Exemplar Grade 4 Science Test Questions

ACT® Aspire®

discoveractaspire.org

Introduction

This booklet explains ACT Aspire® Grade 4 Science test questions by presenting, with their answer keys, sample questions aligned to each reporting category on the test. A key includes the question's depth-of-knowledge (DOK) level,[1] an explanation of the task posed by each question, a thorough explanation of correct responses, ideas for improvement, and more. The exemplar test questions included here are representative of the range of content and types of questions found on the ACT Aspire Grade 4 Science test. Educators can use this resource in several ways:

- Become familiar with ACT Aspire question types.
- See what typical questions in each ACT Aspire reporting category look like.
- Help reinforce or adjust teaching and learning objectives.
- Learn how ACT Aspire improvement idea statements can help students identify key skills they have not yet mastered.

The ACT Aspire Science tests focus on the assessment of science practices using real-world scientific scenarios. At the earlier grades, topics generally focus on everyday student discovery rather than formal science. The scenarios in the upper grade assessments include student investigations, formal scientific research, formal scientific data from references, and students or scientists providing competing explanations for real scientific phenomena.

The content of the tests includes material from biology (life sciences at the earlier grades), chemistry and physics (physical science at the earlier grades), and Earth/space sciences (such as geology, astronomy, and meteorology). Advanced knowledge in these areas is not required, but background knowledge acquired in general, introductory science courses may be needed to answer some of the questions in the upper grade assessments. The tests do not, however, sample specific content knowledge with enough regularity to make inferences about a student's attainment of any broad area, or specific part, of the science content domain. The ACT Aspire tests stress science practices over recall of scientific content, complex mathematics skills, and reading ability. To that end, the ACT Aspire Science tests assess science practices in three domains: Interpretation of Data; Scientific Investigation; and Evaluation of Models, Inferences, and Experimental Results.

[1] Norman L. Webb, "Depth-of-Knowledge Levels for Four Content Areas," last modified March 28, 2002, **http://facstaff.wcer.wisc.edu/normw/All%20content%20areas%20%20DOK%20levels%2032802.doc**.

The ACT Aspire tests currently include selected-response (multiple-choice) questions, technology-enhanced items (online only), and constructed-response tasks. In the technology-enhanced items, students must carry out actions such as moving objects, typing in their answers, and manipulating bar and line graphs to provide their responses. The constructed-response tasks require students to produce, rather than select, a response. Constructed-response tasks assess complex reasoning or thinking skills by providing opportunities for students to explain, justify, critique, create, propose, produce, design, or otherwise demonstrate their knowledge and understanding in ways that are not typically assessed through selected-response items. Constructed-response tasks are scored according to scoring criteria unique to each item. The scoring criteria identify the specific information a student needs to include for a valid and complete response. Depending on the item, a holistic rubric may also be used to score the item. The holistic rubric is used to assess the overall proficiency of the response, allowing for differentiation among multiple skill levels. Some constructed-response tasks, called composite tasks, blend technology-enhanced or selected-response elements with open response.

Improvement Ideas

ACT Aspire includes simple improvement ideas at the reporting category (skill) level on student and parent reports. These improvement ideas are provided for the lowest performing skill for each subject tested. The skills are always ordered from highest performing to lowest performing based on the percentage of points correct. If the percentages for two or more skills are tied, the skill with the lower number of total points is displayed first.

Keep in mind that the order of skills listed on reports may not always be exemplary of where to focus learning. For example, the skills in which a student performed within the ACT Readiness Range may not always be listed first, and the skills in which a student did not perform within the ACT Readiness Range may not always be listed last. Also, keep in mind the total number of points possible in each skill when interpreting the percentage correct.

There are two levels of improvement idea statements (low and high) for ACT Aspire summative reporting. Low statements are given on the report if the student's lowest skill score is below the ACT Readiness Range for that particular skill. High statements are given on the report if the student's lowest skill score is at or above the ACT Readiness Range for that particular skill.

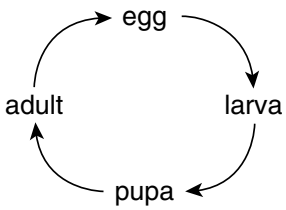
Answer Key

This section presents the grade, item type, DOK level, alignment to the ACT Aspire reporting categories, and correct response for each question. Each question is accompanied by an explanation of the question and the correct response as well as improvement idea statements for ACT Aspire Science.

In the life cycle of a butterfly, an adult butterfly lays an egg. A *larva* (a caterpillar) hatches from the egg. The larva grows and then forms a hard shell, becoming a *pupa*. The pupa then becomes an adult butterfly (see Figure 1).

Figure 1

Life cycle of a butterfly



Students studied how temperature effects the life cycle of one type of butterfly.

Study

The students put cabbage leaves in 30 jars. They added a butterfly egg to each jar and then covered each jar with a lid that had holes in it. They kept 10 jars at a temperature of 17°C, another 10 jars at 22°C, and the last 10 jars at 27°C. Each day, the students looked for any changes in the jars, and they added fresh cabbage leaves to the jars. For each jar, the students recorded the number of days:

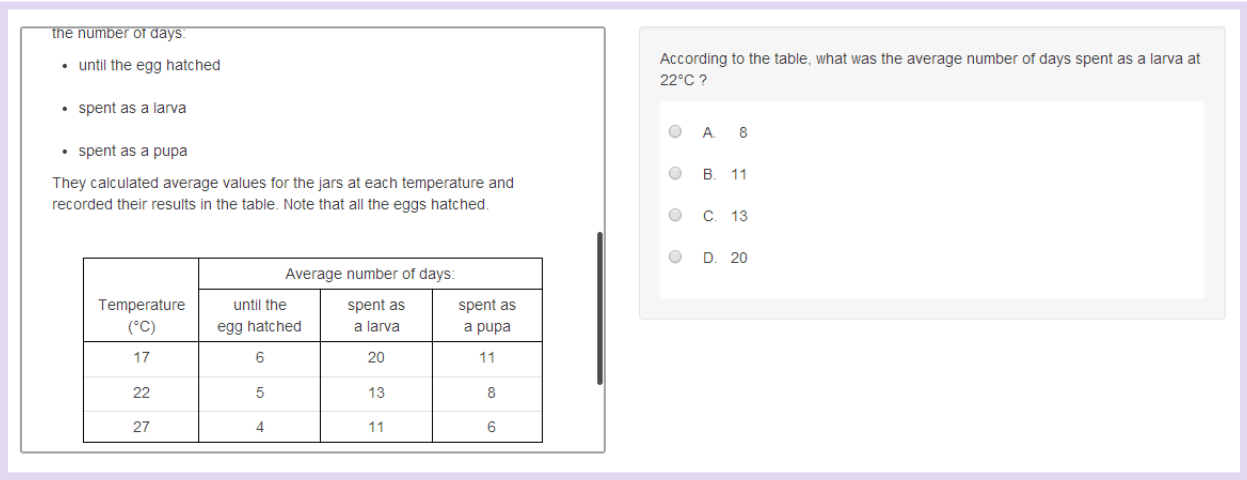
- until the egg hatched
- spent as a larva
- spent as a pupa

They calculated average values for the jars at each temperature and recorded their results in the table. Note that all the eggs hatched.

Temperature (°C)	Average number of days:		
	until the egg hatched	spent as a larva	spent as a pupa
17	6	20	11
22	5	13	8
27	4	11	6

Table adapted from O. W. Richards, "The Biology of the Small White Butterfly (*Pieris rapae*), with Special Reference to the Factors Controlling Its Abundance." ©1940 by John Wiley and Sons, Inc.

Question 1



the number of days:

- until the egg hatched
- spent as a larva
- spent as a pupa

They calculated average values for the jars at each temperature and recorded their results in the table. Note that all the eggs hatched.

Temperature (°C)	Average number of days: until the egg hatched	spent as a larva	spent as a pupa
17	6	20	11
22	5	13	8
27	4	11	6

According to the table, what was the average number of days spent as a larva at 22°C ?

A. 8
B. 11
C. 13
D. 20

Sequence	Grade	Question type	DOK level	Reporting category	Correct response
1	4	Selected Response	1	Interpretation of Data	C

This question requires the examinee to select a single piece of data in the table based on a given condition.

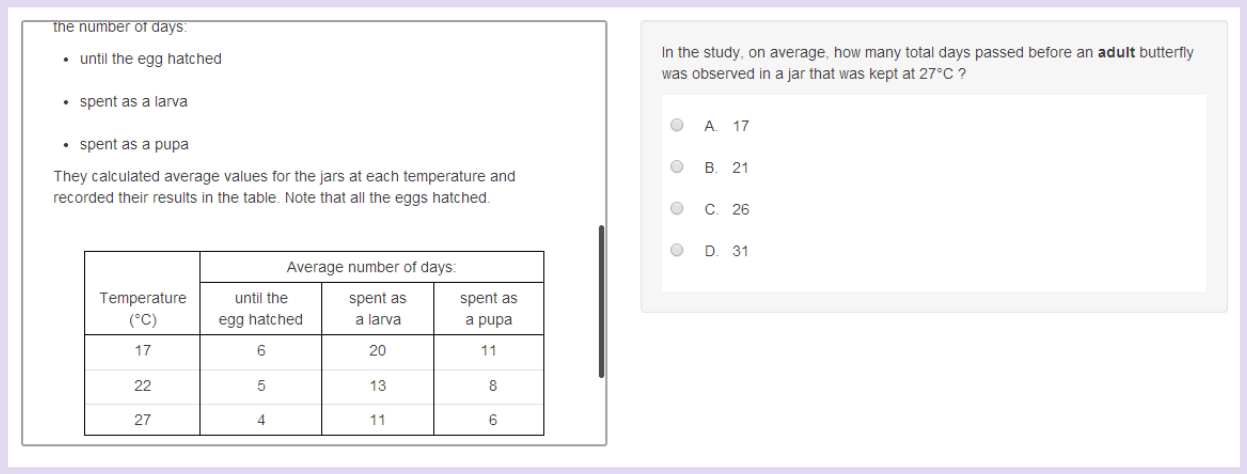
Correct Response

According to the table, the average number of days spent as a larva at 22°C was 13 days, making answer option C the correct response.

Improvement Idea Statements

Reporting category	Grade	Low statement (scored below ACT Readiness Range)	High statement (scored at or above ACT Readiness Range)
Interpretation of Data	4	Generate and interpret a greater number and variety of data presentations (tables, line plots, pictographs, bar graphs). Begin working with more advanced data presentations (dense tables, line graphs).	Generate and interpret more advanced data presentations (dense tables, line graphs). Think about who will use a data presentation to decide how to present data in the most accurate and useful way.

Question 2



Sequence	Grade	Question type	DOK level	Reporting category	Correct response
2	4	Selected Response	2	Scientific Investigation	B

This question requires the examinee to understand an aspect of the design of the study in order to select and combine data from the table.

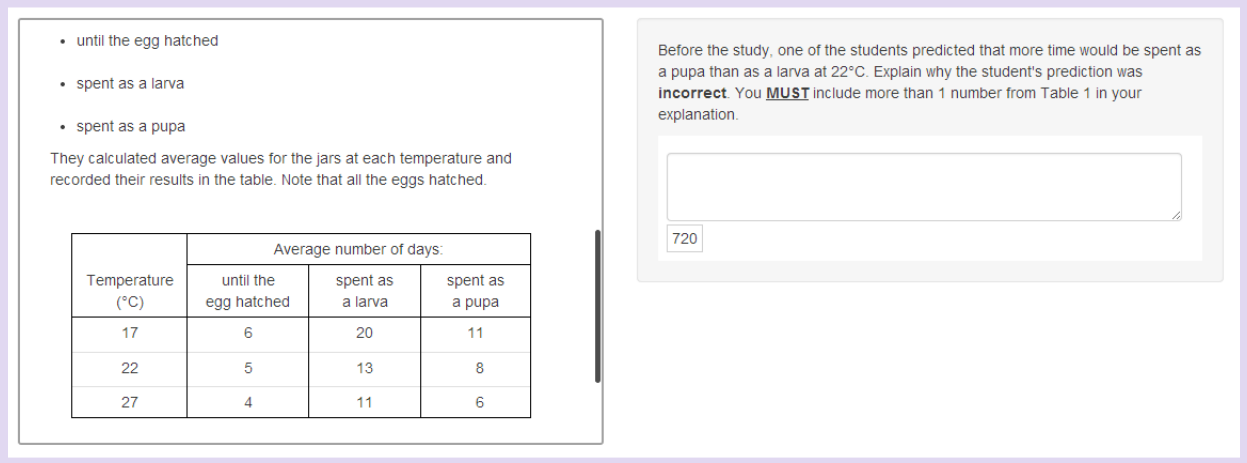
Correct Response

The students observed the jars from the time when they added the eggs until an adult butterfly was observed in a jar, so the total number of days for the jars kept at 27°C would be the sum of the average number of days until the egg hatched (4 days), the average number of days spent as a larva (11 days), and the average number of days spent as a pupa (6 days). So, on average, 21 days passed before an adult butterfly was observed in a jar. Answer option B is the correct response.

Improvement Idea Statements

Reporting category	Grade	Low statement (scored below ACT Readiness Range)	High statement (scored at or above ACT Readiness Range)
Scientific Investigation	4	Generate questions that can be investigated and then design and perform simple investigations that will validly test the questions. Start to examine more complex scientific investigations.	Generate questions that can be investigated and then design and perform scientific investigations to validly test the questions. Evaluate the methods and procedures used in others' investigations.

Question 3



Sequence	Grade	Question type	DOK level	Reporting category	Correct response
3	4	Constructed Response	2	Evaluation of Models, Inferences, and Experimental Results	See scoring guide.

This task requires the examinee to explain why a prediction was incorrect. The examinee must determine which experimental results support their explanation and cite these results in the explanation.

Scoring Guide

2 points; analytic

Rubric

Score	Description
2	The response explains why the student's prediction was incorrect **AND** includes more than one number from Table 1 in the explanation.
1	The response explains why the student's prediction was incorrect, but does not use more than one number from Table 1 in the explanation.
0	The response demonstrates little to no understanding of the concept.

Note: A correct statement of the general trend, such as "All spent more time as larvae," should receive a point.

Sample Student Responses

Score	Response
2	More time was spent as a larva than as a pupa (at 22°C). Time spent as a pupa was 8 days, and time spent as a larva was 13 days. **OR** The time spent as a larva was 13 days, which was 5 days more than that spent as a pupa.
1	The prediction is incorrect because (at 22°C) more time was spent as a larva than as a pupa.
0	13 days

Improvement Idea Statements

Reporting category	Grade	Low statement (scored below ACT Readiness Range)	High statement (scored at or above ACT Readiness Range)
Evaluation of Models, Inferences, and Experimental Results	4	Examine the results of simple investigations. Draw conclusions (claims and predictions) from those results. Consider ways to improve those investigations.	Examine the results of scientific investigations. Draw conclusions (claims and predictions) from those results and modify your investigations based on your conclusions.