

Water for Life Instructions and Answers for Teachers

- Venue: Flower Dome and Cloud Forest
- Estimated duration to complete all questions: 1 hr

Level / Subject:

- Lower Secondary (Science): Interactions within Ecosystems
- Lower Secondary (Geography): Managing the Changing Environment

Learning Objectives:

- Recognise how adaptive traits and changes to the environment affect the survival of organisms
- Discuss Singapore's response to overcoming the challenges of water scarcity



ACTIVITY 1: Braving the Drought (30 min)

(a) At *The Baobabs* in the Flower Dome, you will find trees with swollen, bulging trunks. When they drop their leaves, they look like drumsticks! What is the name of these trees?

Answer: Palo Borracho / Drunken Tree (*Ceiba chodatii*).

Photo reference for teachers:



(b) Read more about the tree identified in (a) above. What is stored in its swollen trunk? State its function.

Answers:

Water is stored in its swollen trunk to survive months of drought in its natural environment.

(c) Proceed to the *Succulent Garden* at the Flower Dome. You will find many plants here that have adapted to a dry environment with prolonged exposure to sunlight and extended periods of drought. Observe them. What are some common physical features that they have? List at least three here.

Answers:

Many of them are / have:

- leafless;
- succulent i.e. juicy, filled with water;
- a thick skin / outer layer;
- ribs along the surface of their stem;
- some shade at the top e.g. more wool / hairs / spines; and
- some form of protection against predators e.g. spines

(d) What are the functions of the physical features you have identified in (c) above?

Leafless:

Lack of leaves to reduce water loss through transpiration. The function of the leaves (photosynthesis) is taken on by other parts of the plant e.g. stem and branches which are noticeably green.

Succulence:

Water is stored in tissues to enable the plant to survive through periods of drought.

Thick skin / outer layer:

A thick epidermis protects the photosynthetic tissues below the surface from excessive sunlight. The surface of the branches, stem and leaves may be covered in wax, and appears grey or bluish. This wax works like a mirror, and reflects part of the light, minimising damage and reducing water loss through evaporation.

Ribs:

Ribs ensure that sunlight reaches different parts of the stem at different times of the day, helping the plant to cool down. One rib shades the next. The ribs also help the plant contract when their volume decreases during the dry season, and to expand rapidly when the rains finally arrive.

Shade at the top:

The top of the plant is more exposed to direct sunlight. Hairs, bristles and spines help to provide shade. Hairs and spines are often silvery or golden to reflect light and prevent the epidermis from becoming scorched by the sun. The hairs also capture a layer of humid air, creating a micro-environment near the skin of the plant thus reducing water loss.

Protection against predators:

In cacti, the leaf buds are modified to produce spines instead of leaves. The spines protect the plant against herbivores that may devour its fleshy stem or leaves.

ACTIVITY 2: Managing Water (30 min)

As you enter the Cloud Forest conservatory, enjoy the magnificent view of the waterfall that greets you at the entrance.

Cloud forests are moist tropical or subtropical montane forests with persistent low-level cloud formation. The plants in cloud forests are well-adapted to the high humidity and low temperature generated by a cloud-immersed environment.

Cloud forests around the world are important sources of freshwater. The plants capture rainwater and vapour that condenses from fog and clouds. Some of this makes its way down the mountain through streams, rivers and waterfalls, supplying people, plants and animals living downstream with a water source, while adding freshwater back to the ecosystem.

(a) A higher sea surface temperature caused by global warming will result in clouds forming at higher altitudes. What will happen to the plants and animals currently living in cloud forests when this happens?

Answers: The plants and animals living in cloud forests are highly dependent on the cool temperature and high humidity created by the clouds. When the clouds form at higher altitudes, there will be an increase in temperature and decrease in humidity at the level where these plants are found. As the environment dries up, these plants will start to die out, which in turn causes the animals that depend on them to die out as well.

(b) You have just learnt how plants adapt themselves to obtain and conserve water and the importance of freshwater. Water is a scarce resource in Singapore. How do we overcome the challenges of this lack of supply? Discuss with a partner and list at least four ways in the table here.

Answers:

S/N	Method(s)
1	Expand local water catchment areas: To collect rainwater and used water, which is treated for drinking.
2	Import water: Import water from Johor, Malaysia, under bilateral agreements.
3	Reclaim water (NEWater): Used water is treated and purified using advanced membrane technologies and disinfected using ultraviolet rays, to create clean potable water.
4	Desalinate water: Sea water is desalinated to produce fresh water.
5	Educate and engage: Educate and engage the public on the importance of conserving water to reduce the water consumption rate.
6	Research, development and collaboration: Continual research and development on technologies for water solutions and national and international collaborations for the sharing and co-creation of sustainable water solutions.

Given above is an example of possible answers. Other answers are acceptable if students provide well-thought out reasoning. Teachers may also share plausible answers for the purpose of general knowledge.

Notes to Teacher:

For more on *Interactions within Ecosystems* and *Managing the Changing Environment*, check out these Secondary School programmes:

- Stretched to the Limit
- The COOL Factor
- Building Singapore (land supply)
- A Blue Future (water quality)
- Home Today, Gone Tomorrow (global warming)

Please refer to our website for more details.