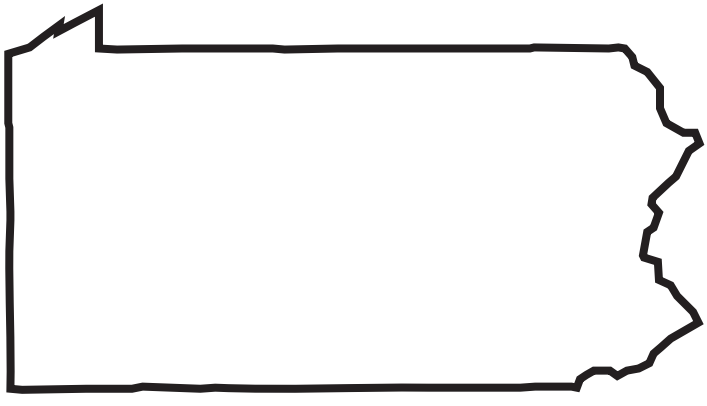
GRADE

8

PSSA Performance Indicator

Science

Form A
Teacher's Guide and Answer Key



Continental Press

Contents

ISBN 978-0-8454-K3972-2

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PSSA Science Performance Indicators

The ***PSSA Science Performance Indicator*** practice tests are designed to help students prepare for the Pennsylvania System of School Assessment (PSSA) in Science. There are two forms of the Performance Indicator available. They are parallel forms that can be administered before instruction and after, or at any time during the school year.

The ***PSSA Finish Line Science, Grade 8*** workbook provides a complete sequence of instruction in the assessed anchors and eligible content. The workbook includes guided practice and independent practice for the assessed science skills and concepts in multiple-choice and open-ended formats. A listing of Assessment Anchors and Eligible Content, as well as Academic Standards, is available at the back of this guide.

The ***PSSA Science Performance Indicators, Grade 8*** are divided into two sessions: Session 1 and Session 2. To emulate the actual testing conditions, the sessions should be administered on the same day. However, if necessary, they may be given on two consecutive days.

Session 1 contains 29 multiple-choice questions and two open-ended items. Multiple-choice questions have four answer choices, one of which is the correct answer. Students should circle the letter of the best answer. Each open-ended question is comprised of two parts, which students must answer in writing. They may be required to read a passage, analyze a table or graph, or make observations about an image.

Session 2 contains 27 multiple-choice questions and three open-ended items.

This teacher's guide includes suggestions for using these test preparation materials, directions for administering the Performance Indicator, and an answer key with correlations to the Pennsylvania Assessment Anchors and Eligible Content for Science for grade 8 and the Academic Standards for grade 8 for Science and Technology and for Environment and Ecology. It also includes a chart connecting the questions on this performance indicator to the corresponding lesson(s) in the *PSSA Finish Line Science* workbook.

The chart below provides a sample timetable for administering the Grade 8 Performance Indicator.

Session 1	29 multiple-choice questions 2 open-ended questions	50 minutes, plus 10 minutes for preparation
Session 2	27 multiple-choice questions 3 open-ended questions	50 minutes, plus 10 minutes for preparation

Using Your Performance Indicator

Science tests today are usually given in multiple sessions. You will probably want your students to work with the ***PSSA Science Performance Indicator*** practice tests in the same way. In addition, schedule review sessions as close as possible to the completion of the test; this will enable you to go over the students' answers while the contents are still fresh in their minds. Be sure to consider with the students ways in which their written responses could be improved. Directions for using the booklet begin below. Those that you will read aloud to the class are in **boldface type** and preceded by the word **SAY;** those that are not meant to be read aloud are in regular type.

The directions that follow instruct the students to write their answers in the test booklets. If you prefer to use separate answer sheets, reproduce the answer sheets on pages 8–9 of this guide. Remind students to write their names on their answer sheets. Then instruct them on how to fill in the circles clearly.

Session 1

Allow 50 minutes for this first session. Make sure each student has a Performance Indicator, Form A, two No. 2 pencils, and optional answer forms, if you are using them.

SAY Turn to the inside front cover of the booklet and write your name on the line provided. You will have 50 minutes to complete Session 1.

Check to be sure students have written their names on the inside front cover of their booklets. Explain to the students that they should read each multiple-choice question and all four answer choices carefully, before marking the best answer. Remind them to write their answers to the open-ended questions neatly. Then take the time to answer any questions the students may have.

SAY Look at page 3 of your booklets.

Read, or have a volunteer read, the directions.

SAY Read the directions and questions on each page carefully. Remember that you have 50 minutes to work on Session 1. Continue working until you reach the word *Stop* on page 19. If you finish early, review your work and just sit quietly until the time is up. Are there any questions?

Pause to answer any questions.

SAY I am now writing the time on the chalkboard. Turn to page 4 and begin.

Check to be sure students have begun working on the booklet correctly. After 40 minutes, alert the students to the time left.

SAY There are 10 minutes left for you to complete Session 1. If you finish page 19 before the time is up, be sure to go back and check your answers.

When time is up, alert the class.

SAY Time's up. Please close your booklets.

Thank the class for their cooperation. Take a short break before beginning Session 2.

Session 2

Allow 50 minutes for the second session. Check that each student has two No. 2 pencils, his or her booklet, and optional answer forms, if you are using them.

SAY **Now you will begin Session 2. You will have 50 minutes to complete this session. Please turn to page 21 and follow along while I read what is on this page.**

Read, or have a volunteer read, the directions.

SAY **Read the directions and questions on each page carefully. Remember that you have 50 minutes to work on Session 2. Continue working until you reach the word *Stop* on page 39. If you finish early, review your work and just sit quietly until the time is up. Are there any questions?**

Pause to answer any questions. Remind the students that you are going to make the session seem as much as possible like the real test they will be taking.

SAY **I am now writing the time on the chalkboard. Turn to page 22 and begin.**

After 40 minutes, alert the students to the time left.

SAY **There are 10 minutes left for you to complete Session 2. If you finish page 39 before the time is up, be sure to go back and check your answers.**

When time is up, alert the class.

SAY **Time's up. Please close your booklets.**

Collect the booklets. Thank the class for their cooperation.

After you check the answers for Sessions 1 and 2 using the answer key on pages 6–7 of this guide, review the responses with students. Continue to work with students to improve all aspects of their science skills.

Answer Key

The first set of brackets following each answer contains the assessment anchor and eligible content addressed. The second set contains the academic standard.

Session 1

1. A [S8.A.2.2.1] [3.7.7.A]
2. B [S8.B.2.1.1] [3.3.7.D]
3. D [S8.C.1.1.2] [3.4.7.A]
4. D [S8.D.1.1.1] [3.5.7.A]
5. B [S8.B.2.2.1] [3.3.7.C]
6. C [S8.B.2.2.2] [3.3.7.C]
7. C [S8.A.1.3.2] [3.1.7.E]
8. B [S8.A.3.1.4] [3.5.7.A]
9. B [S8.C.2.1.1] [3.4.7.B]
10. D [S8.A.3.1.2] [3.1.7.A]
11. D [S8.C.2.2.3] [4.3.7.B]
12. A [S8.A.2.1.2] [3.2.7.B]
13. D [S8.A.3.3.2] [3.1.7.C]
14. D [S8.C.2.1.2] [3.4.7.B]
15. A [S8.D.3.1.1] [3.4.7.D]
16. C [S8.A.1.1.3] [3.2.7.A]
17. Open-ended [S8.A.2.1.5] [3.2.7.D]
    A. *Answers may vary but should say something like the following:* Landslides are more likely to happen in steeper areas.
    B. *Answers may vary but should say something like the following:* The table shows that more than 50% of landslides happened where the slope angle was greater than 30°. The fewest number of landslides happened where the slope angle was less than 5°. Many more landslides happened in the steepest areas.
18. C [S8.D.1.1.4] [3.5.7.A]
19. A [S8.B.2.1.2] [3.3.7.D]
20. D [S8.C.3.1.1] [3.3.7.D]
21. B [S8.A.1.1.4] [3.2.7.A]
22. C [S8.A.2.1.3] [3.2.7.D]
23. D [S8.A.1.1.1] [3.2.7.A]
24. C [S8.A.1.2.4] [3.2.7.C]
25. C [S8.D.1.1.3] [4.4.7.B]
26. A [S8.D.1.3.1] [3.5.7.D]
27. A [S8.A.1.3.3] [4.8.7.C]
28. D [S8.B.2.1.4] [4.7.7.B]
29. D [S8.A.3.1.1] [3.1.7.A]
30. C [S8.A.3.2.2] [3.2.7.B]
31. Open-ended [S8.B.3.2.3] [4.3.7.B]
    A. *Answers may vary but should say something like the following:* The tree loses its leaves in the fall to prepare for winter. The bear stores food as fat and hibernates during the winter. The duck flies to a warmer climate during winter.
    B. *Explanations may vary but should say something like the following:* The tree saves energy by losing leaves that would not be able to make much food during the winter. The bear hibernates, conserving energy during months when it would have a hard time finding food. The duck migrates to avoid cold temperatures and to find better food supplies.

Session 2

32. D [S8.C.1.1.3] [3.4.7.A]
33. B [S8.B.2.1.5] [3.3.7.C]
34. C [S8.A.3.2.1] [3.1.7.B]
35. C [S8.D.1.3.2] [3.5.7.D]
36. D [S8.A.2.1.4] [3.2.7.B]
37. A [S8.A.1.2.3] [3.6.7.C]
38. C [S8.B.3.1.3] [4.6.7.A]
39. C [S8.A.2.1.6] [3.2.7.D]
40. D [S8.A.1.3.1] [3.1.7.D]
41. Open-ended [S8.C.2.1.3] [3.4.7.B]
    A. *Answers may vary but should say something like the following:* Some nuclear energy is transformed into heat energy that turns water into steam. The steam has high pressure and turns a turbine. These are both forms of mechanical energy. The turbine turns a generator. The turning of a generator transforms mechanical energy into electrical energy.
    B. *Answers may vary but should say something like the following:* Electrical energy is transformed into the kinetic energy of a spinning CD and other moving parts in a stereo. It is also transformed into the light energy of a stereo display and laser used to read the CD, the sound energy of the speakers, and the heat given off by the appliance as it is used.

42. D [S8.A.2.1.1] [3.2.7.B]
43. B [S8.D.3.1.2] [3.4.7.D]
44. C [S8.C.2.2.2] [4.2.7.B]
45. C [S8.A.1.2.1] [3.8.7.B]
46. B [S8.D.1.3.3] [3.5.7.D]
47. A [S8.B.2.1.3] [3.3.7.C]
48. C [S8.A.1.3.4] [3.1.7.E]
49. B [S8.A.3.1.3] [3.1.7.A]
50. A [S8.A.3.3.1] [3.1.7.C]
51. Open-ended [S8.D.1.2.1] [4.2.7.C]
    A. *Explanations may vary but should say something like the following:* Plastics are made from petroleum, a nonrenewable resource. Petroleum is also an important fuel resource. It is used to power manufacturing, as well as transportation of many goods. These are two important uses for a limited resource.
    B. *Explanations may vary but should say something like the following:* Recycling or reusing plastics helps conserve petroleum resources. Burning plastics as a fuel could also help conserve petroleum, but may pollute other resources, such as clean air and water. Disposing of plastics in a landfill wastes a resource and can pollute water and soil resources.
52. A [S8.A.1.2.2] [3.8.7.C]
53. D [S8.A.3.1.5] [3.1.7.A]
54. C [S8.C.3.1.2] [3.4.7.C]
55. D [S8.D.2.1.3] [3.5.7.C]
56. B [S8.A.2.2.2] [3.1.7.D]
57. C [S8.C.3.1.3] [3.4.7.C]
58. D [S8.B.3.3.4] [4.5.7.B]
59. C [S8.A.1.1.2] [3.2.7.C]
60. D [S8.A.3.2.3] [3.1.7.B]
61. Open-ended [S8.A.2.2.3] [3.7.7.A]
    A. *Answers may vary but should say something like the following:* A barometer measures air pressure. Certain kinds of weather are associated with high air pressure, low air pressure, or changes in air pressure. These observations can often be made before the weather they are associated with arrives in an area. This allows prediction of weather changes.
    B. *Answers may vary but should say something like the following:* Without this tool, it would be harder to predict the weather. Meteorologists would have to rely on other tools such as satellite images or weather reports from other areas.

Name _____

Session 1—Answer Sheet

1	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2	Ⓐ	Ⓑ	Ⓒ	Ⓓ
3	Ⓐ	Ⓑ	Ⓒ	Ⓓ
4	Ⓐ	Ⓑ	Ⓒ	Ⓓ
5	Ⓐ	Ⓑ	Ⓒ	Ⓓ
6	Ⓐ	Ⓑ	Ⓒ	Ⓓ
7	Ⓐ	Ⓑ	Ⓒ	Ⓓ
8	Ⓐ	Ⓑ	Ⓒ	Ⓓ
9	Ⓐ	Ⓑ	Ⓒ	Ⓓ
10	Ⓐ	Ⓑ	Ⓒ	Ⓓ
11	Ⓐ	Ⓑ	Ⓒ	Ⓓ
12	Ⓐ	Ⓑ	Ⓒ	Ⓓ
13	Ⓐ	Ⓑ	Ⓒ	Ⓓ
14	Ⓐ	Ⓑ	Ⓒ	Ⓓ
15	Ⓐ	Ⓑ	Ⓒ	Ⓓ
16	Ⓐ	Ⓑ	Ⓒ	Ⓓ
17	Ⓐ	Ⓑ	Ⓒ	Ⓓ
18	Ⓐ	Ⓑ	Ⓒ	Ⓓ
19	Ⓐ	Ⓑ	Ⓒ	Ⓓ
20	Ⓐ	Ⓑ	Ⓒ	Ⓓ
21	Ⓐ	Ⓑ	Ⓒ	Ⓓ
22	Ⓐ	Ⓑ	Ⓒ	Ⓓ
23	Ⓐ	Ⓑ	Ⓒ	Ⓓ
24	Ⓐ	Ⓑ	Ⓒ	Ⓓ
25	Ⓐ	Ⓑ	Ⓒ	Ⓓ
26	Ⓐ	Ⓑ	Ⓒ	Ⓓ
27	Ⓐ	Ⓑ	Ⓒ	Ⓓ
28	Ⓐ	Ⓑ	Ⓒ	Ⓓ
29	Ⓐ	Ⓑ	Ⓒ	Ⓓ
30	Ⓐ	Ⓑ	Ⓒ	Ⓓ
31	Ⓐ	Ⓑ	Ⓒ	Ⓓ

Session 2—Answer Sheet

32	Ⓐ	Ⓑ	Ⓒ	Ⓓ
33	Ⓐ	Ⓑ	Ⓒ	Ⓓ
34	Ⓐ	Ⓑ	Ⓒ	Ⓓ
35	Ⓐ	Ⓑ	Ⓒ	Ⓓ
36	Ⓐ	Ⓑ	Ⓒ	Ⓓ
37	Ⓐ	Ⓑ	Ⓒ	Ⓓ
38	Ⓐ	Ⓑ	Ⓒ	Ⓓ
39	Ⓐ	Ⓑ	Ⓒ	Ⓓ
40	Ⓐ	Ⓑ	Ⓒ	Ⓓ
41	Ⓐ	Ⓑ	Ⓒ	Ⓓ
42	Ⓐ	Ⓑ	Ⓒ	Ⓓ
43	Ⓐ	Ⓑ	Ⓒ	Ⓓ
44	Ⓐ	Ⓑ	Ⓒ	Ⓓ
45	Ⓐ	Ⓑ	Ⓒ	Ⓓ
46	Ⓐ	Ⓑ	Ⓒ	Ⓓ
47	Ⓐ	Ⓑ	Ⓒ	Ⓓ
48	Ⓐ	Ⓑ	Ⓒ	Ⓓ
49	Ⓐ	Ⓑ	Ⓒ	Ⓓ
50	Ⓐ	Ⓑ	Ⓒ	Ⓓ
51	Ⓐ	Ⓑ	Ⓒ	Ⓓ
52	Ⓐ	Ⓑ	Ⓒ	Ⓓ
53	Ⓐ	Ⓑ	Ⓒ	Ⓓ
54	Ⓐ	Ⓑ	Ⓒ	Ⓓ
55	Ⓐ	Ⓑ	Ⓒ	Ⓓ
56	Ⓐ	Ⓑ	Ⓒ	Ⓓ
57	Ⓐ	Ⓑ	Ⓒ	Ⓓ
58	Ⓐ	Ⓑ	Ⓒ	Ⓓ
59	Ⓐ	Ⓑ	Ⓒ	Ⓓ
60	Ⓐ	Ⓑ	Ⓒ	Ⓓ
61	Ⓐ	Ⓑ	Ⓒ	Ⓓ

Open-Ended Answer Sheet

Name _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Session 1—Answer Sheet, Answer Key

1	●	Ⓑ	Ⓒ	Ⓓ
2	Ⓐ	●	Ⓒ	Ⓓ
3	Ⓐ	Ⓑ	Ⓒ	●
4	Ⓐ	Ⓑ	Ⓒ	●
5	Ⓐ	●	Ⓒ	Ⓓ
6	Ⓐ	Ⓑ	●	Ⓓ
7	Ⓐ	Ⓑ	●	Ⓓ
8	Ⓐ	●	Ⓒ	Ⓓ
9	Ⓐ	●	Ⓒ	Ⓓ
10	Ⓐ	Ⓑ	Ⓒ	●
11	Ⓐ	Ⓑ	Ⓒ	●
12	●	Ⓑ	Ⓒ	Ⓓ
13	Ⓐ	Ⓑ	Ⓒ	●
14	Ⓐ	Ⓑ	Ⓒ	●
15	●	Ⓑ	Ⓒ	Ⓓ
16	Ⓐ	Ⓑ	●	Ⓓ
~~17~~	Ⓐ	Ⓑ	Ⓒ	Ⓓ
18	Ⓐ	Ⓑ	●	Ⓓ
19	●	Ⓑ	Ⓒ	Ⓓ
20	Ⓐ	Ⓑ	Ⓒ	●
21	Ⓐ	●	Ⓒ	Ⓓ
22	Ⓐ	Ⓑ	●	Ⓓ
23	Ⓐ	Ⓑ	Ⓒ	●
24	Ⓐ	Ⓑ	●	Ⓓ
25	Ⓐ	Ⓑ	●	Ⓓ
26	●	Ⓑ	Ⓒ	Ⓓ
27	●	Ⓑ	Ⓒ	Ⓓ
28	Ⓐ	Ⓑ	Ⓒ	●
29	Ⓐ	Ⓑ	Ⓒ	●
30	Ⓐ	Ⓑ	●	Ⓓ
~~31~~	Ⓐ	Ⓑ	Ⓒ	Ⓓ

Session 2—Answer Sheet, Answer Key

32	Ⓐ	Ⓑ	Ⓒ	●
33	Ⓐ	●	Ⓒ	Ⓓ
34	Ⓐ	Ⓑ	●	Ⓓ
35	Ⓐ	Ⓑ	●	Ⓓ
36	Ⓐ	Ⓑ	Ⓒ	●
37	●	Ⓑ	Ⓒ	Ⓓ
38	Ⓐ	Ⓑ	●	Ⓓ
39	Ⓐ	Ⓑ	●	Ⓓ
40	Ⓐ	Ⓑ	Ⓒ	●
~~41~~	Ⓐ	Ⓑ	Ⓒ	Ⓓ
42	Ⓐ	Ⓑ	Ⓒ	●
43	Ⓐ	●	Ⓒ	Ⓓ
44	Ⓐ	Ⓑ	●	Ⓓ
45	Ⓐ	Ⓑ	●	Ⓓ
46	Ⓐ	●	Ⓒ	Ⓓ
47	●	Ⓑ	Ⓒ	Ⓓ
48	Ⓐ	Ⓑ	●	Ⓓ
49	Ⓐ	●	Ⓒ	Ⓓ
50	●	Ⓑ	Ⓒ	Ⓓ
~~51~~	Ⓐ	Ⓑ	Ⓒ	Ⓓ
52	●	Ⓑ	Ⓒ	Ⓓ
53	Ⓐ	Ⓑ	Ⓒ	●
54	Ⓐ	Ⓑ	●	Ⓓ
55	Ⓐ	Ⓑ	Ⓒ	●
56	Ⓐ	●	Ⓒ	Ⓓ
57	Ⓐ	Ⓑ	●	Ⓓ
58	Ⓐ	Ⓑ	Ⓒ	●
59	Ⓐ	Ⓑ	●	Ⓓ
60	Ⓐ	Ⓑ	Ⓒ	●
~~61~~	Ⓐ	Ⓑ	Ⓒ	Ⓓ

PSSA Science Rubric for Open-Ended Items

Rubrics for the PSSA Science items are specific to the individual problems. The following rubric provides general guidelines for evaluating the open-ended items in the ***PSSA Performance Indicator Science*** practice tests. In reviewing student work, tailor the rubric to the assessment anchor and eligible content covered in the item.

Score	Description
2	The student response demonstrates a thorough understanding of the content, concepts, and procedures involved in the specific anchor. The response is clear, complete, and correct. The response may contain a minor error or omission that does not detract from the student's demonstration of a thorough understanding.
1	The student response demonstrates a partial understanding of the content, concepts, and procedures involved in the specific anchor. The response is somewhat correct and may contain some work that is incomplete or unclear.
0	The student response contains insufficient evidence to demonstrate any understanding of the content, concepts, and procedures involved in the specific anchor. The response may show only information copied or paraphrased from the problem.

Pennsylvania Assessment Anchors and Eligible Content

S8.A *The Nature of Science*

Assessment Anchor S8.A.1: Reasoning and Analysis

S8.A.1.1 Explain, interpret, and apply scientific, environmental, or technological knowledge presented in a variety of formats (e.g., visuals, scenarios, graphs).

- **S8.A.1.1.1** Distinguish between a scientific theory and an opinion, explaining how a theory is supported with evidence, or how new data/information may change existing theories and practices.
- **S8.A.1.1.2** Explain how certain questions can be answered through scientific inquiry and/or technological design.
- **S8.A.1.1.3** Use evidence, such as observations or experimental results, to support inferences about a relationship.
- **S8.A.1.1.4** Develop descriptions, explanations, predictions, and models using evidence.

S8.A.1.2 Identify and explain the impacts of applying scientific, environmental, or technological knowledge to address solutions to practical problems.

- **S8.A.1.2.1** Describe the positive and negative, intended and unintended, effects of specific results or technological developments (e.g., air/space travel, genetic engineering, nuclear fission/fusion, artificial intelligence, lasers, organ transplants).
- **S8.A.1.2.2** Identify environmental issues and explain their potential long-term health effects (e.g., pollution, pest control, vaccinations).
- **S8.A.1.2.3** Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).
- **S8.A.1.2.4** Explain society's standard of living in terms of technological advancements and how these advancements impact agriculture (e.g., transportation, processing, production, storage).

S8.A.1.3 Identify and analyze evidence that certain variables may have caused measurable changes in natural or human-made systems.

- **S8.A.1.3.1** Use ratio to describe change (e.g., percents, parts per million, grams per cubic centimeter, mechanical advantage).
- **S8.A.1.3.2** Use evidence, observations, or explanations to make inferences about change in systems over time (e.g., carrying capacity, succession, population dynamics, loss of mass in chemical reactions, indicator fossils in geologic time scale) and the variables affecting these changes.
- **S8.A.1.3.3** Examine systems changing over time, identifying the possible variables causing this change, and drawing inferences about how these variables affect this change.
- **S8.A.1.3.4** Given a scenario, explain how a dynamically changing environment provides for the sustainability of living systems.

Assessment Anchor S8.A.2: Processes, Procedures, and Tools of Scientific Investigations

S8.A.2.1 Apply knowledge of scientific investigation or technological design in different contexts to make inferences to solve problems.

- **S8.A.2.1.1** Use evidence, observations, or a variety of scales (e.g., mass, distance, volume, temperature) to describe relationships.
- **S8.A.2.1.2** Use space/time relationships, define concepts operationally, raise testable questions, or formulate hypotheses.
- **S8.A.2.1.3** Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.
- **S8.A.2.1.4** Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.

S8.A.2.1.5 Use evidence from investigations to clearly communicate and support conclusions.

S8.A.2.1.6 Identify a design flaw in a simple technological system and devise possible working solutions.

S8.A.2.2 Apply appropriate instruments for a specific purpose and describe the information the instrument can provide.

S8.A.2.2.1 Describe the appropriate use of instruments and scales to accurately and safely measure time, mass, distance, volume, or temperature under a variety of conditions.

S8.A.2.2.2 Apply appropriate measurement systems (e.g., time, mass, distance, volume, temperature) to record and interpret observations under varying conditions.

S8.A.2.2.3 Describe ways technology (e.g., microscope, telescope, micrometer, hydraulics, barometer) extends and enhances human abilities for specific purposes.

Assessment Anchor S8.A.3: Systems, Models, and Patterns

S8.A.3.1 Explain the parts of a simple system, their roles, and their relationships to the system as a whole.

S8.A.3.1.1 Describe a system (e.g., watershed, circulatory system, heating system, agricultural system) as a group of related parts with specific roles that work together to achieve an observed result.

S8.A.3.1.2 Explain the concept of order in a system [e.g., (first to last: manufacturing steps, trophic levels); (simple to complex: cell, tissue, organ, organs system)].

S8.A.3.1.3 Distinguish between system inputs, system processes, system outputs, and feedback (e.g., physical, ecological, biological, informational).

S8.A.3.1.4 Distinguish between open loop (e.g., energy flow, food web) and closed loop (e.g., materials in the nitrogen and carbon cycles, closed-switch) systems.

S8.A.3.1.5 Explain how components of natural and human-made systems play different roles in a working system.

S8.A.3.2 Apply knowledge of models to make predictions, draw inferences, or explain technological concepts.

S8.A.3.2.1 Describe how scientists use models to explore relationships in natural systems (e.g., an ecosystem, river system, the solar system).

S8.A.3.2.2 Describe how engineers use models to develop new and improved technologies to solve problems.

S8.A.3.2.3 Given a model showing simple cause-and-effect relationships in a natural system, predict results that can be used to test the assumptions in the model (e.g., photosynthesis, water cycle, diffusion, infiltration).

S8.A.3.3 Describe repeated processes or recurring elements in natural, scientific, and technological patterns.

S8.A.3.3.1 Identify and describe patterns as repeated processes or recurring elements in human-made systems (e.g., trusses, hub-and-spoke system in communications and transportation systems, feedback controls in regulated systems).

S8.A.3.3.2 Describe repeating structure patterns in nature (e.g., veins in a leaf, tree rings, crystals, water waves) or periodic patterns (e.g., daily, monthly, annually).

S8.B *Biological Sciences*

Assessment Anchor S8.B.1: Structure and Function of Organisms

S8.B.1.1 Describe and compare structural and functional similarities and differences that characterize diverse living things.

S8.B.1.1.1 Describe the structures of living things that help them function effectively in specific ways (e.g., adaptations, characteristics).

S8.B.1.1.2 Compare similarities and differences in internal structures of organisms (e.g., invertebrate/vertebrate, vascular/nonvascular, single-celled/multi-celled) and external structures (e.g., appendages, body segments, type of covering, size, shape).

S8.B.1.1.3 Apply knowledge of characteristic structures to identify or categorize organisms (i.e., plants, animals, fungi, bacteria, and protista).

S8.B.1.1.4 Identify the levels of organization from cell to organism and describe how specific structures (parts), which underlie larger systems, enable the system to function as a whole.

Assessment Anchor S8.B.2: Continuity of Life

S8.B.2.1 Explain the basic concepts of natural selection.

S8.B.2.1.1 Explain how inherited structures or behaviors help organisms survive and reproduce in different environments.

S8.B.2.1.2 Explain how different adaptations in individuals of the same species may affect survivability or reproduction success.

S8.B.2.1.3 Explain that mutations can alter a gene and are the original source of new variations.

S8.B.2.1.4 Describe how selective breeding or biotechnology can change the genetic makeup of organisms.

S8.B.2.1.5 Explain that adaptations are developed over long periods of time and are passed from one generation to another.

S8.B.2.2 Explain how a set of genetic instructions determines inherited traits of organisms.

S8.B.2.2.1 Identify and explain differences between inherited and acquired traits.

S8.B.2.2.2 Recognize that the gene is the basic unit of inheritance, that there are dominant and recessive genes, and that traits are inherited.

Assessment Anchor S8.B.3: Ecological Behavior and Systems

S8.B.3.1 Explain the relationships among and between organisms in different ecosystems and the abiotic and biotic components.

S8.B.3.1.1 Explain the flow of energy through an ecosystem (e.g., food chains, food webs).

S8.B.3.1.2 Identify major biomes and describe abiotic and biotic components (e.g., abiotic: different soil types, air, water, sunlight; biotic: soil microbes, decomposers).

S8.B.3.1.3 Explain relationships among organisms (e.g., producers/consumers, predator/prey) in an ecosystem.

S8.B.3.2 Identify evidence of change to infer and explain the ways different variables may affect change in natural or human-made systems.

S8.B.3.2.1 Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).

S8.B.3.2.2 Use evidence to explain how diversity affects the ecological integrity of natural systems.

S8.B.3.2.3 Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.

S8.B.3.3 Explain how renewable and nonrenewable resources provide for human needs or how these needs impact the environment.

S8.B.3.3.1 Explain how human activities may affect local, regional, and global environments.

S8.B.3.3.2 Explain how renewable and nonrenewable resources provide for human needs (i.e., energy, food, water, clothing, and shelter).

S8.B.3.3.3 Describe how waste management affects the environment (e.g., recycling, composting, landfills, incineration, sewage treatment).

S8.B.3.3.4 Explain the long-term effects of using integrated pest management (e.g., herbicides, natural predators, biogenetics) on the environment.

S8.C *Physical Sciences*

Assessment Anchor S8.C.1: Structure, Properties, and Interaction of Matter and Energy

S8.C.1.1 Explain concepts about the structure and properties (physical and chemical) of matter.

- **S8.C.1.1.1** Explain the differences among elements, compounds, and mixtures.
- **S8.C.1.1.2** Use characteristic physical or chemical properties to distinguish one substance from another (e.g., density, thermal expansion/contraction, freezing/melting points, streak test).
- **S8.C.1.1.3** Identify and describe reactants and products of simple chemical reactions.

Assessment Anchor S8.C.2: Forms, Sources, Conversion, and Transfer of Energy

S8.C.2.1 Describe energy sources, transfer of energy, or conversion of energy.

- **S8.C.2.1.1** Distinguish among forms of energy (e.g., electrical, mechanical, chemical, light, sound, nuclear) and sources of energy (i.e., renewable and nonrenewable energy).
- **S8.C.2.1.2** Explain how energy is transferred from one place to another through convection, conduction, or radiation.
- **S8.C.2.1.3** Describe how one form of energy (e.g., electrical, mechanical, chemical, light, sound, nuclear) can be converted into a different form of energy.

S8.C.2.2 Compare the environmental impact of different energy sources chosen to support human endeavors.

- **S8.C.2.2.1** Describe the sun as the major source of energy that impacts the environment.
- **S8.C.2.2.2** Compare the time span of renewability for fossil fuels and the time span of renewability for alternative fuels.
- **S8.C.2.2.3** Describe the waste (i.e., kind and quantity) derived from the use of renewable and nonrenewable resources and their potential impact on the environment.

Assessment Anchor S8.C.3: Principles of Motion and Force

S8.C.3.1 Describe the effect of multiple forces on the movement, speed, or direction of an object.

- **S8.C.3.1.1** Describe forces acting on objects (e.g., friction, gravity, balanced versus unbalanced).
- **S8.C.3.1.2** Distinguish between kinetic and potential energy.
- **S8.C.3.1.3** Explain that mechanical advantage helps to do work (physics) by either changing a force or changing the direction of the applied force (e.g., simple machines, hydraulic systems).

S8.D *Earth and Space Sciences*

Assessment Anchor S8.D.1: Earth Features and Processes that Change Earth and Its Resources

S8.D.1.1 Describe constructive and destructive natural processes that form different geological structures and resources.

- **S8.D.1.1.1** Explain the rock cycle as changes in the solid earth and rock types found in Pennsylvania (igneous—granite, basalt, pumice; sedimentary—limestone, sandstone, shale, coal; and metamorphic—slate, quartzite, marble, gneiss).
- **S8.D.1.1.2** Describe natural processes that change Earth's surface (e.g., landslides, volcanic eruptions, earthquakes, mountain building, new land being formed, weathering, erosion, sedimentation, soil formation).
- **S8.D.1.1.3** Identify soil types (i.e., humus, topsoil, subsoil, loam, loess, and parent material) and their characteristics (i.e., particle size, porosity, and permeability) found in different biomes and in Pennsylvania, and explain how they formed.
- **S8.D.1.1.4** Explain how fossils provide evidence about plants and animals that once lived throughout Pennsylvania's history (e.g., fossils provide evidence of different environments).

S8.D.1.2 Describe the potential impact of human-made processes on changes to Earth's resources and how they affect everyday life.

- **S8.D.1.2.1** Describe a product's transformation process from production to consumption (e.g., prospecting, propagating, growing, maintaining, adapting, treating, converting, distributing, disposing) and explain the process's potential impact on Earth's resources.
- **S8.D.1.2.2** Describe potential impacts of human-made processes (e.g., manufacturing, agriculture, transportation, mining) on Earth's resources, both nonliving (i.e., air, water, or earth materials) and living (i.e., plants and animals).

S8.D.1.3 Describe characteristic features of Earth's water systems or their impact on resources.

- **S8.D.1.3.1** Describe the water cycle and the physical processes on which it depends (i.e., evaporation, condensation, precipitation, transpiration, runoff, infiltration, energy inputs, and phase changes).
- **S8.D.1.3.2** Compare and contrast characteristics of freshwater and saltwater systems on the basis of their physical characteristics (i.e., composition, density, and electrical conductivity) and their use as natural resources.
- **S8.D.1.3.3** Distinguish among different water systems (e.g., wetland systems, ocean systems, river systems, watersheds) and describe their relationships to each other as well as to landforms.
- **S8.D.1.3.4** Identify the physical characteristics of a stream and how these characteristics determine the types of organisms found within the stream environment (e.g., biological diversity, water quality, flow rate, tributaries, surrounding watershed).

Assessment Anchor S8.D.2: Weather, Climate, and Atmospheric Processes

S8.D.2.1 Explain how pressure, temperature, moisture, and wind are used to describe atmospheric conditions that affect regional weather or climate.

- **S8.D.2.1.1** Explain the impact of water systems on the local weather or the climate of a region (e.g., lake effect snow, land/ocean breezes).
- **S8.D.2.1.2** Identify how global patterns of atmospheric movement influence regional weather and climate.
- **S8.D.2.1.3** Identify how cloud types, wind directions, and barometric pressure changes are associated with weather patterns in different regions of the country.

Assessment Anchor S8.D.3: Composition and Structure of the Universe

S8.D.3.1 Explain the relationships between and among the objects of our solar system.

- **S8.D.3.1.1** Describe patterns of Earth's movements (i.e., rotation and revolution) and the moon's movements (i.e., phases, eclipses, and tides) in relation to the sun.
- **S8.D.3.1.2** Describe the role of gravity as the force that governs the movement of the solar system and universe.
- **S8.D.3.1.3** Compare and contrast characteristics of celestial bodies found in the solar system (e.g., moons, asteroids, comets, meteors, inner and outer planets).

Academic Standards for Science and Technology

3.1 *Unifying Themes*

7.A Explain the parts of a simple system and their relationship to each other.
- Describe a system as a group of related parts that work together to achieve a desired result (e.g., digestive system).
- Explain the importance of order in a system.
- Distinguish between system inputs, system processes, and system outputs.
- Distinguish between open loop and closed loop systems.
- Apply systems analysis to solve problems.

7.B Describe the use of models as an application of scientific or technological concepts.
- Identify and describe different types of models and their functions.
- Apply models to predict specific results and observations (e.g., population growth, effects of infectious organisms).
- Explain systems by outlining a system's relevant parts and its purpose and/or designing a model that illustrates its function.

7.C Identify patterns as repeated processes or recurring elements in science and technology.
- Identify different forms of patterns and use them to group and classify specific objects.
- Identify repeating structure patterns.
- Identify and describe patterns that occur in physical systems (e.g., construction, manufacturing, transportation), informational systems, and biochemical-related systems.

7.D Explain scale as a way of relating concepts and ideas to one another by some measure.
- Apply various applications of size and dimensions of scale to scientific, mathematical, and technological applications.
- Describe scale as a form of ratio and apply to a life situation.

7.E Identify change as a variable in describing natural and physical systems.
- Describe fundamental science and technology concepts that could solve practical problems.
- Explain how ratio is used to describe change.
- Describe the effect of making a change in one part of a system on the system as a whole.

3.2 *Inquiry and Design*

7.A Explain and apply scientific and technological knowledge.
- Distinguish between a scientific theory and a belief.
- Answer "What if" questions based on observation, inference, or prior knowledge or experience.
- Explain how skepticism about an accepted scientific explanation led to a new understanding.
- Explain how new information may change existing theories and practice.

7.B Apply process knowledge to make and interpret observations.
- Measure materials using a variety of scales.
- Describe relationships by making inferences and predictions.
- Communicate, use space/time relationships, formulate hypotheses, test, and experiment.
- Design controlled experiments, recognize variables, and manipulate variables.
- Interpret data, formulate models, design models, and produce solutions.

7.C Identify and use the elements of scientific inquiry to solve problems.
- Generate questions about objects, organisms, and/or events that can be answered through scientific investigations.
- Evaluate the appropriateness of questions.
- Design an investigation with limited variables to investigate a question.
- Conduct a two-part experiment.
- Judge the significance of experimental information in answering the question.
- Communicate appropriate conclusions from the experiment.

7.D Know and use the technological design process to solve problems.
- Define different types of problems.
- Define all aspects of the problems, necessary information, and questions that must be answered.
- Propose the best solution.
- Design and propose alternative methods to achieve solutions.
- Apply a solution.
- Explain the results, present improvements, identify and infer the impacts of the solution.

3.3 *Biological Sciences*

7.A Describe the similarities and differences that characterize diverse living things.
- Describe how the structures of living things help them function in unique ways.
- Explain how to use a dichotomous key to identify plants and animals.
- Account for adaptations among organisms that live in a particular environment.

7.B Describe the cell as the basic structural and functional unit of living things.
- Identify the levels of organization from cell to organism.
- Compare life processes at the organism level with life processes at the cell level.
- Explain that cells and organisms have particular structures that underlie their functions.
- Describe and distinguish among cell cycles, reproductive cycles, and life cycles.
- Explain disease effects on structures or functions of an organism.

7.C Know that every organism has a set of genetic instructions that determines its inherited traits.
- Identify and explain inheritable characteristics.
- Identify that the gene is the basic unit of inheritance.
- Identify basic patterns of inheritance (e.g., dominance, recessive, co-dominance).
- Describe how traits are inherited.
- Distinguish how different living things reproduce (e.g., vegetative budding, sexual).
- Recognize that mutations can alter a gene.
- Describe how selective breeding, natural selection, and genetic technologies can change genetic makeup of organisms.

7.D Explain basic concepts of natural selection.
- Identify adaptations that allow organisms to survive in their environment.
- Describe how an environmental change can affect the survival of organisms and entire species.
- Know that difference in individuals of the same species may give some advantage in surviving and reproducing.
- Recognize that populations of organisms can increase rapidly.
- Describe the role that fossils play in studying the past.
- Explain how biological extinction is a natural process.

3.4 *Physical Science, Chemistry, and Physics*

7.A Describe concepts about the structure and properties of matter.
- Identify elements as basic building blocks of matter that cannot be broken down chemically.
- Distinguish compounds from mixtures.
- Describe and conduct experiments that identify chemical and physical properties.
- Describe reactants and products of simple chemical reactions.

7.B Relate energy sources and transfers to heat and temperature.
- Identify and describe sound changes in moving objects.
- Know that the sun is a major source of energy that emits wavelengths of visible light, infrared and ultraviolet radiation.
- Explain the conversion of one form of energy to another by applying knowledge of each form of energy.
- Explain the parts and functions in an electrical circuit.

7.C Identify and explain the principles of force and motion.
- Describe the motion of an object based on its position, direction, and speed.
- Classify fluid power systems according to fluid used or mode of power transmission (e.g., air, oil).

- Explain various motions using models.
- Explain how sound and light travel in waves of differing speeds, sizes, and frequencies.

7.D Describe essential ideas about the composition and structure of the universe and Earth's place in it.
- Compare various planets' characteristics.
- Describe basic star types and identify the sun as a star type.
- Describe and differentiate comets, asteroids, and meteors.
- Identify gravity as the force that keeps planets in orbit around the sun and governs the rest of the movement of the solar system and the universe.
- Illustrate how the positions of stars and constellations change in relation to Earth during an evening and from month to month.
- Identify equipment and instruments that explore the universe.
- Identify the accomplishments and contributions provided by selected past and present scientists in the field of astronomy.
- Identify and articulate space program efforts to investigate possibilities of living in space and on other planets.

3.5 *Earth Sciences*

7.A Describe earth features and processes.
- Describe major layers of the earth.
- Describe the processes involved in the creation of geologic features (e.g., folding, faulting, volcanism, sedimentation) and that these processes seen today (e.g., erosion, weathering, crustal plate movement) are similar to those in the past.
- Describe the processes that formed Pennsylvania geologic structures and resources including mountains, glacial formations, water gaps, and ridges.
- Explain how the rock cycle affected rock formations in the state of Pennsylvania.
- Distinguish between examples of rapid surface changes (e.g., landslides, earthquakes) and slow surface changes (e.g., weathering).
- Identify living plants and animals that are similar to fossil forms.

7.B Recognize earth resources and how they affect everyday life.
- Identify and locate significant earth resources (e.g., rock types, oil, gas, coal deposits) in Pennsylvania.
- Explain the processes involved in the formation of oil and coal in Pennsylvania.
- Explain the value and uses of different earth resources (e.g., selected minerals, ores, fuel sources, agricultural uses).
- Compare the locations of human settlements as related to available resources.

7.C Describe basic elements of meteorology.
- Explain weather forecasts by interpreting weather data and symbols.
- Explain the oceans' impact on local weather and the climate of a region.
- Identify how cloud types, wind directions, and barometric pressure changes are associated with weather patterns in different regions of the country.
- Explain and illustrate the processes of cloud formation and precipitation.
- Describe and illustrate the major layers of the earth's atmosphere.
- Identify different air masses and global wind patterns and how they relate to the weather patterns in different regions of the U.S.

7.D Explain the behavior and impact of the earth's water systems.
- Explain the water cycle using the processes of evaporation and condensation.
- Describe factors that affect evaporation and condensation.
- Distinguish salt from fresh water (e.g., density, electrical conduction).
- Compare the effect of water type (e.g., polluted, fresh, salt water) and the life contained in them.
- Identify ocean and shoreline features (e.g., bays, inlets, spit, tidal marshes).

3.6 *Technology Education*

7.A Explain biotechnologies that relate to related technologies of propagating, growing, maintaining, adapting, treating, and converting.

- Identify the environmental, societal, and economic impacts that waste has in the environment.
- Identify and explain the impact that a specific medical advancement has had on society.
- Explain the factors that were taken into consideration when a specific object was designed.
- Define and describe how fuels and energy can be generated through the process of biomass conversion.
- Identify and group basic plant and animal production processes.
- Explain the impact that agricultural science has had on biotechnology.

7.B Explain information technologies of encoding, transmitting, receiving, storing, retrieving, and decoding.

- Demonstrate the effectiveness of image generating technique to communicate a story (e.g., photography, video).
- Analyze and evaluate the effectiveness of a graphic object designed and produced to communicate a thought or concept.
- Apply basic technical drawing techniques to communicate an idea or solution to a problem.
- Apply the appropriate method of communications technology to communicate a thought.

7.C Explain physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research, and design.

- Use knowledge of material effectiveness to solve specific construction problems (e.g., steel vs. wood bridges).
- Differentiate among the different types of construction applications (e.g., microwave tower, power plants, aircrafts).
- Explain basic material processes that manufactured objects undergo during production (e.g., separating, forming, combining).
- Evaluate a construction activity by specifying task analyses and necessary resources.
- Explain the relationships among the basic resources needed in the production process for a specific manufactured object.
- Explain the difference between design engineering and production engineering processes.
- Analyze manufacturing steps that affect waste and pollutants.
- Explain transportation technologies of propelling, structuring, suspending, guiding, controlling, and supporting.
- Identify and explain the workings of several mechanical power systems.
- Model and explain examples of vehicular propulsion, control, guidance, structure and suspension systems.
- Explain the limitations of land, marine, air, and space transportation systems.

3.7 *Technological Devices*

7.A Describe the safe and appropriate use of tools, materials, and techniques to answer questions and solve problems.

- Identify uses of tools, machines, materials, information, people, money, energy, and time that meet specific design criteria.
- Describe safe procedures for using tools and materials.
- Assess materials for appropriateness of use.

7.B Use appropriate instruments and apparatus to study materials.

- Select appropriate instruments to measure the size, weight, shape, and temperature of living and non-living objects.
- Apply knowledge of different measurement systems to measure and record objects' properties.

7.C Explain and demonstrate basic computer operations and concepts.

- Know specialized computer applications used in the community.
- Describe the function of advanced input and output devices (e.g., scanners, video images, plotters, projectors) and demonstrate their use.

- Demonstrate age appropriate keyboarding skills and techniques.

7.D Apply computer software to solve specific problems.
- Identify software designed to meet specific needs (e.g., Computer Aided Drafting, design software, tutorial, financial, presentation software).
- Identify and solve basic software problems relevant to specific software application.
- Identify basic multimedia applications.
- Demonstrate a basic knowledge of desktop publishing applications.
- Apply intermediate skills in utilizing word processing, database, and spreadsheet software.
- Apply basic graphic manipulation techniques.

7.E Explain basic computer communications systems.
- Describe the organization and functions of the basic parts that make up the World Wide Web.
- Apply advanced electronic mail functions.
- Apply basic on-line research techniques to solve a specific problem.

3.8 *Science, Technology, and Human Endeavors*

7.A Explain how sciences and technologies are limited in their effects and influences in society.
- Identify and describe the unavoidable constraints of technological design.
- Identify changes in society as a result of a technological development.
- Identify and explain improvements in transportation, health, sanitation, and communications as a result of advancements in science and technology and how they affect our lives.

7.B Explain how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.
- Identify interrelationships between systems and resources.
- Identify and describe the resources necessary to solve a selected problem in a community and improve the quality of life.
- Identify and explain specific examples of how agricultural science has met human needs and has improved the quality of life.

7.C Identify the pros and cons of applying technological and scientific solutions to address problems and the effect upon society.
- Describe the positive and negative expected and unexpected effects of specific technological developments.
- Describe ways technology extends and enhances human abilities.

Academic Standards for Environment and Ecology

4.1 *Watersheds and Wetlands*

7.A Explain the role of the water cycle within a watershed.
- Explain the water cycle.
- Explain the water cycle as it relates to a watershed.

7.B Understand the role of the watershed.
- Identify and explain what determines the boundaries of a watershed.
- Explain how water enters a watershed.
- Explain factors that affect water quality and flow through a watershed.

7.C Explain the effects of water on the life of organisms in a watershed.
- Explain how water is necessary for all life.
- Explain how the physical components of aquatic systems influence the organisms that live there in terms of size, shape, and physical adaptations.
- Describe the life cycle of organisms that depend on water.
- Identify organisms that have aquatic stages of life and describe those stages.

7.D Explain and describe characteristics of a wetland.
- Identify specific characteristics of wetland plants and soils.
- Recognize the common types of plants and animals.
- Describe different types of wetlands.
- Describe the different functions of a wetland.

7.E Describe the impact of watersheds and wetlands on people.
- Explain the impact of watersheds and wetlands in flood control, wildlife habitats, and pollution abatement.
- Explain the influence of flooding on wetlands.

4.2 *Renewable and Nonrenewable Resources*

7.A Know that raw materials come from natural resources.
- Identify resources used to provide humans with energy, food, housing, and water.
- Explain how plants and animals may be classified as natural resources.
- Compare means of growing or acquiring food.
- Identify fiber and other raw materials used in clothing and shelter production.
- Identify types of minerals and fossil fuels used by humans.

7.B Examine the renewability of resources.
- Identify renewable resources and describe their uses.
- Identify nonrenewable resources and describe their uses.
- Compare finished products to their original raw material.
- Identify the waste derived from the use of renewable and nonrenewable resources.
- Determine how consumption may impact the availability of resources.
- Compare the time spans of renewability for fossil fuels and alternative fuels.

7.C Explain natural resource distribution.
- Distinguish between readily available and less accessible resources.
- Identify the locations of different concentrations of fossil fuels and mineral resources.
- Analyze the effects of management practices on air, land, and water in forestry, agriculture, fisheries, wildlife, mining, and food and fiber production that is unique to different climates.

7.D Describe the role of recycling and waste management.
- Identify materials that can be recycled in the community.
- Explain the process of closing the loop in recycling.
- Compare the decomposition rates of different organic materials.
- Describe methods that could be used to reuse materials for new products.

- Evaluate the costs and benefits of disposable products.

4.3 *Environmental Health*

7.A Identify environmental health issues.
- Identify various examples of long-term pollution and explain their effects on environmental health.
- Identify diseases that have been associated with poor environmental quality.
- Describe different types of pest controls and their effects on the environment.
- Identify alternative products that can be used in life to reduce pollution.

7.B Describe how human actions affect the health of the environment.
- Identify land use practices and their relation to environmental health.
- Explain how natural disasters affect environmental health.
- Identify residential and industrial sources of pollution and their effects on environmental health.
- Explain the difference between point and nonpoint source pollution.
- Explain how nonpoint source pollution can affect the water supply and air quality.
- Explain how acid deposition can affect water, soil, and air quality.
- Explain the relationship between resource use, reuse, recycling, and environmental health.

7.C Explain biological diversity.
- Explain the complex, interactive relationships among members of an ecosystem.
- Explain how diversity affects ecological integrity of the natural resources.

4.4 *Agriculture and Society*

7.A Explain society's standard of living in relation to agriculture.
- Compare and contrast agricultural changes that have been made to meet society's needs.
- Compare and contrast how animals and plants affect agricultural systems.
- Compare several technological advancements and their effect(s) on the historical growth of agriculture.
- Compare different environmental conditions related to agricultural production, cost, and quality of the product.

7.B Investigate how agricultural science has recognized the various soil types found in Pennsylvania.
- Explain the importance of particle sizes in different soil types.
- Determine how water has influenced the development of Pennsylvania soil types.
- Investigate how soil types have influenced the plant types used on Pennsylvania farms.
- Analyze how soil types and geographic regions have impacted the profitability of Pennsylvania farms.

7.C Explain agricultural systems' use of natural and human resources.
- Analyze the needs of plants and animals as they relate to climate and soil conditions.
- Identify the plants and animals that can be raised in the area and explain why.
- Identify natural resources necessary for agricultural systems.
- Compare the need for crop production to the need for animal production.
- Define issues associated with food and fiber production.

7.D Explain the improvement of agricultural production through technology.
- Compare the technologies that have advanced agricultural production.
- Explain how energy sources have changed to meet agricultural technology.

4.5 *Integrated Pest Management*

7.A Explain benefits and harmful effects of pests.
- Identify different examples of pests and explain the beneficial or harmful effects of each.
- Identify several locations where pests can be found and compare the effects the pests have on each location.

7.B Explain how pest management affects the environment.
- Explain issues related to integrated pest management including biological technology, resistant varieties, chemical practices, medical technology, and monitoring techniques.
- Describe how integrated pest management and related technology impact human activities.
- Identify issues related to integrated pest management that affect the environment.

7.C Explain various integrated pest management practices used in society.
- Compare and contrast integrated pest management monitoring methods utilized in different community settings.
- Compare integrated pest management to past practices.
- Compare and analyze the long-term effects of using integrated pest management products.

4.6 *Ecosystems and Their Interactions*

7.A Explain the flows of energy and matter from organism to organism within an ecosystem.
- Identify and explain the characteristics of biotic and abiotic.
- Describe and explain the adaptations of plants and animals to their environment.
- Demonstrate the dependency of living components in the ecosystem on the nonliving components.
- Explain energy flow through a food web.
- Explain the importance of the predator/prey relationship and how it maintains the balances within ecosystems.
- Understand limiting factors and predict their effects on an organism.
- Identify niches for producers, consumers, and decomposers within an ecosystem.
- Compare and contrast the major ecosystems of Pennsylvania.
- Identify the major characteristics of a biome.
- Compare and contrast different biomes and their characteristics.
- Identify the relationship of abiotic and biotic components and explain their interaction in an ecosystem.
- Explain how different soil types determine the characteristics of ecosystems.

7.B Explain the concepts of cycles.
- Identify and explain cycles within an ecosystem.
- Analyze the role of different cycles within an ecosystem.

7.C Explain how ecosystems change over time.
- Explain how ecosystems change.
- Identify the succession stages of a given ecosystem.
- Explain how specific organisms may change an ecosystem.
- Explain a change in an ecosystem that relates to humans.

4.7 *Threatened, Endangered, and Extinct Species*

7.A Describe diversity of plants and animals in ecosystems.
- Select an ecosystem and describe different plants and animals that live there.
- Identify adaptations in plants and animals.
- Recognize that adaptations are developed over long periods of time and are passed on from one generation to the next.
- Understand levels of ecosystem organization (e.g., individuals, populations, species).

7.B Explain how species of living organisms adapt to their environment.
- Explain the role of individual variations in natural selection.
- Explain how an adaptation is an inherited structure or behavior that helps an organism survive and reproduce.
- Describe how a particular trait may be selected over time and account for a species' adaptation.
- Compare and contrast animals and plants that have very specific survival requirements with those that have more general requirements for survival.
- Explain how living things respond to changes in their environment.
- Explain how one species may survive an environmental change while another might not.

7.C Explain natural or human actions in relation to the loss of species.
- Identify natural or human impacts that cause habitat loss.
- Explain how habitat loss can affect the interaction among species and the population of a species.
- Analyze and explain the changes in an animal population over time.
- Explain how a habitat management practice affects a population.
- Explain the differences among threatened, endangered, and extinct species.
- Identify Pennsylvania plants and animals that are on the threatened or endangered list.
- Describe state laws passed regarding threatened or endangered species in Pennsylvania.
- Explain why one species may be more susceptible to becoming endangered than another species.

4.8 *Humans and the Environment*

7.A Describe how the development of civilization relates to the environment.
- Explain how people use natural resources in their environment.
- Locate and identify natural resources in different parts of the world.
- Compare and contrast how people use natural resources throughout the world.

7.B Explain how people use natural resources.
- Describe how natural resources are used for survival.
- Explain how natural resources and technological changes have affected the development of civilizations.
- Explain how climate and extreme weather events (e.g., drought, flood) influence people's lives.

7.C Explain how human activities may affect local, regional, and national environments.
- Describe what effect consumption and related generation of wastes have on the environment.
- Explain how a particular human activity has changed the local area over the years.

7.D Explain the importance of maintaining the natural resources at the local, state, and national levels.
- Explain how human activities and natural events have affected ecosystems.
- Explain how conservation practices have influenced ecosystems.
- Define the roles of Pennsylvania agencies that deal with natural resources.

4.9 *Environmental Laws and Regulations*

7.A Explain the role of environmental laws and regulations.
- Identify and explain environmental laws and regulations (e.g., Clean Air Act, Clean Water Act, Recycling and Waste Reduction Act, Act 26 on Agricultural Education).
- Explain the role of local and state agencies in enforcing environmental laws and regulations (e.g., Department of Environmental Protection, Department of Agriculture, Game Commission).

Connecting Assessment to Instruction, Answer Guide

PSSA Science Performance Indicator Grade 8, Form A

This answer guide will help you connect each ***PSSA Science Performance Indicator*** test question directly to the appropriate assessment anchor and eligible content lesson in the ***PSSA Finish Line Science, Grade 8*** workbook. The correlation to the anchor and eligible content will assist you in providing more focused instruction in the areas in which students may require additional support.

Question	Answer	Standard	Assessment Anchor and Eligible Content	*PSSA Finish Line Science, Grade 8*
1	A	3.7.7.A	S8.A.2.2.1	Unit 1, Lesson 6
2	B	3.3.7.D	S8.B.2.1.1	Unit 2, Lesson 4
3	D	3.4.7.A	S8.C.1.1.2	Unit 3, Lesson 1
4	D	3.5.7.A	S8.D.1.1.1	Unit 4, Lesson 1
5	B	3.3.7.C	S8.B.2.2.1	Unit 2, Lesson 3
6	C	3.3.7.C	S8.B.2.2.2	Unit 2, Lesson 3
7	C	3.1.7.E	S8.A.1.3.2	Unit 1, Lesson 3
8	B	3.5.7.A	S8.A.3.1.4	Unit 1, Lesson 2
9	B	3.4.7.B	S8.C.2.1.1	Unit 3, Lesson 4
10	D	3.1.7.A	S8.A.3.1.2	Unit 1, Lesson 2
11	D	4.3.7.B	S8.C.2.2.3	Unit 3, Lesson 6
12	A	3.2.7.B	S8.A.2.1.2	Unit 1, Lesson 7
13	D	3.1.7.C	S8.A.3.3.2	Unit 1, Lesson 4
14	D	3.4.7.B	S8.C.2.1.2	Unit 3, Lesson 5
15	A	3.4.7.D	S8.D.3.1.1	Unit 4, Lesson 6
16	C	3.2.7.A	S8.A.1.1.3	Unit 1, Lesson 1
17	Open-ended	3.2.7.D	S8.A.2.1.5	Unit 1, Lesson 8
18	C	3.5.7.A	S8.D.1.1.4	Unit 4, Lesson 1
19	A	3.3.7.D	S8.B.2.1.2	Unit 2, Lesson 4
20	D	3.3.7.D	S8.C.3.1.1	Unit 3, Lesson 7
21	B	3.2.7.A	S8.A.1.1.4	Unit 1, Lesson 1
22	C	3.2.7.D	S8.A.2.1.3	Unit 1, Lesson 7
23	D	3.2.7.A	S8.A.1.1.1	Unit 1, Lesson 1
24	C	3.2.7.C	S8.A.1.2.4	Unit 1, Lesson 9
25	C	4.4.7.B	S8.D.1.1.3	Unit 4, Lesson 2
26	A	3.5.7.D	S8.D.1.3.1	Unit 4, Lesson 3
27	A	4.8.7.C	S8.A.1.3.3	Unit 1, Lesson 3
28	D	4.7.7.B	S8.B.2.1.4	Unit 2, Lesson 4
29	D	3.1.7.A	S8.A.3.1.1	Unit 1, Lesson 2
30	C	3.2.7.B	S8.A.3.2.2	Unit 1, Lesson 5
31	Open-ended	4.3.7.B	S8.B.3.2.3	Unit 2, Lesson 8
32	D	3.4.7.A	S8.C.1.1.3	Unit 3, Lesson 3
33	B	3.3.7.C	S8.B.2.1.5	Unit 2, Lesson 4

34	C	3.1.7.B	S8.A.3.2.1	Unit 1, Lesson 5
35	C	3.5.7.D	S8.D.1.3.2	Unit 4, Lesson 3
36	D	3.2.7.B	S8.A.2.1.4	Unit 1, Lesson 8
37	A	3.6.7.C	S8.A.1.2.3	Unit 1, Lesson 9
38	C	4.6.7.A	S8.B.3.1.3	Unit 2, Lesson 6
39	C	3.2.7.D	S8.A.2.1.6	Unit 1, Lesson 9
40	D	3.1.7.D	S8.A.1.3.1	Unit 1, Lesson 3
41	Open-ended	3.4.7.B	S8.C.2.1.3	Unit 3, Lesson 5
42	D	3.2.7.B	S8.A.2.1.1	Unit 1, Lesson 8
43	B	3.4.7.D	S8.D.3.1.2	Unit 4, Lesson 6
44	C	4.2.7.B	S8.C.2.2.2	Unit 3, Lesson 6
45	C	3.8.7.B	S8.A.1.2.1	Unit 1, Lesson 9
46	B	3.5.7.D	S8.D.1.3.3	Unit 4, Lesson 3
47	A	3.3.7.C	S8.B.2.1.3	Unit 2, Lesson 4
48	C	3.1.7.E	S8.A.1.3.4	Unit 1, Lesson 3
49	B	3.1.7.A	S8.A.3.1.3	Unit 1, Lesson 2
50	A	3.1.7.C	S8.A.3.3.1	Unit 1, Lesson 4
51	Open-ended	4.2.7.C	S8.D.1.2.1	Unit 4, Lesson 4
52	A	3.8.7.C	S8.A.1.2.2	Unit 1, Lesson 9
53	D	3.1.7.A	S8.A.3.1.5	Unit 1, Lesson 2
54	C	3.4.7.C	S8.C.3.1.2	Unit 3, Lesson 7
55	D	3.5.7.C	S8.D.2.1.3	Unit 4, Lesson 5
56	B	3.1.7.D	S8.A.2.2.2	Unit 1, Lesson 6
57	C	3.4.7.C	S8.C.3.1.3	Unit 3, Lesson 8
58	D	4.5.7.B	S8.B.3.3.4	Unit 2, Lesson 7
59	C	3.2.7.C	S8.A.1.1.2	Unit 1, Lesson 1
60	D	3.1.7.B	S8.A.3.2.3	Unit 1, Lesson 5
61	Open-ended	3.7.7.A	S8.A.2.2.3	Unit 1, Lesson 6

Science

Grade 8

Teacher's Guide and Answer Key

Continental Press
520 East Bainbridge Street ▪ Elizabethtown, PA 17022
800.233.0759 ▪ www.continentalpress.com

ISBN 0-8454-K3972-3

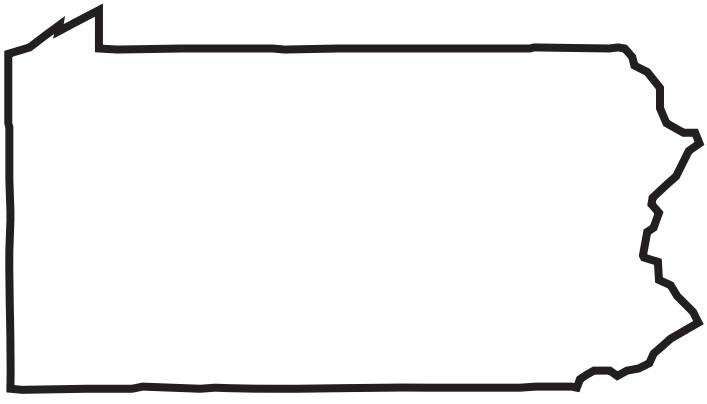
GRADE

8

PSSA Performance Indicator

Science

Form B
Teacher's Guide and Answer Key



Continental Press

Contents

ISBN 978-0-8454-K5382-7

Continental Press

PSSA Science Performance Indicators

The ***PSSA Science Performance Indicator*** practice tests are designed to help students prepare for the Pennsylvania System of School Assessment (PSSA) in Science. There are two forms of the Performance Indicator available. They are parallel forms that can be administered before instruction and after, or at any time during the school year.

The ***PSSA Finish Line Science, Grade 8*** workbook provides a complete sequence of instruction in the assessed anchors and eligible content. The workbook includes guided practice and independent practice for the assessed science skills and concepts in multiple-choice and open-ended formats. A listing of Assessment Anchors and Eligible Content, as well as Academic Standards, is available at the back of this guide.

The ***PSSA Science Performance Indicators, Grade 8*** are divided into two sessions: Session 1 and Session 2. To emulate the actual testing conditions, the sessions should be administered on the same day. However, if necessary, they may be given on two consecutive days.

Session 1 contains 29 multiple-choice questions and two open-ended items. Multiple-choice questions have four answer choices, one of which is the correct answer. Students should circle the letter of the best answer. Each open-ended question is comprised of two parts, which students must answer in writing. They may be required to read a passage, analyze a table or graph, or make observations about an image.

Session 2 contains 27 multiple-choice questions and three open-ended items.

This teacher's guide includes suggestions for using these test preparation materials, directions for administering the Performance Indicator, and an answer key with correlations to the Pennsylvania Assessment Anchors and Eligible Content for Science for grade 8 and the Academic Standards for grade 8 for Science and Technology and for Environment and Ecology. It also includes a chart connecting the questions on this performance indicator to the corresponding lesson(s) in the *PSSA Finish Line Science* workbook.

The chart below provides a sample timetable for administering the Grade 8 Performance Indicator.

Session 1	29 multiple-choice questions 2 open-ended questions	50 minutes, plus 10 minutes for preparation
Session 2	27 multiple-choice questions 3 open-ended questions	50 minutes, plus 10 minutes for preparation

Using Your Performance Indicator

Science tests today are usually given in multiple sessions. You will probably want your students to work with the ***PSSA Science Performance Indicator*** practice tests in the same way. In addition, schedule review sessions as close as possible to the completion of the test; this will enable you to go over the students' answers while the contents are still fresh in their minds. Be sure to consider with the students ways in which their written responses could be improved. Directions for using the booklet begin below. Those that you will read aloud to the class are in **boldface type** and preceded by the word **SAY;** those that are not meant to be read aloud are in regular type.

The directions that follow instruct the students to write their answers in the test booklets. If you prefer to use separate answer sheets, reproduce the answer sheets on pages 8–9 of this guide. Remind students to write their names on their answer sheets. Then instruct them on how to fill in the circles clearly.

Session 1

Allow 50 minutes for this first session. Make sure each student has a Performance Indicator, Form B, two No. 2 pencils, and optional answer forms, if you are using them.

SAY Turn to the inside front cover of the booklet and write your name on the line provided. You will have 50 minutes to complete Session 1.

Check to be sure students have written their names on the inside front cover of their booklets. Explain to the students that they should read each multiple-choice question and all four answer choices carefully, before marking the best answer. Remind them to write their answers to the open-ended questions neatly. Then take the time to answer any questions the students may have.

SAY Look at page 3 of your booklets.

Read, or have a volunteer read, the directions.

SAY Read the directions and questions on each page carefully. Remember that you have 50 minutes to work on Session 1. Continue working until you reach the word *Stop* on page 19. If you finish early, review your work and just sit quietly until the time is up. Are there any questions?

Pause to answer any questions.

SAY I am now writing the time on the chalkboard. Turn to page 4 and begin.

Check to be sure students have begun working on the booklet correctly. After 40 minutes, alert the students to the time left.

SAY There are 10 minutes left for you to complete Session 1. If you finish page 19 before the time is up, be sure to go back and check your answers.

When time is up, alert the class.

SAY Time's up. Please close your booklets.

Thank the class for their cooperation. Take a short break before beginning Session 2.

Session 2

Allow 50 minutes for the second session. Check that each student has two No. 2 pencils, his or her booklet, and optional answer forms, if you are using them.

SAY **Now you will begin Session 2. You will have 50 minutes to complete this session. Please turn to page 21 and follow along while I read what is on this page.**

Read, or have a volunteer read, the directions.

SAY **Read the directions and questions on each page carefully. Remember that you have 50 minutes to work on Session 2. Continue working until you reach the word *Stop* on page 38. If you finish early, review your work and just sit quietly until the time is up. Are there any questions?**

Pause to answer any questions. Remind the students that you are going to make the session seem as much as possible like the real test they will be taking.

SAY **I am now writing the time on the chalkboard. Turn to page 22 and begin.**

After 40 minutes, alert the students to the time left.

SAY **There are 10 minutes left for you to complete Session 2. If you finish page 38 before the time is up, be sure to go back and check your answers.**

When time is up, alert the class.

SAY **Time's up. Please close your booklets.**

Collect the booklets. Thank the class for their cooperation.

After you check the answers for Sessions 1 and 2 using the answer key on pages 6–7 of this guide, review the responses with students. Continue to work with students to improve all aspects of their science skills.

Answer Key

The first set of brackets following each answer contains the assessment anchor and eligible content addressed. The second set contains the academic standard.

Session 1

1. B [S8.A.2.2.1] [3.7.7.A]
2. D [S8.B.2.1.1] [3.3.7.D]
3. B [S8.C.1.1.2] [3.4.7.A]
4. A [S8.D.1.1.1] [3.5.7.A]
5. B [S8.B.2.2.1] [3.3.7.C]
6. D [S8.B.2.2.2] [3.3.7.C]
7. D [S8.A.1.3.2] [3.1.7.E]
8. A [S8.A.3.1.4] [4.6.7.A]
9. A [S8.C.2.1.1] [3.4.7.B]
10. A [S8.A.3.1.2] [3.4.7.B]
11. C [S8.C.2.2.3] [4.2.7.B]
12. D [S8.A.2.1.2] [3.2.7.B]
13. D [S8.A.3.3.2] [3.2.7.B]
14. C [S8.C.2.1.2] [3.4.7.B]
15. A [S8.D.3.1.1] [3.4.7.D]
16. C [S8.A.1.1.3] [3.2.7.B]
17. Open-ended [S8.A.2.1.5] [3.2.7.D]
    A. *Answers may vary but should say something like the following:* The line representing farming with chemical fertilizers shows only a tiny increase in soil organic material over farming with no chemical fertilizers or compost.
    B. *Answers may vary but should say something like the following:* The line representing compost is much higher than the lines representing the other methods. This means composting had the greatest effect on organic matter content of the soil.
18. C [S8.D.1.1.4] [4.4.7.B]
19. C [S8.B.2.1.2] [3.3.7.D]
20. D [S8.C.3.1.1] [3.3.7.D]
21. B [S8.A.1.1.4] [3.2.7.A]
22. B [S8.A.2.1.3] [3.1.7.D]
23. C [S8.A.1.1.1] [3.2.7.A]
24. A [S8.A.1.2.4] [3.2.7.C]
25. B [S8.D.1.1.3] [4.4.7.B]
26. B [S8.D.1.3.1] [3.5.7.D]
27. C [S8.A.1.3.3] [4.8.7.C]
28. A [S8.B.2.1.4] [4.7.7.B]
29. D [S8.A.3.1.1] [3.1.7.A]
30. B [S8.A.3.2.2] [3.2.7.B]
31. Open-ended [S8.A.3.2.3] [4.3.7.B]
    A. *Answers may vary but should say something like the following:* The whales follow an annual migration route. They swim south in the fall and north in the spring.
    B. *Explanations may vary but should say something like the following*: The whales leave an area with good food resources because the environment becomes too harsh. They travel to a warmer, more protected area to deliver their offspring, so they have a better chance of surviving in the warm lagoons. Then they return to their feeding grounds for the warmer summer season to take advantage of the food resources.

Session 2

32. C [S8.C.1.1.3] [3.4.7.A]
33. C [S8.B.2.1.5] [3.3.7.C]
34. D [S8.A.3.2.1] [3.1.7.B]
35. A [S8.D.1.3.2] [3.5.7.D]
36. B [S8.A.2.1.4] [3.2.7.B]
37. B [S8.A.1.2.3] [3.6.7.C]
38. C [S8.B.3.1.3] [4.6.7.A]
39. D [S8.A.2.1.6] [3.2.7.D]
40. A [S8.A.1.3.1] [3.1.7.D]
41. Open-ended [S8.C.2.1.3] [3.4.7.B]
    A. *Answers may vary but should say something like the following:* Squeezing the handle is a form of mechanical energy. The handle is attached to gears and a generator, which turn the mechanical energy into electrical energy. The flashlight bulb uses electrical energy to produce light energy.
    B. *Answers may vary but should say something like the following:* Muscles are powered by chemical energy stored in food molecules. They use this energy to contract and make motions, such as squeezing. This is a form of kinetic energy.

42. C [S8.A.2.1.1] [3.2.7.B]
43. B [S8.D.3.1.2] [3.4.7.D]
44. C [S8.C.2.2.2] [4.2.7.B]
45. B [S8.A.1.2.1] [3.8.7.B]
46. B [S8.D.1.3.3] [3.5.7.D]
47. A [S8.B.2.1.3] [3.3.7.C]
48. B [S8.A.1.3.4] [3.1.7.E]
49. C [S8.A.3.1.3] [3.1.7.A]
50. B [S8.A.3.3.1] [3.1.7.C]
51. Open-ended [S8.D.1.2.1] [4.2.7.C]
    A. *Explanations may vary but should say something like the following:* The sun plantation growing technique requires that areas of rain forest be cut down. This affects not just the rain forest trees, but also other plant and animal species that interact with each other, such as pollinating insects. Also, the cacao trees themselves are used up sooner than they would be. Other renewable inputs, such as water supply, are used up as well.
    B. *Explanations may vary but should say something like the following:* Chemical fertilizers and pesticides are used in greater amounts. These are made from petroleum, a nonrenewable resource. Fuels are also used in the clearing of land, to power farming machinery, and to transport the products of agriculture to areas where they are processed and consumed.
52. C [S8.A.1.2.2] [3.8.7.C]
53. D [S8.A.3.1.5] [3.1.7.A]
54. A [S8.C.3.1.2] [3.4.7.C]
55. C [S8.D.2.1.3] [3.5.7.C]
56. D [S8.A.2.2.2] [3.1.7.D]
57. A [S8.C.3.1.3] [3.4.7.C]
58. B [S8.B.3.3.4] [4.5.7.B]
59. C [S8.A.1.1.2] [3.2.7.C]
60. B [S8.A.3.2.3] [3.1.7.B]
61. Open-ended [S8.A.2.2.3] [3.3.7.A]
    A. *Accept any job that requires application of large forces, for example:* car mechanics, freight transport, construction, *or* manufacturing jobs
    B. *Explanations may vary but should say something like the following:* A car mechanic relies on hydraulic lifts to raise cars into the air to work on the undersides of the cars. Without this lift, the car mechanic would have to get under cars and work in a dark, cramped space.

Name _____

Session 1—Answer Sheet

1	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2	Ⓐ	Ⓑ	Ⓒ	Ⓓ
3	Ⓐ	Ⓑ	Ⓒ	Ⓓ
4	Ⓐ	Ⓑ	Ⓒ	Ⓓ
5	Ⓐ	Ⓑ	Ⓒ	Ⓓ
6	Ⓐ	Ⓑ	Ⓒ	Ⓓ
7	Ⓐ	Ⓑ	Ⓒ	Ⓓ
8	Ⓐ	Ⓑ	Ⓒ	Ⓓ
9	Ⓐ	Ⓑ	Ⓒ	Ⓓ
10	Ⓐ	Ⓑ	Ⓒ	Ⓓ
11	Ⓐ	Ⓑ	Ⓒ	Ⓓ
12	Ⓐ	Ⓑ	Ⓒ	Ⓓ
13	Ⓐ	Ⓑ	Ⓒ	Ⓓ
14	Ⓐ	Ⓑ	Ⓒ	Ⓓ
15	Ⓐ	Ⓑ	Ⓒ	Ⓓ
16	Ⓐ	Ⓑ	Ⓒ	Ⓓ
17	Ⓐ	Ⓑ	Ⓒ	Ⓓ
18	Ⓐ	Ⓑ	Ⓒ	Ⓓ
19	Ⓐ	Ⓑ	Ⓒ	Ⓓ
20	Ⓐ	Ⓑ	Ⓒ	Ⓓ
21	Ⓐ	Ⓑ	Ⓒ	Ⓓ
22	Ⓐ	Ⓑ	Ⓒ	Ⓓ
23	Ⓐ	Ⓑ	Ⓒ	Ⓓ
24	Ⓐ	Ⓑ	Ⓒ	Ⓓ
25	Ⓐ	Ⓑ	Ⓒ	Ⓓ
26	Ⓐ	Ⓑ	Ⓒ	Ⓓ
27	Ⓐ	Ⓑ	Ⓒ	Ⓓ
28	Ⓐ	Ⓑ	Ⓒ	Ⓓ
29	Ⓐ	Ⓑ	Ⓒ	Ⓓ
30	Ⓐ	Ⓑ	Ⓒ	Ⓓ
31	Ⓐ	Ⓑ	Ⓒ	Ⓓ

Session 2—Answer Sheet

32	Ⓐ	Ⓑ	Ⓒ	Ⓓ
33	Ⓐ	Ⓑ	Ⓒ	Ⓓ
34	Ⓐ	Ⓑ	Ⓒ	Ⓓ
35	Ⓐ	Ⓑ	Ⓒ	Ⓓ
36	Ⓐ	Ⓑ	Ⓒ	Ⓓ
37	Ⓐ	Ⓑ	Ⓒ	Ⓓ
38	Ⓐ	Ⓑ	Ⓒ	Ⓓ
39	Ⓐ	Ⓑ	Ⓒ	Ⓓ
40	Ⓐ	Ⓑ	Ⓒ	Ⓓ
41	Ⓐ	Ⓑ	Ⓒ	Ⓓ
42	Ⓐ	Ⓑ	Ⓒ	Ⓓ
43	Ⓐ	Ⓑ	Ⓒ	Ⓓ
44	Ⓐ	Ⓑ	Ⓒ	Ⓓ
45	Ⓐ	Ⓑ	Ⓒ	Ⓓ
46	Ⓐ	Ⓑ	Ⓒ	Ⓓ
47	Ⓐ	Ⓑ	Ⓒ	Ⓓ
48	Ⓐ	Ⓑ	Ⓒ	Ⓓ
49	Ⓐ	Ⓑ	Ⓒ	Ⓓ
50	Ⓐ	Ⓑ	Ⓒ	Ⓓ
51	Ⓐ	Ⓑ	Ⓒ	Ⓓ
52	Ⓐ	Ⓑ	Ⓒ	Ⓓ
53	Ⓐ	Ⓑ	Ⓒ	Ⓓ
54	Ⓐ	Ⓑ	Ⓒ	Ⓓ
55	Ⓐ	Ⓑ	Ⓒ	Ⓓ
56	Ⓐ	Ⓑ	Ⓒ	Ⓓ
57	Ⓐ	Ⓑ	Ⓒ	Ⓓ
58	Ⓐ	Ⓑ	Ⓒ	Ⓓ
59	Ⓐ	Ⓑ	Ⓒ	Ⓓ
60	Ⓐ	Ⓑ	Ⓒ	Ⓓ
61	Ⓐ	Ⓑ	Ⓒ	Ⓓ

Open-Ended Answer Sheet

Name _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Session 1—Answer Sheet, Answer Key

1	Ⓐ	●	Ⓒ	Ⓓ
2	Ⓐ	Ⓑ	Ⓒ	●
3	Ⓐ	●	Ⓒ	Ⓓ
4	●	Ⓑ	Ⓒ	Ⓓ
5	Ⓐ	●	Ⓒ	Ⓓ
6	Ⓐ	Ⓑ	Ⓒ	●
7	Ⓐ	Ⓑ	Ⓒ	●
8	●	Ⓑ	Ⓒ	Ⓓ
9	●	Ⓑ	Ⓒ	Ⓓ
10	●	Ⓑ	Ⓒ	Ⓓ
11	Ⓐ	Ⓑ	●	Ⓓ
12	Ⓐ	Ⓑ	Ⓒ	●
13	Ⓐ	Ⓑ	Ⓒ	●
14	Ⓐ	Ⓑ	●	Ⓓ
15	●	Ⓑ	Ⓒ	Ⓓ
16	Ⓐ	Ⓑ	●	Ⓓ
~~17~~	Ⓐ	Ⓑ	Ⓒ	Ⓓ
18	Ⓐ	Ⓑ	●	Ⓓ
19	Ⓐ	Ⓑ	●	Ⓓ
20	Ⓐ	Ⓑ	Ⓒ	●
21	Ⓐ	●	Ⓒ	Ⓓ
22	Ⓐ	●	Ⓒ	Ⓓ
23	Ⓐ	Ⓑ	●	Ⓓ
24	●	Ⓑ	Ⓒ	Ⓓ
25	Ⓐ	●	Ⓒ	Ⓓ
26	Ⓐ	●	Ⓒ	Ⓓ
27	Ⓐ	Ⓑ	●	Ⓓ
28	●	Ⓑ	Ⓒ	Ⓓ
29	Ⓐ	Ⓑ	Ⓒ	●
30	Ⓐ	●	Ⓒ	Ⓓ
~~31~~	Ⓐ	Ⓑ	Ⓒ	Ⓓ

Session 2—Answer Sheet, Answer Key

32	Ⓐ	Ⓑ	●	Ⓓ
33	Ⓐ	Ⓑ	●	Ⓓ
34	Ⓐ	Ⓑ	Ⓒ	●
35	●	Ⓑ	Ⓒ	Ⓓ
36	Ⓐ	●	Ⓒ	Ⓓ
37	Ⓐ	●	Ⓒ	Ⓓ
38	Ⓐ	Ⓑ	●	Ⓓ
39	Ⓐ	Ⓑ	Ⓒ	●
40	●	Ⓑ	Ⓒ	Ⓓ
~~41~~	Ⓐ	Ⓑ	Ⓒ	Ⓓ
42	Ⓐ	Ⓑ	●	Ⓓ
43	Ⓐ	●	Ⓒ	Ⓓ
44	Ⓐ	Ⓑ	●	Ⓓ
45	Ⓐ	●	Ⓒ	Ⓓ
46	Ⓐ	●	Ⓒ	Ⓓ
47	●	Ⓑ	Ⓒ	Ⓓ
48	Ⓐ	●	Ⓒ	Ⓓ
49	Ⓐ	Ⓑ	●	Ⓓ
50	Ⓐ	●	Ⓒ	Ⓓ
~~51~~	Ⓐ	Ⓑ	Ⓒ	Ⓓ
52	Ⓐ	Ⓑ	●	Ⓓ
53	Ⓐ	Ⓑ	Ⓒ	●
54	●	Ⓑ	Ⓒ	Ⓓ
55	Ⓐ	Ⓑ	●	Ⓓ
56	Ⓐ	Ⓑ	Ⓒ	●
57	●	Ⓑ	Ⓒ	Ⓓ
58	Ⓐ	●	Ⓒ	Ⓓ
59	Ⓐ	Ⓑ	●	Ⓓ
60	Ⓐ	●	Ⓒ	Ⓓ
~~61~~	Ⓐ	Ⓑ	Ⓒ	Ⓓ

PSSA Science Rubric for Open-Ended Items

Rubrics for the PSSA Science items are specific to the individual problems. The following rubric provides general guidelines for evaluating the open-ended items in the ***PSSA Performance Indicator Science*** practice tests. In reviewing student work, tailor the rubric to the assessment anchor and eligible content covered in the item.

Score	Description
2	The student response demonstrates a thorough understanding of the content, concepts, and procedures involved in the specific anchor. The response is clear, complete, and correct. The response may contain a minor error or omission that does not detract from the student's demonstration of a thorough understanding.
1	The student response demonstrates a partial understanding of the content, concepts, and procedures involved in the specific anchor. The response is somewhat correct and may contain some work that is incomplete or unclear.
0	The student response contains insufficient evidence to demonstrate any understanding of the content, concepts, and procedures involved in the specific anchor. The response may show only information copied or paraphrased from the problem.

Pennsylvania Assessment Anchors and Eligible Content

S8.A *The Nature of Science*

Assessment Anchor S8.A.1: Reasoning and Analysis

S8.A.1.1 Explain, interpret, and apply scientific, environmental, or technological knowledge presented in a variety of formats (e.g., visuals, scenarios, graphs).

- **S8.A.1.1.1** Distinguish between a scientific theory and an opinion, explaining how a theory is supported with evidence, or how new data/information may change existing theories and practices.
- **S8.A.1.1.2** Explain how certain questions can be answered through scientific inquiry and/or technological design.
- **S8.A.1.1.3** Use evidence, such as observations or experimental results, to support inferences about a relationship.
- **S8.A.1.1.4** Develop descriptions, explanations, predictions, and models using evidence.

S8.A.1.2 Identify and explain the impacts of applying scientific, environmental, or technological knowledge to address solutions to practical problems.

- **S8.A.1.2.1** Describe the positive and negative, intended and unintended, effects of specific results or technological developments (e.g., air/space travel, genetic engineering, nuclear fission/fusion, artificial intelligence, lasers, organ transplants).
- **S8.A.1.2.2** Identify environmental issues and explain their potential long-term health effects (e.g., pollution, pest control, vaccinations).
- **S8.A.1.2.3** Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).
- **S8.A.1.2.4** Explain society's standard of living in terms of technological advancements and how these advancements impact agriculture (e.g., transportation, processing, production, storage).

S8.A.1.3 Identify and analyze evidence that certain variables may have caused measurable changes in natural or human-made systems.

- **S8.A.1.3.1** Use ratio to describe change (e.g., percents, parts per million, grams per cubic centimeter, mechanical advantage).
- **S8.A.1.3.2** Use evidence, observations, or explanations to make inferences about change in systems over time (e.g., carrying capacity, succession, population dynamics, loss of mass in chemical reactions, indicator fossils in geologic time scale) and the variables affecting these changes.
- **S8.A.1.3.3** Examine systems changing over time, identifying the possible variables causing this change, and drawing inferences about how these variables affect this change.
- **S8.A.1.3.4** Given a scenario, explain how a dynamically changing environment provides for the sustainability of living systems.

Assessment Anchor S8.A.2: Processes, Procedures, and Tools of Scientific Investigations

S8.A.2.1 Apply knowledge of scientific investigation or technological design in different contexts to make inferences to solve problems.

- **S8.A.2.1.1** Use evidence, observations, or a variety of scales (e.g., mass, distance, volume, temperature) to describe relationships.
- **S8.A.2.1.2** Use space/time relationships, define concepts operationally, raise testable questions, or formulate hypotheses.
- **S8.A.2.1.3** Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.
- **S8.A.2.1.4** Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.

S8.A.2.1.5 Use evidence from investigations to clearly communicate and support conclusions.

S8.A.2.1.6 Identify a design flaw in a simple technological system and devise possible working solutions.

S8.A.2.2 Apply appropriate instruments for a specific purpose and describe the information the instrument can provide.

S8.A.2.2.1 Describe the appropriate use of instruments and scales to accurately and safely measure time, mass, distance, volume, or temperature under a variety of conditions.

S8.A.2.2.2 Apply appropriate measurement systems (e.g., time, mass, distance, volume, temperature) to record and interpret observations under varying conditions.

S8.A.2.2.3 Describe ways technology (e.g., microscope, telescope, micrometer, hydraulics, barometer) extends and enhances human abilities for specific purposes.

Assessment Anchor S8.A.3: Systems, Models, and Patterns

S8.A.3.1 Explain the parts of a simple system, their roles, and their relationships to the system as a whole.

S8.A.3.1.1 Describe a system (e.g., watershed, circulatory system, heating system, agricultural system) as a group of related parts with specific roles that work together to achieve an observed result.

S8.A.3.1.2 Explain the concept of order in a system [e.g., (first to last: manufacturing steps, trophic levels); (simple to complex: cell, tissue, organ, organs system)].

S8.A.3.1.3 Distinguish between system inputs, system processes, system outputs, and feedback (e.g., physical, ecological, biological, informational).

S8.A.3.1.4 Distinguish between open loop (e.g., energy flow, food web) and closed loop (e.g., materials in the nitrogen and carbon cycles, closed-switch) systems.

S8.A.3.1.5 Explain how components of natural and human-made systems play different roles in a working system.

S8.A.3.2 Apply knowledge of models to make predictions, draw inferences, or explain technological concepts.

S8.A.3.2.1 Describe how scientists use models to explore relationships in natural systems (e.g., an ecosystem, river system, the solar system).

S8.A.3.2.2 Describe how engineers use models to develop new and improved technologies to solve problems.

S8.A.3.2.3 Given a model showing simple cause-and-effect relationships in a natural system, predict results that can be used to test the assumptions in the model (e.g., photosynthesis, water cycle, diffusion, infiltration).

S8.A.3.3 Describe repeated processes or recurring elements in natural, scientific, and technological patterns.

S8.A.3.3.1 Identify and describe patterns as repeated processes or recurring elements in human-made systems (e.g., trusses, hub-and-spoke system in communications and transportation systems, feedback controls in regulated systems).

S8.A.3.3.2 Describe repeating structure patterns in nature (e.g., veins in a leaf, tree rings, crystals, water waves) or periodic patterns (e.g., daily, monthly, annually).

S8.B *Biological Sciences*

Assessment Anchor S8.B.1: Structure and Function of Organisms

S8.B.1.1 Describe and compare structural and functional similarities and differences that characterize diverse living things.

S8.B.1.1.1 Describe the structures of living things that help them function effectively in specific ways (e.g., adaptations, characteristics).

S8.B.1.1.2 Compare similarities and differences in internal structures of organisms (e.g., invertebrate/vertebrate, vascular/nonvascular, single-celled/multi-celled) and external structures (e.g., appendages, body segments, type of covering, size, shape).

S8.B.1.1.3 Apply knowledge of characteristic structures to identify or categorize organisms (i.e., plants, animals, fungi, bacteria, and protista).

S8.B.1.1.4 Identify the levels of organization from cell to organism and describe how specific structures (parts), which underlie larger systems, enable the system to function as a whole.

Assessment Anchor S8.B.2: Continuity of Life

S8.B.2.1 Explain the basic concepts of natural selection.

S8.B.2.1.1 Explain how inherited structures or behaviors help organisms survive and reproduce in different environments.

S8.B.2.1.2 Explain how different adaptations in individuals of the same species may affect survivability or reproduction success.

S8.B.2.1.3 Explain that mutations can alter a gene and are the original source of new variations.

S8.B.2.1.4 Describe how selective breeding or biotechnology can change the genetic makeup of organisms.

S8.B.2.1.5 Explain that adaptations are developed over long periods of time and are passed from one generation to another.

S8.B.2.2 Explain how a set of genetic instructions determines inherited traits of organisms.

S8.B.2.2.1 Identify and explain differences between inherited and acquired traits.

S8.B.2.2.2 Recognize that the gene is the basic unit of inheritance, that there are dominant and recessive genes, and that traits are inherited.

Assessment Anchor S8.B.3: Ecological Behavior and Systems

S8.B.3.1 Explain the relationships among and between organisms in different ecosystems and the abiotic and biotic components.

S8.B.3.1.1 Explain the flow of energy through an ecosystem (e.g., food chains, food webs).

S8.B.3.1.2 Identify major biomes and describe abiotic and biotic components (e.g., abiotic: different soil types, air, water, sunlight; biotic: soil microbes, decomposers).

S8.B.3.1.3 Explain relationships among organisms (e.g., producers/consumers, predator/prey) in an ecosystem.

S8.B.3.2 Identify evidence of change to infer and explain the ways different variables may affect change in natural or human-made systems.

S8.B.3.2.1 Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).

S8.B.3.2.2 Use evidence to explain how diversity affects the ecological integrity of natural systems.

S8.B.3.2.3 Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.

S8.B.3.3 Explain how renewable and nonrenewable resources provide for human needs or how these needs impact the environment.

S8.B.3.3.1 Explain how human activities may affect local, regional, and global environments.

S8.B.3.3.2 Explain how renewable and nonrenewable resources provide for human needs (i.e., energy, food, water, clothing, and shelter).

S8.B.3.3.3 Describe how waste management affects the environment (e.g., recycling, composting, landfills, incineration, sewage treatment).

S8.B.3.3.4 Explain the long-term effects of using integrated pest management (e.g., herbicides, natural predators, biogenetics) on the environment.

S8.C *Physical Sciences*

Assessment Anchor S8.C.1: Structure, Properties, and Interaction of Matter and Energy

S8.C.1.1 Explain concepts about the structure and properties (physical and chemical) of matter.

- **S8.C.1.1.1** Explain the differences among elements, compounds, and mixtures.
- **S8.C.1.1.2** Use characteristic physical or chemical properties to distinguish one substance from another (e.g., density, thermal expansion/contraction, freezing/melting points, streak test).
- **S8.C.1.1.3** Identify and describe reactants and products of simple chemical reactions.

Assessment Anchor S8.C.2: Forms, Sources, Conversion, and Transfer of Energy

S8.C.2.1 Describe energy sources, transfer of energy, or conversion of energy.

- **S8.C.2.1.1** Distinguish among forms of energy (e.g., electrical, mechanical, chemical, light, sound, nuclear) and sources of energy (i.e., renewable and nonrenewable energy).
- **S8.C.2.1.2** Explain how energy is transferred from one place to another through convection, conduction, or radiation.
- **S8.C.2.1.3** Describe how one form of energy (e.g., electrical, mechanical, chemical, light, sound, nuclear) can be converted into a different form of energy.

S8.C.2.2 Compare the environmental impact of different energy sources chosen to support human endeavors.

- **S8.C.2.2.1** Describe the sun as the major source of energy that impacts the environment.
- **S8.C.2.2.2** Compare the time span of renewability for fossil fuels and the time span of renewability for alternative fuels.
- **S8.C.2.2.3** Describe the waste (i.e., kind and quantity) derived from the use of renewable and nonrenewable resources and their potential impact on the environment.

Assessment Anchor S8.C.3: Principles of Motion and Force

S8.C.3.1 Describe the effect of multiple forces on the movement, speed, or direction of an object.

- **S8.C.3.1.1** Describe forces acting on objects (e.g., friction, gravity, balanced versus unbalanced).
- **S8.C.3.1.2** Distinguish between kinetic and potential energy.
- **S8.C.3.1.3** Explain that mechanical advantage helps to do work (physics) by either changing a force or changing the direction of the applied force (e.g., simple machines, hydraulic systems).

S8.D *Earth and Space Sciences*

Assessment Anchor S8.D.1: Earth Features and Processes that Change Earth and Its Resources

S8.D.1.1 Describe constructive and destructive natural processes that form different geological structures and resources.

- **S8.D.1.1.1** Explain the rock cycle as changes in the solid earth and rock types found in Pennsylvania (igneous—granite, basalt, pumice; sedimentary—limestone, sandstone, shale, coal; and metamorphic—slate, quartzite, marble, gneiss).
- **S8.D.1.1.2** Describe natural processes that change Earth's surface (e.g., landslides, volcanic eruptions, earthquakes, mountain building, new land being formed, weathering, erosion, sedimentation, soil formation).
- **S8.D.1.1.3** Identify soil types (i.e., humus, topsoil, subsoil, loam, loess, and parent material) and their characteristics (i.e., particle size, porosity, and permeability) found in different biomes and in Pennsylvania, and explain how they formed.
- **S8.D.1.1.4** Explain how fossils provide evidence about plants and animals that once lived throughout Pennsylvania's history (e.g., fossils provide evidence of different environments).

S8.D.1.2 Describe the potential impact of human-made processes on changes to Earth's resources and how they affect everyday life.

- **S8.D.1.2.1** Describe a product's transformation process from production to consumption (e.g., prospecting, propagating, growing, maintaining, adapting, treating, converting, distributing, disposing) and explain the process's potential impact on Earth's resources.
- **S8.D.1.2.2** Describe potential impacts of human-made processes (e.g., manufacturing, agriculture, transportation, mining) on Earth's resources, both nonliving (i.e., air, water, or earth materials) and living (i.e., plants and animals).

S8.D.1.3 Describe characteristic features of Earth's water systems or their impact on resources.

- **S8.D.1.3.1** Describe the water cycle and the physical processes on which it depends (i.e., evaporation, condensation, precipitation, transpiration, runoff, infiltration, energy inputs, and phase changes).
- **S8.D.1.3.2** Compare and contrast characteristics of freshwater and saltwater systems on the basis of their physical characteristics (i.e., composition, density, and electrical conductivity) and their use as natural resources.
- **S8.D.1.3.3** Distinguish among different water systems (e.g., wetland systems, ocean systems, river systems, watersheds) and describe their relationships to each other as well as to landforms.
- **S8.D.1.3.4** Identify the physical characteristics of a stream and how these characteristics determine the types of organisms found within the stream environment (e.g., biological diversity, water quality, flow rate, tributaries, surrounding watershed).

Assessment Anchor S8.D.2: Weather, Climate, and Atmospheric Processes

S8.D.2.1 Explain how pressure, temperature, moisture, and wind are used to describe atmospheric conditions that affect regional weather or climate.

- **S8.D.2.1.1** Explain the impact of water systems on the local weather or the climate of a region (e.g., lake effect snow, land/ocean breezes).
- **S8.D.2.1.2** Identify how global patterns of atmospheric movement influence regional weather and climate.
- **S8.D.2.1.3** Identify how cloud types, wind directions, and barometric pressure changes are associated with weather patterns in different regions of the country.

Assessment Anchor S8.D.3: Composition and Structure of the Universe

S8.D.3.1 Explain the relationships between and among the objects of our solar system.

- **S8.D.3.1.1** Describe patterns of Earth's movements (i.e., rotation and revolution) and the moon's movements (i.e., phases, eclipses, and tides) in relation to the sun.
- **S8.D.3.1.2** Describe the role of gravity as the force that governs the movement of the solar system and universe.
- **S8.D.3.1.3** Compare and contrast characteristics of celestial bodies found in the solar system (e.g., moons, asteroids, comets, meteors, inner and outer planets).

Academic Standards for Science and Technology

3.1 *Unifying Themes*

7.A Explain the parts of a simple system and their relationship to each other.
- Describe a system as a group of related parts that work together to achieve a desired result (e.g., digestive system).
- Explain the importance of order in a system.
- Distinguish between system inputs, system processes, and system outputs.
- Distinguish between open loop and closed loop systems.
- Apply systems analysis to solve problems.

7.B Describe the use of models as an application of scientific or technological concepts.
- Identify and describe different types of models and their functions.
- Apply models to predict specific results and observations (e.g., population growth, effects of infectious organisms).
- Explain systems by outlining a system's relevant parts and its purpose and/or designing a model that illustrates its function.

7.C Identify patterns as repeated processes or recurring elements in science and technology.
- Identify different forms of patterns and use them to group and classify specific objects.
- Identify repeating structure patterns.
- Identify and describe patterns that occur in physical systems (e.g., construction, manufacturing, transportation), informational systems, and biochemical-related systems.

7.D Explain scale as a way of relating concepts and ideas to one another by some measure.
- Apply various applications of size and dimensions of scale to scientific, mathematical, and technological applications.
- Describe scale as a form of ratio and apply to a life situation.

7.E Identify change as a variable in describing natural and physical systems.
- Describe fundamental science and technology concepts that could solve practical problems.
- Explain how ratio is used to describe change.
- Describe the effect of making a change in one part of a system on the system as a whole.

3.2 *Inquiry and Design*

7.A Explain and apply scientific and technological knowledge.
- Distinguish between a scientific theory and a belief.
- Answer "What if" questions based on observation, inference, or prior knowledge or experience.
- Explain how skepticism about an accepted scientific explanation led to a new understanding.
- Explain how new information may change existing theories and practice.

7.B Apply process knowledge to make and interpret observations.
- Measure materials using a variety of scales.
- Describe relationships by making inferences and predictions.
- Communicate, use space/time relationships, formulate hypotheses, test, and experiment.
- Design controlled experiments, recognize variables, and manipulate variables.
- Interpret data, formulate models, design models, and produce solutions.

7.C Identify and use the elements of scientific inquiry to solve problems.
- Generate questions about objects, organisms, and/or events that can be answered through scientific investigations.
- Evaluate the appropriateness of questions.
- Design an investigation with limited variables to investigate a question.
- Conduct a two-part experiment.
- Judge the significance of experimental information in answering the question.
- Communicate appropriate conclusions from the experiment.

7.D Know and use the technological design process to solve problems.
- Define different types of problems.
- Define all aspects of the problems, necessary information, and questions that must be answered.
- Propose the best solution.
- Design and propose alternative methods to achieve solutions.
- Apply a solution.
- Explain the results, present improvements, identify and infer the impacts of the solution.

3.3 *Biological Sciences*

7.A Describe the similarities and differences that characterize diverse living things.
- Describe how the structures of living things help them function in unique ways.
- Explain how to use a dichotomous key to identify plants and animals.
- Account for adaptations among organisms that live in a particular environment.

7.B Describe the cell as the basic structural and functional unit of living things.
- Identify the levels of organization from cell to organism.
- Compare life processes at the organism level with life processes at the cell level.
- Explain that cells and organisms have particular structures that underlie their functions.
- Describe and distinguish among cell cycles, reproductive cycles, and life cycles.
- Explain disease effects on structures or functions of an organism.

7.C Know that every organism has a set of genetic instructions that determines its inherited traits.
- Identify and explain inheritable characteristics.
- Identify that the gene is the basic unit of inheritance.
- Identify basic patterns of inheritance (e.g., dominance, recessive, co-dominance).
- Describe how traits are inherited.
- Distinguish how different living things reproduce (e.g., vegetative budding, sexual).
- Recognize that mutations can alter a gene.
- Describe how selective breeding, natural selection, and genetic technologies can change genetic makeup of organisms.

7.D Explain basic concepts of natural selection.
- Identify adaptations that allow organisms to survive in their environment.
- Describe how an environmental change can affect the survival of organisms and entire species.
- Know that difference in individuals of the same species may give some advantage in surviving and reproducing.
- Recognize that populations of organisms can increase rapidly.
- Describe the role that fossils play in studying the past.
- Explain how biological extinction is a natural process.

3.4 *Physical Science, Chemistry, and Physics*

7.A Describe concepts about the structure and properties of matter.
- Identify elements as basic building blocks of matter that cannot be broken down chemically.
- Distinguish compounds from mixtures.
- Describe and conduct experiments that identify chemical and physical properties.
- Describe reactants and products of simple chemical reactions.

7.B Relate energy sources and transfers to heat and temperature.
- Identify and describe sound changes in moving objects.
- Know that the sun is a major source of energy that emits wavelengths of visible light, infrared and ultraviolet radiation.
- Explain the conversion of one form of energy to another by applying knowledge of each form of energy.
- Explain the parts and functions in an electrical circuit.

7.C Identify and explain the principles of force and motion.
- Describe the motion of an object based on its position, direction, and speed.
- Classify fluid power systems according to fluid used or mode of power transmission (e.g., air, oil).

- Explain various motions using models.
- Explain how sound and light travel in waves of differing speeds, sizes, and frequencies.

7.D Describe essential ideas about the composition and structure of the universe and Earth's place in it.
- Compare various planets' characteristics.
- Describe basic star types and identify the sun as a star type.
- Describe and differentiate comets, asteroids, and meteors.
- Identify gravity as the force that keeps planets in orbit around the sun and governs the rest of the movement of the solar system and the universe.
- Illustrate how the positions of stars and constellations change in relation to Earth during an evening and from month to month.
- Identify equipment and instruments that explore the universe.
- Identify the accomplishments and contributions provided by selected past and present scientists in the field of astronomy.
- Identify and articulate space program efforts to investigate possibilities of living in space and on other planets.

3.5 *Earth Sciences*

7.A Describe earth features and processes.
- Describe major layers of the earth.
- Describe the processes involved in the creation of geologic features (e.g., folding, faulting, volcanism, sedimentation) and that these processes seen today (e.g., erosion, weathering, crustal plate movement) are similar to those in the past.
- Describe the processes that formed Pennsylvania geologic structures and resources including mountains, glacial formations, water gaps, and ridges.
- Explain how the rock cycle affected rock formations in the state of Pennsylvania.
- Distinguish between examples of rapid surface changes (e.g., landslides, earthquakes) and slow surface changes (e.g., weathering).
- Identify living plants and animals that are similar to fossil forms.

7.B Recognize earth resources and how they affect everyday life.
- Identify and locate significant earth resources (e.g., rock types, oil, gas, coal deposits) in Pennsylvania.
- Explain the processes involved in the formation of oil and coal in Pennsylvania.
- Explain the value and uses of different earth resources (e.g., selected minerals, ores, fuel sources, agricultural uses).
- Compare the locations of human settlements as related to available resources.

7.C Describe basic elements of meteorology.
- Explain weather forecasts by interpreting weather data and symbols.
- Explain the oceans' impact on local weather and the climate of a region.
- Identify how cloud types, wind directions, and barometric pressure changes are associated with weather patterns in different regions of the country.
- Explain and illustrate the processes of cloud formation and precipitation.
- Describe and illustrate the major layers of the earth's atmosphere.
- Identify different air masses and global wind patterns and how they relate to the weather patterns in different regions of the U.S.

7.D Explain the behavior and impact of the earth's water systems.
- Explain the water cycle using the processes of evaporation and condensation.
- Describe factors that affect evaporation and condensation.
- Distinguish salt from fresh water (e.g., density, electrical conduction).
- Compare the effect of water type (e.g., polluted, fresh, salt water) and the life contained in them.
- Identify ocean and shoreline features (e.g., bays, inlets, spit, tidal marshes).

3.6 *Technology Education*

7.A Explain biotechnologies that relate to related technologies of propagating, growing, maintaining, adapting, treating, and converting.

- Identify the environmental, societal, and economic impacts that waste has in the environment.
- Identify and explain the impact that a specific medical advancement has had on society.
- Explain the factors that were taken into consideration when a specific object was designed.
- Define and describe how fuels and energy can be generated through the process of biomass conversion.
- Identify and group basic plant and animal production processes.
- Explain the impact that agricultural science has had on biotechnology.

7.B Explain information technologies of encoding, transmitting, receiving, storing, retrieving, and decoding.

- Demonstrate the effectiveness of image generating technique to communicate a story (e.g., photography, video).
- Analyze and evaluate the effectiveness of a graphic object designed and produced to communicate a thought or concept.
- Apply basic technical drawing techniques to communicate an idea or solution to a problem.
- Apply the appropriate method of communications technology to communicate a thought.

7.C Explain physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research, and design.

- Use knowledge of material effectiveness to solve specific construction problems (e.g., steel vs. wood bridges).
- Differentiate among the different types of construction applications (e.g., microwave tower, power plants, aircrafts).
- Explain basic material processes that manufactured objects undergo during production (e.g., separating, forming, combining).
- Evaluate a construction activity by specifying task analyses and necessary resources.
- Explain the relationships among the basic resources needed in the production process for a specific manufactured object.
- Explain the difference between design engineering and production engineering processes.
- Analyze manufacturing steps that affect waste and pollutants.
- Explain transportation technologies of propelling, structuring, suspending, guiding, controlling, and supporting.
- Identify and explain the workings of several mechanical power systems.
- Model and explain examples of vehicular propulsion, control, guidance, structure and suspension systems.
- Explain the limitations of land, marine, air, and space transportation systems.

3.7 *Technological Devices*

7.A Describe the safe and appropriate use of tools, materials, and techniques to answer questions and solve problems.

- Identify uses of tools, machines, materials, information, people, money, energy, and time that meet specific design criteria.
- Describe safe procedures for using tools and materials.
- Assess materials for appropriateness of use.

7.B Use appropriate instruments and apparatus to study materials.

- Select appropriate instruments to measure the size, weight, shape, and temperature of living and non-living objects.
- Apply knowledge of different measurement systems to measure and record objects' properties.

7.C Explain and demonstrate basic computer operations and concepts.

- Know specialized computer applications used in the community.
- Describe the function of advanced input and output devices (e.g., scanners, video images, plotters, projectors) and demonstrate their use.

- Demonstrate age appropriate keyboarding skills and techniques.

7.D Apply computer software to solve specific problems.
- Identify software designed to meet specific needs (e.g., Computer Aided Drafting, design software, tutorial, financial, presentation software).
- Identify and solve basic software problems relevant to specific software application.
- Identify basic multimedia applications.
- Demonstrate a basic knowledge of desktop publishing applications.
- Apply intermediate skills in utilizing word processing, database, and spreadsheet software.
- Apply basic graphic manipulation techniques.

7.E Explain basic computer communications systems.
- Describe the organization and functions of the basic parts that make up the World Wide Web.
- Apply advanced electronic mail functions.
- Apply basic on-line research techniques to solve a specific problem.

3.8 *Science, Technology, and Human Endeavors*

7.A Explain how sciences and technologies are limited in their effects and influences in society.
- Identify and describe the unavoidable constraints of technological design.
- Identify changes in society as a result of a technological development.
- Identify and explain improvements in transportation, health, sanitation, and communications as a result of advancements in science and technology and how they affect our lives.

7.B Explain how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.
- Identify interrelationships between systems and resources.
- Identify and describe the resources necessary to solve a selected problem in a community and improve the quality of life.
- Identify and explain specific examples of how agricultural science has met human needs and has improved the quality of life.

7.C Identify the pros and cons of applying technological and scientific solutions to address problems and the effect upon society.
- Describe the positive and negative expected and unexpected effects of specific technological developments.
- Describe ways technology extends and enhances human abilities.

Academic Standards for Environment and Ecology

4.1 *Watersheds and Wetlands*

7.A Explain the role of the water cycle within a watershed.
- Explain the water cycle.
- Explain the water cycle as it relates to a watershed.

7.B Understand the role of the watershed.
- Identify and explain what determines the boundaries of a watershed.
- Explain how water enters a watershed.
- Explain factors that affect water quality and flow through a watershed.

7.C Explain the effects of water on the life of organisms in a watershed.
- Explain how water is necessary for all life.
- Explain how the physical components of aquatic systems influence the organisms that live there in terms of size, shape, and physical adaptations.
- Describe the life cycle of organisms that depend on water.
- Identify organisms that have aquatic stages of life and describe those stages.

7.D Explain and describe characteristics of a wetland.
- Identify specific characteristics of wetland plants and soils.
- Recognize the common types of plants and animals.
- Describe different types of wetlands.
- Describe the different functions of a wetland.

7.E Describe the impact of watersheds and wetlands on people.
- Explain the impact of watersheds and wetlands in flood control, wildlife habitats, and pollution abatement.
- Explain the influence of flooding on wetlands.

4.2 *Renewable and Nonrenewable Resources*

7.A Know that raw materials come from natural resources.
- Identify resources used to provide humans with energy, food, housing, and water.
- Explain how plants and animals may be classified as natural resources.
- Compare means of growing or acquiring food.
- Identify fiber and other raw materials used in clothing and shelter production.
- Identify types of minerals and fossil fuels used by humans.

7.B Examine the renewability of resources.
- Identify renewable resources and describe their uses.
- Identify nonrenewable resources and describe their uses.
- Compare finished products to their original raw material.
- Identify the waste derived from the use of renewable and nonrenewable resources.
- Determine how consumption may impact the availability of resources.
- Compare the time spans of renewability for fossil fuels and alternative fuels.

7.C Explain natural resource distribution.
- Distinguish between readily available and less accessible resources.
- Identify the locations of different concentrations of fossil fuels and mineral resources.
- Analyze the effects of management practices on air, land, and water in forestry, agriculture, fisheries, wildlife, mining, and food and fiber production that is unique to different climates.

7.D Describe the role of recycling and waste management.
- Identify materials that can be recycled in the community.
- Explain the process of closing the loop in recycling.
- Compare the decomposition rates of different organic materials.
- Describe methods that could be used to reuse materials for new products.

- Evaluate the costs and benefits of disposable products.

4.3 *Environmental Health*

7.A Identify environmental health issues.
- Identify various examples of long-term pollution and explain their effects on environmental health.
- Identify diseases that have been associated with poor environmental quality.
- Describe different types of pest controls and their effects on the environment.
- Identify alternative products that can be used in life to reduce pollution.

7.B Describe how human actions affect the health of the environment.
- Identify land use practices and their relation to environmental health.
- Explain how natural disasters affect environmental health.
- Identify residential and industrial sources of pollution and their effects on environmental health.
- Explain the difference between point and nonpoint source pollution.
- Explain how nonpoint source pollution can affect the water supply and air quality.
- Explain how acid deposition can affect water, soil, and air quality.
- Explain the relationship between resource use, reuse, recycling, and environmental health.

7.C Explain biological diversity.
- Explain the complex, interactive relationships among members of an ecosystem.
- Explain how diversity affects ecological integrity of the natural resources.

4.4 *Agriculture and Society*

7.A Explain society's standard of living in relation to agriculture.
- Compare and contrast agricultural changes that have been made to meet society's needs.
- Compare and contrast how animals and plants affect agricultural systems.
- Compare several technological advancements and their effect(s) on the historical growth of agriculture.
- Compare different environmental conditions related to agricultural production, cost, and quality of the product.

7.B Investigate how agricultural science has recognized the various soil types found in Pennsylvania.
- Explain the importance of particle sizes in different soil types.
- Determine how water has influenced the development of Pennsylvania soil types.
- Investigate how soil types have influenced the plant types used on Pennsylvania farms.
- Analyze how soil types and geographic regions have impacted the profitability of Pennsylvania farms.

7.C Explain agricultural systems' use of natural and human resources.
- Analyze the needs of plants and animals as they relate to climate and soil conditions.
- Identify the plants and animals that can be raised in the area and explain why.
- Identify natural resources necessary for agricultural systems.
- Compare the need for crop production to the need for animal production.
- Define issues associated with food and fiber production.

7.D Explain the improvement of agricultural production through technology.
- Compare the technologies that have advanced agricultural production.
- Explain how energy sources have changed to meet agricultural technology.

4.5 *Integrated Pest Management*

7.A Explain benefits and harmful effects of pests.
- Identify different examples of pests and explain the beneficial or harmful effects of each.
- Identify several locations where pests can be found and compare the effects the pests have on each location.

7.B Explain how pest management affects the environment.
- Explain issues related to integrated pest management including biological technology, resistant varieties, chemical practices, medical technology, and monitoring techniques.
- Describe how integrated pest management and related technology impact human activities.
- Identify issues related to integrated pest management that affect the environment.

7.C Explain various integrated pest management practices used in society.
- Compare and contrast integrated pest management monitoring methods utilized in different community settings.
- Compare integrated pest management to past practices.
- Compare and analyze the long-term effects of using integrated pest management products.

4.6 *Ecosystems and Their Interactions*

7.A Explain the flows of energy and matter from organism to organism within an ecosystem.
- Identify and explain the characteristics of biotic and abiotic.
- Describe and explain the adaptations of plants and animals to their environment.
- Demonstrate the dependency of living components in the ecosystem on the nonliving components.
- Explain energy flow through a food web.
- Explain the importance of the predator/prey relationship and how it maintains the balances within ecosystems.
- Understand limiting factors and predict their effects on an organism.
- Identify niches for producers, consumers, and decomposers within an ecosystem.
- Compare and contrast the major ecosystems of Pennsylvania.
- Identify the major characteristics of a biome.
- Compare and contrast different biomes and their characteristics.
- Identify the relationship of abiotic and biotic components and explain their interaction in an ecosystem.
- Explain how different soil types determine the characteristics of ecosystems.

7.B Explain the concepts of cycles.
- Identify and explain cycles within an ecosystem.
- Analyze the role of different cycles within an ecosystem.

7.C Explain how ecosystems change over time.
- Explain how ecosystems change.
- Identify the succession stages of a given ecosystem.
- Explain how specific organisms may change an ecosystem.
- Explain a change in an ecosystem that relates to humans.

4.7 *Threatened, Endangered, and Extinct Species*

7.A Describe diversity of plants and animals in ecosystems.
- Select an ecosystem and describe different plants and animals that live there.
- Identify adaptations in plants and animals.
- Recognize that adaptations are developed over long periods of time and are passed on from one generation to the next.
- Understand levels of ecosystem organization (e.g., individuals, populations, species).

7.B Explain how species of living organisms adapt to their environment.
- Explain the role of individual variations in natural selection.
- Explain how an adaptation is an inherited structure or behavior that helps an organism survive and reproduce.
- Describe how a particular trait may be selected over time and account for a species' adaptation.
- Compare and contrast animals and plants that have very specific survival requirements with those that have more general requirements for survival.
- Explain how living things respond to changes in their environment.
- Explain how one species may survive an environmental change while another might not.

7.C Explain natural or human actions in relation to the loss of species.
- Identify natural or human impacts that cause habitat loss.
- Explain how habitat loss can affect the interaction among species and the population of a species.
- Analyze and explain the changes in an animal population over time.
- Explain how a habitat management practice affects a population.
- Explain the differences among threatened, endangered, and extinct species.
- Identify Pennsylvania plants and animals that are on the threatened or endangered list.
- Describe state laws passed regarding threatened or endangered species in Pennsylvania.
- Explain why one species may be more susceptible to becoming endangered than another species.

4.8 *Humans and the Environment*

7.A Describe how the development of civilization relates to the environment.
- Explain how people use natural resources in their environment.
- Locate and identify natural resources in different parts of the world.
- Compare and contrast how people use natural resources throughout the world.

7.B Explain how people use natural resources.
- Describe how natural resources are used for survival.
- Explain how natural resources and technological changes have affected the development of civilizations.
- Explain how climate and extreme weather events (e.g., drought, flood) influence people's lives.

7.C Explain how human activities may affect local, regional, and national environments.
- Describe what effect consumption and related generation of wastes have on the environment.
- Explain how a particular human activity has changed the local area over the years.

7.D Explain the importance of maintaining the natural resources at the local, state, and national levels.
- Explain how human activities and natural events have affected ecosystems.
- Explain how conservation practices have influenced ecosystems.
- Define the roles of Pennsylvania agencies that deal with natural resources.

4.9 *Environmental Laws and Regulations*

7.A Explain the role of environmental laws and regulations.
- Identify and explain environmental laws and regulations (e.g., Clean Air Act, Clean Water Act, Recycling and Waste Reduction Act, Act 26 on Agricultural Education).
- Explain the role of local and state agencies in enforcing environmental laws and regulations (e.g., Department of Environmental Protection, Department of Agriculture, Game Commission).

Connecting Assessment to Instruction, Answer Guide

PSSA Science Performance Indicator Grade 8, Form B

This answer guide will help you connect each ***PSSA Science Performance Indicator*** test question directly to the appropriate assessment anchor and eligible content lesson in the ***PSSA Finish Line Science, Grade 8*** workbook. The correlation to the anchor and eligible content will assist you in providing more focused instruction in the areas in which students may require additional support.

Question	Answer	Standard	Assessment Anchor and Eligible Content	*PSSA Finish Line Science, Grade 8*
1	B	3.7.7.A	S8.A.2.2.1	Unit 1, Lesson 6
2	D	3.3.7.D	S8.B.2.1.1	Unit 2, Lesson 4
3	B	3.4.7.A	S8.C.1.1.2	Unit 3, Lesson 1
4	A	3.5.7.A	S8.D.1.1.1	Unit 4, Lesson 1
5	B	3.3.7.C	S8.B.2.2.1	Unit 2, Lesson 3
6	D	3.3.7.C	S8.B.2.2.2	Unit 2, Lesson 3
7	D	3.1.7.E	S8.A.1.3.2	Unit 1, Lesson 3
8	A	4.6.7.A	S8.A.3.1.4	Unit 1, Lesson 2
9	A	3.4.7.B	S8.C.2.1.1	Unit 3, Lesson 4
10	A	3.4.7.B	S8.A.3.1.2	Unit 1, Lesson 2
11	C	4.2.7.B	S8.C.2.2.3	Unit 3, Lesson 6
12	D	3.2.7.B	S8.A.2.1.2	Unit 1, Lesson 7
13	D	3.2.7.B	S8.A.3.3.2	Unit 1, Lesson 4
14	C	3.4.7.B	S8.C.2.1.2	Unit 3, Lesson 5
15	A	3.4.7.D	S8.D.3.1.1	Unit 4, Lesson 6
16	C	3.2.7.B	S8.A.1.1.3	Unit 1, Lesson 1
17	Open-ended	3.2.7.D	S8.A.2.1.5	Unit 1, Lesson 8
18	C	4.4.7.B	S8.D.1.1.4	Unit 4, Lesson 1
19	C	3.3.7.D	S8.B.2.1.2	Unit 2, Lesson 4
20	D	3.3.7.D	S8.C.3.1.1	Unit 3, Lesson 7
21	B	3.2.7.A	S8.A.1.1.4	Unit 1, Lesson 1
22	B	3.1.7.D	S8.A.2.1.3	Unit 1, Lesson 7
23	C	3.2.7.A	S8.A.1.1.1	Unit 1, Lesson 1
24	A	3.2.7.C	S8.A.1.2.4	Unit 1, Lesson 9
25	B	4.4.7.B	S8.D.1.1.3	Unit 4, Lesson 2
26	B	3.5.7.D	S8.D.1.3.1	Unit 4, Lesson 3
27	C	4.8.7.C	S8.A.1.3.3	Unit 1, Lesson 3
28	A	4.7.7.B	S8.B.2.1.4	Unit 2, Lesson 4
29	D	3.1.7.A	S8.A.3.1.1	Unit 1, Lesson 2
30	B	3.2.7.B	S8.A.3.2.2	Unit 1, Lesson 5
31	Open-ended	4.3.7.B	S8.A.3.2.3	Unit 2, Lesson 8
32	C	3.4.7.A	S8.C.1.1.3	Unit 3, Lesson 3
33	C	3.3.7.C	S8.B.2.1.5	Unit 2, Lesson 4

34	D	3.1.7.B	S8.A.3.2.1	Unit 1, Lesson 5
35	A	3.5.7.D	S8.D.1.3.2	Unit 4, Lesson 3
36	B	3.2.7.B	S8.A.2.1.4	Unit 1, Lesson 8
37	B	3.6.7.C	S8.A.1.2.3	Unit 1, Lesson 9
38	C	4.6.7.A	S8.B.3.1.3	Unit 2, Lesson 6
39	D	3.2.7.D	S8.A.2.1.6	Unit 1, Lesson 9
40	A	3.1.7.D	S8.A.1.3.1	Unit 1, Lesson 3
41	Open-ended	3.4.7.B	S8.C.2.1.3	Unit 3, Lesson 5
42	C	3.2.7.B	S8.A.2.1.1	Unit 1, Lesson 8
43	B	3.4.7.D	S8.D.3.1.2	Unit 4, Lesson 6
44	C	4.2.7.B	S8.C.2.2.2	Unit 3, Lesson 6
45	B	3.8.7.B	S8.A.1.2.1	Unit 1, Lesson 9
46	B	3.5.7.D	S8.D.1.3.3	Unit 4, Lesson 3
47	A	3.3.7.C	S8.B.2.1.3	Unit 2, Lesson 4
48	B	3.1.7.E	S8.A.1.3.4	Unit 1, Lesson 3
49	C	3.1.7.A	S8.A.3.1.3	Unit 1, Lesson 2
50	B	3.1.7.C	S8.A.3.3.1	Unit 1, Lesson 4
51	Open-ended	4.2.7.C	S8.D.1.2.1	Unit 4, Lesson 4
52	C	3.8.7.C	S8.A.1.2.2	Unit 1, Lesson 9
53	D	3.1.7.A	S8.A.3.1.5	Unit 1, Lesson 2
54	A	3.4.7.C	S8.C.3.1.2	Unit 3, Lesson 7
55	C	3.5.7.C	S8.D.2.1.3	Unit 4, Lesson 5
56	D	3.1.7.D	S8.A.2.2.2	Unit 1, Lesson 6
57	A	3.4.7.C	S8.C.3.1.3	Unit 3, Lesson 8
58	B	4.5.7.B	S8.B.3.3.4	Unit 2, Lesson 7
59	C	3.2.7.C	S8.A.1.1.2	Unit 1, Lesson 1
60	B	3.1.7.B	S8.A.3.2.3	Unit 1, Lesson 5
61	Open-ended	3.3.7.A	S8.A.2.2.3	Unit 1, Lesson 6

Science

Grade 8

Teacher's Guide and Answer Key

Continental Press
520 East Bainbridge Street ▪ Elizabethtown, PA 17022
800.233.0759 ▪ www.continentalpress.com

ISBN 0-8454-K5382-3