Unit Project

Inquiry Investigation
Space Thirst (Student textbook page 232)

Pedagogical Purpose
Through an investigation, students design and test methods to purify water, as astronauts will need to do on long space voyages.

Planning	
Materials	water glucose food colouring plastic or glass containers for samples Other materials as per students' design **BLM 3-27 Unit 3 Inquiry Investigation, Space Thirst** **BLM G-1 Safety Contract** (optional) **BLM G-9 Experimental Design Worksheet** (optional) **BLM A-46 Unit 3 Inquiry Investigation Rubric** (optional)
Time	40–60 min in class 30–40 min preparation
Safety	Remind students to never eat or drink anything in science class. Depending on students' investigation design, you may wish to have water and glass clean-up kits available. You may also wish to spend some time reminding students of safe lab practices. Some students may wish to use chlorine bleach for water purification. Chlorine bleach is very toxic and corrosive. A teacher demonstration is recommended.

Skills Focus
- identify and locate sources
- apply knowledge and understanding of safe practices and procedures
- conduct inquiries
- gather data
- analyze information gathered
- draw conclusions

Background Knowledge
NASA has been working hard to develop water recycling/purification systems for space exploration. Students can research NASA's efforts at **www.scienceontario.ca**.

Activity Notes and Troubleshooting
- Have students work in groups for this investigation.
- If you have not already provided this blackline master to students, you may wish to use **BLM G-1 Safety Contract** to remind students of safe laboratory practices.
- You may wish to have students use **BLM G-9 Experimental Design Worksheet** to help them organize their thinking.
- Students may take a number of different approaches to this investigation, such as filtering or boiling their water sample. Any reasonable approach should be permitted.
- Encourage students to spend some time researching purification methods before they begin planning their invesigation. See **www.scienceontario.ca**.
- You may wish to use **BLM A-46 Unit 3 Inquiry Investigation Rubric** to evaluate students' work for this assignment.

Additional Support

- Ensure that groups are made up of a balance of different intelligences.
- ELL Encourage English language learners to use graphic organizers or diagrams to help them express their ideas for designing an investigation.

Rubric

ACHIEVEMENT CHART CATEGORY	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding	Student developed a list of methods of purifying waste water with limited accuracy.	Student developed a list of methods of purifying waste water with some accuracy.	Student developed a list of methods of purifying waste water with considerable accuracy.	Student developed a highly accurate list of methods of purifying waste water.
Thinking and Investigation	Student wrote a plan with limited accuracy and clarity.	Student wrote a plan with some accuracy and clarity.	Student wrote a plan with considerable accuracy and clarity.	Student wrote a plan with a high degree of accuracy and clarity.
	Student conducted the investigation, carrying out the procedure safely and recording data accurately with limited effectiveness.	Student conducted the investigation, carrying out the procedure safely and recording data accurately with some effectiveness.	Student conducted the investigation, carrying out the procedure safely and recording data accurately with considerable effectiveness.	Student conducted the investigation, carrying out the procedure safely and recording data accurately in a highly effective manner.
	Student evaluated the success of the purification process and proposed possible improvements to the design with limited effectiveness.	Student evaluated the success of the purification process and proposed possible improvements to the design with some effectiveness.	Student evaluated the success of the purification process and proposed possible improvements to the design with considerable effectiveness.	Student evaluated the success of the purification process and proposed possible improvements to the design with a high degree of effectiveness.
	Student identified sources of uncertainty with limited accuracy.	Student identified sources of uncertainty with some accuracy.	Student identified sources of uncertainty with considerable accuracy.	Student identified sources of uncertainty with a high degree of accuracy.
Communication	Student organized information with limited effectiveness.	Student organized information with some effectiveness	Student organized information with considerable effectiveness.	Student organized information with a high degree of effectiveness.
	Student communicated information for selected audience and purpose with limited effectiveness.	Student communicated information for selected audience and purpose with some effectiveness.	Student communicated information for selected audience and purpose with considerable effectiveness.	Student communicated information for selected audience and purpose with a high degree of effectiveness.
Application	Student made connections between results and waste water recycling with limited effectiveness.	Student made connections between results and waste water recycling with some effectiveness.	Student made connections between results and waste water recycling with considerable effectiveness.	Student made connections between results and waste water recycling with a high degree of effectiveness.

Please also see **BLM A-46 Unit 3 Inquiry Investigation Rubric**.

An Issue to Analyze
The Costs and Benefits of Space Travel (Student textbook page 233)

Pedagogical Purpose

Students will learn the various viewpoints on the issue of space exploration and discuss the pros and cons.

Planning	
Materials	Internet access **BLM 3-28 Unit 3 An Issue to Analyze, The Costs and Benefits of Space Travel** **BLM G-13 Citing Sources** (optional) **BLM A-47 Unit 3 An Issue to Analyze Rubric** (optional)
Time	60–90 min in class 30–40 min preparation (for a list of information needed)

Skills Focus

- identify and locate sources
- conduct inquiries
- gather data
- analyze information gathered
- draw conclusions

Background

Students have already been exposed to the pros and cons of space exploration. You may wish to have them review their notes from questions 1 and 2 of the Starting Point Activity on page 221 of Topic 3.5, and Activities 3.15 and 3.16, on pages 224 and 225.

Activity Notes and Troubleshooting

- Students have already likely formed opinions on the pros and cons of space exploration. Encourage them to review their notes before proceeding with their research.
- You might provide copies of **BLM G-13 Citing Sources** for students to compile their research sources for this project.
- Have students take a position contrary to their own opinion for this activity to allow them the opportunity to understand another point of view.
- Students can conduct an informal debate procedure when they have completed their reports. Ensure that students understand appropriate and respectful debate behaviour before proceeding.
- You may wish to use **BLM A-47 Unit 3 An Issue to Analyze Rubric** to evaluate students' work for this assignment.

Additional Support

- DI Ensure that groups are made up of a balance of different intelligences.
- ELL Have students review their notes from Activities 3.15 or 3.16, on pages 224 and 225, for ideas on the pros and cons of space exploration. You may wish to have a brief review or discussion on the pros and cons to help English language learners understand the context of this activity.

Rubric

ACHIEVEMENT CHART CATEGORY	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding	Student demonstrates limited knowledge of space travel technologies.	Student demonstrates some knowledge of space travel technologies.	Student demonstrates considerable knowledge of space travel technologies.	Student demonstrates a high degree of knowledge of space travel technologies.
Thinking and Investigation	Student used few resources to investigate cost and benefits of space travel technologies.	Student used some resources to investigate cost and benefits of space travel technologies.	Student used a variety of resources to investigate cost and benefits of space travel technologies.	Student used many resources to investigate cost and benefits of space travel technologies.
Communication	Student summarized research, using appropriate scientific vocabulary, with limited effectiveness, creativity, and clarity.	Student summarized research, using appropriate scientific vocabulary, with some effectiveness, creativity, and clarity.	Student summarized research, using appropriate scientific vocabulary, with considerable effectiveness, creativity, and clarity.	Student summarized research using appropriate scientific vocabulary, with a high degree of effectiveness, creativity, and clarity.
	Student did not provide a summary of information.	Student provided a summary of information.	Student summarized information in a T-chart.	Student summarized information in a thorough, organized T-chart.
Application	Student did not make a recommendation for space travel technologies based on supporting evidence.	Student made a recommendation for space travel technologies without supporting evidence.	Student made a recommendation for space travel technologies based on supporting evidence.	Student made a detailed recommendation for space travel technologies based on supporting evidence.

Please also see **BLM A-47 An Issue to Analyze Rubric**.