CAST Practice Test Questions
EARTH & SPACE SCIENCES

5

GUEST

Students noticed that a nearby pond, fed by a single stream, was filling up with sediment. The students want to determine what factors are contributing to the amount and type of sediment entering the pond. Which investigation is **most likely** to produce data that will help answer their questions?

Ⓐ Measure the depth of the sediments in the center of the pond once a week during the school year.

Ⓑ Collect and measure the mass of particles carried by the stream in one minute and then in ten minutes.

Ⓒ Collect and measure the mass of clay particles, silt particles, sand grains, and small pebbles carried by the stream at different stream flow velocities.

Ⓓ Obtain samples from different depths in the sediments at the bottom of the pond and determine how the sizes and amounts of particles have changed over time.

7

GUEST

A student is learning about the life cycles of low-mass and high-mass stars and creates a chart comparing the properties of the stars.

Complete the chart by placing a check mark in the box or boxes in each row to indicate if the property applies to low-mass stars, high-mass stars, or both.

	Low-mass stars	High-mass stars
Has a higher core temperature during main sequence stage	☐	☐
Spends a longer time on the main sequence	☐	☐
Burns hydrogen at a faster rate during main sequence stage	☐	☐
Spends the majority of its lifetime burning hydrogen in its core	☐	☐
Can create elements heavier than iron during supernova event	☐	☐

10

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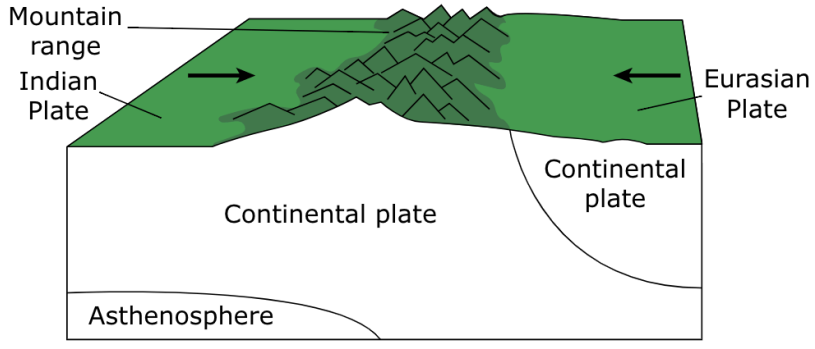
This diagram shows the boundary between the Indian Plate and the Eurasian Plate.



Select the **best** terms from the menus to complete the following statements.

The mountains were formed as a result of the Indian Plate [ ] the Eurasian Plate.

Over time, the effects of [ ] will counteract the process that builds the mountains.

✓	✓
weathering and erosion	colliding with
strike-slip faults	diverging from
sedimentation	sliding over

12

GUEST

For a certain farming community in California, a water shortage is predicted if the average global temperature rises by 1°C. The residents of this community rely on private vehicles powered by fossil fuels for transportation because there is no public transportation system. Farm vehicles powered by diesel fuel are used to harvest the crops and get them to market.

Residents of the farming community want to reduce their impact on global temperature increases by reducing their carbon dioxide (CO_2) emissions. They asked the town planners to propose some possible solutions that will address their transportation concerns and reduce the amount of CO_2 released into the atmosphere. Two potential solutions have been proposed:

- Solution 1: Restrict the use of private vehicles powered by fossil fuels on public roads.
- Solution 2: Promote vehicles powered by renewable energy sources to harvest the crops and get them to market.

Part A

Select **two** questions that residents of the farming community could ask to **quantitatively** evaluate the proposed solutions.

- ☐ Does this plan take into consideration damage to the crops caused by extreme weather events?
- ☐ Will this plan allow our community members to independently select oil suppliers?
- ☐ Will this plan increase our farming community's access to new varieties of seeds?
- ☐ Does this plan allow the farms in our community to continue to be profitable?
- ☐ Does this plan allow for a significant reduction in the use of diesel fuel?

Part B

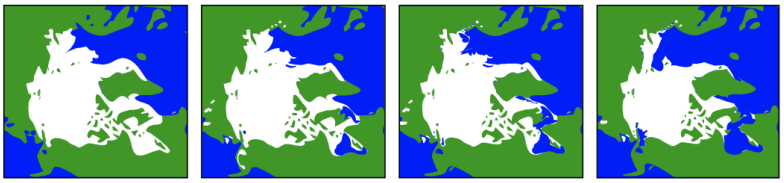
Place a check mark in the boxes to indicate whether each of the two potential solutions addresses the stated transportation concerns of the farming community, the global problem of increasing CO_2 emissions, or both.

	Addresses transportation concerns of farming community	**Addresses global problem of increasing CO_2 emissions**
Solution 1: Restrict the use of private vehicles powered by fossil fuels on public roads.	☐	☐
Solution 2: Promote vehicles powered by renewable energy sources to harvest the crops and get them to market.	☐	☐

14

GUEST

Scientists studied the extent of Arctic sea ice from 1978 to 2016. Observations from selected years are shown in the maps. The white areas show the extent of the sea ice in November of the indicated year. The dark blue areas are ice-free ocean and the green areas are continents in all of the maps.



1978 1990 2000 2016

Part A

Based on the Arctic sea ice images from 1978 to 2016, what is **most likely** going to occur from 2017 to 2027?

Ⓐ Arctic sea ice will move to other parts of the ocean.

Ⓑ Arctic sea ice will freeze and melt at the same rate.

Ⓒ Arctic sea ice will continue to melt at an increasing rate.

Ⓓ Arctic sea ice will continue to expand until it exceeds its 1978 extent.

Part B

Use the menus to complete the statement.

Melting Arctic sea ice contributes to a positive feedback loop in the Arctic. As Arctic sea ice melts, [ ] sunlight is reflected and the temperature of the Arctic Ocean [ ].

more
less

decreases
increases

16

GUEST

A student uses a computer simulation to investigate the effect of earthquakes on buildings. The simulation shows damage to buildings of similar construction except for their height. The simulation settings and the data collected from the simulation are shown.

Type of soil — Soft clay
Magnitude of Earthquake — 8.0

Height of Building (floors/stories)	Degree of Damage
1	Minimal
3	Minimal
5	Severe
7	Severe
9	Severe
11	Moderate
13	Moderate
15	Moderate
17	Minimal
19	Minimal

Select terms from the menus to create a correct conclusion that is based on the simulation.

A building of a height of [ ] floors could be expected to receive a severe amount of damage.

The severe damage to certain buildings is **most likely** due to [ ].

- 4
- 8
- 12

- the frequency of the building vibrations
- how close they are to other buildings
- the strength of the earthquake

17

GUEST

A comet is in an elliptical orbit around the Sun. Select from the menus to **best** describe what happens at locations in the orbit where the comet is getting closer to the Sun.

As the comet approaches the Sun, the gravitational force between the comet and the Sun [ ] and the comet [ ].

- speeds up
- slows down
- maintains the same speed

- decreases
- increases
- remains the same

18

GUEST

Results from a wide range of climate model simulations suggest that Earth's average surface temperature could be between 1.1 and 5.4°C warmer in 2100 than it was in 2015. Some species, such as sugar maple trees, are adapted to survive cooler temperatures and have historically occupied northern parts of North America. Scientists claim that rising average temperatures will change the distribution of sugar maple trees in North America.

In addition to global surface temperature data, which data, if collected, would **best** support or refute the claim?

Ⓐ The soil temperature should be measured daily for one year at two separate locations.

Ⓑ Core samples of the largest sugar maple trees should be taken to determine how old the trees are.

Ⓒ The total number of acres of forested land throughout the range of sugar maple trees should be recorded annually.

Ⓓ Sample sites should be set up throughout the range of sugar maple trees and the number of sugar maple trees counted every five years.

19

GUEST

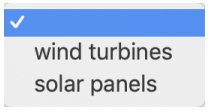
A town council of a small town in Southern California investigates the use of renewable sources of energy to generate electricity. They research both solar panels and wind turbines and collect the data in the table. Neither turbines nor solar panels release CO_2 during their normal operation; however, CO_2 is emitted during their manufacture.

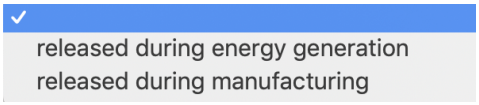
	One Wind Turbine	**40,000 Solar Panels**
Energy consumed during manufacturing (in kWh)	4,300,000	23,100,000
Total mass of carbon dioxide (CO_2) released during manufacturing (in kg)	20,000	9,080,000
Total annual energy generated (in kWh/year)	6,400,000	6,400,000
Annual maintenance cost (in dollars)	140,000	0

The council determines that it requires about 40,000 solar panels to produce the same amount of energy per year as one wind turbine produces per year. Assume a 20-year lifetime for both turbines and solar panels.

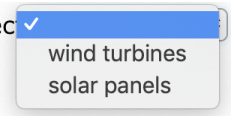
Based on the table, complete these sentences by selecting the **best** phrases from the menus.

If the main goal of the town is to reduce the carbon dioxide (CO_2) released into the atmosphere, then the town council should select [ ] because the amount of CO_2 [ ] is lower.





If the main goal of the town is to reduce maintenance costs, then the town council should selec[ ].



21

GUEST

A small city in California is growing and needs to expand its wastewater treatment capacity. Currently the city has a treatment plant with open tanks that releases the treated effluent into a nearby creek. The city manager asks the wastewater treatment department to prioritize criteria for plans to expand the treatment plant.

The wastewater treatment department sets the following priorities in order of importance:

1. The system must be closed to reduce smell for nearby neighborhoods.
2. The operating costs must be under $340,000 per month.
3. The wastewater must be treated so that the nitrate ion concentration in the effluent does not exceed 0.5 mg/L to prevent algal blooms in the creek.

Three different construction companies submit plans to expand the wastewater treatment plant.

Part A

This table shows the prioritized criteria and information about each plan. Select the parts of each plan that meet the criteria set by the city manager.

Priority	Criteria	Plan A	Plan B	Plan C
1	Open or closed system	Open	Closed	Closed
2	Cost per month for operating wastewater treatment plant	$320,000	$335,000	$345,000
3	Nitrate ion concentration in wastewater effluent	0.4 mg/L	0.6 mg/L	0.4 mg/L

Part B

Select a plan from the menu to complete the sentence.

Plan A
Plan B
Plan C

Based on the prioritized order of the criteria, the city manager should accept [ ].

24

GUEST

In order to reduce air pollution, a particular community identifies three possible solutions. The community also proposes several criteria that the solutions must meet, including low cost and rapid impact. The three possible solutions are:

Solution 1: Begin phasing in renewable sources of electricity generation, which would involve building new types of power plants.
Solution 2: Encourage increased use of ride-sharing.
Solution 3: Encourage people to raise thermostat settings in the summer and lower them in the winter.

Part A

The community identified three constraints to help determine the best approach to reduce air pollution. For each of the three potential solutions, select the check box if the solution meets the constraint.

	Long time to implement change	**Requires change in people's behaviors**	**Provides benefits in a short time period**
Solution 1	☐	☐	☐
Solution 2	☐	☐	☐
Solution 3	☐	☐	☐

Part B

What additional information will be **most** helpful to the community to prioritize these approaches?

Ⓐ the projected reduction in air pollution

Ⓑ the projected cost savings of using renewable resources

Ⓒ the number of homes projected to be built in the next 10 years

Ⓓ the number of cars currently using electricity as an energy source

28

GUEST

The Moon is thought to have formed shortly after the formation of Earth, and therefore the age of the Moon is comparable to that of Earth. The surface of the Moon is covered by ancient craters formed by impacts of small solar-system objects such as meteoroids, but the surface of Earth shows no such craters.

Which **two** statements are valid explanations for this observation?

☐ The Moon shielded Earth from impacts in the early solar system.

☐ Solar-system objects are more likely to impact satellites than planets.

☐ Geologic activity on Earth's surface has destroyed evidence of impacts.

☐ The Moon has a very thin atmosphere, eliminating erosion due to weather.

☐ Earth's atmosphere protected it from impacts by large solar-system objects.

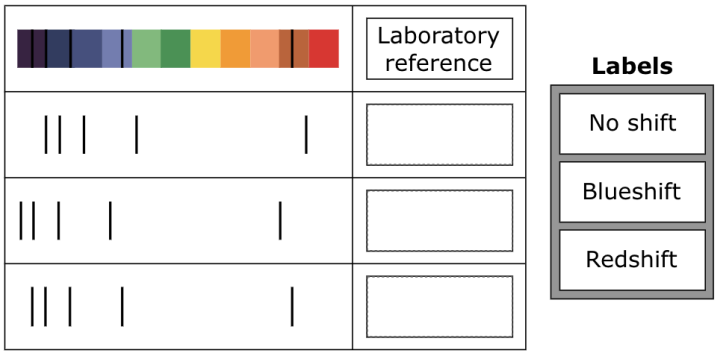
Scientists observe the light spectra from distant galaxies. The absorption lines in a spectrum from a galaxy moving away from Earth are observed to be shifted to longer wavelengths (redshift). The absorption lines from an approaching galaxy shift to shorter wavelengths (blueshift).

Part A

The diagram shows the spectra of three distant galaxies. Each spectrum shows the absorption lines from hydrogen. The pattern of absorption lines is the same for each galaxy, but the wavelengths of the lines are different.

The laboratory reference shows the wavelengths of the hydrogen absorption lines as measured on Earth.

Drag the correct label to each spectrum to identify whether the spectrum is redshifted, blueshifted, or not shifted.



Part B

Which **two** statements best explain how observations of the spectra of light from galaxies are used to support current theories of the origin and evolution of the Universe?

- [ ] Galaxies that are farther away tend to have larger redshifts.
- [ ] The blueshift observed from distant galaxies indicates that galaxies are colliding and forming new stars.
- [ ] The redshift observed from nearby galaxies indicates that most galaxies remain stationary relative to Earth.
- [ ] The blueshift observed from nearby galaxies indicates that the solar system is orbiting a black hole.
- [ ] The redshift observed from distant galaxies indicates that they are moving away faster than nearby galaxies.