

PRACTICE EXAM 39: EARTH AND SPACE SCIENCES REGENTS SIMULATION (50 QUESTIONS)

1. A geologist studies a sequence of flat, undisturbed sedimentary rock layers in a cliff. Which assumption allows the geologist to determine the relative ages of these layers?

- A. That all of the layers were deposited at exactly the same instant, so they must all be precisely the same age
- B. That the layers near the top were deposited first and are therefore the oldest layers in the entire sequence
- C. That sediment is deposited in a completely random order, so the position of a layer reveals nothing about its age
- D. That in an undisturbed sequence, each layer is younger than the layer below it and older than the layer above it

2. A clam shell is buried in sediment that hardens into rock. The shell later dissolves away completely, leaving behind a hollow impression in the rock that has the exact shape of the shell. This hollow impression is called a:

- A. Cast fossil, formed when minerals later fill the empty space and harden into a solid copy of the original shell
- B. Trace fossil, a preserved record of an organism's activity, such as a footprint, burrow, or feeding mark in the rock
- C. Mold fossil, a hollow impression left in the rock that preserves the exact external shape of the dissolved shell
- D. Petrified fossil, formed when the original material of the organism is gradually replaced, cell by cell, with hard minerals

3. A radioactive isotope has a half-life of 2 million years. After 6 million years have passed, what fraction of the original isotope remains in a rock sample?

A. One-eighth of the original isotope remains, because 6 million years is equal to three half-lives of the isotope

B. One-half of the original isotope remains, because 6 million years is equal to just a single half-life of the isotope

C. One-quarter of the original isotope remains, because 6 million years is equal to exactly two half-lives of the isotope

D. One-sixth of the original isotope remains, found by simply dividing the original amount by the six million years that passed

4. Which of the following correctly identifies the earliest and longest portion of geologic time, which makes up the vast majority of Earth's history?

A. The Cenozoic Era, the most recent span of time, during which mammals and flowering plants became dominant on land

B. The Precambrian, the earliest and by far the longest span of time, during which mostly simple single-celled life existed

C. The Mesozoic Era, the span of time during which the dinosaurs were the dominant large animals living on the land

D. The Paleozoic Era, the span of time during which trilobites, early fish, and the first land plants first appeared on Earth

5. In an undisturbed sequence of rock layers, simpler organisms tend to be found in the deeper, older layers, while more complex organisms appear in the higher, younger layers. What does this overall pattern in the fossil record demonstrate?

- A. That every type of organism that has ever lived appeared on the Earth at exactly the same time in the distant past
- B. That complex organisms have always existed and that simpler organisms evolved from them only very recently in time
- C. That fossils are arranged in a completely random order that reveals nothing about the history of life on the planet
- D. That life on Earth has changed over time, with life generally becoming more complex and diverse through the ages

6. Geologists find that distinctive rock formations and mountain belts on the east coast of South America match up closely with those on the west coast of Africa when the two continents are fitted together. How does this support the theory of continental drift?

- A. The matching rocks and mountain belts suggest the two continents were once joined and were later split apart and separated
- B. The matching rocks prove that the same kinds of rocks happen to form independently on every continent across the world
- C. The matching rocks show that strong ocean currents carried identical rocks from one continent to the other quite recently
- D. The matching mountain belts prove that the two continents have always been in their present, widely separated positions

7. After the extinction of the non-avian dinosaurs about 66 million years ago, one group of animals expanded greatly and became the dominant large animals on land. Which group was this?

- A. The trilobites, which spread across the shallow ocean floors and became the dominant animals after the dinosaurs died out
- B. The large flying reptiles, which took over the land and grew to enormous sizes once the dinosaurs were no longer present

C. The mammals, which diversified rapidly and became the dominant large land animals after the dinosaurs went extinct

D. The first single-celled bacteria, which finally appeared for the very first time only after the dinosaurs had gone extinct

8. Scientists propose that much of the water now filling Earth's oceans was added to the early planet over time. Which of the following is a leading scientific explanation for the origin of much of Earth's water?

A. The water was manufactured by the earliest living organisms, which produced the oceans as a byproduct of their growth

B. The water was released from Earth's interior by volcanic outgassing and delivered by impacts of icy comets and asteroids

C. The water was created instantly along with the rest of the planet and has remained exactly the same in amount ever since

D. The water leaked into Earth from the Sun, which slowly dripped liquid water onto the planet over many billions of years

9. Some coastal power plants generate electricity from the regular rise and fall of ocean water caused by the gravitational pull of the Moon. What renewable energy source do these plants use?

A. Geothermal energy, which draws on the heat stored deep within the Earth's interior to produce steam and electricity

B. Solar energy, which uses panels to convert the light arriving directly from the Sun into usable electrical power

C. Wind energy, which uses large turbines to capture the energy of moving air and convert it into electrical power

D. Tidal energy, which captures the energy of the regular rise and fall of ocean water driven by the Moon's gravity

10. Which human activity is the single largest source of the carbon dioxide that humans add to the atmosphere?

- A. The burning of fossil fuels such as coal, oil, and natural gas for energy, transportation, and electricity
- B. The exhaling of carbon dioxide by the billions of people who breathe in and out across the planet each day
- C. The use of solar panels and wind turbines, which release enormous quantities of carbon dioxide during their operation
- D. The planting of new trees and forests, which release far more carbon dioxide than they could ever possibly absorb

11. Large amounts of plastic waste end up in the ocean, where it breaks down into tiny fragments. Why is this plastic pollution especially harmful to marine ecosystems?

- A. The plastic instantly dissolves into harmless salt and water, which actually improves the overall quality of the seawater
- B. The plastic provides an excellent and nutritious food source that helps fish and other marine animals grow much faster
- C. Marine animals mistake the plastic fragments for food and eat them, which can harm or kill the animals and move up the food chain
- D. The plastic chemically combines with seawater to produce extra oxygen, which has no negative effects on marine life at all

12. Some farmers practice "no-till" farming, in which they avoid plowing the soil and instead plant directly into the residue of the previous crop. How does this practice benefit the land?

- A. It exposes far more bare soil to the wind and rain, which speeds up erosion and removes valuable nutrients from the field

- B. It reduces soil erosion and helps the soil retain moisture and organic matter, since the soil is left largely undisturbed
- C. It permanently sterilizes the soil so that no crops, weeds, or any other living plants can ever grow in the field again
- D. It requires the farmer to remove all of the previous crop and leave the field completely bare between the growing seasons

13. Some dry coastal regions obtain fresh drinking water by removing the salt from seawater. What is this process of removing salt from seawater to produce fresh water called?

- A. Filtration, the process of passing water through a fine screen or barrier to remove only the large solid particles from it
- B. Evaporation, the process by which liquid water at the surface changes into invisible water vapor and rises into the air
- C. Condensation, the process by which water vapor in the cooling air changes back into tiny droplets of liquid water
- D. Desalination, the process of removing dissolved salt from seawater to produce fresh water suitable for human use

14. A new highway is built straight through the middle of a large forest, splitting it into two smaller, separated pieces. This breaking up of a continuous habitat into smaller, isolated patches is known as:

- A. Habitat fragmentation, the breaking apart of a once-continuous habitat into smaller, separated patches by human activity
- B. Reforestation, the deliberate replanting of trees to restore a forest in an area where the trees had previously been removed
- C. Eutrophication, the enrichment of a body of water with excess nutrients that triggers a rapid overgrowth of algae
- D. Succession, the gradual and natural process by which the mix of species in an ecosystem changes over a long period of time

15. Planting large numbers of new trees is one proposed strategy for slowing climate change. How does planting more trees help to reduce the buildup of carbon dioxide in the atmosphere?

A. The trees physically block sunlight from reaching the ground, which directly lowers the amount of carbon dioxide in the air

B. The trees release large amounts of pure carbon dioxide, which somehow cancels out the carbon dioxide already in the air

C. The trees absorb carbon dioxide from the air during photosynthesis and store the carbon in their wood, leaves, and roots

D. The trees reflect heat back into space, a process that removes carbon dioxide molecules from the atmosphere entirely

16. The depletion of the stratospheric ozone layer and global warming are two different environmental problems that are often confused. What is the main role of the ozone layer that makes its depletion a concern?

A. The ozone layer is the main gas responsible for trapping heat near Earth's surface, so its loss would rapidly cool the planet

B. The ozone layer supplies all of the oxygen that humans and animals breathe, so its loss would leave nothing left to breathe

C. The ozone layer reflects incoming meteors away from the Earth, so its loss would allow far more meteorites to strike the ground

D. The ozone layer absorbs much of the Sun's harmful ultraviolet radiation, so its depletion allows more of that radiation to reach the surface

17. Of the common strategies for managing waste — reduce, reuse, and recycle — which is generally considered the most effective for conserving resources, and why?

A. Recycle, because turning old products into new ones requires far more energy and raw materials than making products from scratch

- B. Reduce, because using fewer products and materials in the first place prevents waste and conserves resources before any are used
- C. Reuse, because throwing items away after only a single use is the most efficient possible way to manage a society's resources
- D. None of them, because the amount of waste a society produces has no real connection to how many resources it consumes

18. What causes the daily cycle of daytime and nighttime experienced everywhere on Earth?

- A. Earth's rotation on its axis, which turns each location into and then out of the sunlight roughly once every 24 hours
- B. Earth's revolution around the Sun, which carries the planet into and out of the Sun's light once during each year
- C. The Sun physically switching itself on during the day and then switching itself completely off again every night
- D. The Moon moving in front of the Sun each evening and then moving back out of the way again every single morning

19. Which sequence lists the phases of the Moon in the correct order as the Moon goes from new moon to full moon?

- A. New moon, then full moon, then first quarter, then waxing crescent, ending finally back at the new moon phase again
- B. New moon, then waning gibbous, then last quarter, then waning crescent, ending finally at the bright full moon
- C. New moon, then waxing crescent, then first quarter, then waxing gibbous, and finally reaching the full moon
- D. Full moon, then waxing gibbous, then first quarter, then waxing crescent, ending finally at the dark new moon phase

20. If the Sun's gravity were to suddenly disappear, what would most likely happen to the motion of the planets?

- A. The planets would immediately fall straight inward and crash directly into the now-gravityless center of the solar system
- B. The planets would continue orbiting in exactly the same paths, since the Sun's gravity has no effect on their motion at all
- C. The planets would speed up and spiral inward toward the Sun, since gravity is the only force slowing them down in orbit
- D. The planets would fly off in straight lines into space, since it is the Sun's gravity that bends their motion into orbits

21. Astronomers have found that the most massive stars use up their fuel and end their lives much faster than low-mass stars. Why do the most massive stars have the shortest lifetimes?

- A. Massive stars contain so little fuel to begin with that they run out almost immediately after they first form in space
- B. Massive stars burn through their fuel at an enormously faster rate, so even their larger fuel supply is used up quickly
- C. Massive stars do not produce energy by fusion at all, so they cool down and fade away within just a few short years
- D. Massive stars are pulled apart by the gravity of nearby planets long before they ever have a chance to use up their fuel

22. According to the nebular hypothesis, when a cloud of gas and dust collapsed to form the solar system, most of the material gathered at the center. What did this large central concentration of material become?

- A. The Sun, which formed at the center where most of the cloud's material gathered and grew hot and dense enough for fusion

- B. The asteroid belt, a ring of leftover rocky debris that gathered at the very center of the collapsing cloud of gas and dust
- C. The Moon, which formed first at the exact center of the cloud before drifting outward to orbit the newly formed Earth
- D. A black hole, which formed at the center of the cloud and now sits hidden at the very middle of the entire solar system

23. Light from the Sun takes about eight minutes to travel the roughly 150 million kilometers to reach Earth. What does this fact tell us about the sunlight we see at any given moment?

- A. We are seeing the Sun exactly as it appears at that precise instant, since sunlight reaches the Earth completely instantly
- B. We are actually seeing the Sun as it appeared about eight minutes ago, because that is how long its light took to reach us
- C. We are seeing the Sun as it will appear about eight minutes into the future, since light travels forward through time as it moves
- D. We never actually see the real Sun at all, since its light takes far too long to ever reach the surface of the Earth

24. Pluto was once classified as the ninth planet but is now considered a "dwarf planet." Which characteristic of a full-sized planet does Pluto lack?

- A. Pluto does not orbit the Sun at all, instead orbiting a nearby star located far outside of our own solar system
- B. Pluto is not round in shape, instead being a jagged, irregular chunk of rock like a typical small asteroid
- C. Pluto has not cleared its orbit of other objects, sharing its region of space with many other icy bodies
- D. Pluto produces its own light through nuclear fusion, which disqualifies it from being classified as a true planet

25. The Moon shines in the night sky, but it does not produce any light of its own. Why are we able to see the Moon?

A. The Moon reflects light from the Sun, and the changing portion of its sunlit side that faces Earth produces the lunar phases

B. The Moon produces its own light through nuclear fusion in its core, exactly as the Sun and all of the other stars do

C. The Moon glows because it is still extremely hot and molten from its recent formation only a few thousand years ago

D. The Moon is lit up each night by the powerful reflected glow of city lights shining upward from the surface of the Earth

26. What is a galaxy?

A. A single very large star, much bigger than the Sun, that shines so brightly it can be seen across the entire universe

B. A vast system of billions of stars, along with gas and dust, all held together by gravity in one enormous structure

C. A small group of eight planets and their moons that orbit together around one central star such as our own Sun

D. A cloud of gas and dust within which brand-new stars are forming, but which contains no fully formed stars at all

27. The outer planets Jupiter and Saturn are called "gas giants." What are these enormous planets composed of mostly?

A. Solid rock and metal, exactly like the inner terrestrial planets, but simply present in far greater total quantities

- B. Liquid water oceans hundreds of kilometers deep, which cover their entire surfaces from pole to pole without any land
- C. Frozen carbon dioxide and nitrogen ices, packed together into enormous solid balls with no gas or liquid present at all
- D. Mostly hydrogen and helium, the same light gases that are the most abundant elements throughout the universe

28. Astronomers observe that nearly all distant galaxies are moving away from us, and the more distant ones move away faster. What conclusion do these observations support?

- A. That the universe is expanding, with space itself stretching and carrying the galaxies farther apart over time
- B. That the Earth is located at the exact center of a small, fixed universe around which the galaxies slowly revolve
- C. That all of the galaxies in the universe are completely motionless and have never moved from their original places
- D. That the universe is shrinking, with all of its galaxies steadily drawing closer together toward a single point in space

29. After the Sun sets, the ground and the air near it usually become cooler during the night. What is the main reason temperatures drop at night?

- A. The Sun physically moves much farther away from the Earth during the night, which greatly reduces the heat that it provides
- B. Cold air constantly pours down from outer space at night, chilling the surface until the Sun rises again the next morning
- C. The surface continues to radiate heat into space but no longer receives incoming sunlight, so it loses more heat than it gains
- D. The Earth stops rotating completely during the night, which prevents any heat from being generated by its usual motion

30. Inside a cloud, tiny water droplets collide and join together, growing larger and larger until they become too heavy to stay aloft. What happens when these droplets finally become too heavy?

- A. The droplets instantly evaporate back into invisible water vapor and rise even higher up into the atmosphere above
- B. The droplets fall to the ground as precipitation, such as rain, since gravity pulls them downward once they grow heavy enough
- C. The droplets freeze solid and remain permanently suspended in the cloud, never falling to the ground under any conditions
- D. The droplets are blown straight up into outer space, where they leave the Earth's atmosphere entirely behind them

31. As air over a region is heated, it expands and rises. What does this rising of heated air most often produce at the surface below?

- A. A region of high pressure, since the rising warm air presses down more heavily on the surface beneath it as it climbs upward
- B. No change in pressure at all, since the temperature of the air has absolutely no effect on the air pressure at the surface
- C. A sudden and permanent drop in the temperature of the entire region as the warm air is replaced by frigid polar air
- D. A region of low pressure, since the rising air leaves behind less air pressing down on the surface beneath it

32. An air mass forms by sitting over one region for a long time, where it takes on the temperature and moisture conditions of the surface below it. Based on this, an air mass that forms over a cold, snow-covered region in northern Canada would be:

- A. Cold and dry, taking on the frigid, low-moisture conditions of the cold, snow-covered land over which it formed

- B. Warm and humid, taking on the conditions of a hot tropical ocean even though it formed over cold northern land
- C. Hot and dry, taking on the conditions of a scorching desert despite forming over the snow-covered land of Canada
- D. Cool and extremely wet, taking on the conditions of a warm, rainy tropical rainforest located near the planet's equator

33. Hurricanes are rated in categories from 1 to 5 based primarily on which characteristic of the storm?

- A. The total number of separate thunderstorms contained within the spiral rain bands of the entire hurricane system
- B. The exact geographic location where the hurricane first formed over the warm waters of the tropical ocean
- C. The maximum sustained wind speed of the storm, with higher categories indicating faster and more destructive winds
- D. The total number of days that the hurricane has existed since it first developed from a tropical disturbance

34. Ocean currents move enormous amounts of warm and cold water around the globe. What is one major effect of this movement of ocean water on Earth's climate?

- A. Ocean currents have no effect on climate at all, since water is unable to carry any heat from one place to another
- B. Ocean currents redistribute heat around the planet, warming some coastal regions and cooling others far from the tropics
- C. Ocean currents cause the Sun to shine more brightly on the regions they pass, directly heating those coastlines from above
- D. Ocean currents physically push the continents around the globe, which is what slowly changes the climate of each region

35. Earth's climate has changed many times naturally throughout its history. What is one key piece of evidence that scientists use to conclude that the recent, rapid warming is caused largely by human activity?

A. The recent warming has occurred far more slowly than any natural climate change in the entire history of the Earth

B. Recent global temperatures have actually been steadily falling, which can only be explained by recent human activity

C. The recent warming exactly matches the natural cycles of the past, proving that humans have had no influence at all

D. The rise in atmospheric carbon dioxide closely matches the timing and amount of carbon released by burning fossil fuels

36. A wind vane mounted on top of a building turns freely and points in a particular direction as the wind blows. What does a wind vane measure?

A. The direction from which the wind is blowing, since the arrow of the vane turns to point into the oncoming wind

B. The exact speed of the wind in kilometers per hour as it blows past the building on which the vane is mounted

C. The total amount of rainfall that has fallen on the building's roof since the start of the most recent rainstorm

D. The air pressure pressing down on the top of the building at any given moment throughout the day and the night

37. After a warm front passes over a location, what change in temperature and weather does an observer at that location most likely experience?

A. A sharp and sudden drop in temperature, followed immediately by a brief but violent line of severe thunderstorms

- B. No change in either temperature or weather, since a warm front has no effect on the conditions at the surface below it
- C. A gradual rise in temperature and a clearing of the steady precipitation, as warmer air moves into the region behind the front
- D. A rapid drop in air pressure followed by several days of bitterly cold temperatures and continuous heavy snowfall

38. On a hot, humid summer day, the air can feel heavy and uncomfortable. What is true about warm air compared with cold air with respect to water vapor?

- A. Warm air can hold far less water vapor than cold air, which is why humid conditions occur only during the coldest weather
- B. Warm air and cold air can hold exactly the same amount of water vapor, so temperature has no effect on humidity at all
- C. Warm air loses its ability to hold any water vapor at all, which is why hot days are always completely dry and dust-filled
- D. Warm air can hold much more water vapor than cold air, which is why hot summer days often feel so humid and heavy

39. A sedimentary rock is made of sand-sized grains that have been cemented together, and the individual grains can be seen and felt as a gritty texture. What is this rock?

- A. Shale, a sedimentary rock made of extremely fine clay particles that splits into thin, smooth layers and feels smooth
- B. Sandstone, a sedimentary rock made of cemented sand-sized grains that gives the rock a gritty, grainy texture
- C. Granite, a coarse-grained igneous rock made of interlocking crystals of quartz, feldspar, and several other minerals
- D. Marble, a metamorphic rock made of recrystallized calcite that forms when limestone is heated and put under pressure

40. Some minerals can occur in several different surface colors, yet they always leave the same color of powder when scratched on a tile. For identifying such minerals, why is the streak often more reliable than the surface color?

A. The streak color stays the same for a given mineral even when its surface color varies, making streak a more dependable clue

B. The streak color changes constantly depending on the lighting, while the surface color of a mineral always stays exactly the same

C. The surface color is the only truly reliable property of a mineral, and the streak reveals nothing useful about its identity

D. The streak and the surface color are always identical for every mineral, so it makes no difference at all which one is examined

41. Most of the world's volcanoes are located along the boundaries between tectonic plates. Why are volcanoes so commonly found at plate boundaries?

A. The plates are thinnest at their exact centers, far from any boundary, which is the only place magma can ever reach the surface

B. Ocean water collects only along the plate boundaries, and this water is what melts the rock into magma to feed the volcanoes

C. At many plate boundaries, conditions such as subduction or the pulling apart of plates allow magma to form and rise to the surface

D. Volcanoes form randomly across the surface of the Earth and have no relationship at all to the locations of the plate boundaries

42. When iron-rich minerals in a rock are exposed to oxygen and water at the surface, they slowly turn into a reddish-brown, rust-like material. This is a form of chemical weathering known as:

A. Frost wedging, in which water seeps into cracks, freezes, expands, and gradually pries the rock apart into smaller pieces

- B. Abrasion, in which particles carried by wind or water repeatedly strike a rock surface and gradually grind it smooth over time
- C. Exfoliation, in which the release of pressure on a buried rock causes curved sheets to peel away from its outer surface
- D. Oxidation, in which iron-bearing minerals react with oxygen and water to form a new, rust-like reddish-brown material

43. A river carries sediment of many different sizes out into a calm lake. As the river enters the lake and slows down, in what order is the sediment deposited?

- A. The smallest, lightest particles such as clay drop out first near the river's mouth, while the largest boulders travel farthest out
- B. The largest, heaviest particles drop out first near the river's mouth, while the smallest, lightest particles are carried farthest out
- C. All of the particles, regardless of their size, are deposited at exactly the same place at the very same time in one single pile
- D. The sediment is sorted by color rather than by size, with the darkest particles always settling out before the lighter ones do

44. Scientists believe that Earth's solid inner core is composed mainly of which materials, despite being extremely hot?

- A. Iron and nickel, which remain solid in the inner core because the immense pressure there keeps them from melting
- B. Liquid water and ice, which fill the very center of the Earth and slowly circulate to generate the planet's internal heat
- C. Molten silica-rich rock, exactly like the magma that erupts from the volcanoes located at the Earth's outer surface
- D. Light gases such as hydrogen and helium, the same materials that make up the bulk of the Sun and the giant planets

45. For a layer of rock to serve as a good aquifer that supplies water to wells, the rock must allow water to flow through it easily. Which property describes a rock's ability to allow water to pass through it?

A. Hardness, the property that describes how strongly the minerals in the rock resist being scratched by other materials

B. Density, the property that describes how much mass the rock contains within a given amount of its total volume

C. Permeability, the property that describes how easily water can move through the connected pore spaces of the rock

D. Luster, the property that describes the way the surface of the rock or its minerals reflects the light striking it

46. A volcanic rock cools so extremely quickly that no mineral crystals have any time to form, producing a smooth, shiny, glass-like rock. What is this rock?

A. Granite, a coarse-grained igneous rock with large, visible, interlocking crystals that formed by very slow cooling underground

B. Sandstone, a sedimentary rock made of sand grains that were cemented together over long periods of time near the surface

C. Slate, a fine-grained metamorphic rock that forms from shale and splits readily into flat, smooth, thin sheets

D. Obsidian, a smooth, shiny, glass-like volcanic rock that forms when lava cools so quickly that no crystals can form

47. In the upper course of a river, high in the mountains, the river typically flows fast down a steep slope. What is the dominant process in this fast-flowing upper course of the river?

A. Erosion, because the fast-moving water has a great deal of energy and actively cuts down into and wears away the channel

B. Deposition, because fast-moving mountain water is always too weak to carry any sediment and immediately drops all of its load

C. Evaporation, because the water high in the mountains is closer to the Sun and therefore boils away before it can flow downhill

D. Condensation, because the cold mountain air causes the river water to turn into clouds rather than continuing to flow downstream

48. Fertile soil that is good for growing plants is a mixture of several different materials. Which combination best describes what such soil is made of?

A. Only solid, unweathered bedrock, with no broken rock particles, no air, no water, and no organic material mixed in at all

B. Weathered rock particles of various sizes, decayed organic matter called humus, along with air and water in the pore spaces

C. Pure liquid water with a small amount of dissolved salt, and nothing else of any kind mixed into it whatsoever

D. Only smooth, rounded pebbles of solid rock packed tightly together, with absolutely no smaller particles or organic matter

49. An engineering team has developed three possible designs to reduce flooding in a town, each with different costs, levels of effectiveness, and environmental impacts. What is the best way for the team to decide which design to use?

A. Choose the design that happens to look the most impressive, without considering its cost, effectiveness, or impacts at all

B. Choose the very first design the team thought of, since later ideas in the design process are never worth considering at all

C. Compare the designs against the criteria and constraints, weighing the trade-offs to find the one that best balances the goals

D. Choose the most expensive design every time, since a higher cost is always a reliable guarantee of much better performance

50. A scientist publishes the results of an experiment and provides a detailed description of exactly how the experiment was carried out. Why is it important that the scientist describe the procedure in such detail?

A. So that the procedure can be kept secret from all other scientists, which prevents anyone else from ever checking the results

B. So that the published paper will be much longer, since the length of a scientific paper is the true measure of its overall quality

C. So that no other scientist will ever be able to perform a similar experiment, which protects the original scientist's discovery

D. So that other scientists can repeat the experiment to check whether they obtain the same results, confirming the findings

Practice Exam 39: Answer Key with Explanations

1. D — The principle of superposition states that in an undisturbed sequence each layer is younger than the one below it and older than the one above it. This ordering, with the oldest at the bottom, is the basic assumption that lets geologists read relative ages from a stack of layers.
2. C — A hollow impression preserving the external shape of a dissolved shell is a mold fossil. The mold records the organism's outer form even after the original shell is gone, and it becomes a cast only if minerals later fill it.
3. A — In 6 million years the isotope passes through three half-lives ($6 \div 2$), and three halvings leave $1/2 \times 1/2 \times 1/2 = 1/8$ of the original. Counting the number of half-lives and halving repeatedly gives the fraction remaining.
4. B — The Precambrian is the earliest and by far the longest span of geologic time, dominated by simple single-celled life. Recognizing its enormous length shows how brief the age of complex life has been by comparison.
5. D — Simpler organisms in older layers and more complex ones in younger layers demonstrate that life has changed over time, generally becoming more complex and diverse. This documented progression in the fossil record is strong evidence for evolution.
6. A — Matching rock formations and mountain belts across the Atlantic suggest South America and Africa were once joined and later separated. Such continuous geologic structures split by an ocean support the idea that the continents have drifted apart.

7. C — After the dinosaurs went extinct, mammals diversified rapidly and became the dominant large land animals. The emptying of ecological roles allowed the surviving mammals to expand into the Age of Mammals.
8. B — A leading explanation is that much of Earth's water came from volcanic outgassing of the interior and from impacts of icy comets and asteroids. These sources delivered and released the water that filled the early oceans over time.
9. D — Power plants that harness the Moon-driven rise and fall of ocean water use tidal energy, a renewable source. The predictable motion of the tides provides the energy that drives the plant's turbines.
10. A — The largest human source of atmospheric carbon dioxide is the burning of fossil fuels such as coal, oil, and natural gas. This combustion for energy, transportation, and electricity is the central driver of rising carbon dioxide.
11. C — Plastic pollution harms marine ecosystems because animals mistake fragments for food and eat them, which can injure or kill them and pass plastic up the food chain. This ingestion is a key reason ocean plastic is so damaging.
12. B — No-till farming reduces erosion and helps the soil keep moisture and organic matter because the soil is left largely undisturbed. Avoiding plowing protects the soil structure and its fertility over time.
13. D — Removing dissolved salt from seawater to produce usable fresh water is desalination. This process lets dry coastal regions turn abundant seawater into drinkable water.
14. A — Splitting a continuous forest into smaller, isolated patches is habitat fragmentation. Breaking up habitat this way can isolate populations and reduce biodiversity, which is why it is a recognized environmental concern.
15. C — Trees reduce atmospheric carbon dioxide because they absorb it during photosynthesis and store the carbon in their wood, leaves, and roots. This uptake makes forests important natural carbon sinks for slowing climate change.
16. D — The ozone layer matters because it absorbs much of the Sun's harmful ultraviolet radiation, so its depletion lets more of that radiation reach the surface. Protecting against UV exposure is the role that makes ozone loss a serious concern.
17. B — Reducing is generally most effective because using fewer products and materials prevents waste and conserves resources before any are consumed. Stopping waste at the source saves more than managing it after the fact.
18. A — Day and night result from Earth's rotation on its axis, which turns each location into and out of sunlight about once every 24 hours. The planet's spin, not any motion of the Sun, produces the daily cycle.
19. C — From new to full, the Moon passes through new, waxing crescent, first quarter, waxing gibbous, and full. This waxing sequence reflects the steadily growing sunlit portion seen from Earth.
20. D — Without the Sun's gravity, the planets would fly off in straight lines, because it is that gravity that bends their motion into closed orbits. Gravity continually curves their otherwise straight-line inertial motion into orbits.
21. B — The most massive stars have the shortest lifetimes because they burn through their fuel at an enormously faster rate, exhausting even their larger supply quickly. Their intense energy output is what shortens their lives.

22. A — In the nebular hypothesis, most of the collapsing cloud's material gathered at the center and became the Sun, growing hot and dense enough for fusion. The central concentration is what ignited into our star.
23. B — Because sunlight takes about eight minutes to reach Earth, we see the Sun as it appeared about eight minutes ago. The finite speed of light means we always view distant objects as they were when their light left them.
24. C — Pluto is a dwarf planet because it has not cleared its orbit of other objects, sharing its region with many icy bodies. Clearing the neighborhood of an orbit is the criterion of a full planet that Pluto fails to meet.
25. A — We see the Moon because it reflects sunlight, and the changing portion of its sunlit side facing Earth produces the phases. The Moon makes no light of its own; it shines by reflecting the Sun.
26. B — A galaxy is a vast system of billions of stars, along with gas and dust, all bound together by gravity. This definition distinguishes a galaxy from a single star, a solar system, or a star-forming cloud.
27. D — Jupiter and Saturn are composed mostly of hydrogen and helium, the lightest and most abundant elements in the universe. Their gaseous, low-density makeup is what defines them as gas giants.
28. A — Galaxies receding faster the farther away they are supports the conclusion that the universe is expanding, with space stretching and carrying galaxies apart. This expansion is central evidence for the Big Bang.
29. C — Nights cool because the surface keeps radiating heat to space but no longer receives incoming sunlight, so it loses more heat than it gains. The imbalance between continued radiation and absent solar input lowers temperatures.
30. B — When cloud droplets grow heavy enough, gravity pulls them down and they fall as precipitation such as rain. Droplets remain aloft only until they become too heavy for the rising air to support.
31. D — Rising heated air leaves less air pressing down on the surface, producing a region of low pressure. This link between warming, rising air, and low surface pressure helps explain where storms tend to develop.
32. A — An air mass forming over cold, snow-covered northern Canada becomes cold and dry, taking on the low-temperature, low-moisture conditions of its source region. Air masses acquire the character of the surface beneath them.
33. C — Hurricanes are rated 1 to 5 mainly by maximum sustained wind speed, with higher categories meaning faster, more destructive winds. The wind-speed scale gives a quick measure of a storm's potential for damage.
34. B — Ocean currents redistribute heat around the planet, warming some coastal regions and cooling others. This transport of ocean heat is a major influence on the climates of the coasts the currents reach.
35. D — A key line of evidence is that the rise in atmospheric carbon dioxide closely matches the timing and amount of carbon released by burning fossil fuels. This correspondence ties the recent warming to human activity.
36. A — A wind vane measures the direction from which the wind blows, since its arrow turns to point into the oncoming wind. Knowing wind direction is basic to tracking weather systems and fronts.

37. C — After a warm front passes, temperatures gradually rise and the steady precipitation clears as warmer air moves in behind the front. This gentle warming and clearing is typical of a warm front's passage.
38. D — Warm air can hold much more water vapor than cold air, which is why hot summer days can feel so humid and heavy. The greater moisture capacity of warm air underlies high summer humidity.
39. B — A gritty rock of cemented sand-sized grains is sandstone, a clastic sedimentary rock. The visible, sand-sized grains and grainy texture identify it as sandstone rather than a finer or crystalline rock.
40. A — Streak is more reliable than surface color because the powder color stays the same for a given mineral even when the surface color varies. This consistency makes streak a dependable identification clue.
41. C — Volcanoes cluster at plate boundaries because processes such as subduction or the pulling apart of plates allow magma to form and rise to the surface. The tectonic conditions at boundaries are what generate and release magma.
42. D — Iron-rich minerals reacting with oxygen and water to form a rust-like material is oxidation, a type of chemical weathering. The formation of a new reddish-brown compound marks this as chemical, not physical, weathering.
43. B — As a river slows entering a lake, the largest, heaviest particles drop first near the mouth while the smallest are carried farthest out. This size sorting by settling rate produces the graded deposits seen in deltas.
44. A — Earth's inner core is composed mainly of iron and nickel, kept solid by the immense pressure despite its great heat. The crushing pressure at the center is what keeps these metals solid rather than molten.
45. C — Permeability describes how easily water moves through a rock's connected pore spaces, the property a good aquifer needs. High permeability allows water to flow readily to wells.
46. D — A glassy volcanic rock that cooled too fast for crystals to form is obsidian. Its smooth, shiny, crystal-free texture results from extremely rapid cooling of lava.
47. A — In a river's steep, fast upper course, erosion dominates because the high-energy water actively cuts into and wears away the channel. Fast mountain streams carve their channels rather than deposit sediment.
48. B — Fertile soil is a mixture of weathered rock particles of various sizes, decayed organic matter (humus), and air and water in the pore spaces. This combination of mineral, organic, and pore components is what supports plant growth.
49. C — The best way to choose among the flood designs is to compare them against the criteria and constraints, weighing trade-offs to find the one that best balances the goals. Systematic evaluation, not appearance or cost alone, guides good engineering decisions.
50. D — Detailed procedures matter so that other scientists can repeat the experiment and check whether they get the same results, confirming the findings. This reproducibility is central to how science verifies and builds trust in results.