Exemplar Grade 8 Science Test Questions

ACT® Aspire®

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Introduction

This booklet explains ACT Aspire® Grade 8 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 8 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.

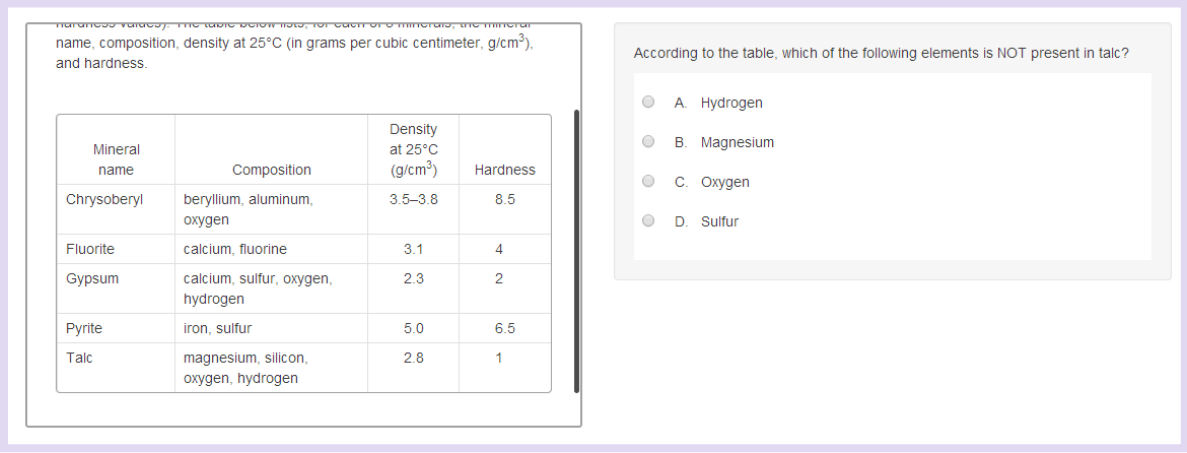
Answer Key

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.

A mineral can often be distinguished from other minerals by its *composition* (the chemical elements that make up the mineral), by its *density* (the mass per unit volume of the mineral), or by its *hardness* (a value from 1 to 10; a mineral with a greater hardness value can scratch all minerals with lesser hardness values). The table below lists, for each of 5 minerals, the mineral name, composition, density at 25°C (in grams per cubic centimeter, g/cm^3), and hardness.

Mineral name	Composition	Density at 25°C (g/cm^3)	Hardness
Chrysoberyl	beryllium, aluminum, oxygen	3.5–3.8	8.5
Fluorite	calcium, fluorine	3.1	4
Gypsum	calcium, sulfur, oxygen, hydrogen	2.3	2
Pyrite	iron, sulfur	5.0	6.5
Talc	magnesium, silicon, oxygen, hydrogen	2.8	1

Question 1



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Gypsum	calcium, sulfur, oxygen, hydrogen	2.3	2
Pyrite	iron, sulfur	5.0	6.5
Talc	magnesium, silicon, oxygen, hydrogen	2.8	1

Sequence	Grade	Question type	DOK level	Reporting category	Correct response
1	8	Selected Response	1	Interpretation of Data	D

This item requires the examinee to select one piece of data from the table.

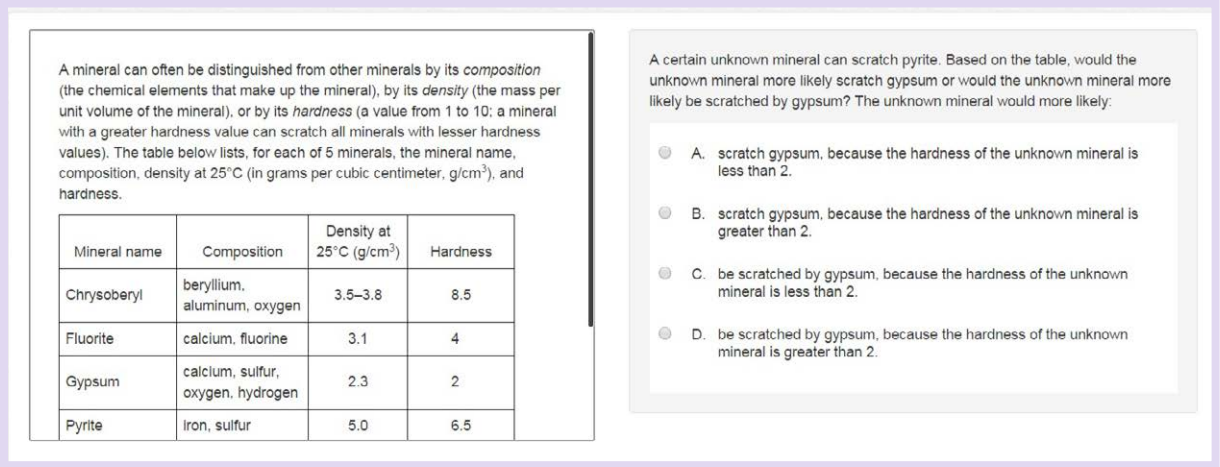
Correct Response

According to the table, the elements present in talc are magnesium, silicon, oxygen, and hydrogen. Sulfur is not one of the elements present in talc.

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	8	Generate and interpret a greater number and variety of data presentations (scientific tables, line graphs, diagrams). Use trends to extend data in data presentations (interpolation, extrapolation).	Carefully consider the intended audience to determine the most accurate and useful way to present data. Use mathematical concepts (interpolation, extrapolation, slope) to interpret and extend from graphs.

Question 2



A mineral can often be distinguished from other minerals by its *composition* (the chemical elements that make up the mineral), by its *density* (the mass per unit volume of the mineral), or by its *hardness* (a value from 1 to 10; a mineral with a greater hardness value can scratch all minerals with lesser hardness values). The table below lists, for each of 5 minerals, the mineral name, composition, density at 25°C (in grams per cubic centimeter, g/cm^3), and hardness.

Mineral name	Composition	Density at 25°C (g/cm^3)	Hardness
Chrysoberyl	beryllium, aluminum, oxygen	3.5–3.8	8.5
Fluorite	calcium, fluorine	3.1	4
Gypsum	calcium, sulfur, oxygen, hydrogen	2.3	2
Pyrite	iron, sulfur	5.0	6.5

A certain unknown mineral can scratch pyrite. Based on the table, would the unknown mineral more likely scratch gypsum or would the unknown mineral more likely be scratched by gypsum? The unknown mineral would more likely:

A. scratch gypsum, because the hardness of the unknown mineral is less than 2.

B. scratch gypsum, because the hardness of the unknown mineral is greater than 2.

C. be scratched by gypsum, because the hardness of the unknown mineral is less than 2.

D. be scratched by gypsum, because the hardness of the unknown mineral is greater than 2.

Sequence	Grade	Question type	DOK level	Reporting category	Correct response
2	8	Selected Response	3	Scientific Investigation	B

This item requires the examinee to predict the results of an experiment.

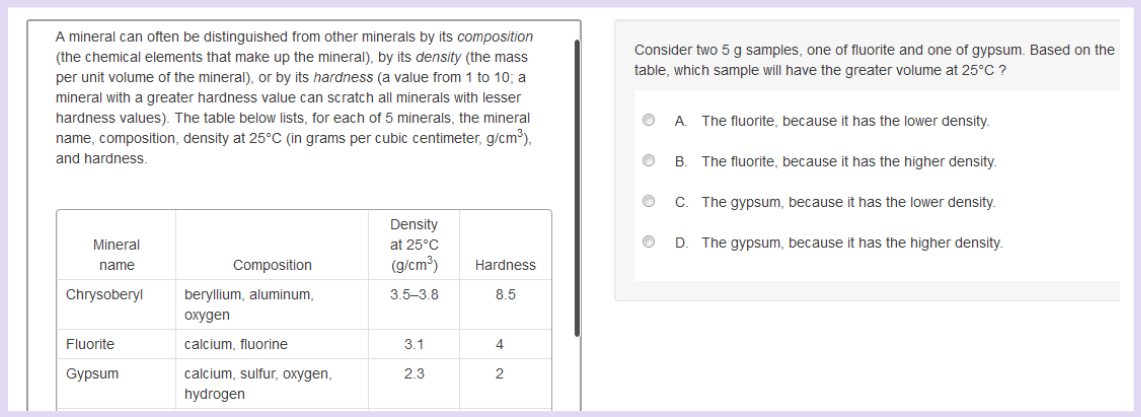
Correct Response

The definition of hardness in the passage says that a mineral with a greater hardness value can scratch all minerals with lesser hardness values. Since the unknown mineral scratched pyrite, it must have a hardness value greater than 6.5, and will therefore scratch any mineral with a lower hardness value, including gypsum (which has a hardness of 2).

Improvement Idea Statements

Reporting category	Grade	Low statement (scored below ACT Readiness Range)	High statement (scored at or above ACT Readiness Range)
Scientific Investigation	8	Generate questions that can be investigated and then design and perform controlled experiments to validly test the questions. Examine complex scientific experiments involving multiple variables.	Generate hypotheses and then design and perform controlled experiments involving multiple variables to validly test the hypotheses. Evaluate experiments for possible sources of measurement error.

Question 3



A mineral can often be distinguished from other minerals by its *composition* (the chemical elements that make up the mineral), by its *density* (the mass per unit volume of the mineral), or by its *hardness* (a value from 1 to 10; a mineral with a greater hardness value can scratch all minerals with lesser hardness values). The table below lists, for each of 5 minerals, the mineral name, composition, density at 25°C (in grams per cubic centimeter, g/cm^3), and hardness.

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Consider two 5 g samples, one of fluorite and one of gypsum. Based on the table, which sample will have the greater volume at 25°C ?

A. The fluorite, because it has the lower density.

B. The fluorite, because it has the higher density.

C. The gypsum, because it has the lower density.

D. The gypsum, because it has the higher density.

Sequence	Grade	Question type	DOK level	Reporting category	Correct response
3	8	Selected Response	2	Evaluation of Models, Inferences, and Experimental Results	C

This item requires the examinee to apply the relationship between mass, volume, and density provided in the passage to data from the table in order to formulate a conclusion.

Correct Response

Based on the density information in the table and the fact that density = mass/volume, a 5 g sample of gypsum will have a greater volume than a 5 g sample of fluorite because the density of gypsum (2.3 g/cm^3) is lower than the density of fluorite (3.1 g/cm^3).

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	8	Compare and evaluate the results of scientific experiments and compare and evaluate competing scientific explanations. Examine ways to improve on scientific experiments and explanations.	Evaluate competing scientific explanations by generating predictions based on each explanation. Explain why the results of scientific experiments support or do not support a scientific explanation.