PRACTICE EXAM 32: EARTH AND SPACE SCIENCES REGENTS SIMULATION (50 QUESTIONS)

1. On a weather map, isobars that are spaced very close together indicate which condition?

A. Strong winds, because closely spaced isobars show a steep pressure gradient over a short distance

B. Calm conditions, because closely spaced isobars always indicate a weak and gentle pressure change

C. Warm temperatures, because the spacing of the isobars directly measures the surface air temperature

D. Heavy rainfall, because the isobars on a map represent the total amount of precipitation expected

2. A boundary between two air masses shows little movement, with the warm and cold air masses neither advancing nor retreating. This boundary is called:

A. A cold front, where a fast-moving cold air mass aggressively pushes underneath a warm air mass

B. A warm front, where a warm air mass steadily advances and rides up over a retreating cold air mass

C. A stationary front, where neither air mass has enough force to displace the other for a time

D. An occluded front, where a cold front overtakes a warm front and lifts the warm air aloft

3. How does energy from the Sun travel through the vacuum of space to reach Earth?

A. By conduction, as heat passes directly from particle to particle across the empty space between bodies

B. By radiation, as electromagnetic waves that travel through empty space without needing any medium

C. By convection, as warm currents of air and gas circulate continuously between the Sun and Earth

D. By compression, as the pressure of solar gas physically pushes the heat outward toward the planets

4. Which atmospheric condition is most necessary for the formation of a thunderstorm?

A. A stable air mass that resists vertical movement and keeps all of the moisture near the ground

B. Cold, dry air at the surface combined with broadly sinking air motion throughout the troposphere

C. A strong temperature inversion that traps a shallow layer of cool air beneath warmer air above

D. Warm, moist air at the surface that is forced upward, rises rapidly, and cools to form tall clouds

5. During a summer afternoon, a sandy beach becomes much hotter than the ocean water next to it. Which property of water best explains this difference?

A. Water has a higher specific heat than sand, so it requires more energy to raise its temperature

B. Water has a lower specific heat than sand, so it heats up far more quickly than the dry beach sand

C. Sand reflects almost all sunlight while water absorbs none of the incoming solar radiation at all

D. Sand is denser than water, which causes it to release its absorbed heat much more slowly overall

6. Why do the trade winds in the Northern Hemisphere blow from the northeast rather than straight from the north?

A. The Sun heats the eastern side of Earth first each morning, pulling the surface winds toward the east

B. The Coriolis effect, caused by Earth's rotation, deflects the moving winds to the right of their path

C. Ocean currents in the tropics physically drag the surface winds toward the northeast direction

D. Mountain ranges along the equator block winds from the north and redirect them toward the northeast

7. Tropical rainforests are located mainly near the equator. Which combination of factors best explains the warm, wet climate found there?

A. Low insolation and descending dry air that together produce mild temperatures and very little rain

B. High insolation and descending dry air that together produce hot temperatures and frequent drought

C. Low insolation and rising moist air that together produce cool temperatures and a steady light drizzle

D. High insolation and rising moist air that together produce high temperatures and heavy rainfall

8. A wind described as a "westerly" wind is one that:

A. Blows toward the west, carrying air from the eastern part of the region toward the west

B. Is found only on the west coast of a continent and never occurs anywhere inland at all

C. Blows from the west, carrying air from the western part of the region toward the east

D. Circles continuously toward the west around a center of low pressure in the atmosphere

9. Without any atmosphere, Earth's average surface temperature would be far below freezing. Which process keeps Earth's surface warm enough for liquid water to exist?

A. The greenhouse effect, in which atmospheric gases absorb and re-emit infrared energy back toward the surface

B. The ozone layer, which generates heat by chemically combining oxygen atoms high in the atmosphere

C. Heat conducted upward from Earth's molten interior, which warms the entire surface from below continuously

D. The reflection of sunlight by clouds, which concentrates incoming solar energy onto the planet's surface

10. Which hazard associated with a landfalling hurricane is typically responsible for the greatest loss of life?

A. The lightning produced by the thunderstorms embedded within the spiral rain bands of the hurricane

B. The storm surge, a dome of seawater pushed ashore by the hurricane's powerful onshore winds

C. The hail that falls from the towering clouds within the most intense portion of the hurricane

D. The static electricity that builds up in the air as the hurricane's winds move across the land

11. Which statement about the rock cycle is correct?

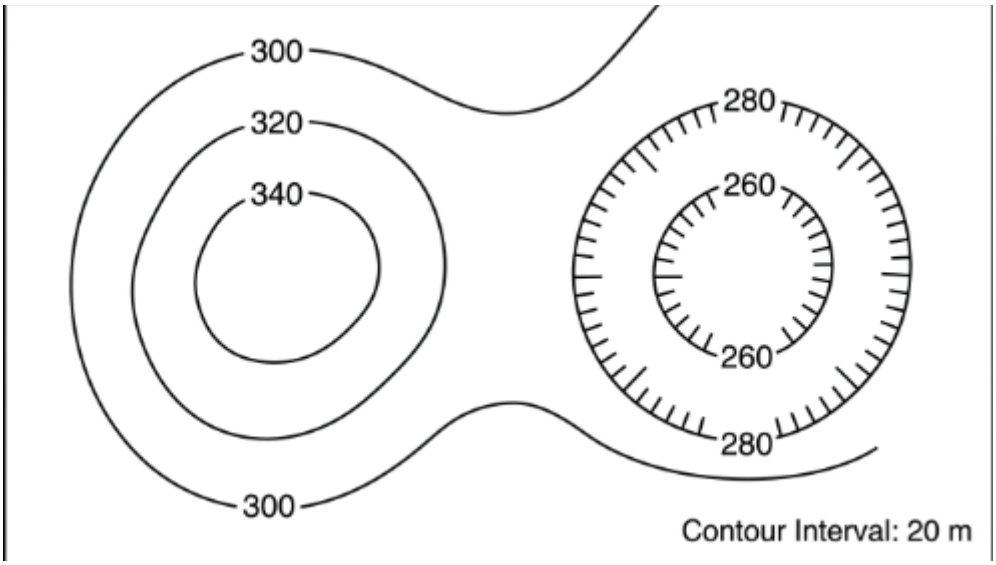
A. Once a rock becomes metamorphic, it can never change into any other type of rock ever again

B. Sedimentary rocks can form only from the weathering of igneous rocks and from nothing else at all

C. The rock cycle always proceeds in one fixed direction: igneous, then sedimentary, then metamorphic

D. Any rock type can be transformed into any other rock type through the right combination of processes

12. On the topographic map below, what does the closed contour line marked with short inward-pointing tick marks (hachures) represent?



A. The highest hilltop on the entire map, rising well above all of the surrounding land area

B. A perfectly flat plain where the land surface does not change in elevation at any point at all

C. A depression, such as a basin or crater, where the land is lower than the surrounding area

D. A steep cliff where the elevation rises almost vertically over a very short horizontal distance

13. The San Andreas Fault in California is a location where two plates slide horizontally past each other. What type of plate boundary does this fault represent?

A. A transform boundary, where the plates grind past one another, producing frequent earthquakes

B. A divergent boundary, where two plates move apart and new crust is created in the gap between them

C. A convergent boundary, where one plate is forced downward beneath another and into the mantle

D. A hot spot, where a plume of magma rises through the center of a plate far from any boundary

14. Most of the world's active volcanoes are located along the edges of the Pacific Ocean in a zone known as the "Ring of Fire." Why are volcanoes concentrated in this region?

A. The ocean water along these coasts is unusually warm, which heats the underlying rock until it melts

B. These coasts mark plate boundaries, especially subduction zones, where magma is generated

C. The Pacific is the deepest ocean, and the great water pressure forces magma upward to the surface

D. Strong ocean currents in the Pacific carry molten rock toward the coastlines from the deep seafloor

15. A pebble, a sand grain, and a clay particle are dropped together into a column of still water. In what order will they reach the bottom?

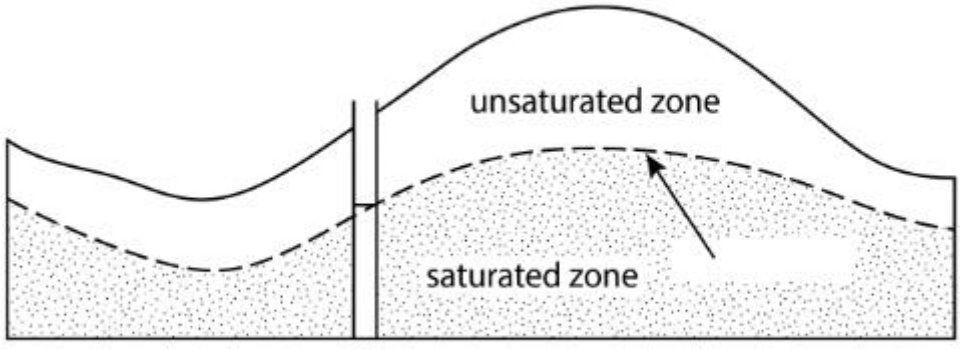
A. The clay particle first, then the sand grain, and finally the pebble, ordered from smallest to largest

B. All three particles will reach the bottom at exactly the same time regardless of their differing sizes

C. The pebble first, then the sand grain, and finally the clay particle, ordered from largest to smallest

D. The sand grain first, then the pebble, and finally the clay particle, with no relation to particle size

16. The cross-section below shows the ground beneath a hill, with a curved line marking the upper surface of the saturated zone. What is this curved line called?



A. The bedrock surface, the boundary between the loose soil above and the solid bedrock far below it

B. The zone of aeration, the region where all of the pore spaces are completely filled with air only

C. An aquiclude, a layer of impermeable rock that completely blocks the downward flow of all water

D. The water table, the upper surface of the zone where all the pore spaces are saturated with water

17. What is the difference between mineral cleavage and mineral fracture?

A. Cleavage is breakage along smooth flat planes, while fracture is irregular breakage not along flat planes

B. Cleavage is irregular breakage, while fracture is breakage that always follows smooth, flat, even planes

C. Cleavage refers only to a mineral's color, while fracture refers only to a mineral's overall hardness

D. Cleavage occurs only in metallic minerals, while fracture occurs only in nonmetallic minerals

18. In a desert, smooth polished rock surfaces and shallow pits are carved into exposed boulders over time. Which agent of erosion is most responsible for shaping these features?

A. Glacial ice slowly grinding across the boulders and leaving long deep parallel scratches behind

B. Ocean waves repeatedly crashing against the boulders and rounding their exposed edges over time

C. Wind carrying sand grains that repeatedly strike the boulders and abrade their surfaces over time

D. Chemical dissolution by acidic rain slowly dissolving the minerals within the exposed desert boulders

19. Why is the focus (or hypocenter) of an earthquake different from its epicenter?

A. The focus is the surface location where the most damage occurs, while the epicenter lies deep underground

B. The focus is the underground point where the rock first ruptures, while the epicenter is the point directly above it on the surface

C. The focus and the epicenter are simply two different names for exactly the same point on Earth's surface

D. The focus is the strongest aftershock, while the epicenter is the very first main shock of the earthquake

20. A fast-moving mountain stream suddenly flows out onto a flat, broad valley floor, depositing its sediment in a fan-shaped landform. What is this landform called?

A. An alluvial fan, formed where a stream loses energy and drops its sediment as the slope flattens out

B. A moraine, a ridge of unsorted debris deposited directly at the leading edge of a melting glacier

C. A sand dune, a mound of wind-blown sand built up by the prevailing winds in an arid environment

D. A sea stack, an isolated column of rock left standing offshore after wave erosion of a rocky headland

21. A light-colored igneous rock is rich in silica and contains minerals such as quartz and potassium feldspar. How would this rock be classified?

A. As a mafic rock, dark and dense, formed from magma low in silica and rich in iron and magnesium

B. As a sedimentary rock, formed from the compaction of light-colored sand grains over long time periods

C. As a metamorphic rock, formed when an existing rock was altered by intense heat and pressure at depth

D. As a felsic rock, light in color and lower in density, formed from magma that is rich in silica content

22. As you descend deeper into a mine shaft, the temperature of the surrounding rock steadily increases. What is the source of this increasing heat?

A. Friction generated by the mining equipment as it continuously cuts through the solid rock of the mine

B. Sunlight that has penetrated deep into the ground and become trapped within the lower rock layers

C. Heat from Earth's interior, produced by radioactive decay and residual heat from the planet's formation

D. Warm air sinking down from the surface and accumulating at the lowest points within the mine shaft

23. When humans burn coal, oil, and natural gas, carbon stored underground for millions of years is released. In what form is this carbon most commonly added to the atmosphere?

A. As pure solid carbon particles that settle quickly back onto the ground near the original source

B. As carbon dioxide gas, a greenhouse gas that contributes to the warming of the atmosphere

C. As liquid carbon that flows directly into rivers and streams before reaching the ocean basins

D. As metallic carbon that bonds with oxygen in the soil and remains permanently locked away there

24. A fishery is considered sustainable when fish are harvested at what rate relative to the population's ability to reproduce?

A. At or below the rate at which the fish population can reproduce and replace those that are caught

B. At a rate far greater than reproduction, to maximize the total catch before the population declines

C. At a rate completely unrelated to reproduction, since fishing has no effect on fish populations at all

D. At whatever rate the market demands, regardless of how quickly the fish population can recover

25. When a natural meadow is replaced by a paved parking lot, how does the local movement of rainwater most likely change?

A. Infiltration into the ground increases sharply because the pavement channels water deep into the soil

B. The total amount of rain that falls on the area decreases because the pavement repels incoming storms

C. Evaporation becomes the only pathway for the water because pavement eliminates all surface runoff

D. Surface runoff increases because the impermeable pavement prevents water from soaking into the ground

26. Acid precipitation forms when certain gases released by burning fossil fuels combine with water vapor in the atmosphere. Which two gases are the primary cause of acid precipitation?

A. Carbon dioxide and oxygen, which combine with the rain to form a strong and highly corrosive acid

B. Sulfur dioxide and nitrogen oxides, which react with water to form sulfuric and nitric acids

C. Helium and argon, inert gases that dissolve into the rainwater and lower its pH value significantly

D. Methane and water vapor, which together produce highly acidic droplets within the storm clouds

27. Scientists drill deep into glaciers and ice sheets to extract long cylinders of ice for study. How do these ice cores help scientists understand past climate?

A. The ice cores contain fossils of land animals that reveal exactly which species lived in each past era

B. The thickness of each ice core directly indicates the exact average temperature of the entire planet

C. Air bubbles trapped in the ice preserve samples of the ancient atmosphere, including past gas concentrations

D. The color of the ice changes with each season, allowing scientists to count individual rainy days exactly

28. Which approach to managing solid waste is generally considered most effective for conserving resources and reducing environmental impact?

A. Reducing the amount of waste generated in the first place, before reusing and then recycling materials

B. Burning all of the waste in open pits to eliminate it quickly without the need for any sorting at all

C. Burying every type of waste in unlined landfills to keep it permanently out of sight underground

D. Shipping all of the waste to the deep ocean, where it can sink far below the reach of human activity

29. Honeybees and other insects that transfer pollen between flowers provide a service essential to the production of many food crops. This benefit is an example of:

A. A provisioning service, because the insects directly supply humans with honey and edible beeswax

B. A regulating or supporting service, because pollination maintains the natural process that crops depend on

C. A cultural service, because watching insects pollinate flowers provides recreation and aesthetic enjoyment

D. A geological service, because the insects gradually break down rock to help form new fertile soil over time

30. Although water covers most of Earth's surface, only a small fraction is available as fresh liquid water for human use. Why is most of Earth's water unavailable for direct human consumption?

A. Most of Earth's water is locked permanently inside the rocks of the deep mantle and the metallic core

B. Most of Earth's water has evaporated into the atmosphere and never returns to the surface ever again

C. Most of Earth's water has already been used up by human activity and cannot ever be replaced now

D. Most of Earth's water is salt water in the oceans, with much of the rest frozen in ice caps and glaciers

31. A river community wants to reduce the damage caused by seasonal floods. Which approach works with natural processes rather than against them?

A. Paving the entire floodplain so that floodwater drains away from the town as fast as possible

B. Building taller and taller concrete walls along the riverbanks until floods can no longer rise above them

C. Restoring wetlands and preserving floodplains that can absorb and store excess water during floods

D. Straightening and deepening the river channel so that all of the floodwater rushes downstream faster

32. Astronomers measure distances to stars in light-years. What does one light-year represent?

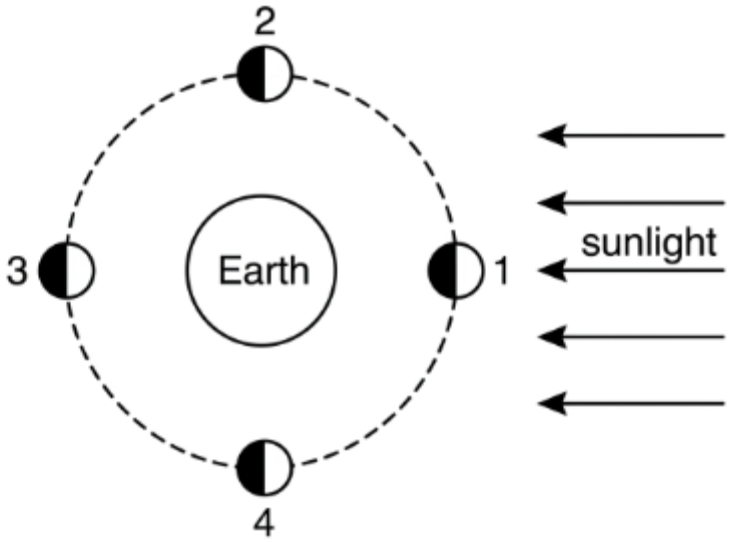
A. The distance that light travels through space in one year, a measure of distance rather than of time

B. The amount of time it takes light from a distant star to finally reach an observer on Earth's surface

C. The total number of years that a particular star has been producing and emitting its light into space

D. The brightness of a star as it would appear if it were viewed from a distance of exactly one full year

33. The diagram shows four positions of the Moon in its orbit around Earth, labeled 1 through 4, with sunlight arriving from the right side. At which position would an observer on Earth see a full moon?



A. Position 1, where the Moon lies directly between Earth and the incoming sunlight from the right

B. Position 3, where the Moon lies on the far side of Earth, opposite the direction of the sunlight

C. Position 2, where the Moon is located at a right angle to the Earth–Sun line at the top of the orbit

D. Position 4, where the Moon is located at a right angle to the Earth–Sun line at the bottom of the orbit

34. Venus has a surface temperature hot enough to melt lead, far hotter than Mercury even though Venus is farther from the Sun. What best explains Venus's extreme surface heat?

A. Venus rotates so rapidly that friction with its thick atmosphere generates enormous amounts of heat

B. Venus is still molten from its very recent formation and has not yet had any time to cool down at all

C. Venus has a thick carbon dioxide atmosphere that traps heat through a runaway greenhouse effect

D. Venus is struck by far more meteorites than Mercury, and each separate impact adds heat to the surface

35. Two stars are observed: one glows blue-white and the other glows reddish. What can be concluded about their surface temperatures?

A. The two stars must have exactly the same surface temperature, since all stars burn at one fixed temperature

B. The reddish star has a higher surface temperature than the blue-white star, since red light carries more energy

C. The color of a star reveals only its distance from Earth and tells nothing about its surface temperature at all

D. The blue-white star has a higher surface temperature than the reddish star, since hotter stars appear bluer

36. Most coastal locations on Earth experience two high tides and two low tides during a period of approximately:

A. 24 hours and 50 minutes, slightly longer than one day because of the Moon's motion along its orbit

B. Exactly 12 hours, so that the tides repeat at the same clock time every single morning and evening

C. 7 days, matching the time it takes the Moon to move through one quarter of its full monthly cycle

D. 365 days, corresponding to one full revolution of the Earth around the Sun over a calendar year

37. Our solar system is located within a vast collection of billions of stars, gas, and dust bound together by gravity. What is this structure called?

A. The solar nebula, the original cloud of gas and dust from which only our Sun and its planets formed

B. The Milky Way galaxy, a spiral galaxy containing the Sun along with hundreds of billions of other stars

C. The Local Group, which consists only of the Sun, the eight planets, and their natural moons together

D. The asteroid belt, a wide band of rocky debris that surrounds the entire solar system on all sides

38. Over the course of a night, stars appear to move in circular paths around a single point in the northern sky near Polaris. What causes this apparent motion?

A. The actual orbital motion of the stars as they physically revolve around the North Star once each night

B. The revolution of Earth around the Sun, which shifts the visible stars a little farther each successive night

C. The gravitational pull of Polaris drawing the surrounding stars into slow circular orbits around itself

D. The rotation of Earth on its axis, which makes the entire sky appear to turn around the celestial pole

39. According to the most widely accepted scientific explanation, how did Earth's Moon most likely form?

A. A Mars-sized body collided with the early Earth, ejecting debris that gradually coalesced into the Moon

B. The Moon formed elsewhere in the solar system and was later captured intact by Earth's gravity

C. The Moon condensed from a separate cloud of gas and dust that was completely independent of Earth

D. The Moon broke away from the Sun during a violent solar flare and slowly drifted toward Earth's orbit

40. Sunspots are regions on the Sun's surface that appear darker than their surroundings. Why do sunspots appear dark?

A. They are holes in the Sun's surface through which the cold blackness of space can be seen directly behind

B. They are clouds of dark dust floating above the surface that block much of the bright light of the Sun

C. They are cooler areas of the Sun's surface, and being cooler, they emit less light than the surrounding regions

D. They are the shadows cast onto the Sun's surface by planets passing between the Sun and the Earth

41. As Earth orbits the Sun, nearby stars appear to shift slightly against the background of distant stars, while very distant stars show almost no shift at all. What does this difference indicate?

A. The nearby stars are physically moving faster through space than the distant background stars are moving

B. The amount of apparent shift decreases as a star's distance increases, allowing distance to be measured

C. The distant stars are completely stationary while only the nearby stars actually move through space

D. The apparent shift is caused by the stars orbiting one another rather than by Earth's own orbital motion

42. An astronaut weighs much less standing on the Moon than on Earth, even though her mass has not changed. What explains this difference in weight?

A. The astronaut's mass actually decreases on the Moon because there is no air to give her body any weight

B. The Moon spins faster than Earth, and this faster spin throws the astronaut partly off of the surface

C. The greater distance between the Moon and the Sun reduces the total pull of gravity acting on the astronaut

D. The Moon's smaller mass produces a weaker gravitational pull than Earth's, so the astronaut weighs less

43. Sedimentary layers are found steeply tilted at a 60-degree angle. According to the principle of original horizontality, what can be concluded?

A. The layers were originally deposited horizontally and were later tilted by Earth's forces after forming

B. The layers were deposited at a 60-degree angle and have remained in that exact position ever since

C. The layers must be igneous rather than sedimentary, since only cooling lava can solidify on a steep slope

D. The tilt proves the layers formed underwater, where sediments always settle at steep angles naturally

44. A distinctive layer of volcanic ash is found in rock outcrops hundreds of kilometers apart. Why is such an ash layer especially useful for correlating rock layers across great distances?

A. Volcanic ash takes millions of years to settle, so each layer represents an enormous span of time

B. Volcanic ash forms slowly over time in each location independently, marking different ages at each site

C. A single eruption spreads ash widely in a short time, so the layer represents the same moment everywhere

D. Volcanic ash is radioactive enough to date itself instantly without any laboratory measurement at all

45. Fossils show that life on Earth has changed gradually over time, with new forms appearing and others going extinct. The fossil record provides strong evidence for which scientific idea?

A. That all species on Earth appeared suddenly at the same time and have remained completely unchanged since

B. That living things have evolved over long periods, with later organisms descending from earlier ones

C. That Earth is only a few thousand years old, far too young for any gradual change to have ever occurred

D. That fossils form randomly and reveal nothing reliable about the actual history of life on Earth at all

46. Throughout Earth's history, several mass extinctions have dramatically reduced the diversity of life. Which of the following has been identified as a cause of a major mass extinction?

A. A massive asteroid impact that filled the atmosphere with dust and disrupted the global climate

B. A gradual increase in the number of species that eventually made the planet too crowded to support life

C. The slow strengthening of Earth's magnetic field, which made the surface uninhabitable for all animals

D. A permanent halt of plate tectonics that caused all of the continents to merge into a single landmass

47. The boundaries between many of the major divisions of the geologic time scale were originally defined based on what evidence?

A. The exact numerical ages obtained from radiometric dating of the rocks at each boundary worldwide

B. The changing position of the continents as recorded in the magnetic minerals of seafloor rocks

C. The thickness of the sediment layers, with each division representing an exactly equal amount of rock

D. Major changes in the fossil record, such as widespread extinctions and the appearance of new life forms

48. The realization that Earth is billions of years old, rather than only a few thousand, was made possible largely by the understanding that:

A. All of Earth's features were formed rapidly during a small number of sudden, violent global catastrophes

B. The same slow geologic processes seen today, acting over immense spans of time, can produce large changes

C. Earth's rocks were all created at one single instant and have never changed in any way since that time

D. The age of Earth can be measured simply by counting the total number of separate rock layers present

49. In the engineering design process, what is the difference between a criterion and a constraint?

A. A criterion is a limit that cannot be exceeded, while a constraint is a goal the design should achieve

B. A criterion and a constraint are identical terms that both simply refer to the total cost of the project

C. A criterion is a requirement the solution should meet, while a constraint is a limitation it must work within

D. A criterion applies only to bridges, while a constraint applies only to buildings and to nothing else at all

50. An engineering team uses a small-scale physical model of a dam in a water tank to study how the real dam might behave. What is the main advantage of testing a scale model first?

A. The scale model is guaranteed to behave in every single way exactly like the full-sized dam will behave

B. Building the model removes the need to ever construct or test the actual full-sized dam at any point

C. The model proves with complete certainty that the final dam can never fail under any possible conditions

D. The model lets the team identify problems and improve the design safely and cheaply before full construction

ANSWERS KEY WITH EXPLANATIONS

1. A — Closely spaced isobars indicate a steep pressure gradient over a short distance, and the steeper the gradient the stronger the wind. Reading isobar spacing to judge wind speed is a core map-interpretation skill, since tightly packed isobars reliably signal strong winds.
2. C — A stationary front occurs where neither the warm nor the cold air mass has enough force to displace the other, so the boundary remains nearly fixed in place. Prolonged cloudiness and precipitation along such a boundary distinguish it from the moving cold and warm fronts.
3. B — Energy from the Sun reaches Earth by radiation, traveling as electromagnetic waves that require no medium and can cross the vacuum of space. Conduction and convection both need matter to transfer heat, so only radiation can move energy across empty space.
4. D — Thunderstorms require warm, moist surface air that is forced upward, rises rapidly, and cools to form tall cumulonimbus clouds. This strong uplift and instability, not stable or sinking air, is what builds the towering clouds that produce thunderstorms.
5. A — Water's high specific heat means it needs much more energy than sand to raise its temperature, so the beach heats far faster than the adjacent water. This property explains why land surfaces warm quickly while nearby water stays comparatively cool during the day.
6. B — The trade winds blow from the northeast rather than due north because the Coriolis effect, produced by Earth's rotation, deflects moving air to the right in the Northern Hemisphere. This deflection bends the north-to-south flow into a northeast-to-southwest path.
7. D — Equatorial rainforests are warm and wet because high insolation delivers intense solar heating while rising moist air cools and condenses into heavy rainfall. The combination of strong sunlight and ascending humid air produces the consistently hot, rainy climate.
8. C — A westerly wind is named for the direction it comes from, so it blows from the west toward the east. Naming winds by their source direction is a standard convention, which is why a westerly carries air eastward.
9. A — The greenhouse effect keeps Earth's surface warm because atmospheric gases absorb outgoing infrared energy and re-emit part of it back toward the surface. Without this trapping and re-radiation of heat, Earth's average temperature would fall well below freezing.
10. B — Storm surge, the dome of seawater driven ashore by a hurricane's onshore winds, is typically the deadliest hurricane hazard because of widespread coastal flooding. Recognizing surge as the leading cause of hurricane deaths underscores the importance of coastal evacuation.
11. D — In the rock cycle any rock type can become any other type given the right processes of melting, weathering, deposition, or heat and pressure. The cycle has no fixed one-way path, so transformation among all three rock types is always possible.
12. C — Closed contour lines marked with inward-pointing hachures indicate a depression, such as a basin or crater, where the land is lower than the surrounding area. The hachure marks are the specific symbol that distinguishes a depression from an ordinary hill on a topographic map.
13. A — The San Andreas Fault is a transform boundary, where two plates grind horizontally past one another and build up stress released as frequent earthquakes. Lateral sliding without creating or destroying crust is the defining feature of a transform boundary.

14. B — Volcanoes cluster in the Ring of Fire because its coasts mark plate boundaries, especially subduction zones, where descending plates generate magma. The tectonic setting, not ocean temperature or depth, is what concentrates volcanic activity around the Pacific rim.
15. C — In still water, larger and denser particles settle fastest, so the pebble reaches the bottom first, then the sand grain, and finally the slow-settling clay. This size-based sorting by settling rate is the principle behind graded bedding in sediments.
16. D — The curved upper surface of the saturated zone is the water table, below which all pore spaces are filled with water. Knowing the water table's position is essential for understanding wells and groundwater supply, since it marks the top of usable groundwater.
17. A — Cleavage is breakage along smooth, flat planes determined by a mineral's internal atomic structure, while fracture is irregular breakage that does not follow flat planes. Distinguishing the two is a key tool for identifying minerals by how they break.
18. C — In deserts, wind carrying sand grains abrades exposed boulders, polishing surfaces and carving shallow pits through sandblasting. This wind abrasion, rather than ice, waves, or acid, is the dominant erosional agent shaping rock in dry, sandy environments.
19. B — The focus is the underground point where rock first ruptures during an earthquake, while the epicenter is the point on the surface directly above it. Separating the two clarifies that surface shaking is felt above the actual underground source of the quake.
20. A — An alluvial fan forms where a fast mountain stream emerges onto a flat valley floor, loses energy, and drops its sediment in a fan shape as the slope flattens. The sudden decrease in gradient and velocity is what causes this characteristic deposit.
21. D — A light-colored, silica-rich igneous rock containing quartz and potassium feldspar is classified as felsic, which is light in color and lower in density. High silica content and light minerals are the defining traits that separate felsic rocks from dark, dense mafic rocks.
22. C — The rising temperature deeper in a mine comes from Earth's internal heat, produced by radioactive decay and residual heat from the planet's formation. This geothermal gradient, increasing with depth, is the source of the warmth felt underground.
23. B — Burning fossil fuels releases the stored carbon mainly as carbon dioxide gas, a greenhouse gas that contributes to atmospheric warming. Recognizing carbon dioxide as the primary combustion product links fossil fuel use directly to the enhanced greenhouse effect.
24. A — A fishery is sustainable when fish are harvested at or below the rate at which the population can reproduce and replace those removed. Harvesting within the population's reproductive capacity allows the resource to renew itself indefinitely rather than collapse.
25. D — Replacing a meadow with pavement increases surface runoff because the impermeable surface prevents water from soaking into the ground. Reduced infiltration and greater runoff are why urbanization raises local flooding risk and stresses drainage systems.
26. B — Acid precipitation forms when sulfur dioxide and nitrogen oxides from fossil fuel combustion react with atmospheric water to produce sulfuric and nitric acids. Identifying these two gases pinpoints the pollutants that must be controlled to reduce acid rain.
27. C — Ice cores trap air bubbles that preserve samples of the ancient atmosphere, recording past concentrations of gases such as carbon dioxide. These trapped bubbles let scientists reconstruct climate conditions from times long before direct measurements existed.
28. A — Reducing the amount of waste generated in the first place is the most effective strategy, ahead of reuse and recycling, because it prevents resource use and pollution at the source. This "reduce first" priority conserves more resources than managing waste after it is created.

29. B — Pollination by insects is a regulating or supporting ecosystem service because it maintains a natural process that crop production depends on. Since pollinators sustain the reproduction of many plants rather than supplying a product directly, the benefit falls outside provisioning services.
30. D — Most of Earth's water is salt water in the oceans, and much of the small freshwater portion is locked in ice caps and glaciers, leaving little accessible fresh liquid water. This distribution explains why usable freshwater is scarce despite water covering most of the planet.
31. C — Restoring wetlands and preserving floodplains works with natural processes by letting these areas absorb and store excess water during floods. This nature-based approach reduces flood damage without the downstream problems caused by paving, walling, or channelizing the river.
32. A — A light-year is the distance light travels in one year, making it a unit of distance rather than of time. Understanding that the term measures distance prevents the common confusion of treating it as an amount of elapsed time.
33. B — A full moon occurs when the Moon lies on the far side of Earth from the Sun, so its entire near side is illuminated, which corresponds to Position 3 opposite the sunlight. The geometry placing Earth between the Sun and Moon is what produces the full phase.
34. C — Venus is hotter than Mercury because its thick carbon dioxide atmosphere traps heat in a runaway greenhouse effect, despite Venus being farther from the Sun. This extreme atmospheric heat-trapping, not proximity to the Sun, accounts for its scorching surface.
35. D — Star color reveals surface temperature, with hotter stars appearing blue-white and cooler stars appearing reddish, so the blue-white star is hotter. This color-temperature relationship lets astronomers estimate a star's surface temperature from its observed color.
36. A — Most coasts experience two high and two low tides over about 24 hours and 50 minutes, slightly longer than a day because the Moon advances in its orbit while Earth rotates. This extra time is why the tidal cycle shifts a little later each day.
37. B — The solar system lies within the Milky Way galaxy, a spiral galaxy containing the Sun and hundreds of billions of other stars bound by gravity. Identifying our galaxy distinguishes it from the much smaller solar nebula or the larger Local Group of galaxies.
38. D — Stars appear to circle Polaris each night because Earth rotates on its axis, making the entire sky seem to turn around the celestial pole. The stars are effectively fixed; their apparent circular motion is a reflection of Earth's spin.
39. A — The widely accepted giant-impact hypothesis holds that a Mars-sized body struck the early Earth, ejecting debris that coalesced into the Moon. This impact origin best explains the Moon's composition and its orbital characteristics relative to Earth.
40. C — Sunspots appear dark because they are cooler regions of the Sun's surface, and cooler areas emit less light than the hotter surroundings. Their darkness is relative, caused by lower temperature and reduced emission rather than by holes or shadows.
41. B — Nearby stars show a larger apparent parallax shift than distant stars as Earth orbits, and the shift decreases with distance, which allows distance to be calculated. This inverse relationship between parallax and distance is the basis for measuring stellar distances.
42. D — The astronaut weighs less on the Moon because the Moon's smaller mass produces a weaker gravitational pull, even though her mass is unchanged. Weight depends on local gravity while mass stays constant, which is why the same body weighs less on the Moon.
43. A — By the principle of original horizontality, sediments are deposited in horizontal layers, so steeply tilted layers must have been moved into that position after they formed. The 60-degree tilt is therefore evidence of later deformation by Earth's forces.

44. C — A single volcanic eruption spreads ash over a wide area within a very short time, so the resulting ash layer represents the same moment everywhere it is found. This makes a widespread ash bed an excellent time marker for correlating distant rock outcrops.
45. B — The gradual appearance and extinction of forms in the fossil record provides strong evidence that living things have evolved over long periods, with later organisms descending from earlier ones. This documented change through time is a central support for the theory of evolution.
46. A — A massive asteroid impact, which can fill the atmosphere with dust and disrupt the global climate, has been identified as a cause of a major mass extinction. Such an impact is most strongly linked to the extinction that ended the age of the dinosaurs.
47. D — The major divisions of the geologic time scale were originally defined by significant changes in the fossil record, such as widespread extinctions and the appearance of new life forms. These biological turning points marked the boundaries long before radiometric dating provided numerical ages.
48. B — Recognizing that the same slow geologic processes seen today, acting over immense spans of time, can produce enormous change made it clear that Earth must be billions of years old. This principle of uniformitarianism replaced the idea of a young Earth shaped only by sudden catastrophes.
49. C — In engineering design, a criterion is a requirement the solution should meet, while a constraint is a limitation the solution must work within, such as budget or materials. Distinguishing goals from limits is essential for evaluating and comparing possible designs.
50. D — Testing a small-scale model lets engineers identify problems and refine the design safely and cheaply before committing to full construction. Catching flaws early in a model avoids the far greater cost and risk of discovering them in the finished structure.