rear surface of the leaf and write down what you think.

The pores of the potamogeton fryeri water plant are different to that of land plants, and are positioned on the front surface. No pores were visible on the rear surface. The pores on the surface of the leaf that floats on the water surface in order to breathe in and out oxygen and carbon dioxide with the atmosphere.

Sera area - a diverse variety of water plants

The Sera area has a large number of ponds and marshes that are home to a wide variety of rare plants such as the nuphar oguraense, and the area has even been selected by the Ministry of the Environment as part of the "500 Important Wetlands in Japan".
The area is known for its rich history of rice cultivation as described by Otanosho, and a large number of ponds were created and managed by the people who used to live there. With its long, rich history, this wetland environment is a precious resource in the area today. These ponds, and the water plants that grow there, will continue to be regarded as an important resource.

Poaceae / Cyperaceae / Juncaceae / Sparganiaceae / Typhaceae
Thin, long leaves in the form of stalks of rice.

Potamogetonaceae / Hydrocharitaceae

Hydrocharitaceae etc / Lentibulariaceae
No split in the leaves

Alismataceae / Pontederiaceae / Nymphaeaceae etc
Leaf shapes can be described as lanceolate, round, hastate or other.

The stem and leaf is split into smaller sections.
Leaf shape is rhomboid. The center of the leaf is bulbous.

Submerged — Emerged — Floating on water surface

Small plant size, floating on water surface.

Lemnaceae / Azolla imbricate (fern) / Ricciaceae (moss)

Trapaceae
Leaves float on the water surface and have netted veins. Flowers are white or yellow.
Leaves float on the water surface and have parallel veins. Flowers do not have petals.

Nymphaeaceae / Menyanthaceae   Potamogetonaceae

Searching for families of water plants
(Reference: Satake, Y. et al. "Wild Flowers of Japan", Heibonsha, 1985)

Have pupils write down the genus name and family name, even if they do not know the exact species. Making them try is the most important point.

Observation of pores

Observations can be made easier if floating-leaved plants such as potamogeton fryeri or brasenia schreberi are used.
① Carefully cut away part of the leaf surface using a razor blade. Point out differences with land plants and how the surface is not as well developed.
② Prepare slide and observe the structure under a microscope.
Results and discussion
- Pores are visible on the front (top) surface (figure 1). There are no ports on the rear (bottom) surface (figure 2).
- The surface with more pores differs to that of land plants (figure 3).

Example observation of pores Water plants   Land plants

0.1mm   0.1mm   0.1mm   0.1mm

Potamogeton fryeri (pondweed) floating leaves   Solidago altissima (goldenrod) leaves
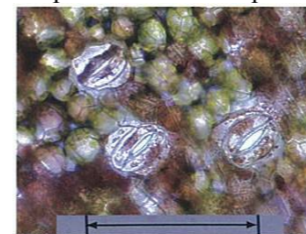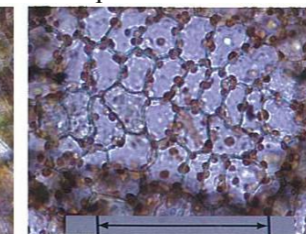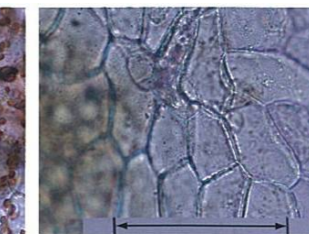Figure 1 Front (top) surface Figure 2 Rear (bottom) surface   Figure 3 Frontsurface   Figure 4 Rear surface