Coordinator Notes: Module 2.2 Water – Water Filtration

This Module explores the importance of water filtration and water treatment!

- Students will learn about the contaminants in raw water, and their potential to make us sick.
- Students will explore and test a range of methods for filtering and treating water.
- The students will construct their own water purification systems using a variety of materials and flocculation techniques.

Session Length:

This Module can be presented in different session durations per your needs.

Lesson plans are provided for:

- A 120 minute session, or, 2 x 60 minute sessions
- 45 minute, 75 minute, and 90 minute sessions

Technology:

PowerPoint: If you do not have access to a data projector and cannot display the PowerPoint presentation, we recommend that you print the most important slides before the session, and either enlarge them onto cardboard to use in place of slides, or create a booklet that students can share in small groups.

The most important slides have been included as a 'Reduced Slides' PowerPoint file, and an easily printable pdf version of these slides is also provided. If you choose this option, we recommend that you still read and use the slide notes included in the full PowerPoint for the session.

The session can be conducted without slides all together, but they offer visual aid in explanation of scientific concepts. We recommend at the very least that instructions for each experiment are printed for the students.

Videos links: The suggested links to online videos within the session can be helpful with explanation. Notes have been included in the slides if there is an essential component to a video which the facilitator should discuss or demonstrate, if the video cannot be played.

Video files: A video file for each Module has been provided to aid explanation and instruction for some experiments and challenges. It is recommended coordinators view video files prior to delivering sessions, if the experiments and challenge activities are unfamiliar.

Please read the Module 2 Risk Assessment before proceeding with the session

Contents	Page

Module 2.2 Water – Water Filtration: Overview

Begin the session by recapping what students recall about the properties of water from the previous sessions "Water Transport Challenge" (Module 2.1).

Encourage students to use the scientific method (introduced in Module 1) to form hypotheses for their experiments in Module 2.

Content overview:

Concept / Activity	Session Duration (minutes)			
	120	90	75	45
Drinking Water Introduce the concept that we can't safely drink water from everywhere we find it.	*	*	*	*
Clean Water Introduce concept that water can be cleaned to make it safe to drink. Water treatment plants provide clean drinking water.	*	*	*	*
Water Treatments – Coagulation and Flocculation Muddy water can be cleaned using chemicals and stirring.	*	*	*	*
Experiment 2.2.1 Muddy Water Explores coagulation and flocculation, cleaning muddy water	*	*	*	*
Water Treatments – key processes Introduce typical water treatment steps in Australia	*	*	*	*
Desalination Introduce additional water sources and treatment options	*	*	-	-
Solutions, Dissolving Introduce concept of small, unseen particles dissolved in water	*	*	-	-
Experiment 2.2.2 Salty Water Explores dissolving, solutions, saturation.	*	*	-	-
Osmosis and Reverse Osmosis Introduces the natural process of osmosis and the process of reverse osmosis used for desalination of sea-water	*	-	-	-
Experiment 2.2.3 Osmosis Explores the concept of osmosis using gummy bears / potato	*	-	-	-
Pathogens Introduce concept of pathogens / microorganisms and build link between 'invisible' bugs, water borne illnesses, and disinfection.	*	*	*	
Water treatments – alternatives to treatment plants Introduces concept of small scale and portable water treatment.	*	*	*	-
Water Filtration Challenge Explores water filtration, providing free exploration time to test out filter mediums to make muddy water clear.	*	*	*	*

Slides:

PowerPoint Slides are available to support the delivery of this module. Slides explain concepts visually, and include short, engaging videos relevant to the topic. A full list of slides and recommended inclusions for each session duration are provided in the table below. Appropriate slides are also noted in lesson plans for each duration.

PowerPoint Presentation: 'M 2.2 - Master Slides 120 minute Session Duration'		**Session Duration (minutes)**			
Slide	**Content**	**120**	**90**	**75**	**45**
1	Introductory title page for Module 2.2	*	*	*	*
2	Prompt slide – discussion, can we drink water from everywhere we find it?	*	*	*	*
3	Prompt slide – discussion, how do we get clean water?	*	*	*	*
4	Video – how Sydney Water collect, store and treat water	*	*	*	*
5	Prompt slide – discussion, can we clean muddy water?	*	*	*	*
6	Experiment 2.2.1 outline, 'Muddy Water' activity	*	*	*	*
7	Prompt slide, overview of 5 main water treatment steps	*	*	*	-
8	Prompt slide – discussion on can we drink sea water?	*	*	*	-
9	Prompt slide - Introduces concept of dissolving, solutions	*	*	-	-
10	Experiment 2.2.2 outline, 'Salty Water' activity	*	*	-	-
11	Prompt slide – outlines Osmosis	*	-	-	-
12	Prompt slide – outlines Reverse Osmosis	*	-	-	-
13	Experiment 2.2.3 outline, 'Osmosis' activity	*	-	-	-
14	Prompt slide – outlines pathogens, microorganisms	*	*	*	-
15	Experiment 2.2.4 outline, 'Microorganisms' activity	*	*	*	-
16	Prompt slide – discuss other water treatment options	*	*	*	-
17	Image of 'LifeStraw' – portable water treatment device	*	*	*	-
18	Image of 'Solar Ball'– portable water treatment device	*	*	*	-
19	Introductory slide for C2.2 'Water Filtration Challenge'	*	*	*	*
20	Overview of Challenge aims and scoring	*	*	*	*
21	Shows images of filtration designs / ideas	*	*	*	*
22	Outline of Filtration Challenge Rules	*	*	*	*
23	Session references, online links	*	*	*	*

Module 2.2 Water – Water Filtration
Lesson Plan
120 minute session or 2 x 60 minute sessions

High Tech: Use PowerPoint Presentation 'M2.2 - Master Slides 120 minute Session Duration'
Low Tech: Print PowerPoint 'M2.2 - Reduced Slides for Printing'. Use slide notes from the ENTIRE 120 minute presentation, adapting discussion to cover omitted slides.

Key Learning Area	**Topics**
Chemistry, Physical World	Water supply & treatment, filtration, dissolving, solutions

Timing	Running Time (hh:mm)	Procedure	Materials
5 min	00:05	**Lesson Introduction** Welcome. Brainstorm: can we drink water wherever we find it?	PowerPoint M2.2 (slides 1-2)
5 min	00:10	**Body of Lesson** **(Lesson 1, 2 x 60 minute sessions)** Discussion & brainstorm, how do we get clean water? Watch Sydney Water video. (If video are unable to be played, coordinator should watch prior to the session).	PowerPoint M2.2 (slide 3-4)
12 min	00:22	Discuss hypothesis, conduct Experiment 2.2.1 Muddy Water and discuss results	PowerPoint M2.2 (slide 5-6), clear cups / jars, alum, spoons, soil + water, markers
3 min	00:25	Introduce / recap the 5 main steps to clean water, used at water treatment plants.	PowerPoint M2.2 (slide 7)
3 min	00:28	Discussion about sea-water. Can we drink it? Introduce concept of desalination as a water supply / treatment process.	PowerPoint M2.2 (slide 8),
2 min	00:30	Introduce concepts solutions and dissolving. Explain water can have 'invisible' particles dissolved in it.	PowerPoint M2.2 (slide 9)

10 min	00:40	Discuss hypothesis, conduct Experiment 2.2.2 Salty Water and discuss results	PowerPoint M2.2 (slide 10), clear cups / jars, salt, water, pepper (or sand), markers
5 min	00:45	Introduce concept of 'osmosis' and reverse osmosis. Link to desalination.	PowerPoint M2.2 (slide 11-12)
10 min	00:55	Discuss hypothesis, conduct Experiment 2.2.3 Osmosis. Note: This experiment may be taken home, or, the session coordinator may also choose to pre-prepare this experiment the night before.	PowerPoint M2.2 (slide 13) water, cups / jars, gummy bears (or potato), salt, water, spoons, markers, rulers
5 min	01:00	**(Break for 2 x 60 minute sessions)**	
		(Lesson 2, 2 x 60 minute sessions)	
5 min	00:05/ 01:05	Review and discuss Osmosis experiment results (if conducted the week prior / at home)	PowerPoint M2.2 (slide 13)
5 min	00:10/ 01:10	Introduce microorganisms, and discuss pathogens and "invisible" bugs that can be present in water.	PowerPoint M2.2 (slide 14)
10 min	00:20/ 01:20	Discuss hypothesis, conduct Experiment 2.2.4 Microorganisms	PowerPoint M2.2 (slide 15), GlitterBug powder, clear cups or jars, water, spoons, paper towel, UV light / torch
5 min	00:25/ 01:25	Discuss ideas for cleaning water, other than water treatment plants.	PowerPoint M2.2 (slides 16-18)
5 min	00:30/ 01:30	Introduce challenge activity and explain materials and rules.	PowerPoint M2.2 (slide 19-22) Plastic PET bottles, mesh, cups, water, rubber bands, paper towel, soil, pebbles, sand, leaves, filters, scissors, oil, food colouring, measuring cups, activated charcoal, ink

15 min	00:45/ 01:35	Form groups and encourage students to build and test the water filtration systems	PowerPoint M2.2 (slide 21)
10 min	00:55/ 01:55	Support groups to undertake testing and scoring	Scoresheet M2.2
5 min	**00:55/ 02:00 END**	**Lesson Conclusion** Clean up. Discussion about the session, which filtration materials were most effective.	

Module 2.2 – Filtration: Experiments

Experiment E2.2.1: Muddy Water

Aim: To observe a chemical process for cleaning muddy water

Materials (per group):

- 2 clear cups or jars
- 1 teaspoon of alum (aluminium sulphate)
- 2 spoons
- Dirty water (2 spoonful's of soil plus 500ml water)
- Marker

Procedure:

1. Form into groups of 2 to 3 students.
2. Mix the soil into the water.
3. Pour an equal amount of dirty water into each cup.
4. Use the marker to label 1 cup 'Floc' and the other 'control'.
5. Add a teaspoon of alum to the cup marked 'Floc'.
6. Stir both cups well for about two minutes. Observe both mixtures.
7. Stop stirring and wait 5 minutes.
8. Observe both mixtures again.

Expected result:

In the 'Floc' cup, the soil formed clumps, and after 5 minutes most of the soil settled to the bottom of the cup, leaving relatively clear water. In the control solution, the soil remained a fine powder suspended in the water, and didn't settle out after leaving it for 5 minutes. At the end of the experiment, the water in the 'Floc' cup looked much clearer than the control.

Explanation:

The fine soil particles in the water can't be easily filtered out, and don't rapidly settle / sink in the water. Adding the chemical alum creates a chemical reaction which causes the soil particles to clump together. This is called 'coagulation'.

The clumps of alum combined with the captured soil particles are called 'floc'. The formed floc clumps are dense enough to sink and settle to the bottom of the cup leaving much cleaner water above.

"Flocculation" is a gentle mixing, or stirring process. It brings together the flocs formed in the coagulation step to form larger flocs.

Notes:

- ***Students may like to participate in creating the muddy water. Sticks / leaves / rocks should be filtered out using a sieve or screen. Soil particles can be crushed in a mortar and pestle to make them finer.***
- ***It is recommended gloves are warn if handling soil / alum. Be aware of potential sensitivities to soil particles.***

Experiment E2.2.2: Salty Water

Aim: To observe how substances dissolve in water

Materials (per group):

- 2 clear cups or jars
- 1/2 cup of salt
- 1 tablespoon of pepper (or sand)
- 2 spoons
- 500ml water
- Marker

Procedure:

1. Form into groups of 2 to 3.
2. Pour an equal amount of water into each cup.
3. Use the marker to label one cup 'salt'. Add a spoonful of salt to this cup.
4. Use the marker to label the second cup 'pepper'. Add a spoonful of pepper to this cup.
5. Stir both cups and observe. What do you see? Record your results.
6. Now, continue to add more spoonful's of salt to the 'salt' cup, stir each time.
7. Observe and record your results.

Expected Result:
Pepper will not dissolve / disappear in water. Salt will dissolve / disappear in water. The water will remain clear with a spoonful of salt dissolved, students will observe a "solution". However, there is a limit to how much salt can dissolve in a glass of room temperature water. As more salt is added, students will observe the solution become "saturated", the mixture will appear cloudy and added salt will cease to dissolve.

Explanation:
This experiment explores dissolving. Dissolving means to completely mix into a "solution". Some substances can dissolve easily into others, while others cannot. There is a limit to how much of one substance can dissolve in another. Whether a substance dissolves in water or not depends on its internal 'molecular' structure.

A solution is made when one substance called the solute "dissolves" into another substance called the solvent. Dissolving is when the solute breaks up from a larger crystal of molecules into much smaller groups or individual molecules. This break up is caused by coming into contact with the solvent. In the case of salt water, the water molecules break off salt molecules and surround them. Each salt molecule still exists. It is just now surrounded by water molecules, rather than other salt molecules.

Extensions:
Is there a difference between warm and cold water? Can you dissolve more or less salt in warm water? What else does / does not dissolve in water?

Notes:

- ***Be aware of potential sensitivities to salt.***

Experiment 2.2.3: Osmosis

NOTE: This experiment takes more than 1 hour to see the results. The experiment may be taken home, or, the session coordinator may choose to pre-prepare the experiment the night before, and demonstrate results to the group.

Aim: To observe the effect of osmosis

Materials (per person):

- gummy bears (or raw potato pieces)
- 3 clear cups or jars
- 3 tablespoons of salt
- 300ml water
- Marker, Spoon, Ruler

Procedure:

1. Label the three cups "salt water", "fresh water" and control.
2. Fill the fresh water and salt water cups half full with water. The control cup remains empty.
3. Add 3 tablespoons salt to the salt water cup and stir for a minute.
4. Add a gummy bear to each cup and leave them overnight (at least 4 hours).
5. Observe the record the difference in the 3 gummy bears the next day.

Alternately, cut a raw potato into evenly sized sticks, approx. 1cm wide x 1 cm x 4cm long. Measure the pieces and record the sizes. Place a piece of potato into each cup. Set aside and observe after 20 minutes. Measure the pieces. Have they changed size?

Expected Result:
The gummy bear in the fresh water cup should increase in size. (The longer it is left the bigger it will be). The gummy bear in the salt water solution should be the same size or slightly shrivelled. The control gummy bear should be exactly the same as at the start of the experiment. (Similar results are to be expected for raw potato pieces).

Explanation:
Osmosis is a passive (doesn't require energy) process in which water moves from an area of low solute concentration, to an area of high solute concentration, through a semi permeable membrane (through which the solute can't travel). Solute = a substance dissolved in a solution.

In the fresh water cup, the gummy bear got bigger as water moved into it. This is because the gummy bear has a higher concentration of solute than the water, so water moves into the gummy bear by osmosis. In the salt cup, the salt water has a higher concentration of solutes than the gummy bear so some water from inside the gummy bear moves into the salt water solution by osmosis. The control is simply to compare the original size of the gummy bear to the now bigger or smaller gummy bears.

Note:

- ***Be aware of potential allergies to gummy bears and / or potato.***

Experiment E2.2.4: Microorganisms

Aim: To simulate and observe microorganisms in water

Materials (per group):

- 1/8 teaspoon 'GlitterBug' powder (a small pinch)
- 2 clear cups or jars
- 150ml water
- Spoon or stirring stick
- 3 sheets paper towel
- UV light / torch (shared between groups)

Procedure:

1. Form into groups of 2 – 3 students.
2. Half-fill 1 cup / jar with water.
3. Observe the water with the UV torch / light. What do you see?
4. Add a pinch of GlitterBug to the water in the cup, stir for 1 minute.
5. Observe the mixture of GlitterBug & water with the UV torch / light.
6. Place 1 piece of the paper towel over the empty cup / jar, and push down gently so the paper towel forms a shallow bowl inside the cup.
7. Slowly pour the water and GlitterBug mixture into the empty cup, using the paper towel as a filter.
8. Remove the paper towel and observe it with the UV light.
9. Observe the filtered water with the UV light.

Expected Result:
The plain water will look clear when the UV light is shined through it. The mixture of powder and water will appear slightly cloudy, and will glow when the UV light is shined through it. Some clumps of powder may float on the water surface (GlitterBug will not dissolve in water). The paper towel will filter/trap some of the larger clumps of GlitterBug particles out of the water. The filtered water will appear less cloudy, but will still glow when the UV light is shined through as not all GlitterBug particles will be removed. The paper towel will glow where the GlitterBug and water mixture has soaked through when UV light is shined on it.

Explanation:
While GlitterBug powder is synthetic (man-made) not organic, it is a good simulation of a microorganism in water (like a bacteria). The powder GlitterBug particles do not dissolve, but are suspended in the water. Because the powder particles are so small, they are hard to filter out. Even if we filter the mixture over and over again, some of the finest particles of GlitterBug will remain in the water. This is why a chemical treatment like disinfection is used to destroy bacteria in water, as filters are not fine enough to confidently remove all pathogens.

Notes:

- ***Dispose of GlitterBug in rubbish bins, do not pour in drains.***
- ***Warm water will improve initial mixing of GlitterBug and water.***

Challenge M2.2 – Water Filtration Challenge

Coordinator Notes

Scoring:

A scoring mechanism is included, so the element of 'competition' may challenge all students to participate to their fullest. You may remove the scoring system all together if it does not work with your group of students.

When scoring it is important to only announce the greatest volume of water filtered and / or the clearest appearing water - so there will be no 'losers' or last place. It is important to highlight the good teamwork and strategies of each group.

Consider asking students how they might approach the task differently if asked to do it again, or how they might teach the same things they learned during the club to a younger student.

**** If you choose not to use a scoring system modify the slides that reference a 'score'****

Activity Notes

- Optional Storyline: A community has called for help! Their water treatment plant has broken down, and they need help to provide clean water to the town taps while the plant is being repaired. Your task is to come up with a filtration system to filter out all the leaves, dirt and rubbish caught in the water upstream of the treatment plant.
- Spilt water must be cleaned up straight away. Encourage students to keep the area safe and puddle free.
- Encourage students to work together as a team and take turns participating.
- The materials used to 'dirty' the water and to filter the water can be varied. Choose suggestions from the materials list, based on available material in your area.
- Allocate one point for each millilitre of water filtered, up to 50 points.
- Allocate 5 points if the filtered water appears lighter in colour than the dirty water.
- Allocate 5 points if the filtered water contains less solid / suspended particles than the dirty water.

Rules

- The final filtration system is limited to three of the filtering / flocculation materials. Students can choose up to three materials they think will clean water the best when combined.
- Crushed and uncrushed materials of the same substance can both be used, and will be counted as one material.
- Students decide how much of any one material is used for their system.
- Aim for at least 50 mL of water to make it through the system into the "drinking" cup.
- **Do not allow anyone drink the water (dirty or filtered)!**
- Scoring is based on: number of filter materials, visible particles (floating solids), turbidity (cloudiness/colour) and whether they managed to filter any water!

Score Sheet: M 2.2 – Water Filtration Challenge

Notes:

- Allocate bonus 5 points if only 3 filter materials are used!
- Allocate one point for each millilitre of water filtered, up to 50 points.
- Allocate 5 points if the filtered water appears lighter in colour than the dirty water.
- Allocate 5 points if the filtered water contains less solid / suspended particles than the dirty water.

Team or Individual Name				
Only three filter materials used? Yes = 5 points No = 0 points **(A)**	**Volume of Water Filtered?** 1 point per ml (up to 50 points) **(B)**	**Has the filtered water become less murky?** Yes = 5 points **(C)**	**Have solids been filtered out of the water?** Yes = 5 points **(D)**	**Total Points (A+B+C+D)**

Team or Individual Name				
Only three filter materials used? Yes = 5 points No = 0 points **(A)**	**Volume of Water Filtered?** 1 point per ml (up to 50 points) **(B)**	**Has the filtered water become less murky?** Yes = 5 points **(C)**	**Have solids been filtered out of the water?** Yes = 5 points **(D)**	**Total Points (A+B+C+D)**

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Team or Individual Name				
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Team or Individual Name				
Only three filter materials used? Yes = 5 points No = 0 points **(A)**	**Volume of Water Filtered?** 1 point per ml (up to 50 points) **(B)**	**Has the filtered water become less murky?** Yes = 5 points **(C)**	**Have solids been filtered out of the water?** Yes = 5 points **(D)**	**Total Points (A+B+C+D)**

Module 2.2 Water – Water Filtration
Lesson Plan
90 minute session

High Tech: Adapt PowerPoint Presentation 'M2.2 - Master Slides', hide slides: 11, 12, 13.
Low Tech: Print PowerPoint 'M2.2 - Reduced Slides for Printing'. Use slide notes for the ENTIRE 90 minute presentation, adapting discussion to cover omitted slides.

Key Learning Area			**Topics**
Chemistry, Physical World			Water supply & treatment, filtration, dissolving, solutions
Timing	**Running Time (hh:mm)**	**Procedure**	**Materials**
5 min	00:05	**Lesson Introduction** Welcome. Brainstorm: can we drink water wherever we find it?	PowerPoint M2.2 (slides 1-2)
5 min	00:10	**Body of Lesson** Discussion & brainstorm, how do we get clean water? Watch Sydney Water video. (If video are unable to be played, coordinator should watch prior to the session).	PowerPoint M2.2 (slide 3-4)
12 min	00:22	Discuss hypothesis, conduct Experiment 2.2.1 Muddy Water and discuss results	PowerPoint M2.2 (slide 5-6), clear cups / jars, alum, spoons, soil + water, markers
3 min	00:25	Introduce / recap the 5 main steps to clean water, used at water treatment plants.	PowerPoint M2.2 (slide 7)
3 min	00:28	Discussion about sea-water. Can we drink it? Introduce concept of desalination as a water supply / treatment process.	PowerPoint M2.2 (slide 8),
2 min	00:30	Introduce concepts solutions and dissolving. Explain water can have 'invisible' particles dissolved in it.	PowerPoint M2.2 (slide 9)

10 min	00:40	Discuss hypothesis, conduct Experiment 2.2.2 Salty Water and discuss results	PowerPoint M2.2 (slide 10), clear cups / jars, salt, water, pepper (or sand), markers
5 min	00:45	Introduce microorganisms, and discuss pathogens and "invisible" bugs that can be present in water.	PowerPoint M2.2 (slide 14)
10 min	00:55	Discuss hypothesis, conduct Experiment 2.2.4 Microorganisms	PowerPoint M2.2 (slide 15), GlitterBug powder, clear cups or jars, water, spoons, paper towel, UV light / torch
5 min	01:00	Discuss ideas for cleaning water, other than water treatment plants.	PowerPoint M2.2 (slides 16-18)
5 min	01:05	Introduce challenge activity and explain materials and rules.	PowerPoint M2.2 (slide 19-22) Plastic PET bottles, mesh, cups, water, rubber bands, paper towel, soil, pebbles, sand, leaves, filters, scissors, oil, food colouring, measuring cups, activated charcoal, ink
10 min	01:10	Form groups and encourage students to build and test the water filtration systems	PowerPoint M2.2 (slide 21)
10 min	01:25	Support groups to undertake testing and scoring	Scoresheet M2.2
5 min	**01:30 END**	**Lesson Conclusion** Clean up. Discussion about the session, which filtration materials were most effective.	

Module 2.2 Water – Water Filtration
Lesson Plan
75 minute session

High Tech: Adapt PowerPoint Presentation 'M2.2 - Master Slides', hide slides: 9, 10, 11, 12, 13.
Low Tech: Print PowerPoint 'M2.2 - Reduced Slides for Printing'. Use slide notes for the ENTIRE 75 minute presentation, adapting discussion to cover omitted slides.

Key Learning Area	**Topics**
Chemistry, Physical World	Water supply & treatment, filtration, dissolving, solutions

Timing	Running Time (hh:mm)	Procedure	Materials
		Lesson Introduction	
5 min	00:05	Welcome. Brainstorm: can we drink water wherever we find it?	PowerPoint M2.2 (slides 1-2)
		Body of Lesson	
5 min	00:10	Discussion & brainstorm, how do we get clean water? Watch Sydney Water video. (If video are unable to be played, coordinator should watch prior to the session).	PowerPoint M2.2 (slide 3-4)
10 min	00:20	Discuss hypothesis, conduct Experiment 2.2.1 Muddy Water and discuss results	PowerPoint M2.2 (slide 5-6), clear cups / jars, alum, spoons, soil + water, markers
3 min	00:23	Introduce / recap the 5 main steps to clean water, used at water treatment plants.	PowerPoint M2.2 (slide 7)
2 min	00:25	Discussion about sea-water. Can we drink it? Introduce concept of desalination as a water supply / treatment process.	PowerPoint M2.2 (slide 8),
5 min	00:30	Introduce microorganisms, and discuss pathogens and "invisible" bugs that can be present in water.	PowerPoint M2.2 (slide 14)

10 min	00:40	Discuss hypothesis, conduct Experiment 2.2.4 Microorganisms	PowerPoint M2.2 (slide 15), GlitterBug powder, clear cups or jars, water, spoons, paper towel, UV light / torch
5 min	00:45	Discuss ideas for cleaning water, other than water treatment plants.	PowerPoint M2.2 (slides 16-18)
5 min	00:50	Introduce challenge activity and explain materials and rules.	PowerPoint M2.2 (slide 19-22) Plastic PET bottles, mesh, cups, water, rubber bands, paper towel, soil, pebbles, sand, leaves, filters, scissors, oil, food colouring, measuring cups, activated charcoal, ink
10 min	01:00	Form groups and encourage students to build and test the water filtration systems.	PowerPoint M2.2 (slide 21)
10 min	01:10	Support groups to undertake testing and scoring	Scoresheet M2.2
		Lesson Conclusion	
5 min	**01:15 END**	Clean up. Discussion about the session, which filtration materials were most effective.	

Module 2.2 Water – Water Filtration
Lesson Plan
45 minute session

High Tech: Adapt PowerPoint Presentation 'M2.2 - Master Slides', hide slides: 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18.
Low Tech: Print PowerPoint 'M2.2 - Reduced Slides for Printing'. Use slide notes for the ENTIRE 45 minute presentation, adapting discussion to cover omitted slides.

Key Learning Area	**Topics**
Chemistry, Physical World	Water supply & treatment, filtration, dissolving, solutions

Timing	Running Time (hh:mm)	Procedure	Materials
5 min	00:05	**Lesson Introduction** Welcome. Brainstorm: can we drink water wherever we find it?	PowerPoint M2.2 (slides 1-2)
5 min	00:10	**Body of Lesson** Discussion & brainstorm, how do we get clean water? Watch Sydney Water video. (If video are unable to be played, coordinator should watch prior to the session).	PowerPoint M2.2 (slide 3-4)
10 min	00:20	Discuss hypothesis, conduct Experiment 2.2.1 Muddy Water and discuss results	PowerPoint M2.2 (slide 5-6), clear cups / jars, alum, spoons, soil + water, markers
5 min	00:25	Introduce challenge activity and explain materials and rules.	PowerPoint M2.2 (slide 19-22) Plastic PET bottles, mesh, cups, water, rubber bands, paper towel, soil, pebbles, sand, leaves, filters, scissors, oil, food colouring, measuring cups, activated charcoal, ink
15 min	00:40	Form groups and encourage students to build and test the water filtration systems. Support groups to undertake testing and scoring	PowerPoint M2.2 (slide 21) Scoresheet M2.2

5 min	**00:45 END**	**Lesson Conclusion** Clean up. Discussion about the session, which filtration materials were most effective.	

Module 2.2 - References:

Drinking Water Treatment Processes, Water Supply, Pathogens

https://www.hunterwater.com.au/Water-and-Sewer/Water-Supply/Water-Treatment-Processes.aspx

https://www.sawater.com.au/community-and-environment/our-water-and-sewerage-systems/water-treatment/conventional-water-treatment-plants

https://www.watercorporation.com.au/home/education/teaching-resources/elearning

http://hsc.sca.nsw.gov.au/biology/water-pathogens

Desalination Facts

http://www.ffc.org.au/FFC_files/desal/Whatisdesalination-factsheet-1.pdf

Solutions and Dissolving

http://www.ducksters.com/science/chemistry/solutions_and_dissolving.php

Osmosis & Reverse Osmosis

http://puretecwater.com/reverse-osmosis/what-is-reverse-osmosis

http://www.science-sparks.com/2015/04/18/osmosis-made-easy/

https://sciencing.com/osmosis-kids-8650496.html

Module 2.2 - Required Materials

- Pens, pencils and writing paper are generally required every session.
- Students may like to bring a note pad to record their observations and ideas.
- A group usually refers to 2 - 4 students.

Activity	Material	Amount	Where can I find it?
All sessions	PowerPoint Slides* (digital, or printed)	1 per coordinator	Coordinator Package
All sessions	Printed PowerPoint* Slide Notes	1 per coordinator	Coordinator Package
All sessions	Printed Lesson Plan	1 per coordinator	Coordinator Package
All sessions	Printed Module 2 Risk Assessment	1	Coordinator Package
All sessions	Computer, Data Projector, Screen	1	Venue
Water Filtration Challenge (All session durations) *Note: Use this list as a guide. Other material may be used instead of, or in addition To, the listed materials.*	Alum (aluminium sulphate)	1 packet / tub (1 teaspoon/group)	Swimming pool supply shops
	Clear cups / jars	1 per group	Supermarket / recycled
	250ml Measuring cups for scoring	2	Supermarket, homewares store
	Rubber bands	1 packet (allow 2 per group)	Supermarket, stationary shop
	1 to 2 Litre plastic PET soft drink / water / juice bottles	1 per group (cut off base)	Recycled, or supermarket
	scissors	4 pairs for session	Supermarket, stationary shop
	stockings	1 to 2 pairs	Recycled, or supermarket
	Rubber bands	2 – 3 per group	Supermarket
	Paper towel	2 – 3 rolls	Supermarket
	Fine sand, rough sand, gravel, pebbles	Approx. 1 cup of each per group	Hardware store, pet store
	Activated charcoal/carbon	1 cup per group	Pet stores, garden supply stores
	Coffee filter paper	2 per group	Supermarket
	Soil	½ cup per group	Hardware / garden supply store
	Water	250ml per group	Supermarket, venue

Required materials list continues on next 2 pages

* PowerPoint Slides have been provided as a Master Slide Set for a 120 minute (or 2 x 60 minute) session duration. Hide/ omit slides as noted in lesson plans for delivery of shorter session durations.

Activity	Material	Amount	Where can I find it?
Experiment 2.2.1 'Muddy Water' (All sessions)	Water	Approx. 2 cups, 500ml per group	Venue, supermarket
	Clear cups / jars	2 per group	Supermarket, recycled or homewares store
	Soil	2 spoonful's per group	Pharmacy or supermarket
	Spoons	2 per group	Supermarket, recycled or homewares store
	Alum (aluminium sulphate)	1 packet / tub (1 teaspoon/group)	Swimming pool supply shops
	Paper towel	1 long roll for session	Supermarket
Experiment 2.2.2 'Salty water' (120 minute session, 2 x 60 minute sessions, 90 minute session)	Water	Approx. 2 cups, 500ml per group	Venue, supermarket
	Clear cups / jars	2 per group	Supermarket, recycled or homewares store
	Salt	½ cup table salt per group	Supermarket
	Pepper (or sand)	1 tablespoon / group	Supermarket
	Spoons	2 per group	Supermarket, recycled or homewares store
Experiment 2.2.3 'Osmosis' (120 minute session, 2 x 60 minute sessions) *Note: Raw potato pieces can be used in place of gummy bears*	Gummy bears	3 per group	Supermarket
	Water	Approx. 300ml per group	Venue, supermarket
	Clear cups / jars	3 per group	Supermarket, recycled or homewares store
	Spoons	1 per group	Supermarket, recycled or homewares store
	Ruler	1 per group	Supermarket, stationary shop
Experiment 2.2.4 Microorganisms (120 minute session, 2 x 60 minute sessions, 90 minute & 75 minute session)	GlitterBug Powder	1 tub (1/8 teaspoon per group)	**See link list over page**
	UV light / torch	1 – 2 per session	**See link list over page**
	Clear cups / jars	2 per group	Supermarket, recycled or homewares store
	Water	Approx. 150ml per group	Venue, supermarket
	Spoons	1 per group	Supermarket, recycled or homewares store
	Paper towel	1 long roll for session	Supermarket

Note:

Some listed materials, for example Alum, cups, jars, and spoons can be re-used for multiple experiments, or, used in both an experiment and the Challenge.

Review the experiments you plan to include, and the required materials for efficiencies, prior to sourcing materials for your session.

Online shopping links:

GlitterBug Powder (From $49.50):

https://glitterbug.net.au

http://www.glowpaint.com.au/blue-uv-black-light-powder/

UV Torch / Light (From $14.95):

https://www.jaycar.com.au/mini-ultra-violet-fluoro-light-w-torch/p/SL3146

https://glitterbug.net.au

http://www.glowpaint.com.au/400nm-12-led-uv-black-light-torch/