



**NEW ENGLAND
COMMON ASSESSMENT PROGRAM**

**Released Items
Support Materials
2014**

**Grade 11
Science**

**NECAP 2014 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	C	1
2	INQ	PS 2-6	2	MC	C	1
3	SAE	PS 3-10	2	MC	B	1
4	POC	PS 1-3	2	CR		4
5	NOS	ESS 1-2	2	MC	A	1
6	NOS	ESS 3-6	1	MC	C	1
7	POC	ESS 3-8	1	MC	D	1
8	SAE	LS 2-3	2	MC	B	1
9	NOS	LS 4-9	2	MC	D	1
10	FAF	LS 4-10	2	MC	B	1

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	CR	3
2	INQ	3	2	SA	2
3	INQ	9	2	SA	2
4	INQ	10	2	SA	2
5	INQ	5	2	SA	2
6	INQ	12	3	SA	2
7	INQ	11	2	CR	3
8	INQ	13	3	SA	2

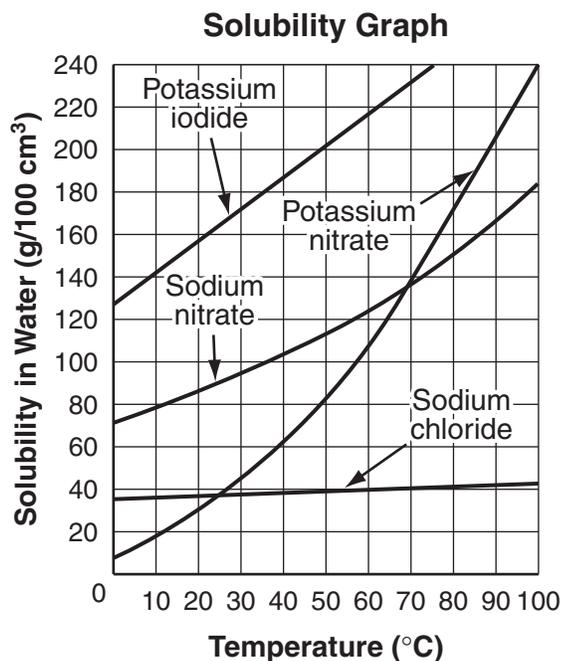
¹Big Idea: NOS = Nature of Science, SAE = Systems and Energy, MAS = Models and Scale, POC = Patterns of Change, FAF = Form and Function, INQ = Scientific Inquiry

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

NECAP 2014 RELEASED ITEMS
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PS1 (9-11) INQ-1 Use physical and chemical properties as determined through an investigation to identify a substance.

- 1 The graph below shows the solubility of four compounds.



Which compound has almost the same solubility in warm water and cold water?

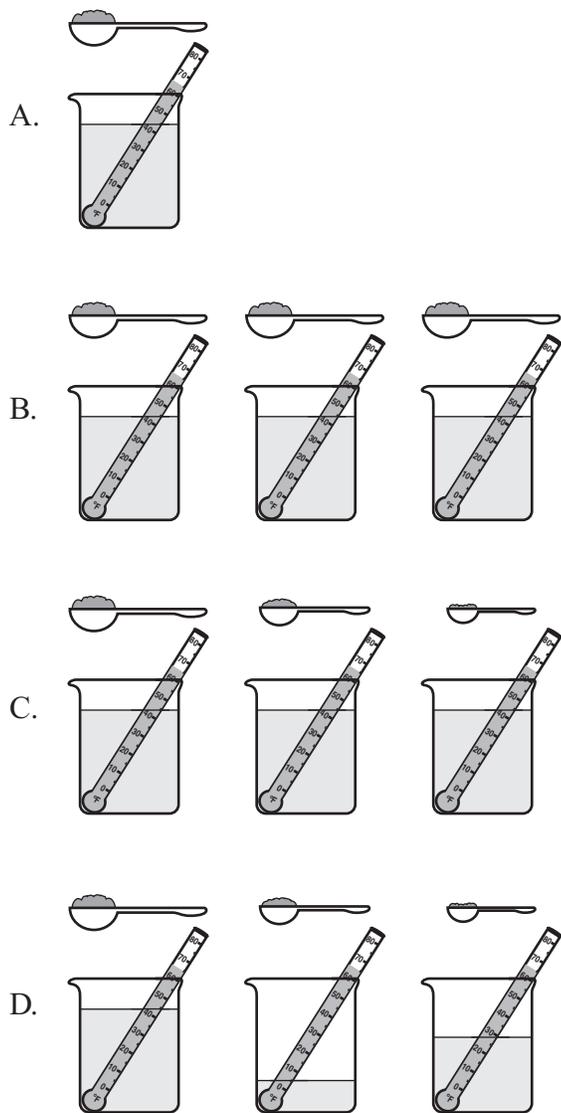
- A. potassium iodide
- B. potassium nitrate
- C. sodium chloride
- D. sodium nitrate

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PS2 (9-11) INQ-6 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 A student is investigating reactions that absorb energy. She wonders how the temperature of water changes when different amounts of potassium chloride (KCl) are added to it.

Which experimental setup would **best** answer the student's question?



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PS3 (9-11) SAE-10 Explain the effects on wavelength and frequency as electromagnetic waves interact with matter (e.g., light diffractions, blue sky).

Please use the Electromagnetic Spectrum on the reference sheet to answer the question.

- 3** What is the relationship among the frequency, wavelength, and energy of electromagnetic waves?
- A. Waves with high frequencies have long wavelengths and low energy.
 - B. Waves with high frequencies have short wavelengths and high energy.
 - C. Waves with low frequencies have short wavelengths and low energy.
 - D. Waves with low frequencies have long wavelengths and high energy.

PS1 (9-11) POC-3 Explain how properties of elements and the location of elements on the periodic table are related.

Please use the periodic table on the reference sheet to answer the question.

- 4** In 1869, Dmitri Mendeleev arranged his periodic table of elements based on the properties of the elements known at the time. The modern periodic table, which displays the patterns of properties of the elements, is similar to Mendeleev's arrangement of elements.
- a. Identify **two** elements that have properties similar to those of helium (He).
 - b. Identify **two** other patterns of properties shown in the periodic table and describe evidence that supports your response.

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Scoring Guide

Score	Description
4	The response demonstrates a thorough understanding of how properties of elements and the location of elements on the periodic table are related. The response gives two examples of elements with properties similar to helium and gives two other patterns in the periodic table and describes evidence that supports the patterns.
3	The response demonstrates a general understanding of how properties of elements and the location of elements on the periodic table are related. The overall response is general.
2	The response demonstrates a limited understanding of how properties of elements and the location of elements on the periodic table are related. The overall response is limited.
1	The response demonstrates a minimal understanding of how properties of elements and the location of elements on the periodic table are related. The overall response is minimal.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response

Part a. A thorough response may be exemplified by any two of the following:
neon, argon, krypton, xenon, or radon

Part b. Possible responses include:

- Atomic mass: The atomic mass increases as the elements are found down a group or across a period.
- Atomic number: The atomic number increases as the elements are found down a group or across a period.
- Valence electrons: The valence number increases as the elements are found across the groups (except the transition elements).
- Atomic size [radius]: The atomic size decreases across the table and increases down the table.
- Reactivity: The pattern of reactivity should be specific to metal or non-metal.
- Metal/non-metal: The pattern should describe specific properties of metal or non-metal.

Note: Evidence should match the pattern and may be based on the values in a periodic table; subatomic particles used as evidence should be identified.

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SCORE POINT 4

4 a. All of the noble gases have similar properties to that of Helium, a few are Neon, Argon, and Krypton. They all have the same number of valence electrons and are relatively unwilling to react since they have a full outer shell.

b. Another pattern seen in the periodic table is atom size. As you move across a period the number of electrons in the atoms' outermost shell increases, this increase in electrons ~~results~~ results in a greater pull between the positively charged nucleus and the electrons in the orbitals making the atoms smaller in size as you move across a period. One more pattern is that of atomic mass, as you move down a group or across a period the atomic mass increases. This is because you are constantly adding protons (and electrons) to each atom, that is what results in a new element this addition of new "pieces" increased the atoms mass.

The response gives 3 correct examples of elements with properties similar to helium in Part A, although only 2 are required. In Part B, two valid patterns—atomic size and mass—are identified and supported thoroughly with evidence.

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SCORE POINT 3

4 A. 1. Neon
2. Argon

B. 1. Atomic Number pattern; From Hydrogen going right,
the atomic number always increases by 1.

2. Atomic Mass pattern; From Hydrogen going
right, the mass always increases.

Two correct elements are identified in Part A. In Part B, there are two valid patterns, but the explanations are general observations from the table instead of in-depth explanations of why the patterns occur.

SCORE POINT 2A

4 a. Neon (NE) and Hydrogen (H)

b. Two other patterns would be all the
Gases are together like carbon, oxygen, sulfur, etc.
Another pattern would be that all the Elements
are (from left to right) in order by their masses.
Oxygen (15.999) then next to it is Fluorine (18.998).

Part A has one correct (Neon) and one incorrect (Hydrogen) element. Part B only contains one correct pattern (atomic mass) and gives some limited evidence in support.

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SCORE POINT 2B

4 a) Neon (Ne) + Argon (Ar)

b) Nickel, Copper and Zinc are in the same Period and are very similar

Two correct elements are given in Part A. In Part B, the response receives no credit. Listing elements in a period is not the same as a pattern in properties of elements on the periodic table.

SCORE POINT 1

4 a, Lithium (Li) and Sodium (Na) are similar to Helium because they have the same number of valence electrons and are in the same group and are both metals like Helium

b, In each group, each element has the same number of valence electrons, and the elements go in order by what their atomic mass is which is how they get their atomic number.

Part A is incorrect. In Part B, the response demonstrates a minimal understanding by listing one pattern across the table (atomic mass) and one group pattern (valence electrons), but there is no evidence used in support.

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SCORE POINT 0

4 A. Hydrogen, and Carbon

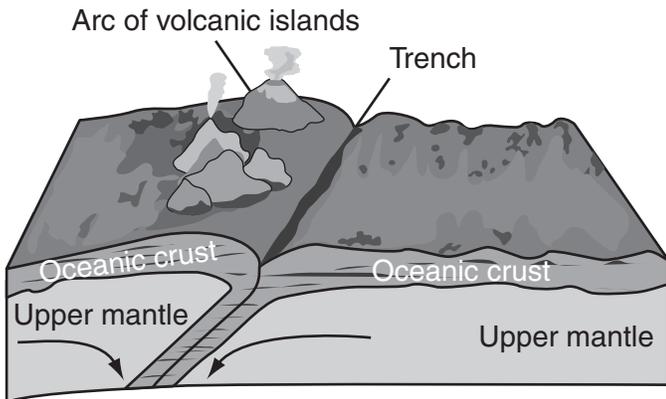
B. Hydrogen and carbon. are both
air. And are both dangerous.

The response is totally incorrect in both parts.

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ESS1 (9-11) NOS-2 Trace the development of the theory of plate tectonics or provide supporting geologic/geographic evidence that supports the validity of the theory of plate tectonics.

- 5 The diagram below shows the motion of Earth's crust.



Based on the diagram, what causes the formation of an arc of volcanic islands?

- A. magma from a subducting plate moving up through oceanic crust
- B. magma from an oceanic plate and a continental plate colliding
- C. magma from an earthquake at a transform plate boundary in the ocean
- D. magma from seafloor-spreading at a divergent plate boundary

**NECAP 2014 RELEASED ITEMS
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ESS3 (9-11) NOS-6 Provide scientific evidence that supports or refutes the “Big Bang” theory of how the universe was formed.

- 6** Galaxies farther from Earth are moving faster than galaxies closer to Earth. Which statement does this evidence **best** support?
- A. The universe is becoming more compact.
 - B. The universe is undergoing chaotic motion.
 - C. The universe is expanding in all directions.
 - D. The universe is made of subatomic particles.

ESS3 (9-11) POC-8 Explain the relationships between or among the energy produced from nuclear reactions, the origin of elements, and the life cycles of stars.

- 7** What **must** happen before a protostar becomes a star?
- A. Cosmic background radiation has to increase by 50%.
 - B. Gravity has to change gas and dust into planets.
 - C. Pressure has to build up and cause a large explosion.
 - D. The temperature has to rise enough for nuclear fusion to begin.

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LS2 (9-11) 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.

- 8 A large ship leaked 3000 gallons of oil while moving through a shallow bay. The oil spill destroyed 50% of the algae in the bay.

How will the oil spill **most likely** affect the amount of energy available to organisms in the bay?

- A. The amount of energy will increase.
- B. The amount of energy will decrease.
- C. The amount of energy will stay the same.
- D. The amount of energy will balance.

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LS4 (9-11) NOS-9 Use evidence to make and support conclusions about the ways that humans or other organisms are affected by environmental factors or heredity (e.g., pathogens, diseases, medical advances, pollution, mutations).

- 9 The Ames test uses bacteria to determine if a chemical substance is a mutagen, a substance that changes DNA. Many mutagens cause cancer in humans.

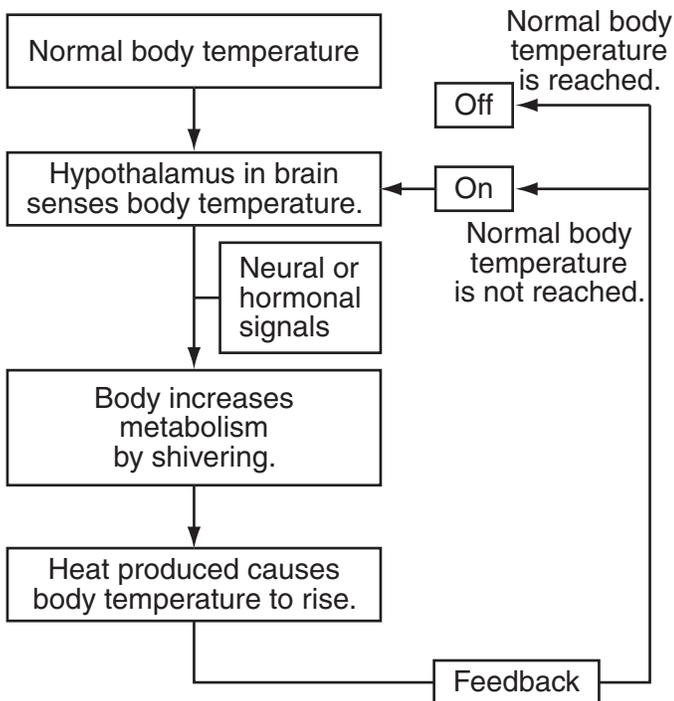
Which characteristic of bacteria makes them useful to test for chemical mutagens?

- A. Bacteria and humans have identical genomes.
- B. Bacterial cell structures are very complex.
- C. The molecules that cause changes in bacterial structure can be found in many environments.
- D. The molecules that make up DNA's structure in bacteria and in humans are the same.

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LS4 (9-11) FAF-10 Explain how the immune system, endocrine system, or nervous system works and draw conclusions about how systems interact to maintain homeostasis in the human body.

- 10 The diagram below represents the human body temperature regulated around the normal body temperature.



The temperature-regulation system of the human body operates similar to a home furnace.

Which part of the human body temperature-regulation system works like the thermostat in a home?

- A. the normal body temperature
- B. the hypothalamus
- C. the hormonal signal
- D. the neural signal

**NECAP 2014 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Broad Area of Inquiry:
Inquiry Construct 1:

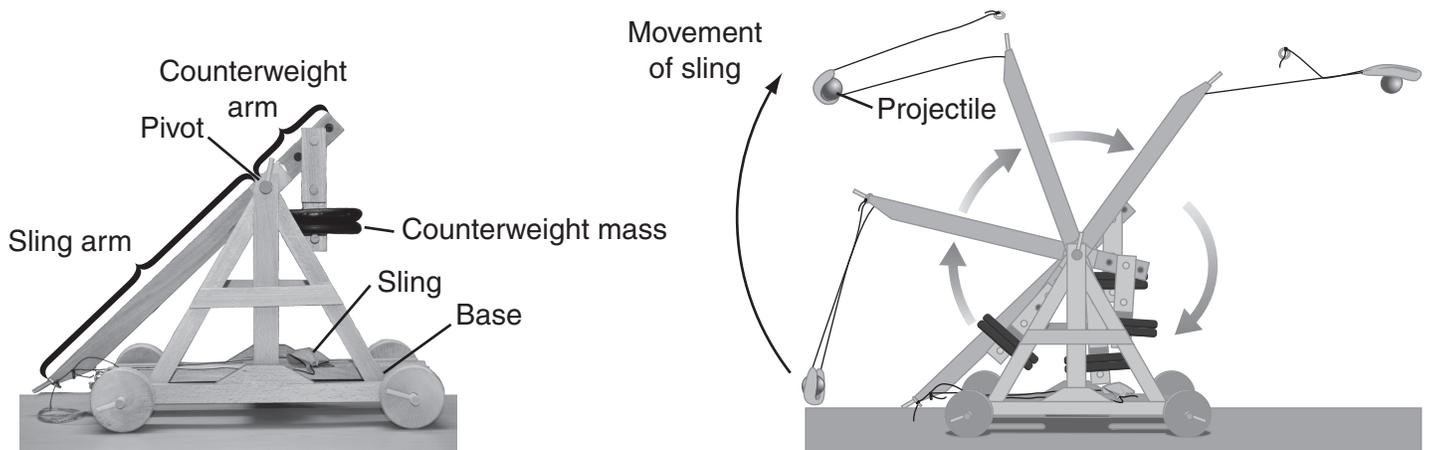
Formulating Questions and Hypothesizing
Analyze information from observations, research, or experimental data for the purpose of formulating a question, hypothesis, or prediction.

- 1 Based on **Table 1** and **Diagram 1**, write a hypothesis about how a change in one of the variables might affect the throwing contest results. Explain the reasoning for your hypothesis.

Table 1: Limits for Model Trebuchet Variables

Variable	Range
Arm ratio	2.5:1 to 4.0:1
Counterweight mass	10 kg to 60 kg
Projectile mass	0.5 kg or 1.0 kg
All other variables remain constant.	

Diagram 1: Trebuchet Design and How It Works



**NECAP 2014 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Scoring Guide

Score	Description
3	The response demonstrates a thorough understanding of how to analyze information from observations, research, or experimental data for the purpose of formulating a hypothesis. The response includes one hypothesis about how a change in one variable might affect the throwing contest results and explains the reasoning for the hypothesis.
2	The response demonstrates a general understanding of how to analyze information from observations, research, or experimental data for the purpose of formulating a hypothesis.
1	The response demonstrates a limited understanding of how to analyze information from observations, research, or experimental data for the purpose of formulating a hypothesis.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response

A thorough understanding can be exemplified by any of the three following sample responses:

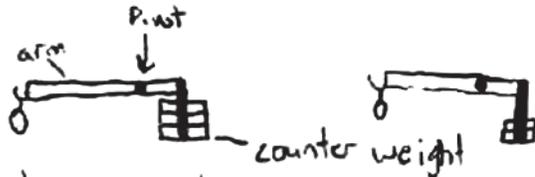
1. Hypothesis: As the arm ratio (length) increases, the distance of the projectile will increase.
Reasoning: larger trebuchets have longer arms, which would apply the throwing force over a longer distance according to Diagram 1.
2. Hypothesis: As the counterweight mass increases, the distance of projectile will increase.
Reasoning: greater counterweight mass means more force moving the trebuchet arm according to Diagram 1.
3. Hypothesis: As the projectile mass increases, the distance of the projectile will decrease.
Reasoning: greater force is required to accelerate a heavier object, and the force cannot increase if all the other variables remain unchanged as shown in Table 1.

Note: A correct response may propose an alternative hypothesis, so long as the hypothesis is supported by logical reasoning based on Diagram 1 or Table 1 data.

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SCORE POINT 3

- ① - My hypothesis is that a larger counter weight will throw a projectile farther than a smaller counter weight.



- A larger counter weight will throw farther because the more weight the more force is pulling the arm and the more force will cause the arm to have a higher velocity, throwing the ball farther.

The response gives a good, testable hypothesis which includes both an independent (counterweight mass) and a dependent (distance) variable. The reasoning is thorough, and includes a good discussion of the relationship between force and velocity.

SCORE POINT 2

- ① If the counterweight mass was increased then the movement of the sling will be faster and therefore the projectile will be launched farther

The response gives a valid prediction that could be tested, and some reasoning that is embedded within the response. The reasoning does not address the role that forces play in this scenario.

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SCORE POINT 1

- ① If projectile mass is heavier it could be harder to throw.

The response gives a testable hypothesis, although it is not clear what "harder" means in terms of a dependent variable. There is no reasoning given.

SCORE POINT 0

- ① If one of the variables changes then the results of the throw will not be at best, because that's how science works.

The response is too vague to demonstrate understanding of the task. The independent and dependent variables are unclear, and the hypothesis is not testable.

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Broad Area of Inquiry:	Formulating Questions and Hypothesizing
Inquiry Construct 3:	Make and describe observations in order to ask questions, hypothesize, make predictions related to topic.

- 2 Based on the data in **Tables 2a** and **2b**, identify one change to the trebuchet design that will increase the distance the projectile travels. Be sure to include evidence from the tables that supports your answer.

**Table 2a: Design Test Launches
(0.5 kg projectile)**

Trial	Counterweight Mass (kg)	Arm Ratio	Flight Distance (m)
1	50	4:1	58.7
2	40	4:1	49.3
3	50	3:1	61.8

**Table 2b: Design Test Launches
(1.0 kg projectile)**

Trial	Counterweight Mass (kg)	Arm Ratio	Flight Distance (m)
1	50	4:1	41.4
2	40	4:1	37.7
3	50	3:1	43.1

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Scoring Guide

Score	Description
2	The response demonstrates a general understanding of how to make and describe observations in order to ask questions, hypothesize, and make predictions related to topic. The response identifies one change to the trebuchet design that will increase the projectile flight distance and includes evidence from the tables that supports the answer.
1	The response demonstrates a limited understanding of how to make and describe observations in order to ask questions, hypothesize, and make predictions related to topic.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response

A general understanding can be exemplified by the following sample response:

- increase counterweight mass; data shows increasing counterweight mass increased flight distance from 49.3 to 61.8 m.
- reduce arm ratio; data shows reducing arm ratio from 4:1 to 3:1 increased distance from 41.4 m to 43.1 m.

Note: Accept responses that state that if the variable decreased flight distance, increasing that variable might increase flight distance.

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SCORE POINT 2

- ② One change to the trebuchet design that will increase the distance is the arm ratio. When the arm ratio in Table 2a was 4:1 with a counterweight of 50kg the distance was 58.7m. With the same weight, but the arm ratio being 3:1 the distance then became 61.8m. The arm ratio was a major effect on the trials. With a smaller arm ratio the distance will increase.

The response correctly identifies a change to the design that would increase the distance (smaller arm ratio), and uses evidence from the tables to support the rationale.

SCORE POINT 1

- ② you can see the increase for all the trials in the flight distance as the counterweight mass gets higher the more the distance increases.

The response describes that an increase in counterweight corresponds to an increase in distance, but the data support from the tables is not specific.

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SCORE POINT 0

2

The mass of the counterweight could affect the whole experiment. If there isn't the same counterweight, there is likely to be different results.

The response does not receive credit, because it is not clear what change to the counterweight would correspond to an increase in distance.

**NECAP 2014 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Broad Area of Inquiry:	Conducting Investigations
Inquiry Construct 9:	Collect sufficient data to study question, hypothesis, or relationships.

- 3 Explain how the use of multiple tests helped the students achieve the maximum flight distance during the investigation. Identify data from **Table 3** that supports your explanation.

**Table 3: Projectile Flight Distance with Controlled Counterweight Mass of 50 kg
(1 kg projectile mass)**

Group	Test 1		Test 2		Test 3	
	Arm Ratio	Flight Distance (m)	Arm Ratio	Flight Distance (m)	Arm Ratio	Flight Distance (m)
1	4.0:1	42.0	3.5:1	46.2	3.5:1	46.5
2	3.0:1	53.2	3.0:1	54.0	3.0:1	52.9
3	3.0:1	46.7	2.5:1	43.8	3.0:1	46.1
4	4.0:1	50.0	3.5:1	53.2	3.0:1	53.0

Scoring Guide

Score	Description
2	The response demonstrates a general understanding of how to collect sufficient data to study question, hypothesis, or relationships. The response explains how the use of multiple tests helped the students achieve the maximum flight distance during the investigation and identifies data from Table 3 that supports the explanation.
1	The response demonstrates a limited understanding of how to collect sufficient data to study question, hypothesis, or relationships.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response

A general understanding can be exemplified by the following sample response:

The results of each test for distance showed the effect of changing the arm ratio. The students used the results to make a better prediction about what adjustment to arm ratio would give them more distance. For example, one group reduced their arm ratio from 3.0:1 to 2.5:1 and got less distance in Test 2. That allowed them to increase the ratio back to 3.0:1 and get more distance in Test 3.

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SCORE POINT 2

- 3 Multiple tests helped the students achieve maximum flight distance. When the different groups changed their arm ratios they recorded the distances for that ratio and if it was shorter they adjusted the ratio. Group 1 started with a 4:1 arm ratio and the projectile's flight distance was 42, but with a ratio change to 3.5:1, they attained a whole 4.2 m. more of their flight distance. Group three had a flight distance of 46.7 m with arm ratio 3:1, and realized shortening the ratio to 2.5:1 was too short as it decreased the flight path 2.9 m. This is how testing helped the students understand.

The response contains a complete explanation about why multiple trials were important to test the effect of changing the arm ratio. Only supporting data from group three is required for full credit.

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SCORE POINT 1

- 3 By conducting multiple tests the students were able to adjust the variable of their choosing (arm ratio) to look at its effects on the flight distance. It provides a controlled trial and error situation that is repeatable.

The response gives a nice explanation about why it is important to conduct multiple tests, but the response lacks supporting evidence from table 3.

SCORE POINT 0

- 3 The use of multiple tests helped the students to find the maximum flight distance by testing several different arm-ratios a multitude of times.

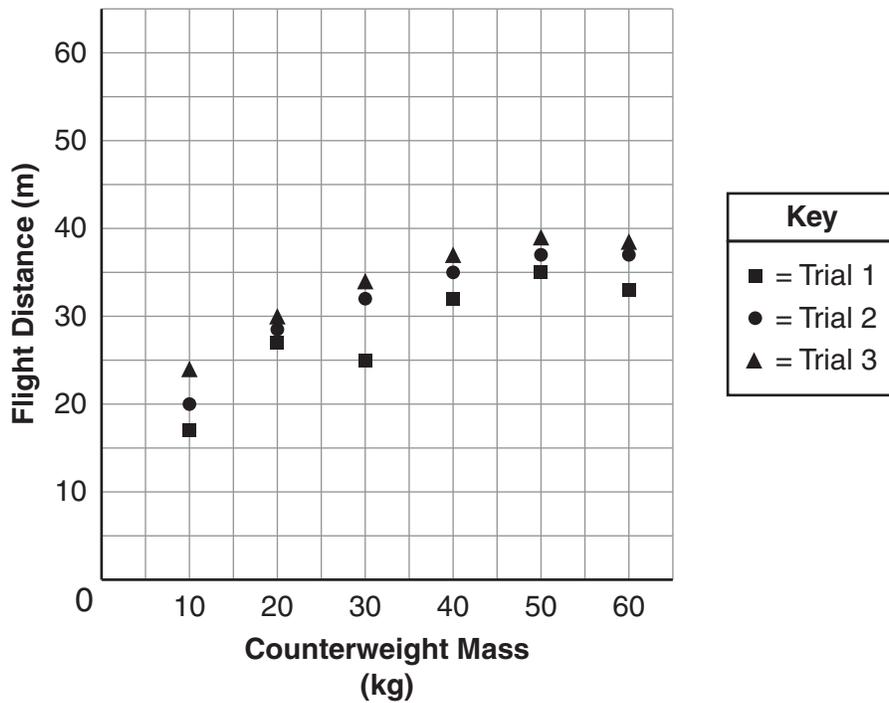
The response does not demonstrate understanding of the task. The response is too similar to the prompt and does not use any evidence from table 3.

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

- 4 Use the trend shown in **Graph 1** to determine which counterweight mass to use to make a projectile land in a basket 35 meters away. Explain how the data pattern supports your choice.

Graph 1: The Effect of Counterweight Mass on Flight Distance



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Scoring Guide

Score	Description
2	The response demonstrates a general understanding of how to summarize results based on data. The response determines which counterweight mass to use to make a projectile land in a basket 35 meters away and explains how the data pattern supports the choice.
1	The response demonstrates a limited understanding of how to summarize results based on data.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response

A general understanding can be exemplified by the following sample response:

The team could use a 40 kg counterweight to get the projectile to go 35 meters. This is about where the line between the middle data points for a 40 kg counterweight crosses the 35 meter line on the graph.

Note: 30–60 kg can be used with a reasonable explanation.

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SCORE POINT 2

- 4 In order to make a projectile land in a basket 35 meters away, the 40 kg counterweight should be used. By using the trend shown in Graph 1, the 40 kg weight is determined as the best. Although the 50 kg weight also resulted in the projectile landing at the 35 meter mark, the 40 kg weight is more accurate. For each trial, the flight distance was at or very close to 35 meters, making the 40 kg counterweight the best option.

The response correctly identifies the trend in the graph and uses it to determine which counterweight mass would be best to use. The response also compares different masses and gives a logical explanation to support the choice of 40 kg.

SCORE POINT 1

- 4 40 kg for counterweight.
according to the graph the trials for this weight are closest to 35m for distance. Trial 2 for this weight is at exactly 35m distance.

The response correctly identifies the trend in the graph and determines which counterweight mass would be best to use. The response does not compare different counterweight masses and does not clearly explain the trend in the graph.

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SCORE POINT 0

4

The best counter weight out of the 3 trials would have to be the one they used in trial #3 because out of all 3 trials it had the highest distance during the flight test.

The response does not demonstrate understanding of the task.

**NECAP 2014 RELEASED INQUIRY TASK
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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.
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- 5 Based on Table 4, identify whether the students should change the independent or dependent variable. Explain what effect the change will have on the results.

**Table 4: Projectile Accuracy: Distance from Basket
(3:1 Arm Ratio)**

Group	Test 1		Test 2		Test 3	
	Counter-weight Mass (kg)	Distance from Basket (m)	Counter-weight Mass (kg)	Distance from Basket (m)	Counter-weight Mass (kg)	Distance from Basket (m)
1	33	1.8	38	0.7	37	1.2
2	30	3.3	35	1.1	38	0.2
3	30	1.2	28	1.3	25	0.3
4	25	5.6	33	0.5	32	1.4

Scoring Guide

Score	Description
2	The response demonstrates a general understanding of how to develop an organized and logical approach to investigating the question, including controlling variables. The response identifies whether the students should change the independent or dependent variable and explains what effect the change will have on the results.
1	The response demonstrates a limited understanding of how to develop an organized and logical approach to investigating the question, including controlling variables.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response

A general understanding can be exemplified by the following sample response:

The independent variable for accuracy is counterweight mass. The dependent variable is projectile distance from basket. The counterweight mass was changed to affect projectile distance from the basket.

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SCORE POINT 2

5

The students should change their independent variable. The independent variable is the counterweight mass. By increasing or decreasing the independent variable the students would find the perfect amount of counterweight mass to create the best distance for the projectile to land in the basket.

The response correctly identifies that the students should change the independent variable and explains what effect the change will have on the results.

SCORE POINT 1

5

they should change the independent variable because then the dependent variable will adjust to it, and make for a more accurate distance.

The response correctly identifies that the students should change the independent variable, but the explanation is vague and not necessarily true.

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SCORE POINT 0

- 5 I believe the student should change both because they can get accurate results. Keeping one thing the same at all times might not show all the results needed for the amount of work.

The response is totally incorrect.

**NECAP 2014 RELEASED INQUIRY TASK
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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.
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- 6 Explain how the data from this investigation **support** or **refute** your hypothesis from question 1. Cite evidence from this investigation.

Scoring Guide

Score	Description
2	The response demonstrates a general understanding of how to use evidence to support and justify interpretations and conclusions or explain how the evidence refutes the hypothesis. The response uses any data from this investigation to explain how the data from this investigation supports or refutes the hypothesis from question 1.
1	The response demonstrates a limited understanding of how to use evidence to support and justify interpretations and conclusions or explain how the evidence refutes the hypothesis.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response

A general understanding can be exemplified by one of the following sample responses:

- Hypothesis:** As the arm ratio (length) increases, the distance of the projectile will increase. Tables 2a and 2b show that decreasing the arm ratio (shortening the throwing arm) increased the flight distance by 12.5 m and 5.4 m. Table 3 data also show that decreasing the arm ratio from 4.0:1 to 3.5:1 increases the flight distance of the projectile by 4.2 m and 3.2 m. This data refutes my hypothesis.
- Hypothesis:** As the counterweight mass increases, the distance of the projectile will increase. Tables 2a and 2b show that increasing the counterweight mass from 40 to 50 results in greater distances (49.3 m to 58.7 m in Table 2a; 37.7 m to 41.4 m in Table 2b). This supports my hypothesis.
- Hypothesis:** As the projectile mass increases, the distance of the projectile will decrease. Table 2a shows that the range of projectile flight distances for a 0.5 kg projectile was 49.3 m to 61.8 m. Table 2b shows that the range of projectile flight distances for a 1.0 kg projectile was 37.7 m to 43.1 m. This clearly shows that the heavier projectiles did not travel as far. This supports my hypothesis.

Notes:

- A correct response may cite any data from within the task that logically supports (agrees with) or refutes (disagrees with) the hypothesis.
- A correct response may include support for or refutation of an acceptable alternative hypothesis presented in Question #1.

NECAP 2014 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 2

6 The data from this investigation supports my hypothesis from question 1 because in Table 2a the distances were further with a 5 kg projectile than in Table 2b with a 1 kg projectile.

1 I hypothesize that if the projectile mass is smaller like .5 kg instead of 1 kg then it will be thrown farther. The weight is less so the Trebuchet would deliver the same amount of force on a 1 kg as a .5 kg and a 5 kg would go further because it is lighter.

The response uses specific data from tables 2a and 2b to explain how the data from this investigation support the hypothesis from question 1.

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GRADE 11 SCIENCE

SCORE POINT 1

6 The data from this investigation refuted my hypothesis from question 1, I thought more counter weight would throw the machine off and make the ball travel less. I was wrong, clearly adding more counter-weight would help the ball travel.

1 If the counterweight mass is increased, then the distance of the flying object will decrease. This is so because if only the counterweight is increased, and not everything else like the sling arm, then the object being thrown will go straight down because there is an uneven ratio of counter weight and it will go so fast to be able to release the ball.

The response explains that the data from the investigation support the hypothesis from question 1, but does not use specific data to support the answer.

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SCORE POINT 0

6 The data from the investigation supports my hypothesis.

1 The smaller the projectiles mass, there will be less distance it would travel. This is because it will not gain as much momentum. If a smaller projectile is used, there would need to be a larger counterweight.

The response does not demonstrate understanding of the task. The response incorrectly states that the data from the investigation support the student's hypothesis.

**NECAP 2014 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.
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- 7 Identify an example of data from **Table 4** that does not seem to agree with the other data in the table. Explain what may have caused the difference in data sets.

Scoring Guide

Score	Description
3	The response demonstrates a thorough understanding of analyzing data, including determining if data are relevant, artifact, irrelevant, or anomalous. The response identifies an example of data from Table 4 that does not seem to agree with the results produced by other groups who did the investigation and explains what may have caused the difference in data sets.
2	The response demonstrates a general understanding of communicating how scientific knowledge applies to propose further investigations.
1	The response demonstrates a limited understanding of communicating how scientific knowledge applies to propose further investigations.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response

A thorough understanding can be exemplified by the following sample response:

- When one group reduced their counterweight mass from Trial 2 to Trial 3, the projectile distance should have decreased. The distance increased from 0.7 to 1.2 instead. The trebuchet just might not be very accurate from one trial to the next.
- The students could have made an error in measuring the length.
- The students could have made an error in recording the data.

NECAP 2014 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 3

- 7 One example of data in Table 4 that doesn't seem to agree with the rest is Test 3's, Group 3's counterweight of 25kg producing a 0.3m distance. All the other data in the table indicates that the smaller the counterweight, the less distance it will go, but this is the opposite. Something that could have caused this difference is human error. There could have been an improper measurement done.

The response identifies an example of data from Table 4 that does not seem to agree with the results produced by other groups, and provides an explanation that human error may have caused the difference in data sets.

NECAP 2014 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 2

- 7 In the first test of Group 4, they used a counterweight mass of 25 kg, which produces a flight distance that was 5.6 m away from the basket. Because this group might have forgotten to weight properly, their results were altered.

The response identifies the 25 kg test from Table 4, which is not the best test to pick, although it does seem like it could be higher than expected. The response adds that human error may have caused the difference in data sets, which is an acceptable explanation.

NECAP 2014 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 1

- 7 Even though they have the same mass there are two completely different numbers. the wind might of pushed it or against it.

The identification of which test does not fit is rather vague, but the wind as an outside factor is an acceptable explanation.

SCORE POINT 0

- 7 There are no examples of data not agreeing.

The response is totally incorrect.

**NECAP 2014 RELEASED INQUIRY TASK
GRADE 11 SCIENCE**

Broad Area of Inquiry: Inquiry Construct 13:	Developing and Evaluating Explanations Communicate how scientific knowledge applies to explain results, propose further investigations, or construct and analyze alternative explanations.
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- 8 Identify one variable based on all the data from the trebuchet investigation that will **best** help the students win the throwing contest. Use evidence from this investigation to support your reasoning.

Scoring Guide

Score	Description
2	The response demonstrates a general understanding of communicating how scientific knowledge applies to propose further investigations. The response identifies one variable based on the trebuchet investigation that will help the students win the throwing contest and uses evidence from the investigation to support the reasoning.
1	The response demonstrates a limited understanding of communicating how scientific knowledge applies to propose further investigations.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response

A general understanding can be exemplified by the following sample response:

The counterweight mass, because the distance the projectile traveled is affected by the counterweight mass (student response must include data).

NECAP 2014 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 2A

8 The variable that would best help the students win is arm ratio. In graph 1, the results of changing the counterweight are very scattered for each mass; in other words, it is not very accurate. Changing the arm ratio however, proved to yield more accurate results with less change. In table 3, group 1 used a 3.5:1 ratio for tests 2 and 3. Test 2 yielded a 46.2 meter flight distance and test 3 yielded a 46.5 meter flight distance. With a difference of .3 meters, this is a fairly accurate trebuchet. Also group 3 used an arm ratio of 3:1 for tests 1 and 3. The difference of flight distances was .6 meters which also proves that the arm ratio is a major factor in accuracy.

The response identifies arm ratio as a variable that will help the students win the throwing contest, and uses plenty of detailed evidence from the investigation to support the reasoning.

NECAP 2014 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 2B

8

The counterweight mass is the variable that will best help the students win the contest. The 40 kg counterweight mass was the best for throwing the projectile 35 m as shown by Graph 1.

The response identifies counterweight mass as a variable that will help the students win the throwing contest, and uses a relevant piece of specific evidence from the investigation to support the reasoning.

NECAP 2014 RELEASED INQUIRY TASK
GRADE 11 SCIENCE

SCORE POINT 1

- 8 The counter weight mass is the variable that will most help the students because a change in counter weight mass affects the flight distance of the projectile more than a change in any other variable.

The response identifies counterweight mass as a variable that will help the students win, but there is no specific evidence from the investigation to support the reasoning.

SCORE POINT 0

- 8 I think that group 1 would win because they are in the middle of other groups.

The response is totally irrelevant to the task.