The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

EARTH AND SPACE SCIENCES

Wednesday, August 20, 2025 — 8:30 to 11:30 a.m., only

Student Name _____

School Name _____

The possession or use of any communications device is strictly prohibited when taking this examination. If you have or use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

Print your name and the name of your school on the lines above.

Use your knowledge of **Earth and Space Sciences** to answer all questions in this examination. Before you begin this examination, you must be provided with the ***2024 Edition Reference Tables for Earth and Space Sciences***. You may need to use these reference tables to answer some of the questions.

You are to answer all questions in this examination. You may use scrap paper to work out the answers to the questions, but be sure to record your answers on your answer sheet and in your test booklet. A separate answer sheet for multiple-choice questions has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet. Record your answers for the constructed-response questions in your test booklet.

All answers in your test booklet should be written in pen, except for graphs and drawings, which should be done in pencil.

When you have completed the examination, you must sign the declaration printed on your separate answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet and test booklet cannot be accepted if you fail to sign this declaration.

NOTICE …

A four-function or scientific calculator and a copy of the ***2024 Edition Reference Tables for Earth and Space Sciences*** must be available for you to use while taking this examination.

Note that diagrams are not drawn to scale unless otherwise noted.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

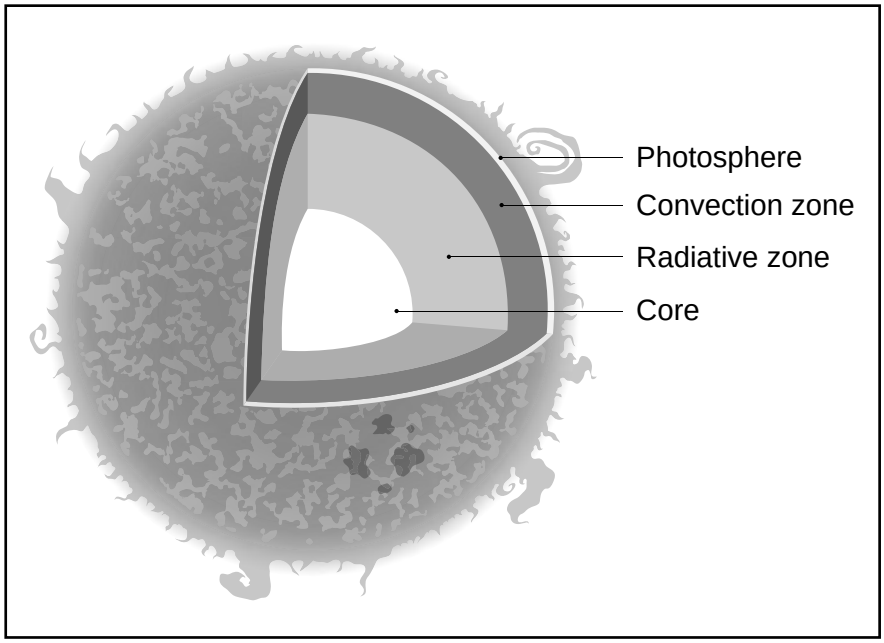
Base your answers to questions 1 through 5 on the information below and on your knowledge of Earth and Space Sciences. Some questions may require the use of the ***2024 Edition Reference Tables for Earth and Space Sciences***. Be sure to record your answers for the multiple-choice questions on a separate answer sheet provided. Record your answers for the constructed-response questions in your test booklet.

Energy in the Sun

The Sun's energy influences the environment of all celestial objects in our solar system. Different forms of the hydrogen and helium atoms contained in the Sun's core, deuterium (^{2}H) and the helium atom (^{3}He), are under very high temperatures and pressures. These atoms combine to form helium (^{4}He), while releasing tremendous amounts of energy.

The model below shows some information about the Sun.

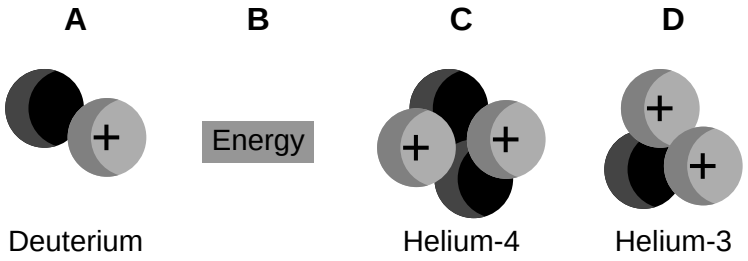
Layers of the Sun Model



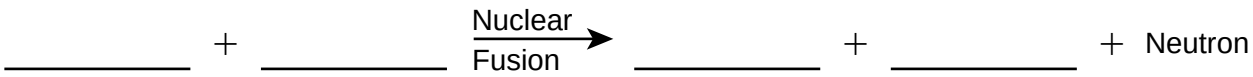
(Not drawn to scale)

Sun's Layer	Information About Layer	Temperature
Photosphere	Observable layer – gives off electromagnetic energy	6700°F – 11,000°F or 4000K – 6500K
Convection zone	• Convection causes hot material to rise to surface and cool • Creates sunspots and solar flares	11,000°F – 2 million °F
Radiative zone	Serves as a passage for radiation energy from core to surface	7 million °F
Core	Nuclear reactions occur	27 million °F or 15 million K

Four components of nuclear fusion, labeled *A*, *B*, *C*, and *D*, including models of the nuclei of deuterium, helium-4, and helium-3, are shown below.



1 Complete the model of nuclear fusion by placing the letter of the component into the correct position in the equation. [1]



2 Which claim best describes where energy is produced in the Sun and how the energy is released into space?

(1) Energy is produced in the core, travels through different layers, and is then released at the photosphere.

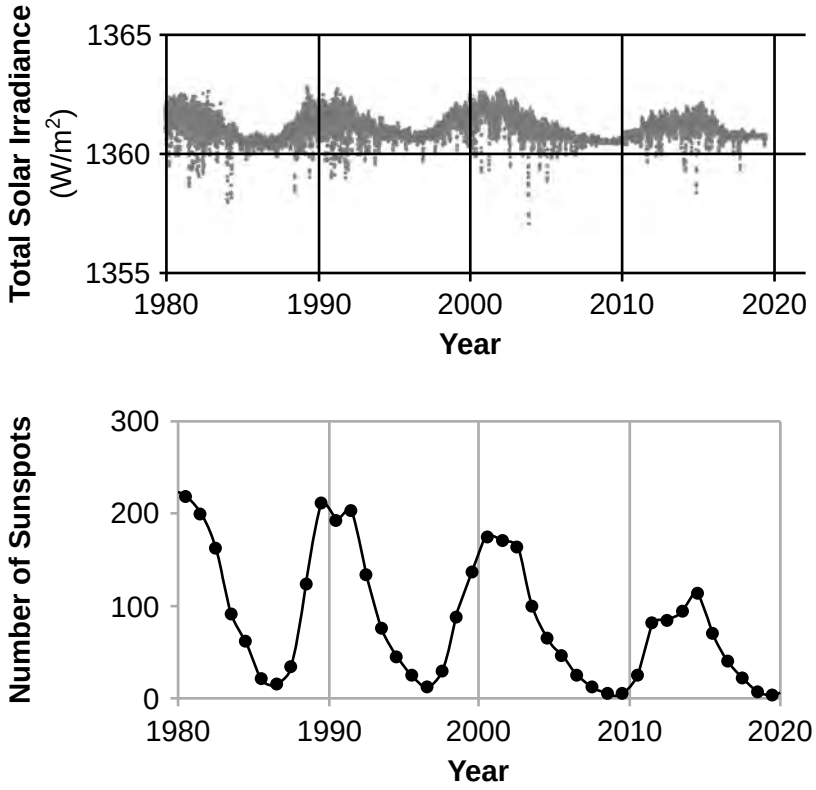
(2) Energy is produced in the photosphere, travels through different layers, and is then released at the core.

(3) Energy is produced in the radiative zone and is directly released into space.

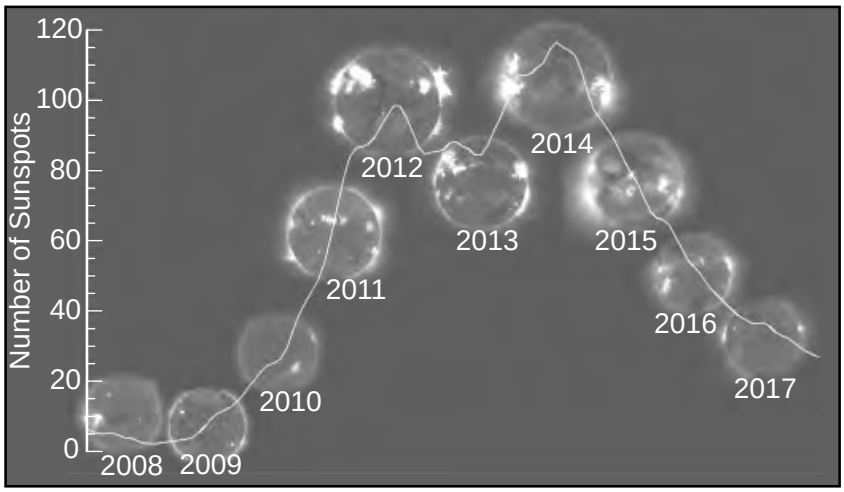
(4) Energy is produced in the core and is directly released into space.

Scientists have identified an 11-year solar cycle. During this cycle there is an increase and a decrease in the number of dark areas (sunspots) on the Sun's surface. Periods in the cycle with the highest numbers are called maxima, while periods in the cycle with the lowest numbers are called minima.

The graphs below show the output of light energy from the entire disk of the Sun, measured at Earth (Total Solar Irradiance) in watts per meter squared (W/m^2), and some information about sunspots.

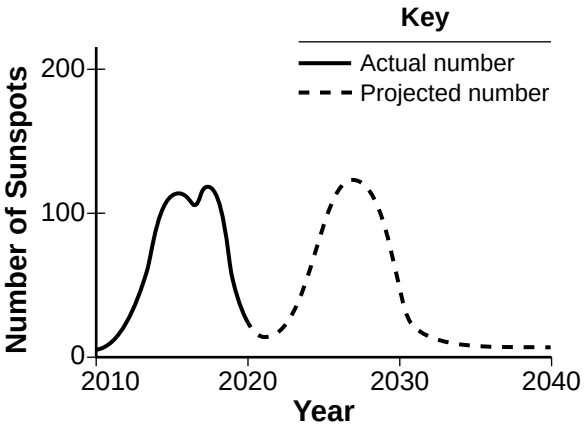


The model below shows photographs of the Sun with active areas (lighter regions) from 2008 to 2017. These active areas indicate high-frequency radiation emitted from the Sun. The line on the model represents the number of sunspots during the same time period.

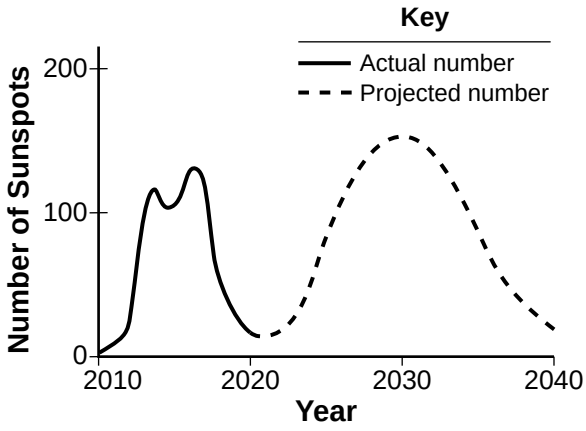


3 Use evidence from the **two** graphs *and* the model to describe how the Sun's irradiance varies with sunspot activity. [1]

4 Which graph best illustrates the projected pattern of the number of sunspots from 2020–2040, based on evidence from the graphs and model?



(1)



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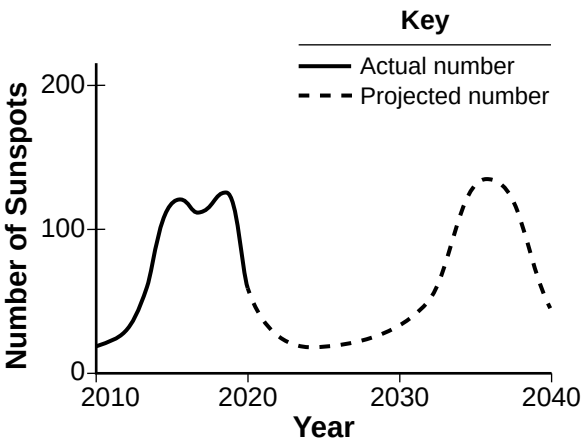

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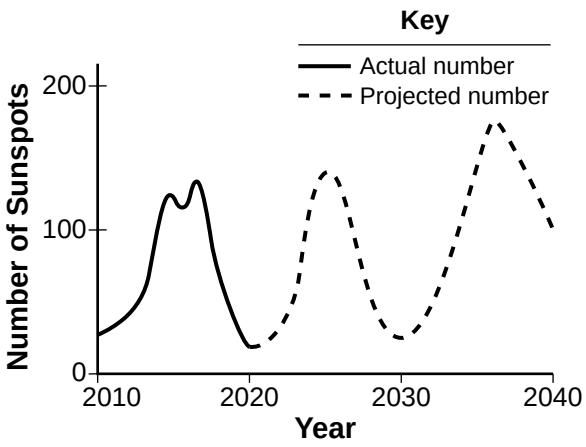


(4)

As a star ages, the hydrogen in its core gets used up. The core begins to undergo a gravitational collapse and becomes more dense. The chart below shows some information about elements in some stars.

Elements Produced During Stellar Evolution in Some Stars

Fusion Product	Temperature	Stage of Star
Helium	15 million K	Early stage
Carbon Oxygen Neon Sodium Magnesium Silicon Sulfur Calcium Iron	200 million K  3 billion K	Late stage
All elements heavier than iron	Greater than 3 billion K	Star explodes

5 Which claim best describes the process of nucleosynthesis in a star?

(1) Lighter elements are produced in a star's core near the end of its life cycle.

(2) Lighter elements are produced at lower temperatures during a supernova.

(3) Heavier elements are produced at the end of a star's life span as temperatures increase.

(4) Heavier elements are produced at lower temperatures and lighter elements are produced at higher temperatures.

Base your answers to questions 6 through 10 on the information below and on your knowledge of Earth and Space Sciences. Some questions may require the use of the ***2024 Edition Reference Tables for Earth and Space Sciences***.

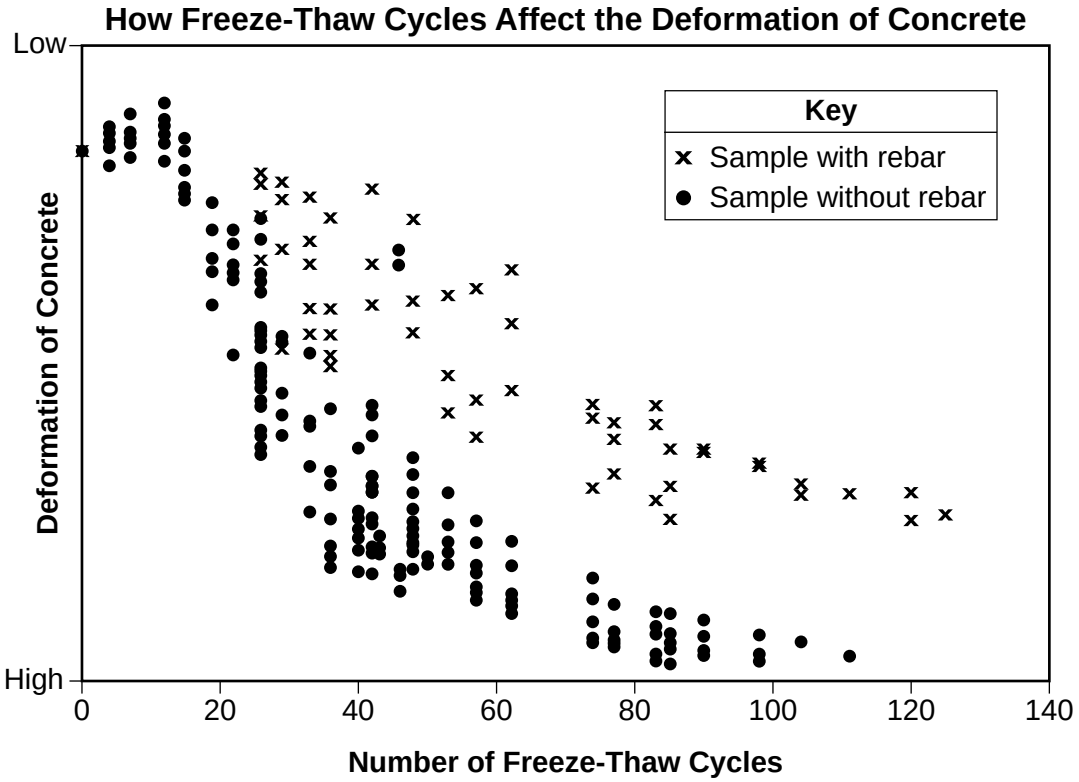
The Power of Water

Water in its many forms is unique to our planet. It is required for life as we know it and it can be used for a wide variety of beneficial purposes such as recreation and generating electricity. However, water can also be destructive and cause problems for humanity.

Concrete is an important building material that can be affected by water. The photograph below shows how structures are built with concrete and rebar (metal rods used to provide strength).

Concrete Pour With Rebar Structure

An experiment was conducted on samples of concrete, with and without rebar, to see how freeze-thaw cycles affected the deformation of the concrete. The graph shows some information about the freeze-thaw experiment.



6 Describe a property of water that *increases* the deformation of concrete due to repeated freeze-thaw cycles. Also, describe the relative amount of deformation to concrete samples when metal rebar is added compared to samples without rebar. [1]

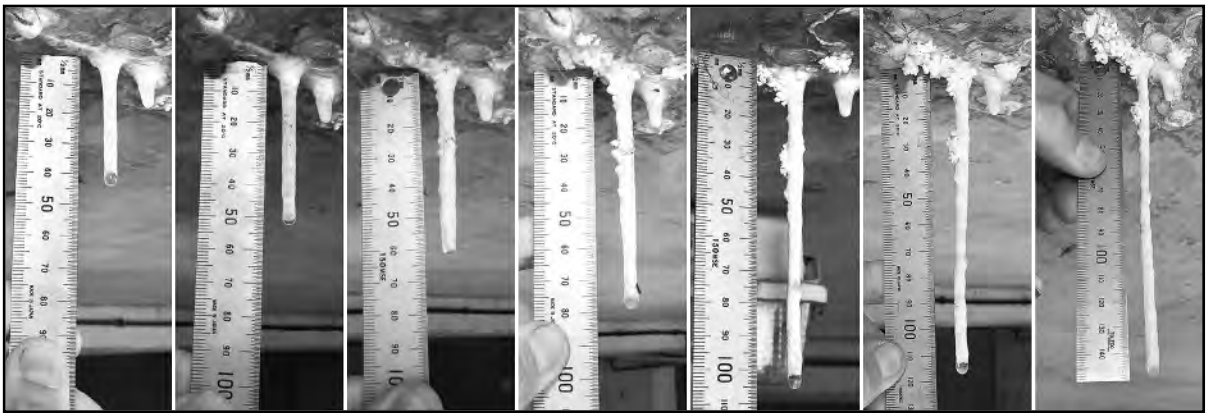
Property of water: _____

Relative amount of deformation: _____

_____

Calthemite straws are deposits found on the underside of concrete structures such as parking garages. Calthemites are not considered stalactites, as they do not form naturally in caves and cavern systems. The series of photographs below shows the growth of a calthemite straw measured in millimeters (mm).

Growth of Calthemite Straw



7 Which claim correctly summarizes the effect of water on the concrete in the parking structure producing the calthemite straws?

(1) Surface water evaporates minerals and transports them a short distance. The minerals then condense, forming calthemite straws.

(2) Surface water melts minerals and transports them a short distance. The minerals then freeze, forming calthemite straws.

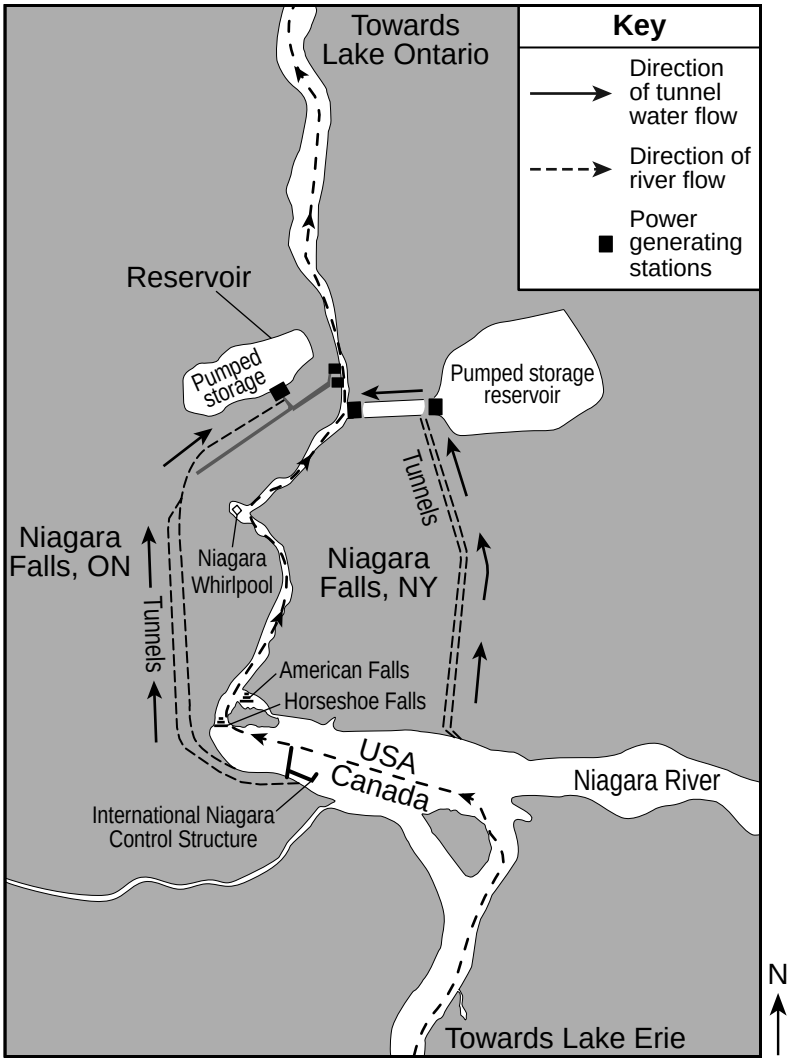
(3) Surface water dissolves minerals and transports them a short distance. The minerals then precipitate, forming calthemite straws.

(4) Surface water absorbs minerals and transports them a short distance. The minerals then expand, forming calthemite straws.

The power of water is utilized at Niagara Falls. Two large power generation facilities have been in operation there for decades. Water from the Niagara River is diverted through pipes and tunnels upstream from the falls. This water is then run through turbines to generate electricity before it is released back to the river below the falls.

The map below shows some information about the Niagara Falls region.

Niagara Falls Power Generation



8 How does the production of electricity by hydroelectric power plants at Niagara Falls, rather than by burning fossil fuels, affect Earth's atmosphere and change the climate?

(1) Hydroelectric power plants use a renewable resource that increases atmospheric oxygen levels, which negatively impacts global climate.

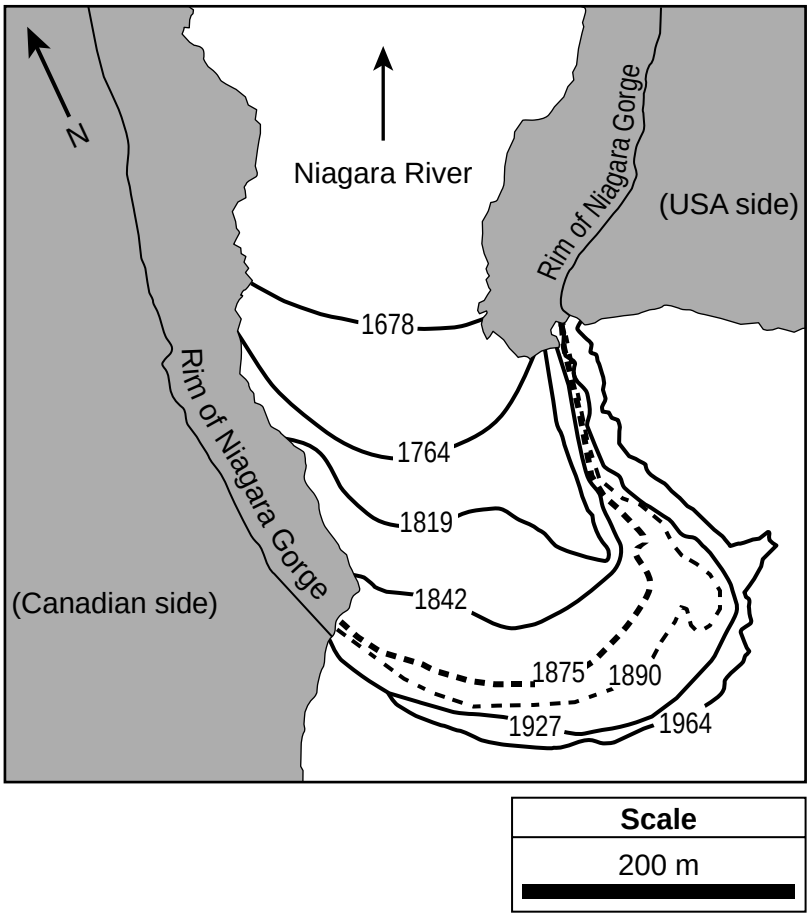
(2) Hydroelectric power plants use a renewable resource that decreases atmospheric carbon dioxide levels, which positively impacts global climate.

(3) Hydroelectric power plants use a renewable resource that increases water vapor in the atmosphere, which causes the local climate to be more humid.

(4) Hydroelectric power plants use a renewable resource that decreases water vapor in the atmosphere, which causes the local climate to be more arid.

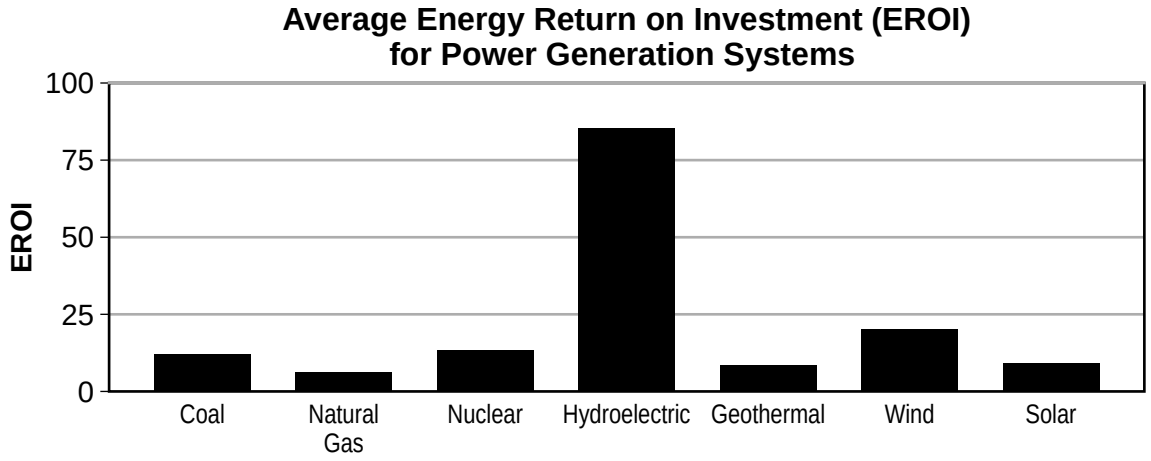
The map below shows some information about the changing position of the edge of the falls over time.

Retreat of Horseshoe Falls



9 Analyze data from the **two** maps to make a claim about how the construction of the hydroelectric power plants and diversion tunnels caused the rate of erosion at Horseshoe Falls to decrease. [1]

No source of electricity is 100% efficient. All sources of electricity require substantial monetary investment to build structures, maintain them, employ workers, and establish a power grid to get electricity to consumers. The Energy Return on Investment calculation (EROI) is a comparison of the amount of money invested in electricity generation to the amount of electricity produced. When the EROI value is large, that means producing energy from that source is relatively easy and cost-effective. The graph below compares EROI values for seven electricity production methods.



10 Based on the graph, which statement accurately describes the Energy Return on Investment (EROI) for the energy sources?

(1) The greatest EROI for a renewable energy source is approximately five times greater than the greatest EROI for a nonrenewable energy source.

(2) The greatest EROI for a nonrenewable energy source is the same as the smallest EROI for a renewable energy source.

(3) The EROI for coal is the same as the EROI for wind.

(4) The EROI for each renewable energy source is half the EROI for each nonrenewable energy source.

Base your answers to questions 11 through 15 on the information below and on your knowledge of Earth and Space Sciences. Some questions may require the use of the ***2024 Edition Reference Tables for Earth and Space Sciences***.

Telescopes and the History of the Universe

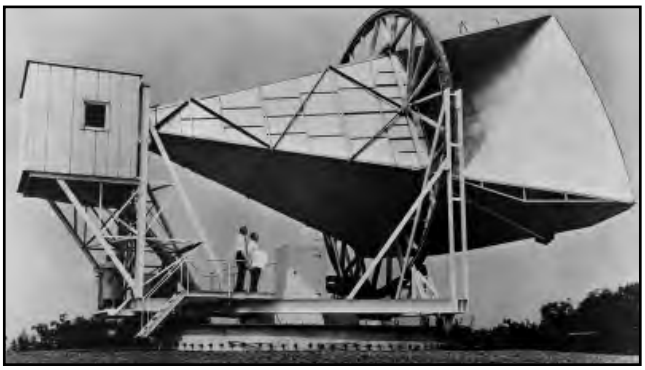
Two space telescopes that are providing astronomers with information about the early universe are the Hubble Space Telescope (HST) and the James Webb Space Telescope (JWST).

The HST orbits Earth at a distance of 540 km above the surface and can observe visible, ultraviolet (UV), and infrared (IR) radiation. It contains cameras and spectrographs that break light into the colors of the spectrum for analysis of elements found in stars.

Hubble has determined the age of the universe to a more precise date of 13.8 billion years old and has photographed galaxies in all stages of evolution—even galaxies from the early universe.

A central idea of the Big Bang theory is that the universe expanded rapidly and released energy. Scientists have been gathering evidence for this expansion and energy release since the early 1920s.

The photograph below, from 1964, shows two scientists in New Jersey with a radio telescope aimed towards outer space. This telescope was one of the first to record cosmic microwave background radiation coming from all directions in space.



11 Which explanation about the cosmic microwave background radiation provides evidence for the Big Bang theory?

(1) Since the cosmic microwave background radiation was detected coming from all directions, it must be evidence for multiple explosions occurring at the same time 13.8 billion years ago.

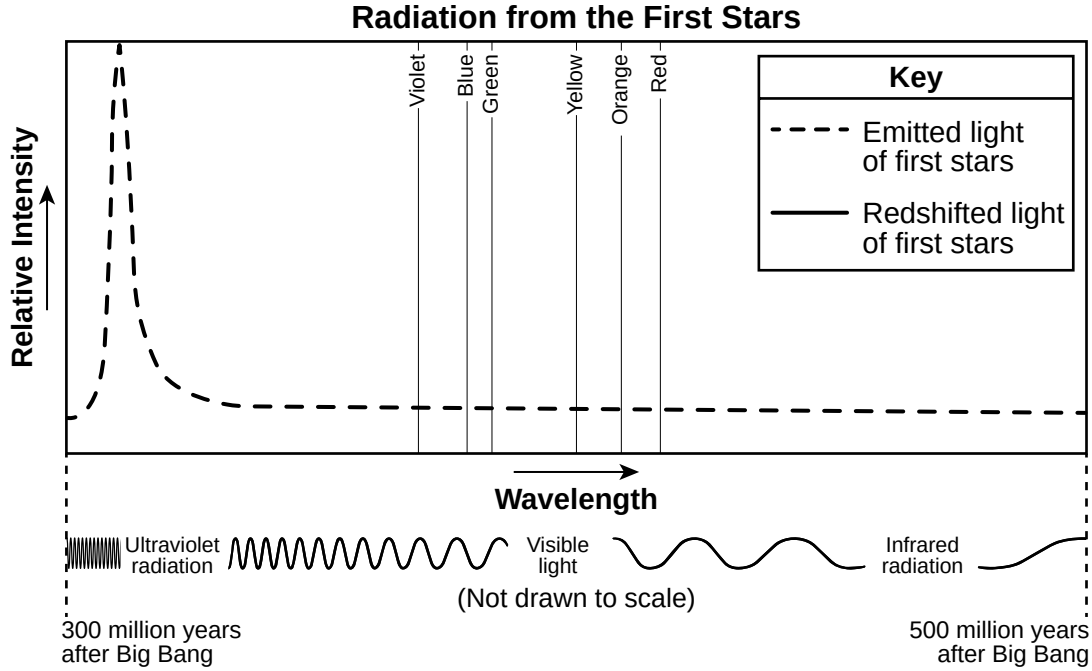
(2) Mathematical calculations showed that if the universe began with a Big Bang, it would have released a huge amount of energy in all directions and would be detected as cosmic microwave background radiation.

(3) Cosmic microwave background radiation is produced by every star and galaxy in the universe, which were created at the same time as the Big Bang.

(4) The presence of cosmic microwave background radiation is evidence for the energy released from dying stars that exploded in a Big Bang and created our present day universe.

The only evidence astronomers have for the first stars that formed is the electromagnetic radiation they left behind. Telescopes like Hubble can detect objects billions of light-years away (billions of years back in time).

The graph below shows some information about the first stars that formed after the Big Bang.



12 Describe how wavelengths of emitted radiation from first stars have changed since the Big Bang and explain how this difference in wavelength is evidence for how the universe changed since the Big Bang. [1]

Difference in wavelength: _____

_____

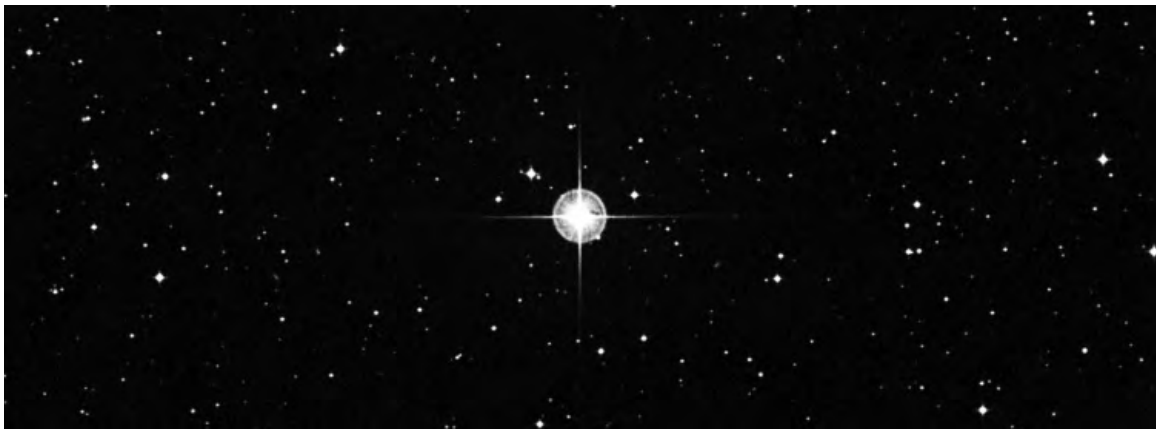
How the universe changed: _____

_____

_____

One of the oldest stars ever observed by HST is classified as a giant star called Methuselah in the Milky Way Galaxy. It is believed to be almost as old as the universe itself. Based on Methuselah's composition, scientists do not believe it is one of the first stars.

Digital Image of Methuselah in the Constellation Libra



13 Which statement correctly explains why the composition of Methuselah, a massive star, provides evidence that Methuselah is ***not*** one of the first stars formed during the Big Bang?

(1) Methuselah is composed of 100% helium, but the first stars were composed of 75% hydrogen and 25% iron.

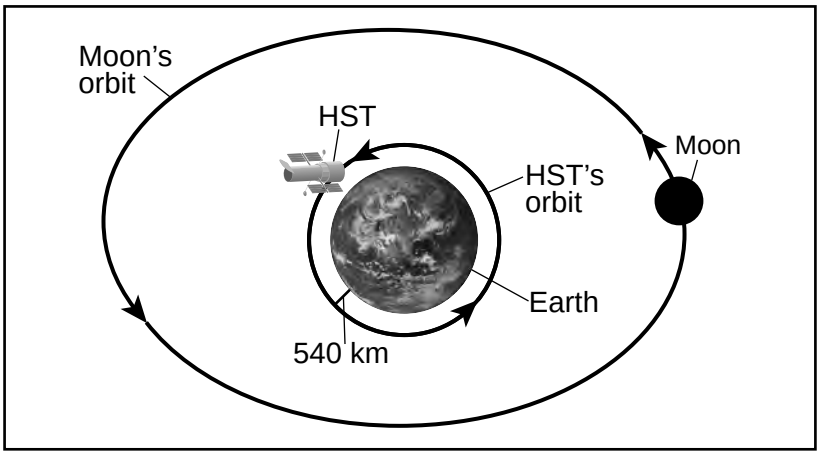
(2) Methuselah is composed of hydrogen, helium, and some trace heavier elements, but the first stars contained a greater percentage of heavier elements.

(3) The first stars were composed of 100% hydrogen, but Methuselah is composed of 50% hydrogen and 50% helium.

(4) The first stars were composed of 75% hydrogen and 25% helium, but Methuselah also contains metals of heavier elements in its core.

The model represents the locations of the HST orbit and the Moon's orbit around Earth. The Moon's orbital distance varies from approximately 363,100 km to 405,700 km.

Orbits of HST and the Moon Model



(Not drawn to scale)

The orbital motions of satellites, natural or human-made, are determined by the strength of the gravitational field at the satellite's location. The model below shows the formula used to calculate the strength of Earth's gravitational field for Earth's satellites.

Gravitational Field Model

$$g = \frac{Gm_E}{r^2}$$

Key	
g:	gravitational field strength
G:	universal gravitational constant
m_E:	mass of Earth
r:	distance between center of Earth and center of satellite

14 Based on the *Gravitational Field Model*, use the word list to complete the passage by placing the correct terms on the lines below to describe the effects of Earth's gravitational field on the motion of HST and the Moon. [1]

Word List

A	B	C
less	less	less
greater	greater	greater

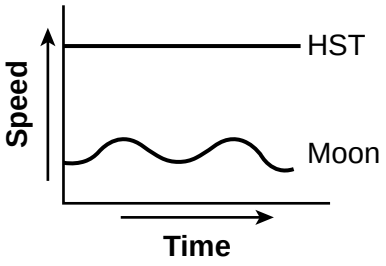
Compared to the average distance from Earth to the Moon, the distance from Earth to HST is ___A___ . As a result, Earth's gravitational field strength at the location of HST is ___B___ than Earth's gravitational field strength at any location of the Moon's orbit. Therefore, in order to remain in a stable orbit, the orbital period of HST must be ___C___ than the orbital period of the Moon.

A: _____

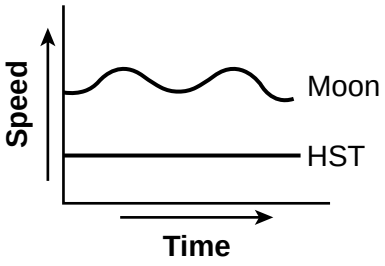
B: _____

C: _____

15 Based on the model and Kepler's Laws, which graph correctly represents the relative orbital speeds of HST and the Moon as the two satellites orbit Earth *twice*?



(1)



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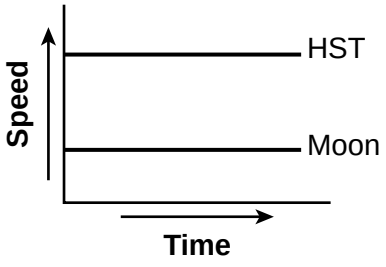

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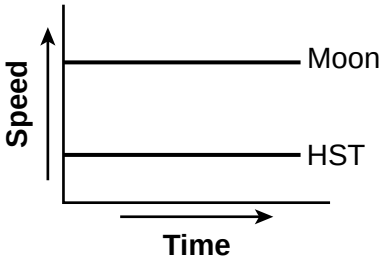


(4)

Base your answers to questions 16 through 20 on the information below and on your knowledge of Earth and Space Sciences. Some questions may require the use of the ***2024 Edition Reference Tables for Earth and Space Sciences***.

Horse Latitudes

The historical term "horse latitudes" (areas located at approximately 30°N and 30°S latitude) comes from the legend of Spanish sailing ships that would often become stalled for days or even weeks when they encountered areas that usually experienced calm winds, sunny skies, and little or no precipitation. Many of these ships carried horses to the Americas as part of their cargo. Unable to sail and resupply due to lack of wind, crews often ran low on drinking water. To conserve scarce water, sailors on these ships would sometimes throw the horses they were transporting overboard. Thus, the phrase "horse latitudes" was born.

16 Which statement correctly identifies the air movement patterns associated with the planetary wind "horse latitudes"?

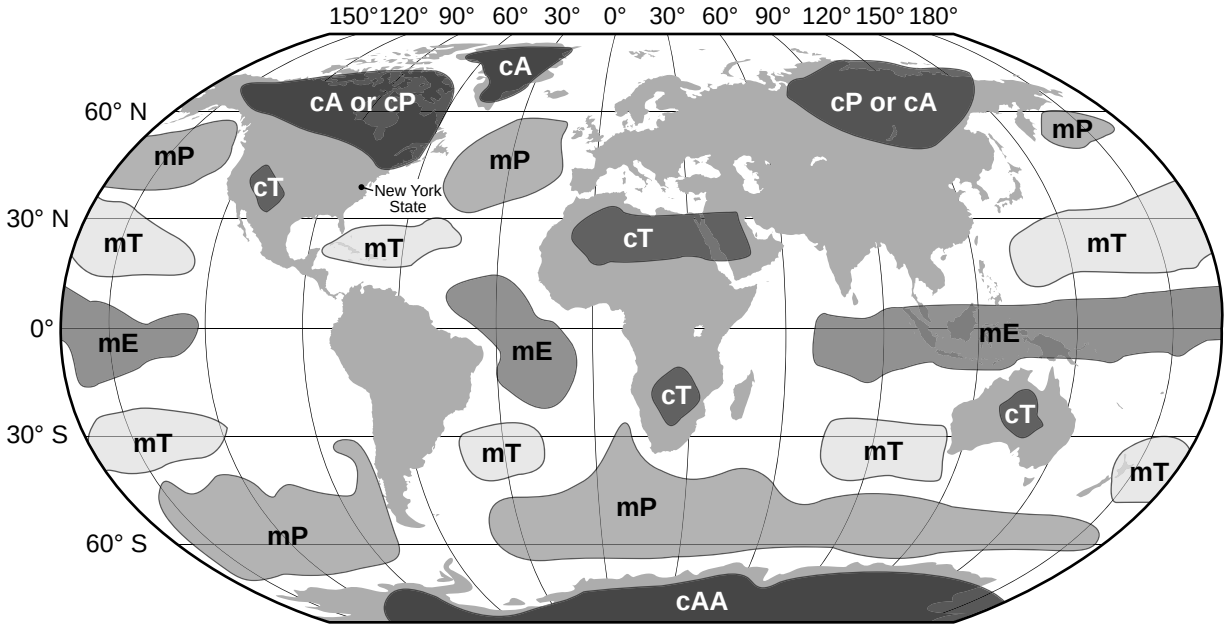
(1) Air at these latitudes is typically ascending in the atmosphere after converging at the surface.

(2) Air at these latitudes is typically ascending in the atmosphere after diverging at the surface.

(3) Air at these latitudes is typically descending in the atmosphere before converging at the surface.

(4) Air at these latitudes is typically descending in the atmosphere before diverging at the surface.

Map of Air Mass Source Regions



Data Table: Air Masses

Air Mass Name	Air Mass Code
Continental Polar	cP
Continental Tropical	cT
Maritime Polar	mP
Maritime Tropical	mT
Maritime Equatorial	mE
Continental Arctic	cA
Continental Antarctic	cAA

17 Which winds drive the movement of a continental tropical air mass across Earth's surface away from the northern "horse latitudes" toward 60°N?

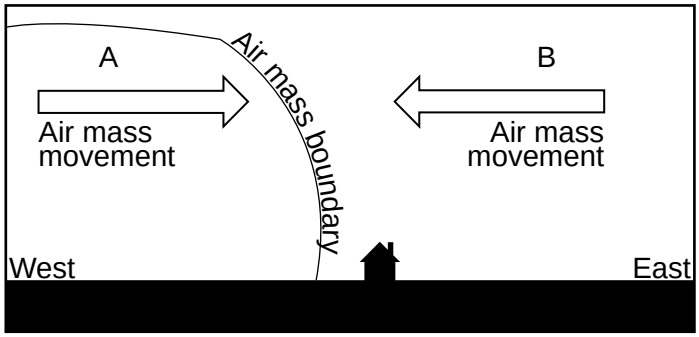
(1) Northeast trade winds move cT air masses from northeast to southwest.

(2) Prevailing westerly winds move cT air masses from northeast to southwest.

(3) Northeast trade winds move cT air masses from southwest to northeast.

(4) Prevailing westerly winds move cT air masses from southwest to northeast.

Utica, New York is located at approximately 43°N. In the model below, Utica is influenced by a cold, dry air mass (A). A warm, moist air mass (B) that originated along the east coast of the United States enters the region. The model shows these two air masses interacting near a residence in Utica.



(Not drawn to scale)

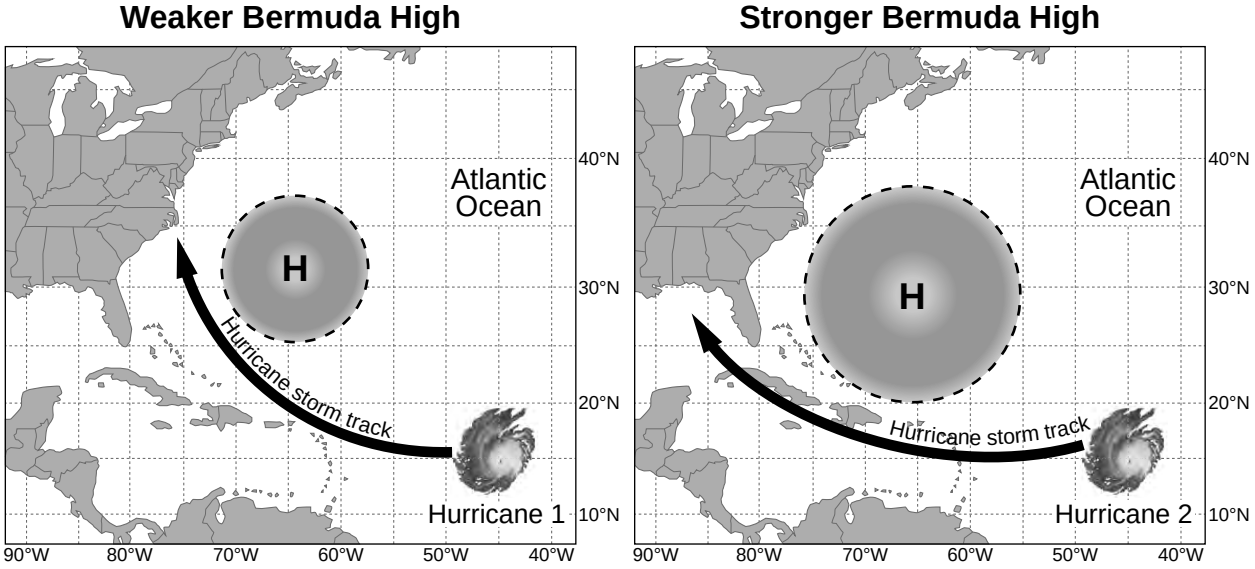
18 Identify each air mass using its two-letter code. Also, place a checkmark (✓) in the box that indicates the resulting change in weather conditions in the next few hours that would most likely be experienced by an observer who resides in the house shown in the model. [1]

Code for Air Mass *A*: _____

Code for Air Mass *B*: _____

Weather Conditions	Increases	Decreases
cloud cover		
chance of precipitation		
air temperature		

The Bermuda high pressure system forms in the "horse latitude" region of the North Atlantic Ocean. Air circulation around the margins of the Bermuda high is known as "steering flow" and can influence a hurricane's storm track. Meteorologists analyze the position and strength of Bermuda high pressure systems to help make predictions about hurricane storm tracks and determinations about where hurricanes will make landfall. The maps below show some information about the effects of Bermuda highs.



19 Which table correctly compares the characteristics of Hurricane 2 to Hurricane 1 and its associated Bermuda high?

(1)

Steering Flow	Storm Track	Bermuda High
farther south, then west	west, then north	clockwise and strong

(2)

Steering Flow	Storm Track	Bermuda High
farther south, then west	east, then north	clockwise and weak

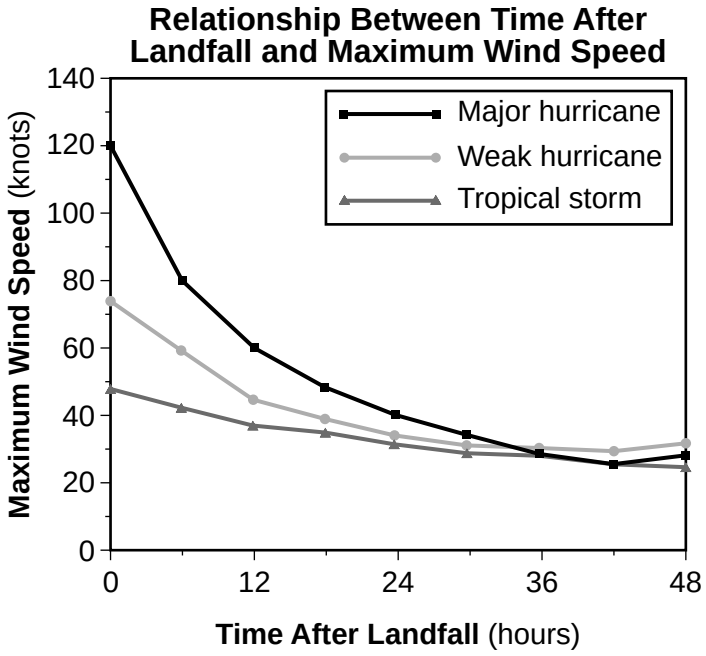
(3)

Steering Flow	Storm Track	Bermuda High
farther north, then west	west, then north	counterclockwise and strong

(4)

Steering Flow	Storm Track	Bermuda High
farther north, then west	east, then north	counterclockwise and weak

The graph below shows some information about hurricanes and tropical storms.



20 Compare the atmospheric pressure at 12 hours after landfall to the atmospheric pressure at 24 hours after landfall using the wind speed and landfall data shown in the graph to justify your response. [1]

Base your answers to questions 21 through 26 on the information below and on your knowledge of Earth and Space Sciences. Some questions may require the use of the ***2024 Edition Reference Tables for Earth and Space Sciences***.

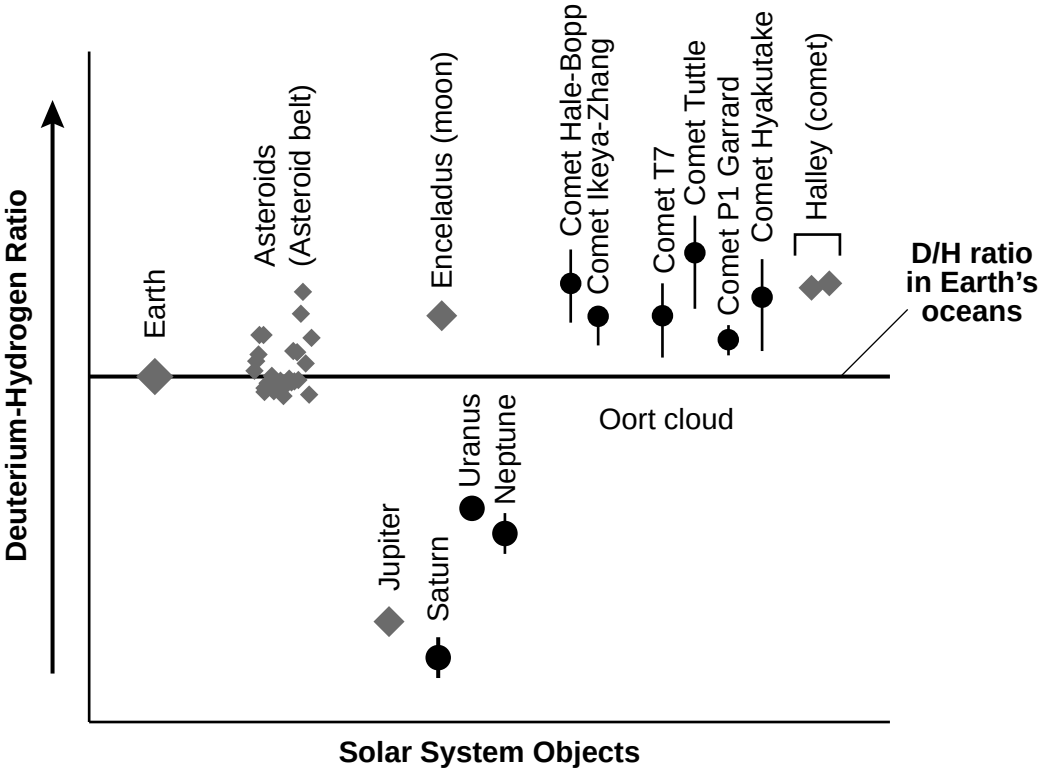
How Did Earth Get Its Water?

Scientists are unsure about where and how Earth got its water. Early Earth lacked an atmosphere and was very hot, so water would not have formed in such an environment. One theory is that water was brought to Earth when comets collided with Earth, since comets are made of frozen water, gases, and dust.

Another theory centers around asteroids. Earth is believed to have formed from the clumping together of space debris. These early solar system materials contained the elements hydrogen and oxygen. The chemical proportions of the water found on asteroids are similar, though different, from Earth's water.

The most recent discoveries have come from studies of dust particles brought back to Earth from the Hokawa asteroid. The particles were found to have water and an oxygen-hydrogen ion. The source of the hydrogen is believed to be from solar wind — hydrogen ions ejected from the Sun streaming through space and lodging onto the surface of dust particles. These particles have been falling to Earth since the solar system formed. The space dust is believed to have provided about 50% of Earth's water.

The graph below shows the relative deuterium-to-hydrogen ratio (D/H) in water found in solar system objects. Diamond symbols are measurements obtained by satellites. Dots are estimated values. Deuterium is a "heavier" form of hydrogen. This ratio is an important factor in determining where in the solar system an object formed and how asteroids, comets, and the solar wind contributed to the water in Earth's oceans.



21 A student makes a claim that the water on our planet is most similar to the water found on comets based on its D/H ratio, so comets must be a major source of water on early Earth. Which statement, based on evidence from the graph, would *refute* this claim?

(1) The source of Earth's water is the four largest planets in our solar system because these planets have water with higher D/H ratios than Earth's oceans.

(2) The water on all the comets has the same D/H ratios except Halley, so Halley is not a source of water for Earth's early oceans.

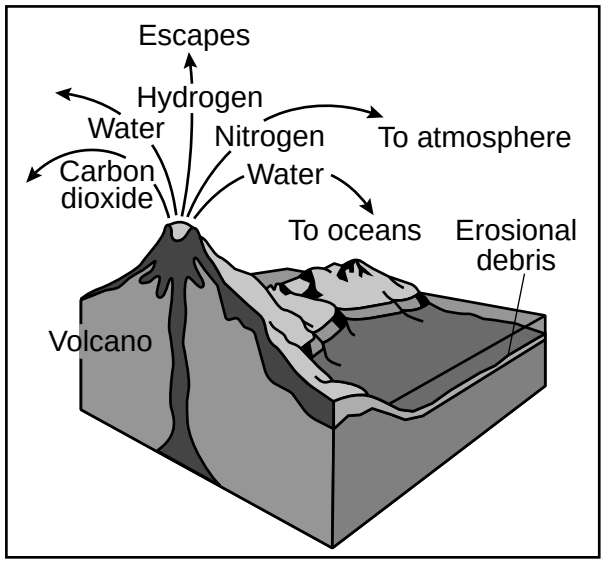
(3) Many asteroids have water that is very close in D/H ratios to Earth's oceans, so asteroids could be a source of water on early Earth.

(4) Water on Enceladus has a similar D/H ratio to comets, so Enceladus could also be a source of water for Earth.

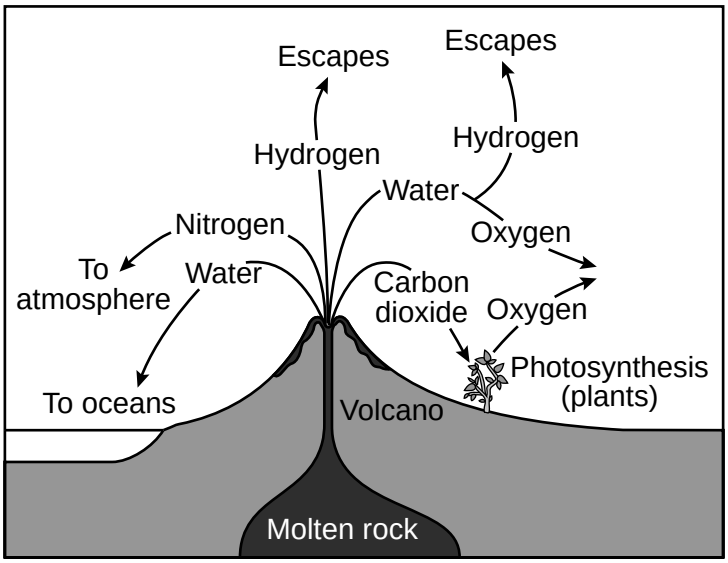
Earth's first significant atmosphere was formed from the release of gases from volcanic eruptions, when the mantle is believed to have been molten. Gases from the interior were released and accumulated into a gaseous surface layer trapped by gravitational forces. Solar wind from the Sun swept the light gases (hydrogen and helium) away, leaving behind heavier gases in the early atmosphere.

The models below show gases entering Earth's atmosphere at two different times.

Early Earth Volcanic Outgassing Model



Present Day Volcanic Outgassing Model



22 Which statement is correctly supported by evidence from the two models showing volcanic outgassing?

(1) All gases emitted from early Earth volcanoes escaped to outer space.

(2) The outgassing of water from Earth's interior contributed to the development of Earth's early oceans.

(3) Earth's early atmosphere contained significant amounts of hydrogen and helium as a result of volcanic outgassing.

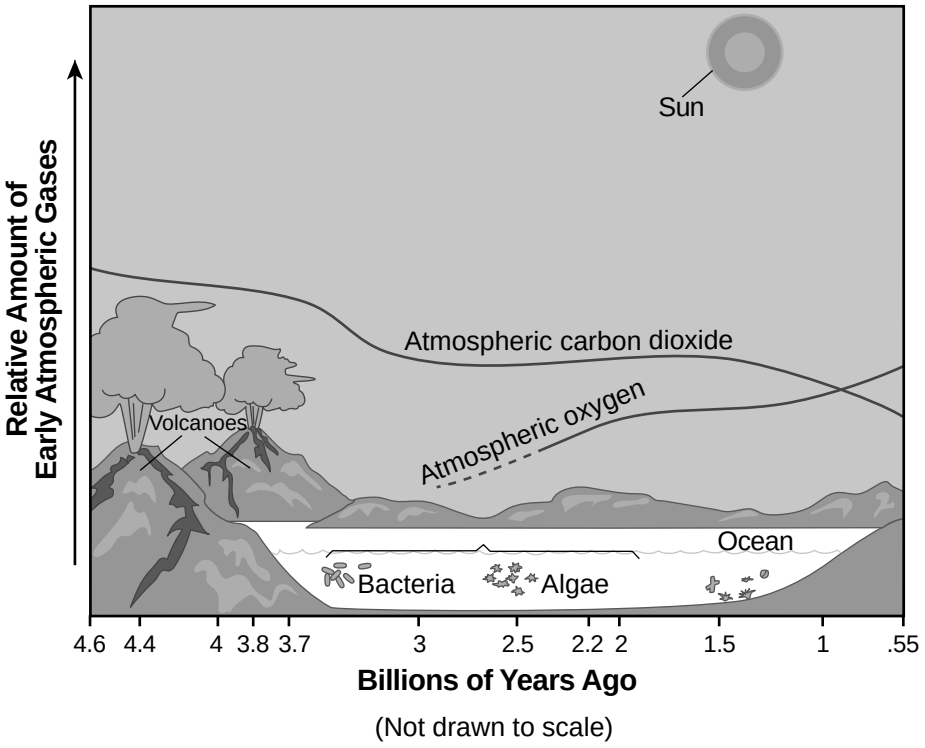
(4) Present-day volcanoes directly release oxygen that is used by marine and land plants, which in turn release carbon dioxide.

The water in Earth's early oceans provided the necessary environment for life about 3 to 3.5 billion years ago. Organisms such as stromatolites were the earliest example of life on Earth and were capable of photosynthesis.

From about two billion years ago to 500 million years ago, Earth's atmosphere changed significantly, driven by an increase of many different life forms. Living and fossilized stromatolites can still be found today in Australia.

2.7-Billion-Year-Old Fossilized Stromatolite – Australia

Model of Changes in Atmospheric Gases



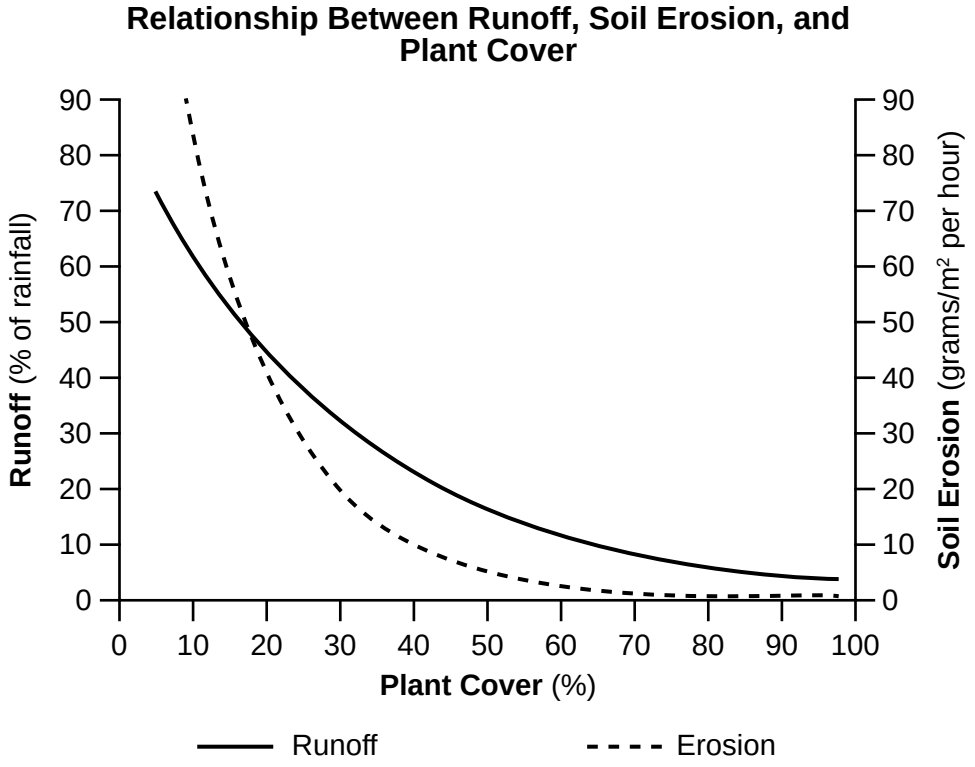
(Not drawn to scale)

23 Construct an argument, based on evidence in the model, about how stromatolites in Earth's oceans caused Earth's early atmosphere to evolve. [1]

As life on Earth evolved and expanded onto land, fresh water became a vital resource. This is especially true for humans who use fresh water in a variety of ways.

Humans have caused changes in land use through deforestation, agricultural expansion, and urbanization. These changes can impact soil in both positive and negative ways.

The graph below shows some information about factors that affect erosion.



24 Use the graph to complete the claims that describe how changes in the percent of plant cover on a land surface cause changes to runoff and the amount of soil eroded during a rain event. [1]

Claim #1: As the percent of plant cover (increases *or* decreases) runoff

circle one

will _____.

Claim #2: As the percent of plant cover (increases *or* decreases) the amount of

circle one

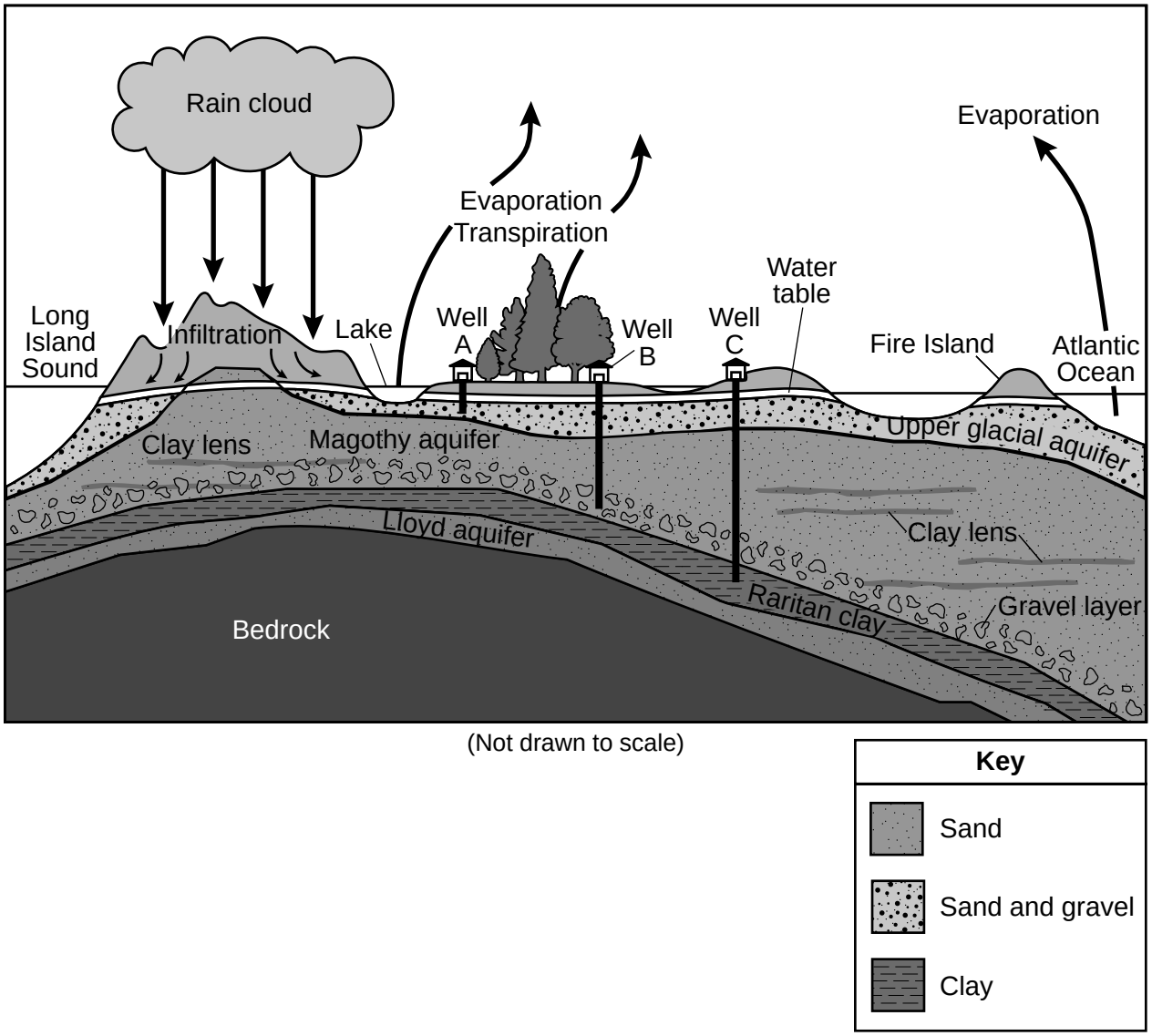
soil eroded during a rain event will _____.

In areas where human population density is high, managing fresh water availability is essential.

A large, underground store of water is called an aquifer. One of the most important aquifers in New York State is beneath Long Island and supplies 400 million gallons of water per day to over 2.8 million people.

The cross section below represents water cycle processes for the Long Island area. The three aquifers (Upper Glacial, Magothy, and Lloyd) and sediment or rock layers that together make up the larger Long Island aquifer region are shown.

Water Cycle and the Long Island Aquifer Model



25 A groundwater investigation is planned for water Well *B* and Well *C* from the cross section. A scientist believes that Well *B* will supply water at a faster rate than Well *C*. Which statement most likely explains why the scientist is correct?

(1) The sediments at the base of Well *B* are less porous with a higher permeability than Well *C*.

(2) The sediments at the base of Well *B* are more porous with a higher permeability than Well *C*.

(3) The sediments at the base of Well *C* are more porous with a lower permeability than Well *B*.

(4) The sediments at the base of Well *C* are less porous with a higher permeability than Well *B*.

A period of drought occurs when the amount of rainfall an area receives and the amount of precipitation that eventually infiltrates into the ground to reach an aquifer is greatly reduced. When Long Island aquifers experience periods of drought or over-pumping from water wells, salt water from the Atlantic Ocean can intrude into the aquifer, polluting the fresh water.

26 Describe how a prolonged period of drought would affect the depth of the water table. Also, describe how this change would affect residents supplied by water from Well *A* more than residents supplied by water from Well *B*. [1]

Water table depth: _____

Effect on Well *A* and Well *B* residents: _____

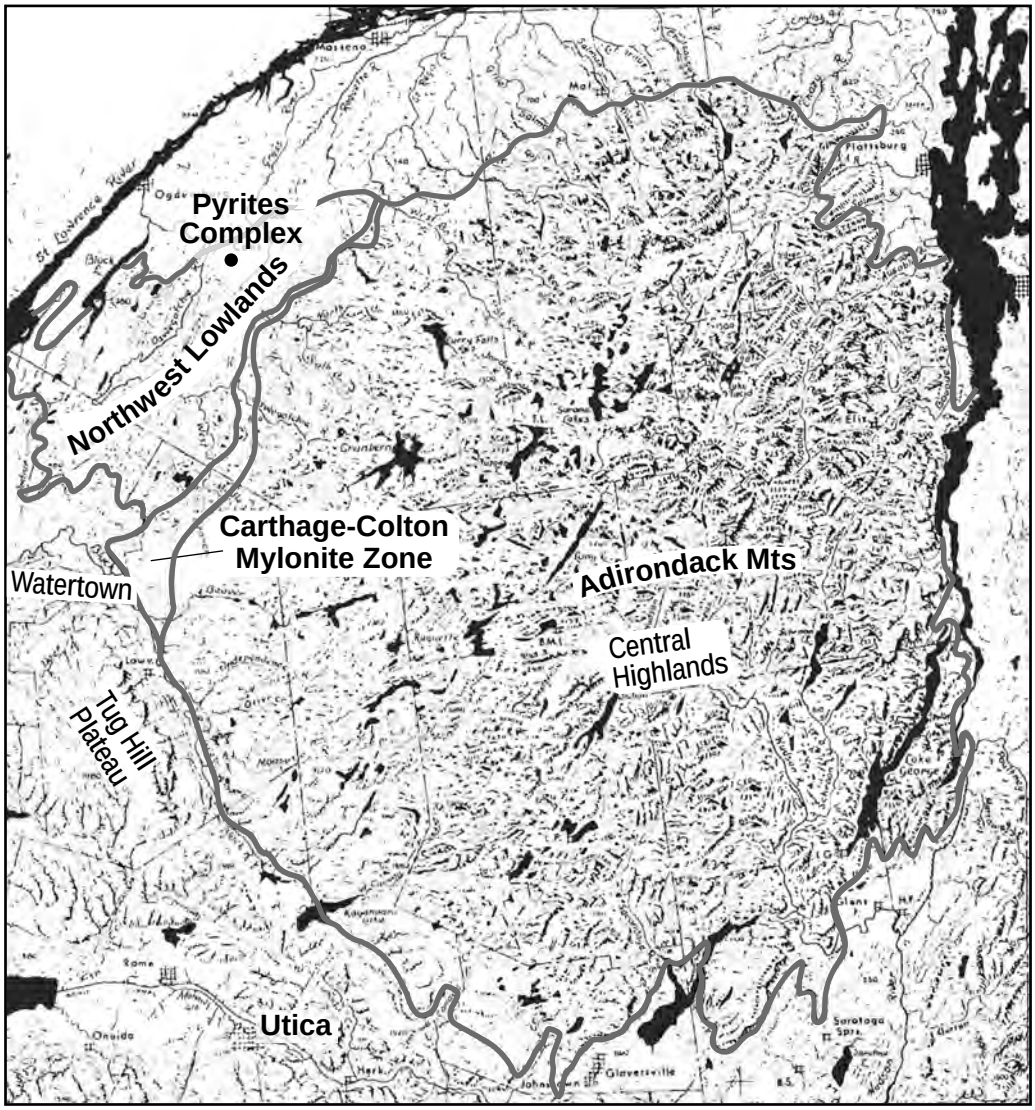
_____

_____

Base your answers to questions 27 through 30 on the information below and on your knowledge of Earth and Space Sciences. Some questions may require the use of the ***2024 Edition Reference Tables for Earth and Space Sciences***.

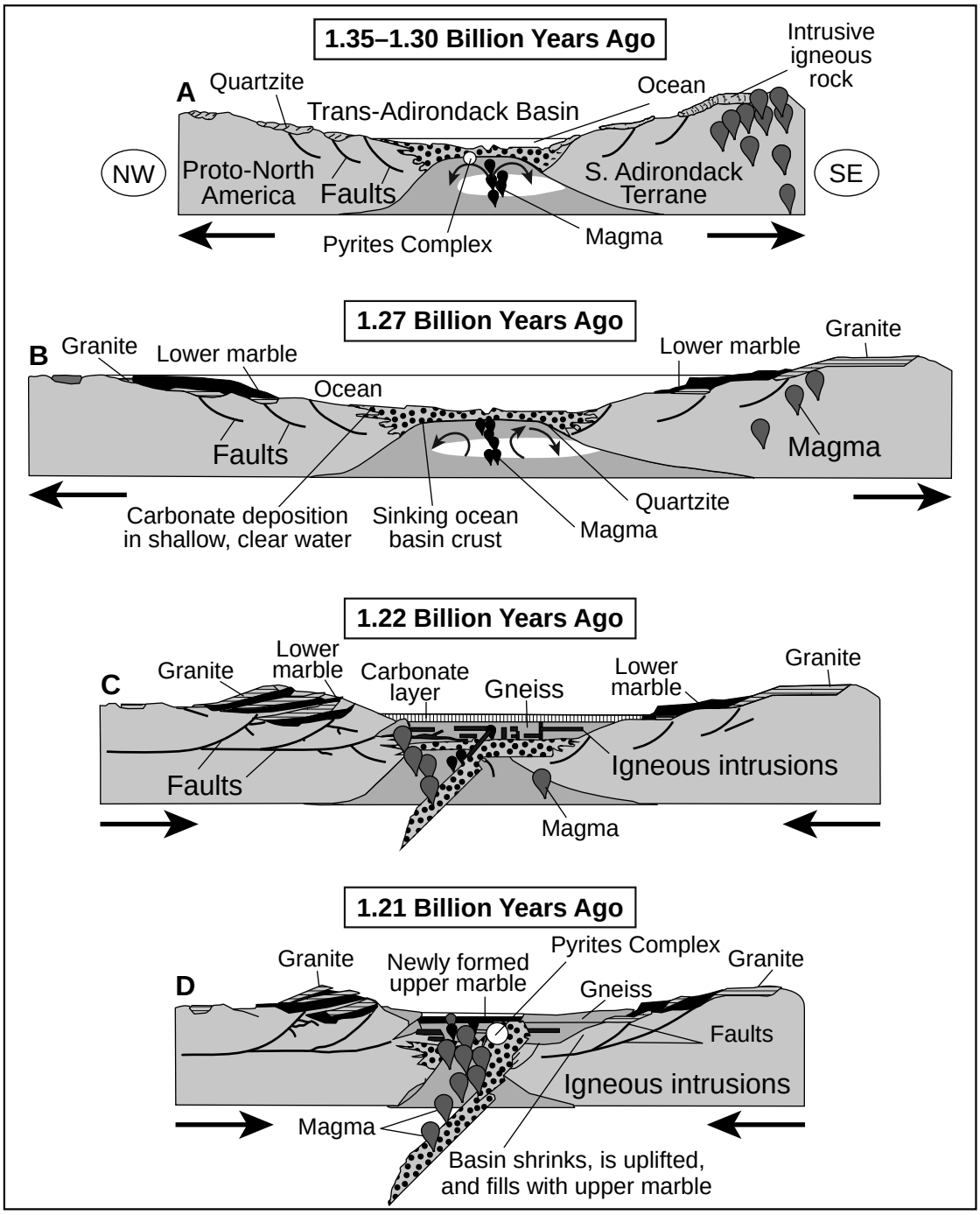
Northern New York's Pyrites Complex

The Pyrites Complex, located in New York State's Northwest Lowlands, represents a 1.35- to 1.21-billion-year-old fragment of ocean crust and upper mantle rocks. Most of the rocks in the Northwest Lowlands are metamorphosed sedimentary and igneous rocks. The map below shows the location of the Pyrites Complex within the Northwest Lowlands. Bodies of water are shown in black.



Models *A*, *B*, *C*, and *D* represent the formation of the Pyrites Complex. Arrows indicate the direction of plate motion.

Formation of the Pyrites Complex



(Not drawn to scale)

27 Use **one** of the *Formation of the Pyrites Complex* models to identify **one** geologic process responsible for the cycling of matter that contributed to the formation of the Pyrites Complex. Include the letter of the model in your answer. [1]

Letter of Model: _____

Geologic Process: _____

_____

28 A student made a chart of constructive and destructive geologic processes from information shown in the *Formation of the Pyrites Complex* models.

Constructive	Destructive
Model B: new ocean crust formed	**Model C:** subduction of oceanic crust
Model A: intrusive igneous rock rises to the surface	**Model D:** ocean basin shrinks
Model B: deposition of sediment along ocean basin	**Model D:** marble is formed from metamorphism of limestone

Which table below shows an additional process that is classified correctly and could be added to the table above?

(1)

Constructive
Model A: Trans-Adirondack Basin shrinks

(2)

Destructive
Model B: faults first appear along either side of the ocean basin

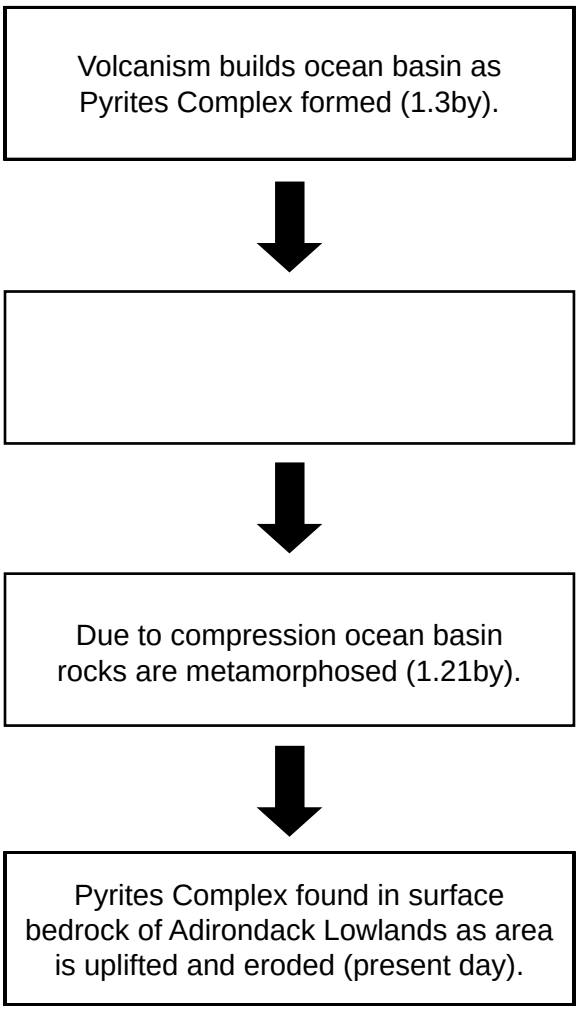
(3)

Constructive
Model C: granite and lower marble are uplifted

(4)

Destructive
Model D: basin fills with upper marble

The flow chart below shows four geologic stages that led to the formation of the Pyrites Complex. The second geologic stage was intentionally left blank.



29 Based on evidence from the *Formation of the Pyrites Complex* models, which geologic process correctly identifies the missing stage in the flow chart above?

(1) Quartzite is formed from lower marble.

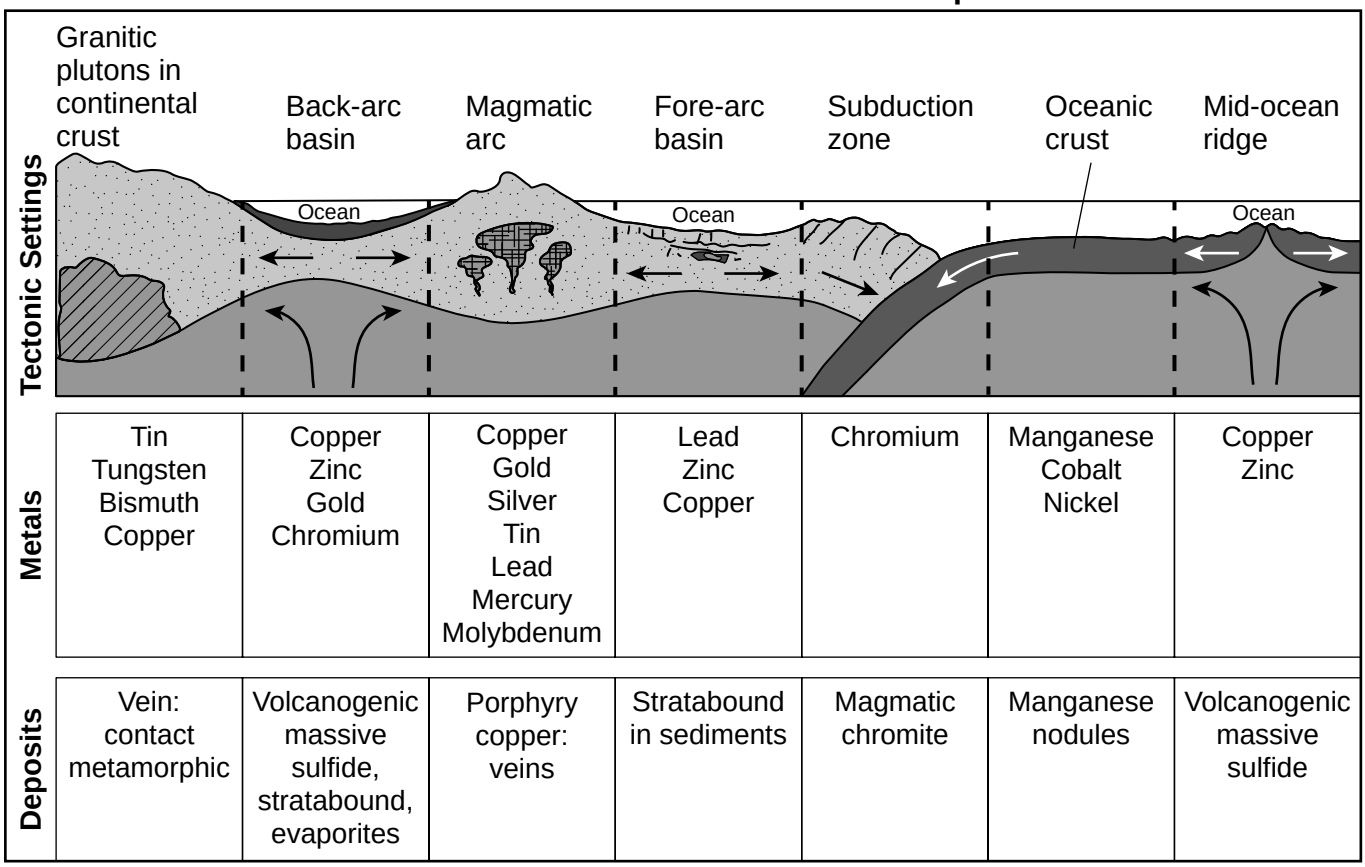
(2) Ocean floor continues to form and widens.

(3) Faults move granite beneath the ocean basin.

(4) Divergence causes the ocean to become narrower and shallower.

The model below pairs tectonic locations with metal deposits that form within them.

Tectonic Locations Where Mineral and Metal Deposits Form



30 Based on the model above, identify the two tectonic settings in which pyrite, a sulfide-based deposit, forms in association with zinc and copper.

(1) back-arc basin and mid-ocean ridge

(2) fore-arc basin and magmatic arc

(3) mid-ocean ridge and granitic plutons in continental crust

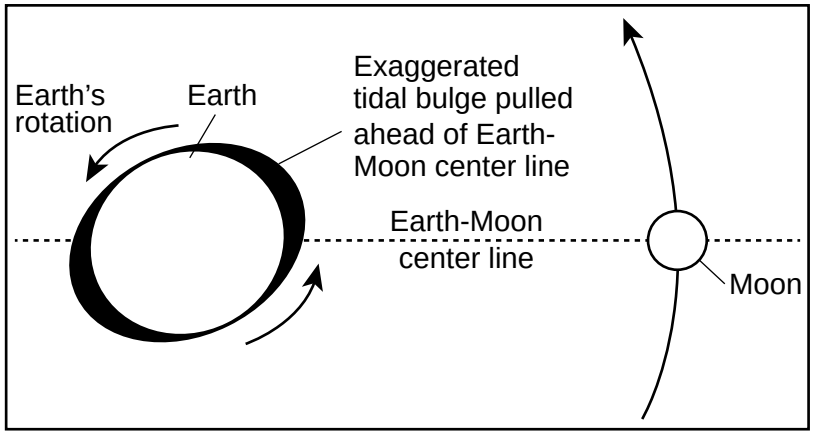
(4) subduction zone and fore-arc basin

Base your answers to questions 31 through 35 on the information below and on your knowledge of Earth and Space Sciences. Some questions may require the use of the ***2024 Edition Reference Tables for Earth and Space Sciences***.

Earth-Moon History

About four billion years ago, the Moon was very close to Earth, and Earth may have been rotating at a much faster rate than today. It is estimated that each Earth day, at that time, may have been six to eight hours long, which, when calculated, would result in an Earth year of about 1400 days. The force that causes tides on Earth creates tidal friction which, over time, slowed Earth's rotation, causing Earth days to become about 24 hours long. As Earth's rate of rotation has decreased, the Moon has continued to move farther away from Earth at an average rate of 3.8 cm/yr. The Moon orbits Earth at an average distance of 384,400 km. The model and graph below show some information about tides.

Simplified Model of Tidal Bulge on Earth



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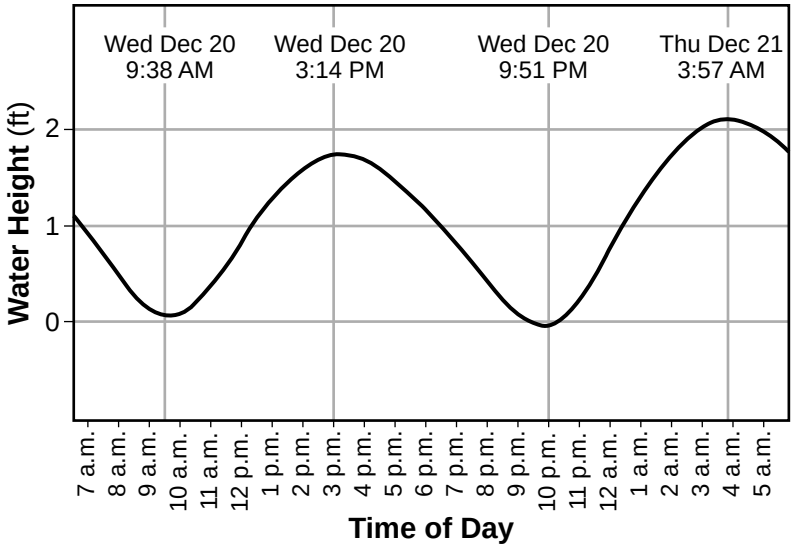
Observed Tides at Montauk Harbor, NY



31 Which row in the table below correctly identifies the evidence and explanation for the observed cyclic change in tides at Montauk Harbor?

Row	Evidence	Explanation
(1)	change of about two feet in height of water	The Moon's rotation as it orbits Earth causes water level changes.
(2)	change of about two feet in height of water	Earth's revolution around the Sun causes water level changes.
(3)	high tides approximately 12 hours apart	Earth's rotation results in a tidal bulge at a location approximately twice per day.
(4)	high tides approximately 12 hours apart	The Moon's revolution around Earth results in a tidal bulge at a location approximately twice per day.

32 Determine, in centimeters, how much farther away from Earth the Moon's average orbit will be 1000 years from the present day, and explain why this change in distance will *not* significantly affect the Moon's period of revolution around Earth. [1]

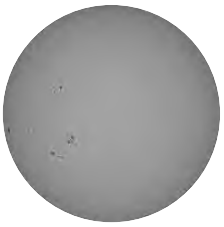
Distance: _____ **cm**

Explanation: _____

_____

The table below shows some information about the Sun and the Moon.

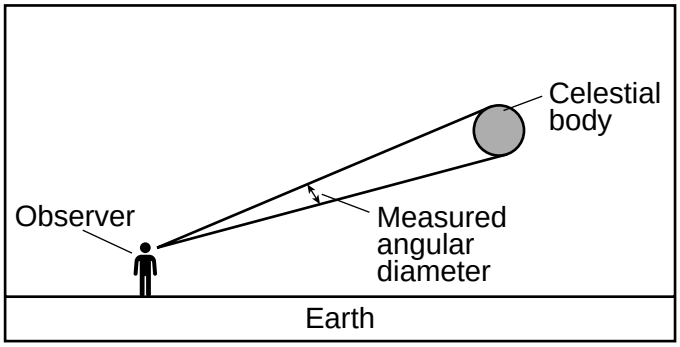
Sun and Moon Data

	Sun at Perihelion	Sun at Aphelion	Moon at Perigee	Moon at Apogee
Image of Apparent Size as Viewed from Earth				
Approximate Distance from Earth (km)	147,100,000	152,100,000	363,300	405,500
Approximate Measured Angular Diameter (°)	0.54	0.52	0.56	0.49

33 Construct an explanation to support the claim that in about 700 million years, a total solar eclipse on Earth's surface will be impossible. [1]

The measured angular diameter of a celestial body is the angle that the diameter of the body makes as seen from Earth.

Measured Angular Diameter



(Not drawn to scale)

34 Based on the information in the table, which lettered pair correctly completes the passage below?

The change in the angular diameter of the Moon during the Moon's orbit is __A__ than the change in the angular diameter of the Sun during Earth's orbit because the Moon's orbit is inferred to be __B__ elliptical than Earth's orbit.

(1)	(2)	(3)	(4)
A: smaller	A: greater	A: smaller	A: greater
B: more	B: more	B: less	B: less

Astronomers theorize that the Moon formed as a result of a collision between Earth and another planet. The debris created during this collision circulated around Earth and formed the Moon. Evidence for the age of the Moon is found in zircon, a mineral found in lunar rocks. This mineral contains uranium-238.

The table below shows some information about four rock samples taken from the lunar surface.

Lunar Samples and Percent of Uranium Remaining

Sample	Location	Percent of Uranium Remaining
A	Highland Crust	49.31
B	Lunar Mare	79.25
C	Oceanus Procellarum	73.33
D	Imbrium Basin	61.83

35 Using the table, identify the letter of the sample that provides evidence to support the claim that the Moon is approximately 4.53 billion years old. Explain how this evidence supports the claim. [1]

Sample: _____

Explanation: _____

_____

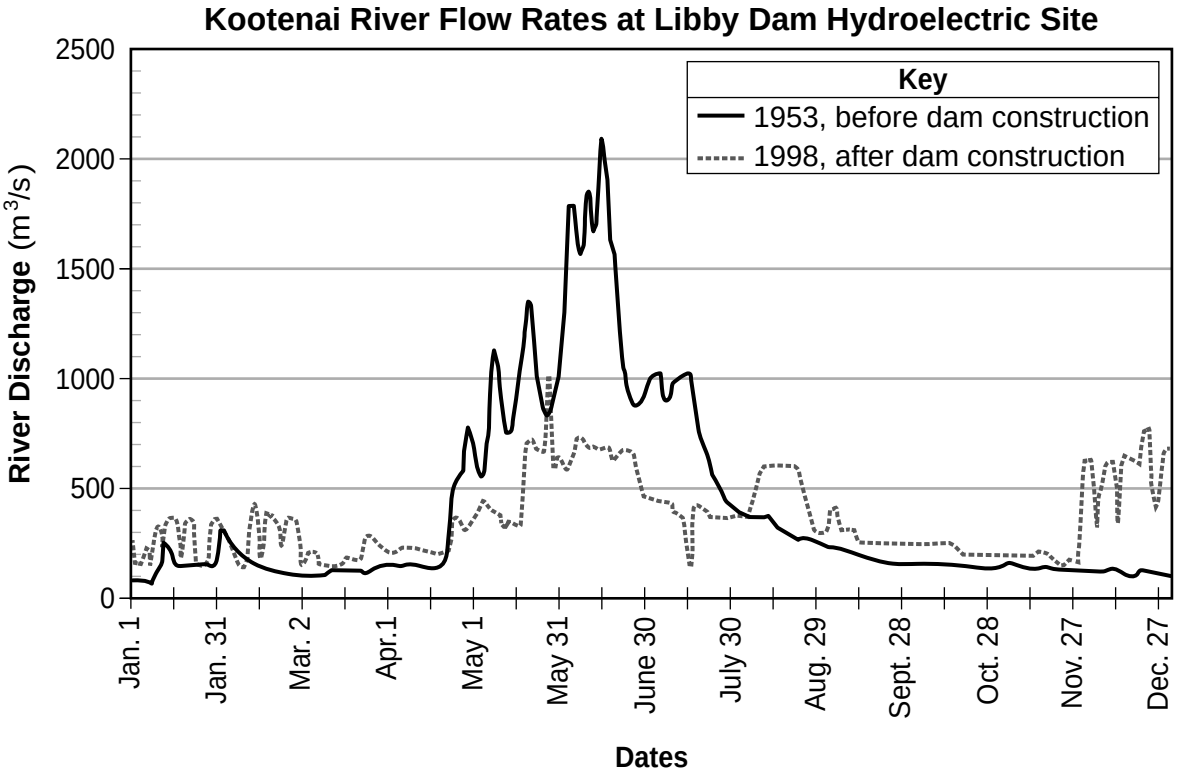
_____

Base your answers to questions 36 through 40 on the information below and on your knowledge of Earth and Space Sciences. Some questions may require the use of the ***2024 Edition Reference Tables for Earth and Space Sciences***.

Dams and Flood Mitigation

Dams and other structures are often put in place in river systems to help reduce life and property losses to residents living near rivers due to flooding. Dams are also built to generate electricity.

The graph below shows river flow rates on the Kootenai River in Montana in cubic meters per second (m^3/s).



36 Which claim identifies a benefit of developing and managing the Libby Dam Hydroelectric Project after its construction?

(1) The river flow rates have increased for the entire year, increasing the amount of electricity generated.

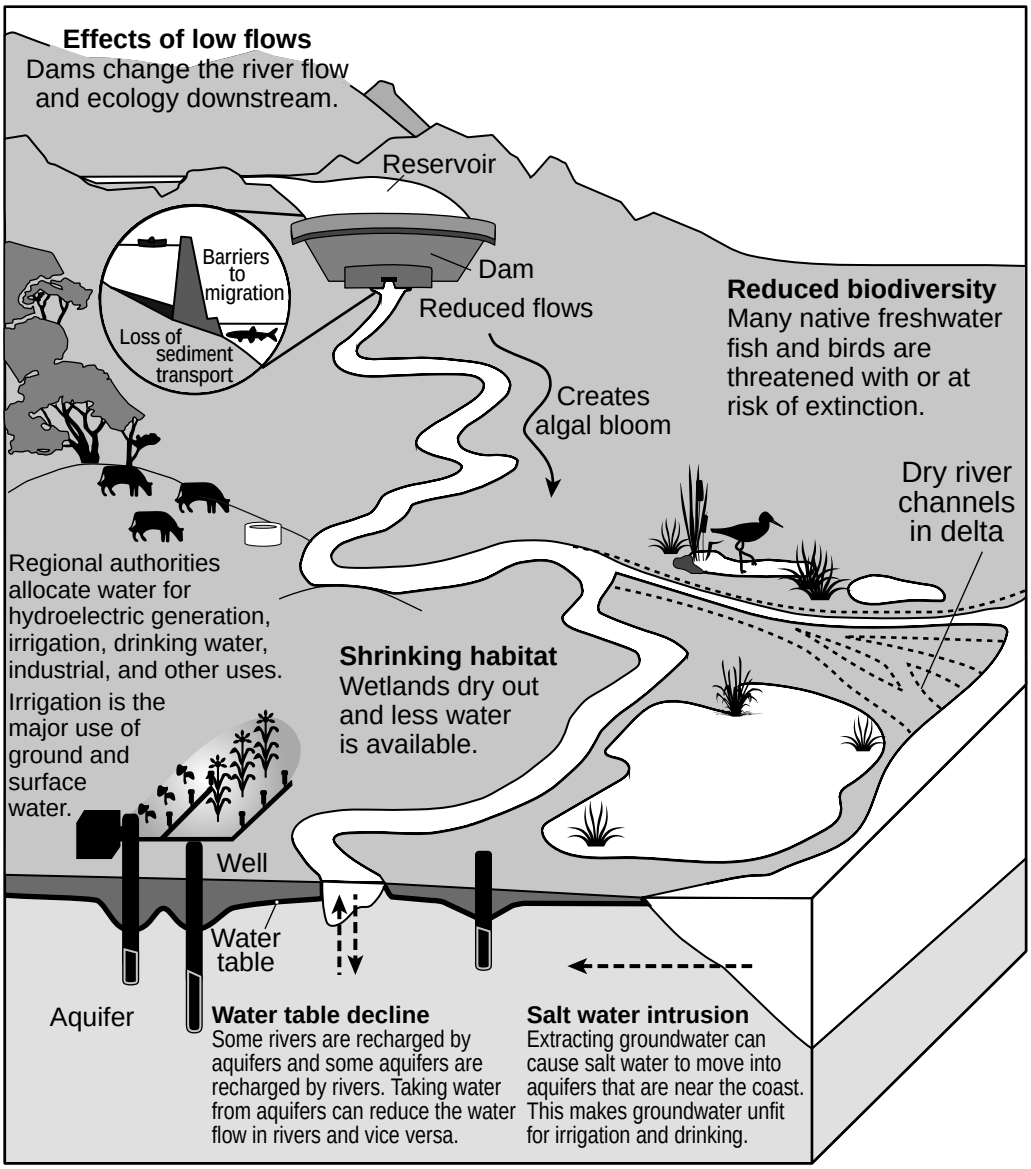
(2) The river flow rates have decreased during the winter months, increasing the amount of electricity generated.

(3) After dam construction, the river flow rates changed less throughout the year and allowed for more control of electric generation.

(4) After dam construction, the river flow rates changed more throughout the year and allowed for more control of electric generation.

The model below shows some information about a river system.

River Ecosystem with a Dam



(Not drawn to scale)

37 Which statement correctly identifies a relationship between the hydrosphere and the biosphere in a river system with *reduced* water flow below a dam?

(1) Lower water levels below the dam will lower the water table and will increase biodiversity of native fish and birds.

(2) The water table will rise and provide a benefit to agricultural areas, industrial areas, and wetlands.

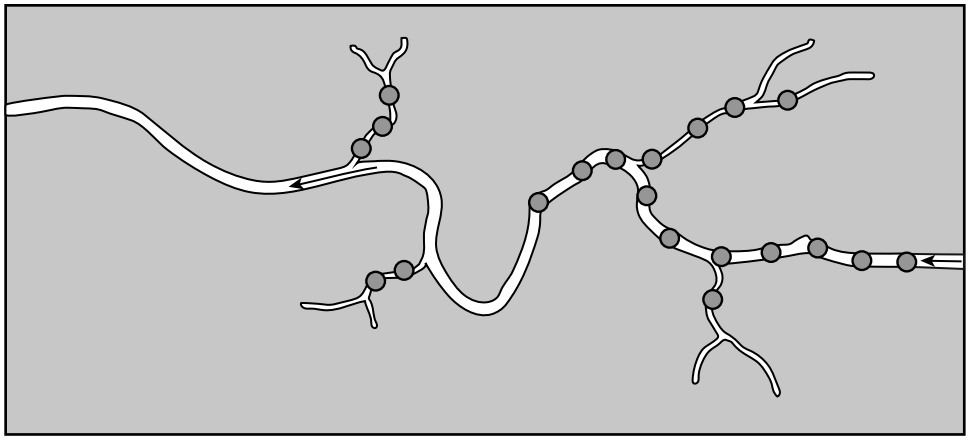
(3) Reduced oxygen levels in the stream will create algal blooms, which improve habitat for fish.

(4) A decrease in water flow promotes salt water intrusion, which is harmful to certain plants and animals.

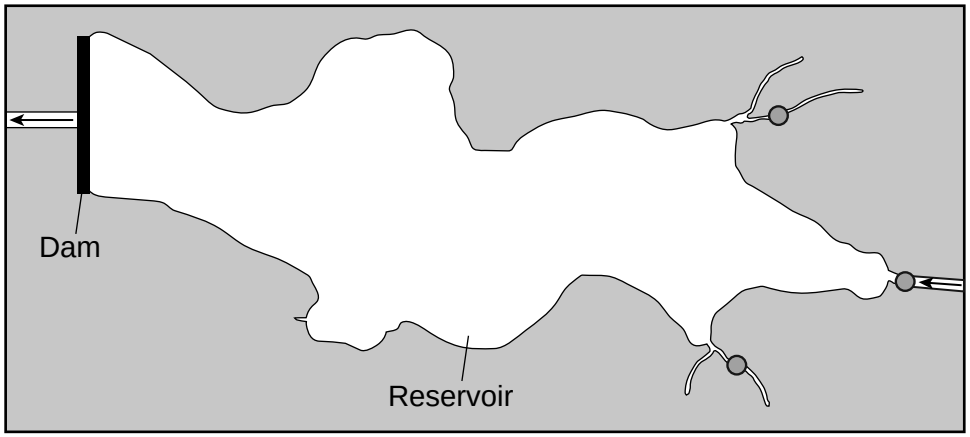
38 Use the model to construct a claim about the amount of coastal sediment deposited by a river system before and after a dam is constructed. [1]

The diagrams below show a river system before and after being dammed to create a reservoir. Arrows indicate direction of flow of the river from upstream to downstream.

Free-Flowing River



River with Dam and Reservoir



(Not drawn to scale)

Key
Fish spawning and rearing habitat

39 Based on the *River Ecosystem with a Dam* model and the diagrams, which evidence-based statement correctly identifies how the availability of fish-spawning habitats has influenced commercial fishing above the dam?

(1) Dams increase water levels upstream, decreasing fish spawning and decreasing commercial fishing opportunities.

(2) Dams increase dissolved oxygen downstream, decreasing water quality and decreasing commercial fishing opportunities.

(3) Dams decrease water levels upstream, increasing fish spawning and decreasing commercial fishing opportunities.

(4) Dams decrease dissolved oxygen downstream, increasing water quality and increasing commercial fishing opportunities.

Some residents in coastal areas impacted by flooding have decided to place their existing homes on stilts above identified floodwater levels. The data table shows some information about flood damage.

Cost of Flood Damage in a 2500 Square Foot Home

Floodwater Height (inches)	**Damage Amount** (U.S. dollars)
6”	$52,037
12”	$72,162
24”	$87,326
36”	$94,538
48”	$103,355

Home Being Raised Onto Stilts

40 Use the *Cost of Flood Damage in a 2500 Square-Foot Home* table to calculate how much a homeowner could potentially save after spending $56,250 to raise their 2500-square-foot home to avoid being impacted by a 24-inch flood. [1]

Amount saved: $ _____

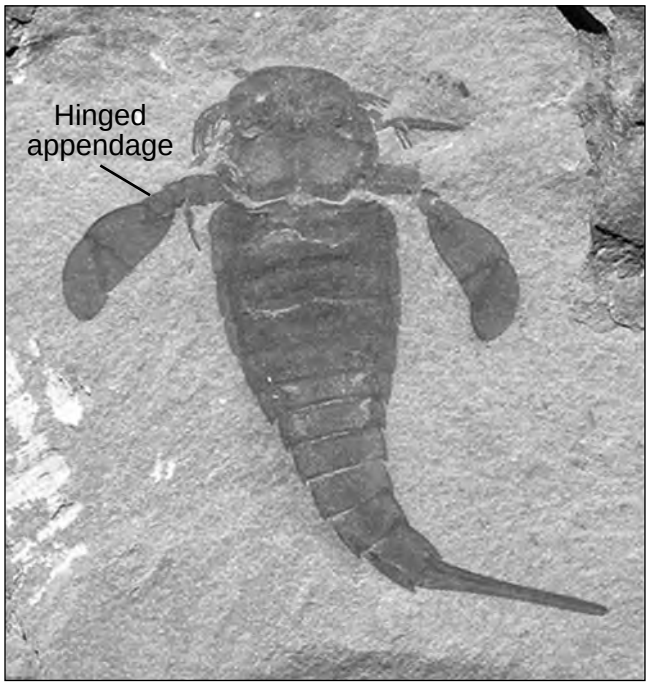
Base your answers to questions 41 through 45 on the information below and on your knowledge of Earth and Space Sciences. Some questions may require the use of the ***2024 Edition Reference Tables for Earth and Space Sciences***.

New York State Fossils of Note

The New York State fossil shown below is a Silurian-age eurypterid called *Eurypterus remipes*.

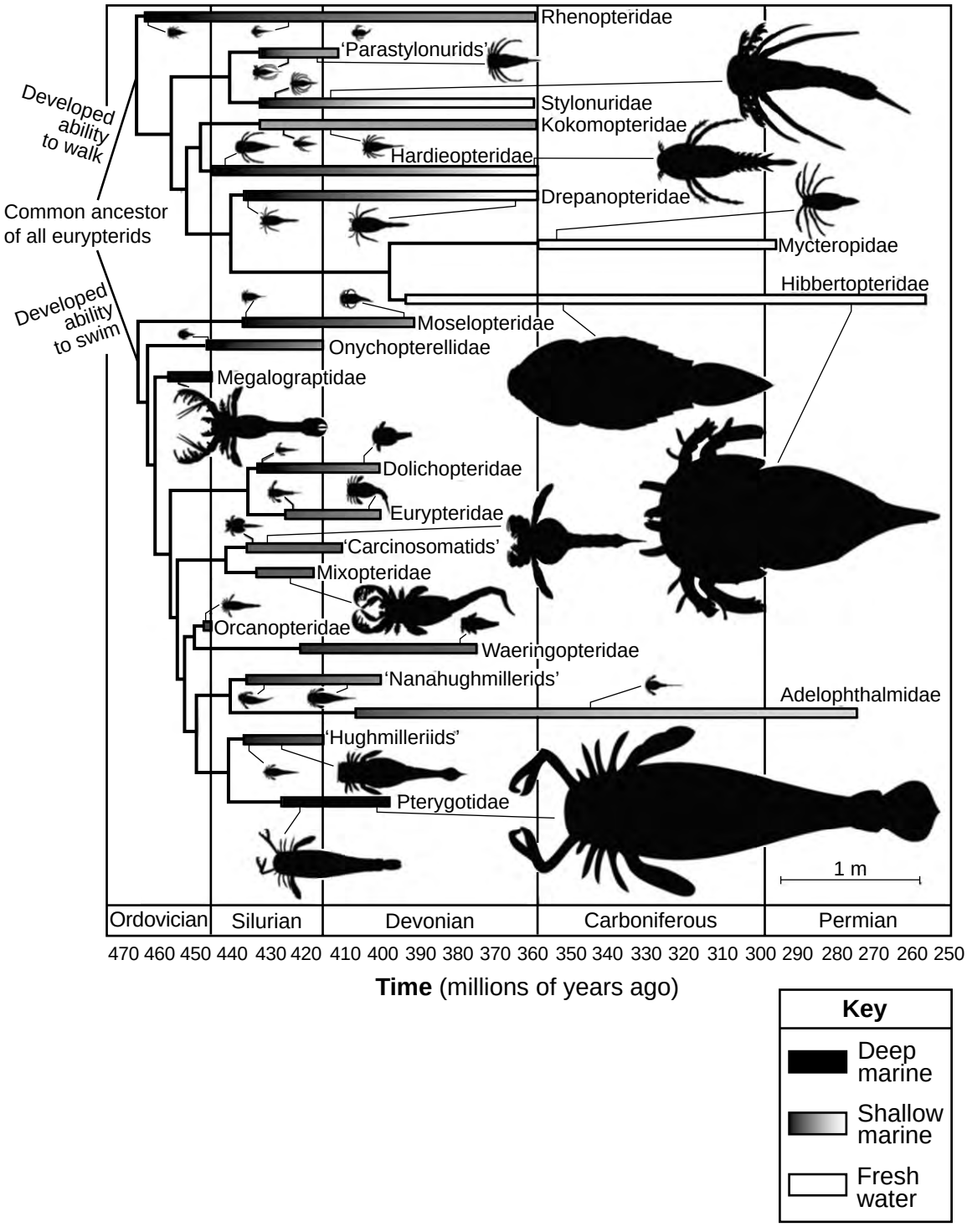
This fossil was originally believed to be a catfish before being correctly described as an arthropod — an invertebrate with a segmented exoskeleton and hinged appendages. Some eurypterid appendages were used for walking, while other appendages were used for swimming.

New York State Fossil
Eurypterus remipes



The model below is a family-level evolutionary tree (cladogram) for various eurypterids. The bars represent known temporal ranges for each family. Some eurypterid silhouettes are shown to scale with lines indicating their temporal placement in each family.

Temporal Ranges of Eurypterid Families Model



41 Which row in the table correctly identifies the family of *Eurypterus remipes*, the age of the fossil, and the type of movement its appendages were used for?

Row	Family	Age (mya)	Type of Movement
(1)	Rhenopteridae	350	walking
(2)	Pterygotidae	330	walking
(3)	Eurypteridae	420	swimming
(4)	Mycteropidae	355	swimming

42 Use information from the model to describe the temporal ranges of fossilized eurypterids that lived in a deep marine environment compared to those that lived in fresh water. [1]

43 Based on evidence in the model, which table correctly completes the passage below?

Evidence of the mass extinction of __A__ eurypterid families can be inferred from the model. This extinction event occurred at the end of the __B__ period. After this event, the majority of remaining eurypterid families lived in a __C__ environment.

(1)

A	walking
B	Silurian
C	fresh water

(2)

A	walking
B	Devonian
C	fresh water

(3)

A	swimming
B	Devonian
C	deep marine

(4)

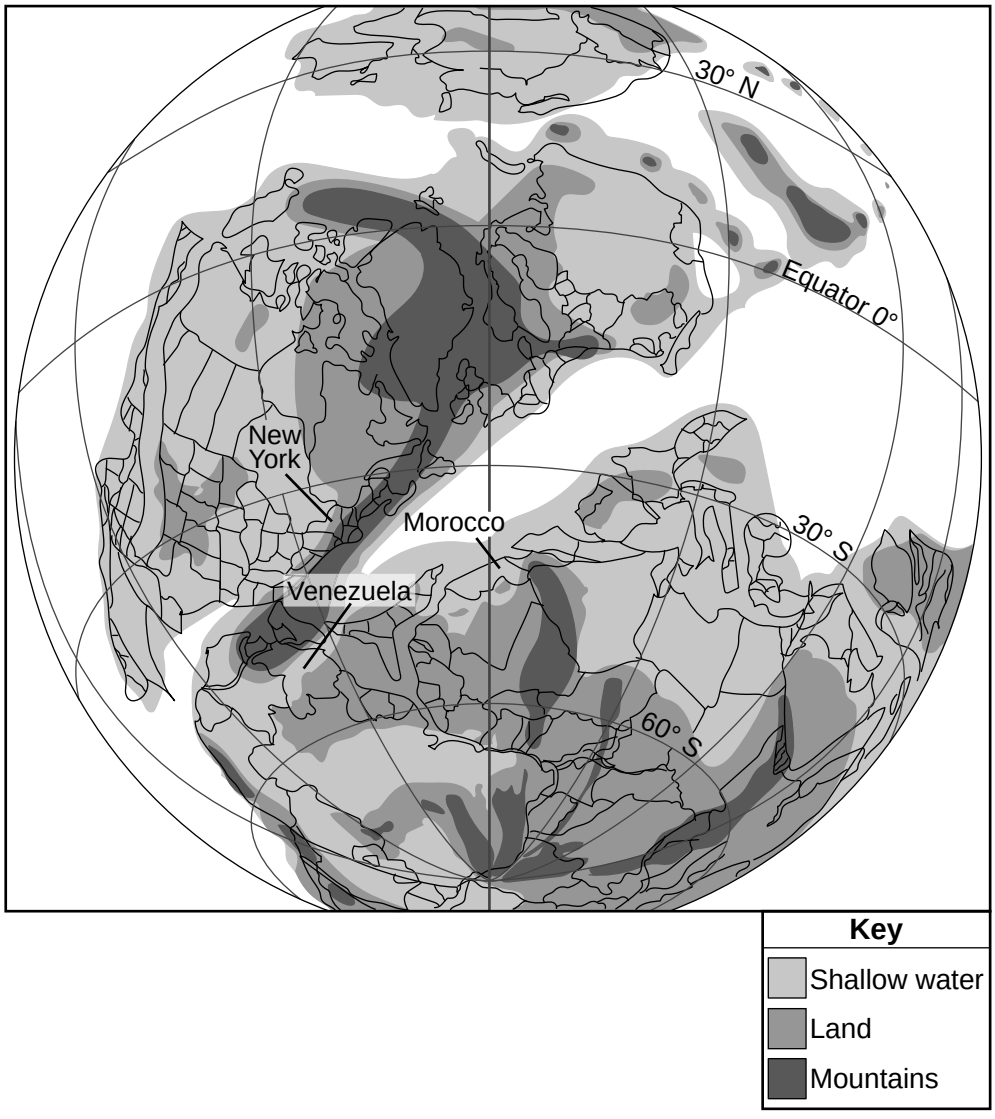
A	swimming
B	Silurian
C	deep marine

One of the world's oldest fossil forests was found in the 1850s in Gilboa, New York. Preserved plant remains were unearthed at the Riverside Quarry dated to about 390 million years ago in the Devonian Period. This was a time when land plants were evolving into forest ecosystems.

Four hundred and eighty-six objects (root mounds, horizontal stems and plant fragments) were identified in the rock, including two types of trees. *Eospermatopteris* trees were found and are related to ferns. Aneurophytalean progymnosperms called *Tetraxylopteris* also were found. *Tetraxylopteris* grew underground but sprouted above ground. These same fossil trees have also been found in Venezuela and Morocco.

The map below shows the location of landmasses when the first ancient forests existed during the Devonian Period.

Middle Devonian Paleomap – 390 mya



44 Which evidence from the paleomap could be used to support an explanation for the presence of similar ancient plant and tree fossils found in Gilboa, NY, Morocco, and Venezuela?

(1) These three landmasses were located next to each other during the Devonian Period.

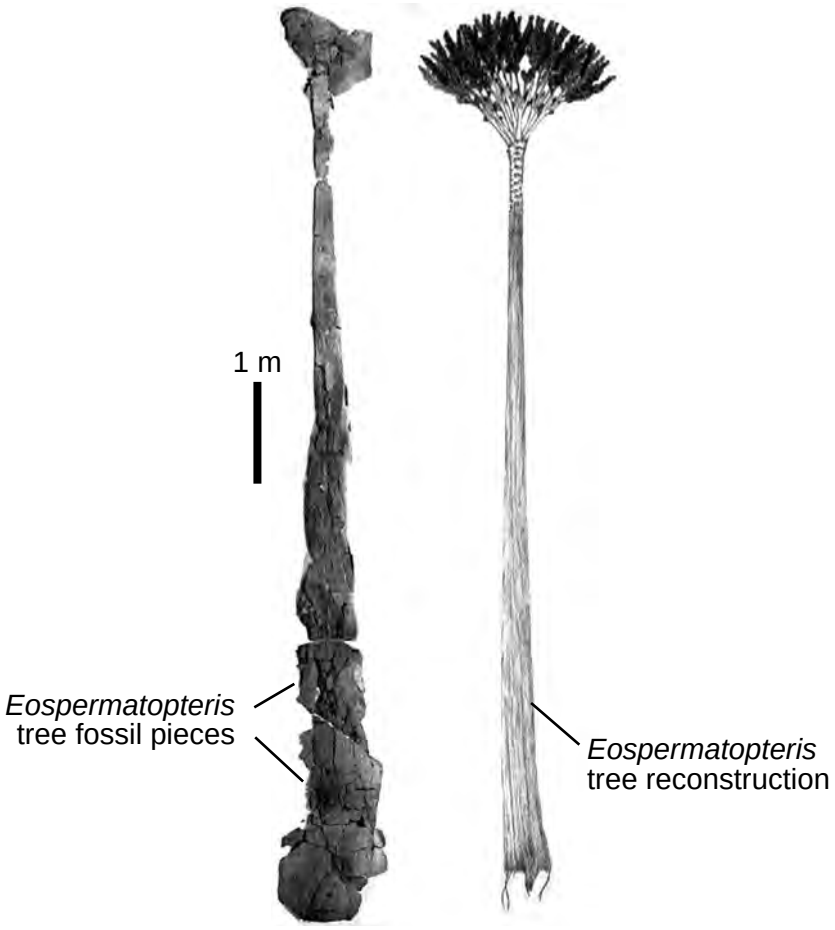
(2) These three landmasses were located in a similar climate zone that allowed ancient forests to survive during the Devonian Period.

(3) All of New York, Morocco, and Venezuela were northern hemisphere landmasses located above water during the Devonian Period.

(4) New York, Morocco, and Venezuela had tropical ecosystems that allowed for ancient forests to develop in mountainous areas.

The image below shows the fossils found in sandstones and mudstones near Gilboa, New York, and an artist's reconstruction of this type of tree typically found in the Devonian forest.

Gilboa Forest Fossil Tree and Reconstruction Diagram



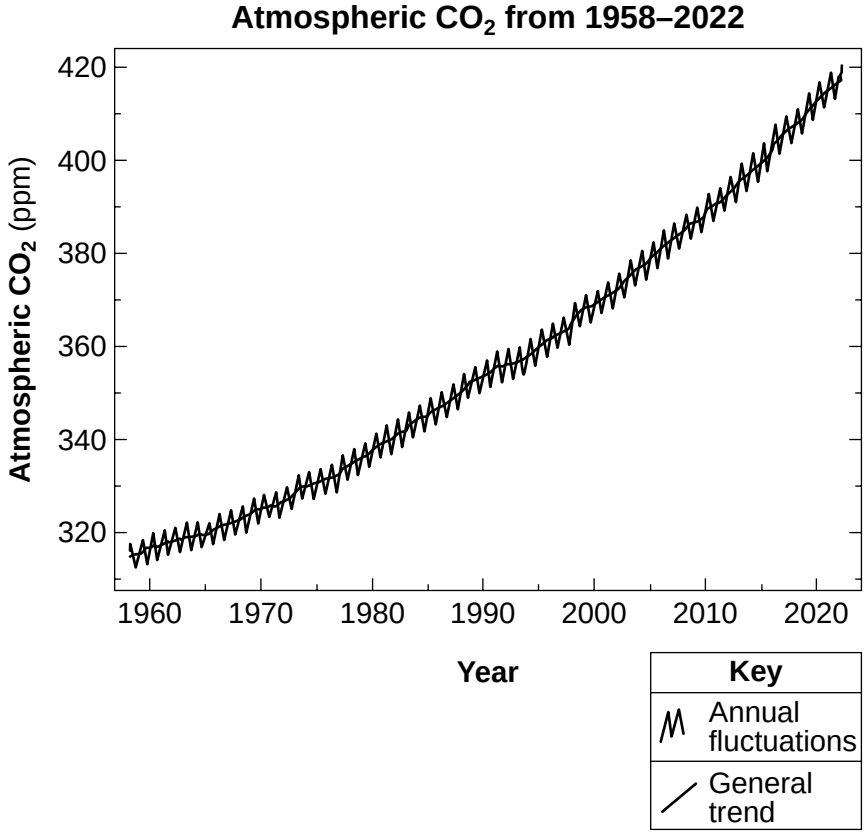
45 Based on the diagram, which row in the table below provides the correct evidence that accurately describes the height (in meters) and environment of formation for the *Eospermatopteris* tree fossil?

Row	Height of Tree (meters)	Environment of Formations
(1)	1	volcanic
(2)	3	swamp
(3)	5	deep marine
(4)	9	terrestrial

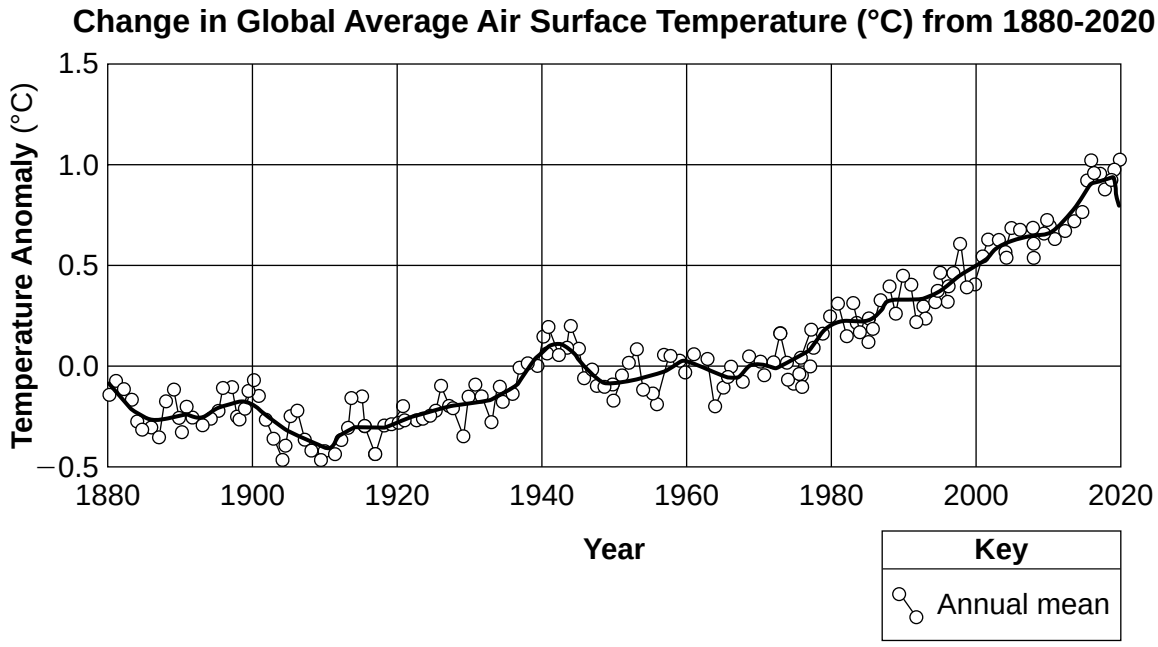
Base your answers to questions 46 through 50 on the information below and on your knowledge of Earth and Space Sciences. Some questions may require the use of the ***2024 Edition Reference Tables for Earth and Space Sciences***.

Atmospheric Carbon Dioxide

The chemistry of the oceans and coastal regions around the world are particularly vulnerable to changes in greenhouse gases. As atmospheric carbon dioxide emissions and polluted waters enter the marine environment, the waters become more acidic and less suitable for certain species. The full extent of this threat to marine ecosystems by human activity is not well understood, but proactive efforts are needed to protect the well-being of New York State's marine ecosystems. The graph below shows changes in atmospheric CO_2 levels in parts per million (ppm).

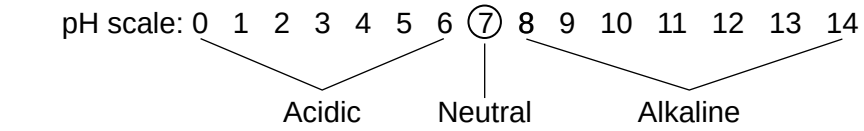


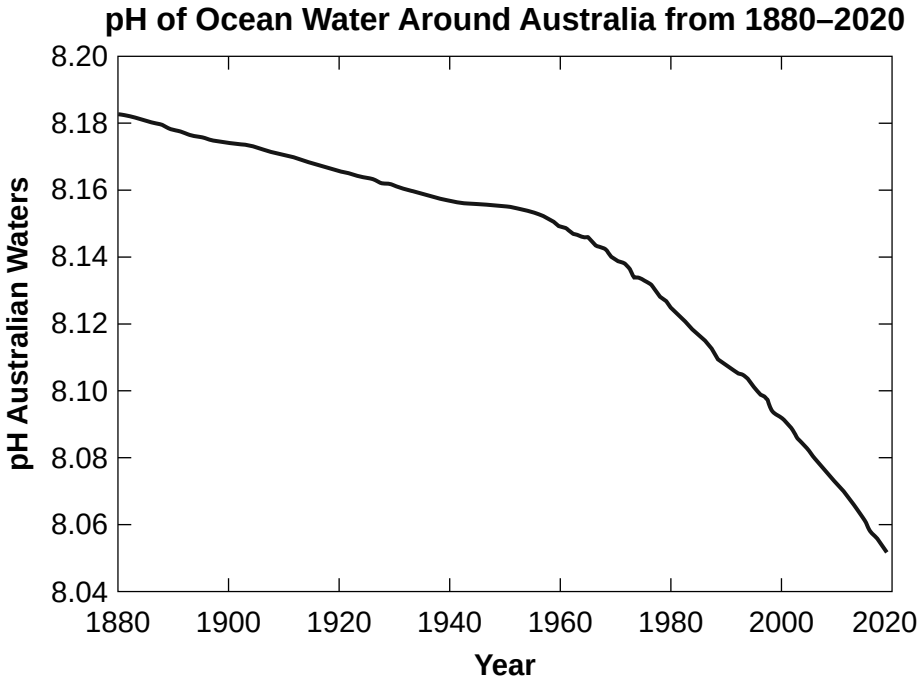
The graph below shows the change in global air surface temperature compared to the long-term average (0.0°C temperature anomaly). The line represents the general trend in the data points for the indicated time period.



46 Describe how atmospheric CO_2 levels have affected the flow of energy out of the atmosphere *and* describe how this change in energy flow has affected the global climate. Use evidence from *both* graphs in your description. [1]

The model below shows the pH scale (0–14) that is a measure of the acidity or alkalinity of water. The graph below shows some information about the pH of ocean water.





47 The change in the atmospheric carbon dioxide level from 1958 to 2020 has caused the waters around Australia to show

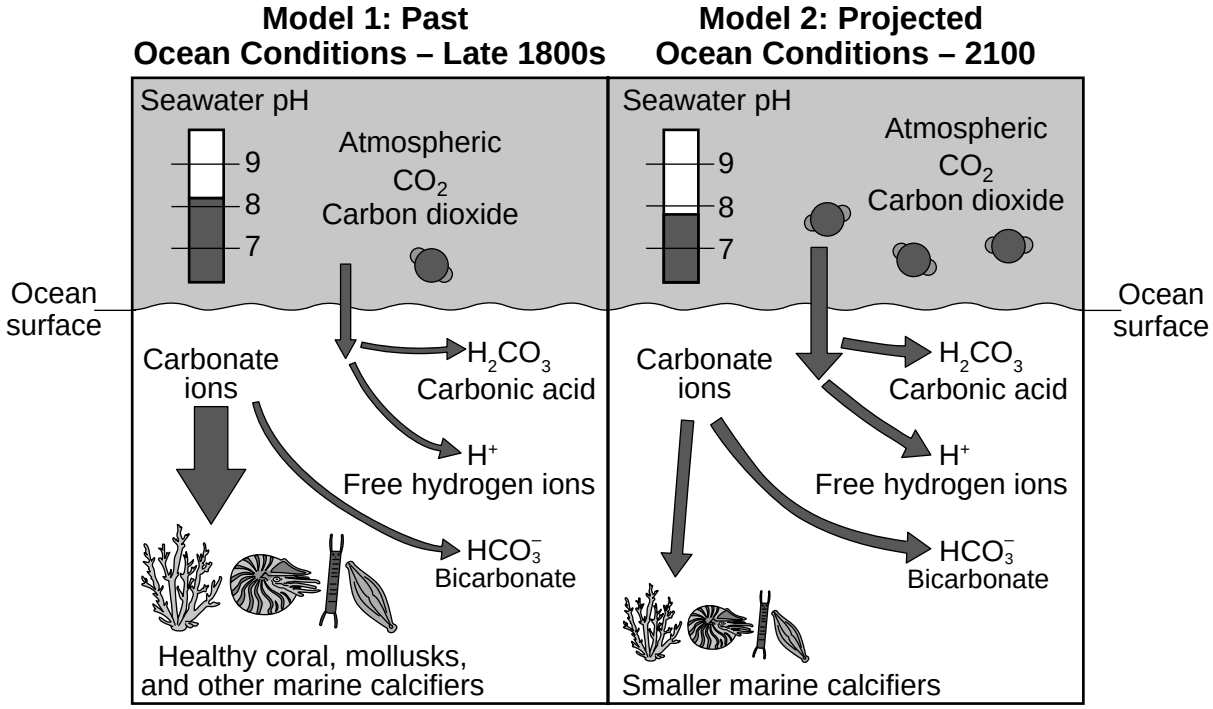
(1) a decrease in oceanic pH and an increased acidity

(2) a decrease in oceanic pH and a decreased acidity

(3) an increase in oceanic pH and an increased acidity

(4) an increase in oceanic pH and a decreased acidity

The acidity of ocean water is determined by the relative amounts of H^+ ions. The models below show the ocean acidification process for two different time periods. The thickness of the arrows indicates relative amounts of substances in the atmosphere and oceans.



48 From the time in *Model 1* to the time in *Model 2*, determine if the atmospheric CO_2 entering the ocean and the ocean carbonate ions are projected to increase, decrease, or remain the same. [1]

Atmospheric CO_2 entering ocean: _____

Ocean carbonate ions: _____

49 Use the information in the models to explain how the projected (2100) availability of carbonate ions will change *and* will affect the marine calcifiers. [1]

_____

_____

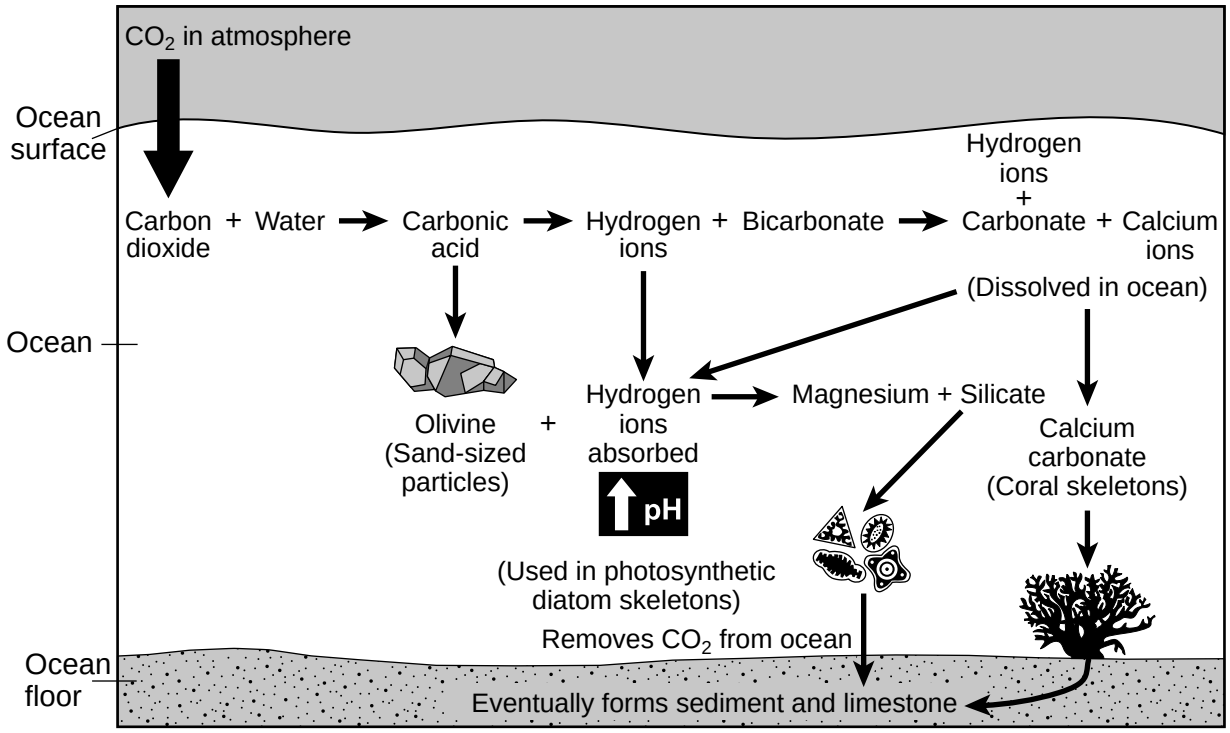
_____

Mineral weathering, which takes place over geologic time scales, is one of the main mechanisms Earth uses to recycle carbon dioxide. In a process called Coastal Carbon Capture, a common volcanic mineral, olivine, is used to limit the impacts of CO_2 on the hydrosphere. In this process, olivine is mined from Earth, ground into sand-sized particles, and then transported to coastal regions where it is spread along shorelines. Once in the water, the olivine sand will absorb hydrogen ions, gradually making the water less acidic and potentially protecting wildlife like shellfish, corals, and fish.

In July 2022, this technique was performed at the eastern end of Long Island, New York, as part of an ongoing research project.

The model shows some information about the coastal carbon capture process.

Coastal Carbon Capture: Adding Olivine Sand to Oceans



50 Which claim correctly summarizes how the Coastal Carbon Capture process is a solution that will reduce the impact of ocean acidification?

(1) Olivine will lower the pH of the ocean and decrease CO_2 levels.

(2) Olivine will increase the pH of the ocean and decrease ocean CO_2 levels.

(3) Olivine will lower the pH of the ocean and increase ocean CO_2 levels.

(4) Olivine will increase the pH of the ocean and increase ocean CO_2 levels.

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EARTH AND SPACE SCIENCES

The State Education Department / The University of the State of New York

Regents Examination in Earth and Space Sciences – August 2025

Scoring Key: (Multiple-Choice Questions)

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Earth and Space Sciences	August '25	**2**	1	MC	1	1
Earth and Space Sciences	August '25	**4**	4	MC	1	1
Earth and Space Sciences	August '25	**5**	3	MC	1	1
Earth and Space Sciences	August '25	**7**	3	MC	1	1
Earth and Space Sciences	August '25	**8**	2	MC	1	1
Earth and Space Sciences	August '25	**10**	1	MC	1	1
Earth and Space Sciences	August '25	**11**	2	MC	1	1
Earth and Space Sciences	August '25	**13**	4	MC	1	1
Earth and Space Sciences	August '25	**15**	1	MC	1	1
Earth and Space Sciences	August '25	**16**	4	MC	1	1
Earth and Space Sciences	August '25	**17**	4	MC	1	1
Earth and Space Sciences	August '25	**19**	1	MC	1	1
Earth and Space Sciences	August '25	**21**	3	MC	1	1
Earth and Space Sciences	August '25	**22**	2	MC	1	1
Earth and Space Sciences	August '25	**25**	2	MC	1	1
Earth and Space Sciences	August '25	**28**	3	MC	1	1
Earth and Space Sciences	August '25	**29**	2	MC	1	1
Earth and Space Sciences	August '25	**30**	1	MC	1	1
Earth and Space Sciences	August '25	**31**	3	MC	1	1
Earth and Space Sciences	August '25	**34**	2	MC	1	1
Earth and Space Sciences	August '25	**36**	3	MC	1	1
Earth and Space Sciences	August '25	**37**	4	MC	1	1
Earth and Space Sciences	August '25	**39**	1	MC	1	1
Earth and Space Sciences	August '25	**41**	3	MC	1	1
Earth and Space Sciences	August '25	**43**	2	MC	1	1
Earth and Space Sciences	August '25	**44**	2	MC	1	1
Earth and Space Sciences	August '25	**45**	4	MC	1	1
Earth and Space Sciences	August '25	**47**	1	MC	1	1
Earth and Space Sciences	August '25	**50**	2	MC	1	1

Regents Examination in Earth and Space Sciences – August 2025

Scoring Key: Constructed-Response Questions

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Earth and Space Sciences	August '25	**1**	–	CR	1	1
Earth and Space Sciences	August '25	**3**	–	CR	1	1
Earth and Space Sciences	August '25	**6**	–	CR	1	1
Earth and Space Sciences	August '25	**9**	–	CR	1	1
Earth and Space Sciences	August '25	**12**	–	CR	1	1
Earth and Space Sciences	August '25	**14**	–	CR	1	1
Earth and Space Sciences	August '25	**18**	–	CR	1	1
Earth and Space Sciences	August '25	**20**	–	CR	1	1
Earth and Space Sciences	August '25	**23**	–	CR	1	1
Earth and Space Sciences	August '25	**24**	–	CR	1	1
Earth and Space Sciences	August '25	**26**	–	CR	1	1
Earth and Space Sciences	August '25	**27**	–	CR	1	1
Earth and Space Sciences	August '25	**32**	–	CR	1	1
Earth and Space Sciences	August '25	**33**	–	CR	1	1
Earth and Space Sciences	August '25	**35**	–	CR	1	1
Earth and Space Sciences	August '25	**38**	–	CR	1	1
Earth and Space Sciences	August '25	**40**	–	CR	1	1
Earth and Space Sciences	August '25	**42**	–	CR	1	1
Earth and Space Sciences	August '25	**46**	–	CR	1	1
Earth and Space Sciences	August '25	**48**	–	CR	1	1
Earth and Space Sciences	August '25	**49**	–	CR	1	1

Key
MC = Multiple-choice question
CR = Constructed-response question

The chart for determining students' final examination scores for the **August 2025 Regents Examination in Earth and Space Sciences** will be available on the Department's web site at **https://www.nysedregents.org/earth_space_sciences/** no later than August 20, 2025. Conversion charts provided for the previous administrations of the Physical Setting/Earth Science examination must NOT be used to determine students' final scores for this administration.

FOR TEACHERS ONLY

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

EARTH AND SPACE SCIENCES

Wednesday, August 20, 2025 — 8:30 to 11:30 a.m., only

RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 2 before rating student papers.

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Check this web site at: https://www.nysed.gov/state-assessment/high-school-regents-examinations and select the link "Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents Examination period.

Directions to the Teacher

Follow the procedures below for scoring student answer papers for the Regents Examination in Earth and Space Sciences. Additional information about scoring is provided in the publication *Information Booklet for Scoring Regents Examinations in the Sciences*.

Allow 1 credit for each correct response.

At least two science teachers must participate in the scoring of the open-ended questions on a student's paper. Each of these teachers should be responsible for scoring a selected number of the open-ended questions on each answer paper. No one teacher is to score more than approximately one-half of the open-ended questions on a student's answer paper. Teachers may not score their own students' answer papers.

Students' responses must be scored strictly according to the Rating Guide. For open-ended questions, credit may be allowed for responses other than those given in the rating guide if the response is a scientifically accurate answer to the question and demonstrates adequate knowledge as indicated by the examples in the rating guide. Do not attempt to correct the student's work by making insertions or changes of any kind. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

Fractional credit is *not* allowed. Only whole-number credit may be given for a response. If the student gives more than one answer to a question, only the first answer should be rated. Units need not be given when the wording of the questions allows such omissions.

For hand scoring, raters should enter the scores earned in the appropriate boxes printed on the separate answer sheet. Next, the rater should add these scores and enter the total in the space provided. Then the student's raw score on the test should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: https://www.nysed.gov/state-assessment/high-school-regents-examinations no later than August 20, 2025. The student's scale score should be entered in the box labeled "Scale Score" on the student's answer sheet. The scale score is the student's final examination score.

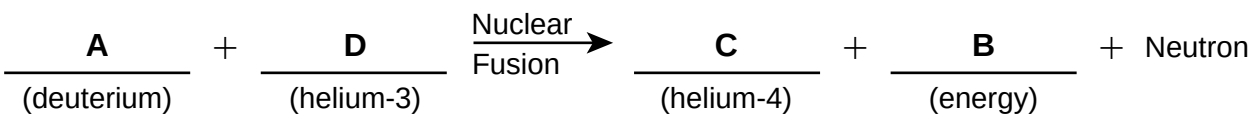
Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that, for each administration, the conversion chart provided for that administration be used to determine the student's final score.

The test item map on page 11 identifies the Performance Expectation with which each test question is aligned. All NYSP-12SLS Performance Expectations are three-dimensional (https://www.nysed.gov/sites/default/files/programs/standards-instruction/p-12-science-learning-standards.pdf). The integration of these three dimensions provides students with a context for the content of science (DCI), the methods by which science knowledge is acquired and understood (SEP), and the ways in which the sciences are connected through concepts that have universal meaning across the disciplines (CCC).

1 [1] Allow 1 credit for a correctly completed equation with letters *A* and *D* on the left side of the arrow and letters *C* and *B* on the right side of the arrow.

Example of a 1-credit response:



Note: Allow credit if student identifies components with words or chemical symbols instead of letters.

2 [1] Allow 1 credit for 1.

3 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Higher frequency radiation is emitted at times near maxima in the solar cycle.

— Solar irradiance is higher when the number of sunspots is higher.

4 [1] Allow 1 credit for 4.

5 [1] Allow 1 credit for 3.

6 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Property of water:

— When water freezes, it expands by about 10%.

— Water expands when it freezes.

Relative amount of deformation:

— Concrete samples with rebar have a lower deformation with fewer freeze-thaw cycles than concrete without rebar.

— Concrete samples without rebar have a higher deformation than samples with rebar.

7 [1] Allow 1 credit for 3.

8 [1] Allow 1 credit for 2.

9 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— The diversion of water through tunnels above the level of Horseshoe Falls resulted in less water flowing over the falls and a slower rate of erosion.

— Less water flowing over Horseshoe Falls due to diversion above the falls resulted in a slower rate of erosion at the falls.

10 [1] Allow 1 credit for 1.

11 [1] Allow 1 credit for 2.

12 [1] Allow 1 credit for a correct description *and* explanation. Acceptable responses include, but are not limited to:

Difference in wavelength:

— The wavelengths have become greater or longer.

— The wavelengths show a red shift.

How the universe changed:

— The change to greater wavelengths is evidence for the expansion of the universe.

— Red shift is evidence that the universe has expanded.

Note: Evidence for evolution of changing universe must include that the universe is expanding/getting bigger.

13 [1] Allow 1 credit for 4.

14 [1] Allow 1 credit for correctly completing the passage with *three* correct responses, as shown below:

A: <u>less</u>

B: <u>greater</u>

C: <u>less</u>

15 [1] Allow 1 credit for 1.

16 [1] Allow 1 credit for 4.

17 [1] Allow 1 credit for 4.

18 [1] Allow credit for indicating correct air mass designations for *both* air masses, as shown below *and* allow credit for a correctly completed table, as shown below. Allow credit if a symbol other than a checkmark is used.

Air Mass *A*: cP *or* cA

Air Mass *B*: mT

Weather Conditions	Increases	Decreases
cloud cover	✓	
chance of precipitation	✓	
air temperature		✓

19 [1] Allow 1 credit for 1.

20 [1] Allow 1 credit for an acceptable response. Acceptable responses include, but are not limited to:

— From 12 to 24 hours after landfall, a major hurricane's wind speed decreased from approximately 60 knots to approximately 45 knots, which means air pressure increased.

— From 12 to 24 hours after landfall the wind speed drops, so atmospheric pressure must have increased.

— A decrease in wind speed (between 12 and 24 hours) means the air pressure has increased.

21 [1] Allow 1 credit for 3.

22 [1] Allow 1 credit for 2.

23 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Stromatolites carried out photosynthesis, which removed CO_2 from the ocean and atmosphere, and increased oxygen levels into the atmosphere.

— For about 2 billion years, stromatolites have added oxygen to Earth's atmosphere through photosynthesis.

24 [1] Allow 1 credit for *two* correctly completed claims that include a circled choice and the related result. Acceptable responses include:

	Circled Choice:	Claim 1 (runoff)
Percent of plant cover	increase	— decrease/becomes less
	decrease	— increase/becomes greater
	Circled Choice:	**Claim 2 (soil erosion)**
	increase	— decrease/becomes less
	decrease	— increase/becomes greater

25 [1] Allow 1 credit for 2.

26 [1] Allow 1 credit for *both* a correct water table depth and an effect on Well *A* and Well *B* residents. Acceptable responses include, but are not limited to:

Water table depth:

— The water table would drop to a lower level compared to its previous location.

— The level of the water table would be farther from the surface than its previous location.

Effect on Well *A* and Well *B* residents:

— Well *A* residents could be without water, while Well *B* residents could still have access to water.

— Well *A* residents could experience greater salt water contamination than Well *B* because Well *A* extends into the Upper Glacial Aquifer, which is in contact with ocean water.

27 [1] Allow 1 credit for an acceptable response with a letter and correct geologic process. Acceptable responses include, but are not limited to:

Letter of Model	Geologic Process
A	— rising magma by thermal convection — matter cycled upward from Earth's interior
B	— magma rises to area of lower pressure due to density differences — magma rises at mid-ocean ridge as tectonic plates diverge
C	— tectonic plates converge, causing subduction of oceanic plate creating less-dense magma that rises back to surface — magma forms under subduction boundary and rises to surface
D	— marble created from heat and pressure of converging plates — basin is uplifted by heat and pressure of converging plates

Note: Do *not* allow volcanism as a geologic process because volcanism is a surface feature that results from the cycling of matter (convection).

28 [1] Allow 1 credit for 3.

29 [1] Allow 1 credit for 2.

30 [1] Allow 1 credit for 1.

31 [1] Allow 1 credit for 3.

32 [1] Allow 1 credit for 3800 cm *and* an acceptable explanation. Acceptable explanations include, but are not limited to:

— A 3800 cm change in distance would not considerably affect the Moon's period of revolution since it is such a small value compared to the distance between the Moon and Earth.

— A distance change of 3800 cm is very small compared to 384,400 km, causing very little change in the period of the Moon's revolution.

33 [1] Allow 1 credit for an acceptable response. Acceptable responses include, but are not limited to:

— The Moon is moving away from Earth. In 700 million years, the Moon will no longer completely cover the diameter of the Sun and part of the Sun will still be seen.

— The Moon's apparent diameter will be smaller than the apparent diameter of the Sun, resulting in a portion of the Sun being visible.

34 [1] Allow 1 credit for 2.

35 [1] Allow 1 credit for Sample *A and* a correct explanation. Correct explanations include, but are not limited to:

— Sample *A* has 49.31% uranium-238 remaining, which indicates that half of the original uranium-238 has decayed since the Moon formed 4.53 billion years ago.

— Uranium-238 has a half-life of 4.5 billion years and Sample *A* has approximately half of its original uranium-238 remaining, which indicates the Moon is approximately 4.5 billion years old.

36 [1] Allow 1 credit for 3.

37 [1] Allow 1 credit for 4.

38 [1] Allow 1 credit for an acceptable response. Acceptable responses include, but are not limited to:

— Prior to the dam's construction, more sediment would have been deposited along the coast. After construction, more sediment is trapped behind the dam, reducing coastal deposition.

— The dam traps sediment after it is constructed and reduces how much sediment is deposited at the coast.

39 [1] Allow 1 credit for 1.

40 [1] Allow 1 credit for $31,076.

41 [1] Allow 1 credit for 3.

42 [1] Allow 1 credit for a correct explanation. Correct explanations include, but are not limited to:

— Deep marine eurypterids (like Pterygotidae and Megalograptidae) existed for less time than fresh water eurypterids (like Mycteropidae and Hibbertopteridae).

— Eurypterid families that evolved from deep marine to fresh water (like Stylonuridae and Drepanopteridae) were only deep marine for a short period of time before becoming shallow marine or fresh water eurypterids.

43 [1] Allow 1 credit for 2.

44 [1] Allow 1 credit for 2.

45 [1] Allow 1 credit for 4.

46 [1] Allow 1 credit for an acceptable response. Acceptable responses include, but are not limited to:

— An increase in CO_2 caused less energy to flow out of the atmosphere which raised temperatures by almost 1°C, warming the climate.

— More atmospheric CO_2 caused less energy to flow out of the atmosphere which raised the average air temperature, raising global air surface temperatures.

Note: Student responses must describe the flow of energy out of the atmosphere due to changes in CO_2 concentrations.

47 [1] Allow 1 credit for 1.

48 [1] Allow 1 credit for *both* correct responses. Acceptable responses include, but are not limited to:

Atmospheric CO_2 entering ocean: __increase__

Ocean carbonate ions: __decrease__

49 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— As the availability of carbonate ions decreases, the size/health of marine calcifiers decreases.

— Marine calcifiers/corals will not have enough carbonate ions in the oceans to make their shells.

— With less carbonate ions, marine organisms that need carbonate ions will have a harder time surviving because they need carbonate ions to make their shells.

50 [1] Allow 1 credit for 2.

The *Chart for Determining the Final Examination Score for the August 2025 Regents Examination in Earth and Space Sciences* will be posted on the Department's web site at: https://www.nysed.gov/state-assessment/high-school-regents-examinations no later than August 20, 2025. Conversion charts provided for previous administrations of the Regents Examination in Earth and Space Sciences must NOT be used to determine students' final scores for this administration.

Online Submission of Teacher Evaluations of the Test to the Department

Suggestions and feedback from teachers provide an important contribution to the test development process. The Department provides an online evaluation form for State assessments. It contains spaces for teachers to respond to several specific questions and to make suggestions. Instructions for completing the evaluation form are as follows:

1. Go to https://www.nysed.gov/state-assessment/teacher-feedback-state-assessments.
2. Click Regents Examinations.
3. Complete the required demographic fields.
4. Select the test title from the Regents Examination dropdown list.
5. Complete each evaluation question and provide comments in the space provided.
6. Click the SUBMIT button at the bottom of the page to submit the completed form.

THE STATE EDUCATION DEPARTMENT

THE UNIVERSITY OF THE STATE OF NEW YORK / ALBANY, NY 12234

August 2025 Earth and Space Sciences Test Item Map to the Standards

Question	Type	Points	Performance Expectation
1	Constructed Response	1	HS-ESS1-1
2	Multiple Choice	1	HS-ESS1-1
3	Constructed Response	1	HS-ESS1-1
4	Multiple Choice	1	HS-ESS1-1
5	Multiple Choice	1	HS-ESS1-3
6	Constructed Response	1	HS-ESS2-5
7	Multiple Choice	1	HS-ESS2-5
8	Multiple Choice	1	HS-ESS3-4
9	Constructed Response	1	HS-ESS2-2
10	Multiple Choice	1	HS-ESS3-2
11	Multiple Choice	1	HS-ESS1-2
12	Constructed Response	1	HS-ESS1-2
13	Multiple Choice	1	HS-ESS1-2
14	Constructed Response	1	HS-ESS1-4
15	Multiple Choice	1	HS-ESS1-4
16	Multiple Choice	1	HS-ESS2-8
17	Multiple Choice	1	HS-ESS2-8
18	Constructed Response	1	HS-ESS2-8
19	Multiple Choice	1	HS-ESS2-8
20	Constructed Response	1	HS-ESS2-8
21	Multiple Choice	1	HS-ESS1-6
22	Multiple Choice	1	HS-ESS2-7
23	Constructed Response	1	HS-ESS2-7
24	Constructed Response	1	HS-ESS2-2
25	Multiple Choice	1	HS-ESS2-5
26	Constructed Response	1	HS-ESS3-1
27	Constructed Response	1	HS-ESS2-3
28	Multiple Choice	1	HS-ESS2-1
29	Multiple Choice	1	HS-ESS2-3
30	Multiple Choice	1	HS-ESS2-1
31	Multiple Choice	1	HS-ESS1-7
32	Constructed Response	1	HS-ESS1-4
33	Constructed Response	1	HS-ESS1-7
34	Multiple Choice	1	HS-ESS1-4
35	Constructed Response	1	HS-ESS1-6
36	Multiple Choice	1	HS-ESS3-2
37	Multiple Choice	1	HS-ESS3-6
38	Constructed Response	1	HS-ESS2-2
39	Multiple Choice	1	HS-ESS3-1
40	Constructed Response	1	HS-ETS1-1
41	Multiple Choice	1	HS-ESS1-6
42	Constructed Response	1	HS-ESS2-1
43	Multiple Choice	1	HS-ESS1-6
44	Multiple Choice	1	HS-ESS2-1
45	Multiple Choice	1	HS-ESS1-6
46	Constructed Response	1	HS-ESS2-4
47	Multiple Choice	1	HS-ESS3-6
48	Constructed Response	1	HS-ESS3-6
49	Constructed Response	1	HS-ESS3-6
50	Multiple Choice	1	HS-ESS3-4

The State Education Department / The University of the State of New York

Regents Examination in Earth and Space Sciences – August 2025

Chart for Converting Total Test Raw Scores to Final Exam Scores (Scale Scores)

(Use for the August 2025 exam only.)

Raw Score	Scale Score	Performance Level
50	**100**	5
49	**99**	5
48	**98**	5
47	**98**	5
46	**97**	5
45	**96**	5
44	**95**	5
43	**94**	5
42	**93**	5
41	**91**	5
40	**90**	5
39	**89**	5
38	**88**	5
37	**86**	5
36	**85**	5
35	**84**	4
34	**82**	4

Raw Score	Scale Score	Performance Level
33	**81**	4
32	**80**	4
31	**78**	4
30	**77**	4
29	**76**	3
28	**74**	3
27	**73**	3
26	**72**	3
25	**71**	3
24	**69**	3
23	**68**	3
22	**67**	3
21	**65**	3
20	**64**	2
19	**63**	2
18	**61**	2
17	**60**	2

Raw Score	Scale Score	Performance Level
16	**58**	2
15	**56**	2
14	**55**	2
13	**52**	1
12	**50**	1
11	**48**	1
10	**45**	1
9	**42**	1
8	**39**	1
7	**35**	1
6	**32**	1
5	**28**	1
4	**23**	1
3	**18**	1
2	**13**	1
1	**7**	1
0	**0**	1

To determine the student's final examination score (scale score), find the student's total test raw score in the column labeled "Raw Score" and then locate the scale score that corresponds to that raw score. The scale score is the student's final examination score. Enter this score in the space labeled "Scale Score" on the student's answer sheet.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart change from one administration to another, it is crucial that for each administration the conversion chart provided for that administration be used to determine the student's final score. The chart above is usable only for this administration of the Regents Examination in Earth and Space Sciences.