Item Specifications for the Indiana Assessment Grade 4 Science (Beginning 2018-19 School Year)

These item specifications serve as a foundational resource in the assessment development process. This document is the first in a series of documents that will be made available in the future.

Item specifications identify the standards being assessed. In addition they provide information about each of the related items including: evidence elicited, depth of knowledge (DOK), limits and constraints, and item types. Panels of content teachers at each grade level, representative of Indiana student populations, in partnership with the Department of Education developed the item specifications.

The 2016 Indiana Science Standards increased the breadth and scope of the 2010 standards by adding a new component: process standards. Students are expected to identify and explain content, as well as understand how the data were collected and analyzed to reach those conclusions (scientific and engineering process). The Indiana assessment is designed to test students' understanding of science and engineering processes in conjunction with content. They are expected to integrate both into their understanding and answers.

In addition to the new content and process standards, Indiana added computer science standards to keep up with the changing technological environment our students face. These standards help prepare them to be responsible digital citizens and understand the role technology plays in modern society. Federal accountability requires that these be tested with the science content and process standards.

Overview

The rows of each item specification highlight key features of items included on Indiana assessments as follows:

Reporting Category: The broad content category for the standard representing a segment or domain of content approved by educators as key for reporting. Examples across content areas may include: Number Sense in Mathematics (7.NS); Physical Science in Science (4.PS); and Writing in English/Language Arts (9-10.W).

Standard: Each Indiana Academic Standard is noted under the Reporting Category.

Evidence Statement(s): Statements that describe the knowledge and skills that an assessment item should elicit from students.

Content Limit(s)/ Constraint(s): Statements that list the boundaries or limits of assessment items for that standard.

Depth of Knowledge: Webb's Depth of Knowledge categorizes items by the complexity of thinking required. Descriptions of each level are: (1) recall and reproduction, (2) skills and concepts, (3) strategic thinking, and (4) extended thinking. For a complete description of each go to: http://www.doe.in.gov/sites/default/files/assessment/depth-knowledge-powerpointenglish-10.pdf

Item Type(s): Four possible item types including multiple choice (MC), constructed response (CR), technology-enhanced (TE), and extended response (ER).

Sample Item Stem(s): Examples of items stems that satisfy the requirements of the specification.

Sample Item(s): Full example items that satisfy the requirements of the specifications.

Reporting Category	4.PS - Physical Science
Standard	4.PS.1 - Investigate transportation systems and devices that operate on or in land, water, air and space and recognize the forces (lift, drag, friction, thrust and gravity) that affect their motion.
Evidence Statement(s)	Students conduct races in the classroom with various vehicles, using lift, drag, friction, thrust and gravity as the basis for data collection. They then record their data and explain their reasoning based on their data. Students "drag and drop" the name of the force into the appropriate section of the graphic that demonstrates it. The student demonstrates knowledge of the relationships between force, motion, and environmental factors.
Content Limit(s)/ Constraint(s)	Focus on a single type of transportation system per item to narrow focus.
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Constructed Response (CR)
Sample Item Stem(s)	Which force is least/greatest? What type of force affects…? Which vehicle would be best used on/in…?

Reporting Category	4.PS - Physical Science
Standard	4.PS.2 - Investigate the relationship of the speed of an object to the energy of that object.
Evidence Statement(s)	Students conduct investigations calculating the speed of an object and the amount of energy it uses. They record their data and explain their reasoning based on their data. Students are able to identify which objects need greater force to move, based on their greater mass. The student demonstrates knowledge of the relationship between kinetic and potential energy and how those relationships impact speed.
Content Limit(s)/ Constraint(s)	Provide the formula for speed.
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	How is speed affected when mass is added/subtracted? Is more/less potential energy required when…?

Sample Item (CR)

Ben was playing with a remote-controlled toy truck on a sidewalk. The toy truck travelled 300 centimeters (cm) at a speed of 54 centimeters per second (cm/s). Ben then put 50 grams (g) of soil into the bed of the truck and let the truck again travel for 300 centimeters (cm). Describe how the speed of the truck will be affected after adding the soil to the truck. Explain your answer.

Key:

Any response indicating that the speed of the truck would decrease after the soil is added AND any explanation indicating that the additional mass of the soil would cause the truck to slow down.

Reporting Category	4.PS - Physical Science
Standard	4.PS.3 - Investigate how multiple simple machines work together to perform everyday tasks.
Evidence Statement(s)	Students look at a real-life scenario and explain how to use simple machines make the work easier. Students use different types of simple machines to perform tasks. They then write about how the machines can be used together to make these tasks even easier. Students demonstrate knowledge of simple machines, the force associated with each simple machine, and how simple machines can work together. Students identify simple machines in everyday objects.
Content Limit(s)/ Constraint(s)	Pulley, lever, wedge, wheel and axle, inclined plane, and screw can be assessed.
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Identify the {simple machine(s)} in this diagram. What type of simple machine does…?

Reporting Category	4.PS - Physical Science
Standard	4.PS.4 - Describe and investigate the different ways in which energy can be generated and/or converted from one form of energy to another form of energy.
Evidence Statement(s)	Students identify the different forms of energy and explain how they are generated. Students then explain how each type of energy is converted into a different type of energy. Given a graphic that shows energy transferred from one form to another, students describe the transfer process. Students identify various energy types in a chain reaction graphic. Students demonstrate knowledge of how one form of energy can be transformed into a different form of energy in a variety of ways.
Content Limit(s)/ Constraint(s)	Do not use joules or Law of Conservation of Energy.
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Describe/identify the types/forms of energy shown in this diagram… Explain how {type of energy} is converted to {type of energy}.

Reporting Category	4.PS - Physical Science
Standard	4.PS.5 - Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
Evidence Statement(s)	Students can label a diagram depicting sound, light, heat, and electric current and explain how energy is transferred for each type of energy. The students demonstrate knowledge of energy transfer and can recognize real energy transformations.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	What are the different types of energy shown in this diagram? How does energy get from … to … in this diagram?

Reporting Category	4.ESS - Earth and Space Science
Standard	4.ESS.1 - Investigate how the moon appears to move through the sky and it changes day to day, emphasizing the importance of how the moon impacts the Earth, the rising and setting times, and solar and lunar eclipses.
Evidence Statement(s)	Students label the different phases of the moon on a diagram. Students use a data table to answer questions about moonrise and moonset times. Students explain what happens in solar and lunar eclipses. Students construct an explanation for what causes rising and setting times of the moon. Students demonstrate knowledge of the moon's orbit, positional changes, and the relationship between the moon, the sun, and Earth.
Content Limit(s)/ Constraint(s)	Provide diagrams/images when assessing this standard.
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	What causes different phases/eclipses/setting or rising of the moon? What position does the moon/sun/Earth need to be in to cause a full/partial eclipse? Describe the effect of the moon on…?

Reporting Category	4.ESS - Earth and Space Science
Standard	4.ESS.2 - Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
Evidence Statement(s)	Students identify how natural resources become fuels and how using them affects the environment. (Examples include: the processes of wind pushing turbine, and oil becoming gas.) Students describe the impact of renewable resources (wind-, solar-, hydro-energy) on the environment.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	2
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Which of the following natural resources become {this type of fuel}? Which of the following fuels would have the most/least impact on...?

Reporting Category	4.ESS - Earth and Space Science
Standard	4.ESS.3 - Describe how geological forces change the shape of the land suddenly and over time.
Evidence Statement(s)	Students identify changes in the land by comparing pictures and explaining how those changes were made. Students demonstrate knowledge of how geological forces change the land, both suddenly and over time.
Content Limit(s)/ Constraint(s)	Landslide, earthquake, volcano, erosion, weathering, rocks, rock cycle, glaciers, wind and water are assessable. When providing images of landforms make sure the images are very clear.
Depth of Knowledge	2
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Which of the following forces would change the landscape quickly/slowly? Compare these two pictures, what might have caused the change shown? Explain how you came to your answer.

Sample Item (CR):

When the Rocky Mountains first formed, they were taller than they are today. Identify and describe TWO natural causes that could have caused the Rocky Mountains to become shorter over time.

Key

The Rocky Mountains could have been eroded by wind, rain, and/or ice. (Any two of these three causes will suffice for a correct response.)

Reporting Category	4.ESS - Earth and Space Science
Standard	4.ESS.4 - Develop solutions that could be implemented to reduce the impact of humans on the natural environment and the natural environment on humans.
Evidence Statement(s)	Students demonstrate knowledge of the relationship between humans and the natural environment and explain how to reduce negative impacts on both. Students provide solutions to reduce human impacts on the environment or to reduce environmental impacts on humans. (Example: providing green space for animals etc. in a situation where the humans are encroaching on animal habitat.)
Content Limit(s)/ Constraint(s)	**D**o not assess reduce, reuse, recycle. When clarification is needed, provide examples of the natural environment used as the context of assessment items.
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Which solution would be the best to reduce impact on…? How might the environment impact…? What could people do to…?

Reporting Category	4.LS - Life Science
Standard	4.LS.1 - Observe, analyze, and interpret how offspring are very much, but not exactly, like their parents or one another. Describe how these differences in physical characteristics among individuals in a population may be advantageous for survival and reproduction.
Evidence Statement(s)	Students analyze which characteristics help animals and humans survive and reproduce in their environments. Students match parents with their offspring and describe how physical characteristics are positive for survival. The student demonstrates knowledge of the relationship between offspring and their parents and how physical characteristics can be advantageous, or serve a purpose.
Content Limit(s)/ Constraint(s)	Items should be based on inherited, not acquired, traits.
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Which {type of baby animal} most likely belongs to these {parent animals}? Which {types of animals} would be most likely to survive in this environment?

Reporting Category	4.LS - Life Science
Standard	4.LS.2 - Use evidence to support the explanation that a change in the environment may result in a plant or animal will survive and reproduce, move to a new location, or die.
Evidence Statement(s)	Students match causes and effects using a chart. Students are given a "scenario" and then predict which organisms will survive/die/move to a new environment based on evidence of favorable traits. Students demonstrate knowledge of the relationship between the environment and plants and animals.
Content Limit(s)/ Constraint(s)	Use organisms that are common to Indiana or provide enough context about the organism and its environment to be able to provide an explanation. Can use native/non-native, do not use invasive.
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	If the environment changed {description of change}, what might happen with {native species}?

Reporting Category	4.LS - Life Science
Standard	4.LS.3 - Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction in a different ecosystems.
Evidence Statement(s)	Students write an argument to explain how the external/internal structures of organisms help them survive in specific environments. Given a description of an organisms' external/interior structures and its environment, students argue/explain how the structures will help the organism survive. Students demonstrate knowledge of the functions of internal and external structures in plants and animals.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Explain how {specific characteristic} helps {type of species} in {native ecosystem}. How does {internal/external structure} help a plant/animal survive in their environment?

Reporting Category	3-5.E - Engineering
Standard	3-5.E.1 - Identify a simple problem with the design of an object that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost.
Evidence Statement(s)	Students identify a design problem, the criteria for success and constraints, such as materials, time, or cost, and how constraints can affect solutions. Students are given a scenario, and then identify which three situations are most likely to cause the problem. Students then articulate the problem.
Content Limit(s)/ Constraint(s)	All grade 4 engineering standards must be assessed together in a problem set with a common scenario.
Depth of Knowledge	2
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Describe what might cause the problem described in {scenario}. Why is this solution not appropriate for {scenario}? Explain.

Reporting Category	3-5.E - Engineering
Standard	3-5.E.2 - Construct and compare multiple plausible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
Evidence Statement(s)	Students list multiple solutions for a design problem, and rank them based on their likelihood of solving the problem. The student demonstrates knowledge of possible solutions and how criteria and constraints weigh on each solution.
Content Limit(s)/ Constraint(s)	All grade 4 engineering standards must be assessed together in a problem set with a common scenario.
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Put these solutions in order of most/least likely to solve the problem. Given these {criteria/constraints} which is the best solution?

Reporting Category	3-5.E - Engineering
Standard	3-5.E.3 - Construct and perform fair investigations in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
Evidence Statement(s)	Students choose a model or prototype, construct and perform a fair investigation, and identify improvements that can be made. If students are given the investigation with an explanation of what the malfunction is, they could answer questions about the best way to modify the prototype.
Content Limit(s)/ Constraint(s)	All grade 4 engineering standards must be assessed together in a problem set with a common scenario.
Depth of Knowledge	4
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE), Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	How could {prototype/model} be changed to better meet the criteria? What went wrong with the design/solution? How can the solution be changed to correct the malfunction?

Reporting Category	SEPS - Science & Engineering Process Standards ER and CR Items are dual-aligned with content standards.
Standard	SEPS.1 - Posing questions (for science) and defining problems (for engineering) A practice of science is posing and refining questions that lead to descriptions and explanations of how the natural and designed world(s) work and these questions can be scientifically tested. Engineering questions clarify problems to determine criteria for possible solutions and identify constraints to solve problems about the designed world.
Evidence Statement(s)	Students can pose questions that can be answered scientifically, i.e., with controlled variables. Students pose questions to help determine criteria and constraints needed for a successful design solution.
Content Limit(s)/ Constraint(s)	Students need to be provided enough context to be able to come up with appropriate questions.
Depth of Knowledge	3
Item Type(s)	Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	What is the question the scientist is testing? What question would you ask to meet the criteria/constraints?

Reporting Category	SEPS - Science & Engineering Process Standards ER and CR Items are dual-aligned with content standards.
Standard	SEPS.2 - Developing and using models and tools A practice of both science and engineering is to use and construct conceptual models that illustrate ideas and explanations. Models are used to develop questions, predictions and explanations; analyze and identify flaws in systems; build and revise scientific explanations and proposed engineered systems; and communicate ideas. Measurements and observations are used to revise and improve models and designs. Models include, but are not limited to: diagrams, drawings, physical replicas, mathematical representations, analogies, and other technological models. Another practice of both science and engineering is to identify and correctly use tools to construct, obtain, and evaluate questions and problems. Utilize appropriate tools while identifying their limitations. Tools include, but are not limited to: pencil and paper, models, ruler, a protractor, a calculator, laboratory equipment, safety gear, a spreadsheet, experiment data collection software, and other technological tools.
Evidence Statement(s)	Students select the most appropriate model in a given situation and explain their selection. Students select the most appropriate tool in a given situation and explain their selection. Students identify situations in which it is appropriate to use a model. Students create a graph/model/diagram to represent data. Students use a "tool" to measure.
Content Limit(s)/ Constraint(s)	Context/models/graphs/tools should be grade-level appropriate.
Depth of Knowledge	3
Item Type(s)	Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Graph the data in the table. Which graph best matches the data in the table? Which tool(s) would the scientist need to use to collect the necessary data? Use/read {tool} accurately.

Sample Item:

Eric predicted that warm water would boil faster than water at room temperature. He performed an experiment to determine whether water at 40°C boiled faster than water at 20°C. The table below shows his data.

Trial	Starting Temperature (°C)	Amount of Water (L)	Time Needed to Boil (minutes)
A	20	2	9
B	20	2	10
C	20	2	9
D	20	2	9.5
E	40	2	6
F	40	2	5
G	40	2	15

Name TWO tools Eric used to complete his experiment.

Key

Any two of the following would suffice for a correct response:

- Thermometer,
- stove/burner/hot plate,
- graduated cylinder/beaker

Reporting Category	SEPS - Science & Engineering Process Standards ER and CR Items are dual-aligned with content standards.
Standard	SEPS.3 - Constructing and performing investigations Scientists and engineers are constructing and performing investigations in the field or laboratory, working collaboratively as well as individually. Researching analogous problems in order to gain insight into possible solutions allows them to make conjectures about the form and meaning of the solution. A plan to a solution pathway is developed prior to constructing and performing investigations. Constructing investigations systematically encompasses identified variables and parameters generating quality data. While performing, scientists and engineers monitor and record progress. After performing, they evaluate to make changes to modify and repeat the investigation if necessary.
Evidence Statement(s)	Students demonstrate knowledge of researching problems in order to identify solutions and how to reach those solutions by using a systematic approach. Students can identify the control and independent/dependent variable. Student can describe the steps in an investigation. Student can plan an investigation. Given the steps of investigation, students can order the steps.
Content Limit(s)/ Constraint(s)	Analogous problems need to be grade-level appropriate.
Depth of Knowledge	3
Item Type(s)	Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	What is the independent/dependent variable in {experiment}? Put the steps in the proper order. Why did the scientist include {specific step} in the experiment?

Sample Item (CR):

Amy performed a science experiment in which she followed the following steps:

1. Fill two pots with the same type and amount of soil
2. Plant five seeds of the same plant type into each pot
3. Place Pot A next to a sunny window
4. Place Pot B in a dark room
5. Add the same amount of water to each pot every three days

After 4 weeks, Amy observed the plants in both pots. The plants in Pot A were green, with tall, thick stems. The plants in Pot B were yellow, with tall, thin stems. Explain whether or not this is a fair test.

Key

This is a fair test because all conditions were kept the same except for the one being tested, which was the light or lack of it that the plants were grown in.

Reporting Category	SEPS - Science & Engineering Process Standards ER and CR Items are dual-aligned with content standards.
Standard	SEPS.4 - Analyzing and interpreting data Investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists and engineers use a range of tools to identify the significant features in the data. They identify sources of error in the investigations and calculate the degree of certainty in the results. Advances in science and engineering makes analysis of proposed solutions more efficient and effective. They analyze their results by continually asking themselves questions; possible questions may be, but are not limited to: “Does this make sense?” "Could my results be duplicated?" and/or “Does the design solve the problem with the given constraints?”
Evidence Statement(s)	Students demonstrate how data are analyzed in order to identify problems and solutions. Students analyze data from tables, etc., to notice trends. Students find a piece of data that is an outlier (way off) from the pattern. Students make predictions/conclusions about what may have gone wrong to result in outliers.
Content Limit(s)/ Constraint(s)	Make sure the data are presented in a grade-level appropriate format.
Depth of Knowledge	3
Item Type(s)	Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Which {data point} does not match the others? Explain why it might not match. Which statement best describes how the graph is trending?

Sample Item:

Eric predicted that warm water would boil faster than water at room temperature. He performed an experiment to determine whether water at 40°C boiled faster than water at 20°C. The table below shows his data.

Trial	Starting Temperature (°C)	Amount of Water (L)	Time Needed to Boil (minutes)
A	20	2	9
B	20	2	10
C	20	2	9
D	20	2	9.5
E	40	2	6
F	40	2	5
G	40	2	15
H	40	2	5.5

Part 1: Explain whether or not the data support Eric's prediction.

Part 2: Look at the data for Trial G. Describe ONE possible explanation for why this trial has different outcome from the other trials.

Key

Part 1: A correct response is any response that indicates:

Most of the data support Eric's prediction because the 40°C water in trials E, F, and H all took less time to boil than the 20°C water in trials A-D. However, the 40°C water in trial G took longer to boil than the water in all the other trials. Because trial G's results are so different from the rest, this trial should be thrown out and the conclusion should be that Eric's prediction has been proven.

Part 2: A correct response should include one or more of the following:

Trial G may be different because:

- The temperature of the stove/burner/hot plate used to heat the water sample in trial G might not have been the same as those used to heat the other samples.
- The water sample in trial G might have had something/another chemical in it in addition to the water, which made the boiling point higher for that sample than for the others.
- The original temperature of the water in trial G might have been lower than 40°C and its initial temperature recorded incorrectly in the table.

Reporting Category	SEPS - Science & Engineering Process Standards ER and CR Items are dual-aligned with content standards.
Standard	SEPS.5 - Using mathematics and computational thinking In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; solving equations exactly or approximately; and recognizing, expressing, and applying quantitative relationships. Mathematical and computational approaches enable scientists and engineers to predict the behavior of systems and test the validity of such predictions. Scientists and engineers understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
Evidence Statement(s)	Students explain that mathematics and computations support science and these can be used to predict, confirm, and/or express information. Students predict the next data point in a pattern or trend. Students can perform grade-appropriate calculations.
Content Limit(s)/ Constraint(s)	Math concepts assessed should be one grade level below students' current grade and numbers should be whole numbers. Context should be covered in the content standards for the grade.
Depth of Knowledge	2
Item Type(s)	Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Predict the next data point on this graph. What is the average of this set of data?

Reporting Category	SEPS - Science & Engineering Process Standards ER and CR Items are dual-aligned with content standards.
Standard	SEPS.6 - Constructing explanations (for science) and designing solutions (for engineering) Scientists and engineers use their results from the investigation in constructing descriptions and explanations, citing the interpretation of data, connecting the investigation to how the natural and designed world(s) work. They construct or design logical coherent explanations or solutions of phenomena that incorporate their understanding of science and/or engineering or a model that represents it, and are consistent with the available evidence.
Evidence Statement(s)	Students demonstrate how results can be used as evidence. Students give the scientific explanation for why something works. (Use the evidence as a springboard to explain why something works that way/or doesn't work). Students use background knowledge to explain the science behind a given scientific scenario.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	3
Item Type(s)	Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Do the data support/reject the hypothesis? Which of the following conclusions are best supported by this graph/data table?

Reporting Category	SEPS - Science & Engineering Process Standards ER and CR Items are dual-aligned with content standards.
Standard	SEPS.7 - Engaging in argument from evidence Scientists and engineers use reasoning and argument based on evidence to identify the best explanation for a natural phenomenon or the best solution to a design problem. Scientists and engineers use argumentation, the process by which evidence-based conclusions and solutions are reached, to listen to, compare, and evaluate competing ideas and methods based on merits. Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building data models, and using evidence to evaluate claims.
Evidence Statement(s)	Students support arguments with evidence or explain why an argument is not supported. Given opposing conclusions or ideas, students select which one the evidence supports. Students compare and contrast opposing conclusions/explanations/solutions.
Content Limit(s)/ Constraint(s)	No more than two conclusions, etc., to compare.
Depth of Knowledge	3
Item Type(s)	Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Which conclusion is best supported by the evidence? Explain why this argument is not supported by the evidence.

Reporting Category	SEPS - Science & Engineering Process Standards ER and CR Items are dual-aligned with content standards.
Standard	SEPS.8 - Obtaining, evaluating, and communicating information Scientists and engineers need to be communicating clearly and articulating the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations, as well as, orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs.
Evidence Statement(s)	Students demonstrate how scientists and engineers use a variety of ways to communicate ideas and critique work. Students communicate using tables/graphs.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	2
Item Type(s)	Extended Response (ER), Constructed Response (CR)
Sample Item Stem(s)	Create a graph from the data table. Which graph would be the best to share the results of the experiment with other scientists/students?

Sample item:

Eric predicted that warm water would boil faster than water at room temperature. He performed an experiment to determine whether water at 40°C boiled faster than water at 20°C. The table below shows his data.

Trial	Starting Temperature (°C)	Amount of Water (L)	Time Needed to Boil (minutes)
A	20	2	9
B	20	2	10
C	20	2	9
D	20	2	9.5
E	40	2	6
F	40	2	5
G	40	2	15
H	40	2	5.5

Eric's teacher suggests that Eric communicate his results to other scientists. Explain why it is important for scientists to communicate their results with other scientists.

Key

(A correct response is any response indicating any of the following:)

Communicating results of experiments with other scientists is important because:

- other scientists can then repeat the experiment to make sure the results are reliable
- other scientists can use the information to inform their own work on similar experiments/research
- other scientists can use the information as a basis for new research/experiments

Reporting Category	3-5.DI - Data and Information
Standard	3-5.DI.1 - Understand and use the basic steps in algorithmic problem solving (e.g., problem statement and exploration, examination of sample instances, design, implementation, and testing).
Evidence Statement(s)	Students demonstrate how to use algorithmic problem solving in the design process. For example, sequencing the steps of a simple algorithm.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	1
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	Describe the result of completing {set of steps}. Put the following steps in the correct order.

Reporting Category	3-5.DI - Data and Information
Standard	3-5.DI.2 - Develop a simple understanding of an algorithm (e.g., search, sequence of events, or sorting) using computer-free exercises.
Evidence Statement(s)	Students demonstrate how to conceptualize an algorithm without the use of a computer. Use the steps of an algorithm to solve a problem.
Content Limit(s)/ Constraint(s)	Make content neutral. Avoid math processes.
Depth of Knowledge	2
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	Complete the following steps to find the answer. Sort items using these steps.

Reporting Category	3-5.DI - Data and Information
Standard	3-5.DI.3 - Demonstrate how a string of bits can be used to represent alphanumeric information and how 1's and 0's represent information.
Evidence Statement(s)	Students demonstrate how to represent information using alphanumeric information and binary numbers.
Content Limit(s)/ Constraint(s)	Assessed in the classroom
Depth of Knowledge	2
Item Type(s)	NA
Sample Item Stem(s)	Use {key} to decode this string of numbers and letters.

Reporting Category	3-5.DI - Data and Information
Standard	3-5.DI.4 - Describe how a simulation can be used to solve a problem.
Evidence Statement(s)	Students solve problems using simulations. Students describe how the simulation is used to solve the problem and explains when a simulation would be useful in a given situation.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	2
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	Which simulation best matches {scenario}? Choose the best scenario to help the student/scientist understand the problem. Explain your choice.

Reporting Category	3-5.DI - Data and Information
Standard	3-5.DI.5 - Understand the connections between computer science and other fields.
Evidence Statement(s)	Students explain how computer science is found in other fields. Students demonstrate how computer science connects to and supports other fields of study.
Content Limit(s)/ Constraint(s)	Assessed in the classroom
Depth of Knowledge	1
Item Type(s)	NA
Sample Item Stem(s)	How would a scientist use computer science?

Reporting Category	3-5.CD - Computing Devices and Systems
Standard	3-5.CD.1 - Demonstrate proficiency with keyboards and other input and output devices.
Evidence Statement(s)	Students use keyboarding skills to create a flyer or mini poster. Students demonstrate proficiency using familiar input and output devices.
Content Limit(s)/ Constraint(s)	Assessed in the classroom
Depth of Knowledge	1
Item Type(s)	NA
Sample Item Stem(s)	What would a student use to…?

Reporting Category	3-5.CD - Computing Devices and Systems
Standard	3-5.CD.2 - Understand the pervasiveness of computers and computing in daily life (e.g., voicemail, downloading videos and audio files, microwave ovens, thermostats, wireless Internet, mobile computing devices, GPS systems).
Evidence Statement(s)	Students explain how computers are an integral part of daily life. Students demonstrate how computers are used in daily life.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	1
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	Where might you find computers? How/where are computers used every day? (This would involve items with chips, not necessarily computers.)

Reporting Category	3-5.CD - Computing Devices and Systems
Standard	3-5.CD.3 - Supply troubleshooting strategies for identifying simple hardware and software problems that may occur during use.
Evidence Statement(s)	Students demonstrate how to troubleshoot while using a computer or other common device.
Content Limit(s)/ Constraint(s)	Contexts must be general, not for a specific program or software. Do not assess whether a problem is a hardware or software problem. Assessable devices include computers, phones, and tablets.
Depth of Knowledge	2
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	If a computer/device does not turn on/off/function, what steps would/should be taken to solve that problem?

Reporting Category	3-5.CD - Computing Devices and Systems
Standard	3-5.CD.4 - Recognize that computers model intelligent behavior (as found in robotics, speech and language recognition, and computer animation).
Evidence Statement(s)	Students explain how computers mimic artificial intelligence. Students demonstrate the intellectual relationship between humans and computers.
Content Limit(s)/ Constraint(s)	Assessed in the classroom
Depth of Knowledge	1
Item Type(s)	NA
Sample Item Stem(s)	How do humans use computers in daily tasks?

Reporting Category	3-5.PA - Programs and Algorithms
Standard	3-5.PA.1 - Use technology resources (e.g., calculators, data collection probes, mobile devices, videos, educational software, and web tools) for problem-solving and self-directed learning, and general-purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, facilitate learning, and individual/collaborative writing, communication, and publishing activities.
Evidence Statement(s)	Students demonstrate how to use technology resources to provide or obtain information. Students use digital tools to analyze data.
Content Limit(s)/ Constraint(s)	Assessed in the classroom
Depth of Knowledge	Varies dependent on technologies being utilized.
Item Type(s)	NA
Sample Item Stem(s)	What types of software would be used to…?

Reporting Category	3-5.PA - Programs and Algorithms
Standard	3-5.PA.2 - Use digital tools to gather, manipulate, and modify data for use by a program.
Evidence Statement(s)	Students use digital tools to analyze data. Students demonstrate how to use digital tools for programming.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	2
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	How would/should data be recorded to…?

Reporting Category	3-5.PA - Programs and Algorithms
Standard	3-5.PA.3 - Implement problem solutions using a block-based visual programming language.
Evidence Statement(s)	Students solve problems by coding. Students demonstrate how to use block-based visual programming language.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	2
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	Put these blocks of code into the correct order to successfully execute the problem/solve the problem.

Reporting Category	3-5.NC - Networking and Communication
Standard	3-5.NC.1 - Use online resources (e.g., email, online discussions, collaborative web environments) to participate in collaborative problem-solving activities for the purpose of developing solutions or products.
Evidence Statement(s)	Students collaborate using online resources to solve problems. Students demonstrate how to use online resources to communicate with others to solve a problem.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	2
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	What software would students use to share information?

Reporting Category	3-5.NC - Networking and Communication
Standard	3-5.NC.2 - Use productivity technology tools (e.g., word processing, spreadsheet, presentation software) for individual and collaborative writing, communication, and publishing activities.
Evidence Statement(s)	Students communicate using technology tools. Students demonstrate how to use productivity technology to write, communicate, and/or publish material.
Content Limit(s)/ Constraint(s)	Assessed in the classroom
Depth of Knowledge	2
Item Type(s)	NA
Sample Item Stem(s)	What types of software would be used to…?

Reporting Category	3-5.IC - Impact and Culture
Standard	3-5.IC.1 - Discuss basic issues related to responsible use of technology and information, and the consequences of inappropriate use.
Evidence Statement(s)	Students explain the responsible use of technology. Students demonstrate how to responsibly use technology and are aware of the etiquette, rules, and consequences of the use of technology.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	2
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	Which of the following actions are appropriate/inappropriate uses of technology?

Reporting Category	3-5.IC - Impact and Culture
Standard	3-5.IC.2 - Identify the impact of technology (e.g., social networking, cyber bullying, mobile computing and communication, web technologies, cyber security, and virtualization) on personal life and society.
Evidence Statement(s)	Students describe the impacts of technology on life, both personally and in society as a whole. Students understand the positive and negative uses of technology both personally and in society.
Content Limit(s)/ Constraint(s)	None
Depth of Knowledge	2
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	What are some positive/negative impacts of {specific technology/software on society/daily life, etc.}?

Reporting Category	3-5.IC - Impact and Culture
Standard	3-5.IC.3 - Discuss basic issues related to responsible use of technology and information, and the consequences of inappropriate use.
Evidence Statement(s)	Students evaluate the validity of various sources found electronically. Students demonstrate how to determine or distinguish between reliable and unreliable electronic information sources.
Content Limit(s)/ Constraint(s)	Getting into the bias might be too far for fourth grade--the energy company paying for the research, for example. Do not assess the term "validity," but "valid" is acceptable.
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	Which sources are more/most valid for collecting data/doing research? Explain how to tell if a web site is a valid source of information.

Reporting Category	3-5.IC - Impact and Culture
Standard	3-5.IC.4 - Understand ethical issues that relate to computers and networks (e.g., equity of access, security, privacy, copyright, and intellectual property).
Evidence Statement(s)	Students discuss the ethical issues related to technology. Students describe how computers can be used in ethical and unethical ways.
Content Limit(s)/ Constraint(s)	Only assess equity of access, privacy, plagiarism. Do not use the words "ethics" or "ethical" in the items.
Depth of Knowledge	3
Item Type(s)	Multiple Choice (MC), Technology-Enhanced (TE)
Sample Item Stem(s)	How might technology be used to help/harm people?