

Science

Constructed Response Items

Measures of Student Learning: NC's Common Exams

Released Fall 2012

These released test items may be used by school systems to help acquaint students with constructed response items on the Measures of Student Learning: NC's Common Exams. These materials must not be used for personal or financial gain.

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The questions you read next will require you to answer in writing.

1. Write your answers on separate paper.
2. Be sure to write your name on each page.

- 1 Atomic size is one of many trends of the periodic table.
 - Describe one reason atomic size may vary among the elements of the periodic table.
 - List the correct order of aluminum, magnesium, phosphorus, silicon, sodium, and sulfur, based on decreasing atomic size.
- 2 During a laboratory experiment, 75 grams of water at 100°C is transformed into steam at 100°C .
 - Describe how this experiment confirms the law of conservation of energy.
 - How much heat energy is needed to completely change the state of the water? Show your work.
- 3 A compound contains the elements copper and chlorine in a ratio of 1 copper : 2 chlorine.
 - What is the empirical formula for this compound?
 - What is the percent composition of copper in this compound? Show your work.
 - What is the percent composition of chlorine in this compound? Show your work.



- 4 Acids are solutions with specific characteristics.
- Describe the chemical reaction which occurs between an acid and a metal.
 - If a ribbon of magnesium and hydrochloric acid were combined, which products would result in this chemical reaction?
- 5 A solution containing 12.9 g of MgCl_2 is dissolved in water to make a 0.54-L solution.
- What is the Molarity of the solution? Show your work.
 - Describe how decreasing the volume would affect the Molarity of the solution.

RUBRICS --- CHEMISTRY



1. Atomic size is one of many trends of the periodic table.

- Describe one reason atomic size may vary among the elements of the periodic table.
- List the correct order of aluminum, magnesium, phosphorus, silicon, sodium, and sulfur, based on decreasing atomic size.

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Describes a reason atomic size varies on the periodic table; sequences the elements in order of decreasing atomic size

2. During a laboratory experiment, 75 grams of water at 100°C is transformed into steam at 100°C.

- Describe how this experiment confirms the law of conservation of energy.
- How much heat energy is needed to completely change the state of the water? Show your work.

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Describes how the experiment follows the law of conservation of energy; calculates the amount of heat energy transferred during the phase change

3. A compound contains the elements copper and chlorine in a ratio of 1 copper : 2 chlorine.

- What is the empirical formula for this compound?
- What is the percent composition of copper in this compound? Show your work.
- What is the percent composition of chlorine in this compound? Show your work.

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 3 requirements of a level 3 performance

Score 2 Fulfills 2 of 3 requirements of a level 3 performance

Score 3 Determines the empirical formula for copper and chlorine; calculates the percent composition of copper; calculates the percent composition of chlorine



4. Acids are solutions with specific characteristics.

- Describe the chemical reaction which occurs between an acid and a metal.
- If a ribbon of magnesium and hydrochloric acid were combined, which products would result in this chemical reaction?

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Describes the chemical reaction between an acid and a metal; identifies the products of the chemical reaction between magnesium and hydrochloric acid

5. A solution containing 12.9 g of MgCl_2 is dissolved in water to make a 0.54-L solution.

- What is the Molarity of the solution? Show your work.
- Describe how decreasing the volume would affect the Molarity of the solution.

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Calculates the Molarity of the solution; describes how decreasing the volume could affect the Molarity of the solution

APPENDIX TO CONSTRUCTED RESPONSE KEY CHEMISTRY



QID	Discrete Answers for Student Responses (* Student answers may vary.)
1	Score Point 1: * Score Point 2: Na, Mg, Al, Si, P, S
2	Score Point 1: * Score Point 2: 169,000 J
3	Score Point 1: CuCl_2 Score Point 2: 47 % Score Point 3: 53 %
4	Score Point 1: * Score Point 2: hydrogen gas (H_2) and magnesium chloride/salt (MgCl_2)
5	Score Point 1: 0.25 M Score Point 2: *



The questions you read next will require you to answer in writing.

1. Write your answers on separate paper.
2. Be sure to write your name on each page.

- 1 A weather map shows closely spaced isobar lines over an area.
 - What do the isobar lines represent?
 - What do the closely spaced isobars indicate about the weather in the area?
- 2 Volcanoes are a major geologic feature on Earth.
 - Describe the particles and gases emitted during a volcanic eruption.
 - Describe how a volcano can impact global climate.
- 3 Hydroelectric resources can be used to produce electricity in some areas of the country.
 - What is an advantage of using hydroelectric resources for power rather than using fossil fuel resources for power?
 - What is a disadvantage of using hydroelectric resources for the production of electricity?
- 4 Many farmers use conventional methods of growing crops.
 - What is one advantage of using conventional agricultural methods?
 - How can conventional agricultural methods impact the economy?



- 5 To conserve natural resources, people are encouraged to “reduce, reuse, recycle.”
- Identify one example of a material that could be reused.
 - How could reusing the object provide a lasting impact on the environment?

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1. A weather map shows closely spaced isobar lines over an area.

- What do the isobar lines represent?
- What do the closely spaced isobars indicate about the weather in the area?

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Explains what isobar lines represent; provides an accurate description of the weather associated with closely spaced isobars

2. Volcanoes are a major geologic feature on Earth.

- Describe the particles and gases emitted during a volcanic eruption.
- Describe how a volcano can impact global climate.

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Provides an accurate description of the particles and gases emitted from a volcanic eruption; provides an accurate description of how those particles can lead to global climate change

3. Hydroelectric resources can be used to produce electricity in some areas of the country.

- What is an advantage of using hydroelectric resources for power rather than using fossil fuel resources for power?
- What is a disadvantage of using hydroelectric resources for the production of electricity?

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Provides an advantage of using hydroelectric resources; provides a disadvantage of using hydroelectric resources



4. Many farmers use conventional methods of growing crops.

- What is one advantage of using conventional agricultural methods?
- How can conventional agricultural methods impact the economy?

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Provides an advantage for conventional agricultural methods; assesses the impact conventional agricultural methods have on the economy

5. To conserve natural resources, people are encouraged to “reduce, reuse, recycle.”

- Identify one example of a material that could be reused.
- How could reusing the object provide a lasting impact on the environment?

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

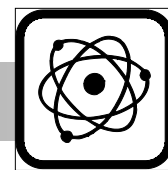
Score 2 Provides an example of an item that could be reused; assesses the lasting impact of reusing the item on the environment

**APPENDIX TO CONSTRUCTED RESPONSE KEY
EARTH/ENVIRONMENTAL SCIENCE**



QID	Discrete Answers for Student Responses (* Student answers may vary.)
1	Score Point 1: * Score Point 2: *
2	Score Point 1: * Score Point 2: *
3	Score Point 1: * Score Point 2: *
4	Score Point 1: * Score Point 2: *
5	Score Point 1: * Score Point 2: *

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The questions you read next will require you to answer in writing.

1. Write your answers on separate paper.
2. Be sure to write your name on each page.

- 1 Describing an object's movement depends on the frame of reference that is being used.
 - What is a frame of reference?
 - Choose one object in the classroom and provide an example of how that object can be used as a frame of reference.

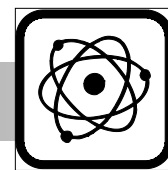
- 2 Matter changes from one state to another state during a phase change.
 - Explain how the processes of evaporation and boiling are similar.
 - Explain how the processes of evaporation and boiling are different.

- 3 A student is holding a stack of books.
 - Is the student doing any work on the books? Explain your answer.

- 4 A man wants to move a 200-N box a height of 4 meters, using a ramp that is 5 meters long.
 - What type of simple machine is the ramp?
 - Describe what happens to the input force now as a result of using the ramp to move the box.
 - Calculate the Ideal Mechanical Advantage (IMA) of the ramp. Show your work.



- 5 A wave has a frequency of 55 Hz and a speed of 35 m/s.
- What is the wavelength of the wave? Show your work.
 - If the frequency of the wave increases, what will happen to the wavelength?
- 6 A girl drops a penny in the shallow end of a swimming pool. As she bends down to pick up the penny, she realizes that the penny is farther away in the pool than it appears.
- Identify the wave behavior that is taking place.
 - How does the wave behavior cause the penny to appear closer than it actually is?



1. Describing an object's movement depends on the frame of reference that is being used.

- What is a frame of reference?
- Choose one object in the classroom and provide an example of how that object can be used as a frame of reference.

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 3 requirements of a level 3 performance

Score 2 Fulfills 2 of 3 requirements of a level 3 performance

Score 3 Describes frame of reference; identifies an example that can be used as a frame of reference; provides an example of how the object can be used as a frame of reference

2. Matter changes from one state to another state during a phase change.

- Explain how the processes of evaporation and boiling are similar.
- Explain how the processes of evaporation and boiling are different.

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Provides an explanation for how evaporation and boiling are similar; provides an explanation for how evaporation and boiling are different

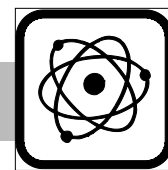
3. A student is holding a stack of books.

- Is the student doing any work on the books? Explain your answer.

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Determines if the student is performing work; explains valid reason for answer



4. A man wants to move a 200-N box a height of 4 meters, using a ramp that is 5 meters long.

- What type of simple machine is the ramp?
- Describe what happens to the input force now as a result of using the ramp to move the box.
- Calculate the Ideal Mechanical Advantage (IMA) of the ramp. Show your work.

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 3 requirements of a level 3 performance

Score 2 Fulfills 2 of 3 requirements of a level 3 performance

Score 3 Identifies an accurate type of simple machine associated with the ramp; provides an accurate description of how the input force is impacted by using a ramp; calculates an accurate value for the IMA of the inclined plane (ramp)

5. A wave has a frequency of 55 Hz and a speed of 35 m/s.

- What is the wavelength of the wave? Show your work.
- If the frequency of the wave increases, what will happen to the wavelength?

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Calculates the wavelength of the wave; describes the change in wavelength as frequency increases

6. A girl drops a penny in the shallow end of a swimming pool. As she bends down to pick up the penny, she realizes that the penny is farther away in the pool than it appears.

- Identify the wave behavior that is taking place.
- How does the wave behavior cause the penny to appear closer than it actually is?

Score 0 No response or the response does not address the prompt

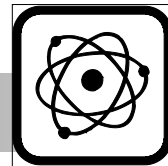
Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Identifies the wave behavior that causes light waves to bend; provides an explanation of refraction

**APPENDIX TO CONSTRUCTED RESPONSE KEY
PHYSICAL SCIENCE**



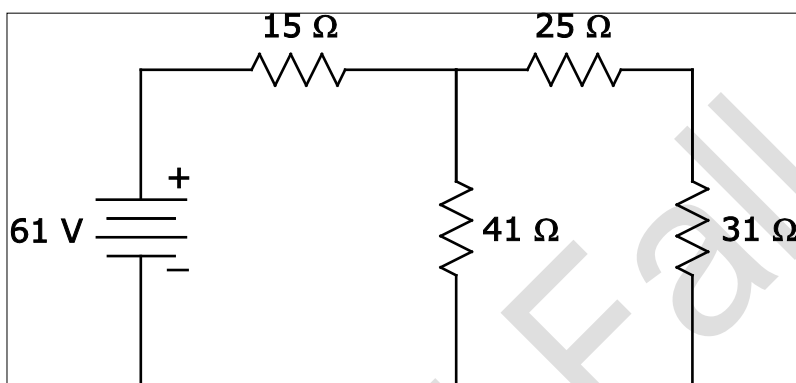
QID	Discrete Answers for Student Responses (* Student answers may vary.)
1	Score Point 1: * Score Point 2: * Score Point 3: *
2	Score Point 1: * Score Point 2: *
3	Score Point 1: No Score Point 2: *
4	Score Point 1: inclined plane Score Point 2: * Score Point 3: 1.25
5	Score Point 1: 0.64 m Score Point 2: *
6	Score Point 1: refraction Score Point 2: *



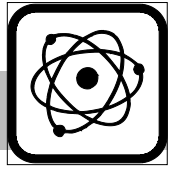
The questions you read next will require you to answer in writing.

1. Write your answers on separate paper.
2. Be sure to write your name on each page.

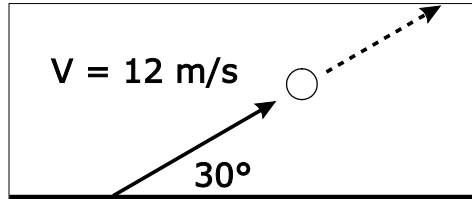
- 1 This diagram represents a DC circuit. Using the information in the circuit diagram, answer the questions below.



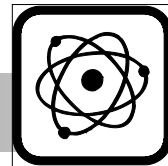
- What is the total resistance of the circuit? Show your work.
- How much total current is flowing through the circuit? Show your work.
- If the 41-Ω resistor seems to be producing a different amount of resistance than 41 Ω, what should be done to verify this?



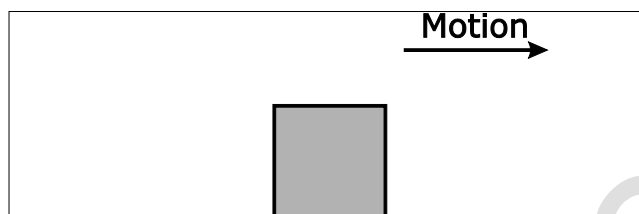
- 2 An object is projected with a velocity of 12.0 m/s at an angle 30.0° above the horizontal. Ignore air resistance.



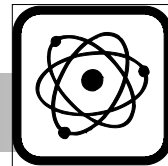
- What are the horizontal and vertical components of the initial velocity of the object? Show your work.
 - What distance does the object travel in the vertical direction? Show your work.
- 3 A force of 18 N parallel to the ground pulls on a 4.8-kg box, but the box remains at rest.
- What is the frictional force acting on the box? Show your work.
 - Draw and label a free-body diagram to explain your answer.
- 4 After applying a braking force of 290 N , the speed of a 115-kg motorcycle decreased from 45 m/s to 30 m/s .
- How much time did it take for the motorcycle to decrease its speed to 30 m/s ? Explain your answer.
 - Explain, using Newton's laws of motion, why decreasing the speed of a moving object is not instantaneous.



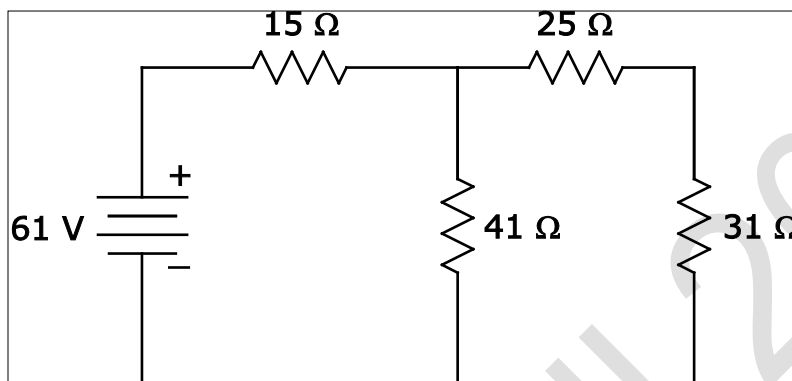
- 5 A horizontal force acts on a block, making it slide on a horizontal surface. The force of friction between the block and the surface is 0.5 N.



- If the direction of the applied initial force causing the block to slide is reversed, how will this affect the force of friction on the block? Explain your answer.
- How will reversing the initial force affect the net force on the block? Explain your answer.
- How will reversing the initial force affect the acceleration of the block? Explain your answer.



1. This diagram represents a DC circuit. Using the information in the circuit diagram, answer the questions below.



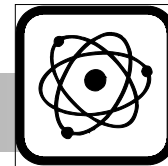
- What is the total resistance of the circuit? Show your work.
- How much total current is flowing through the circuit? Show your work.
- If the 41- Ω resistor seems to be producing a different amount of resistance than 41 Ω , what should be done to verify this?

Score 0 No response or the response does not address the prompt

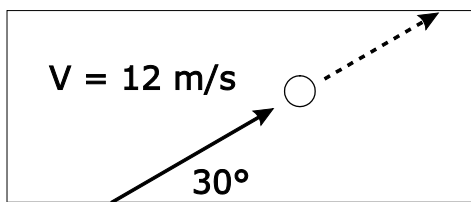
Score 1 Fulfills only 1 of 2 requirements of a level 3 performance

Score 2 Fulfills 2 of 3 requirements of a level 3 performance

Score 3 Calculates the circuit's total resistance; calculates the amount of current flowing through the circuit; describes a way to determine the status of the 41- Ω resistor



2. An object is projected with a velocity of 12.0 m/s at an angle 30.0° above the horizontal. Ignore air resistance.



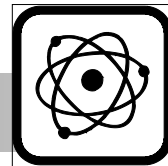
- What are the horizontal and vertical components of the initial velocity of the object? Show your work.
- What distance does the object travel in the vertical direction? Show your work.

Score 0	No response or the response does not address the prompt
Score 1	Fulfills only 1 of 3 requirements of a level 3 performance
Score 2	Fulfills 2 of 3 requirements of a level 3 performance
Score 3	Calculates the horizontal initial velocity; calculates the vertical initial velocity; calculates the vertical distance traveled by the object

3. A force of 18 N parallel to the ground pulls on a 4.8-kg box, but the box remains at rest.

- What is the frictional force acting on the box? Show your work.
- Draw and label a free-body diagram to explain your answer.

Score 0	No response or the response does not address the prompt
Score 1	Fulfills only 1 of 2 requirements of a level 2 performance
Score 2	Calculates the frictional force acting on the box; draws and labels a free body diagram describing the scenario



4. After applying a braking force of 290 N, the speed of a 115-kg motorcycle decreased from 45 m/s to 30 m/s.

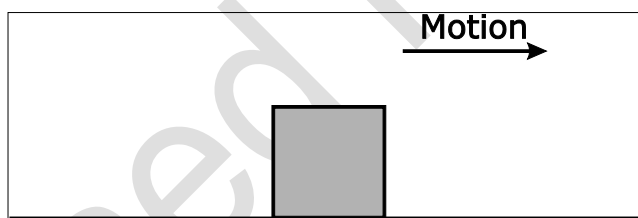
- How much time did it take for the motorcycle to decrease its speed to 30 m/s? Explain your answer.
- Explain, using Newton's laws of motion, why decreasing the speed of a moving object is not instantaneous.

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 2 requirements of a level 2 performance

Score 2 Calculates the amount of time required for the motorcycle to decrease its speed; explains why decreasing speed is not instantaneous using Newton's laws of motion

5. A horizontal force acts on a block, making it slide on a horizontal surface. The force of friction between the block and the surface is 0.5 N.



- If the direction of the applied initial force causing the block to slide is reversed, how will this affect the force of friction on the block? Explain your answer.
- How will reversing the initial force affect the net force on the block? Explain your answer.
- How will reversing the initial force affect the acceleration of the block? Explain your answer.

Score 0 No response or the response does not address the prompt

Score 1 Fulfills only 1 of 3 requirements of a level 3 performance

Score 2 Fulfills 2 of 3 requirements of a level 3 performance

Score 3 Explains how reversing the applied force affects the force of friction; explains how reversing the applied force affects the net force; explains how reversing the applied force affects the acceleration of the block

Appendix to Constructed Response Key for Physics 2012–2013

Form ID: 123

QID	Discrete Answers for Student Responses (* Student answers may vary.)
1	Score Point 1: 38.7Ω or any equivalent/rounded value Score Point 2: 1.6 A or any equivalent/rounded value Score Point 3: *
2	Score Point 1: horizontal $v_i = 6\sqrt{3}$ m/s or 10.4 m/s and vertical $v_i = 6$ m/s Score Point 2: 1.84 m or 3.67 m or any equivalent/rounded values
3	Score Point 1: 18 N Score Point 2: *
4	Score Point 1: 5.9 s or any equivalent/rounded value Score Point 2: *
5	Score Point 1: * Score Point 2: * Score Point 3: *