

# Science-Related Skills Assessed on the Reading Test

## ▶ Information and Ideas

- ▶ **Reading closely** — These questions focus on the explicit and implicit meaning of text and on extrapolating beyond the information and ideas in a text.
  - Determining explicit meanings — The student will identify information and ideas explicitly stated in text.
  - Determining implicit meanings — The student will draw reasonable inferences and logical conclusions from text.
  - Using analogical reasoning — The student will extrapolate in a reasonable way from the information and ideas in a text or apply information and ideas in a text to a new, analogous situation.
- ▶ **Citing textual evidence** — The student will cite the textual evidence that best supports a given claim or point.

# Science-Related Skills Assessed on the Reading Test (continued)

- ▶ **Summarizing** — The student will identify a reasonable summary of a text or of key information and ideas in text.
- ▶ **Understanding relationships** — The student will identify explicitly stated relationships or determine implicit relationships between and among individuals, events, or ideas (e.g., cause-effect, comparison-contrast, sequence).
- ▶ **Interpreting words and phrases in context** — The student will determine the meaning of words and phrases in context.
  
- ▶ **Synthesis**
  - ▶ **Analyzing multiple texts** — The student will synthesize information and ideas from paired texts.
  - ▶ **Analyzing quantitative information** — The student will analyze information presented quantitatively in such forms as graphs, tables, and charts and/or relate that information to information presented in text.

# Science Sample Paired Passages

Questions 1–11 are based on a set of passages. Passage 1 is adapted from Nicholas Carr, “Author Nicholas Carr: The Web Shatters Focus, Rewires Brains.” ©2010 by Condé Nast. Passage 2 is from Steven Pinker, “Mind Over Mass Media.” ©2010 by The New York Times Company.

## Passage 1:

The mental consequences of our online info-crunching are not universally bad. Certain cognitive skills are strengthened by our use of computers and the Net. These tend to involve more primitive mental functions, such as hand-eye coordination, reflex response, and the processing of visual cues....

## Passage 2:

Critics of new media sometimes use science itself to press their case, citing research that shows how “experience can change the brain.” But cognitive neuroscientists roll their eyes at such talk....

# Interpreting Words and Phrases In Context — Sample Question

4. As used in line 42, “plastic” most nearly means
- A) creative.
  - B) artificial.
  - C) malleable.
  - D) sculptural.

*In order to comprehend challenging texts and communicate effectively, students need a well-developed vocabulary and a range of vocabulary-related skills, including the ability to determine the meaning of words and phrases as they’re used in particular contexts.*

# Analyzing Multiple Texts Sample Question

10. On which of the following points would the authors of both passages most likely agree?
- A) Computer-savvy children tend to demonstrate better hand-eye coordination than do their parents.
  - B) Those who criticize consumers of electronic media tend to overreact in their criticism.
  - C) Improved visual-spatial skills do not generalize to improved skills in other areas.
  - D) Internet users are unlikely to prefer reading onscreen text to reading actual books.

*The student must be able to synthesize information and ideas from paired texts.*

# Citing Textual Evidence Sample Question

11. Which choice provides the best evidence that the author of Passage 2 would agree to some extent with the claim attributed to Michael Merzenich in lines 43–45, Passage 1?
- A) Lines 56–58 (“Critics... brain”)
  - B) Lines 60–61 (“Yes... changes”)
  - C) Lines 62–65 (“But... experience”)
  - D) Lines 91–92 (“Media... consumes”)

*Students must understand what counts as evidence in science and be able to evaluate how – and how effectively – particular authors and speakers use (or fail to use) evidence to support their claims and points.*

# Analyzing Arguments Sample Question

This passage is adapted from J. D. Watson and F. H. C. Crick, “Genetical Implications of the Structure of Deoxyribonucleic Acid.” ©1953 by Nature Publishing Group.

The chemical formula of deoxyribonucleic acid (DNA) is now well established. The molecule is a very long chain, the backbone of which consists of a regular alternation of sugar and phosphate groups. To each sugar is attached a nitrogenous base, which can be of four different types. Two of the possible bases — adenine and guanine — are purines, and the other two — thymine and cytosine — are pyrimidines. So far as is known, the sequence of bases along the chain is irregular. The monomer unit, consisting of phosphate, sugar and base, is known as a nucleotide....

2. A student claims that nitrogenous bases pair randomly with one another. Which of the following statements in the passage contradicts the student’s claim?
- A) Lines 5–6 (“To each... types”)
  - B) Lines 9–10 (“So far... irregular”)
  - C) Lines 25–27 (“The bases... other”)
  - D) Lines 29–31 (“One member... chains”)

# Tasks Related to Informational Graphics on the Reading Test

- ▶ **Basic:** Interpret the graph.
- ▶ **More Complex:** Draw a conclusion from the graph.
- ▶ **Most Complex:** Draw a connection between the text and the graph.



# Analyzing Quantitative Information

## Sample Question

8. Do the data in the table support the authors' proposed pairing of bases in DNA?

| Base Composition of DNA |                                      |             |              |             |
|-------------------------|--------------------------------------|-------------|--------------|-------------|
| Organism                | Percentage of base in organism's DNA |             |              |             |
|                         | adenine (%)                          | guanine (%) | cytosine (%) | thymine (%) |
| Maize                   | 26.8                                 | 22.8        | 23.2         | 27.2        |
| Octopus                 | 33.2                                 | 17.6        | 17.6         | 31.6        |
| Chicken                 | 28.0                                 | 22.0        | 21.6         | 28.4        |
| Rat                     | 28.6                                 | 21.4        | 20.5         | 28.4        |
| Human                   | 29.3                                 | 20.7        | 20.0         | 30.0        |
| Grasshopper             | 29.3                                 | 20.5        | 20.7         | 29.3        |
| Sea urchin              | 32.8                                 | 17.7        | 17.3         | 32.1        |
| Wheat                   | 27.3                                 | 22.7        | 22.8         | 27.1        |
| Yeast                   | 31.3                                 | 18.7        | 17.1         | 32.9        |
| <i>E. coli</i>          | 24.7                                 | 26.0        | 25.7         | 23.6        |

Adapted from Manju Bansal, "DNA Structure: Revisiting the Watson-Crick Double Helix." ©2003 by Current Science Association, Bangalore.

- A) Yes, because for each given organism, the percentage of adenine is closest to the percentage of thymine, and the percentage of guanine is closest to the percentage of cytosine.
- B) Yes, because for each given organism, the percentage of adenine is closest to the percentage of guanine, and the percentage of cytosine is closest to the percentage of thymine.
- C) No, because for each given organism, the percentage of adenine is closest to the percentage of thymine, and the percentage of guanine is closest to the percentage of cytosine.
- D) No, because for each given organism, the percentage of adenine is closest to the percentage of guanine, and the percentage of cytosine is closest to the percentage of thymine.

# Instructional Strategies — Reading Test

- ▶ Give students opportunities to practice reading long passages of 500+ words in which text and data (e.g. tables or graphs) are paired. Give students the opportunity to read and analyze not only authentic science articles, but also articles written about science.
- ▶ Allow students to examine tables, charts, and graphs prior to reading or discussing explanations of the data. Give them an opportunity to generate hypotheses about the data and then confirm or contrast their ideas with the textual conclusions.
- ▶ Practice synthesis by asking students to read primary and secondary sources on the same science topic, identifying ambiguities, areas of agreement and disagreement among authors, and the limits of scientific thinking.

# Instructional Strategies — Reading Test (continued)

- ▶ Promote close reading of complex text by asking students to consider and discuss:
  - ▶ What the text says explicitly
  - ▶ What reasonable inferences and conclusions can be drawn
  - ▶ What textual evidence supports their analysis (quotations, facts, figures, etc.)

# Science-Related Skills Assessed on the Writing and Language Test

**Expression of Ideas** — These questions focus on revision of text for topic development, accuracy (consistency between text and graphic[s]), logic, cohesion, and rhetorically effective use of language.

## ▶ Development

- ▶ Proposition — The student will add, revise, or retain central ideas, main claims, counterclaims, topic sentences, and the like to structure text and convey arguments, information, and ideas clearly and effectively.
- ▶ Support — The student will add, revise, or retain information and ideas (e.g., details, facts, statistics) intended to support claims or points in text.
- ▶ Focus — The student will add, revise, retain, or delete information and ideas in text for the sake of relevance to topic and purpose.
- ▶ Quantitative information — The student will relate information presented quantitatively in such forms as graphs, charts, and tables to information presented in text.

# Science-Related Skills Assessed on the Writing and Language Test (continued)

- ▶ **Organization** — These questions focus on revision of text to improve the logic and cohesion of text at the sentence, paragraph, and whole-text levels.
- ▶ **Effective language use** — These questions focus on revision of text to improve the use of language to accomplish particular rhetorical purposes.
  - ▶ Precision — The student will revise text as needed to improve the exactness or content appropriateness of word choice.

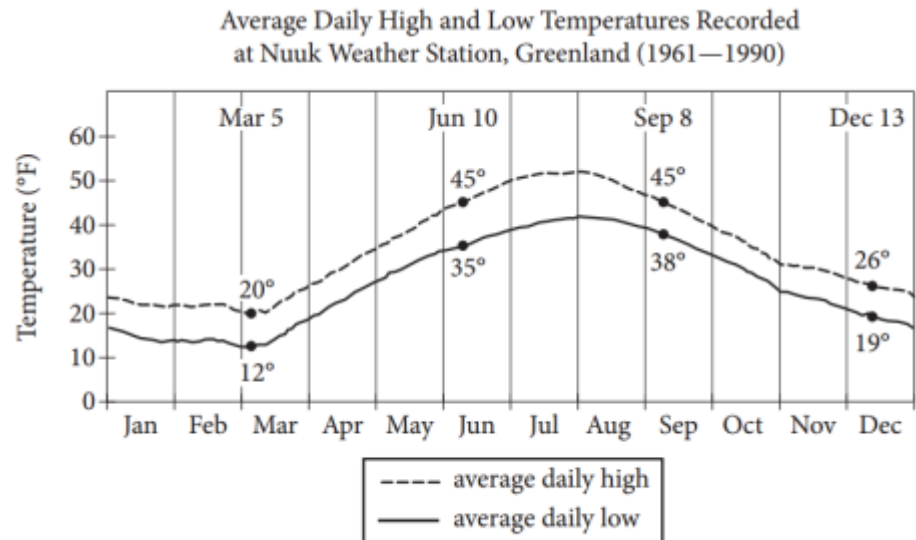
# Tasks Related to Informational Graphics on the Writing and Language Test

- ▶ **Basic:** Interpret data on the graphic correctly.
- ▶ **More Complex:** Correct a misinterpretation of what the data in the graph shows.
- ▶ **Most Complex:** Use data in the graphic to offer or improve support for a claim.

# Informational Graphic — Analyzing Quantitative Information

The size of the ice sheet fluctuates seasonally: in summer, average daily high temperatures in Greenland can rise to slightly above 50 degrees Fahrenheit, partially melting the ice; in the winter, the sheet thickens as additional snow falls, and average daily low temperatures can drop 1 to as low as 20 degrees.

- Which choice most accurately and effectively represents the information in the graph?
  - NO CHANGE
  - to 12 degrees Fahrenheit.
  - to their lowest point on December 13.
  - to 10 degrees Fahrenheit and stay there for months.



Adapted from WMO. ©2014 by World Meteorological Organization.

# Revising and Editing to Strengthen Arguments

...“Soot is an extremely powerful light absorber. It settles over the ice and captures the Sun’s heat.” The result is a self-reinforcing cycle. As the ice melts, the land and water under the ice become exposed, and since land and water are darker than snow, the surface absorbs even more heat, which **9** is related to the rising temperatures.

9. Which choice best completes the description of self-reinforcing cycle?
- A) NO CHANGE
  - B) raises the surface temperature.
  - C) begins to cool at a certain point.
  - D) leads to additional melting



# Instructional Strategies — Writing and Language Test

- ▶ Teach students in all classes to practice writing and language analysis skills — using effective language, clearly expressing ideas, and properly utilizing standard English conventions — to develop their analyses of social studies, science, and career-related passages.
- ▶ Familiarize students with the analysis of graphs, and charts in conjunction with text. Using the informational graphics in a textbook or periodical, provide students with inaccurate interpretations of graphics and ask them to correct the error(s). Have them explicitly describe the data they used to make each correction.
- ▶ Provide students with a science paper accompanied by an informational graphic. Ask students to use evidence (i.e., descriptive details and data from informational graphics) to add or refine central ideas, develop and strengthen claims and points, sharpen focus, and improve precision and accuracy.

# Math Test: Analysis in a Science Context

# Math Test Format

- ▶ Three Math subscores
  - ▶ Heart of Algebra
  - ▶ Problem Solving and Data Analysis
  - ▶ Passport to Advanced Math
- ▶ Two Portions
  - ▶ Calculator permitted
  - ▶ No-Calculator
- ▶ Two question types
  - ▶ Multiple Choice
  - ▶ Student-Produced Response

Answer:  $\frac{7}{12}$

Write answer in boxes. →

|   |   |   |   |
|---|---|---|---|
| 7 | / | 1 | 2 |
| . | ● | / | . |
| 0 | 0 | 0 | 0 |
| ① | ① | ● | ① |
| ② | ② | ② | ● |
| ③ | ③ | ③ | ③ |
| ④ | ④ | ④ | ④ |
| ⑤ | ⑤ | ⑤ | ⑤ |
| ⑥ | ⑥ | ⑥ | ⑥ |
| ● | ⑦ | ⑦ | ⑦ |
| ⑧ | ⑧ | ⑧ | ⑧ |
| ⑨ | ⑨ | ⑨ | ⑨ |

Grid in result. {

Answer: 2.5

← Fraction line

|   |   |   |   |
|---|---|---|---|
|   | 2 | . | 5 |
| . | / | / | . |
| ● | 0 | ● | 0 |
| ① | ① | ① | ① |
| ② | ● | ② | ② |
| ③ | ③ | ③ | ③ |
| ④ | ④ | ④ | ④ |
| ⑤ | ⑤ | ⑤ | ● |
| ⑥ | ⑥ | ⑥ | ⑥ |
| ⑦ | ⑦ | ⑦ | ⑦ |
| ⑧ | ⑧ | ⑧ | ⑧ |
| ⑨ | ⑨ | ⑨ | ⑨ |

← Decimal point

# Assessing Math Skills in Science Contexts

- ▶ Emphasis on students' ability to apply math knowledge and skills to solve problems and analyze data grounded in authentic and meaningful science contexts.
- ▶ Questions call on students to consider scenarios, analyze data, and solve problems reflecting real-world tasks in sciences.
- ▶ Tasks are aligned with Advanced Placement<sup>®</sup> Science Practices.
  - ▶ Science Practice 2: The student can use mathematics appropriately.
  - ▶ Science Practice 4: The student can plan and implement data collection strategies in relation to a particular scientific question.
  - ▶ Science Practice 5: The student can perform data analysis and evaluation of evidence.
- ▶ Prior knowledge of specific science topics is not assessed on the Math Test.

# Science-Related Skills — Math Test

## ▶ Conceptual Understanding

- ▶ Interpret the variables and constants in expressions for linear functions within the context presented.
  - The student will make connections between a context and the linear function that models the context and will identify or describe the real-life meaning of a constant term, a variable, or a feature of the given equation.
- ▶ Use the relationship between two variables to investigate key features of the graph.
  - The student will make connections between the graphical representation of a relationship and properties of the graph by selecting the graph that represents the properties described; using the graph to identify a value or set of values.
- ▶ Evaluate reports to make inferences, justify conclusions, and determine appropriateness of data collection methods.
  - The student will evaluate reports to make inferences, justify conclusions, and determine appropriateness of data collection methods. The reports may consist of tables, graphs, and text summaries.

# Math Test Sample Question #1 — No Calculator

Student-Produced Response Question

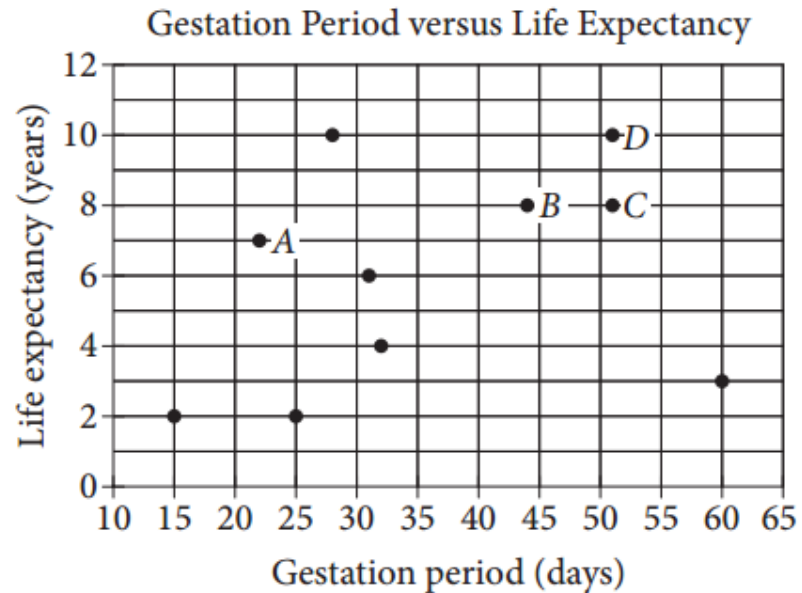
## Heart of Algebra

1. The mesosphere is the layer of Earth's atmosphere between 50 kilometers and 85 kilometers above Earth's surface. At a distance of 50 kilometers from Earth's surface, the temperature in the mesosphere is  $-5^{\circ}$  Celsius, and at a distance of 80 kilometers from Earth's surface, the temperature in the mesosphere is  $-80^{\circ}$  Celsius. For every additional 10 kilometers from Earth's surface, the temperature in the mesosphere decreases by  $k^{\circ}$  Celsius, where  $k$  is a constant. What is the value of  $k$ ?

# Math Test Sample Question #2 — Calculator

## Problem Solving and Data Analysis

2. What is the life expectancy, in years, of the animal that has the longest gestation period?
- A) 3
  - B) 4
  - C) 8
  - D) 10



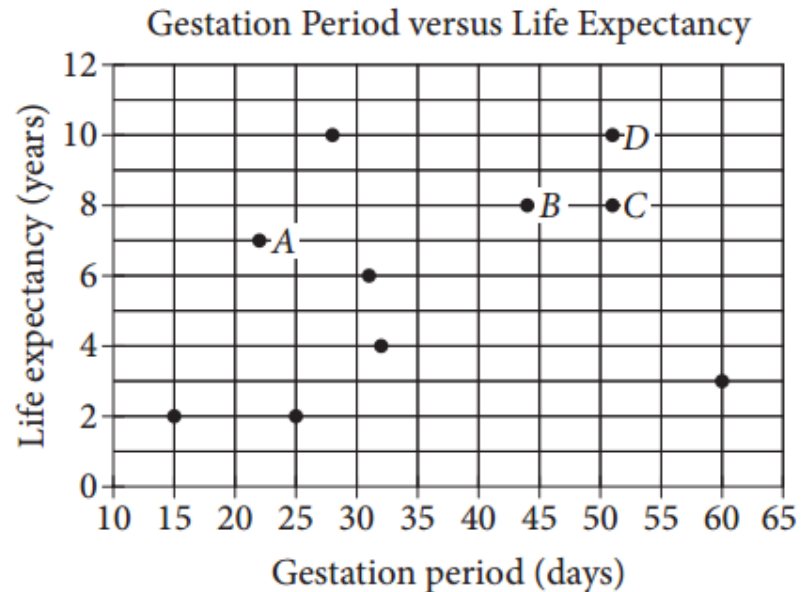
A curator at a wildlife society created the scatterplot above to examine the relationship between the gestation period and life expectancy of 10 species of animals.

# Math Test Sample Question #3 — Calculator

## Problem Solving and Data Analysis

3. Of the labeled points, which represents the animal for which the ratio of life expectancy to gestation period is greatest?

- A) A
- B) B
- C) C
- D) D



A curator at a wildlife society created the scatterplot above to examine the relationship between the gestation period and life expectancy of 10 species of animals.



# Math Test Sample Question #4 — Calculator

## Problem Solving and Data Analysis

4. Katarina is a botanist studying the production of pears by two types of pear trees. She noticed that Type A trees produced 20 percent more pears than Type B trees did. Based on Katarina's observation, if the Type A trees produced 144 pears, how many pears did the Type B trees produce?
- A) 115
  - B) 120
  - C) 124
  - D) 173

# Math Test Sample Question #5 — Calculator

## Passport to Advanced Math

5.

$$h = -4.9t^2 + 25t$$

The equation above expresses the approximate height  $h$ , in meters, of a ball  $t$  seconds after it is launched vertically upward from the ground with an initial velocity of 25 meters per seconds. After approximately how many seconds will the ball hit the ground?

- A) 3.5
- B) 4.0
- C) 4.5
- D) 5.0

# Instructional Strategies — Math Test

- ▶ Help students become fluent in working with numbers and data that are important in reading, writing, and communicating about texts and topics in science by regularly gathering, organizing, and analyzing relevant data.
- ▶ Give students opportunities to practice fluency of mathematical skills by asking them to work to solve problems without the use of calculators.
- ▶ Emphasize finding relationships between variables — linear, quadratic, and exponential relationships.
- ▶ Review data collection techniques and determine appropriateness of data collection methods; evaluate reports and develop conclusions based on the data.