



CAST PRACTICE TEST

3-Dimensions of Science Learning Using NGSS

HIGH SCHOOL
Teacher





High School CAST Practice Test

SAMPLE

This sample only contains six questions with the answers

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A Science Teacher's Best Friend

We at Education4Equity recognized that throughout the state of California, science teachers are pondering how to best prepare their students for the CAST (California Science Test). The Next Generation Science Standards (NGSS) with the introduction of the 3-Dimensions of Science Learning (DCI – Disciplinary Core ideas; SEP – Science and Engineering Practices; and CCC – Crosscutting Concepts) have brought to the table a way of teaching science that is both inspiring, but at times overwhelming. A seven minute explanation of the new way of organizing the standards is given here: <https://www.youtube.com/watch?v=Q6eoRnrwL-A&t=9s> and links off of the NGSS website: <https://www.nextgenscience.org/standards/standards>.

Because science teachers all have their own way of introducing scientific concepts, we felt the best way to prepare a teacher and their students for the California Science Test (CAST), was to create a practice test that did the following:

1. It gave teachers, regardless of their background, a unified way to prepare students for the California specific test.
2. It allowed teachers to focus on helping students enter into the experience of dealing with various phenomenon.
3. It provided teachers the most flexibility in using various curriculum.
4. It has a proven record of raising student scores by as much as 30%.

In addition to using our practice test questions, we at Education4Equity highly encourage teachers to make use of these two resources for understanding the background of practice test questions and for creating your own test questions.

1. The CAASPP Online Practice and Training Tests Portal

<http://www.caaspp.org/practice-and-training/index.html>

2. Item Specifications

<https://www.cde.ca.gov/ta/tg/ca/castitemspecs.asp>

Don't hesitate to contact us if you need ideas for how to use the practice test questions to turn your classroom into a center of curiosity, innovation, and enlightenment. Simply email help@education4equity.com. We have tests for Elementary (which we mainly call the 5th grade test), for Middle school (which we call the 8th grade test) and for High School (which we call the High School test). The 3 books are listed on the next page, and each book comes in a student version and a teacher version with answers. We have not put all the answer in this book since this book is mainly a sample for teachers, principals and superintendents to get a "taste" of what we at Education4Equity are providing. See below for the front cover of our books.

We end on a note of comfort to all science teachers:

Be encouraged and please join us in the effort to make our students top critical thinkers in the world. We hope these practice questions will not be seen as a chore to burden you with added work, but as a "best friend" that lists "experiential opportunities" to stir up student curiosity.

In conclusion we'd like to give special thanks to the 40-member team who wrote the NGSS Standards, Jill Wertheim, Ph.D. (Stanford), Linda de Lucchi (Berkley), Ayele Dodoo, Ed.D. (WestEd), and the team that supports the CAASPP Web Portal. To all owner of our books, please take note that the way we deliver the answers to each practice question is highly instructive and helps teachers and students alike think like practitioners.

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Discrete Items—Section 1

1. Write your name.

First

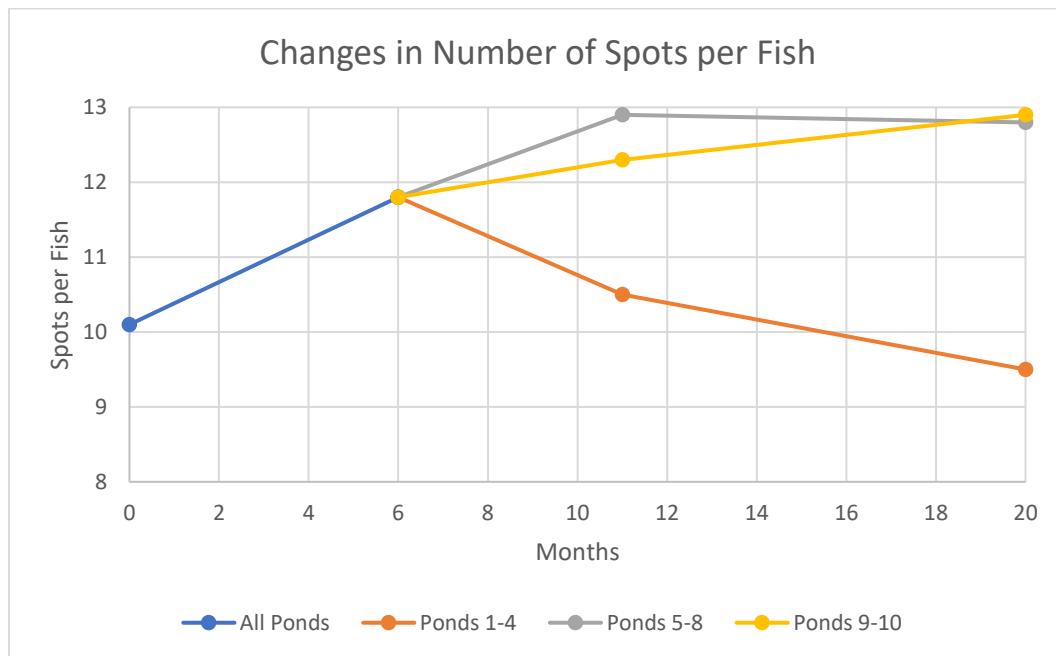
Last

2. The males of a certain species of guppy that is native to Venezuela and some Caribbean islands have colorful spots on their bodies that vary from male to male and that help them attract females for mating. However, the colorful spots also make the males more visible to predators.

A biologist conducted an experiment to see how different amounts of pressure from predators would affect populations of guppies. Ten ponds were set up in a greenhouse to mimic the natural habitat of the guppies as follows:

Ponds 1–4	Aggressive predator (guppies are a primary food source)
Ponds 5–8	Mostly harmless predator (guppies are not a primary food source)
Ponds 9–10	No predator

The biologist added the predators after 6 months and counted the number and size of the spots on the male guppies at 11 months and again at 20 months. Because guppies can begin to reproduce 5–6 weeks after birth, it only takes about 5 months to have 4 generations of guppies. The biologist's data is shown in the table.



Circle the words or phrases in **BOLD** that **best** complete the statements about the changes in the guppy populations.

The biologist's data show that **pressure from predators / sexual selection** caused the number of spots per guppy to increase in **Ponds 1–4 / Ponds 5–8**. The data also show that **pressure from predators / sexual selection** caused the number of spots per guppy to decrease in **Ponds 1–4 / Ponds 5–8**.

3. In the 1930s, a severe drought affected the southern Great Plains region of the United States.

Native grasses hold soil in place, and soil helps hold in moisture. Farmers had plowed up huge areas of native grasses in order to plant crops. Under drought conditions, the soil dried out and blew away in huge dust storms that gave the region the nickname the “Dust Bowl.”

During dust storms, visibility was sometimes limited to only 3 to 5 feet. People could not raise crops or graze livestock on the depleted soil.



A dust storm in Texas on April 18, 1935

Part A

Circle the options in **BOLD** that **best** complete the sentence about how the drought and dust storms of the 1930s affected the population in the “Dust Bowl” region.

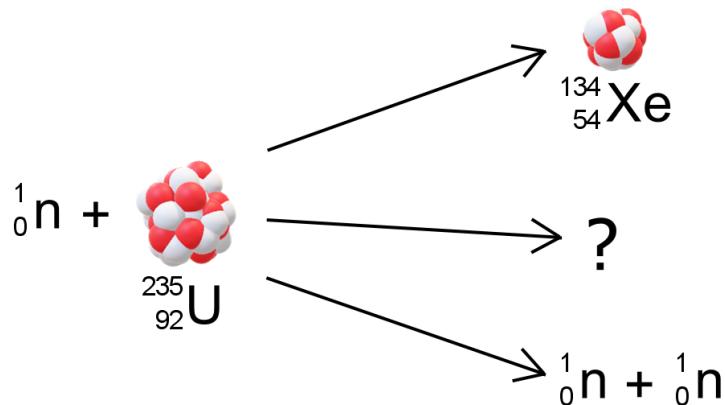
The “Dust Bowl” conditions most likely caused **economic / physical / economic and physical** hardships for people living in the region, resulting in the **poverty / migration / poverty and migration** of large numbers of people.

Part B

Select the **two** items from the list that would provide **the most help** in reversing the “Dust Bowl” conditions.

- the return of normal rainfall in the region
- a reduction in the number of cattle in order to stop overgrazing
- the planting of trees to break the wind and hold soil in place
- using farming methods that conserve the soil

4. A nuclear power plant uses a controlled fission reaction to generate electricity.



Select the particle that correctly completes the model of the fission reaction.

A. $^{94}_{36} Kr$

B. $^{100}_{38} Sr$

C. $^{96}_{37} Rb$

D. $^4_2 He$

5. A mining company extracts phosphate from the earth and processes it to produce phosphoric acid, an ingredient in chemical fertilizers. The process also produces a waste slurry (a mixture of water and insoluble materials). The mining company disposes of the slurry in a large, shallow depression on its property; the resulting pond allows the water to drain or evaporate and leaves the insoluble materials behind.

One day, a hole opens up in the ground beneath the pond. The hole is 160 feet in diameter and nearly 200 feet deep.

The mining company hires a geologist to find out why the hole opened up and to determine whether there is any risk of damage to the rest of their property.

From the following list, select the **three** items that would be **best** to investigate in order to gather evidence of what caused the hole to open up.

- the path that water would follow in draining from the slurry pond
- the thickness of the rock layers under the bottom of the hole
- the effects of human activities on the area around the hole
- the pH of the waste slurry that was disposed of in the pond
- the solubility in water of the rock layers surrounding the hole

- 6.** A team of biologists studies the metabolism of glucose ($C_6H_{12}O_6$) in fat cells. They culture fat cells from rats and separate the cells into two groups, Group A and Group B. The table shows what they add to each group and their experimental results.

	Added to the culture:	Radioactivity (as carbon-14) recovered in fatty acids (e.g., $C_{17}H_{35}COOH$) after 180 minutes:
Group A (control group)	Glucose labeled with carbon-14	60%
Group B (experimental group)	Glucose labeled with carbon-14 + insulin (a hormone that regulates animal metabolism)	91%

In the space below, describe the process that took place with most of the glucose molecules. Include two steps in your description. Do not use chemical formulas or describe specific chemical reactions in your answer.

Glossary

Word	Definition
aquatic	water-based
colonizing	living and/or growing in a place
components	the parts that make up something (such as a mixture)
compost	a mixture of decayed organic material used as fertilizer or for improving soil
composted	broken down by decomposing organisms
composting	the process of changing organic materials into compost
depression	an area of lower ground
disposes of	gets rid of
eliminates	gets rid of
emissions	substances (often gases) released into the air
emitters	devices that send out or release something (such as water)
excess	more than is needed; too much
extensive	a large amount of something
footprint	the outline of the base of something
fragmented	broken up
groundwater	underground water sources
guppy	a small fish that gives live birth and is often kept as an aquarium pet
infrastructure	the basic equipment and structures needed for a community to function (e.g., roads, systems for distributing water or electricity, etc.)
luminosity	a measure of the light energy given off by an object
maintenance-free	not needing care in order to remain in good condition
native	living or growing naturally in a certain area
nature preserve	an area where plants and animals are protected from some or all human activity
runoff	water from rain or snow that runs into bodies of water like streams and lakes
sustainability	the ability to continue a method or process for a long time without destroying or completely using up natural resources

Standards and Answers

Standard:	HS-LS4	Biological Evolution: Unity and Diversity		
Performance Expectation:	LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.		
	Clarification Statement	Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.		
	Assessment Boundary	None provided.		
SEP	DCI	CCC		
Constructing Explanations and Designing Solutions	LS4.C—Adaptation	Cause and Effect		
Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not.	Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.		

Sources:

https://www.jstor.org/stable/2408316?seq=1#page_scan_tab_contents

Item	Answer	Notes
2	“sexual selection” and “Ponds 5–8” “pressure from predators” and “Ponds 1–4”	

Standard:	HS-ESS3	Earth and Human Activity		
Performance Expectation:	ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. [Clarification Statement:]		
	Clarification Statement	Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting, and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.		
	Assessment Boundary	None provided.		
SEP	DCI	CCC		
Constructing Explanations and Designing Solutions	ESS3.B—Natural Hazards	Cause and Effect		
Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.	Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.		

Sources:

- <https://www.britannica.com/place/Dust-Bowl>
- <https://www.britannica.com/event/Great-Depression/Economic-impact#ref802221>
- <http://www.pbs.org/wgbh/americanexperience/features/dustbowl-drought/>
- <https://www.nasa.gov/centers/goddard/news/topstory/2004/0319dustbowl.html>

Item	Answer	Notes
3a	“economic and physical” “poverty and migration”	
3b	“return of normal rainfall in the region” “planting trees to break the wind and hold soil in place”	

Standard:	HS-PS1	Matter and Its Interactions		
Performance Expectation:	PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.		
	Clarification Statement	Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.		
	Assessment Boundary	Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays.		
SEP	DCI	CCC		
Developing and Using Models	PS1.C—Nuclear Processes		Energy and Matter	
Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.	In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.		

Sources:

<https://www2.lbl.gov/abc/Basic.html>

<http://hyperphysics.phy-astr.gsu.edu/hbase/NucEne/fisfrag.html>

Item	Answer	Notes
4	B	

Standard:	HS-ESS2	Earth's Systems		
Performance Expectation:	ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.		
	Clarification Statement	Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).		
	Assessment Boundary	None provided.		
	SEP	DCI	CCC	
	Planning and Carrying Out Investigations	ESS2.C—The Roles of Water in Earth's Surface Processes	Structure and Function	
	Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.	The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.	

Sources:

<https://www.ardaman.com/FileRepository/Resources/6559f986-7427-47df-906b-3370fd94b973.pdf>

<https://pubs.usgs.gov/circ/circ1182/pdf/15WCFlorida.pdf>

Item	Answer	Notes
5	<p>“the path that water would follow in draining from the slurry pond”</p> <p>“the pH of the waste slurry that was disposed of in the pond”</p> <p>“the solubility in water of the rock layers surrounding the hole”</p>	

Standard:	HS-LS1	From Molecules to Organisms: Structures and Processes		
Performance Expectation:	LS1-6	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.		
	Clarification Statement	Emphasis is on using evidence from models and simulations to support explanations.		
	Assessment Boundary	Assessment does not include the details of the specific chemical reactions or identification of macromolecules.		
SEP	DCI	CCC		
Constructing Explanations and Designing Solutions	LS1.C—Organization for Matter and Energy Flow in Organisms		Energy and Matter	
Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products.		Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.	

Sources:

<http://www.jbc.org/content/241/17/4004.full.pdf>

<https://www.britannica.com/science/metabolism/The-fragmentation-of-complex-molecules>

Item	Answer	Notes
6	<p>2 points</p> <p>Exemplar: Most of the glucose molecules that were introduced into the culture were (1) catabolized (broken down) into smaller molecules which were then (2) recombined to form fatty acids.</p> <p>Rubric: The response explains that glucose was catabolized into smaller molecules AND explains that the smaller molecules were used to form fatty acids.</p> <p>1 point</p> <p>Exemplar: Most of the glucose molecules that were introduced into the culture were used to make fatty acids.</p> <p>Rubric: The response explains that glucose was used to make fatty acids but does not indicate that the glucose molecules were first catabolized.</p> <p>0 points</p> <p>Exemplar: Most of the glucose was used by the cells for energy.</p> <p>Rubric: A 0-point response attempts to answer the prompt but is incorrect.</p>	