PRACTICE EXAM 44: EARTH AND SPACE SCIENCES REGENTS SIMULATION (50 QUESTIONS)

1. Almost all of Earth's weather, including clouds, storms, and precipitation, occurs in the lowest layer of the atmosphere. What is this lowest layer, where weather takes place, called?

A. The stratosphere, the layer above the weather layer that contains the protective ozone and where jet aircraft often cruise smoothly

B. The troposphere, the lowest layer of the atmosphere, which contains most of the air and is where nearly all of Earth's weather occurs

C. The thermosphere, a very high layer where the air is extremely thin and temperatures rise sharply as solar radiation is absorbed

D. The exosphere, the outermost and uppermost layer of the atmosphere, which gradually fades into the empty vacuum of outer space

2. The Sun's energy travels about 150 million kilometers through the empty vacuum of space to reach Earth. By which method of heat transfer does the Sun's energy travel through space?

A. Conduction, the transfer of heat by direct contact between particles, which carries the Sun's energy across the space to the Earth

B. Convection, the transfer of heat by the movement of a heated fluid, which carries the Sun's energy through space to reach the Earth

C. Radiation, the transfer of energy by electromagnetic waves, which can travel through the empty vacuum of space to reach the Earth

D. Combustion, the rapid burning of a fuel in the space between the Sun and Earth, which delivers the Sun's heat across the great distance

3. On a cold, clear autumn night, the temperature near the ground drops below freezing, and by morning a thin layer of ice crystals has formed on the grass and car windows. What is this ice, formed directly from water vapor, called?

A. Sleet, the small pellets of ice that form when raindrops fall through a layer of freezing air and freeze before they reach the ground

B. Hail, the lumps of layered ice that form inside strong thunderstorm updrafts when ice is carried up and down and grows larger each time

C. Dew, the droplets of liquid water that form when water vapor condenses on cool surfaces during a night when temperatures stay above freezing

D. Frost, the ice crystals that form directly on surfaces when water vapor turns to ice as the temperature drops below freezing overnight

4. A weather forecaster notes that a low-pressure system is moving into the region. What kind of weather is most commonly associated with the arrival of a low-pressure system?

A. Cloudy, unsettled, and stormy weather, since air rises in a low-pressure system, cools, and forms clouds and precipitation

B. Clear, calm, and sunny weather, since the sinking air in a low-pressure system prevents any clouds or precipitation from forming

C. No change in the weather at all, since the air pressure over a region has no measurable effect on the conditions at the surface

D. A permanent and unchanging deep freeze, since low-pressure systems always lock in bitterly cold temperatures for many months

5. A meteorologist uses a device with two thermometers, one with a wet cloth around its bulb and one with a dry bulb, to determine the humidity. When the air is very dry, how do the readings of the two thermometers compare?

A. The wet-bulb and dry-bulb thermometers always read exactly the same temperature, since humidity has no effect on either thermometer

B. The wet-bulb thermometer reads much lower than the dry-bulb thermometer, because rapid evaporation from the wet cloth cools its bulb

C. The wet-bulb thermometer reads much higher than the dry-bulb thermometer, because the wet cloth traps heat and warms its bulb

D. The two thermometers give random, unrelated readings that change unpredictably and cannot be used to determine the humidity at all

6. During a thunderstorm, a person sees a flash of lightning and then hears the thunder several seconds later, even though both happen at the same instant. Why is the thunder heard after the lightning is seen?

A. The thunder is actually produced several seconds after the lightning, so the delay reflects the real time gap between the two events

B. The lightning travels backward in time, which is why it always reaches an observer's eyes before the thunder ever leaves the cloud

C. Sound and light travel at exactly the same speed, so the delay must be caused by the thunder taking a longer path through the air

D. Light travels much faster than sound, so the flash reaches the observer almost instantly while the slower thunder arrives later

7. In the Northern Hemisphere, summer days are both longer and warmer than winter days. Which combination of factors makes summer warmer than winter?

A. The Earth is much closer to the Sun in summer and much farther away in winter, which is the sole reason that summer is the warmer season

B. The Sun physically produces far more heat during the summer months and then deliberately produces much less during the winter months

C. In summer the Sun is higher in the sky, so its rays strike more directly, and the days are longer, giving more hours of heating each day

D. The Moon blocks much of the Sun's heat all winter long and then moves out of the way each summer to let the full heat reach the surface

8. A fast-moving cold front catches up to and overtakes a slower warm front, lifting the warm air completely off the ground between the two cold air masses. What type of front forms in this situation?

A. An occluded front, which forms when a cold front overtakes a warm front and lifts the warm air up off the ground between two cold masses

B. A stationary front, which forms when the boundary between two air masses stalls in place and barely moves for several days at a time

C. A sea-breeze front, which forms each afternoon along a coastline where cool ocean air pushes inland beneath the warmer air over the land

D. A dry line, which forms inland where a boundary separates very dry desert air from the more humid air found closer to a large body of water

9. Moist air is forced to rise over a tall mountain range, dropping heavy rain on the windward side. By the time the air descends the far side, it is dry, creating a desert. What is this dry region on the far side of the mountains called?

A. A floodplain, the flat, low-lying area beside a river that is periodically covered with water and fresh sediment whenever the river overflows

B. A rain shadow, the dry region on the downwind side of a mountain range where descending air has already lost most of its moisture

C. A watershed, the entire region of land from which all of the rain and melting snow drains into one single river system or body of water

D. A delta, the fan-shaped deposit of sediment that builds up where a river slows down and drops its load as it flows into a lake or the sea

10. Weather forecasts for tomorrow are usually quite accurate, but forecasts for ten days from now are much less reliable. Why does the accuracy of a weather forecast decrease the further into the future it tries to predict?

A. Meteorologists deliberately make distant forecasts wrong on purpose, since they prefer to keep the long-range weather a secret from the public

B. The atmosphere stops following any physical laws after a single day, which makes predicting beyond tomorrow completely impossible to do

C. The atmosphere is a complex system in which small uncertainties grow over time, so prediction errors increase the further ahead one forecasts

D. The weather instruments used by forecasters work perfectly today but always break down exactly ten days after they are first switched on

11. In an undisturbed sequence of sedimentary rock, which layer is the oldest, and why?

A. The middle layer is the oldest, because sediment always begins building up from the center of a sequence and then spreads outward over time

B. The top layer is the oldest, because the highest layers were the first to be laid down before the lower layers formed beneath them later

C. All of the layers are exactly the same age, since every layer in an undisturbed sequence is always deposited at the very same instant in time

D. The bottom layer is the oldest, because in an undisturbed sequence the lowest layers were deposited first, before the layers above them

12. In radiometric dating, scientists measure the amounts of a radioactive "parent" isotope and the "daughter" product it decays into. How do the relative amounts of parent and daughter isotopes change as a rock ages?

A. The amount of parent isotope increases while the daughter decreases, since radioactive decay creates more parent isotope over time

B. The parent isotope steadily decreases while the daughter product increases, since the parent decays into the daughter as time passes

C. Both the parent and daughter isotopes stay exactly the same forever, since radioactive isotopes never change in amount once a rock forms

D. The parent and daughter amounts swap back and forth repeatedly, so the ratio between them reveals nothing useful about the rock's age

13. Some of the most complete fossils of ancient insects are found perfectly preserved inside hardened tree resin, or amber, with their delicate body parts intact. Why does amber preserve such delicate organisms so completely?

A. The amber heats the trapped insect until it turns to solid stone, which is the only way the insect's delicate body parts can survive intact

B. The amber dissolves the insect completely and then rebuilds an exact stone copy of it, which preserves even the most delicate of details

C. The sticky resin quickly surrounds and seals the insect, protecting it from decay, scavengers, and air so its fine details are preserved

D. The amber repeatedly freezes and thaws the insect, and this freezing process is what hardens its delicate body into a lasting fossil

14. The boundaries between the major divisions of the geologic time scale, such as between eras, often mark times when the fossil record changes dramatically. What kind of event commonly marks these major boundaries in the time scale?

A. A change in the color of the rock layers, which is the only feature geologists use to mark the boundaries between the major time divisions

B. A mass extinction or major change in life, where many species disappear from the fossil record and new groups later appear and diversify

C. The complete disappearance of all rock layers, since no rock at all formed during the moments when the major boundaries occurred

D. A sudden reversal of the order of the layers, where the rocks flip upside down each time one major division of time changes to the next

15. Alfred Wegener proposed the idea of continental drift, supporting it with several lines of evidence. Which of the following was one of the main pieces of evidence Wegener used to argue that the continents had once been joined?

A. The matching shapes of coastlines and matching fossils and rock formations found on continents now separated by wide oceans

B. Direct photographs of the continents physically sliding apart, which Wegener took from space to prove that the continents were moving

C. Written historical records left by ancient sailors who personally watched the single supercontinent break apart into separate pieces

D. The fact that all of the continents are exactly the same size and shape, which proves that they must once have been a single landmass

16. A radioactive isotope has a half-life of 1 million years. A rock sample is found to contain one-sixteenth of the original amount of this isotope. Approximately how old is the rock?

A. About 1 million years old, since one-sixteenth of the isotope remaining corresponds to just a single half-life of the isotope passing

B. About 2 million years old, since one-sixteenth of the isotope remaining corresponds to exactly two half-lives of the isotope passing

C. About 16 million years old, found by multiplying the one-million-year half-life directly by the sixteen in the fraction one-sixteenth

D. About 4 million years old, since one-sixteenth remaining means four half-lives have passed, and four times one million years is four million

17. The fossil record of the horse shows a series of ancestors that gradually changed over millions of years, becoming larger and developing fewer toes. What does this gradual sequence of changes in the fossil record best illustrate?

A. That the modern horse appeared suddenly and fully formed, with no ancestors of any kind ever existing before it in the fossil record

B. That all of the different horse ancestors lived at exactly the same time, which is why their fossils are found together in the same layers

C. That species can change gradually over long periods of time through evolution, as documented step by step in the fossil record

D. That the fossil record is completely random, so the apparent sequence of horse ancestors is just a coincidence with no real meaning at all

18. Earth's earliest atmosphere is thought to have contained gases released by volcanoes, such as water vapor, carbon dioxide, and nitrogen, but almost no free oxygen. What later caused free oxygen to build up in the atmosphere?

A. Photosynthesis by early organisms, which took in carbon dioxide and released oxygen as a waste product, slowly building up oxygen over time

B. A sudden, single volcanic eruption that released all of the atmosphere's oxygen at once in one enormous burst early in Earth's history

C. The freezing of the oceans into ice, which somehow released vast amounts of pure oxygen gas into the air as the water turned solid

D. The arrival of oxygen from the Sun, which beamed the gas directly down to the Earth's surface over the course of billions of years

19. Some power plants burn plant material, such as wood chips and crop waste, or capture the gas released as this material decays, to generate energy. What renewable energy source does this represent?

A. Geothermal energy, which is produced from the natural heat stored deep within the Earth's interior rather than from any plant material

B. Biomass energy, which is produced from recently living plant or organic material that is burned or processed to release stored energy

C. Tidal energy, which is produced from the regular rise and fall of ocean water that is driven by the gravitational pull of the Moon

D. Nuclear energy, which is produced by splitting the nuclei of heavy atoms such as uranium and has nothing to do with any plant material

20. Large cities are often several degrees warmer than the surrounding countryside, especially at night. This effect, in which a city is warmer than nearby rural areas, is known as the:

A. Greenhouse effect, the natural warming of the entire planet that occurs when atmospheric gases trap heat radiating from Earth's surface

B. Rain shadow effect, the drying of the air on the downwind side of a mountain range after the air has lost its moisture climbing the slope

C. Coriolis effect, the deflection of large-scale moving air and water caused by the rotation of the Earth on its axis as it spins each day

D. Urban heat island effect, in which a city's pavement and buildings absorb and hold heat, keeping the city warmer than the rural surroundings

21. Unlike materials such as paper or food scraps, most plastics take hundreds of years to break down in the environment. Why does plastic waste remain a problem in the environment for such a long time?

A. Plastic is quickly eaten and digested by ordinary soil bacteria within a few days, which is the reason it disappears so rapidly from nature

B. Plastic instantly dissolves in rainwater into harmless minerals, so it actually leaves the environment faster than almost any other material

C. Plastic does not easily break down or decompose naturally, so it persists in the environment for very long periods and accumulates over time

D. Plastic evaporates completely into the air within hours of being discarded, which is why it never causes any lasting environmental problems

22. Many countries set aside national parks and nature reserves where development, hunting, and resource extraction are limited or banned. How do these protected areas help the environment?

A. They preserve natural habitats and the species that live in them, helping to protect biodiversity from the pressures of human development

B. They guarantee that all of the wildlife inside them will go extinct, since protecting an area is the surest way to wipe out its native species

C. They have no effect on wildlife at all, since setting aside land cannot influence whether plants and animals are able to survive there

D. They increase pollution and habitat destruction within their borders, since protected status always encourages heavy industrial activity

23. Fresh water for human use comes from both surface water, such as rivers and lakes, and groundwater stored beneath the surface. Which of the following correctly describes groundwater?

A. Groundwater is the salty water found in the oceans, which makes up the largest and most easily used supply of drinking water on the planet

B. Groundwater is the water vapor held in the clouds high above the surface, which falls as rain whenever a region needs more drinking water

C. Groundwater is the frozen water locked in the polar ice caps, which is pumped directly from the poles to supply cities around the world

D. Groundwater is the water stored in the spaces within soil and rock beneath the surface, which can be reached by digging or drilling wells

24. As regions warm, scientists observe that some plant and animal species are gradually shifting their ranges toward the poles or to higher elevations. Why are these species shifting toward cooler areas?

A. The species are shifting purely at random, since changes in temperature have no influence on where plants and animals are able to live

B. As their original habitats become too warm, the species move toward cooler regions where the temperatures still suit their needs

C. The species are deliberately moving toward the equator and to lower elevations, seeking out the warmest possible places to live and breed

D. The species are following the migrating Sun, which physically moves toward the poles a little more each year and drags the wildlife along

25. A large fraction of the food produced worldwide is thrown away before it is ever eaten. Why does reducing food waste benefit the environment?

A. Producing food uses land, water, and energy, so wasting less food means fewer of those resources and less pollution are spent for nothing

B. Wasting food has no environmental impact whatsoever, since food simply vanishes harmlessly the moment it is thrown into the garbage

C. Throwing away more food is actually better for the environment, since rotting food in landfills cleans the surrounding air and soil

D. Reducing food waste increases the total amount of land, water, and energy needed to feed people, which harms the environment further

26. Burning fossil fuels and wood releases tiny solid particles into the air that are small enough to be breathed deep into the lungs. Why is this fine particulate matter a concern for human health?

A. The fine particles are far too large to ever be inhaled, so they simply settle harmlessly to the ground and pose no risk to people at all

B. The fine particles are an essential nutrient that the human body needs, so breathing in more of them actually improves a person's health

C. The fine particles can be inhaled deep into the lungs, where they can cause or worsen breathing and heart problems over time

D. The fine particles instantly turn into harmless oxygen the moment they enter the lungs, which means they have no effect on human health

27. A timber company replants new trees after harvesting and cuts only a portion of a forest at a time, allowing the forest to regrow. This approach to managing a forest is best described as:

A. Overharvesting, the practice of removing a resource far faster than it can ever be replaced, which leads to the permanent loss of the resource

B. Strip mining, the practice of removing large amounts of surface rock and soil to reach valuable minerals buried in the ground beneath it

C. Monoculture farming, the practice of planting a single crop species across an entire field year after year without any variation at all

D. Sustainable forestry, the practice of harvesting and replanting trees at a rate that allows the forest to renew itself for future use

28. Over long periods of time, exposed rock at Earth's surface is broken down into smaller and smaller pieces and carried away to new locations. Which two processes together break rock into sediment and transport it elsewhere?

A. Weathering, which breaks rock into smaller pieces, and erosion, which carries the loosened pieces away to new locations

B. Deposition, which lays down new rock, and cementation, which immediately glues that fresh rock into even larger solid masses

C. Melting, which turns the rock into magma, and crystallization, which cools the magma back into the very same rock it started as

D. Condensation, which forms water droplets on the rock, and evaporation, which then dries the rock back out without changing it at all

29. Two minerals, graphite and diamond, are both made entirely of carbon atoms, yet graphite is soft and dark while diamond is extremely hard and clear. What accounts for these dramatic differences between two minerals made of the same element?

A. Graphite and diamond are actually made of completely different elements, which is the real reason they have such different properties

B. The differences are caused only by the colors that humans have painted onto each mineral, and not by anything about the minerals themselves

C. The carbon atoms are arranged in different internal crystal structures, and this difference in atomic arrangement gives them different properties

D. There are no real differences between graphite and diamond, since any two minerals made of the same element are always completely identical

30. A large number of the world's active volcanoes are located in a zone that encircles the Pacific Ocean, where many tectonic plates meet. What is this volcanically and seismically active zone commonly called?

A. The Bermuda Triangle, a region of the Atlantic Ocean known mainly through popular legend rather than for any volcanic or seismic activity

B. The Ring of Fire, the zone of frequent earthquakes and volcanoes that encircles the Pacific Ocean along the boundaries of many plates

C. The Sahara Belt, a broad band of hot desert that stretches across northern Africa and has no connection to volcanoes or plate boundaries

D. The Gulf Stream, a warm ocean current that flows through the Atlantic Ocean and has nothing to do with volcanoes or earthquakes

31. A tree growing in a crack in a large rock slowly widens the crack as its roots grow thicker, eventually splitting the rock apart. What type of weathering does this represent?

A. Chemical weathering, since the tree's roots release acids that dissolve the minerals in the rock and change them into entirely new substances

B. Deposition, since the growing tree lays down new layers of sediment on top of the rock that gradually build up and bury it over many years

C. Erosion, since the tree picks up the broken pieces of rock and physically carries them far away to be dropped in a completely new location

D. Mechanical weathering, since the growing roots physically pry the rock apart into pieces without changing the rock's chemical composition

32. Earth is made up of several layers, including the crust, mantle, outer core, and inner core. Which of these layers is by far the thickest, making up the largest portion of Earth's volume?

A. The mantle, the thick layer of hot, slowly flowing rock between the crust and the core, which makes up the largest part of Earth's volume

B. The crust, the thin, rocky outer skin of the Earth, which despite being very thin still makes up the greatest share of the planet's volume

C. The outer core, the layer of liquid metal surrounding the inner core, which alone accounts for more than half of the entire Earth's volume

D. The inner core, the small, solid metal sphere at the very center of the Earth, which is by far the largest layer by total volume of them all

33. A geologist examines a cliff face showing many distinct horizontal layers of sedimentary rock stacked on top of one another. What does the presence of these many separate layers indicate about how the rock formed?

A. The entire cliff formed in a single instant, with all of its many layers being deposited together at exactly the same moment in time

B. The layers formed from the bottom downward, with each new layer appearing underneath the older layers rather than on top of them

C. The sediment was deposited in separate episodes over a long period of time, with each layer representing a distinct period of deposition

D. The layers reveal nothing about how or when the rock formed, since the number of layers in a rock is completely random and meaningless

34. An aquifer is replenished, or recharged, when water from the surface soaks down into it. Which of the following would most directly reduce the recharge of an aquifer in a region?

A. Allowing rain to fall on open fields and forests, which lets large amounts of water soak naturally into the ground and refill the aquifer

B. Paving large areas with roads and parking lots, which prevents rainwater from soaking into the ground and reduces the aquifer's recharge

C. Planting more trees and gardens across the region, which increases how much rainwater is able to soak down and replenish the aquifer

D. Building shallow ponds that hold rainwater on the surface, which gives the water more time to slowly soak down and recharge the aquifer

35. A geologist rubs an unknown mineral across a rough, unglazed porcelain tile and observes the color of the powder it leaves behind. Which mineral property is the geologist testing?

A. Cleavage, the tendency of a mineral to split along smooth, flat planes that are determined by the internal arrangement of its atoms

B. Hardness, the measure of how strongly a mineral resists being scratched, which is ranked on a scale running from talc up to diamond

C. Luster, the way the surface of a mineral reflects light, described with terms such as metallic, glassy, pearly, dull, silky, or earthy

D. Streak, the color of the powder a mineral leaves when rubbed across an unglazed tile, which is often more reliable than its surface color

36. When two continental plates collide, neither is dense enough to sink beneath the other, so the crust is pushed and crumpled upward. What landform results from this kind of continent-continent collision?

A. A tall mountain range, formed as the colliding continental plates crumple and push the crust upward into folded and uplifted mountains

B. A deep ocean trench, formed as one of the two continental plates plunges far down beneath the other into the mantle at the boundary

C. A broad, flat plain, formed as the collision smooths and flattens the crust completely level over the entire area where the plates meet

D. A long mid-ocean ridge, formed as the two colliding continents pull apart from each other and allow magma to rise up between them

37. A geologist finds a rock that contains visible fossils and is made of distinct flat layers. Based on these two features, which type of rock is this most likely to be?

A. An igneous rock, since igneous rocks commonly contain abundant fossils and form in the flat, distinct layers described by the geologist

B. A sedimentary rock, since fossils and flat layers are characteristic features of sedimentary rocks formed from deposited sediment

C. A metamorphic rock, since the heat and pressure that form metamorphic rocks are what create the fossils and flat layers found in them

D. A volcanic glass, since rapidly cooled lava typically traps large numbers of fossils and forms the distinct flat layers described here

38. Which of the following correctly lists the first four planets in order, starting from the planet closest to the Sun and moving outward?

A. Venus, then Mercury, then Earth, then Mars, beginning with the second planet and then jumping back to the planet closest to the Sun

B. Earth, then Mars, then Mercury, then Venus, beginning with our home planet and then moving in toward the Sun and back out again

C. Mercury, then Venus, then Earth, then Mars, beginning with the planet closest to the Sun and moving outward through the inner planets

D. Mars, then Earth, then Venus, then Mercury, beginning with the fourth planet and moving inward toward the planet closest to the Sun

39. Planets that orbit close to the Sun travel along their orbits at much faster speeds than planets that orbit far from the Sun. Why do the inner planets move faster in their orbits than the outer planets?

A. The Sun's gravity is stronger closer in, so the inner planets must move faster to stay in orbit, while the outer planets move more slowly

B. The Sun's gravity is much weaker close to the Sun, so the inner planets are flung around their orbits at the highest possible speeds

C. The inner planets are far larger and heavier than the outer planets, and this greater size is the only reason they travel so much faster

D. All of the planets actually orbit at exactly the same speed, so the apparent difference in their orbital speeds is merely an illusion

40. The stars that form a constellation appear close together in the night sky, but in reality they are often separated by vast distances and only happen to line up from Earth's point of view. What does this reveal about constellations?

A. The stars in a constellation are all physically connected to one another by invisible threads, which is what holds the pattern together in space

B. The stars in a constellation are all exactly the same distance from Earth, which is the reason they appear to form a flat, two-dimensional pattern

C. The stars in a constellation always formed together at the same time and place, which guarantees that they will remain grouped forever

D. A constellation is only an apparent pattern seen from Earth, since its stars can lie at very different distances and are not truly grouped together

41. The visible surface of the Sun, the layer that gives off the light we see, has a specific name. What is the bright visible surface layer of the Sun called?

A. The corona, the outermost layer of the Sun's atmosphere, which extends far out into space and is normally visible only during an eclipse

B. The photosphere, the bright visible surface layer of the Sun that gives off the light we see and marks the apparent edge of the Sun's disk

C. The core, the extremely hot, dense central region of the Sun where nuclear fusion takes place and the Sun's energy is actually generated

D. The chromosphere, a thin reddish layer of the Sun's atmosphere that lies just above the visible surface and below the outer corona

42. The leading scientific explanation for the origin of Earth's Moon is the giant-impact hypothesis. According to this hypothesis, how did the Moon form?

A. The Moon was a passing asteroid that was captured intact by Earth's gravity as it drifted through the solar system in the distant past

B. The Moon formed separately at the center of the solar system and then slowly drifted outward until it settled into orbit around the Earth

C. A Mars-sized body collided with the early Earth, and the debris blasted into orbit gradually came together to form the Moon

D. The Moon split off from the Sun during a powerful solar eruption and was then pulled into orbit around the Earth shortly afterward

43. When astronomers observe a galaxy that is millions of light-years away, they say they are "looking back in time." Why does observing a very distant galaxy mean looking into the past?

A. The galaxy's light took millions of years to reach Earth, so we see the galaxy as it was when that light left it, not as it is right now

B. The galaxy physically travels backward through time as we watch it, which is what allows astronomers to observe events from the distant past

C. The light from the galaxy travels infinitely fast, reaching Earth instantly, so astronomers are actually seeing the galaxy exactly as it is today

D. Astronomers use special time-travel telescopes that physically send the observer into the past in order to view the distant galaxy up close

44. The outer planets, such as Neptune, are extremely cold compared with the inner planets. What is the main reason the outer planets are so much colder than the inner planets?

A. The outer planets spin so rapidly on their axes that the friction cools them down far below the temperatures of the slower inner planets

B. The outer planets are made of a special cold material that generates no heat, while the inner planets are made of a naturally warm material

C. The outer planets block all of the Sun's light from ever reaching them, so they receive no solar energy and remain frozen at all times

D. The outer planets are much farther from the Sun, so they receive far less of the Sun's heat and light and remain extremely cold

45. New stars form within enormous clouds of gas and dust in space, where gravity pulls the material together until it becomes hot and dense enough to begin nuclear fusion. What is such a cloud of gas and dust, where stars are born, called?

A. A galaxy, a vast system of billions of fully formed stars, gas, and dust all held together by gravity in one enormous rotating structure

B. A nebula, a large cloud of gas and dust in space within which gravity can pull material together to form brand-new stars over time

C. A comet, a small icy body that develops a long glowing tail of gas and dust as it travels close to the Sun on its long, looping orbit

D. A black hole, a region of space with gravity so strong that not even light can escape from it once it has crossed the hole's boundary

46. In the Northern Hemisphere, the summer solstice in June is the day with the most hours of daylight in the entire year. Why does the summer solstice have the longest period of daylight?

A. On that day the Northern Hemisphere is tilted most directly toward the Sun, so the Sun stays above the horizon for the longest time

B. On that day the Earth is physically closest to the Sun in its orbit, which is the sole reason that the daylight lasts longer than on any other day

C. On that day the Earth temporarily stops rotating, which stretches out the daytime to its greatest possible length for that one day of the year

D. On that day the Moon moves entirely out of the sky, and its absence is what allows the daylight to last longer than on any other day of the year

47. Thousands of artificial satellites orbit the Earth, performing many useful tasks for people on the ground. Which of the following is a common and important use of artificial satellites?

A. Generating all of the electricity used by every city on Earth by beaming unlimited free power down from their orbits high above the planet

B. Physically holding the Earth together in space, since without the constant pull of the orbiting satellites the planet would break apart

C. Providing communication, navigation such as GPS, and weather and Earth observation by relaying and collecting signals from orbit

D. Producing the Earth's gravity, since it is actually the orbiting satellites, rather than the planet's own mass, that keeps people on the ground

48. Using the observed expansion of the universe and other evidence, scientists have estimated how long ago the Big Bang occurred. Approximately how old is the universe according to current scientific evidence?

A. About 6,000 years old, a figure that scientists have calculated directly from the measured rate at which the universe is currently expanding

B. About 1 million years old, meaning the universe is only slightly older than the first appearance of early human ancestors on the Earth

C. About 4.6 billion years old, meaning the universe formed at exactly the same time that the Earth and the rest of the solar system did

D. About 13.8 billion years old, a figure based on the observed expansion of the universe and other independent lines of scientific evidence

49. An engineering team tests a new design for a flood barrier and discovers that water leaks through several gaps. What does the engineering design process say the team should do with this test result?

A. Use the information about where it leaked to redesign and improve the barrier, then build and test the improved version once again

B. Discard the project entirely and never attempt to design any flood barrier again, since a single failed test proves the task is impossible

C. Sell the leaking barrier to communities exactly as it is, since the very first version of any design is always the final, finished product

D. Ignore the leaks completely and build many identical copies of the same leaking barrier, expecting each new copy to somehow work better

50. Scientists often build models, such as a small physical model of a river system or a computer simulation of the atmosphere, to study things that are too large or complex to examine directly. What is one important reason scientists use such models?

A. Models are always perfectly identical to the real thing in every possible detail, so studying a model is exactly the same as studying reality itself

B. Models are built only to look attractive in museums and textbooks, and they provide no real scientific information about the systems they represent

C. Models simplify complex systems so scientists can study and test ideas about them, making predictions that would be hard to make otherwise

D. Models are used because they make every system far more complicated and confusing than it really is, which is the main goal of building them

Practice Exam 44: Answer Key with Explanations

1. B — The troposphere is the lowest atmospheric layer, holding most of the air and nearly all of Earth's weather. Clouds, storms, and precipitation occur here because this is where most water vapor and vertical air motion are concentrated.
2. C — The Sun's energy crosses the vacuum of space by radiation, the transfer of energy as electromagnetic waves. Unlike conduction and convection, radiation requires no medium, so it can travel through empty space to reach Earth.

3. D — Ice crystals forming directly from water vapor on surfaces when temperatures drop below freezing are frost. Because the vapor turns straight to ice rather than first condensing as liquid, frost differs from dew.
4. A — A low-pressure system brings cloudy, unsettled, stormy weather because its air rises, cools, and condenses into clouds and precipitation. Rising air is the key reason low pressure is associated with active weather.
5. B — In dry air, rapid evaporation from the wet cloth cools the wet-bulb thermometer, so it reads much lower than the dry bulb. The size of this difference indicates how dry the air is, allowing humidity to be determined.
6. D — Thunder is heard after lightning is seen because light travels far faster than sound. The flash arrives almost instantly while the slower sound takes additional seconds to cover the same distance.
7. C — Summer is warmer because the Sun is higher in the sky, striking the surface more directly, and the days are longer, giving more hours of heating. These two effects of axial tilt, not distance to the Sun, drive the seasons.
8. A — When a cold front overtakes a warm front and lifts the warm air off the ground between two cold masses, an occluded front forms. This catching-up of one front to another is what defines an occlusion.
9. B — The dry region on the downwind side of mountains, where descending air has lost its moisture, is a rain shadow. The air drops its rain climbing the windward side, leaving the far side dry.
10. C — Forecast accuracy decreases with time because the atmosphere is a complex system in which small uncertainties grow, compounding prediction errors. This sensitivity to tiny differences limits how far ahead forecasts stay reliable.
11. D — In an undisturbed sequence, the bottom layer is oldest because the lowest layers were deposited first, before the layers above. This is the law of superposition, the foundation of reading relative ages in rock.
12. B — As a rock ages, the radioactive parent isotope steadily decreases while the daughter product it decays into increases. Measuring the ratio of parent to daughter therefore reveals how much time has passed since the rock formed.
13. C — Amber preserves delicate organisms because the sticky resin quickly surrounds and seals the insect, shielding it from decay, scavengers, and air. This rapid, airtight encasement keeps even fine body parts intact.
14. B — Major boundaries in the geologic time scale commonly mark mass extinctions or major changes in life, where many species vanish and new groups later diversify. These shifts in the fossil record are used to define the divisions of time.
15. A — Wegener's evidence included matching coastline shapes and matching fossils and rock formations on continents now separated by oceans. Such correspondences suggested the continents had once been joined and later drifted apart.
16. D — One-sixteenth remaining means four halvings have occurred ($1 \rightarrow 1/2 \rightarrow 1/4 \rightarrow 1/8 \rightarrow 1/16$), or four half-lives. Four times the 1-million-year half-life gives an age of about 4 million years.
17. C — The gradual changes in the horse lineage illustrate that species can change over long periods through evolution, documented step by step in the fossil record. The sequence of ancestors records evolutionary change over millions of years.
18. A — Free oxygen built up because early photosynthetic organisms took in carbon dioxide and released oxygen as a waste product. Over vast stretches of time this oxygen accumulated, transforming Earth's atmosphere.

19. B — Burning plant material or capturing the gas from its decay to produce energy is biomass energy. Because the plant material is recently living and can be regrown, biomass is classified as a renewable source.
20. D — A city being warmer than its rural surroundings, especially at night, is the urban heat island effect. Pavement and buildings absorb and retain heat, raising city temperatures above those of the countryside.
21. C — Plastic persists because it does not easily break down or decompose naturally, so it remains in the environment for very long periods and accumulates. This durability is why plastic pollution is such a long-lasting problem.
22. A — National parks and reserves preserve natural habitats and the species within them, helping protect biodiversity from human development. Limiting activities like hunting and extraction shields ecosystems that would otherwise be degraded.
23. D — Groundwater is the water stored in spaces within soil and rock beneath the surface, reachable by digging or drilling wells. It is a major source of fresh water distinct from surface water in rivers and lakes.
24. B — Species shift toward cooler regions because their original habitats become too warm, and the poleward or higher areas still suit their temperature needs. These range shifts are a documented response to a warming climate.
25. A — Producing food consumes land, water, and energy, so wasting less food means fewer of those resources and less pollution are spent for nothing. Cutting food waste therefore conserves the resources used to grow and transport it.
26. C — Fine particulate matter is a health concern because the tiny particles can be inhaled deep into the lungs, where they cause or worsen breathing and heart problems. Their small size lets them reach sensitive lung tissue and enter the bloodstream.
27. D — Harvesting and replanting trees at a rate that lets the forest renew itself is sustainable forestry. By cutting only part of the forest and replanting, the company keeps the resource available for the future.
28. A — Weathering breaks rock into smaller pieces, and erosion carries those loosened pieces away to new locations. Together these two processes turn solid rock into transported sediment.
29. C — Graphite and diamond differ because their carbon atoms are arranged in different internal crystal structures, and that arrangement determines their properties. The same element in different structures yields very different hardness and appearance.
30. B — The zone of frequent volcanoes and earthquakes encircling the Pacific Ocean is the Ring of Fire. Its activity results from the many plate boundaries that ring the Pacific basin.
31. D — Roots growing in a crack and prying the rock apart is mechanical weathering, since the rock is physically broken without changing its chemical makeup. The widening force of the growing roots fractures the rock into pieces.
32. A — The mantle, the thick layer of hot, slowly flowing rock between crust and core, makes up the largest share of Earth's volume. Its great thickness dwarfs the thin crust and the comparatively small core layers.
33. C — Many separate horizontal layers indicate the sediment was deposited in distinct episodes over a long time, each layer marking a period of deposition. The stacking of layers records a sequence of separate depositional events.
34. B — Paving large areas with roads and parking lots prevents rainwater from soaking in, reducing how much reaches and recharges the aquifer. Impervious surfaces send water to runoff instead of infiltration.

35. D — Rubbing a mineral on an unglazed tile to observe the powder color tests its streak. Streak is often more reliable than surface color for identification because it stays consistent even when surface color varies.
36. A — A continent-continent collision crumples and pushes the crust upward into a tall, folded mountain range. Because neither plate is dense enough to subduct, the crust thickens and rises instead.
37. B — Visible fossils and distinct flat layers are characteristic of sedimentary rock formed from deposited sediment. Fossils survive the gentle conditions of sediment burial, and layering reflects successive deposition.
38. C — In order from the Sun outward, the first four planets are Mercury, Venus, Earth, and Mars. These inner rocky planets are the closest to the Sun before the asteroid belt and the gas giants.
39. A — The Sun's gravity is stronger closer in, so inner planets must move faster to stay in orbit, while distant planets move more slowly. This balance between gravity and orbital speed is why inner planets race around the Sun.
40. D — A constellation is only an apparent pattern seen from Earth, since its stars can lie at very different distances and are not truly grouped. The stars merely line up from our vantage point rather than being physically associated.
41. B — The bright visible surface of the Sun that emits the light we see is the photosphere. It marks the apparent edge of the Sun's disk, below the chromosphere and corona of the solar atmosphere.
42. C — The giant-impact hypothesis holds that a Mars-sized body struck the early Earth, and the debris blasted into orbit gradually coalesced into the Moon. This explains the Moon's composition and its orbit around Earth.
43. A — A distant galaxy's light took millions of years to reach Earth, so we see it as it was when that light left, not as it is now. Because light travels at a finite speed, looking far into space is looking back in time.
44. D — The outer planets are far colder mainly because they are much farther from the Sun and receive far less of its heat and light. Distance reduces the solar energy reaching them, leaving them frozen.
45. B — A cloud of gas and dust in space where gravity gathers material into new stars is a nebula. Within it, collapsing material grows hot and dense enough to ignite nuclear fusion and become a star.
46. A — At the summer solstice the Northern Hemisphere is tilted most directly toward the Sun, so the Sun stays above the horizon longest. This maximum tilt toward the Sun produces the year's longest daylight, not any change in distance.
47. C — Satellites commonly provide communication, navigation such as GPS, and weather and Earth observation by relaying and collecting signals from orbit. These practical functions are why thousands of satellites circle the planet.
48. D — Current evidence, including the observed expansion of the universe, places its age at about 13.8 billion years. This far exceeds the roughly 4.6-billion-year age of the Earth and solar system.
49. A — The engineering design process is iterative, so the team should use the information about where it leaked to redesign and improve the barrier, then test again. Treating a failed test as feedback drives the design toward a working solution.
50. C — Models simplify complex systems so scientists can study and test ideas and make predictions that would otherwise be difficult. By representing something too large or intricate to examine directly, a model makes it manageable to investigate.