PRACTICE EXAM 42: EARTH AND SPACE SCIENCES REGENTS SIMULATION (50 QUESTIONS)

1. A sedimentary rock such as limestone is buried deep beneath the surface, where intense heat and pressure transform it into a new rock without melting it. What type of rock does the limestone become?

A. Another sedimentary rock identical to the original limestone, since burial alone cannot change one rock into a different type

B. An igneous rock, because any rock that is buried deep underground automatically melts into magma and then cools into igneous rock

C. A loose pile of sediment, because heat and pressure always break a buried rock apart into small grains rather than changing it

D. A metamorphic rock such as marble, because heat and pressure change the limestone's structure without melting it completely

2. To be classified as a mineral, a substance must meet several requirements. Which of the following is one of the requirements that a substance must satisfy to be considered a mineral?

A. It must be a naturally occurring, inorganic solid with a definite chemical composition and an orderly crystal structure

B. It must be manufactured by humans in a laboratory, since only artificially produced substances can be classified as minerals

C. It must come from a once-living organism, since minerals always form from the decayed remains of plants and animals

D. It must be a liquid at room temperature, since a substance can only be a true mineral if it is able to flow freely as a fluid

3. Earthquake magnitude is measured on a scale in which each whole-number increase represents about 32 times more energy released. Based on this, how does a magnitude 6 earthquake compare with a magnitude 5 earthquake?

A. A magnitude 6 earthquake releases exactly the same amount of energy as a magnitude 5, since the numbers differ by only one unit

B. A magnitude 6 earthquake releases roughly 32 times more energy than a magnitude 5 earthquake, since each whole step multiplies the energy

C. A magnitude 6 earthquake releases only twice as much energy as a magnitude 5, since the scale simply doubles with each whole number

D. A magnitude 6 earthquake releases less energy than a magnitude 5, since higher numbers on the scale indicate weaker earthquakes

4. A volcano with broad, gently sloping sides is built up from many eruptions of thin, runny lava that flows easily over great distances before hardening. What type of volcano is this?

A. A composite volcano, a tall, steep-sided cone built from alternating layers of thick lava and explosively erupted ash and cinders

B. A cinder cone volcano, a small, steep-sided hill built from loose fragments of lava that are blasted into the air and pile up nearby

C. A shield volcano, a broad volcano with gentle slopes built from many flows of thin, runny lava that spreads out over wide areas

D. A caldera, a large bowl-shaped depression that forms when the summit of a volcano collapses into the emptied magma chamber below

5. In regions with thick limestone bedrock, slightly acidic groundwater slowly dissolves the rock over thousands of years, creating underground caverns and caves. What type of weathering produces these caves?

A. Frost wedging, a form of mechanical weathering in which water freezes in cracks, expands, and physically pries the rock apart

B. Abrasion, a form of mechanical weathering in which wind- or water-carried particles strike and grind down an exposed rock surface

C. Exfoliation, a form of mechanical weathering in which the release of pressure causes curved outer sheets of rock to peel away

D. Chemical weathering, in which slightly acidic water reacts with and dissolves the limestone, gradually hollowing out the caverns

6. In a typical soil profile, the dark, uppermost layer is rich in organic matter and is where most plant roots grow. What is this nutrient-rich upper layer of soil called?

A. Bedrock, the layer of solid, unweathered rock that lies at the very bottom of a soil profile beneath all of the looser material

B. Topsoil, the dark, uppermost soil layer that is rich in organic matter and humus and where most plant roots are concentrated

C. Subsoil, the layer beneath the topsoil that contains minerals washed down from above but holds little organic material of its own

D. Parent material, the partly weathered rock from which the soil above it is gradually formed over very long periods of time

7. A geologist finds a deposit containing a jumbled, unsorted mixture of boulders, sand, and clay all mixed together, with scratches gouged into nearby bedrock. Which agent of erosion most likely produced this deposit?

A. A glacier, because moving ice carries and dumps an unsorted mix of all particle sizes and gouges scratches into the bedrock it crosses

B. A calm lake, because still water always deposits a perfectly sorted mixture with the finest clay particles resting on the very top

C. Gentle wind, because a light breeze is strong enough to pick up and pile together huge boulders along with sand and fine clay

D. A slow underground spring, because emerging groundwater carves deep scratches into bedrock and dumps large unsorted boulders

8. When an oceanic plate and a continental plate collide at a convergent boundary, the denser oceanic plate sinks beneath the less dense continental plate. Why does the oceanic plate sink beneath the continental plate?

A. The oceanic plate is much thicker than the continental plate, and thicker plates always sink beneath thinner ones when they collide

B. The continental plate is made of far denser rock, so its great weight forces it downward beneath the lighter oceanic plate every time

C. Oceanic crust is denser than continental crust, so when the two collide the denser oceanic plate sinks beneath the lighter continental plate

D. The two plates have exactly equal density, so which plate sinks beneath the other is entirely random each time a collision occurs

9. The most abundant group of minerals in Earth's crust is built from a basic structural unit combining silicon and oxygen. What is this most common group of rock-forming minerals called?

A. The carbonates, a group of minerals such as calcite that are built around a carbon-and-oxygen structural unit found in limestone

B. The native elements, a group consisting of minerals such as gold and copper that occur in nature as a single pure element alone

C. The oxides, a group of minerals in which a metal such as iron is combined directly with oxygen, as in the iron ore hematite

D. The silicates, the most abundant group of minerals in the crust, built from a structural unit of silicon combined with oxygen

10. Where a large river flows into the calm water of an ocean or lake, it slows down and drops the sediment it was carrying, building up a fan-shaped landform at its mouth. What is this landform called?

A. A meander, one of the looping, snake-like bends that a slow river develops as it winds back and forth across a broad, flat floodplain

B. A delta, the fan-shaped deposit of sediment that builds up where a river slows and drops its load as it enters an ocean or a lake

C. A tributary, a smaller stream or river that flows into and joins a larger main river somewhere along the larger river's course

D. A canyon, a deep, narrow valley with very steep rock walls that a fast-flowing river carves downward into the underlying bedrock

11. A homeowner installs solar panels on their roof to generate electricity directly from sunlight. Which of the following is a genuine advantage of generating electricity from solar panels rather than from a coal-burning power plant?

A. Solar panels generate electricity without burning fuel or releasing carbon dioxide, so they do not add greenhouse gases to the air

B. Solar panels release large amounts of carbon dioxide and soot as they operate, which makes the surrounding air much dirtier

C. Solar panels rely on a limited underground fuel supply that will be completely used up within only a few short years of operation

D. Solar panels can produce exactly the same steady output in the dark of night as they do at noon on a bright, cloudless summer day

12. A city facing a long drought wants to reduce the amount of fresh water its residents use. Which of the following would most directly help conserve the city's limited fresh water supply?

A. Encouraging residents to leave taps running continuously all day, since constantly flowing water uses far less than water turned on and off

B. Paving over all of the city's parks and gardens with concrete, since paved surfaces are widely known to create new fresh water

C. Fixing leaking pipes and installing low-flow fixtures, since reducing waste and the amount used per task lowers overall water demand

D. Watering lawns heavily at midday in full sun, since watering when evaporation is highest is the most efficient way to use water

13. In a food chain, energy flows from producers to the animals that eat them and then to the predators. If humans removed nearly all of the top predators from an ecosystem, what is a likely result?

A. The ecosystem would remain completely unchanged, since the loss of top predators has no effect on any of the other organisms

B. The populations of the prey that the predators once controlled could grow unchecked, disrupting the balance of the ecosystem

C. The producers at the base of the food chain would immediately vanish, since plants depend directly on predators for their survival

D. Every species in the ecosystem would instantly go extinct at the same moment, leaving the entire area completely devoid of life

14. A nuclear power plant generates electricity by splitting the nuclei of uranium atoms to release heat, which turns water into steam to spin turbines. Which statement about this energy source is accurate?

A. Nuclear power burns uranium like coal, releasing large amounts of carbon dioxide that make it the leading cause of climate change

B. Nuclear power uses sunlight as its fuel, so it is a fully renewable resource that can never be used up no matter how much is consumed

C. Nuclear power produces no waste of any kind, so the spent fuel it generates is completely harmless and needs no special handling

D. Nuclear power uses uranium, a nonrenewable fuel, and produces radioactive waste that must be carefully stored for long periods

15. Tropical rainforests are sometimes described as important "carbon sinks." What does it mean to call a rainforest a carbon sink, and why does cutting it down matter?

A. The forest absorbs and stores large amounts of carbon, so clearing it both removes that storage and releases stored carbon to the air

B. The forest produces enormous amounts of carbon dioxide, so cutting it down is the most effective way to reduce atmospheric carbon

C. The forest has no effect on atmospheric carbon at all, so whether it is preserved or cut down makes no difference to the climate

D. The forest is made entirely of carbon dioxide gas, so cutting the trees physically releases solid blocks of carbon onto the ground

16. Fertilizer and pesticide runoff that washes into a river from many scattered farm fields across a wide area, with no single identifiable outlet, is an example of what kind of pollution?

A. Point source pollution, because the contamination enters the river from one single, clearly identifiable pipe or discharge point

B. Thermal pollution, because the main problem is that the runoff raises the temperature of the river water rather than its chemistry

C. Nonpoint source pollution, because the contamination enters the river from many scattered, diffuse sources rather than one single outlet

D. Noise pollution, because the runoff from the scattered farm fields produces loud sounds that disturb the wildlife living along the river

17. A farmer plants a different crop in a field each year in a planned sequence, including crops that restore nitrogen to the soil, rather than planting the same crop every year. What is this practice called, and how does it help?

A. Monoculture, which helps by planting the single most profitable crop in the same field every year to maximize the total yearly harvest

B. Crop rotation, which helps by varying the crops each year so soil nutrients are replenished and pests and diseases are kept in check

C. Clear-cutting, which helps by removing all of the vegetation from the field at once so that the bare soil can rest for a full season

D. Irrigation, which helps by delivering large amounts of extra water to the field so that the same crop can be grown there continuously

18. Communities respond to climate change in two broad ways: mitigation, which reduces the causes, and adaptation, which adjusts to the effects. Which of the following is an example of mitigation rather than adaptation?

A. Building higher sea walls along a coastline to protect a city from the flooding caused by rising sea levels and stronger storms

B. Developing new crop varieties that can survive the longer droughts and higher temperatures expected in a warming future climate

C. Relocating a coastal community farther inland to escape the rising ocean waters that are gradually flooding the original town site

D. Switching from coal-fired power plants to wind and solar energy in order to reduce the greenhouse gas emissions causing the warming

19. A community starts a program to recycle glass, metal, and paper instead of sending these materials to a landfill. Besides reducing landfill waste, what is another environmental benefit of recycling these materials?

A. It reduces the need to extract and process new raw materials, conserving natural resources and the energy required to obtain them

B. It greatly increases the demand for mining new raw materials, since recycled goods always require far more raw ore than new ones

C. It has no effect on resource use at all, since recycled materials and brand-new materials require exactly the same resources to produce

D. It permanently destroys the recycled materials so they can never be used again, which steadily shrinks the total supply of resources

20. During a total solar eclipse, the daytime sky darkens as the Sun is blocked from view. What arrangement of the Sun, Earth, and Moon produces a solar eclipse?

A. The Earth passes directly between the Sun and the Moon, so Earth's shadow falls upon the surface of the Moon and darkens it

B. The Sun passes directly between the Earth and the Moon, so the Sun's body blocks the Moon from being seen from the Earth

C. The Moon passes directly between the Sun and the Earth, so the Moon's shadow falls upon the Earth and blocks the Sun from view

D. The three bodies line up at a wide right angle, with the Moon far off to one side and well away from the line to the Sun

21. Mercury experiences scorching daytime temperatures but frigid nighttime temperatures, with an enormous difference between the two. What best explains Mercury's extreme swing between day and night temperatures?

A. Mercury is tilted so sharply on its axis that one side always faces the Sun while the other side is permanently locked in darkness

B. Mercury orbits the Sun so rapidly that it crosses from the hot side of the solar system to the cold side many times each day

C. Mercury has a thick, heat-trapping atmosphere that overheats the day side and then releases all of that heat at once each night

D. Mercury has almost no atmosphere to trap or distribute heat, so the day side heats up greatly while the night side loses heat to space

22. Stars end their lives in different ways: some fade quietly into white dwarfs, while others explode as supernovae. What single property of a star most determines which of these fates it will meet?

A. The star's color, since only blue stars can ever become white dwarfs while only red stars are able to explode as supernovae

B. The star's mass, since low-mass stars tend to end as white dwarfs while high-mass stars end in supernova explosions

C. The star's distance from Earth, since only the stars that happen to be closest to our planet are able to explode as supernovae

D. The star's name, since astronomers assign each star's eventual fate when they first catalog and officially name the star

23. An astronaut has the same mass on Earth and on the Moon, yet weighs only about one-sixth as much on the Moon. What is the difference between mass and weight that explains this?

A. Mass is the amount of matter in an object and stays the same, while weight is the force of gravity on that mass and changes with gravity

B. Mass is the force of gravity pulling on an object, while weight is the total amount of matter, so only the mass changes between locations

C. Mass and weight are exactly the same quantity measured in different units, so an object's mass and weight always change together equally

D. Mass changes depending on where an object is located, while weight is a fixed property that never changes no matter where the object goes

24. During a crescent moon, only a thin sliver of the Moon appears lit while the rest is dark. Why does only part of the Moon appear illuminated during this phase?

A. The Earth's shadow is covering most of the Moon, leaving only the thin uncovered sliver of the surface visible and lit from behind

B. The Moon produces its own light, and during a crescent phase it simply chooses to switch most of that light off to conserve its energy

C. We are seeing only a small part of the Moon's sunlit half from our position, since the Sun lights one half of the Moon at all times

D. Thick clouds in Earth's atmosphere block our view of most of the Moon, allowing only the thin crescent portion to shine through

25. Nearly all of the planets orbit the Sun in the same direction and roughly in the same flat plane. What does this shared direction and flat arrangement of the orbits suggest about the solar system's origin?

A. It suggests that each planet was captured separately from deep space at a different time, which is why they all happen to line up by chance

B. It suggests that the planets all formed together from a single spinning, flattened disk of gas and dust that surrounded the young Sun

C. It suggests that the planets were carefully arranged into their orbits in their current flat plane only within the last few thousand years

D. It suggests that the Sun pushes the planets into a flat plane each day, since without this constant pushing the orbits would be random

26. Astronomers estimate that the observable universe contains a vast number of galaxies, each made up of enormous numbers of stars. Roughly how many stars does a typical large galaxy such as the Milky Way contain?

A. A few dozen stars, meaning that a single large galaxy contains only about as many stars as can be counted on a person's fingers

B. About one thousand stars, meaning a large galaxy holds roughly the same number of stars as a small town holds people

C. Around one million stars, which is the absolute maximum number of stars that any galaxy in the universe could ever possibly contain

D. Hundreds of billions of stars, meaning that even a single large galaxy contains an almost unimaginably enormous number of stars

27. On two days each year, called the equinoxes, daytime and nighttime are nearly equal in length all over the world. What is happening at these times with respect to the Sun?

A. Neither hemisphere is tilted toward or away from the Sun, so sunlight is shared nearly equally and day and night are about equal

B. The Earth stops rotating completely for one full day, which makes the daytime and the nighttime come out to exactly equal lengths

C. The Sun moves much closer to the Earth than usual, which is the specific reason that the lengths of day and night become equal

D. The Northern Hemisphere is tilted as sharply toward the Sun as it ever gets, producing the longest day of the entire year worldwide

28. A larger telescope can see fainter, more distant objects than a smaller telescope. What is the main reason a telescope with a larger main mirror or lens can detect fainter objects?

A. A larger telescope is physically closer to the distant stars, which makes those faint objects appear much brighter than they really are

B. A larger telescope generates its own light and shines it onto the distant objects, illuminating them so they can be seen more easily

C. A larger mirror or lens collects more light, so it can gather enough of the faint light from distant objects to make them visible

D. A larger telescope slows down the incoming light so that more of it can be examined, which has nothing to do with how much is collected

29. Asteroids and comets are both small bodies orbiting the Sun, but they differ in what they are made of. What is the main difference in composition between a typical asteroid and a typical comet?

A. Asteroids are made almost entirely of ice and frozen gases, while comets are made of solid metal and contain no ice of any kind

B. Asteroids and comets have exactly the same composition, so the two terms simply describe identical objects given two different names

C. Asteroids are giant balls of hot glowing gas like small stars, while comets are cold and solid chunks of pure iron and nickel metal

D. Asteroids are made mostly of rock and metal, while comets are made largely of ice, dust, and frozen gases that vaporize near the Sun

30. The gravitational force between two objects depends on their masses and the distance between them. According to this relationship, what happens to the gravitational pull between two objects as the distance between them increases?

A. The gravitational pull grows weaker as the distance between the two objects increases, since gravity decreases with greater separation

B. The gravitational pull grows stronger as the distance increases, since objects that are farther apart always attract each other more

C. The gravitational pull stays exactly the same at every distance, since the separation between two objects has no effect on gravity at all

D. The gravitational pull disappears entirely the instant the objects are no longer touching, since gravity requires direct physical contact

31. A geologist says one rock layer is "older than the layer above it" but does not give a number of years. Another geologist says a rock is "4.2 million years old." Which terms correctly describe these two kinds of dating?

A. The first is absolute dating because it gives the order of events, and the second is relative dating because it provides a specific number

B. The first is relative dating because it gives only the order of events, and the second is absolute dating because it gives a specific age in years

C. Both statements are examples of relative dating, since neither one can ever provide any information about the actual ages of the rocks

D. Both statements are examples of absolute dating, since both clearly state the exact age of each rock in millions of years before present

32. Paleontologists discover a set of fossilized dinosaur footprints preserved in ancient mud. What kind of information can these trace fossils provide that fossilized bones alone might not?

A. The exact color of the dinosaur's skin and the precise sounds it made, both of which footprints record in perfect and complete detail

B. The complete internal organ structure of the dinosaur, since footprints preserve a full record of the animal's heart, lungs, and stomach

C. Absolutely nothing, since footprints are not true fossils and can never reveal any information about the animals that made them

D. Evidence about how the dinosaur moved and behaved, such as its walking speed, stride length, and whether it traveled in groups

33. Scientists have found fossils of ancient animals that show a mix of features from fish and from four-legged land animals, such as fins together with primitive limb bones. What is the significance of such "transitional" fossils?

A. They prove that fish and land animals are completely unrelated, since no living thing could ever possess features of two different groups

B. They show that all species appeared suddenly and fully formed, with no gradual change occurring at any point in the history of life

C. They provide evidence of gradual evolutionary change over time, documenting steps in the transition between major groups of organisms

D. They reveal that fossils form randomly and carry no real information about the history or the relationships of living things on Earth

34. A volcanic ash layer contains a radioactive isotope with a half-life of 1.3 million years. Measurements show that exactly half of the original isotope still remains. Approximately how old is the ash layer?

A. About 1.3 million years, because exactly half of the isotope remaining corresponds to one half-life having passed

B. About 2.6 million years, because half of the original amount remaining always corresponds to two full half-lives passing

C. About 650,000 years, because half of the isotope remaining means that only half of one half-life has so far elapsed

D. The age cannot be determined, because the fraction of isotope remaining provides no information about how much time has passed

35. The fossil record provides only a partial picture of past life, and many organisms left no fossils at all. Which of the following best explains why so few organisms become fossils?

A. Fossilization happens to nearly every organism that has ever died, so the fossil record is almost perfectly complete and leaves out very little

B. Most organisms decay or are eaten before they can be buried, and fossilization requires rare, specific conditions, so few remains are preserved

C. Organisms with hard parts can never be fossilized at all, so only soft-bodied creatures like jellyfish are ever found in the fossil record

D. Fossils form only from organisms that lived within the last few hundred years, so nothing older than that has ever been preserved as a fossil

36. Identical fossils of the same ancient land reptile, which could not have swum across an ocean, are found on continents that are now separated by thousands of kilometers of sea. How does this support continental drift?

A. It shows that this reptile was an excellent long-distance ocean swimmer, easily crossing the wide seas between the separated continents

B. It shows that identical species always evolve completely independently on every continent, so matching fossils reveal nothing about drift

C. It suggests the continents were once joined, allowing the land reptile to live across a continuous landmass that later split apart and drifted

D. It proves the continents have always been in exactly their present separated positions, since the fossils are found right where they formed

37. Scientists estimate the age of the Earth by radiometric dating of the oldest rocks and meteorites. Approximately how old is the Earth according to this evidence?

A. About 6,000 years old, a figure derived directly from radiometric dating of the very oldest rocks and meteorites ever discovered

B. About 1 million years old, meaning that the Earth formed at roughly the same time that the first early humans appeared on the planet

C. About 100 million years old, meaning the Earth is only slightly older than the age of the dinosaurs that once roamed its surface

D. About 4.6 billion years old, a figure based on radiometric dating of the oldest Earth rocks and of meteorites from the early solar system

38. The law of superposition states that lower layers are older in an undisturbed sequence. Under what circumstance might this rule fail, so that an older layer is found resting on top of a younger one?

A. When tectonic forces have folded or overturned the rock layers, the original order can be reversed so an older layer sits above a younger one

B. The rule can never fail under any circumstance, since lower layers are always older no matter what forces have acted upon the rocks

C. The rule fails only when the layers are observed at night, since the order of rock layers somehow reverses itself after the Sun sets

D. The rule fails whenever the layers are made of limestone, since limestone is the one rock type that always forms in reverse order

39. A hiker climbing a tall mountain notices it becomes harder to breathe at high elevations. What happens to air pressure as altitude increases, and why?

A. Air pressure increases with altitude, because there is far more air pressing down from above at the top of a mountain than at sea level

B. Air pressure decreases with altitude, because there is less air above pressing down, so the higher you go the lower the pressure becomes

C. Air pressure stays exactly the same at every altitude, since the amount of air pressing down does not change between sea level and a peak

D. Air pressure becomes zero immediately above sea level, since all of the atmosphere's air is found only in a thin layer right at the surface

40. On a cold winter day, raindrops fall through a layer of below-freezing air near the ground and freeze into small ice pellets before landing. What form of precipitation is this?

A. Snow, which forms when water vapor in a cloud freezes directly into six-sided ice crystals that then fall to the ground as flakes

B. Hail, which forms in the strong updrafts of summer thunderstorms when ice is carried up and down repeatedly, adding layers each time

C. Drizzle, which consists of very fine liquid water droplets that fall slowly from low stratus clouds and never freeze before landing

D. Sleet, which forms when raindrops fall through a layer of below-freezing air and freeze into small ice pellets before reaching the ground

41. Wind is simply the movement of air across the surface of the Earth. What is the fundamental cause of wind?

A. Wind is caused by the rotation of the Earth alone, which physically drags the still air along with it and would blow even without the Sun

B. Wind is caused by trees and tall buildings waving back and forth, which pushes the surrounding air and sets it into horizontal motion

C. Wind is caused by differences in air pressure, as air flows from regions of higher pressure toward regions of lower pressure

D. Wind is caused by the Moon's gravity pulling the atmosphere along behind it, just as that same gravity raises the ocean tides each day

42. On a humid morning, the air holds a fixed amount of water vapor. As the day warms up and the air temperature rises, what happens to the relative humidity if no water vapor is added or removed?

A. The relative humidity decreases, because warmer air can hold more water vapor, so the same amount of vapor fills a smaller fraction of the air's capacity

B. The relative humidity increases, because warming the air somehow forces additional water vapor into it even when none is being added

C. The relative humidity stays exactly the same, because the temperature of the air has absolutely no effect on its relative humidity at all

D. The relative humidity instantly drops to zero, because any rise in temperature immediately removes all of the water vapor from the air

43. Sometimes the boundary between a cold air mass and a warm air mass stalls and barely moves for several days, often bringing long periods of clouds and rain to the same area. What is this type of front called?

A. A cold front, the boundary along which a fast-moving cold air mass advances and pushes underneath a warmer air mass ahead of it

B. A warm front, the boundary along which an advancing warm air mass rides up and over a retreating mass of cooler, denser air

C. An occluded front, the boundary that forms when a fast cold front overtakes a warm front and lifts the warm air completely off the ground

D. A stationary front, the boundary between two air masses that has stalled and barely moves, often bringing days of clouds and steady rain

44. A warm ocean current flows along the coast of a region located at a fairly high latitude. The coastal cities there have milder winters than other cities at the same latitude farther inland. How does the warm current produce this milder climate?

A. The warm current physically pushes the coastal cities closer to the equator each winter, which is what gives them their milder weather

B. The warm current releases heat into the air above it, and winds carry that warmth onshore, keeping the nearby coast milder in winter

C. The warm current blocks all sunlight from reaching the inland cities, which is the reason those inland cities end up far colder in winter

D. The warm current has no real effect on climate, so the milder winters along that particular coastline must be entirely a coincidence

45. Tornadoes most often form from a particular kind of severe thunderstorm when strong winds at different heights cause the rising air within the storm to begin rotating. Under which conditions are tornadoes most likely to develop?

A. Within gentle, light rain showers falling from thin, high clouds on an otherwise calm, cool, and completely windless afternoon

B. Over the open ocean far from any land, where warm tropical water provides the moisture that thunderstorms need to grow into tornadoes

C. From powerful thunderstorms where warm, moist air and changing winds with height cause strong, rotating updrafts to develop

D. During clear, sunny, high-pressure weather, when sinking dry air and cloudless skies create the calm conditions tornadoes require

46. To describe the climate of a region, a scientist looks at temperature and precipitation data averaged over thirty years rather than the conditions of a single day. Why must climate be based on such long-term averages?

A. Climate is the long-term average of weather, so many years of data are needed to reveal the typical patterns rather than one day's conditions

B. Climate changes completely from one hour to the next, so only by averaging thirty years of data can a single hour's climate be captured

C. A single day's weather is always exactly equal to a region's climate, so the thirty years of data are collected purely out of habit

D. Climate refers only to the weather expected tomorrow, so the thirty years of past data are used solely to forecast the next day's conditions

47. Certain gases in the atmosphere are especially effective at trapping heat and contributing to the greenhouse effect. Which of the following is a major greenhouse gas released in large amounts by burning fossil fuels?

A. Oxygen, the gas that makes up about one-fifth of the atmosphere and that humans and animals breathe in to stay alive

B. Nitrogen, the gas that makes up the largest share of the atmosphere by far but plays little role in trapping heat near the surface

C. Argon, an inert gas that makes up a small portion of the atmosphere and does not react chemically or trap heat in any significant way

D. Carbon dioxide, a major heat-trapping greenhouse gas that is released in large quantities when coal, oil, and natural gas are burned

48. Modern meteorologists forecast the weather by combining data from many sources, including satellites, radar, surface stations, and computer models. Why do forecasters rely on so many different sources of data rather than just one?

A. Using many sources makes the forecast far less accurate, so meteorologists do it only to make the process appear more complicated to the public

B. Combining many sources gives a more complete picture of the atmosphere, which improves the accuracy of the resulting weather forecast

C. Each source provides exactly the same information, so using several of them is simply a way to waste time without changing the forecast at all

D. Forecasters are required to ignore all of the data they collect and instead guess the weather randomly, regardless of how many sources they have

49. Before manufacturing thousands of units of a new product, an engineering team builds a single working model and runs it through a series of tests. What is the main purpose of building and testing this prototype?

A. To immediately begin selling that single model to as many customers as possible, since the first model built is always ready for the market

B. To make the design process take as long as possible, since adding extra steps with no real purpose is a recognized goal of good engineering

C. To identify flaws and see how the design performs under real conditions so it can be improved before full-scale production begins

D. To prove that the very first design is already flawless, since prototypes are built only to confirm that no changes will ever be needed

50. Before a scientific study is published in a respected journal, other scientists in the same field examine the work, check the methods, and evaluate the conclusions. What is this process called, and why is it important?

A. Peer review, which is important because independent experts can catch errors and judge the quality of the work before it is published

B. Brainstorming, which is important because it lets the original scientist generate as many new ideas as possible before starting the study

C. Marketing, which is important because it helps the journal sell as many copies of the published study as possible to the general public

D. Data collection, which is important because it is the stage at which the scientist first gathers the measurements used in the study

Practice Exam 42: Answer Key with Explanations

1. D — Heat and pressure applied to a buried rock without melting it produce a metamorphic rock, so limestone transforms into marble. Because the rock changes form in the solid state, this is metamorphism rather than melting or re-deposition.
2. A — A mineral must be a naturally occurring, inorganic solid with a definite chemical composition and an orderly crystal structure. These criteria exclude human-made, organic, or liquid substances, which is why all four conditions must be met.
3. B — Each whole-number step on the magnitude scale represents about 32 times more energy released, so a magnitude 6 releases roughly 32 times the energy of a magnitude 5. This logarithmic scaling is why small magnitude differences correspond to large energy differences.
4. C — A broad, gently sloping volcano built from many flows of thin, runny lava is a shield volcano. The low viscosity of the lava lets it spread widely before hardening, producing the characteristic gentle slopes.
5. D — Slightly acidic groundwater reacting with and dissolving limestone is chemical weathering, which hollows out caverns over long periods. Because the rock's minerals are chemically altered and removed, this differs from purely physical, mechanical weathering.
6. B — The dark, organic-rich uppermost layer where most roots grow is the topsoil. Its concentration of humus and nutrients makes it the most fertile and agriculturally important soil layer.
7. A — An unsorted jumble of all particle sizes together with scratched bedrock is the signature of glacial deposition. Moving ice carries debris of every size and gouges grooves into the rock it crosses, unlike water or wind, which sort sediment by size.
8. C — Oceanic crust is denser than continental crust, so at a collision the denser oceanic plate sinks beneath the lighter continental plate. This density difference is what drives subduction at ocean-continent boundaries.
9. D — The silicates, built from a silicon-oxygen structural unit, are the most abundant group of minerals in Earth's crust. Their dominance reflects the crust's high silicon and oxygen content.
10. B — Sediment dropped where a river slows on entering an ocean or lake builds a fan-shaped delta. The loss of the river's energy causes it to deposit its load at the mouth, constructing the landform.
11. A — Solar panels generate electricity without burning fuel or releasing carbon dioxide, so they add no greenhouse gases during operation. This clean output is their key advantage over a coal-burning plant.
12. C — Fixing leaks and installing low-flow fixtures directly conserves water by cutting waste and reducing the amount used per task. Lowering overall demand is the most effective way to stretch a limited supply during drought.
13. B — Removing top predators lets prey populations that they once controlled grow unchecked, disrupting the ecosystem's balance. This cascade shows how predators help regulate the species below them in the food chain.
14. D — Nuclear power uses uranium, a nonrenewable fuel, and produces radioactive waste that must be stored carefully for long periods. It emits little carbon dioxide during operation but is not renewable and is not waste-free.
15. A — A carbon sink absorbs and stores large amounts of carbon, so clearing a rainforest both removes that ongoing storage and releases the carbon already held in the trees. This double effect is why deforestation worsens atmospheric carbon levels.

16. C — Pollution entering a river from many scattered, diffuse sources with no single outlet is nonpoint source pollution. Its dispersed origin makes it harder to trace and control than point source pollution from a single pipe.
17. B — Planting a planned sequence of different crops, including nitrogen-restoring ones, is crop rotation. Varying the crops replenishes soil nutrients and disrupts the pests and diseases that build up under continuous single-crop planting.
18. D — Switching from coal to wind and solar is mitigation because it reduces the greenhouse gas emissions that cause warming. Adaptation measures like sea walls or drought-resistant crops instead adjust to the effects rather than addressing the cause.
19. A — Recycling reduces the need to extract and process new raw materials, conserving natural resources and the energy required to obtain them. This benefit comes on top of reducing the volume of waste sent to landfills.
20. C — A solar eclipse occurs when the Moon passes directly between the Sun and Earth, casting its shadow on Earth and blocking the Sun. This alignment, with the Moon in the middle, is what hides the Sun from view.
21. D — Mercury's extreme day-night temperature swing results from having almost no atmosphere to trap or distribute heat. The day side heats intensely while the night side radiates its heat away to space.
22. B — A star's mass most determines its fate: low-mass stars end as white dwarfs, while high-mass stars explode as supernovae. Mass governs the gravity and fuel available, which controls how the star dies.
23. A — Mass is the amount of matter in an object and stays constant, while weight is the gravitational force on that mass and changes with local gravity. The Moon's weaker gravity reduces the astronaut's weight while leaving the mass unchanged.
24. C — During a crescent phase we see only a small portion of the Moon's permanently sunlit half from our viewing angle. The Sun always lights one half of the Moon, and the phase depends on how much of that lit half faces Earth.
25. B — Planets orbiting in the same direction and flat plane indicate they formed together from a single spinning, flattened disk of gas and dust around the young Sun. The shared motion is a fingerprint of that common origin.
26. D — A large galaxy such as the Milky Way contains hundreds of billions of stars. This staggering number conveys the immense scale of even a single galaxy within the far larger universe.
27. A — At the equinoxes neither hemisphere is tilted toward or away from the Sun, so sunlight is shared nearly equally and day and night are about equal worldwide. This balanced orientation, not any change in rotation or distance, produces equal day and night.
28. C — A larger mirror or lens collects more light, allowing the telescope to gather enough faint light from distant objects to make them visible. Light-gathering power, which grows with aperture size, is what reveals fainter objects.
29. D — Asteroids are made mostly of rock and metal, while comets are largely ice, dust, and frozen gases that vaporize near the Sun. This compositional difference is why comets develop glowing tails and asteroids do not.
30. A — Gravitational pull grows weaker as the distance between two objects increases, since gravity decreases with greater separation. This inverse relationship with distance is a fundamental feature of gravitational attraction.

31. B — Stating only that one layer is older than another is relative dating (order of events), while giving a specific age in years is absolute dating. Relative dating sequences events, whereas absolute dating assigns numerical ages.
32. D — Trace fossils such as footprints reveal behavior and movement—walking speed, stride length, and whether animals traveled in groups—that bones alone may not show. They record activity rather than the body itself, adding behavioral information.
33. C — Transitional fossils with a mix of fish and land-animal features provide evidence of gradual evolutionary change, documenting steps between major groups. Such intermediate forms show how one group of organisms evolved into another over time.
34. A — Exactly half of the isotope remaining corresponds to one half-life having passed, so the layer is about 1.3 million years old. One half-life is by definition the time for half of a radioactive sample to decay.
35. B — Few organisms become fossils because most decay or are eaten before burial, and fossilization requires rare, specific conditions. These hurdles make preservation uncommon, leaving the fossil record incomplete.
36. C — Identical land-reptile fossils on now-separated continents suggest those continents were once joined as a continuous landmass that later split and drifted apart. A land animal that could not cross oceans points to former connection rather than independent appearance.
37. D — Radiometric dating of the oldest Earth rocks and of meteorites gives an age of about 4.6 billion years for the Earth. Meteorites preserve material from the early solar system, helping anchor this age.
38. A — Superposition can be reversed when tectonic forces fold or overturn rock layers, placing an older layer above a younger one. Recognizing such deformation prevents misreading the original depositional order.
39. B — Air pressure decreases with altitude because less air lies above to press down at greater heights. The thinner air at high elevation is what makes breathing harder on a tall mountain.
40. D — Raindrops that fall through below-freezing air and freeze into small ice pellets before landing are sleet. The freezing occurs during the fall, distinguishing sleet from snow, hail, and liquid drizzle.
41. C — Wind is fundamentally caused by differences in air pressure, with air flowing from higher pressure toward lower pressure. These pressure differences, driven by uneven heating, set the air in horizontal motion.
42. A — As air warms it can hold more water vapor, so the same fixed amount of vapor fills a smaller fraction of its capacity and the relative humidity decreases. Relative humidity depends on temperature even when the actual vapor content stays constant.
43. D — A boundary between two air masses that stalls and barely moves, often bringing days of clouds and rain, is a stationary front. Its lack of movement keeps similar weather over the same area for an extended time.
44. B — A warm current releases heat into the air above it, and onshore winds carry that warmth to the coast, keeping coastal winters milder. This transfer of ocean heat to the atmosphere moderates the nearby climate.
45. C — Tornadoes most often develop from powerful thunderstorms where warm, moist air and winds changing with height create strong, rotating updrafts. This combination of instability and wind shear is what spins up tornadoes.

46. A — Climate is the long-term average of weather, so many years of data are needed to reveal a region's typical patterns rather than one day's conditions. Averaging over decades smooths out short-term variability to capture the true climate.
47. D — Carbon dioxide is a major heat-trapping greenhouse gas released in large amounts when coal, oil, and natural gas are burned. Its accumulation from fossil-fuel combustion is a primary driver of global warming.
48. B — Combining satellites, radar, surface stations, and models gives a more complete picture of the atmosphere, improving forecast accuracy. Multiple data sources fill in each other's gaps that a single source would miss.
49. C — A prototype is built and tested to identify flaws and observe real-world performance so the design can be improved before full-scale production. Catching problems at this stage prevents costly errors across thousands of units.
50. A — Independent experts examining the methods and conclusions before publication is peer review, which catches errors and judges quality. This scrutiny helps ensure that published findings are reliable and sound.