Traditional Separation Techniques – Example Teaching Sequence (Year 7)

Chemical sciences

Students explore how Aboriginal and/or Torres Strait Islander Peoples apply their knowledge of **pure substances** and **mixtures** to separate and isolate desired materials. They examine how the physical properties of matter, including particle size, mass, density, and solubility influence the selection of appropriate separation techniques for wet and dry mixtures, including **solutions, suspensions, and colloids**. Students explore specialised techniques such as **yandying, winnowing, filtration, cold pressing** and **heat-based oil extraction**, analysing how these processes demonstrate an understanding that different mixtures require different methods to obtain a pure substance.

Students experiment the efficiency of different fine and coarse natural filters in separating suspended solids from water by using traditional methods to make a sample of dirty water appear clear. Students develop and exhibit a range of **working scientifically** skills, such as **observing, questioning and predicting, planning, conducting experiments, processing data and information, analysing data and information**, and **communicating**. Students recognise that Aboriginal and/or Torres Strait Islander Peoples used these same STEM skills thousands of years ago to understand natural materials and develop efficient and reliable separation techniques. Students see how this Traditional Knowledge of matter and mixtures was utilised to develop efficient and predictable separation techniques.

Before you start:

1. All documents and resources are available via our website: Traditional Separation Techniques education resources.
2. Review the following teacher documents:
    - *Context PPT (Traditional Separation Techniques)* and *Classroom Activities (Traditional Separation Techniques*).
    - *Experiment PPT (Traditional Separation Techniques)*, *Teacher Experiment Procedures (Traditional Separation Techniques)* and *Equipment list and Hazard Planner (Traditional Separation Techniques).*
    - *Curriculum Links (Traditional Separation Techniques).*

3. The classroom activities have been designed to chunk information and to provide opportunities to check understanding.

4. Familiarise yourself with one of the central experiments: *what natural materials are most effective at filtering dirty water?* OR *how does particle size impact coconut oil extraction?* OR *how does particle size impact the intensity of eucalyptus oil aroma during heat-based extraction?*

5. Review the example teaching sequence below and adjust based on the needs of your class. Sixty-minute lessons are assumed in this example.

Lesson	Lesson objectives	Resources	NSW Syllabus
1	• Identify suitable separation techniques for particular mixtures and solutions. • Demonstrate different separation techniques. • Discuss differences between mixtures and solutions.	• *Context PPT (Traditional Separation Techniques)* • *Classroom Activities Guide (Traditional Separation Techniques)*	*SC4-SOL-01*
2	• Define different separation techniques used for mixtures and solutions. • Identify separation techniques used by Aboriginal and/or Torres Strait Islander Peoples for water purification, food preparations and medicines. • Match equipment used in separation techniques with natural materials used traditionally by Aboriginal and/or Torres Strait Islander peoples.	• *Context PPT (Traditional Separation Techniques).* • *Classroom Activities Guide (Traditional Separation Techniques).*	*SC4-SOL-01*

3	**Traditional separation technique experiments:**
	Filtration experiment:
	• Identify the question: w*hat natural materials are most effective at filtering dirty water?*
	  ○ Make hypothesis to guide scientific experiment.
	• Identify independent, dependent, and control variables.
	• Can use the concept of 'fair test' when explaining variables:
	  ○ Outline steps to identify safety risks.
	  ○ Follow a planned procedure to undertake safe and valid experimentation.
	OR
	Oil extraction experiment:
		• *Teacher Experiment Procedures Guide (Traditional Separation Techniques).*
		
		AND:
		• *Equipment List and Hazard Management Guide (Filtering dirty water).*
		• *Student Experiment Procedure and Planner (Filtering dirty water).*
		• *Experiment PPT (Filtering dirty water)*
		OR
		• *Equipment List and Hazard Management Guide (Coconut oil extraction).*
		• *Student Experiment Procedure and Planner (Coconut oil extraction).*
			SC4-WS-03
			SC4-WS-04
			SC4-WS-07

	• Identify the question: h*ow does particle size impact coconut oil extraction?*
	  ○ Make hypothesis to guide scientific experiment.
	• Identify independent, dependent and control variables.
	• Can use the concept of 'fair test' when explaining variables:
	  ○ Outline steps to identify safety risks.
	  ○ Follow a planned procedure to undertake safe and valid experimentation.
	OR
	Eucalyptus oil experiment:
	• Identify the question: h*ow does particle size impact the intensity of eucalyptus oil aroma during heat-based extraction?*
	  ○ Make hypothesis to guide scientific experiment.
	• Identify independent, dependent and control variables.
	• Can use the concept of 'fair test' when explaining variables:
	  ○ Outline steps to identify safety risks.
	  ○ Follow a planned procedure to undertake safe and valid experimentation.
	  ○
		• *Experiment PPT (Coconut oil extraction).*
		OR
		• *Equipment List and Hazard Management Guide (Eucalyptus oil extraction).*
		• *Student Experiment Procedure and Planner (Eucalyptus oil extraction).*
		• *Experiment PPT (Eucalyptus oil extraction).*	

Lesson 1

Prior knowledge: Introduction to states of matter and the particle model.

Learning intentions:

- Discuss the differences between mixtures and solutions.
- Define different separation techniques used for mixtures and solutions.
- Demonstrate different separation techniques.

Success criteria:

- Can describe mixtures and solutions using the particle model.
- Can separate a mixture into its parts.

Resources: See example teaching sequence above on page 3.

Classroom activities

1. Share learning intentions and success criteria.
2. Recap states of matter and particle model.
3. Show what you know:
    a. What have you seen, heard or learnt about atoms, elements, and compounds?
    b. How do atoms, elements, and compounds relate to each other? What are the similarities and differences?
    c. What do you know about mixtures?
    d. How does knowing about atoms, compounds and elements help us understand mixtures?
4. Discussion and note taking – atoms, pure substances and mixtures: Separation Techniques Context PowerPoint slides 3 – 6:
    a. Can you give some examples of homogenous and heterogenous mixtures?
    b. Why might it be important to know that each substance maintains its physical and chemical properties?
5. Classroom Activity 1: Separating solid materials:
    a. What are some of the properties of these materials?
    b. How could the nuts or washers be separated from the rest of the mixture?
    c. How could the polystyrene be separated from the rest of the mixture?
    d. Why could different techniques be used for different types of solids?
6. Discussion and note taking – solutions: Separation Techniques Context PowerPoint slides 7 – 8.
7. Classroom activity 3: Saltwater separation:
    a. What kind of mixture are you making?
    b. What do you know about the properties of salt and water that could help you separate them?
    c. How could the components in salty water be separated?
    d. What is the most efficient way to separate the salt and water?

8. Check your understanding: Separation Techniques Context PowerPoint slides 12 – 16.

Next lesson – Traditional separation methods.

Lesson 2

Prior knowledge: Introduction to mixtures, properties of matter and separation methods.

Learning intentions:

- Identify traditional separation techniques and natural material used by Aboriginal and/or Torres Strait Islander peoples for water purification, food preparations, and medicines.

Success criteria:

- Can describe different separation techniques used for mixtures and solutions.
- Can identify and explain how Aboriginal and/or Torres Strait Islander Peoples use separation techniques in water purification, food preparation and medicines.
- Can match modern laboratory equipment with traditional natural materials used for separation techniques.

Resources: See example teaching sequence above on page 2.

Classroom activities

1. Share learning intentions and success criteria.
2. Recap pure substances, mixtures, properties and separation techniques.
3. Show what you know:
    a. What do you already know about traditional separation and filtering techniques used by Aboriginal and/or Torres Strait Islander Peoples?
4. Discussion and note-taking - Separation Techniques Context PowerPoint slides 17 – 21.
5. Classroom Activity 4: Separating sand from seeds – yandying, handpicking, sieving:
    a. Why is the sand-seed mixture considered a mixture and not a pure substance?
    b. What physical properties allowed you to separate sand and seeds?
    c. How did the separation technique use differences in physical properties to separate the mixture?
    d. Which technique was most effective at separating the components completely? Use evidence from your results to justify your answer.
6. Discussion and note taking – solutions: Separation Techniques Context PowerPoint slides 25 – 28.
7. Check your understanding: Separation Techniques Context PowerPoint slides 29 – 32.
8. Watch ‘Native Secrets’ video - slide 33.
9. Native Secrets video – Check your understanding: Separation techniques PowerPoint slides 34-39.
10. Knowledge check: Separation Techniques Context PowerPoint slide 40.

Next lesson – Traditional separation methods.

Lesson 3

Prior knowledge: introduction to Aboriginal and/or Torres Strait Islander separation techniques.

Learning intentions: (select 3-5)

- Identify the question: what natural materials are most effective at filtering dirty water?
- Make hypothesis to guide scientific experiment.
- Identify independent, dependent, and control variables.
- Can use the concept of 'fair test' when explaining variables.
- Outline steps to identify safety risks.
- Follow a planned procedure to undertake safe and valid experimentation.

Success criteria:

- Can generate a prediction.
- Can safely conduct a practical experiment.

Resources: See example teaching sequence above on page 2.

Safety

- Safety glasses and gloves must be worn at all times.
- Masks are recommended when handling dry propagating sand and/or dry peat moss to reduce inhalation of fine particles.
- Wash hands thoroughly after completing the experiment.
- Conduct the experiment outdoors and in a well-ventilated area.

Classroom activities

1. Review: mixtures, properties of substances, and separation techniques, introduction to Aboriginal and/or Torres Strait Islander traditional separation techniques.
2. Share Learning Intentions and Success Criteria.
3. Introduce experiment question: w*hat natural materials are most effective at filtering dirty water?*

   Encourage students to examine dirty water sample.

   a. What could be in dirty water?
4. What type of mixture is dirty water?
   b. How could you clean dirty water?
   c. What separation techniques could be used for this type of mixture?
   d. If a filter is effective at cleaning dirty water, what would it do?
5. Introduce and discuss filter materials.
   a. How would these filters be used for different purposes?
   b. Which particles in the dirty water would these filters remove?
   c. How are these filters similar or different?
6. Develop experiment hypothesis.

a. Which combination of these natural materials do you think would be most effective at filtering dirty water? Why?

b. How would using more than one type of natural material affect the results?

7. Hand out *Traditional Separation Techniques – Filtering Dirty Water Experiment planner:* record question and hypothesis.

8. Ask the students to suggest how they will determine which filter is the most effective and discuss how valid these measurements would be.

    a. How will we know which filter is the most effective?

    b. How can the clarity of water me measured?

    c. How can the data and observations be quantitative?

9. Define dependent, independent, and control variables:

    a. What will your group change?

    b. What will your group measure?

    c. What data is going to be collected?

    d. How is the data going to be recorded?

    e. How could filtering material affect the experiment?

    f. How could the order in which the filtration process is carried out affect the experiment?

    g. How could the type of impurities in the water affect the experiment?

    h. How could the type of filtration technique used affect the experiment?

    i. How could the amount of water used affect the experiment?

    j. How could the time allowed to filter water affect the experiment?

10. Discuss and record safety considerations.

11. Conduct experiment.

12. Class discussion to begin analysing results.

    a. What cup has the best clarity? Why?

    b. What observations did your group make?

    c. What data did you collect?

    d. How have your observations and data compared to your hypothesis?

13. Facilitate data representation discussion.

    a. What data was collected during observations of the experiment?

    b. How can the data and observations collected during the experiment be represented effectively?

14. Allow time for groups to decide on an effective way to represent data and record onto their *Traditional Separation Techniques Student Experiment Planner*.

    a. What patterns did your group identify from the data?

    b. What natural materials were most effective at filtering dirty water?

15. Conclusion.

    a. Do the results support your hypothesis? Why/why not?

    b. How did different group's observations compare to yours?

16. Explain to students that reflection is an important aspect of the experiment process to identify areas of the experiment that need to be changed or improved. These could include possible changes to the method, equipment list or data-gathering techniques.

    a. What worked well during the experiment? Why?

    b. What challenges did your group encounter during the experiment?

    c. Was it a fair test? Why?

d. What could you change to improve the experiment?

17. Link back to Aboriginal and Torres Strait Islander context:
    a. What does this experiment suggest about Aboriginal and/or Torres Strait Islander Peoples' Knowledge of local environments and ecosystems, particularly in relation to water sources and using natural materials?
    b. How would Knowledge of local plants and soils help determine which materials are safe and appropriate to use when filtering water?
    c. Why is it important that this ecological Knowledge and traditional filtering practice is observed, tested and passed down through generations?
    d. How might Knowledge of Country allow Aboriginal and/or Torres Strait Islander Peoples to choose suitable water sources to use? Can you think of/research what signs would help to decide this?
18. What benefits would this have for communities?
19. Alternatively, teachers may choose one of the following experiments:

    Coconut oil extraction experiment:

    a. Identify the question: How does particle size impact coconut oil extraction?
    b. Make hypothesis to guide scientific experiment.
    c. Identify independent, dependent and control variables.

    OR

    Eucalyptus oil extraction experiment:

    a. Identify the question: h*ow does particle size impact the intensity of eucalyptus oil aroma during heat-based extraction?*
    b. Make hypothesis to guide scientific experiment.
    c. Identify independent, dependent, and control variables.

Next lesson – consider Classroom Activities for suggestion.