

### 5.1/4.1 Scientific Investigation, Reasoning, and Logic

### Question/Answer Packet #1


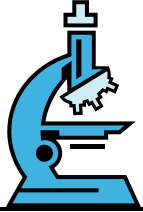
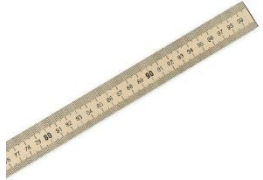


The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which:

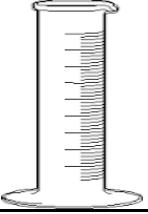

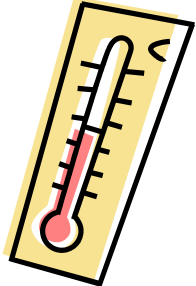

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#### Objectives for the 1<sup>st</sup> Marking Period

- 5.1d) hypotheses are formed from testable questions; (1<sup>st</sup>)
- 4.1h) hypotheses are developed as cause and effect relationships; (1<sup>st</sup>)
- 5.1e) independent and dependent variables are identified; (1<sup>st</sup>)
- 4.1f) independent and dependent variables are identified; (1<sup>st</sup>) (2<sup>nd</sup>) (3<sup>rd</sup>)
- 5.1f) constants in an experimental situation are identified; (1<sup>st</sup>)
- 4.1g) constants in an experimental situation are identified; (1<sup>st</sup>) (2<sup>nd</sup>) (3<sup>rd</sup>)
- 4.1c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units; (1<sup>st</sup>) (3<sup>rd</sup>)
- 4.1d) appropriate instruments are selected and used to measure elapsed time; (1<sup>st</sup>)

1. Hypothesis	An explanation based on scientific reasoning that can be tested to see if it is correct. A hypothesis usually starts with an "If...then statement."
2. Variable	Something that can be changed in an experiment.
3. Independent Variable	Something changed in an experiment on purpose <b>to see how it affects the outcome</b> . (Also known as the <b>manipulated variable</b> )
4. Dependent Variable	Something in an experiment that can be measured or observed to see how it responds to a change made to the independent variable (Also known as the <b>responding variable</b> )
5. Control	The part of an experiment where the independent variable is left unchanged to provide a comparison.
6. Observation	Gaining information about an object or event by using any of your senses.
7. Data	All the facts, descriptions, and numbers collected during an experiment.
8. Quantitative Data	Information using <u>number</u> measurements such as width, height, volume, speed, or temperature.
9. Qualitative Data	Information that can be observed, such as relative size, color, shape, smell, or other properties. It does not rely on measuring tools. (Use your senses)
10. Compare/Contrast	Discovering similarities & differences between objects
11. Conclusion	Based on observation, the opinion you form after reviewing the evidence of your experiment.
12. Classifying	Sorting or grouping objects or ideas based on properties that they share.
13. Constants	Things that remain the same on purpose during an experiment.
14. Scientific Method	<p>A systematic approach to learning about the world by:</p> <ul style="list-style-type: none"><li>• Asking a question-What?, Where?, When?, How?, &amp; Why?</li><li>• Doing research</li><li>• Developing a hypothesis</li><li>• Designing &amp; conducting an experiment to test your hypothesis</li><li>• Record &amp; analyze your data</li><li>• Develop a conclusion &amp; share your findings</li><li>• Ask new questions &amp; start again</li></ul>

15. Hand lens	Used to magnify items. They are used in scientific research, police work and everyday life. They are magnifying glasses small enough to be held in a hand and easy to manipulate.	
16. Microscope	A tool used to make small objects appear larger. It lets you see details you couldn't see with your eyes alone.	
17. Metric System	A way of measuring dimensions, distance, mass, and volume used by scientists around the world, and based on the number 10.	
18. Meter	<b>Units of measure for height, length, width, or distance.</b> Possible measuring tool used: meter stick, tape measure, ruler • Millimeters = mm      • Centimeters = cm • Meters = m              • Kilometers = km	
19. Meter stick	A measuring <b>stick</b> one-meter-long that is marked off in centimeters and usually millimeters. • The function of a meter stick is to measure the length of an object or distance using the metric system. • The length or distance shouldn't be extremely small or large in order to obtain an accurate and efficient result.	
20. Gram	<b>Unit of measure for mass.</b> Possible measuring tool used: balance scale or spring scale • Grams = g • Kilograms = kg	
21. Balance scale	<b>Used to find an object's mass, or amount of matter.</b>  It has a balanced beam and two pans. When the pans contain exactly the same mass the beam is in balance.	
22. Spring scale	<b>A type of weighing scale.</b> It consists of a spring fixed at one end with a hook to attach an object at the other.	
23. Mass	A measure of the amount of matter in an object.	
24. Weight	A measure of the gravitational pull on an object.	
25. Liter	<b>Unit of measure for volume.</b> Possible measuring tool used: graduated cylinder or beaker • Milliliters = ml • Liters = l	

26. Graduated cylinder	<p>A narrow, round container used to precisely measure the volume of a liquid.</p> 
27. Beaker	<p>A deep cup or glass with a wide mouth and a lip used for pouring</p> 
28. Celsius	<p>An internationally accepted scale used to measure temperature. Possible measuring tool used: thermometer</p> <ul style="list-style-type: none"> <li>• Celsius = °C</li> <li>• Using this system, water freezes at 0° and boils at 100°</li> </ul>
29. Thermometer	<p>An instrument used to measure temperature (thermal energy) .</p> 
30. How is time measured?	<p>In seconds, minutes, and hours Possible measuring tool used: a stopwatch or a clock</p>
31. Stopwatch	<p>An instrument used to measure elapsed time.</p> 

**SOL 5.1/4.1 Scientific Investigation, Reasoning, and Logic****Question/Answer Packet#2**

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which:

**Objectives for the 2<sup>nd</sup> Marking Period**

- 5.1h) predictions are made using patterns from data collected, and simple graphical data are generated; (2<sup>nd</sup>)
- 5.1j) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and (2<sup>nd</sup>)
- 4.1l) models are constructed to clarify explanations, demonstrate relationships, and solve needs; (2<sup>nd</sup>)
- 5.1i) inferences are made and conclusions are drawn; (2<sup>nd</sup>)
- 4.1a) distinctions are made among observations, conclusions, inferences, and predictions; (2<sup>nd</sup>)
- 4.1b) objects or events are classified and arranged according to characteristics or properties; (2<sup>nd</sup>)
- 4.1f) independent and dependent variables are identified; (1<sup>st</sup>) (2<sup>nd</sup>) (3<sup>rd</sup>)\*
- 4.1g) constants in an experimental situation are identified; (1<sup>st</sup>) (2<sup>nd</sup>) (3<sup>rd</sup>)\*

\* Repeated from the first marking period.

<b>1. Prediction</b>	An educated guess about what you expect to happen in the future based on past experience and careful observation.
<b>2. Graphs</b>	Numerical or descriptive information sorted into a quickly understood visual format. Bar graphs
<b>3. Bar graph</b>	A graph that uses horizontal or vertical rectangular bars to compare amounts in a side-by-side format.
<b>4. Line graph</b>	A graph that uses lines to show changes over a period of time.
<b>5. Trend</b>	The general direction in which data is headed or the way it is changing.
<b>6. Model</b>	A three-dimensional representation of something.
<b>7. Conclusion</b>	Something made based on an observation, but is not something that can be seen
<b>8. Inference</b>	A conclusion based on evidence about what has already occurred.
<b>9. Independent Variable*</b>	Something changed in an experiment on purpose <b>to see how it affects the outcome.</b> (Also known as the <b>manipulated variable</b> )
<b>10. Dependent Variable*</b>	Something in an experiment that can be measured or observed to see how it responds to a change made to the independent variable (Also known as the <b>responding variable</b> )
<b>11. Constants*</b>	Things that remain the same on purpose during an experiment.
<b>12. Quantitative Data*</b>	Information using <u>number</u> measurements such as width, height, volume, speed, or temperature.
<b>13. Qualitative Data*</b>	Information that can be observed, such as relative size, color, shape, smell, or other properties. It does not rely on measuring tools. (Use your senses)
<b>14. Scientific Method*</b>	A systematic approach to learning about the world by: <ul style="list-style-type: none"><li>• Asking a question-What?, Where?, When?, How?, &amp; Why?</li><li>• Doing research</li><li>• Developing a hypothesis</li><li>• Designing &amp; conducting an experiment to test your hypothesis</li><li>• Record &amp; analyze your data</li><li>• Develop a conclusion &amp; share your findings</li><li>• Ask new questions &amp; start again</li></ul>

**SOL 5.1/4.1 Scientific Investigation, Reasoning, and Logic****Question/Answer Packet#3**

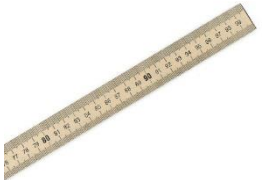


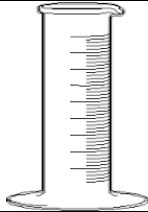

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which:

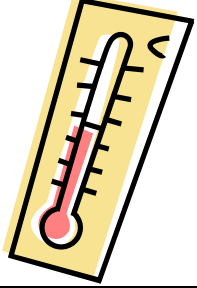

**Objectives for the 3<sup>rd</sup> Marking Period**

- 5.1a) items such as rocks, minerals, and organisms are identified using various classification keys; (3<sup>rd</sup>) (4<sup>th</sup>)  
 5.1b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools; (3<sup>rd</sup>) (4<sup>th</sup>)  
 5.1c) estimates are made and accurate measurements of elapsed time are made using proper tools; (3<sup>rd</sup>) (4<sup>th</sup>)  
 5.1g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements; (3<sup>rd</sup>) (4<sup>th</sup>)  
 4.1k) data are communicated with simple graphs, pictures, written statements, and numbers; (3<sup>rd</sup>)  
 4.1f) independent and dependent variables are identified; (1<sup>st</sup>) (2<sup>nd</sup>) (3<sup>rd</sup>)\*  
 4.1g) constants in an experimental situation are identified; (1<sup>st</sup>) (2<sup>nd</sup>) (3<sup>rd</sup>)\*  
 4.1c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units; (1<sup>st</sup>) (3<sup>rd</sup>)\*

\* Repeated from a previous marking period.

<b>1. Classification key</b>	The classification and naming of animals, plants, minerals, and rocks in an ordered system that shows their natural relationships
<b>2. Estimation</b>	A rough or approximate calculation of the amount, size, or value of something.
<b>3. Graphs*</b>	Numerical or descriptive information sorted into a quickly understood visual format. Bar graphs
<b>4. Bar graph*</b>	A graph that uses horizontal or vertical rectangular bars to compare amounts in a side-by-side format.
<b>5. Line graph*</b>	A graph that uses lines to show changes over a period of time.
<b>6. Trend*</b>	The general direction in which data is headed or the way it is changing.
<b>7. Dependent Variable*</b>	Something in an experiment that can be measured or observed to see how it responds to a change made to the independent variable (Also known as the <b>responding variable</b> )
<b>8. Independent Variable*</b>	Something changed in an experiment on purpose <b>to see how it affects the outcome</b> . (Also known as the <b>manipulated variable</b> )
<b>9. Constants*</b>	Things that remain the same on purpose during an experiment.
<b>10. Quantitative Data*</b>	Information using <u>number</u> measurements such as width, height, volume, speed, or temperature.
<b>11. Qualitative Data*</b>	Information that can be observed, such as relative size, color, shape, smell, or other properties. It does not rely on measuring tools. (Use your senses)
<b>12. Metric System*</b>	A way of measuring dimensions, distance, mass, and volume used by scientists around the world, and based on the number 10.
<b>13. Meter*</b>	Units of measure for height, length, width, or distance. Possible instruments used: meter stick, tape measure, ruler • Millimeters = mm      • Centimeters = cm • Meters = m              • Kilometers = km

14. Meter stick*	<p>A measuring <b>stick</b> one-meter-long that is marked off in centimeters and usually millimeters.</p> <ul style="list-style-type: none"> <li>The function of a meter stick is to measure the length of an object or distance using the metric system.</li> <li>The length or distance shouldn't be extremely small or large in order to obtain an accurate and efficient result.</li> </ul> 
15. Gram*	<p><b>Unit of measure for mass.</b> Possible measuring tool used: balance scale or spring scale</p> <ul style="list-style-type: none"> <li>Grams = g • Kilograms = kg</li> </ul>
16. Balance scale*	<p><b>Used to find an object's mass, or amount of matter.</b></p> <p>It has a balanced beam and two pans. When the pans contain exactly the same mass the beam is in balance.</p> 
17. Spring scale*	<p><b>A type of weighing scale.</b> It consists of spring fixed at one end with a hook to attach an object at the other.</p> 
18. Mass*	A measure of the amount of matter in an object.
19. Weight*	A measure of the gravitational pull on an object.
20. Liter*	<p><b>Unit of measure for volume.</b> Possible measuring tool used: graduated cylinder or beaker</p> <ul style="list-style-type: none"> <li>Milliliters = ml • Liters = l</li> </ul>
21. Graduated cylinder*	<p>A narrow, round container used to precisely measure the volume of a liquid.</p> 
22. Beaker*	<p>A deep cup or glass with a wide mouth and a lip used for pouring</p> 
23. Celsius*	<p>An internationally accepted scale used to measure temperature. Possible measuring tool used: thermometer</p> <ul style="list-style-type: none"> <li>Celsius = °C</li> <li>Using this system, water freezes at 0° and boils at 100°</li> </ul>

<b>24. Thermometer*</b>	<p>An instrument used to measure temperature (thermal energy) .</p> 
<b>25. How is time measured?*</b>	<p>In seconds, minutes, and hours Instrument used: a stopwatch or a clock</p>
<b>26. Stopwatch*</b>	<p>An instrument used to measure elapsed time.</p> 

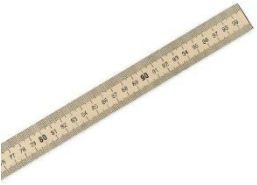

**SOL 5.1/4.1 Scientific Investigation, Reasoning, and Logic****Question/Answer Packet#4**

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which:


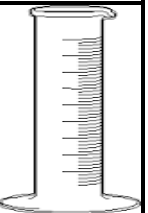

**Objectives for the 4<sup>th</sup> Marking Period**

- 4.1e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources; (4<sup>th</sup>)
- 4.1i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs; (4<sup>th</sup>)
- 4.1j) numerical data that are contradictory or unusual in experimental results are recognized; (4<sup>th</sup>)
- 5.1a) items such as rocks, minerals, and organisms are identified using various classification keys; (3<sup>rd</sup>) (4<sup>th</sup>)\*
- 5.1b) estimates are made and accurate measurements of length, mass, volume, and temperature are made in metric units using proper tools; (3<sup>rd</sup>) (4<sup>th</sup>)\*
- 5.1c) estimates are made and accurate measurements of elapsed time are made using proper tools; (3<sup>rd</sup>) (4<sup>th</sup>)\*
- 5.1g) data are collected, recorded, analyzed, and communicated using proper graphical representations and metric measurements; (3<sup>rd</sup>) (4<sup>th</sup>)\*

\* Repeated from a previous marking period.

<b>1. Prediction*</b>	An educated guess about what you expect to happen in the future based on past experience and careful observation.
<b>2. Graphs*</b>	Numerical or descriptive information sorted into a quickly understood visual format. Bar graphs
<b>3. Bar graph*</b>	A graph that uses horizontal or vertical rectangular bars to compare amounts in a side-by-side format.
<b>4. Line graph*</b>	A graph that uses lines to show changes over a period of time.
<b>5. Trend*</b>	The general direction in which data is headed or the way it is changing.
<b>6. Classification key*</b>	The classification and naming of animals, plants, minerals, and rocks in an ordered system that shows their natural relationships
<b>7. Metric System*</b>	A way of measuring dimensions, distance, mass, and volume used by scientists around the world, and based on the number 10.
<b>8. Meter*</b>	<b>Units of measure for height, length, width, or distance.</b> Possible measuring tool used: meter stick, tape measure, ruler <ul style="list-style-type: none"><li>• Millimeters = mm</li><li>• Centimeters = cm</li><li>• Meters = m</li><li>• Kilometers = km</li></ul>
<b>9. Meter stick*</b>	A measuring <b>stick</b> one-meter-long that is marked off in centimeters and usually millimeters. <ul style="list-style-type: none"><li>• The function of a meter stick is to measure the length of an object or distance using the metric system.</li><li>• The length or distance shouldn't be extremely small or large in order to obtain an accurate and efficient result.</li></ul> 
<b>10. Gram*</b>	<b>Unit of measure for mass.</b> Possible measuring tool used: balance scale or spring scale <ul style="list-style-type: none"><li>• Grams = g</li><li>• Kilograms = kg</li></ul>
<b>11. Balance scale*</b>	<b>Used to find an object's mass, or amount of matter.</b>  It has a balanced beam and two pans. When the pans contain exactly the same mass the beam is in balance. 



12. Spring scale*	<p><b>A type of weighing scale.</b> It consists of spring fixed at one end with a hook to attach an object at the other.</p> 
13. Mass*	A measure of the amount of matter in an object.
14. Weight*	A measure of the gravitational pull on an object.
15. Liter*	<p>Unit of measure for volume. Possible measuring tool used: graduated cylinder or beaker • Milliliters = ml • Liters = l</p>
16. Graduated cylinder*	<p>A narrow, round container used to precisely measure the volume of a liquid.</p> 
17. Beaker*	<p>A deep cup or glass with a wide mouth and a lip used for pouring</p> 
18. Celsius*	<p>An internationally accepted scale used to measure temperature. Possible measuring tool used: thermometer • Celsius = °C • Using this system, water freezes at 0° and boils at 100°</p>
19. Thermometer*	An instrument used to measure temperature (thermal energy).
20. How is time measured?*	<p>In seconds, minutes, and hours Instrument used: a stopwatch or a clock</p>
21. Stopwatch*	<p>An instrument used to measure elapsed time.</p> 