Sample of Grade 11 Inquiry Task

Developing Extended Response (ER) Tasks as NON-Investigations

The purpose of this section is to provide a sample of what grade 11 NON-investigations might look like, using the Tri-State Planning Guide for NON-Investigations as a model for ER task design.

Sample Grade 11 Investigation – "What's Causing the Changes to this Lake Huron Feeder Stream?"

In this extended response task, students are asked to use a case study of a stream that feeds Lake Huron to graph and analyze data, make interpretations and predictions, and make connections to real-world phenomena related to causes of environmental disturbances and their effects on ecosystems.

Grade Level: 11
Extended Response Task: "What's Causing the Changes to this Lake Huron Feeder Stream?" **Assessment**
Item Types: SAs and 3-CRs

Testing Session: 3

Alignment to INQ Assessment Target(s):
FOCUS: LS2 (9-**11**) INQ+SAE -**3**
Using data from a specific ecosystem, explain relationships or make predictions about how environmental disturbance (human impact or natural events) affects the flow of energy or cycling of matter in an ecosystem

RELATED CONTENT: LS2 (9-**11**) POC+ SAE –**4**
Trace the cycling of matter (e.g., carbon cycle) and the flow of energy in a living system from its source through its transformation in cellular, biochemical processes (e.g., photosynthesis, cellular respiration, fermentation)

Depth of Knowledge: Levels 1, 2, and 3

Source: Adapted from *Science IV: Essential Interactions,* (Chapter 4, pages 112- 151: Sustaining Aquatic Habitats) Centre Pointe Learning, Inc., 2001, and *Science Exemplars*, Preview Kit (pages 1-14), "What's Causing the Changes in pH?" www.exemplars.com.

Sample High School ER Task: "What's Causing the Changes to this Lake Huron Feeder Stream?"

In this task, you will answer questions to show what you have learned about ecosystems, the flow of energy and cycling of matter in ecosystems, and the analysis and interpretation of data. Read the questions carefully and answer them completely, using data or examples to support your responses.

Part 1:
You have learned that there are many biotic and abiotic factors that affect the flow of energy and cycling of matter in ecosystems.

1. Use what you know about the flow of energy in an ecosystem to explain the specific concepts and processes that allow water plants to survive and thrive in freshwater ecosystems. Be sure to start with the energy source and trace it through its major transformations, including photosynthesis and cellular respiration. You may use diagrams with explanations in your response.

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Item type: CR (3 points)

Background Knowledge about Content
LS2 (9-**11**) POC+ SAE –**4**
Trace the cycling of matter (e.g., carbon cycle) and the flow of energy in a living system from its source through its transformation in cellular, biochemical processes (e.g., photosynthesis, cellular respiration, fermentation)

DOK 1 - Recall or recognize a fact, term, definition, simple procedure (such as one step), or property Represent in words or diagrams a scientific concept or relationship
DOK 2 - Specify and explain the relationship between facts, terms, properties, or variables

Case Study of a Lake Huron Feeder Stream*

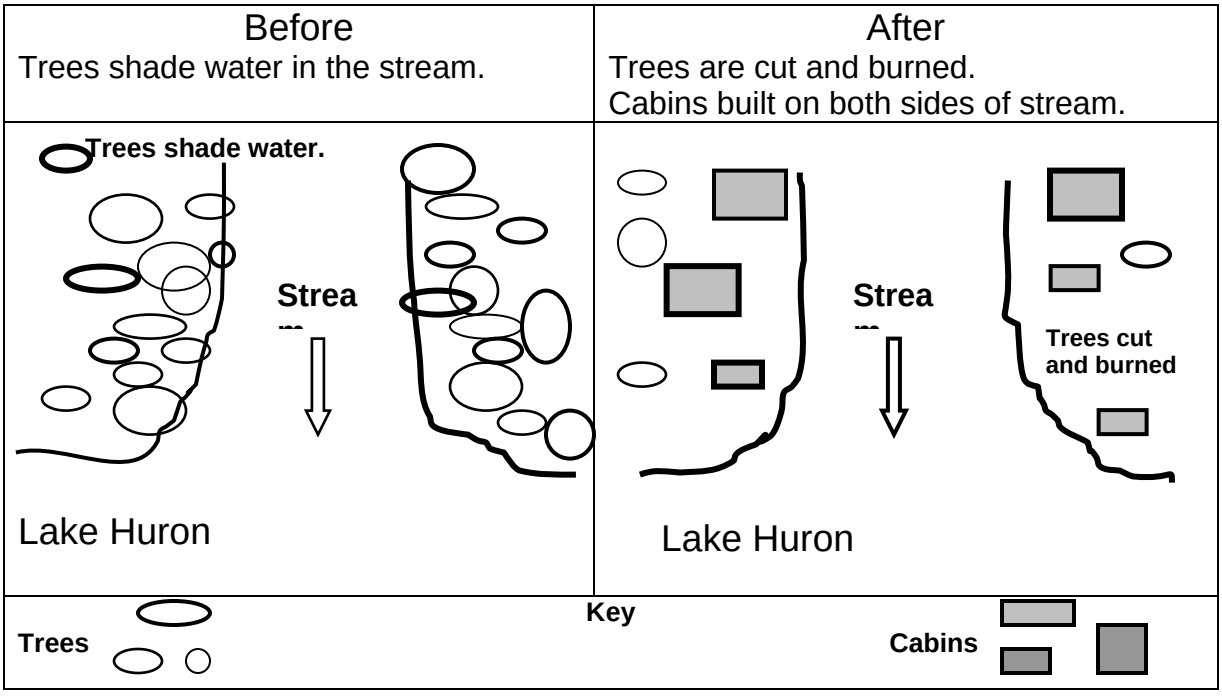
The Great Lakes are the largest surface freshwater system on Earth, covering an area of approximately 244,000 square km. These five lakes provide drinking water and water for industrial use, transportation, fishing, and recreational activities. Lake Huron is one the Great Lakes; it borders the state of Michigan and the province of Ontario, Canada.

At one time, a stream flowing into Lake Huron was a prime location for fishing and boating. This made it a perfect location for development, as well. A developer cleared most of the trees to make room to build cabins on both sides of the stream. Many of these trees that once provided shade for the water in the stream, were stacked in piles and burned.

Plant growth in the stream soon increased, which made boating increasingly difficult. The developer attempted to address the problem by spraying herbicides on the plants. Many plants died, but soon fishing in the stream was also negatively affected.

The diagram below shows before and after views of the stream.

* Source: *Science IV: Essential Interactions,* (pages 126-128- Sustaining Aquatic Habitats) Centre Pointe Learning, Inc., 2001

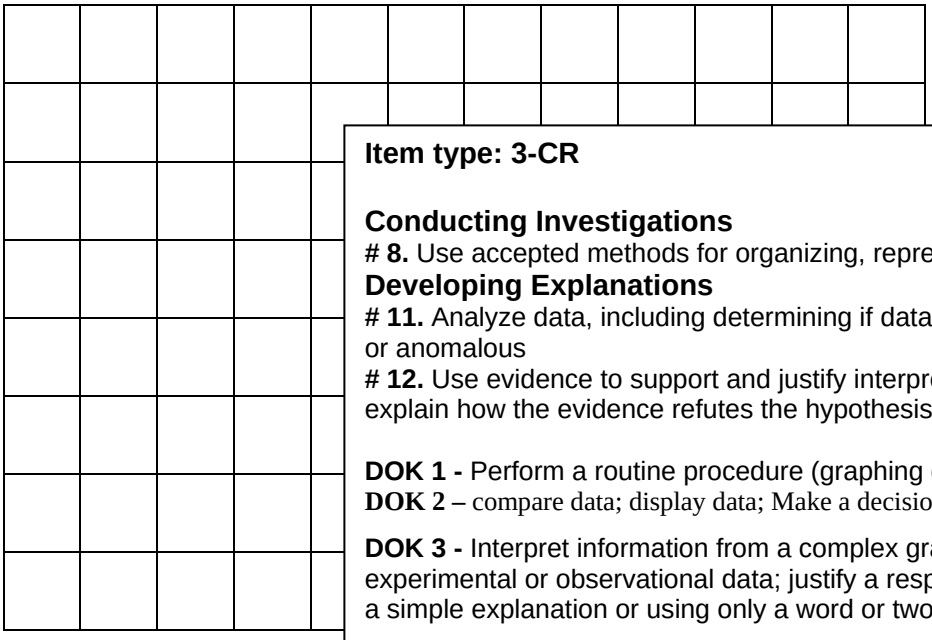


Numerous tests were conducted in order to collect data before and after the developer began to remove trees along the stream banks in order to build cabins. The data from the results of those tests are presented in the table below.

Table 1: Test results before and after deforestation along the Lake Huron feeder stream
(Data Source: *Science IV: Essential Interactions,* (page 128 - Sustaining Aquatic Habitats) Centre Pointe Learning, Inc., 2001

Data collection Tests	Before removal of trees	1 year after tree removal	5 years after tree removal
Mean temperature (°C) in June	12	15	17
Mean water depth	1.5	1.2	1.1
Mean dissolved oxygen (ppm) in June	7.8	5.5	5.1
Phosphates (ppm)	0.2	3.6	2.5
Nitrates (ppm)	0.1	1.2	0.6
Inorganic solids (g/L)	0.1	1.6	1.3

2a. Use the grid below to construct a graph (bar or line) of the data from the table to show changes in mean dissolved oxygen, phosphate, and nitrate levels. You will then analyze the data in order to explain how and why these levels changed. Be sure to label each axis and each data set clearly.



Item type: 3-CR

Conducting Investigations
 # 8. Use accepted methods for organizing, representing, and manipulating data
Developing Explanations
 # 11. Analyze data, including determining if data are relevant, artifact, irrelevant, or anomalous
 # 12. Use evidence to support and justify interpretations and conclusions or explain how the evidence refutes the hypothesis

DOK 1 - Perform a routine procedure (graphing data – line or bar graph)
DOK 2 – compare data; display data; Make a decision as to how to approach a problem

DOK 3 - Interpret information from a complex graph; Form conclusions from experimental or observational data; justify a response; Explain thinking (beyond a simple explanation or using only a word or two to respond)

2b. Researchers did not find evidence of fertilizer use of other non-point source pollution during this time that might have contributed to the changes in nitrate and phosphorous levels. Use the data from your graph and data from Table 1 to describe how the nitrate and phosphorous levels in the stream changed over this period of time. Provide an explanation about what probably caused these changes to occur after the trees were cut down.

3. Using the data provided, predict what effect these changes might have on plants and animals in the stream ecosystem during the next five years.

Item type: 3-CR

Formulating Questions & Hypothesizing
 # 1. Analyze information for the purpose of formulating a question, prediction /hypothesis
 # 2. Construct coherent argument in support of a question, hypothesis, and prediction

DOK 2 or 3 depending on complexity of argument
DOK 2 – Specify and explain the relationship between facts, terms, properties, or variables
DOK 3 – Form conclusions from experimental or observational data; justify a response; Explain thinking (beyond a simple explanation or using only a word or two to respond)

4. Design an investigation to test your prediction that includes: your hypothesis; data that needs to be collected; tools, methods, and procedures for controlling variables and collecting sufficient data; and a rationale for this experimental design. You may use diagrams with explanations in your response.

Item type: 3-CR

Planning & Critiquing Investigations
#4. Identify information/evidence that needs to be collected in order to answer the question, hypothesis, and prediction
#5. Develop an organized and logical approach to investigating the question, including controlling variables
#6. Provide reasoning for appropriateness of materials, tools, procedures, and scale used in the investigation

DOK 2 – Make a decision as to how to approach the problem
DOK 3 –Explain thinking (beyond a simple explanation or using only a word or two to respond); Identify research questions and design investigations for a scientific problem

5. Using the data provided, explain how changes in water depth, temperature, and dissolved oxygen relate to one another.

Item type: 3-CR

Developing Explanations
#10 Summarize results based on data
12. Use evidence to support and justify interpretations and conclusions or explain how the evidence refutes the hypothesis
#13. Communicate how scientific knowledge applies to explain results, propose further investigations, or construct and analyze alternative explanations

DOK 2 – Make a decision as to how to approach the problem; Specify and explain the relationship between facts, terms, properties, or variables
DOK 3 –Explain thinking (beyond a simple explanation or using only a word or two to respond); Form conclusions from experimental or observational data; justify a response;

6. Speculate about what things might reverse these changes in the stream and how they might impact the ecosystem.

Item type: 3-CR

Developing Explanations
#10 Summarize results based on data
12. Use evidence to support and justify interpretations and conclusions or explain how the evidence refutes the hypothesis
#13. Communicate how scientific knowledge applies to explain results, propose further investigations, or construct and analyze alternative explanations

DOK 2 – Make a decision as to how to approach the problem; Specify and explain the relationship between facts, terms, properties, or variables
DOK 3 –Explain thinking (beyond a simple explanation or using only a word or two to respond); Form conclusions from experimental or observational data; justify a response;