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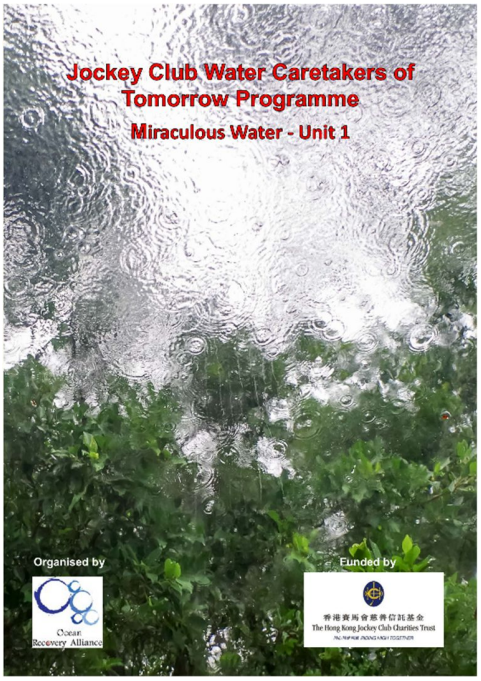
同心同步同進 RIDING HIGH TOGETHER

Teacher Notes for
Unit 1: Miraculous Water

About the Jockey Club Water Caretakers of Tomorrow Programme:

The Jockey Club Water Caretakers of Tomorrow Programme is a collaboration funded by The Hong Kong Jockey Club Charities Trust and developed by Ocean Recovery Alliance, Ltd. It is an educational curriculum programme designed for students in Form 1-3 early secondary school in Hong Kong. Through a combination of both inquiry-based and project-based learning, students develop understanding and appreciation for our water systems and functions, at both the local and global levels. They learn how to assess threats such as pollution and habitat destruction, while also developing ways to mitigate them. This understanding will empower our youth to take an active role as caretakers of our water resources of the future, and to share their commitment with their families and communities.

Using the Lessons in the Classroom



The Jockey Club Water Caretakers of Tomorrow Programme consists of eight units. The units have been developed to allow for using as many as your time and your curriculum will allow. Each unit can stand alone, although it is strongly recommended that Unit 1: Miraculous Water, be implemented first as it lays the groundwork for the other units. Please note that there is repetition in some of the topics covered in each of the units. This is intentional. As it is likely that most teachers will not be able to complete all of the eight units, the curriculum has been designed to contain as many of the important concepts as possible, within each unit. Teachers are encouraged to pick and choose from the range of topics and activities in each unit, such that unnecessary repetition is avoided.

Teacher Notes and Student Notes

Each unit consists of Teacher Notes and Student Notes. The Teacher Notes include information about skills accessed, materials needed, recommended assessments, suggested extensions, cross-curricular links and other information that could help determine how the Unit and the individual lessons might fit into a teacher's curriculum. The Student Notes can be

printed out for the students to use throughout the unit. It includes background information, instructions for all the activities, as well as space to record their learning. The students should also have access to the Student Notes online as many of the activities and additional information are linked to websites on the internet.

It is also recommended that students keep their own "learning log" or journal to record their progress in understanding the issues as well as the actions they might take.

Extensions

All the lessons contain "Extensions" which provide additional rigor or challenges for students. These suggestions for enrichment can help to streamline the lessons to the grade level, curricular or differentiation needs of your own students. Some of the extensions utilize case studies or contain more photographic material or recommended websites, all of which might be suited to students with different learning styles.

Safety in the Classroom and in the Field
Teachers will go over their school's rules for safe and responsible behaviour both inside and outside the classroom, before doing all of the activities in the units. The Teacher Notes will, however, identify particular safety concerns to be aware of in specific activities.

Student Action and Social Responsibility
The aim of every unit in this project is to build student understanding of water resource issues. Through that understanding, it is hoped that they will be motivated to work toward positive change individually, locally and globally. It is, however, important that their teachers communicate the importance of their being sensitive to the complexities of cultural norms and political processes.

Objectives of Unit 1: Miraculous Water

At the end of the lessons in this unit, students will be able to:

- describe the main physical and chemical properties of water
- use experimental methods to demonstrate the properties of water
- define the role of water in the environment
- apply their knowledge of the water cycle

Student skills table

Lesson	Critical thinking	Supporting Opinions with evidence	Applying scientific principles	Experiment Design	Data Collection /Graphing and Data Analysis	Reading for Understanding	Using technologies for mapping	Research and/or Presentation
1								
2								
3								
4								

Cross-curricular Links:

Lesson 1: *Chemistry* (reading scientific text, experiments with water properties), *Mathematics* (Extension question: calculating percent)

Lesson 2: Earth *Science and Geography* (water cycle and permeability experiment, reading graphs), *Language Arts* (water cycle poem or rap)

Lesson 3: *Geography, Earth Science* (erosion experiment)
Language Arts (writing a narrative about water's path)

Unit Vocabulary - refer to Student Notes
Student Notes includes all the vocabulary and definitions that the students should be aware of in order to understand the topics covered.

Materials and Technology Needed

Materials and Technology Needed

Activity					
Lesson	**1**	**2**	**3**	**4**	**5**
1	Plastic tubing, water, bucket of water, different containers, coin, pipette, plastic litre bottle	Kettle, cold glass, beaker, matches, plastic litre bottle, warm water	Ice cube tray, ice cubes blunt dinner knife, marker	Water, Sugar, Salt Beaker, Filter paper, Source of heat,	2 Beakers or jars, Soil, Funnel, Spoon, Camera from mobile phone or laptop, Light source, grid paper, marker
2	Access to internet	Bowl, Clear wrap, salt and spatula, heat lamp	Access to internet	Access to internet	Bucket of water, access to outdoors
3	large tray with sides (e.g. cat litter tray) sand or cat litter, water in jug pipette		Download Water Cycle Powerpoint in Additional Resources	Download “Where Did My Raindrop Go” Powerpoint	

Unit Introduction:
1- Go over the Student Aims and the Vocabulary with the students
2- Have students complete the interviews which access their prior knowledge about the topics. At the end of the unit, the students should go back to their answers and correct them, using the knowledge they have gained.

Lesson 1

Objectives: In this lesson, students will understand:

- States or phases of water
- Phase changes of water
- Unique physical and chemical properties of water
- Properties of solutions
- Turbidity and its importance as a water quality indicator

Activity 1: Liquid Water
The three experiments in this section investigate properties of water that are important in understanding how water behaves in the landscape. Follow the instructions in Student Notes for the experiments in this activity. The students should predict what they think will happen in each experiment, as well as their best idea about why this has occurred.

Activity 2: It's a Gas
Follow the instructions in Student Notes for this activity. After the students complete the experiment, along with their explanation for what they saw, explain the following:

In "Boiling Hot" students should recognize that condensation occurs on a cold glass.

Clouds are more likely to form when it's cold. When you squeeze the bottle, the pressure increases, causing the temperature inside the bottle to rise. When you release the bottle, the pressure decreases, causing the temperature inside the bottle to fall. This makes the water molecules condense (become water droplets). The smoke particles from the match were the condensation nuclei, which allow the water molecules to condense around the smoke.

Activity 3: Solid water - It's Real Cool
Follow the instructions in the Student Notes for these activities. Note that there are two extensions in this section. One of them involves calculating the amount of ice below an iceberg and the other involves measuring temperature during phase change from liquid to gas.

Activity 4: Chemical Properties of Water

Students read about the bipolarity of the water molecule and watch the YouTube video about the unique properties this bipolarity leads to. This is followed up with some experiments about the properties of solutions and the effects of turbidity. The coin experiment should demonstrate that the bipolarity of the water molecule results in the creation of surface tension as the molecules stick to each other.

Activity 5: Suspensions

Students observe the properties of suspensions and contrast that with what they know about solutions. In the Turbidity experiment, they learn how turbidity of water affects the ability for light to pass through. Then they are asked to consider how plants and animals are affected by turbidity.

Lesson 2: Earth, the Water Planet

Objectives: In this lesson, students will understand:

- What the water cycle means
- How weather and climate are defined
- What groundwater is and how surface permeability affects it

Activity 1: Water Cycle

Students learn about the water cycle by annotating the water cycle diagram provided. All the terms they are unfamiliar with are found in the glossary at the beginning of the unit. Further information about the water cycle can be found in the websites cited.

Activity 2: Mini Water Cycle

1- Students follow the instructions in Student Notes.
2- Once the students have determined that the water droplets formed on the plastic wrap are not salty, they should be encouraged to name all the sources of freshwater that enter the sea such as rivers and precipitation.

Activity 3: Rapped in the Water Cycle

1- Have the students watch some YouTube videos made about the water cycle.
2- Then they need to write their own poem, song or rap that describes the water cycle for students their age.
3- Alternatively they can review some of the ones they watch, criticizing the specific things that are incorrect or missing in each.

Activity 4: Weather vs. Climate
This activity requires the students to understand the difference between weather and climate in order to put these concepts into context both for the purposes of the water cycle and for future lessons about climate change.

1- Have the students follow the prompts.
2- Access to the internet is preferable but not required, until the last part of the activity which asks the students to look at a similar climate map to the one for Hong Kong.

Activity 5: Hidden Water
This activity requires access to different types of ground surfaces around the school property.
1- Students make predictions and observations about the permeability of water on the different surfaces
2- Students label the diagram to indicate the potential sources of groundwater contamination
3- Students follow the prompts to consider the effects of major weather events on the groundwater

Lesson 3: The Power of Water

Objectives: In this lesson students will understand

- Why water can exert so much power on land
- How water shapes the landscape
- The different types of structures used to mitigate the effects of erosion
- The variety of ways water is cycled through the landscape
- The effects of different environments on the path of water in the landscape

Activity 1:
1- Start off by having the students watch the video of raindrops hitting different surfaces.
2- Have the students follow the instructions for the experiment about erosion. Students might want to take photos and do a time lapse recording of the experiment.

Activity 2:
Students look at the photos of different structures in the Hong Kong landscape and determine what their functions might be. The functions are either for slowing water down, diverting it, capturing flow, or slope protection.

Activity 3: Water Cycle Review Powerpoint

Students download the powerpoint about the water cycle from the Resources section for Unit 1. They should have a richer understanding for the elements of the water cycle by this point in the Unit.

Activity 4: Where Did My Raindrop Go?

1- Students can use photos from the powerpoint, and add to these as needed. They select a path for their water drop and illustrate its journey with their own slideshow.
2- Students share each other's journey.
3- Alternatively, students can turn their water drop journey into a storybook for lower grade students.