



**NEW ENGLAND
COMMON ASSESSMENT PROGRAM**

**Released Items
Support Materials
2012**

**Grade 11
Science**

**NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE**

Grade 11 Science Released Item Information

Item Number	Big Idea ¹	Assessment Target	Depth of Knowledge Code	Item Type ²	Answer Key	Total Possible Points
1	INQ	PS 1-1	2	MC	B	1
2	SAE	PS 2-6	2	MC	D	1
3	SAE	PS 2-7	1	MC	D	1
4	POC	ESS 1-1	2	MC	D	1
5	POC	ESS 1-3	2	MC	D	1
6	SAE	ESS 3-7	1	MC	D	1
7	FAF	LS 1-1	2	MC	A	1
8	POC	LS 1-2	1	MC	D	1
9	INQ	LS 3-8	2	MC	D	1
10	SAE	LS 1-1	3	CR		4

Grade 11 Science Released Inquiry Task Information

Item Number	Big Idea ¹	Inquiry Construct	Depth of Knowledge Code	Item Type ²	Total Possible Points
1	INQ	1	3	SA	2
2	INQ	8	2	CR	3
3	INQ	10	2	SA	2
4	INQ	5	3	CR	3
5	INQ	11	2	SA	2
6	INQ	2	3	CR	3
7	INQ	12	3	CR	3

¹Big Idea: NOS = Nature of Science, SAE = Systems and Energy, MAS = Models and Scale, POC = Patterns of Change, FAF = Form and Function, INQ = Scientific Inquiry

²Item Type: MC = Multiple Choice, CR = Constructed Response, SA = Short Answer

**NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE**

PS1 (9–11) INQ-1 Students will use physical and chemical properties as determined through an investigation to identify a substance.

- 1 The table below shows the densities of four metals.

Metal Densities

Metal	Density (g/cm³)
Magnesium	1.7
Aluminum	2.7
Iron	7.8
Lead	11.3

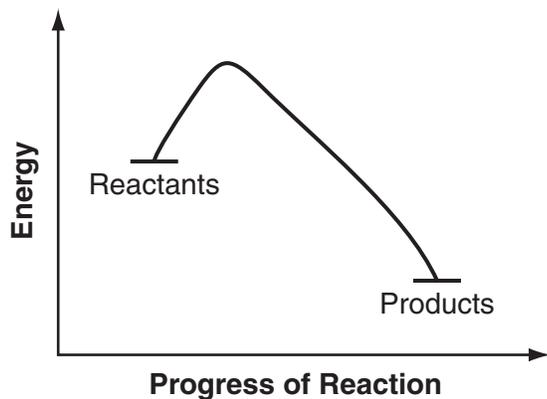
A student has four rods, each made from one of the metals listed in the table. Which additional set of data will allow the student to identify the rods using the table?

- A. the color and mass of each rod
- B. the mass and volume of each rod
- C. the volume and length of each rod
- D. the length and shape of each rod

NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE

PS2 (9–11) SAE-6 Students will, using information provided about chemical changes, draw conclusions about and explain the energy flow in a given chemical reaction (e.g., exothermic reactions, endothermic reactions).

- 2 The graph below shows the change in energy that occurs during a chemical reaction.



Which of the following is **most likely** to happen as the reaction nears completion?

- A. The energy level of the reactants remains constant.
- B. The energy level of the reactants increases gradually.
- C. The reaction takes in energy from its surroundings.
- D. The reaction releases energy to its surroundings.

**NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE**

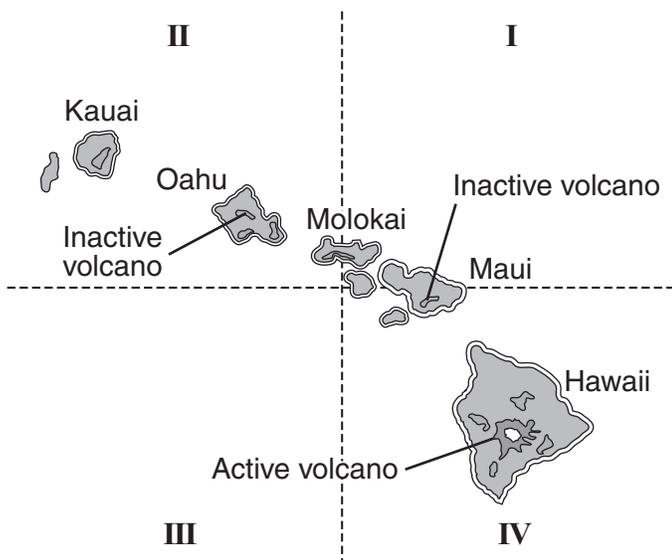
PS2 (9–11) SAE-7 Students will explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles.

- 3 Which statement **best** describes a relationship between electricity and magnetism?
- A. Electric currents weaken magnetic fields.
 - B. There can be no magnetic fields without electric currents.
 - C. Electric currents can demagnetize permanent magnets.
 - D. Changing magnetic fields can create electric currents.

NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE

ESS1 (9–11) POC-1 Students will, provided with geologic data (including movement of plates) on a given locale, predict the likelihood for an Earth event (e.g., volcanos, mountain ranges, islands, earthquakes, tides, tsunamis).

- 4 The Hawaiian Islands formed as the lithosphere moved over a hot spot.



In which region will another island **most likely** form in the future?

- A. region I
- B. region II
- C. region III
- D. region IV

**NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE**

ESS1 (9–11) POC-3 Students will explain how internal and external sources of heat (energy) fuel geologic processes (e.g., rock cycle, plate tectonics, sea floor spreading).

Please use the Plate Movements diagram on the reference sheet to answer the question.

- 5** Black smokers vent superheated water and minerals onto the ocean floor. Tall chimneys of solidified minerals develop around these vents.

Black smokers are located **most likely** in which region of Earth's plate boundaries?

- A. the Eurasian and African Plates
- B. the Nazca and South American Plates
- C. the North American and Pacific Plates
- D. the South American and African Plates

ESS3 (9–11) SAE-7 Students will, based on the nature of electromagnetic waves, explain the movement and location of objects in the universe or their composition (e.g., red shift, blue shift, line spectra).

- 6** A source of light is moving toward an observer. What can the observer detect?
- A. The speed of the light is increasing.
 - B. The energy of the light is growing less intense.
 - C. The wave crests of the light are spreading apart.
 - D. The wavelength of the light is becoming shorter.

**NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE**

LS1 (9–11) FAF-1 Students will use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multi-cellular organism needs for survival (e.g., protein synthesis, DNA replication, nerve cells).

- 7** If a single-celled saltwater organism is placed in freshwater, it will not be able to survive.

Which statement explains why this is true?

- A. The organism's cell will absorb too much water through osmosis.
- B. The organism's cell will release too many hydrogen ions through diffusion.
- C. The organism's cell will release too much water through facilitated diffusion.
- D. The organism's cell will absorb too many sodium ions through osmosis.

LS1 (9–11) POC-2 Students will explain or justify with evidence how the alteration of the DNA sequence may produce new gene combinations that make little difference, enhance capabilities, or can be harmful to the organism (e.g., selective breeding, genetic engineering, mutations).

- 8** Which change is the primary effect of a DNA mutation?

- A. coding for a new carbohydrate
- B. coding for a new lipid
- C. coding for a different kind of nucleic acid
- D. coding for a different protein

**NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE**

LS3 (9–11) INQ-8 Students will, given information about living or extinct organisms, cite evidence to explain the frequency of inherited characteristics of organisms in a population, OR explain the evolution of varied structures (with defined functions) that affected the organisms' survival in a specific environment (e.g., giraffe, wind pollination, or flowers).

- 9 Monarch butterflies are poisonous and bad-tasting to birds. Viceroy butterflies have developed a color pattern similar to that of monarch butterflies but are tasty to birds.

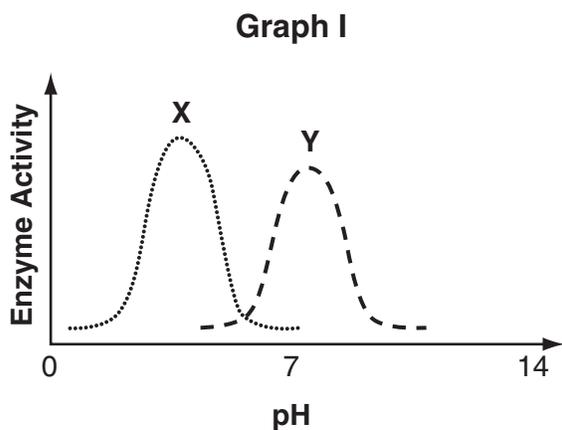
How might the similar appearance of the two types of butterflies be a **disadvantage** to monarch butterflies?

- A. Both types of butterflies will be unable to determine mates in their own species because the two types look so much alike.
- B. The increased number of viceroy butterflies will cause a decrease in the food supply available for monarch caterpillars.
- C. Birds might develop resistance to the poison in monarch butterflies and start eating both types of butterflies.
- D. Birds might mistake monarch butterflies for viceroy butterflies and start attacking more monarch butterflies.

NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE

LS1 (9–11) SAE-1 Students will use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multi-cellular organism needs for survival (e.g., protein synthesis, DNA replication, nerve cells).

- 10 Enzymes are biological catalysts that require specific environmental conditions for proper functioning. The graph below shows the activity of enzymes X and Y.



- Use data from the graph to describe the environmental condition each enzyme needs for proper functioning.
- Identify which enzyme is **most likely** found in a human stomach. Explain your reasoning.

**NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE**

Scoring Guide

Score	Description
4	The response demonstrates a thorough understanding of using data to explain how specific cell organelles regulate what the cell needs. The response uses data from a graph to describe in detail the environmental condition enzymes X and Y need for proper functioning. The response also identifies which enzyme is most likely found in a human stomach and explains the answer in detail.
3	The response demonstrates a general understanding of using data to explain what a cellular organism needs for survival. The overall response is general.
2	The response demonstrates a limited understanding of using data to explain what a cellular organism needs for survival. The overall response is limited.
1	The response demonstrates a minimal understanding of using data to explain what a cellular organism needs for survival. The overall response is minimal.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response

Training Notes:

a. A thorough response can be exemplified by the following sample response:

The graph shows that enzyme functioning is affected by the pH of its environment. Enzyme X is most effective in an acid environment (or high H⁺ ions or pH of about 4). Enzyme Y is most effective in a neutral (or pH of about 7) or slightly basic environment. [The response may include a statement about the graph such as the graph shows that the maximum enzyme activity peaks at different pH levels for Enzyme X and Enzyme Y.]

b. A thorough response can be exemplified by the following sample response:

Enzyme X is most likely found in the stomach because Enzyme X has its maximum activity in an acidic environment and the stomach produces HCl, which is an acid needed for digestion.

NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE

SCORE POINT 4

- 10 The X enzyme functions its best at lower pH levels. The Y enzyme does best at a moderate pH level. The X enzyme therefore needs a more acidic environment while the Y enzyme needs one that is neither basic nor acidic. The X enzyme would be found in a human stomach because our stomachs have acid in them to digest food.

The response includes a correct range of environmental conditions at which Enzymes X and Y function with reference to the graph. The response also correctly identifies Enzyme X as the enzyme most likely found in the stomach and explains why in sufficient detail, including a connection between the pH scale and acidity.

NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE

SCORE POINT 3

10 a. X needs a pH of 1-7 and Y needs a pH of 5-10. X does best around 5 and Y does best around 7.

b. X because the pH in the stomach is low.

The response gives a broad range of pH values for each enzyme given; however, it does name the pH values at which each enzyme functions best. In part (b), there is a correct connection between Enzyme X and the stomach; however, the response does not connect the idea of acidity to the pH range given for Enzyme X on the graph.

NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE

SCORE POINT 2

- 10 Enzyme X needs to be in an environment with a pH scale of 0-7. The most active it will be would be in an environment with a pH scale of 4.
- Enzyme Y would need to be in an environment with a pH scale of 4-11. The most active it will be would be in an environment with a pH scale of 8.
- I believe enzyme Y would more likely be found in the human stomach because the human stomach is very acidic and 8 is more acidic than 4.

The response demonstrates a limited understanding of the relationship between enzyme function and the pH scale. The response correctly identifies a broad range of pH functionality for each enzyme; however, the response reverses the pH scale and suggests that pH 8 is more acidic than pH 4.

NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE

SCORE POINT 1

10

(A) The pH most change

(B) X → we need more enzyme activity to help break down & digest food.

The response demonstrates a minimal understanding of the environmental conditions needed for proper functioning of these enzymes. This response receives credit for determining the correct enzyme that would function in the human stomach. Part (a) of the question was never addressed; part (b) needs more detail about how the student came to choose this enzyme with support from the graph.

NECAP 2012 RELEASED ITEMS
GRADE 11 SCIENCE

SCORE POINT 0

- 10 a) Each enzyme needs kind of the same environmental conditions. The better the environmental condition the better the enzyme activity because it needs a healthy environment to produce a healthy enzyme.
- b) The enzyme most likely found in a human stomach is enzyme y.

The response does not use specific data from the graph to answer part (a). Part (b) had an incorrect choice of enzyme with no explanation included.

**NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Broad Area of Inquiry: Inquiry Construct 1:	Formulating Questions and Hypothesizing Analyze information from observations, research, or experimental data for the purpose of formulating a question, hypothesis, or prediction.
--	---

- 1 Write a hypothesis about what causes some fish to have higher mercury concentrations than other fish. Explain your reasoning.

Scoring Guide

Score	Description
2	The response demonstrates a general understanding of how to analyze information from data for the purpose of formulating a hypothesis. The response includes a hypothesis about what causes some fish to have higher concentrations of mercury than other species and explains the reasoning.
1	The response demonstrates a limited understanding of how to analyze information from experimental data for the purpose of formulating a hypothesis.
0	The response does not contain any correct elements or is irrelevant.
Blank	No response

Training Notes:

Sample responses:

- Mercury concentration in fish will increase with increasing trophic level because as the trophic level increases the prey eaten is higher on the food chain. This food will have more mercury than the food in a lower trophic level.
- Mercury concentration in fish will increase with increasing length and weight because bigger fish are probably older than smaller fish and so have been accumulating mercury in their body for a longer period of time.
- Mercury concentration in fish will increase with increasing mercury pollution in the body of water. Organisms that live in water that has a lot of mercury will most likely ingest more mercury than those in water that doesn't have much mercury.

Training notes:

To receive full credit the response must include

- a statement that can be reasonably investigated by research (Internet, books, magazines, newspapers).
- a cause-effect relationship between mercury levels in fish and the idea of increasing mercury accumulation in organisms. This relationship may be either directly stated or implied.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 2

- ① predatory fish may have higher mercury levels than those fish who eat plants alone. Although plant eating fish may ingest small levels of mercury which results from soil pollution, predatory fish ingest much higher levels of mercury as a result of their own nature. They take on all mercury content of those fish they ingest

The response offers a reasonable hypothesis and contains a general explanation for the reasoning behind the hypothesis.

SCORE POINT 1

- ① If a fish is at the top of the food web, it will have a higher mercury concentration.

The response offers a reasonable hypothesis without explanation for the reasoning behind the hypothesis.

SCORE POINT 0

- ① Ones exposed to different chemicals

The response contains no correct or relevant information.

**NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Broad Area of Inquiry: Inquiry Construct 8:	Conducting Investigations Use accepted methods for organizing, representing, and manipulating data.
--	---

- 2 Use the data in Figure 2 to graph the mercury concentration of the organisms in each **trophic level**. Be sure to include all the required elements of a graph.

Scoring Guide

Score	Description
3	The response demonstrates a thorough understanding of how to use accepted methods for representing data. The response includes a graph of the mercury concentration for each trophic level as given in the data in Figure 2. The graph includes all the appropriate information.
2	The response demonstrates a general understanding of how to use accepted methods for representing data.
1	The response demonstrates a limited understanding of how to use accepted methods for representing data.
0	The response does not contain any correct elements or is irrelevant.
Blank	No response

Training Notes:

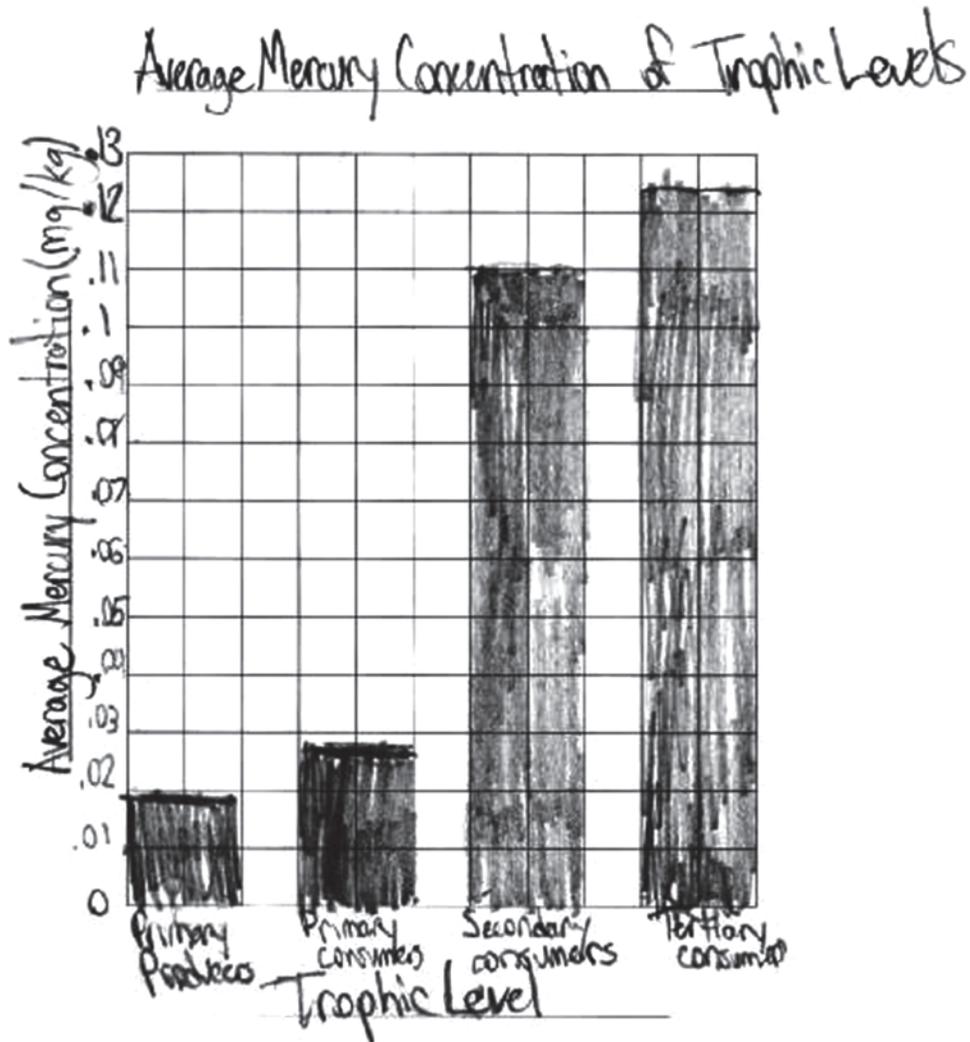
To receive full credit the response must

- be a bar graph.
- be properly titled (effect of the independent variable on the dependent variable) with axes clearly and correctly labeled.
- have units clearly denoted such that graph can be accurately interpreted (unit values obvious and spacing between values relatively proportional per data).

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 3

2

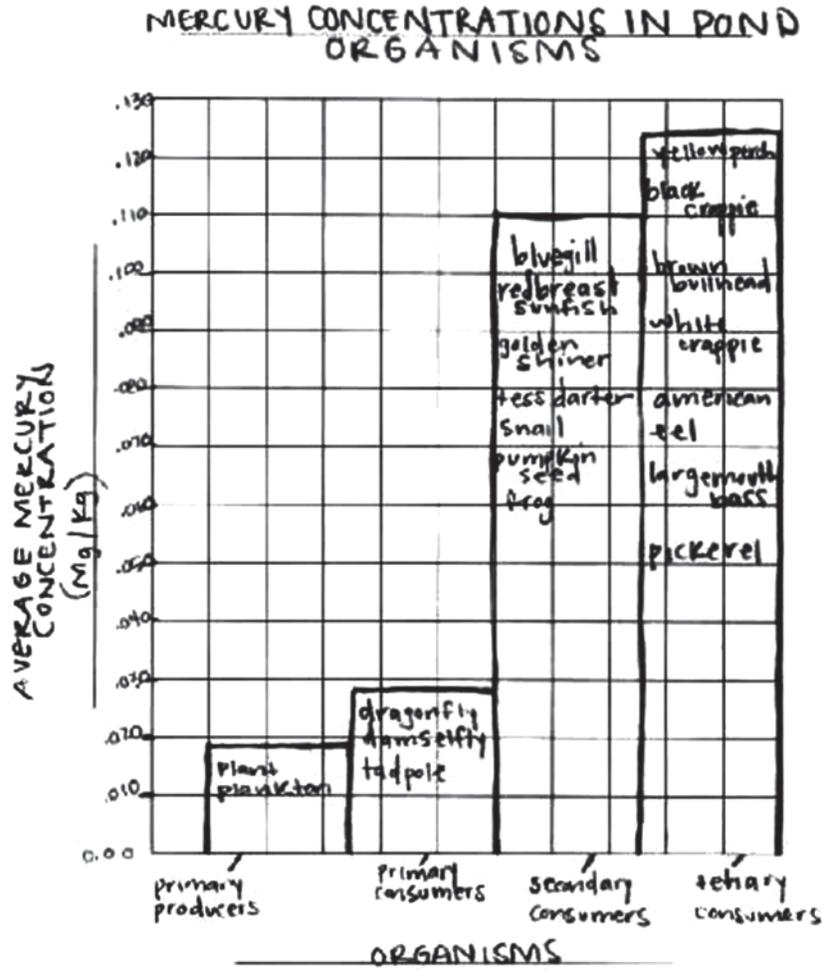


The response shows a properly titled bar graph with data and variables correctly represented. The axes are clearly labeled with the correct units.

NECAP 2012 RELEASED INQUIRY TASK
 GRADE 11 SCIENCE

SCORE POINT 2 (EXAMPLE A)

2



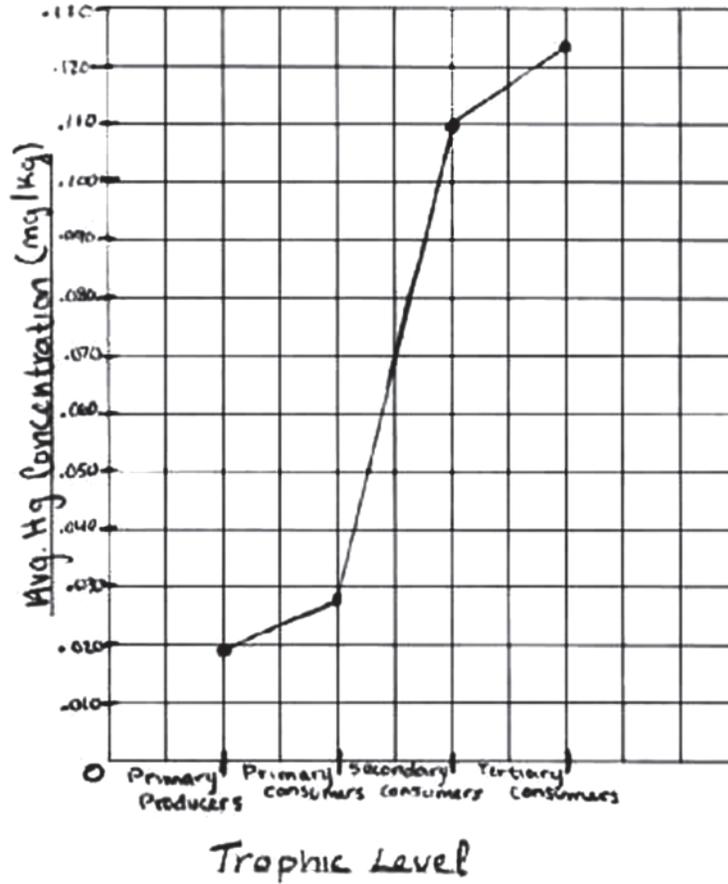
The response shows the data clearly and accurately and contains proper labels and units; however, this is a histogram, not a bar graph.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 2 (EXAMPLE B)

2

Hg Concentrations in Pond Organisms

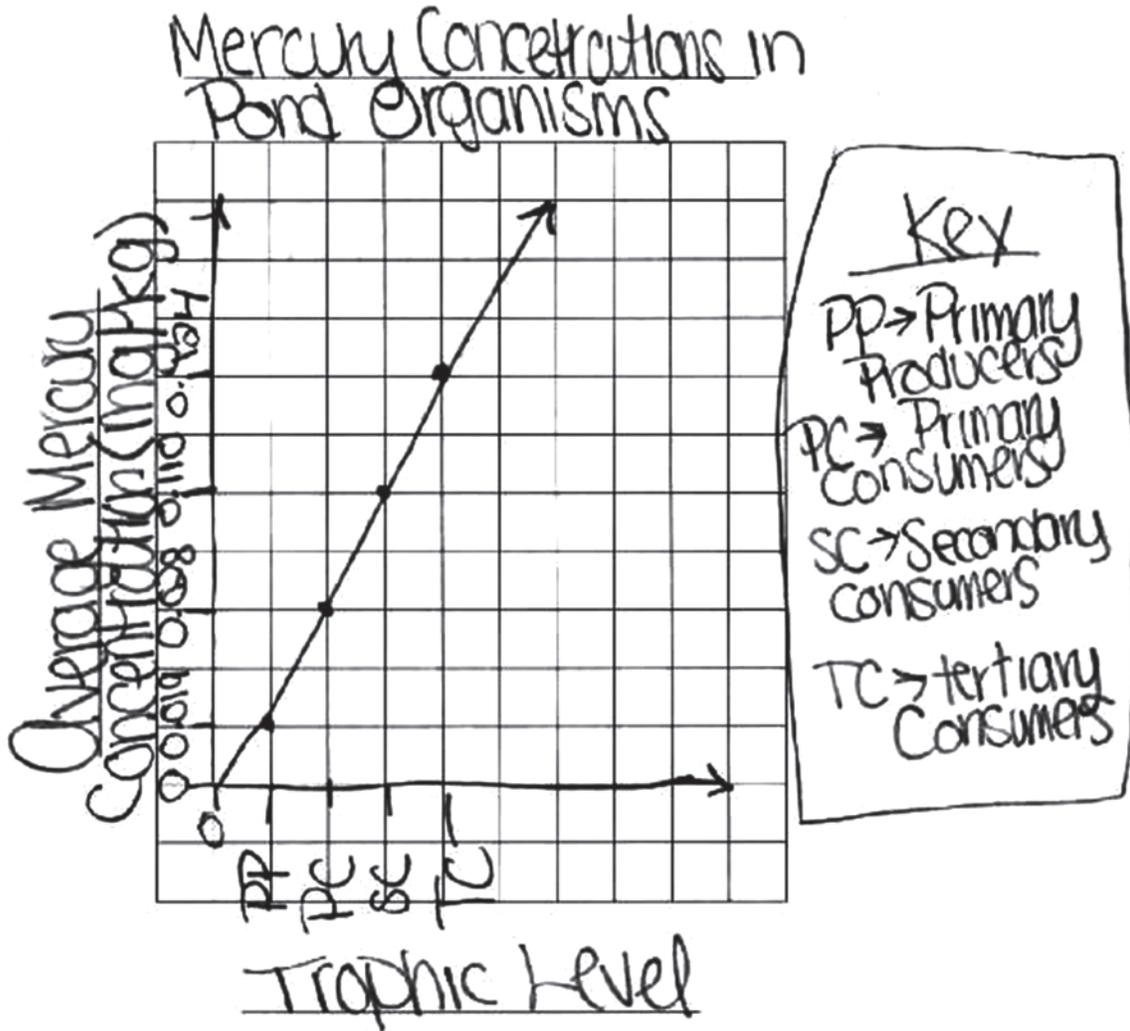


The response shows the data clearly and accurately and contains proper labels and units; however, this is a line graph, not a bar graph.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 1

2



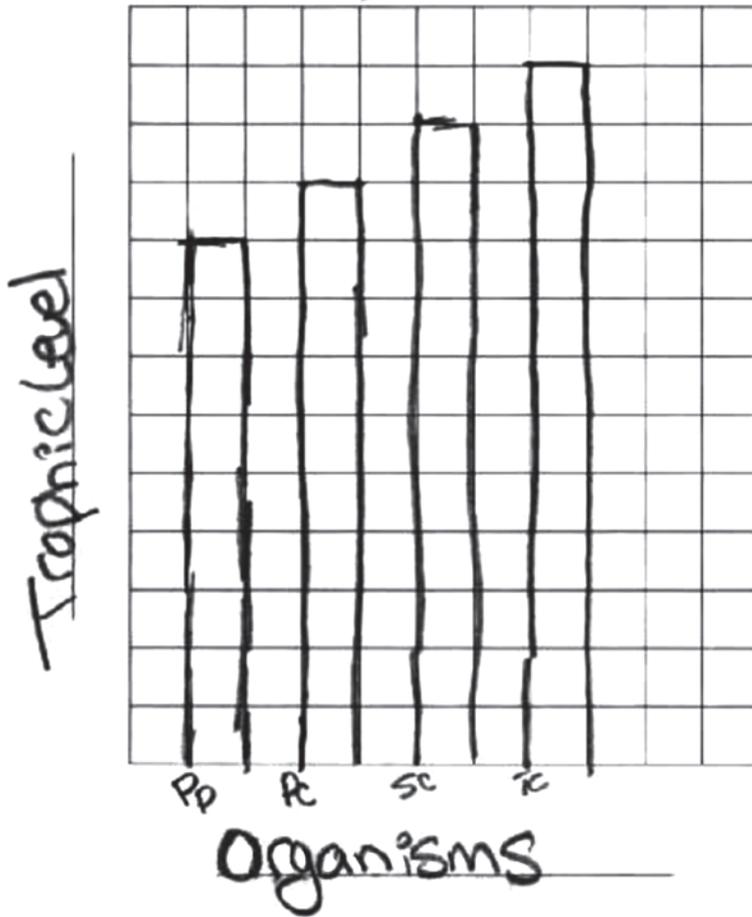
The response has an appropriate title and properly labeled axes. However, this line graph has a y-axis that is set on an arbitrary scale that does not properly represent the relative magnitude of the data.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 0

2

Average Mercury Concentration



The response does not demonstrate an understanding of how to properly graph data.

**NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Broad Area of Inquiry: Inquiry Construct 10:	Conducting Investigations Summarize results based on data.
---	--

- 3 Based on the data in Figure 2 and your graph, describe the **pattern of mercury concentration** among the organisms in the ponds. Support your description with specific examples from the data.

Scoring Guide

Score	Description
2	The response demonstrates a general understanding of how to summarize results based on data. The response includes a description of the pattern of mercury concentration among organisms in the pond as shown in Figure 2 or your graph.
1	The response demonstrates a limited understanding of how to summarize results based on data.
0	The response does not contain any correct elements or is irrelevant.
Blank	No response

Training Notes:

Sample response:

As trophic level increases from primary producer to tertiary consumer, the mercury concentration in the organisms also increases. The average mercury concentration increased from 0.019 mg/kg for organisms in the primary producer trophic level to 0.124 mg/kg for organisms in the tertiary consumer trophic level.

Training notes:

To receive full credit the response must include

- identification of the trend of increasing concentration at higher trophic levels.
- a concrete example that compares a mercury measurement at a lower trophic level with a mercury measurement at a higher trophic level.

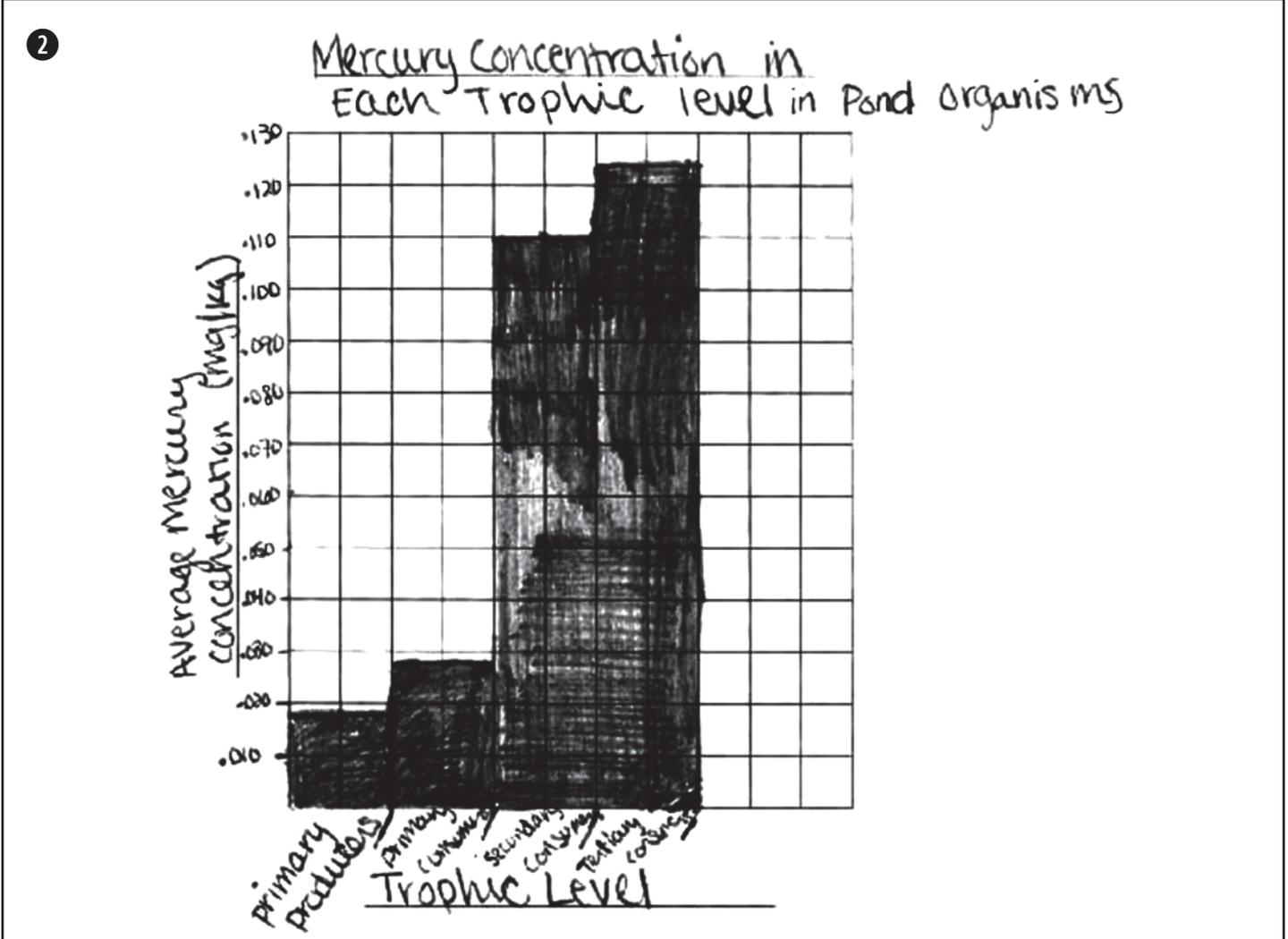
NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 2

- 3 The pattern of mercury concentration among the organisms in the ponds increases as the trophic level increases. The first primary producers such as, plants and plankton, have an average mercury concentration of $.019 \text{ mg/kg}$. Then the primary consumers eat the primary producers and have an average concentration of $.078 \text{ mg/kg}$. This shows that the top consumers have the most mercury because they gain more mercury from each organism they eat.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 2 (CONTINUED)



The response includes an identification of the trend in increasing mercury concentrations at higher trophic levels. The response also compares two data points in upper and lower trophic levels from Figure 2 or the student's graph to support the identification of the trend.

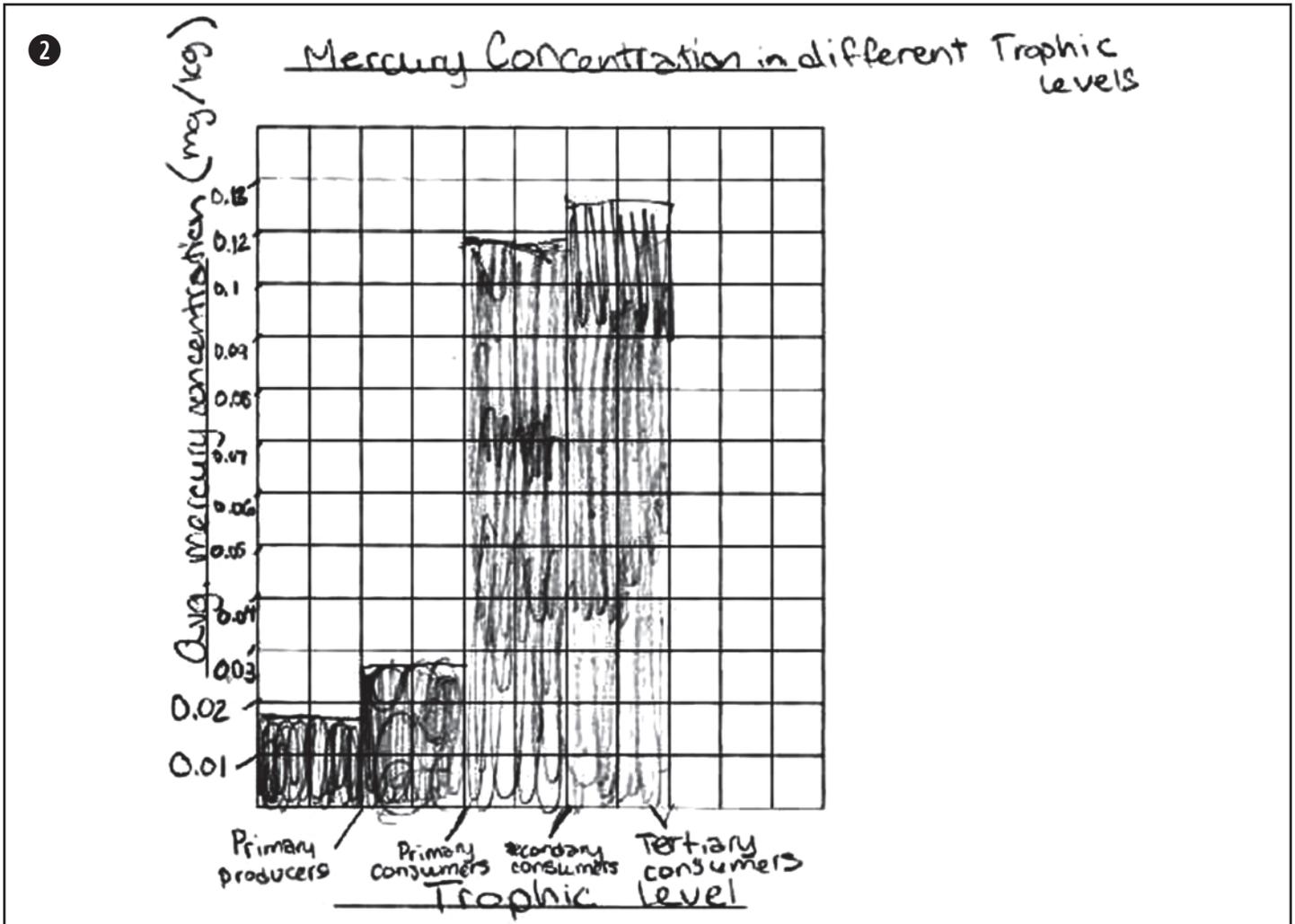
NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 1

- 3 Organisms that are higher up in the food chain have a higher concentration of mercury. This can be attributed to the fact that bigger fish tend to be predatory, and therefore eat the smaller fish. The mercury works its way up the foodchain and makes it so the bigger fish have higher concentrations of mercury.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 1 (CONTINUED)



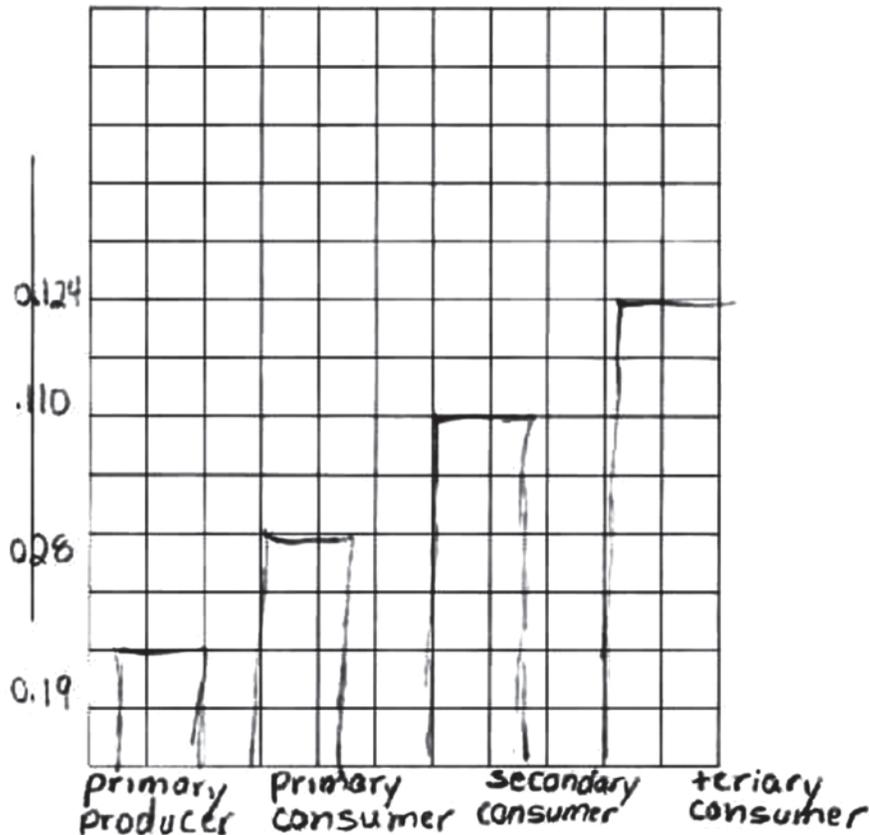
The response includes an identification of the trend in increasing mercury concentrations at higher trophic levels. This identification is supported by a limited statement drawn from the overall data, but does not compare mercury measurements at different trophic levels.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 0

- 3 The graph show that primary consumer is lowest one that has the least mercury. The primary consumer, secondary consumer, and Teri ary consumer, it show how much mercury that has the most in.

- 2 Mercury Concentrations in pond Organism.



The trend stated in the response is incorrect—the producers, not the primary consumers, have the least mercury. The additional information given is an observation of the information given in the graph rather than a pattern. This response contains no relevant correct information.

**NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Broad Area of Inquiry: Inquiry Construct 5:	Planning and Critiquing of Investigations Develop an organized and logical approach to investigating the question, including controlling variables.
--	---

- 4 Find data in Figure 1 that do **not** agree with the data in Figure 2.
- a. Describe a different procedure for recording the data in Figure 2 that would provide a better understanding of mercury concentrations in the organisms.

 - b. Explain why this procedure might improve the agreement of the data in Figure 1 and Figure 2.

Scoring Guide

Score	Description
3	The response demonstrates a thorough understanding of how to develop an organized and logical approach to investigating a question. The response includes a clear description of a different procedure for recording the data in Figure 2 that would provide a better understanding of the data. The response also explains why this procedure might improve the agreement of the data in Figure 1 and Figure 2, with sufficient and logical reasons given.
2	The response demonstrates a general understanding of communicating how to develop an organized and logical approach to investigating a question.
1	The response demonstrates a limited understanding of communicating how to develop an organized and logical approach to investigating a question.
0	The response does not contain any correct elements or is irrelevant.
Blank	No response

Training Notes:

Sample response:

It is unclear if the data are recorded for each species separately in Figure 2 or as an average for all of the organisms at each trophic level. For example, brown bullheads have low mercury in Figure 1, but in Figure 2 they are tertiary consumers with the highest level of mercury. But, we don't know the actual mercury level for brown bullheads in Figure 2. It might be lower than the mercury levels of other tertiary consumers, which would agree better with Figure 1 data.

Training notes:

To receive full credit the response must include

- a clear description of a different procedure.
- logical, relevant reasons the different result would improve data agreement.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 3

- 4 a. Based on the data from Figure 1, the mercury levels in fish vary greatly. However, in Figure 2 fish are grouped together based on trophic level and presented with an Average Mercury Concentration which can be very misleading. The Average Concentration makes it seem as though all organisms in that trophic level contain similar concentrations. To provide a better understanding of mercury concentrations in the organisms, data should be collected and presented for each individual fish so that one can see whether they are similar or they vary.
- b. This procedure might improve the agreement of data in Figure 1 and Figure 2 because at this point, fish with low and high concentrations are grouped together and presented with a single average concentration. If they each have their own concentration, then you will be able to compare one fish to another and how the trophic level affects concentration.

The response offers a reasonable alternative procedure for recording the data in Figure 2 and supports the alternative procedure with a thorough explanation of how it would improve the data agreement between Figures 1 and 2.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 2

- 4 a. The yellow perch and the Pickerel are said to be on the same trophic level (tertiary consumers), with a 0.124 mg/kg ave. but the picture shows the pickerel is actually much higher. If the data in Figure 2 was shown by species and not as an average, it would be easier to compare species.
- b. This would help because by showing the measurements by species you could see the highs and lows of the Mercury concentrations, and see if the pickerel's numerical data is actually a lot larger than the yellow perch like figure 1 shows.

Much of part (a) in this response is devoted to identifying the data disagreement between the two figures; only the last sentence gives an alternative recording procedure. Part (b) offers a general explanation of how the alternative procedure would improve the data agreement between the two figures.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 1

4

• Brown bullhead considered a high amount of Hg in Fig. 2, but low in Fig. 1.

a. A graph showing individual organism Hg concentrations.

b. The data wouldn't be so generalized.

Overall, a limited alternative procedure is given with a vague explanation as to how it would improve data agreement.

SCORE POINT 0

4

a. Brown Bullhead does not show the same amount of Mercury. In Figure 2 it would be Tertiary but in Figure 1 it would be Secondary.

The response restates the problem with the data agreement between the two figures. This was not part of the question asked and receives no credit. The response does not identify or explain an alternative procedure for recording the data that would improve data agreement.

**NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Broad Area of Inquiry: Inquiry Construct 11:	Developing and Evaluating Explanations Analyze data, including determining if data are relevant, artifact, irrelevant, or anomalous.
---	--

- 5 Analyze the data in Figure 2 and Figure 3. Based on the data in Figure 3, describe one advantage and one disadvantage of presenting the **average mercury concentration** of each trophic level in Figure 2.

Scoring Guide

Score	Description
2	The response demonstrates a general understanding of how to provide reasons for appropriateness of procedures. The response includes descriptions of one advantage and one disadvantage of presenting the average mercury concentration for each trophic level in Figure 2, as supported by the data in Figure 3.
1	The response demonstrates a limited understanding of how to provide reasons for appropriateness of procedures.
0	The response does not contain any correct elements or is irrelevant.
Blank	No response

**NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Training Notes:

Sample response:

An advantage of presenting the average mercury concentration for each trophic level in Figure 2 is that the trend of increasing mercury concentration with increasing trophic level is more obvious to see. Figure 3 shows a broad range of mercury concentration in yellow perch that overlaps the mercury concentration of organisms in other trophic levels. This is probably true for species in all of the trophic levels. Therefore, presenting the average is the best way to illustrate the trend.

A disadvantage of presenting the average mercury concentration for each trophic level in Figure 2 is that the average does not identify differences between mercury concentration or the range of mercury concentration for each species. This may be important for someone who is deciding what fish to eat.

Training notes:

Possible advantages may include, but are not limited to, the following:

- makes trend(s)/pattern(s) clearer
- simplifies data or graphic presentation

Possible disadvantages may include, but are not limited to, the following:

- individual fish and species data unknown
- data is not verifiable/repeatable
- sources of error are not as apparent
- range of measurements is not given
- number of fish species per pond
- size and age of fish

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 2

- 5 One disadvantage of showing the average mercury concentration of each trophic level is that it gives people the misconception that all animals of that trophic level have similar mercury concentrations. Someone who analyzed Figure 2 would assume that yellow perch have an average mercury concentration of about 0.124 mg/kg, where it is only 0.106 mg/kg, because when animals with a lot of mercury are averaged with the low mercury-concentrated yellow perch, the average becomes higher. One advantage of doing this is being able to compare the mercury concentration, one trophic level versus another.

The response gives a thorough explanation of a disadvantage to Figure 2, using specific data from both figures. The advantage given is correct and concise.

SCORE POINT 1 (EXAMPLE A)

- 5 One Advantage of Presenting the average mercury concentration of a trophic level is that you can show the relationship between the levels, but one disadvantage is you won't know the exact information of each fish as figure 3 presents.

The response gives a limited advantage and disadvantage without significant support from the figures.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 1 (EXAMPLE B)

- 5 The advantage of showing the average mercury concentration of each trophic level is seeing each average. The disadvantage is not knowing the concentration for each type of organism in that trophic level.

The response does not state why giving an average of the trophic levels is an advantage. The disadvantage offered is a correct statement, but does not explain why this is a disadvantage. There is also no data support from the figures in the response.

SCORE POINT 0

- 5 One Advantage is that in figure three you know the exact mercury level of a specific fish but the disadvantage is that you don't know about the other fish.

The response discusses an advantage and a disadvantage of Figure 3, not of Figure 2 as specifically stated in the question.

**NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Broad Area of Inquiry:	Formulating Questions & Hypothesizing
Inquiry Construct 2:	Construct coherent argument in support of a question, hypothesis, prediction.

- 6 Identify the **pattern** of the data shown in Figure 4. Explain how this pattern provides information to help answer the research question.

Scoring Guide

Score	Description
3	The response demonstrates a thorough understanding of how to construct a coherent argument in support of a hypothesis. The response correctly identifies the pattern of the data and explains how the pattern provides information to help answer the research question.
2	The response demonstrates a general understanding of how to construct a coherent argument in support of a hypothesis.
1	The response demonstrates a limited understanding of how to construct a coherent argument in support of a hypothesis.
0	The response does not contain any correct elements or is irrelevant.
Blank	No response

Training Notes:

Sample response:

Mercury concentration in largemouth, smallmouth, and spotted bass generally increases as fish length increases. Therefore, one cause of higher mercury concentration in fish may be size. This relationship is probably due to

- the age of the fish. As a fish gets older, it increases in size.
- the quantity of food the fish eats. The larger the fish, the greater the amount of food that it eats and the greater the amount of mercury it takes into its body.
- the time to accumulate mercury in tissues. As a fish gets older and increases in size, it has had more time than a smaller, younger fish to add mercury to the tissues in its body.
- the type of species, which contributes to size or length of fish.

Training notes:

To receive full credit the response must include

- a clear statement of the positive relationship between mercury concentration and fish length.
- a valid explanation of how this relationship relates to the research question.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 3

- 6 The general pattern in Figure 4 is that the larger the fish, the higher the mercury concentration that they have. This pattern provides information to help answer the research question because clearly the larger fish, who eat the smaller fish, have higher mercury concentrations than the medium fish (who eat some small fish) and the small fish (who have plant diets). This information helps provide information that the fish's diet (which is parallel to what size of fish they are) causes different mercury concentrations within them.

The response clearly identifies the correct pattern between fish length and mercury concentration. The response also includes a thorough explanation of how the pattern provides information to help answer the research question.

SCORE POINT 2

- 6 The graph displays a trend which shows that fish with longer lengths tend to have a higher concentration of mercury. If length is related to trophic level, this could explain why some fish have higher concentrations of mercury than other fish.

The response correctly identifies the pattern between fish length and mercury concentration. There is a limited connection back to the research question without further explanation.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 1

- 6 In this visual, the fish that are longer have a higher concentration of mercury. This supports my hypothesis (based on the research question) that the bigger the fish, the more mercury it has.

The response correctly identifies the trend shown in Figure 4. The connection back to the research question restates the trend in the data rather than offering further explanation.

SCORE POINT 0

- 6 The Pattern is Fish length: and Mercury Concentration. This Pattern Provides information to help answer the research question by giving the PPM and mm of growth of largemouth Bass, Smallmouth Bass and Spotted Bass. The O(circle) represent the largemouth Bass, Δ (triangle) represent the Smallmouth Bass, and \square (square) represent the Spotted Bass. The figure show us the growth of Bass in Part Per million and Fish length.

The response describes Figure 4 without any identification of the trend or connection back to answer the research question.

**NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Broad Area of Inquiry: Inquiry Construct 12:	Developing and Evaluating Explanations Use evidence to support and justify interpretations and conclusions or explain how the evidence refutes the hypothesis.
---	--

- 7 Based on the data in Figures 1, 2, 3, and 4, explain whether the evidence **supports or refutes** the hypothesis you proposed in question 1. Include **two** specific examples to support your reasoning.

Scoring Guide

Score	Description
3	The response demonstrates a thorough understanding of how to use data to explain how the evidence supports or refutes the hypothesis. The response explains whether the hypothesis is supported or not supported (refuted) by the data/evidence. The response includes two specific data examples to support the reasoning.
2	The response demonstrates a general understanding of how to use data to explain how the evidence supports or refutes the hypothesis.
1	The response demonstrates a limited understanding of how to use data to explain how the evidence supports or refutes the hypothesis.
0	The response does not contain any correct elements or is irrelevant.
Blank	No response

Training Notes:

Sample response:

I hypothesized that mercury concentration in fish will increase with increasing trophic level. The data in Figure 1 and Figure 2 support my hypothesis. Figure 1 shows that big predatory fish at the top of the food chain have the highest mercury levels (bass and pickerel). Figure 2 shows that mercury concentration increased from 0.019 ppm for primary producers to 0.124 ppm for tertiary consumers.

Training notes:

To receive full credit the response must include

- a statement affirming or denying that the hypothesis is supported.
- citation of at least two (2) specific examples from the data presented that logically support the conclusion.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 3

- 7 Based on the data in figures 1, 2, 3, and 4 all evidently show supporting data to the hypothesis I proposed in question one. One specific example to support my reasoning is fig 2 which showed that organisms in different trophic levels have different Hg concentrations. If the organisms were higher in the food chain than the mercury levels increased. Also data in figure 4 showed support by relating fish length to these high mercury concentrations. I concluded that since larger organisms are higher in the food chain they tend to eat more which may have resulted in their high Hg concentrations.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 3 (CONTINUED)

1

A larger, predatory fish will have a higher mercury concentration due to its high mercury intake by eating smaller fish. The higher the fish is in the food web most likely causes the fish to become more exposed to mercury through its food habits. Compared to fish lower in the food chain this marine life only eats plants because of their size which evidently shown in figure 1, that fish with herbivore characteristics have low mercury concentration, therefore, low mercury intake.

The response gives a clear statement supporting the student's hypothesis with two specific examples to support the reasoning.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 2

- 7 The evidences support my hypothesis. I said that the predatory fish will have higher Hg Concentrations. For example largemouth basses and pickerels had higher Hg concentrations than the fish that eat mostly plants. The evidence also showed that bigger fish, which are mostly predatory fish, ~~are~~ are higher in Hg concentrations

- 1 Predatory fish may have higher Hg concentration than fish that eat mostly plants. Hg can pass on to one organism to another organism. Small fish from the areas of high Hg concentration are eating by the predatory fish by doing so it will increase their Hg concentration. Plants-eating fish don't take in a lot of Hg because they don't eat other small fish. However, the predatory fish may have high concentration of mercury because they feed on other fish

The response gives a clear statement supporting the student's hypothesis with two pieces of general evidence from unnamed sources.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 1

7 The figures support my hypothesis because it shows that the fish eat each other which can cause different levels of Hg concentration.

1 Some fish might have a higher Hg concentration than other fish because they could eat smaller fish that have a low Hg concentration, and that would lead to a build up of Hg over time.

The response includes a limited statement of support for the student's hypothesis without specific data or evidence from the figures.

NECAP 2012 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 0

- 7 The evidence refutes my hypothesis because my hypothesis wasn't accurate.
- It has to do w/ population
 - Where they live in the pond/ocean

- 1 Fish who have higher mercury is determined where in the ocean they live.

The response contradicts itself by refuting the student's hypothesis and then supporting the refutation with an incorrect statement followed by a restatement of the hypothesis.