SCIENCE Assessment
Changes for 2010

Measurements of Student Progress (Grades 3-8)

High School Proficiency Exam

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Purpose: To provide information on changes and examples for the state science assessment.

New for 2010:

- Extended response (4-point) questions have been eliminated.
- The questions previously asked as extended response have been revised to short answer (2-point) questions. See pages 15, 31, and 47 for examples.
- One new question type, completion items, will begin to be introduced. See pages 14, 28, and 44 for examples.
- Testing time is reduced to a single session.

Unchanged in 2010:

- The science standards tested in 2010 are the 2005 Grade Level Expecations (GLE).
- The 2010 science test will look very similar to previous science tests.
- The science assessment materials on the OSPI science website are still appropriate for classroom use and will help prepare students for the state assessment. These include Powerful Classroom Assessments and Released Item Documents.
- The science test is based on investigation, application, and systems scenarios.
- A small number of stand-alone items may appear in the test. These items are not connected to a scenario.
- The operational science test has multiple-choice (1 point) and short answer (2-point) questions.
- The points on the science tests are balanced among physical, earth/ space, and living systems.
- The science test is untimed.

2010 and Beyond
Highlights for Grades 5 & 8

Alignment to standards:
- 2010 Science Measurement of Student Progress aligned to 2005 GLEs: http://www.k12.wa.us/assessment/WASL/Sciencepubdocs/ScienceGLEswithWASLEvidencesofLrng.pdf
- 2010 scores and scales have the same meaning as previous assessments
- 2011 Science Measurement of Student Progress will align to 2009 Revised content standards: http://www.k12.wa.us/CurriculumInstruct/Science/pubdocs/WAScienceStandardsFINAL.pdf
- 2011 cut scores and scales will be established by the State Board in summer 2011

Test length shortened:
- Grade 5: Single testing session—about 75 minutes
- Grade 8: Single testing session—about 90 minutes

Reduction of constructed response questions:
- No extended-response (4-point) questions
- No more than 25% of the points will be from short-snswer (2-point) questions
- Previous extended-response questions have been restructured into short answer questions (see pages 15 and 31 for examples)

New item types:
- Completion items (worth 1 point) will be operational in 2011

Later testing window:
- 2 ½ week window: May 12-28, 2010
- Student score reports to districts on August 16, 2010

Online testing:
- Not available in science for 2010
- Voluntary in 2011

2010 and Beyond
Highlights for High School

Alignment to standards:
- 2010 and 2011 Science High School Proficiency Exam aligned to 2005 GLEs: http://www.k12.wa.us/assessment/WASL/Sciencepubdocs/ScienceGLEswithWASLEvidencesofLrng.pdf
- 2010 and 2011 scores and scales have the same meaning as previous years
- 2012 Science High School Proficiency Exam will align to 2009 content standards: http://www.k12.wa.us/CurriculumInstruct/Science/pubdocs/WAScienceStandardsFINAL.pdf
- 2012 cut scores and scales will be established by the State Board in summer 2012

Test length shortened:
- Total testing time about 120 minutes
- Can be given in one or two sessions, but must be done in one day

Reduction of constructed response questions:
- No extended-response (4-point) questions
- No more than 25% of the points will be from short-answer (2-point) questions
- Previous extended-response questions have been restructured into short-answer questions (see page 47 for example)

No change to testing window for 2010:
- Science exam to be given on April 15, 2010
- Student score reports to districts on August 16, 2010

Online testing:
- Not available in science for 2010 or 2011
- Voluntary in 2012

Rollout Schedule for Online Testing

SCIENCE	Measurements of Student Progress		High School Proficiency Exam
	Grade 5	**Grade 8**	
2010	P/P	P/P	P/P
2011	Online	Online	P/P
2012	Online	Online	Online

Key

P/P = Paper/Pencil

(*) = Research Online

= 25% Online	= 80% Online
= 50% Online	= 100% Online

Adjustments to Number of Items and Points

Science -- 2006 thru 2008			
	Grade 5	Grade 8	HS
MC	21	28	28
SA	10	11	11
ER	2	3	3
Total Items	33	42	42
Total Points	**49**	**62**	**62**

Science -- 2009			
	Grade 5	Grade 8	HS
MC	21	28	28
SA	8	7	11
ER	0	2	3
Total Items	29	37	42
Total Points	**37**	**50**	**62**

Science -- 2010 & beyond (2012 & beyond in HS is To Be Determined)			
	Grade 5	Grade 8	HS
MC/CP	26	30	35
SA	4	5	5
Total Items	30	35	40
Total Points	**34**	**40**	**45**

Key:
MC = Multiple Choice, 1 point
CP = Completion, 1 point
SA = Short Answer, 2 points
ER = Extended Response, 4 points

Item Types Defined

	Multiple-Choice	Short Answer	Completion
Point Value	1	2	1
Distinguishing Feature(s)	Students select their answer from 3 choices (elementary) or 4 choices (secondary) .	Students write their answer using sentences or phrases on lines inside a box.	Students write a word or a short phrase inside a small box.

Grade 5

Student Sample Pages

Puddle Problem

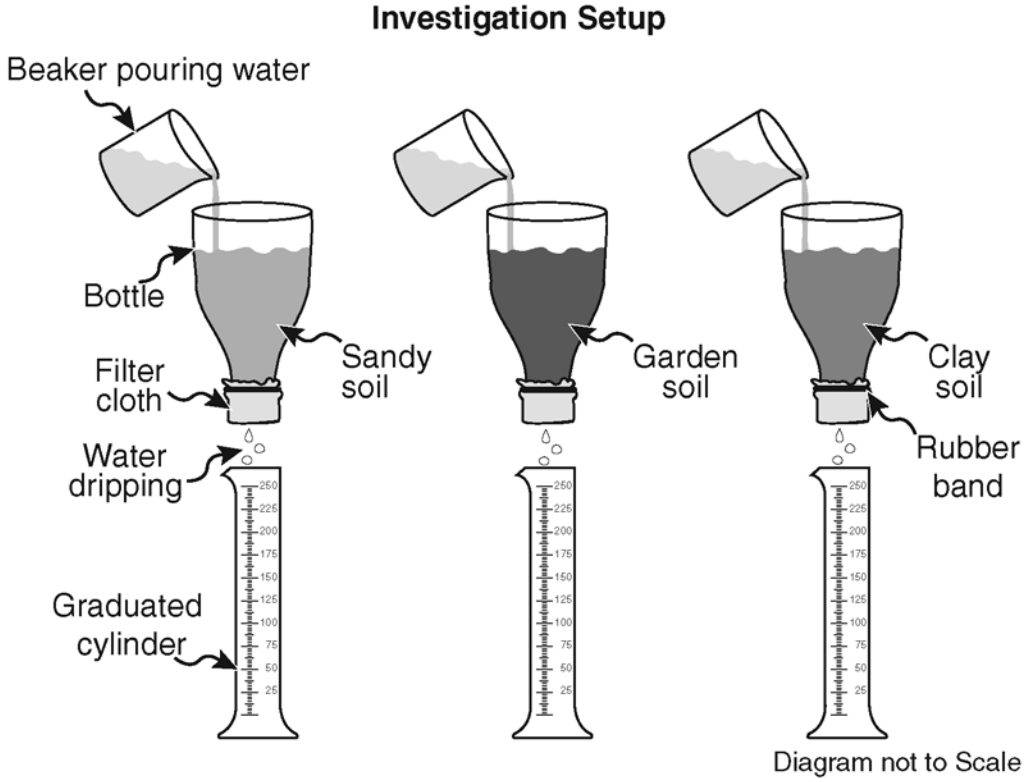
Directions: Use the following information to answer questions 1 through 8.

Meena and Roland play soccer at a nearby park. After a rain, the soccer field always had large puddles that did not go away for a few days. Meena wondered if the kind of soil has something to do with how long the puddles stayed. They did the following investigation.

Question: What is the effect of different kinds of soil on the amount of water that drains through the soil?

Prediction: Sandy soil will allow more water to drain through than other kinds of soils after 25 minutes.

Materials:
equal amounts of sandy soil, garden soil, and clay soil
plastic bottles with bottoms cut off
filter cloth
rubber bands
graduated cylinders
beakers
stopwatch
water



Puddle Problem

Procedure:

1. Cover the small openings of the bottles with the squares of filter cloth and rubber bands.
2. Put sandy soil into the large opening of one bottle.
3. Hold the bottle over the graduated cylinder.
4. Pour 500 milliliters of water into the bottle.
5. Start the stopwatch.
6. After 25 minutes, record the amount of water in the graduated cylinder as Trial 1 for sandy soil.
7. Repeat steps 1 through 6 two more times for Trials 2 and 3.
8. Repeat steps 1 through 7 for garden and clay soils.
9. Find and record the average amount of water drained for each kind of soil.

Data:

Kind of Soil vs. Amount of Water Drained

Kind of Soil	Amount of Water Drained after 25 minutes (milliliters)			
	Trial 1	Trial 2	Trial 3	Average
Sandy	189	193	194	192
Garden	134	127	117	126
Clay	4	5	4	4

1 Which variable was the measured (responding) variable in this investigation?

- O **A.** The size of the filter cloth
- O **B.** The height of the bottles
- O **C.** The amount of water drained

2 Which variable was kept the same (controlled) in this investigation?

- O **A.** Amount of water poured into the soils
- O **B.** Amount of water in the puddles on the field
- O **C.** Amount of water that drained through the soils

3 Why did Meena and Roland do three trials during their investigation?

- O **A.** To find a way to remove the puddles
- O **B.** To identify more kinds of soil
- O **C.** To be more sure of the results

4 Write a conclusion for the investigation.

In your conclusion, be sure to:

- Answer the investigative question.
- Include **supporting** data from the Kind of Soil vs. Amount of Water Drained table.
- Explain how these data **support** your conclusion.

Question: What is the effect of different kinds of soil on the amount of water that drains through the soil?

5 What does soil provide for the grass on the soccer field?

- O **A.** Mineral nutrients
- O **B.** Chemical energy
- O **C.** Additional roots

6 Meena and Roland wanted the water on the soccer field to drain faster. Based on the investigation, which kind of soil should be added to the soccer field soil?

Write your answer in the box.

7 How might the additional water on the soccer field affect the worms living in the soil?

- O **A.** The worms may be unable to move.
- O **B.** The worms may have less sunlight.
- O **C.** The worms may have less air.

8 Plan a controlled investigation to answer the question in the box. You may use any materials and equipment in your procedure.

In your procedure, be sure to include:

- Logical steps to do the investigation
- One changed (manipulated) variable
- One measured (responding) variable
- How often measurements should be taken and recorded

Question: What is the effect of different heights of soil on the time for 50 milliliter of water to drain?
Procedure:

Grade 5

Teacher Answer Pages

Puddle Problem
(Released in 2009)
Scenario Map and Rubrics

Title: Puddle Problem											**Grade: 5**
Description: Students investigate an Earth system using a model.											
Item Description Evidence of Learning for the Grade Level Expectation		**Grade Level Expectation & Evidence of Learning Codes** Systems of Science: Properties of Systems	Structure of Systems	Changes in Systems	Inquiry in Science	Application of Science	**Item Type** Multiple Choice/	Completion	Short Answer	Cognitive Level
1	Identify the measured (responding) variable in an investigation.				IN02d 2.1.2		C			II
2	Identify a variable kept the same (controlled) in an investigation.				IN02b 2.1.2		A			I
3	Identify how the method of investigation ensures reliable results.				IN09a 2.2.4		C			I
4	Write a conclusion including supporting data from an investigation.				IN03a 2.1.3				SA	II
5	Identify soils based on physical properties.	PR05b 1.1.5					A			I
6*	Identify possible solutions to a problem.					AP02b 3.1.2		CP		II
7*	Identify how an organism's ability to survive is affected by a change in the ecosystem.			CH10c 1.3.10			C			II
8*	Construct a logical plan for a simple controlled or field investigation.				IN02e 2.1.2				SA	II

* These questions were not included in the 2009 Science Assessment. They are included here as examples to help teachers and students understand what these items could look like on the 2010 assessment.

Scoring Rubric for Item 4: Puddle Problem Conclusion

Performance Description	Attributes
A **2-point response** demonstrates the student understands the GLE: Explaining IN03a (2.1.3) Understand how to construct a reasonable explanation using evidence BY writing a conclusion including supporting data from an investigation. Example: *Sandy soil drained the most water after 25 minutes. The clay soil drained 4 mL. The sandy soil drained 192 mL. The sandy soil drained 188 mL more than clay soil.*	3–4
A **1-point response** demonstrates the student has partial understanding of the GLE.	2
A **0-point response** demonstrates the student has little or no understanding of the GLE.	0–1

Kind of Soil vs. Amount of Water Drained

Kind of Soil	Amount of Water Drained after 25 minutes (milliliters)			
	Trial 1	Trial 2	Trial 3	Average
Sandy	189	193	194	192
Garden	134	127	117	126
Clay	4	5	4	4

Scoring Rubric for Item 4: Puddle Problem Conclusion (continued)

Attributes of a Conclusion Note: The italicized print is the part of the "Example" that is credited for the attribute.	
Performance Description	**Attributes**
Conclusive statement correctly answers the investigative question (or correctly states whether the hypothesis/prediction was correct): *Sandy soil drained the most water after 25 minutes.* Attribute Notes: 1. A vague conclusive statement (e.g. *the type of soil did affect the amount of water drained*) cannot be credited for this attribute, but other attributes can be credited. 2. A response with an incorrect conclusive statement or no conclusive statement may not be credited any attributes. 3. A response with both a correct and an incorrect conclusive statement (e.g. *The clay drained the most….the sandy soil drained the most…)* cannot be credited for this attribute but other attributes can be credited, if separate from any contradictory statements.	1
Supporting data should <u>at least</u> be over the entire range of the conditions investigated. Thus the minimum reported data are the lowest and highest conditions of the manipulated variable for quantitative data (responding variable when manipulated variable information is descriptive).	
Supporting Data for Clay: *The clay soil drained 4 mL.* OR *The sandy soil drained 188 mL more than clay soil.*	1
Supporting Data for Sandy Soil: *The sandy soil drained 192 mL.* OR *The sandy soil drained 188 mL more than clay soil.*	1
Explanatory language, separate from the conclusive statement, is used to connect or compare the supporting data to the conclusive statement: *The sandy soil drained 188 mL more than clay soil.* Attribute Notes: 1. This attribute can only be credited when at least one numeric value (or the text from a descriptive data table) for the responding variable is included in the response. 2. A copy of the conclusive statement cannot be credited for explanatory language. However, a rephrased credited conclusive statement can be credited. 3. Explanatory language comparing the range of the manipulated and responding variables may be credited (e.g. *The clay soil drained **only** 4 mL.)*. 4. If a response misquotes trend data between the highest and lowest conditions, this attribute cannot be credited. (e.g. *The garden soil drained 125 mL.*) 5. Transitional words (e.g. *however, therefore, because, so, then, clearly, but*) cannot be credited as explanatory language even when added to a conclusive statement. 6. A compound sentence as a conclusive statement may be read as two separate sentences.	1
Total Possible Attributes	4

Scoring Rubric for Item 4: Puddle Problem Conclusion (continued)

General Notes:

1. **Copying the Data Table**: Responses copying the whole data table verbatim may not be credited the supporting data attribute even with a correct conclusive statement and explanatory language.
   a) For grades 3-5, a translation of the whole data table into sentences is acceptable.
   b) N/A
2. **Supporting Data**: Responses must give the precise numerical values or precise descriptive language from the data table for both the manipulated and responding variables.
   a) N/A
   b) For grades 3-5, consistent trial data, or data before the completion of the investigation when measuring a responding variable over time, can be credited.
   c) Rounded numerical values cannot be credited. (e.g. *200* cannot be credited for sandy soil). However, a zero after a decimal point may be omitted (e.g. N/A).
   d) Units are not necessary for credit (e.g. *192* is acceptable for *192 mL*).
   e) Minor language differences in descriptive data may be acceptable as decided in range finding (e.g. *sand* for sandy, *regular* for garden).
   f) For grades 3-5, the manipulated variable may be implied.
3. **Derived Data:** Responses giving their own derived data between conditions can be credited for supporting data **and** explanatory language (e.g. *The sandy soil drained 188 mL more than clay soil.*).
   a) When the derived data uses the lowest and/or highest conditions, one or both supporting data points can be credited.
   b) Minor arithmetic errors in derived values are acceptable as decided in range finding. (e.g. none found at range finding).

Scoring Rubric for Item 6: Puddle Problem Solution*

Performance Description
A **1-point response** demonstrates the student understands the GLE: Designing Solutions AP02b (3.1.2) Understand how the scientific design process is used to develop and implement solutions to human problems BY identifying possible solutions to a problem. Response identifies the kind of soil that should be added to the soccer field by stating one of the following: • *Sandy soil* • *Sand* • *Soil with sand* • *sand* • *sandi sol* (and any other misspellings that were meant to communicate "sandy")
A **0-point response** demonstrates the student has little or no understanding of the GLE.

NOTE This item has not been through Range Finding and is included for demonstration purposes only. Additional right answers may be determined by a Rangefinding Committee based on actual student responses.

Scoring Rubric for Item 8: Puddle Problem New Procedure

Performance Description	Attributes
A **2-point response** demonstrates the student understands the GLE: Planning and Conducting Safe Investigations IN02e (2.1.2) Understand how to plan and conduct simple investigations following all safety rules BY constructing a logical plan for a simple controlled or field investigation.	4-5
A **1-point response** demonstrates the student has partial understanding of the GLE.	2-3
A **0-point response** demonstrates the student has little or no understanding of the GLE.	0-1

Attributes of a Procedure

Attribute Name	Description	Attribute
Changed (manipulated) Variable	Only one changed (manipulated) variable (*different heights of soil*) is identified or implied in the procedure or data table (if given).	1
Measured (responding) Variable	The measured (responding) variable (*time for water to drain*) is identified or implied in the procedure or data table (if given).	1
Record Measurements	The procedure states or implies measurements are recorded periodically or gives a data table. Attribute Notes: 1. If artificial data for the responding variable is given, this attribute cannot be credited. 2. The phrase 'take measurement' cannot be used to mean record.	1
Trials are Repeated	More than one trial for at least one condition is planned, or implied in a data table, to measure the measured (responding) variable.	1
Logical Steps	The steps of the procedure are detailed enough to repeat the procedure effectively (examples of illogical steps: no ending time indicated, states *Set up as diagrammed,* but diagram is inadequate, recording vague data or results).	1
	Total Possible Attributes	**5**

Scoring Rubric for Item 8: Puddle Problem New Procedure (continued)*

General Notes:

1. **Inappropriate Procedures:** If the response does not plan an appropriate procedure for the given question, the response may not earn any of the possible attributes.
   Examples:
   a) Repeats the procedure from the scenario
   b) Measures only one condition (therefore cannot establish the controlled or manipulated variables)
   c) Purposefully changes more than one variable simultaneously
   d) Writes a procedure that is too vague to possibly be appropriate
   e) Writes a prediction instead of a procedure
2. **Naming Attributes:** If the response names a bulleted attribute listed after "Procedure that includes:" without including that attribute in the procedure, the attribute point cannot be credited. When a bulleted attribute is named and implied in the response, both must be correct to be credited.
3. **Clarifying Vagueness in Procedures:**
   a) N/A
   b) Measuring a vague parameter (e.g. *amount of soil* instead of height) may be credited as a manipulated or responding variable. However, a vague parameter is difficult to repeatedly measure, so the logical steps attribute cannot be credited.
   c) The term "repeat" at the end of a step refers to that step only.
   d) The term "repeat" as a separate step (or in a new paragraph) refers to the whole procedure.
   e) The term "repeat," when qualified, cannot be credited for multiple trials (e.g. *repeat if necessary, repeat as desired)*.
   f) A vague action that calls for the manipulated variable to be changed (e.g. *change the height*) without indicating how many times, gives no end to the investigation so the logical steps attribute cannot be credited.
   g) N/A
   h) When a procedure conflicts with the labeled diagram, the procedure is too illogical to be effectively repeated. Therefore, the logical steps attribute cannot be credited, but the procedure can be scored for attributes that are not in conflict.

NOTE This item has not been through Range Finding and is included for demonstration purposes only. Additional right answers may be determined by a Rangefinding Committee based on actual student responses.

Grade 8

Student Sample Pages

Danger! Mudflow!

Directions: Use the following information to answer questions 1 through 7.

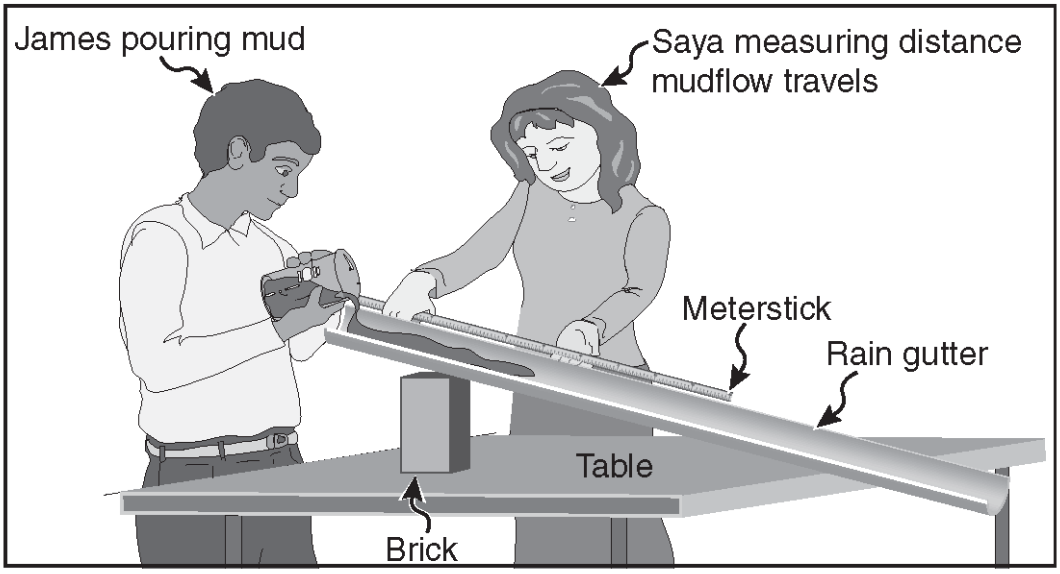
Saya and James wanted to investigate mud, a mixture of soil and water. They wondered how water affects a mudflow. They built a model as shown below, and did the following investigation.

Question: What is the effect of the volume of water in mud on the distance a mudflow travels?

Hypothesis (prediction): As the volume of water in mud increases, a mudflow will travel farther because water erodes soil.

Materials:
dry soil
water
balance
stirring rod
graduated cylinder
beaker
piece of rain gutter
brick
meterstick

Investigation Setup



Danger! Mudflow!

Procedure:

1. Put the rain gutter on the table and use a brick to hold one end of the gutter up, making a slope.
2. Stir 100 grams of dry soil and 20 milliliters (mL) of water together in a beaker to make mud.
3. Pour the mud into the top of the raised end of the rain gutter.
4. Measure and record the distance the front of the mudflow traveled as Trial 1.
5. Rinse and dry the rain gutter to remove the mud.
6. Repeat steps 2 through 5 two times as Trials 2 and 3.
7. Repeat steps 2 through 6 for 25 mL of water, 30 mL of water, and 35 mL of water.
8. Calculate and record the average distance the mudflow traveled for each volume of water used.

Data:

Volume of Water vs. Distance Mudflow Traveled

Volume of Water (milliliters)	Distance Mudflow Traveled (centimeters)			
	Trial 1	Trial 2	Trial 3	Average
20	19	25	20	21
25	97	84	97	93
30	112	108	126	115
35	144	167	170	160

1 Which variable was the responding (dependent) variable in this investigation?

Write your answer in the box.

2 Which variable was a controlled (kept the same) variable in this investigation?

- O **A.** Time for mudflow to move
- O **B.** Speed of mudflow
- O **C.** Amount of water
- O **D.** Mass of dry soil

3 Based on the results of James and Saya's investigation, which weather condition is most likely to produce a large mudflow?

- O **A.** Strong winds
- O **B.** Heavy rains
- O **C.** Low snowfall
- O **D.** High temperatures

4 Write a conclusion for this investigation.

In your conclusion, be sure to:

- Answer the investigative question.
- Include **supporting** data from the Volume of Water vs. Distance Mudflow Traveled table.
- Explain how these data **support** your conclusion.

Question: What is the effect of the volume of water in mud on the distance a mudflow travels?

5 What caused the mudflow to stop moving in each trial of the investigation?

- O **A.** Kinetic energy of the mud increased.
- O **B.** Gravitational force on the mud decreased.
- O **C.** The mass of the mud became greater as the mud moved.
- O **D.** Friction became greater than the force of gravity on the mud.

6 Why did Saya and James repeat the investigation three times?

- O **A.** To fill in the data table
- O **B.** To support the hypothesis
- O **C.** To be sure the data is reliable
- O **D.** To make the results identical

7 Plan a controlled investigation to answer the question printed in the box. You may use any materials and equipment in your procedure.

In your procedure, be sure to include:

- Logical steps to do the investigation
- One controlled (kept the same) variable
- One manipulated (changed) variable
- One responding (dependent) variable
- How often measurements should be taken and recorded

Question: What is the effect of different angles (slopes) of the rain gutter on the distance a mudflow travels?
Procedure:

Grade 8

Teacher Answer Pages

Danger! Mudflow!
(Released in 2009)
Scenario Map and Rubrics

Title: Danger! Mudflow!										**Grade: 8**
Description: Students investigate an Earth system using a model.										
Item Description Evidence of Learning for the Grade Level Expectation		**Grade Level Expectation & Evidence of Learning Codes** Systems of Science: Properties of Systems	Structure of Systems	Changes in Systems	Inquiry in Science	Application of Science	**Item Type** Multiple Choice	Completion	Short Answer	Cognitive Level
1*	Identify the responding (dependent) variable in an investigation.				IN02d 2.1.2			CP		I
2*	Identify the controlled (kept the same) variable in an investigation.				IN02b 2.1.2		D			I
3	Identify or write a scientific explanation of an observed phenomena using given data or information.				IN03c 2.1.3		B			I
4	Write a scientific conclusion, including supporting data from an investigation, using inferential logic.				IN03a 2.1.3				SA	II
5	Identify how frictional forces act to stop the motion of objects.			CH02b 1.3.2			D			I
6	Identify how the method of an investigation ensures reliable results.				IN09a 2.2.4		C			I
7*	Construct a logical plan for a controlled investigation.				IN02e 2.1.2				SA	II

* These questions were not included in the 2009 Science Assessment. They are included here as examples to help teachers and students understand what these items could look like on the 2010 assessment.

Scoring Rubric for Item 1: Danger! Mudflow! Variable*

Performance Description
A **1-point response** demonstrates the student understands the GLE: Planning and Conducting Safe Investigations IN02d (2.1.2) Understand how to plan and conduct safe investigations BY identifying the responding (dependent) variable in an investigation. Response identifies the responding (dependent) variable by stating one of the following: • *Distance the mudflow traveled* • *Distance mud went* • *distance* • *distance of soil* • (and any other misspellings that were meant to communicate "distance of soil")
A **0-point response** demonstrates the student has little or no understanding of the GLE.

NOTE This item has not been through Range Finding and is included for demonstration purposes only. Additional right answers may be determined by a Rangefinding Committee based on actual student responses.

Scoring Rubric for Item 4: Danger! Mudflow! Conclusion

Performance Description	Attributes
A **2-point response** demonstrates the student understands the GLE: Explaining IN03a (2.1.3): Apply understanding of how to construct a scientific explanation using evidence and inferential logic BY writing a scientific conclusion, including supporting data from an investigation, using inferential logic. Example: *The greater the volume of water in the mud, the greater the distance the mudflow traveled. With 20 mL water, the mudflow traveled an average of 21 cm. With 35 mL water, the mudflow moved an average of 160 cm. The mud with 35 mL moved about 8 times farther than the mud with 20 mL of water.*	3–4
A **1-point response** demonstrates the student has partial understanding of the GLE.	2
A **0-point response** demonstrates the student has little or no understanding of the GLE.	0–1

Volume of Water vs. Distance Mudflow Traveled

Volume of Water (milliliters)	Distance Mudflow Traveled (centimeters)			
	Trial 1	Trial 2	Trial 3	Average
20	19	25	20	21
25	97	84	97	93
30	112	108	126	115
35	144	167	170	160

Scoring Rubric for Item 4: Danger! Mudflow! Conclusion (continued)

Attributes of a Conclusion Note: The italicized print is the part of the "Example" that is credited for the attribute.	
Description	**Attributes**
Conclusive statement correctly answers the investigative question (or correctly states whether the hypothesis/prediction was correct): *The greater the volume of water in the mud, the greater the distance the mudflow traveled.* Attribute Notes: 1. A vague conclusive statement (e.g., *the amount of water did affect the distance the mudflow traveled*) cannot be credited for this attribute, but other attributes can be credited. 2. A response with an incorrect conclusive statement or no conclusive statement may not be credited any attributes. 3. A response with both a correct and an incorrect conclusive statement (e.g., *As the water volume increased distance traveled decreased … as the volume got smaller so did the distance*) cannot be credited for this attribute, but other attributes can be credited, if separate from any contradictory statements.	1
Supporting data should <u>at least</u> be over the entire range of the conditions investigated. Thus the minimum reported data are the lowest and highest conditions of the manipulated variable for quantitative data (responding variable when the manipulated variable information is descriptive).	
Supporting Data for 20 mL of water: *With 20 mL water, the mudflow traveled an average of 21 cm.*	1
Supporting Data for 35 mL of water: *With 35 mL water, the mudflow moved an average of 160 cm.*	1
Explanatory language, separate from the conclusive statement, is used to connect or compare the supporting data to the conclusive statement: *The mud with 35 mL moved about 8 times farther than the mud with 20 mL of water.* Attribute Notes: 1. This attribute can only be credited when at least one numeric value (or the text from a descriptive data table) for the responding or manipulated variable is included in the response. 2. A copy of the conclusive statement cannot be credited for explanatory language. However, a re-phrased credited conclusive statement can be credited. 3. Explanatory language comparing the range of the manipulated and/or responding variables may be credited (e.g., *When the amount of water was **lowest**—20 mL, the distance the mudflow traveled was **lowest**—21 cm).* 4. If a response misquotes trend data between the highest and lowest conditions, this attribute cannot be credited. (e.g., *With 25 mL of water…90 cm).* 5. Transitional words (e.g., *however, therefore, because, so, then, clearly, but*) cannot be credited as explanatory language even when added to a conclusive statement. 6. A compound sentence as a conclusive statement may be read as two separate sentences.	1
Total Possible Attributes	4

Scoring Rubric for Item 4: Danger! Mudflow! Conclusion (continued)

General Notes:

1. **Copying the Data Table:** If a response just copies the whole data table verbatim, supporting data attributes may not be credited even with a correct conclusive statement and explanatory language.
   a) N/A.
   b) For grades 6–8 and high school, a discussion of the whole data table **may** be acceptable when the data table is minimal with a very small number of data cells.
2. **Supporting Data:** Responses must give the precise numerical values or precise descriptive language from the data table for both the manipulated and responding variables.
   a) Average data (if given) rather than trial data, or data from the end of the investigation, must be included for grades 6–8 and high school.
   b) N/A
   c) Rounded numerical values cannot be credited (e.g. *20* cannot be credited for *21*). However, a zero after a decimal point may be omitted (e.g. N/A).
   d) Units are not necessary for credit (e.g. *160* is acceptable for *160 cm*).
   e) Minor language differences in descriptive data may be acceptable as decided in range finding.
   f) N/A.
3. **Derived Data:** Responses giving their own derived data between conditions can be credited for supporting data **and** explanatory language (e.g., *Increasing the volume of water by 15ml caused the distance the mud traveled to increase by 139cm*).
   a) When the derived data uses the lowest and/or highest conditions, one or both supporting data attributes can be credited.
   b) Minor arithmetic errors in derived values can be acceptable as decided in range finding (e.g., *OVER eight times as far*).

Scoring Rubric for Item 7: Danger! Mudflow! New Procedure

Performance Description	Attributes
A **2-point response** demonstrates the student understands the GLE Planning and Conducting Safe Investigations: IN02e (2.1.2): Understand how to plan and conduct scientific investigations BY constructing a logical plan for a controlled or field investigation.	5–6
A **1-point response** demonstrates the student has partial understanding of the GLE.	3–4
A **0-point response** demonstrates the student has little or no understanding of the GLE.	0–2

Attributes of a Procedure

Attribute Name	Description	Attributes
One Controlled (kept the same) Variable	At least one controlled (kept the same) variable is identified or implied in the procedure or the materials list (e.g., *mudflow sample mass, rain gutter, water volume in mudflow sample mass, starting point on rain gutter, point at which mudflow is measured*).	1
Manipulated (changed) Variable	Only one manipulated (changed) variable (*angle/slope of the rain gutter*) is identified or implied in the procedure or data table (if given). Attribute note: Response may be credited as a clear manipulated variable if the response gives specific angles or explicitly explains how to change the angle or the height of the gutter (e.g., *add a brick* when elaborated with *to change the angle/height of the gutter* or *on top of the other brick*)	1
Responding (dependent) Variable	The responding (dependent) variable (*distance mudflow travels*) is identified or implied in the procedure or data table (if given).	1
Record Measurements	The procedure states or implies measurements are recorded periodically or gives a data table. Attribute Notes: 1. If artificial data for the responding variable is given, this attribute cannot be credited. 2. The phrase "take measurement" cannot be used to mean record.	1
Trials are Repeated	More than one trial for all conditions is planned, or implied in a data table, to measure the responding variable.	1
Logical Steps	The steps of the procedure are detailed enough to repeat the procedure effectively (examples of illogical steps: no ending time indicated, states *Set up as diagrammed* but diagram is inadequate, recording vague data or results).	1
	Total Possible Attributes	**6**

Scoring Rubric for Item 7: Danger! Mudflow! New Procedure (continued)*

General Notes:

1. **Inappropriate Procedures:** If the response does not plan an appropriate procedure for the given question, the response may not earn any of the possible procedure attributes.
   Examples:
   a) Repeats the procedure from the scenario
   b) Measures only one condition (therefore cannot establish the controlled or manipulated variables)
   c) Purposefully changes more than one variable simultaneously
   d) Writes a procedure that is too vague to possibly be appropriate
   e) Writes a prediction instead of a procedure
2. **Naming Attributes:** If the response names a bulleted attribute listed after "Procedure that includes:" without including that attribute in the procedure, the attribute cannot be credited. When a bulleted attribute is named and implied in the response, both must be correct to be credited.
3. **Clarifying Vagueness in Procedures:**
   a) N/A
   b) Measuring a vague parameter (e.g., *size of mudflow* instead of distance) may be credited as a manipulated or responding variable. However, a vague parameter is difficult to repeatedly measure, so the logical steps attribute cannot be credited.
   c) The term "repeat" at the end of a step refers to that step only.
   d) The term "repeat" as a separate step (or in a new paragraph) refers to the whole procedure.
   e) The term "repeat," when qualified, cannot be credited for multiple trials (e.g., *repeat if necessary, repeat as desired*).
   f) A vague action that calls for the manipulated variable to be changed (e.g., *increase the angle by 5º*) without indicating how many times, gives no end to the investigation so the logical steps attribute cannot be credited.
   g) NA
   h) When a procedure conflicts with the labeled diagram, the procedure is too illogical to be effectively repeated. Therefore, the logical steps attribute cannot be credited, but the procedure can be scored for attributes that are not in conflict.

NOTE This item has not been through Range Finding and is included for demonstration purposes only. Additional right answers may be determined by a Rangefinding Committee based on actual student responses.

High School

Student Sample Pages

Sliding Away

Directions: Use the following information to answer questions 1 through 8.

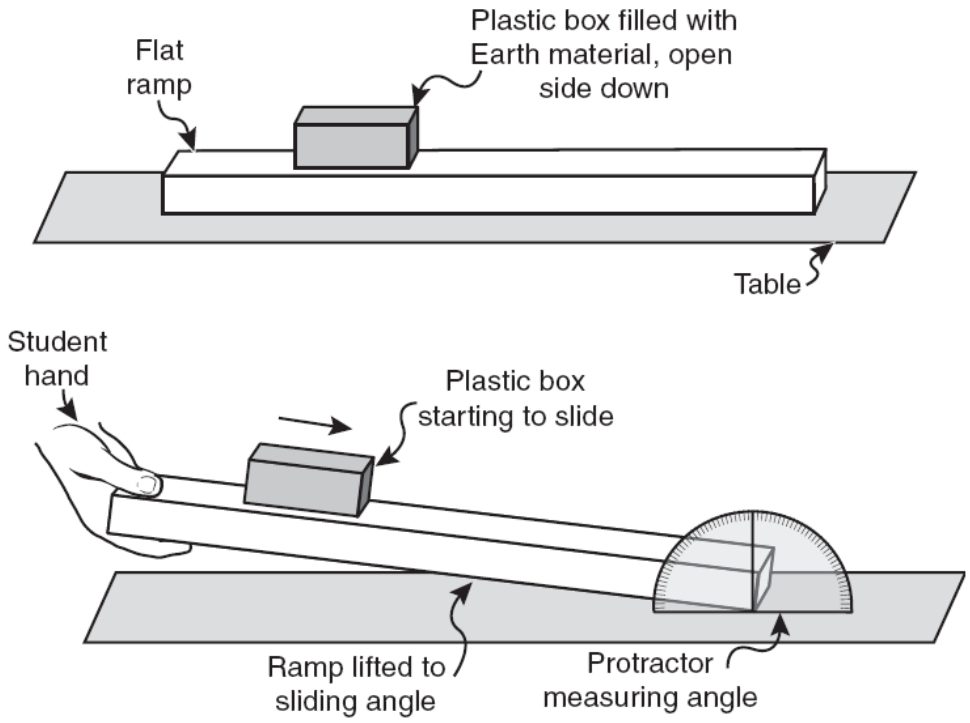
Elizabeth and Billy live in a mountainous area where landslides occur. They noticed that landslides are more common on some steep hills than other steep hills. Elizabeth and Billy wondered if some types of Earth materials tend to slide down steep hills more than others. They conducted the following investigation, using a ramp to model the slope of a hill.

Question: What is the effect of type of Earth material (gravel, sand, and silt) on the ramp angle at which the Earth material will slide?

Hypothesis: Sand will slide at the lowest ramp angle because sand is made of loose grains.

Materials:
clear, plastic box with an open top
Earth materials: dry gravel, dry sand, and dry silt
scale
protractor
ramp

Investigation Setup



Sliding Away

Procedure:

1. Make sure the ramp is clean and dry before each trial.
2. Fill the plastic box with 4.9 newtons (N) or 1.1 pounds of gravel.
3. Put the plastic box **open side down** on the ramp when the ramp is flat on the table.
4. Slowly lift one end of the ramp until the plastic box filled with gravel starts to slide down the ramp.
5. Measure and record the angle at which the plastic box filled with gravel starts to slide as Trial 1.
6. Repeat steps 1 through 5 two more times as Trials 2 and 3 for the gravel.
7. Repeat steps 1 through 6 using sand and then silt.
8. Calculate and record the average ramp angle for each Earth material.

Data:

Earth Material vs. Ramp Angle

Earth Material	Ramp Angle (degrees)			
	Trial 1	Trial 2	Trial 3	Average
Gravel	19	20	22	20
Sand	25	23	23	24
Silt	28	28	25	27

1 Which two variables were the controlled variables in this investigation?

- O **A**. Ramp angle and type of Earth material
- O **B**. Ramp surface and weight of Earth materials
- O **C**. Density of Earth materials and steepness of ramp
- O **D**. Particle size of the Earth materials and ramp length

2 Which variable was the responding (dependent) variable in this investigation?

- O **A**. Density of the Earth materials in the plastic box
- O **B**. Ramp surface the plastic box slides down
- O **C**. Time for each Earth material to slide
- O **D**. Ramp angle when each slide begins

3 Which variable was the manipulated (changed) variable in this investigation?
Write your answer in the box

4 Write a conclusion for this investigation.

In your conclusion, be sure to:

- Answer the investigative question.
- Include **supporting** data from the Earth Material vs. Ramp Angle table.
- Explain how these data **support** your conclusion.

Question: What is the effect of type of Earth material (gravel, sand, and silt) on the ramp angle at which the Earth material will slide?

5 Which of the following procedural steps in the investigation **increases** validity of this investigation?

- O **A**. Filling the plastic box with gravel
- O **B**. Placing the plastic box open side down on the ramp
- O **C**. Making sure the ramp is clean and dry before each trial
- O **D**. Measuring the ramp angle when the Earth material starts to slide

6 Which difference between sand and gravel most likely accounts for different results on the ramp?

- O **A**. The force of gravity changes with the smaller particles of sand.
- O **B**. The mass of the sand is less, causing a smaller gravitational force.
- O **C**. The volume of gravel is higher, resulting in greater pressure on the ramp.
- O **D**. The particles of gravel have fewer surfaces in contact with the ramp.

7 What happened to the plastic box's potential energy just as the box began to slide down the ramp?

- O **A**. The potential energy of the box began transforming into kinetic energy.
- O **B**. The potential energy of the box began transforming into heat energy.
- O **C**. The potential energy of the box remained the same.
- O **D**. The potential energy of the box began increasing.

8 Plan a controlled investigation to answer the question printed in the box. In your procedure, you may use any materials and equipment.

In your procedure, be sure to include:

- Logical steps to do the investigation
- Two controlled variables
- One manipulated variable
- One responding variable
- How often measurements should be taken and recorded

Question: What is the effect of the weight of sand on the time for the sand to slide down the ramp?
Procedure:

High School

Teacher Answer Pages

Sliding Away
(Released 2007)
Scenario Map and Rubrics

Title: Sliding Away											**Grade: High School**
Description: Students investigate how the type of Earth material affects the ramp angle at which the Earth material slides.											
Item Description		**Grade Level Expectation & Evidence of Learning Codes**					**Item Type**				
		Systems of Science			Inquiry in Science	Application of Science	Multiple Choice	Completion	Short Answer	Cognitive Level
WASL Evidence of Learning for the Grade Level Expectation		Properties of Systems	Structure of Systems	Changes in Systems						
1*	Identify the controlled variables in an investigation.				IN02b 2.1.2		B			I
2*	Identify the responding variable in an investigation.				IN02d 2.1.2		D			I
3*	Identify the manipulated variable in an investigation.				IN02c 2.1.2			CP		I
4	Write a conclusion including supporting data from an investigation.				IN03a 2.1.3				SA	II
5	Identify the purpose of the steps of an investigation in terms of the validity of the investigation.				IN09d 2.2.4		C			I
6	Identify a scientific explanation of an observed phenomenon using given data or information.				IN03c 2.1.3		D			II
7	Identify how energy is transferred or transformed within and among physical systems.		ST02a 1.2.2				A			I
8*	Construct a logical plan for a systematic and complex scientific controlled investigation.				IN02e 2.1.2				SA	II

* These questions were not included in the 2007 Science Assessment. They are included here as examples to help teachers and students understand what these items could look like on the 2010 assessment.

Scoring Rubric for Item 3: Sliding Away Variable*

Performance Description
A **1-point response** demonstrates the student understands the GLE: Planning and Conducting Safe Investigations IN02c (2.1.2) Understand how to plan and conduct safe investigations BY identifying the manipulated variable in an investigation. Response identifies the manipulated variable by stating one of the following: • *Earth material* • *Kind of earth material* • *Size of grains* • *Different sizes of pebbles* • (and any other misspellings that were meant to communicate the above list)
A **0-point response** demonstrates the student has little or no understanding of the GLE.

NOTE This item has not been through Range Finding and is included for demonstration purposes only. Additional right answers may be determined by a Rangefinding Committee based on actual student responses.

Scoring Rubric for Item 4: Sliding Away Conclusion

Performance Description	**Attributes**
A **2-point response** demonstrates the student understands the GLE: Explaining IN03a (2.1.3) Synthesize a revised scientific explanation using evidence, data, and inferential logic BY writing a scientific conclusion, including supporting data from an investigation, using inferential logic. Example: *The angle at which silt slides is greater than the angle at which gravel and sand slide. Silt didn't slide until the ramp was at 27 degrees. Gravel slid at 20 degrees. Silt slid at a ramp angle 7 degrees greater than gravel.*	3-4
A **1-point response** demonstrates the student has partial understanding of the GLE.	2
A **0-point response** demonstrates the student has little or no understanding of the GLE.	0-1

Earth Material vs. Ramp Angle

Earth Material	**Ramp Angle** (degrees)			
	Trial 1	Trial 2	Trial 3	Average
Gravel	19	20	22	20
Sand	25	23	23	24
Silt	28	28	25	27

Scoring Rubric for Item 4: Sliding Away Conclusion (continued)

Attributes of a Conclusion Note: The italicized print is the part of the "Example" that is credited for the attribute.	
Description	**Attributes**
Conclusive statement correctly answers the investigative question (or correctly states whether the hypothesis/prediction was correct): *The angle at which silt slides is greater than the angles at which gravel and sand slide.* Attribute Notes: 1. A vague conclusive statement (e.g. *the type of Earth material did affect the angle at which Earth materials slide*) cannot be credited for this attribute but other attributes can be credited. 2. A response with an incorrect conclusive statement or no conclusive statement may not be credited any attributes. (E.g. *Gravel slid first because the box with gravel is heaviest.* OR *The material with the lowest total weight pushing on the ramp, silt, slides at the highest angle.*) 3. A response with both a correct and an incorrect conclusive statement (e.g., *Gravel slid first… silt slid first*) cannot be credited for this attribute, but other attributes can be credited, if separate from any contradictory statements.	1
Supporting data should <u>at least</u> be over the entire range of the conditions investigated. Thus, the minimum reported data are the lowest and highest conditions of the manipulated variable for quantitative data (responding variable when the manipulated variable information is descriptive).	
Supporting data for gravel: *Gravel slid at 20 degrees.*	1
Supporting data for silt: *Silt didn't slide until the ramp was at 27 degrees.*	1
Explanatory language, separate from the conclusive statement, is used to connect or compare the supporting data to the conclusive statement: *Silt slid at a ramp angle 7 degrees greater than gravel.* Attribute Notes: 1. This attribute can only be credited when at least one numeric value (or the text from a descriptive data table) for the manipulated or responding variable is included in the response. 2. A copy of the conclusive statement cannot be credited for explanatory language. However, a re-phrased credited conclusive statement can be credited. 3. Explanatory language comparing the range of the manipulated and/or responding variables may be credited. (E.g. *When the Earth material was gravel, the ramp angle for sliding was the **lowest**, 20 degrees.)* 4. If a response misquotes trend data between the highest and lowest conditions, this attribute cannot be credited. (e.g. *Sand slid at 26 degrees.*) 5. Transitional words (e.g. however, therefore, because, so, then, clearly, but) cannot be credited as explanatory language even when added to a conclusive statement. 6. A compound sentence as a conclusive statement may be read as two separate sentences.	1
Total Possible Attributes	4

Scoring Rubric for Item 4: Sliding Away Conclusion (continued)

General Notes:

1. **Copying the Data Table**: If a response just copies the whole data table verbatim, supporting data attributes may not be credited even with a correct conclusive statement and explanatory language.
   a) N/A.
   b) For grades 6-8 and high school, a discussion of the whole data table **may** be acceptable when the data table is minimal with a very small number of data cells.
2. **Supporting Data**: Responses must give the precise numerical values or precise descriptive language from the data table for both the manipulated and responding variables.
   a) Average data (if given) rather than trial data, or data from the end of the investigation, must be included for grades 6-8 and high school.
   b) N/A.
   c) Rounded numerical values cannot be credited (e.g. *30* cannot be credited for *27*). However, a zero after a decimal point may be omitted (e.g. N/A).
   d) Units are not necessary for credit (e.g. *20* is acceptable for *20 degrees*).
   e) Minor language differences in descriptive data may be acceptable as decided in range finding (e.g. N/A).
   f) N/A.
3. **Derived Data:** Responses giving their own derived data between conditions can be credited for supporting data **and** explanatory language (e.g. *the gravel slid at a ramp angle 7 degrees less than the angle at which silt slid*).
   a) When the derived data uses the lowest and/or highest conditions, one or both supporting data points can be credited.
   b) Minor arithmetic errors in derived values are acceptable as decided in range finding.
4. *Particle* or *grain size* can be synonymous with *sand, gravel,* and *silt*, if the response defines or clearly implies the largest particles/grains as gravel and the smallest particles/grains as silt.
5. Responses that refer to *easiest to slide* or *slide before/first* for lowest/lower ramp angle and/or *hardest to slide* or *slide after/last* for highest/higher ramp angle may be creditable. Speed of sliding (e.g. s*liding fast/sliding slow)* cannot be credited as ramp angle.
6. References to the weight or mass of the individual Earth materials (e.g. *gravel is heaviest/most weight/most mass)* may be interpreted as referring particle size and can be credited. A response which indicates the total mass in the box or on the ramp is different for each Earth material may not receive any score points.

Scoring Rubric for Item 8:Sliding Away New Procedure

Performance Description	Attributes
A **2-point response** demonstrates the student understands the GLE Planning and Conducting Safe Investigations: IN02e (2.1.2): Understand how to plan and conduct scientific investigations BY constructing a logical plan for a systematic and complex controlled or field investigation.	5–7
A **1-point response** demonstrates the student has partial understanding of the GLE.	3–4
A **0-point response** demonstrates the student has little or no understanding of the GLE.	0–2

Attributes of a Procedure

Attribute Name	Description	Attributes
Controlled Variables	At least two controlled variables is identified or implied in the procedure (e.g., *length of ramp, container*).	1
Manipulated Variable	Only one manipulated variable (*weight of sand*) is identified or implied in the procedure or data table (if given).	1
Responding Variable	The responding variable (*time to slide down the ramp*) is identified or implied in the procedure or data table (if given).	1
Record Measurements	The procedure states or implies measurements are recorded periodically or gives a data table. Attribute Notes: 1. If artificial data for the responding variable is given, this attribute cannot be credited. 2. The phrase "take measurement" cannot be used to mean record.	1
Trials are Repeated	More than one trial for all conditions is planned, or implied in a data table, to measure the responding variable.	1
Extra Validity Measure	The procedure includes a validity measure **not** included in the scenario investigation (e.g. more controlled variables, better measuring technique, increased range of conditions, control for sample bias).	1
Logical Steps	The steps of the procedure are detailed enough to repeat the procedure effectively (examples of illogical steps: no ending time indicated, states *Set up as diagrammed* but diagram is inadequate, recording vague data or results).	1
	Total Possible Attributes	**7**

Scoring Rubric for Item 8: Sliding Away New Procedure (continued)*

General Notes:

1. **Inappropriate Procedures:** If the response does not plan an appropriate procedure for the given question, the response may not earn any of the possible procedure attributes.
   Examples:
   a) Repeats the procedure from the scenario
   b) Measures only one condition (therefore cannot establish the controlled or manipulated variables)
   c) Purposefully changes more than one variable simultaneously
   d) Writes a procedure that is too vague to possibly be appropriate
   e) Writes a prediction instead of a procedure
2. **Naming Attributes:** If the response names a bulleted attribute listed after "Procedure that includes:" without including that attribute in the procedure, the attribute cannot be credited. When a bulleted attribute is named and implied in the response, both must be correct to be credited.
3. **Clarifying Vagueness in Procedures:**
   a) N/A
   b) Measuring a vague parameter (e.g., *different sand* instead of weight) may be credited as a manipulated or responding variable. However, a vague parameter is difficult to repeatedly measure, so the logical steps attribute cannot be credited.
   c) The term "repeat" at the end of a step refers to that step only.
   d) The term "repeat" as a separate step (or in a new paragraph) refers to the whole procedure.
   e) The term "repeat," when qualified, cannot be credited for multiple trials (e.g., *repeat if necessary, repeat as desired*).
   f) A vague action that calls for the manipulated variable to be changed (e.g., *increase the amount of sand by 50 g*) without indicating how many times, gives no end to the investigation so the logical steps attribute cannot be credited.
   g) At high school, a vague action that calls for the manipulated variable to be changed without indicating how many times, cannot be credited for more than two conditions of the manipulated variable.
   h) When a procedure conflicts with the labeled diagram, the procedure is too illogical to be effectively repeated. Therefore, the logical steps attribute cannot be credited, but the procedure can be scored for attributes that are not in conflict.

NOTE This item has not been through Range Finding and is included for demonstration purposes only. Additional right answers may be determined by a Rangefinding Committee based on actual student responses.

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