How to Interpret the Alabama Science Performance Level Descriptors

The Alabama Science Performance Level Descriptors (PLDs) were developed based on student performance data from the ACT Science Test. The initial phase of development was the establishment of quantitatively derived cut scores, resulting in four performance levels (referred to as Levels 1–4). PLDs were then to be developed with Alabama science teachers for Levels 2–4. Teachers studied items that had a high likelihood of being answered correctly by students in each performance level and, based on the analysis, the teachers articulated what students who performed in each score level were able to consistently demonstrate on the ACT Science Test. When a student's ACT Science Test score is taken as an indication of the student's performance level, the knowledge and skill statements in the PLDs describe what the student is *likely* able to do. The PLDs are not a guarantee or exhaustive list of what an individual student *can* or *will* do.

Because of this approach, the domain of the assessment was ultimately the domain of the PLDs. The ACT Science Test focuses on Science and Engineering Practices and Crosscutting Concepts assessed in content-rich scenarios that reflect Disciplinary Core Ideas. These three domains make up the content standards in the *Alabama Course of Study: Science*. The PLDs are constructed to represent Science and Engineering Practices and Crosscutting Concepts with a requirement that they are applied to the fundamental content knowledge in the Earth & space, life, and physical sciences from the Disciplinary Core Ideas. The team of Alabama science teachers developing the PLDs felt that while science content is of critical importance, teachers most often focus too strongly on the content, leaving practices and crosscutting concepts behind and therefore, they favored having the focus of the PLDs be on practices and crosscutting concepts. The consensus was having this focus would make the PLDs more useful by steering teachers toward the 3-dimensional learning model that underpins the *Alabama Course of Study: Science.*

The PLDs are arranged into three separate tables. Each table represents the science knowledge, skills, and practices in one of three assessment reporting categories for the ACT Science Test (*Interpretation of Data*, *Scientific Investigation*, and *Evaluation of Models, Inferences, and Experimental Results*). The science knowledge, skills, and practices in each reporting category are each further organized into three skill areas that provide some insights into how science skills and practices can be developed in the science classroom.

Each PLD includes coding that links the PLD to the content standards in the *Alabama Course of Study: Science*. The coding indicates the Science and Engineering Practices and Crosscutting Concepts to which the PLD is most strongly aligned. The codes are shown in Table 1.

Code	Science and Enginee
SEP1	Asking questions & defining probl
SEP2	Developing & using models
SEP3	Planning & carrying out investigat
SEP4	Analyzing & interpreting data
SEP5	Using mathematics & computatio
SEP6	Constructing explanations & desig
SEP7	Engaging in argument from evider
SEP8	Obtaining, evaluating, & commun

Code	Crosscutting Concept
CCC1	Patterns
CCC2	Cause & effect
CCC3	Scale, proportion, & quantity
CCC4	Systems & system models
CCC5	Energy & matter
CCC6	Structure & function
CCC7	Stability & change

Each PLD is also linked by coding to one or more standards in the *ACT College and Career Readiness Standards for Science*. The codes for each of those standards can be found as an appendix following this additional version of the PLDs.

Draft Alabama High School Science Performance Level Descriptors: Interpretation of Data (IOD)

Based on the 3-dimensional model articulated in the Alabama Course of Study, the Science and Engineering Practices and Crosscutting Concepts described in the PLDs must be learned with and applied to the Disciplinary Core Ideas in the Earth & space, life, and physical sciences.

Science Skills & Practices Developed in the Classroom	Level 2 (16-19)	Level 3 (20-25)	Level 4 (26-36)
Locating and Understanding: While learning and applying the core ideas in the Earth & space, life, and physical sciences, students should work with scientific text, tables, graphs, and diagrams while learning and engaging in science. Students should become familiar with the conventions for presenting scientific information and be able to locate data in scientific data presentations.	• Examine data displayed in a simple or complex scientific table, graph, or diagram to determine what information is present and then locate relevant pieces of the displayed data. *[SEP2, SEP4; CC1; CC4] [IOD 201, 203, 301, 303, 401]* • Identify and describe the features of scientific tables, graphs, and diagrams (e.g., axis labels, units of measure) of data. *[SEP2-4; CC1,3-4] [IOD 202]* • Understand and properly use common scientific terminology, symbols, and units of measure when constructing explanations, arguing from evidence, and communicating information. *[SEP6-8; CC3] [IOD 302]*	Students scoring 20 or higher can likely demonstrate all the science skills in Level 2 of **Locating and Understanding**.	Students scoring 26 or higher can likely demonstrate all the science skills in **Locating and Understanding**.
Inferring and Translating: While learning and applying the core ideas in the Earth & space, life, and physical sciences, students should interpret and construct scientific tables, graphs, and diagrams of qualitative and quantitative data to find trends and relationships, compare and combine data within data displays, and convert data from one type of display to another. Students should be able to work with data across multiple scientific tables and graphs. Students should regularly apply an appropriate level of mathematics to scientific data.	• Analyze and interpret patterns in a simple scientific table, graph, or diagram to describe the effect of changing one variable on another variable. *[SEP4,7; CC1,3] [IOD 304]* • Compare and contrast the scale, proportion, or quantity of data in a simple scientific graph, table, or diagram to support explanations, predict phenomena, analyze systems, and solve problems (e.g., order data from a table or graph based on given criteria). *[SEP4,8; CC1,3,4] [IOD 402]* • Integrate data from a simple scientific graph, table, or diagram in qualitatively or quantitatively meaningful ways to make scientific claims, including claims about specific causes and effects (e.g., summing daily measurements to obtain a weekly total). *[SEP4,8; CC2,3] [IOD 402]*	Students scoring 20-25 can likely demonstrate all the science skills in Level 2 in **Inferring and Translating** and can likely: • Develop a graphical model or diagram based on raw data or from a table of data to describe and support scientific claims and explanations. (e.g., convert tabular data into a graph) *[SEP2,4,5,8; CC1,3] [IOD 403]* • Compare and contrast the scale, proportion, or quantity of data in two different simple scientific graphs, tables, or diagrams to support explanations, predict phenomena, analyze systems, and solve problems (e.g., compare the scale of data in a table to that in a related graph). *[SEP4,8; CC1,3,4] [IOD 501]* • Integrate data from two or more simple scientific graphs, tables, or diagrams in meaningful ways to make scientific claims, including claims about specific causes and effects (e.g., categorize data from a table using a scale found in another table). *[SEP4,8; CC2,3] [IOD 501]* • Analyze and interpret patterns in a complex scientific table, graph, or diagram to describe the effect of a change in one variable on another variable. *[SEP4,7; CC1; CC3] [IOD 503]* • Determine and/or apply a simple mathematical relationship that exists between data to describe and support scientific claims and explanations. (e.g., applying ratios, simple unit conversions, averaging data). *[SEP2,5; CC1,3] [IOD 504]*	Students scoring 26 or higher can likely demonstrate all the science skills in Levels 2 and 3 in **Inferring and Translating** and can likely: • Compare and contrast the scale, proportion, or quantity of data in a complex scientific graph, table, or diagram to support explanations, predict phenomena, analyze systems, and solve problems (e.g., compare rates of change in different regions of a titration curve). *[SEP4,8; CC1,3,4] [IOD 502]* • Integrate data from a complex scientific graph, table, or diagram in meaningful ways to make scientific claims, including claims about specific causes and effects (e.g., summing data from two different curves in a graph represented by two *y*-axes). *[SEP4, SEP8; CC2; CC3] [IOD 502]* • Compare and contrast the scale, proportion, or quantity of data in two different complex scientific graphs, tables, or diagrams to support explanations, predict phenomena, analyze systems, and solve problems (e.g., compare phases of two substances represented by different phase diagrams). *[SEP4,8; CC1,3,4] [IOD 601, 701]* • Integrate data from two or more complex scientific graphs, tables, or diagrams in meaningful ways to make scientific claims, including claims about specific causes and effects (e.g., use a calibration curve to determine a concentration from a measured absorption value). *[SEP4, SEP8; CC2; CC3] [IOD 601, 701]* • Determine and/or apply a complex mathematical relationship that exists between data to describe and support scientific claims and explanations. (e.g., compound unit conversions, dimensional analysis). *[SEP2, SEP5; CC1; CC3] [IOD 602]*
Extending and Reevaluating: While learning and applying the core ideas in the Earth & space, life, and physical sciences, students should examine trends in scientific graphs and tables of qualitative and quantitative data to predict values that fall between known data points. Students should be able to predict values that are beyond the range of presented data and to apply new findings to their interpretations.	Students scoring 16-19 may demonstrate some of the skills and practices in the higher score ranges of **Extending and Reevaluating**, but not consistently.	• Analyze and interpret patterns in a simple scientific table or graph to qualitatively or quantitatively estimate a value or range of values that falls between two known values (i.e. interpolation). *[SEP4,5,8; CC1,3] [IOD 404]* • Analyze and interpret patterns in a simple scientific table or graph to qualitatively or quantitatively estimate a value or range of values that extends beyond the set of known values (i.e. extrapolation). *[SEP4, SEP5, SEP8; CC1; CC3] [IOD 404]* • Revise interpretations of simple scientific data based on new evidence. *[SEP1,2,4;CC1-3] [IOD 505]*	Students scoring 26 or higher can likely demonstrate all the science skills in Level 3 in **Extending and Reevaluating** and can likely: • Analyze and interpret patterns in a complex scientific table or graph to qualitatively or quantitatively estimate a value or range of values that falls between two known values (i.e. interpolation). *[SEP4, SEP5, SEP8; CC1; CC3] [IOD 603]* • Analyze and interpret patterns in a complex scientific table or graph to qualitatively or quantitatively estimate a value or range of values that extends beyond the set of known values (i.e. extrapolation). *[SEP4, SEP5, SEP8; CC1; CC3] [IOD 603]* • Revise interpretations of complex scientific data based on new evidence. *[SEP1,2,4;CC1-3] [IOD 702]*

What do "simple" and "complex" mean when they describe scientific data presentations in the Alabama Science Performance Level Descriptors?

Concepts/Quantities Represented by a Simple Data Presentation	Type/Nature of a Simple Data Presentation
Concepts are likely to be familiar to, or readily understood by, high school students regardless of their exposure to rigorous science instruction: temperature, rainfall—or density and concentration (even if only understood qualitatively); newly introduced but readily understood quantities (e.g., percent of offspring, angle of reflection); numbers of things—or a simple quantity—per another familiar quantity, like rotations per minute or number of lightning strikes per storm event.	The type and nature of these data presentations are likely to be familiar to high school students regardless of their exposure to rigorous science instruction: tables with one or more columns and single headings, bar graphs with clusters of three or fewer bars, line graphs with three or fewer curves (with a legend, when needed), pie charts, and flow diagrams (e.g., a food web).

Draft Alabama High School Science Performance Level Descriptors: Scientific Investigation (SIN)

Based on the 3-dimensional model articulated in the Alabama Course of Study, the Science and Engineering Practices and Crosscutting Concepts described in the PLDs must be learned with and applied to the Disciplinary Core Ideas in the Earth & space, life, and physical sciences.

Science Skills & Practices Developed in the Classroom	Level 2 (16-19)	Level 3 (20-25)	Level 4 (26-36)
Locating and Comparing: While learning and applying the core ideas in the Earth & space, life, and physical sciences, students should examine investigations to determine why they were carried out and what facts underlie the investigation, and to compare and contrast the elements of the different experiments that make up an investigation.	• Examine the procedure for a simple scientific investigation to locate key concepts needed to understand what phenomenon is being studied or what problem the investigators are trying to solve. *[SEP3,8] [SIN 201]*	Students scoring 20-25 can likely demonstrate all the science skills in Level 2 in **Locating and Comparing** and can likely: • Examine the procedure for a complex scientific investigation to locate key concepts needed to understand what phenomenon is being studied or what problem the investigators are trying to solve. *[SEP3,8] [SIN 303]*	Students scoring 26 or higher can likely demonstrate all the science skills in Levels 2 and 3 of **Locating and Comparing**
Designing and Implementing: While learning and applying the core ideas in the Earth & space, life, and physical sciences, students should examine investigations to identify the experimental hypothesis, controls, and variables, and what methods and tools were used to carry out the investigation. Students should understand why these design aspects and procedures were used and whether those choices best served the intent of the investigation and should apply findings to design and carry out investigations.	• Select appropriate tools to conduct a simple investigation that can serve as evidence to construct and revise a model, support an explanation for phenomena, or refine a solution to a problem. *[SEP3] [SIN 202, 301]*	Students scoring 20-25 can likely demonstrate all the science skills in Level 2 in **Designing and Implementing** and can likely: • Select appropriate tools to conduct a complex investigation that can serve as evidence to construct and revise a model, support an explanation for phenomena, or refine a solution to a problem. *[SEP3] [SIN 302, 402]* • Understand how a simple investigation was designed to provide accurate and reliable evidence to test conceptual, mathematical, physical, and empirical models (e.g., controlling variables, number of trials, inputs/outputs, constraints). *[SEP3, SEP8] [SIN 401, 403]* • Compare and contrast related simple and complex scientific investigations to identify similarities and differences in their designs, methods, and tools. *[SEP3] [SIN 404, 405]*	Students scoring 20-25 can likely demonstrate all the science skills in Levels 2 and 3 in **Designing and Implementing** and can likely: • Understand how a complex investigation was designed to provide accurate and reliable evidence to test conceptual, mathematical, physical, and empirical models (e.g., controlling variables, number of trials, inputs/outputs, constraints). *[SEP3,8] [SIN 403, 501]* • Determine, refine, and evaluate empirically testable questions and hypotheses that are the bases for scientific investigations. *[SEP3,8] [SIN 601]* • Evaluate the suitability of the design of an investigation to provide accurate and reliable evidence to test conceptual, mathematical, physical, and empirical models (e.g., identify possible flaws because of precision and accuracy issues, inadequate control of variables, or insufficient number of trials). *[SEP3, SEP8] [SIN 701]*
Extending and Improving: While learning and applying the core ideas in the Earth & space, life, and physical sciences, students should examine the results and procedures of investigations to predict how changing the value of a variable or altering the experimental design will produce new results or allow new questions to be addressed. Students may be ready to explore revising and extending investigations and to carry out new investigations that more fully address the questions they seek to answer.	Students scoring 15 or lower may demonstrate some of the skills and practices in the higher score ranges of **Extending and Improving**, but not consistently.	• Use and/or develop a model based on patterns of evidence from an investigation in order to predict which experimental conditions would produce an outcome that satisfies specified criteria or solves a problem. *[SEP2,3; CC1,2] [SIN 503]*	• Use and/or develop a model based on patterns of evidence from an investigation in order to predict the outcome of an additional trial or measurement. *[SEP2,3; CC1,2] [SIN 502]* • Refine the design of an experiment or propose a valid alternate method for testing a hypothesis or solving a problem. *[SEP3] [SIN 602]* • Predict how modifying the design or methods of an investigation may affect the results and its suitability to serve as evidence to build and revise models, support explanations for phenomena, and refine solutions to problems. *[SEP3,8] [SIN 702]* • Plan and design a new investigation that could be carried out to provide additional evidence to build and revise models, support explanations for phenomena, and refine solutions to problems, or to evaluate the results of the original investigation. *[SEP38] [SIN 703]*

Concepts/Quantities Represented by a Complex Data Presentation
Some concepts are likely to be familiar to high school students who have had rigorous science instruction (but may not be to students lacking this instruction), such as momentum, freezing point depression, and reaction rate (even if only understood qualitatively). Others may be newly introduced but readily understood quantities (e.g., genetic frequency, work). In some cases, the concepts may be unfamiliar to high school students, even those who have had rigorous science instruction, such as heat (enthalpy) of reaction ($\Delta H°$) or torque, or concepts specific to complex scenarios that are fully explained in the text but will be challenging to many high school students. For those concepts, students of all levels will likely need to rely heavily on the explanations and definitions provided.

Type/Nature of a Complex Data Presentation
Many of the data presentations will be familiar to high school students who have had exposure to rigorous science instruction but challenging to other high school students, such as histograms, Venn diagrams, bar graphs with clusters of four or more bars and a legend, line graphs with several curves and a legend, line graphs with two *y*-axes, and flow diagrams with multiple outcomes. Other data presentations may be unfamiliar to high school students regardless of their exposure to rigorous science instruction, such as phase diagrams, combination bar/line graphs with two *y*-axes, or graphs with logarithmic scales.

What do "simple" and "complex" mean when they describe scientific experiments in the Alabama Science Performance Level Descriptors?

What do "simple" and "complex" mean when they describe scientific experiments in the Alabama Science Performance Level Descriptors?

Concepts/Quantities in a Simple Experiment
Concepts are likely to be familiar to, or readily understood by, high school students regardless of their exposure to rigorous science instruction: temperature, rainfall—or density and concentration (even if only understood qualitatively); newly introduced but readily understood quantities (e.g., percent of offspring, angle of reflection); numbers of things—or a simple quantity—per another familiar quantity, like rotations per minute or number of lightning strikes per storm event.

Experimental Design and Methods of a Simple Experiment
These experiments are likely to be familiar to high school students, even those who have not had consistent and well-guided opportunities to engage in science investigations. Examples include field studies involving several test plots and experiments having several steps, some basic and some intricate, in which the number of variables measured or controlled is 4 or fewer. Methods and tools include simple dilutions to vary concentration, using instrumentation (like a pH meter), and sorting soils by particle size.

Concepts/Quantities in a Complex Experiment
Some concepts are likely to be familiar to high school students who have had rigorous science instruction (but may not be to students lacking this instruction), such as momentum, freezing point depression, and reaction rate (even if only understood qualitatively). Others may be newly introduced but readily understood quantities (e.g., genetic frequency, work). In some cases, the concepts may be unfamiliar to high school students, even those who have had rigorous science instruction, such as heat (enthalpy) of reaction ($\Delta H°$) or torque, or concepts specific to complex scenarios that are fully explained in the text but will be challenging to many high school students. For those concepts, students of all levels will likely need to rely heavily on the explanations and definitions provided.

Experimental Design and Methods of a Complex Experiment
Some experiments are likely to be familiar to, or readily understood by, high school students who have had consistent and well-guided opportunities to engage in science investigations (but may not be to students lacking this experience). Examples include experiments having several intricate steps with 5 variables that are measured or controlled and experiments that employ methods and tools such as burets, paper chromatography, and simple circuits. Some experiments may be challenging for high school students to follow, regardless of their level of experience engaging in science investigations, such as experiments having several intricate steps and 6 or more variables measured or controlled, with more than one variable being measured simultaneously. These experiments may employ unfamiliar, newly introduced methods and tools.

Draft Alabama High School Science Performance Level Descriptors: Evaluation of Models, Inferences, and Experimental Results (EMI)

Based on the 3-dimensional model articulated in the Alabama Course of Study, the Science and Engineering Practices and Crosscutting Concepts described in the PLDs must be learned with and applied to the Disciplinary Core Ideas in the Earth & space, life, and physical sciences.

Science Skills & Practices Developed in the Classroom	Level 2 (16-19)	Level 3 (20-25)	Level 4 (26-36)
Models—Understanding & Comparing: While learning and applying the core ideas in the Earth & space, life, and physical sciences, students should examine competing models proposed to explain a scientific phenomenon to determine each model's key assertions and to discern matters on which models agree or disagree.	• Analyze an explanation or the description of a model constructed to explain scientific phenomena or solve a problem to find key facts and cited data. *[SEP 2,6,8; CC1–4] [EMI 201]* • Compare and contrast competing arguments and models constructed to determine which models cite certain key facts and data. *[SEP 2,6,7,8; CC1–4] [EMI 302]* • Evaluate the merits of a set of simple scientific claims, predictions, or conclusions to determine which one is, or is not, consistent with an argument/model. *[SEP 2,6,7,8; CC1–4] [EMI 401]*	Students scoring 20-25 can likely demonstrate all the science skills in Level 2 in **Models—Understanding & Comparing** and can likely: • Compare and contrast competing models to determine key similarities and differences in how they explain scientific observations. *[SEP 2,6,7,8; CC1–4] [EMI 404]*	Students scoring 26 or higher can likely demonstrate all the science skills in Levels 2 and 3 of **Models—Understanding & Comparing**
Models—Evaluating & Extending: While learning and applying the core ideas in the Earth & space, life, and physical sciences, students will encounter competing models proposed to explain a scientific phenomenon. Students should evaluate the relative strengths and weaknesses of competing models, and students should be ready to use models to construct predictions and conclusions.	• Evaluate the merits of a set of simple scientific claims, predictions, or conclusions to determine which one is, or is not, consistent with an argument/model. *[SEP 2,6,7,8; CC1–4] [EMI 401]*	Students scoring 20-25 can likely demonstrate all the science skills in Level 2 in **Models— Evaluating & Extending** and can likely: • Evaluate the merits of a set of simple scientific claims, predictions, or conclusions to determine which one is, or is not, consistent with two or more competing arguments/models. *[SEP 2,6,7,8; CC1–4] [EMI 501]* • Construct a simple scientific claim or prediction and justify it based on one or more arguments/models. *[SEP 2,6,7,8; CC1–4] [EMI 502, 603]*	Students scoring 26 or higher can likely demonstrate all the science skills in Level 2 in **Models— Evaluating & Extending** and can likely: • Evaluate the merits of a set of complex scientific claims, predictions, or conclusions to determine which one is, or is not, consistent with two or more competing arguments/models. *[SEP 2,6,7,8; CC1–4] [EMI 601, 701]* • Evaluate merits and limitations of competing arguments/models to determine which one best explains phenomena or solves a problem, including how they are impacted by new or additional evidence. *[SEP 2,6,7,8; CC1–4] [EMI 503]* • Determine how competing arguments/models are impacted by new or additional evidence. *[SEP 2,6,7,8; CC1–4] [EMI 504]* • Compare and contrast competing arguments and models to determine which one best supports or contradicts a scientific claim, prediction, or conclusion. *[SEP 2,6,7,8; CC1–4] [EMI 505]* • Construct and defend an argument to justify why scientific data support or weakens a model. *[SEP 2,6,7,8; CC1–4] [EMI 602]* • Construct a complex scientific claim or prediction and justify it based on one or more arguments/models. *[SEP 2,6,7,8; CC1–4] [EMI 603, 702]*
Inferences & Results—Evaluating & Extending: While learning and applying the core ideas in the Earth & space, life, and physical sciences, students should examine reputable sources of scientific information along with the results of scientific investigations to evaluate claims and to make valid inferences. Students should be ready to generate and defend claims.	• Evaluate the merits of a set of simple scientific claims, predictions, or conclusions to determine which one is best supported by one source of data (e.g., graphs, tables, or diagrams). *[SEP2,6,8; CC1–4] [EMI 401]*	Students scoring 20-25 can likely demonstrate all the science skills in Level 2 in **Inferences & Results—Evaluating & Extending** and can likely: • Evaluate the merits of a set of simple scientific claims, predictions, or conclusions to determine which one is best supported by multiple sources of data (e.g., graphs, tables, or diagrams). *[SEP 2,6,8; CC1–4] [EMI 501]* • Evaluate different sets of experimental results to determine which results best support or contradict a scientific claim, prediction, or conclusion. *[SEP 2,6,8; CC1–4] [EMI 505]* • Evaluate a simple scientific claim or conclusion and justify why it is, or is not, supported by the findings of scientific investigations. *[SEP 2,6,7,8; CC1–4] [EMI 502]* • Construct a simple scientific claim or prediction and justify it based on the findings of scientific investigations. *[SEP 2,6,7,8; CC1–4] [EMI 401, 501, 502]*	Students scoring 26 or higher can likely demonstrate all the science skills in Levels 2 and 3 in **Inferences & Results—Evaluating & Extending** and can likely: • Evaluate the merits of a set of complex scientific claims, predictions, or conclusions to determine which one is best supported by one or more sources of scientific data (e.g., both a scientific table and a graph of experimental results). *[SEP 2,6,8; CC1–4]* [EMI 601, 701] • Evaluate a complex scientific claim or conclusion and justify why it is, or is not, supported by the findings of scientific investigations. *[SEP 2,6,7,8; CC1–4] [EMI 702]* • Construct a complex scientific claim or prediction and justify it based on the findings of scientific investigations. *[SEP 2,6,7,8; CC1–4] [EMI 601, 701, 702]*

APPENDIX:

The ACT College and Career Readiness Standards for Science

	ACT College and Career Readiness Standards—Science		
	Interpretation of Data (IOD)	**Scientific Investigation (SIN)**	**Evaluation of Models, Inferences, and Experimental Results (EMI)**
13–15	201. Select one piece of data from a simple data presentation (e.g., a simple food web diagram) 202. Identify basic features of a table, graph, or diagram (e.g., units of measurement) 203. Find basic information in text that describes a simple data presentation	201. Find basic information in text that describes a simple experiment 202. Understand the tools and functions of tools used in a simple experiment	201. Find basic information in a model (conceptual)
16–19	301. Select two or more pieces of data from a simple data presentation 302. Understand basic scientific terminology 303. Find basic information in text that describes a complex data presentation 304. Determine how the values of variables change as the value of another variable changes in a simple data presentation	301. Understand the methods used in a simple experiment 302. Understand the tools and functions of tools used in a complex experiment 303. Find basic information in text that describes a complex experiment	301. Identify implications in a model 302. Determine which models present certain basic information

20–23	401. Select data from a complex data presentation (e.g., a phase diagram) 402. Compare or combine data from a simple data presentation (e.g., order or sum data from a table) 403. Translate information into a table, graph, or diagram 404. Perform a simple interpolation or simple extrapolation using data in a table or graph	401. Understand a simple experimental design 402. Understand the methods used in a complex experiment 403. Identify a control in an experiment 404. Identify similarities and differences between experiments 405. Determine which experiments utilized a given tool, method, or aspect of design	401. Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text 402. Identify key assumptions in a model 403. Determine which models imply certain information 404. Identify similarities and differences between models
24–27	501. Compare or combine data from two or more simple data presentations (e.g., categorize data from a table using a scale from another table) 502. Compare or combine data from a complex data presentation 503. Determine how the values of variables change as the value of another variable changes in a complex data presentation 504. Determine and/or use a simple (e.g., linear) mathematical relationship that exists between data 505. Analyze presented information when given new, simple information	501. Understand a complex experimental design 502. Predict the results of an additional trial or measurement in an experiment 503. Determine the experimental conditions that would produce specified results	501. Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with two or more data presentations, models, and/or pieces of information in text 502. Determine whether presented information, or new information, supports or contradicts a simple hypothesis or conclusion, and why 503. Identify the strengths and weaknesses of models 504. Determine which models are supported or weakened by new information 505. Determine which experimental results or models support or contradict a hypothesis, prediction, or conclusion
28–32	601. Compare or combine data from a simple data presentation with data from a complex data presentation 602. Determine and/or use a complex (e.g., nonlinear) mathematical relationship that exists between data 603. Perform a complex interpolation or complex extrapolation using data in a table or graph	601. Determine the hypothesis for an experiment 602. Determine an alternate method for testing a hypothesis	601. Determine which complex hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text 602. Determine whether presented information, or new information, supports or weakens a model, and why 603. Use new information to make a prediction based on a model
33–36	701. Compare or combine data from two or more complex data presentations 702. Analyze presented information when given new, complex information	701. Understand precision and accuracy issues 702. Predict the effects of modifying the design or methods of an experiment 703. Determine which additional trial or experiment could be performed to enhance or evaluate experimental results	701. Determine which complex hypothesis, prediction, or conclusion is, or is not, consistent with two or more data presentations, models, and/or pieces of information in text 702. Determine whether presented information, or new information, supports or contradicts a complex hypothesis or conclusion, and why

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