

# PRACTICE EXAM 46: EARTH AND SPACE SCIENCES REGENTS SIMULATION (50 QUESTIONS)

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1. A building is designed with large south-facing windows that let in sunlight to warm the interior during winter, reducing the need for heating. This use of sunlight to directly warm a building is an example of:

- A. Geothermal heating, which uses the natural heat of the Earth's interior to warm a building rather than the light of the Sun
- B. Fossil fuel heating, which warms a building by burning coal, oil, or natural gas inside a furnace located within the building
- C. Nuclear heating, which warms a building using the heat released by splitting the nuclei of heavy atoms in a small reactor
- D. Passive solar heating, which uses sunlight entering through windows to directly warm a building and reduce the need for other heating

2. Scientists note that producing some foods generates far more greenhouse gas emissions than others. Which of the following dietary changes would generally most reduce the greenhouse gas emissions associated with a person's food?

- A. Eating more imported, out-of-season produce flown in by air from distant countries, since air freight produces the fewest emissions of all
- B. Eating more locally grown plant-based foods and less resource-intensive meat, since producing meat generally generates more greenhouse gases
- C. Increasing the amount of food thrown away uneaten, since wasted food has no connection at all to greenhouse gas emissions of any kind
- D. Eating only foods that require the most land, water, and energy to produce, since high-resource foods always have the lowest emissions

3. Pollution dumped onto the ground or into a small stream in one part of a watershed can end up affecting a river or lake far downstream. Why can pollution in one place affect water far away within the same watershed?

A. Pollution always stays exactly where it is first released and can never move from that spot, so downstream areas are never affected at all

B. Pollution travels upstream against the current, which is why only the areas above the pollution source are ever affected by it within a watershed

C. All the water in a watershed drains toward the same river or lake, so pollutants are carried along by the flowing water to areas downstream

D. Pollution evaporates instantly the moment it touches any water, so it leaves the watershed entirely and cannot affect any downstream areas

4. In a food web, many species are connected, and the removal of one species can affect many others. If a species of plant that many animals rely on for food were to disappear, what is the most likely result?

A. The animals that depend on the plant for food could decline, and other species connected to them in the food web could be affected as well

B. Nothing would change at all, since the removal of a single plant species can never have any effect on the other organisms in a food web

C. Every animal in the food web would immediately become a plant, growing leaves and making its own food to replace the missing species

D. The food web would instantly become far more stable and healthy, since removing any species always strengthens the entire ecosystem

5. Coal formed over millions of years from the buried remains of ancient swamp plants that were compressed under heat and pressure. Why does this origin make coal a nonrenewable resource on a human timescale?

A. Coal is constantly forming in huge amounts today, far faster than people could ever use it, which is what makes it a nonrenewable resource

B. Coal forms in just a few minutes whenever it is needed, so it can always be replaced instantly, which is why it is called nonrenewable

C. Coal is made fresh in factories each day, but the factories produce only small amounts, which is the reason coal is considered nonrenewable

D. Coal takes millions of years to form from buried plant remains, so it cannot be replaced anywhere near as fast as people are using it up

6. A species whose population has dropped so low that it is at serious risk of disappearing completely is classified as endangered. Why do conservationists work to protect endangered species before they are gone?

A. Because endangered species are completely useless to their ecosystems, protecting them is done purely for sentimental reasons and nothing more

B. Because a species that goes extinct can easily be brought back to life at any time, there is no real urgency to protect endangered species

C. Because extinction is permanent and each species plays a role in its ecosystem, protecting endangered species helps preserve biodiversity

D. Because protecting endangered species always causes the rest of the ecosystem to collapse, conservation efforts are aimed at harming nature

7. Acid rain forms when pollutants from burning fossil fuels combine with water in the atmosphere. Which of the following is a harmful effect of acid rain on the environment?

A. Acid rain makes lakes far more suitable for fish and other aquatic life, which is the main reason it is considered an environmental benefit

B. Acid rain can lower the pH of lakes and streams and damage forests, harming the plants and animals that live in those ecosystems

C. Acid rain adds valuable nutrients to the soil that make forests grow faster, so areas that receive acid rain always have the healthiest trees

D. Acid rain has no measurable effect of any kind on the environment, since the small amount of acid involved is far too weak to cause harm

8. Many communities encourage people to use reusable water bottles and shopping bags instead of single-use plastic ones. How does switching to reusable items benefit the environment?

- A. It reduces the amount of plastic waste produced and the resources used to make new single-use items, cutting both waste and resource use
- B. It greatly increases the total amount of plastic waste sent to landfills, since reusable items break down far faster than disposable ones
- C. It has no effect on the environment at all, since whether a person uses reusable or single-use items cannot influence how much waste is made
- D. It requires far more new plastic to be manufactured overall, since each reusable item must be thrown away and replaced after a single use

9. When a large area of forest is cleared to build a new housing development, the animals that lived there lose their homes. This loss of the natural environment that organisms depend on is known as:

- A. Reforestation, the deliberate replanting of trees to restore a forest in an area where the trees had previously been cut down or removed
- B. Conservation, the careful protection and managed use of natural resources so that they remain available for use by future generations
- C. Succession, the gradual and natural process by which the mix of species in an ecosystem changes over a long period of time after a disturbance
- D. Habitat destruction, the loss or damage of the natural environment that organisms depend on, which can reduce or eliminate local populations

10. Earth's atmosphere is a mixture of gases. Which two gases together make up the vast majority of the dry air in the atmosphere?

- A. Carbon dioxide and water vapor, which together account for about 99 percent of all the gas found in Earth's dry atmosphere
- B. Hydrogen and helium, the two lightest gases, which together make up nearly all of the dry air in the Earth's lower atmosphere
- C. Nitrogen and oxygen, which together make up about 99 percent of the dry air, with nitrogen being by far the most abundant
- D. Ozone and argon, two relatively rare gases, which together account for the overwhelming majority of the gas in Earth's atmosphere

11. Hail forms only in tall, powerful thunderstorms with strong updrafts. How do the layered balls of ice that make up hail form inside such a storm?

A. Raindrops freeze the instant they leave the cloud and fall straight to the ground without ever being lifted back up, forming smooth, single-layer ice

B. Ice crystals form high in the atmosphere and drift gently down through calm air, slowly melting into the rounded, layered shapes seen in hail

C. Snowflakes near the ground are blown upward once by the wind and immediately fall as hail, which is why hailstones have only one thin layer

D. Strong updrafts carry ice up and down repeatedly through the storm cloud, adding a new layer of ice each time until the hailstone grows heavy enough to fall

12. A tall, towering cloud with a dark base and an anvil-shaped top builds up on a hot summer afternoon and soon produces heavy rain, lightning, and thunder. What type of cloud is this?

A. A cirrus cloud, a high, thin, wispy cloud made of ice crystals that forms at very high altitudes and usually signals only fair, clear weather

B. A cumulonimbus cloud, the tall, towering storm cloud with a dark base that produces thunderstorms with heavy rain, lightning, and thunder

C. A stratus cloud, a low, flat, featureless gray sheet of cloud that covers the sky and usually produces only light drizzle or a steady mist

D. A fog bank, a thick cloud that forms at ground level and reduces visibility but never produces lightning, thunder, or any heavy rainfall at all

13. On a sunny day, the surface of a paved road becomes very hot, and the air in direct contact with the road surface is warmed by touching it. This transfer of heat by direct contact between the hot pavement and the air is an example of:

A. Radiation, the transfer of energy by electromagnetic waves, which is how the Sun's energy travels through the empty vacuum of space to Earth

B. Convection, the transfer of heat by the movement of a heated fluid, in which warm fluid rises and cooler, denser fluid sinks to take its place

C. Precipitation, the falling of water from clouds to the surface of the Earth in the form of rain, snow, sleet, or hail under the force of gravity

D. Conduction, the transfer of heat by direct contact between two touching substances, such as the hot pavement warming the air against it

14. When a portion of air near the ground is heated, it tends to rise upward through the cooler air around it. Why does warm air rise?

A. Warm air expands and becomes less dense than the surrounding cooler air, and less dense air rises above the denser air around it

B. Warm air becomes much heavier and denser than the cool air around it, and this added weight is what pushes the warm air upward

C. Warm air is pulled upward by the gravity of the Moon, which is the only force capable of lifting heated air up off the surface of the Earth

D. Warm air contains no gas at all, leaving an empty space that floats upward through the heavier gas that fills the rest of the atmosphere

15. A warm front approaches a region as a mass of warm air gradually rides up and over a retreating mass of cooler air. What weather typically accompanies the approach of a warm front?

A. A sudden, violent line of severe thunderstorms followed within minutes by a sharp drop in temperature and rapidly clearing skies behind it

B. Completely clear, calm, and unchanging skies with no clouds or precipitation, since a warm front has no effect on the weather below it

C. A long period of gradually thickening clouds and steady, widespread light rain, followed by warmer temperatures once the front passes

D. A sudden and lasting deep freeze with heavy snow and powerful winds, since warm fronts always bring the coldest weather of the season

16. A meteorologist needs to record how hot or cold the air is at a weather station throughout the day. Which instrument is used to measure the temperature of the air?

- A. A barometer, the instrument used to measure the pressure of the atmosphere, whose rising or falling readings often signal a coming weather change
- B. A thermometer, the instrument used to measure temperature, often by the expansion and contraction of a liquid or by an electronic sensor
- C. An anemometer, the instrument used to measure the speed of the wind by the rate at which the wind spins the cups mounted on the device
- D. A hygrometer, the instrument used to measure the amount of water vapor, or humidity, that is present in the surrounding air at a location

17. The world's oceans absorb a large amount of the Sun's heat and store it for long periods. How does this ability of the oceans to store heat affect Earth's climate?

- A. It has no effect on climate at all, since the oceans release any heat they absorb back into space immediately and store none of it for any time
- B. It causes the entire planet to overheat rapidly, since the stored ocean heat is released all at once in a single burst each and every year
- C. It makes Earth's climate far more extreme, since the oceans cause much larger swings between very hot and very cold global temperatures
- D. It helps moderate Earth's climate, since the oceans absorb, store, and slowly release heat, which smooths out temperature changes over time

18. During a thunderstorm, the safest place for a person to be is indoors in a sturdy building or inside a hard-topped vehicle. Why are open areas, tall isolated trees, and water especially dangerous during a thunderstorm?

- A. Lightning tends to strike tall or isolated objects and can travel through water, so these locations greatly increase a person's risk of being struck
- B. Lightning is strongly attracted to the inside of sturdy buildings and vehicles, so being indoors is actually the most dangerous place to be in a storm
- C. Open areas and water are completely safe during a thunderstorm, while the only real danger comes from being inside a sturdy, enclosed building
- D. Lightning never strikes tall trees, open fields, or water, so these locations are in fact the safest possible places to wait out any thunderstorm

19. Satellite measurements over recent decades show that the area of Arctic sea ice at the end of each summer has been steadily decreasing. What does this trend in Arctic sea ice provide evidence of?

- A. A steadily cooling global climate, since shrinking sea ice can only be explained by falling rather than rising global average temperatures
- B. No change in the global climate at all, since the amount of Arctic sea ice has absolutely no connection to global temperatures of any kind
- C. A warming global climate, since rising temperatures cause more of the Arctic sea ice to melt and reduce the area that remains each summer
- D. A rapidly expanding global ice cover, since decreasing summer sea ice is a clear sign that the planet as a whole is freezing over more each year

20. A geologist examines an undisturbed cliff and wants to identify the youngest rock layer present. Where in the sequence should the geologist look for the youngest layer?

- A. At the very bottom of the sequence, since in an undisturbed sequence the lowest layers were always the last ones to be deposited
- B. At the very top of the sequence, since in an undisturbed sequence each new layer is deposited on top, making the highest layer the youngest
- C. Exactly in the middle of the sequence, since deposition always begins at the center of a sequence and the youngest material ends up there
- D. Anywhere at random, since the age of a rock layer has no connection at all to its position within an undisturbed sequence of layers

21. Some fossils of ancient ferns and fish are preserved as thin, dark films of carbon on a rock surface, showing the detailed outline of the original organism. This type of preservation, which leaves behind a carbon residue, is called:

- A. Carbonization, in which heat and pressure drive off most of an organism's material and leave behind a thin film of carbon in its shape
- B. Petrification, in which the original material of an organism is gradually replaced, particle by particle, with hard minerals to form solid stone

C. Freezing, in which an entire organism is preserved intact within ice that keeps its soft tissues from decaying for thousands of years

D. Amber preservation, in which a small organism is trapped and sealed inside hardened tree resin that protects its delicate body from decay

22. A radioactive isotope used to date rocks has a half-life of 250 million years. If a rock sample contains one-fourth of the original amount of this isotope, how much time has passed since the rock formed?

A. About 125 million years, since one-fourth of the isotope remaining corresponds to just half of one half-life of the isotope having passed

B. About 250 million years, since one-fourth of the isotope remaining corresponds to exactly one full half-life of the isotope having passed

C. About 1 billion years, since one-fourth of the isotope remaining corresponds to four full half-lives of the isotope having passed in total

D. About 500 million years, since one-fourth remaining means two half-lives have passed, and two times 250 million years equals 500 million

23. During one era of geologic time, dinosaurs were the dominant large animals on land, and the first birds and flowering plants also appeared. What is this era, often called the "Age of Reptiles," called?

A. The Cenozoic Era, the most recent era of geologic time, during which mammals became the dominant large animals after the dinosaurs died out

B. The Paleozoic Era, an early era during which trilobites, the first fish, and the first land plants and amphibians appeared and flourished

C. The Mesozoic Era, the era often called the Age of Reptiles, during which dinosaurs dominated the land and the first birds and flowers appeared

D. The Precambrian, the earliest and by far the longest span of geologic time, during which only simple single-celled organisms lived on the planet

24. Scientists discovered that the rock of the ocean floor is youngest near the mid-ocean ridges and grows progressively older with distance away from the ridges on both sides. How does this pattern support seafloor spreading?

- A. It shows that new ocean crust forms at the ridge and then moves outward in both directions, getting older as it travels away from the ridge
- B. It shows that the ocean floor never moves at all, since rock of every age is mixed together randomly across the entire seafloor everywhere
- C. It shows that the oldest rock forms at the ridge itself, proving that the seafloor grows older toward the ridge rather than away from it
- D. It shows that the ocean floor is exactly the same age everywhere, which proves that no new crust has ever been created at the mid-ocean ridges

25. A geologist finds fossils of ocean corals and seashells in the rock layers of a mountain located far inland, high above sea level. What does the presence of these marine fossils most likely indicate about this area?

- A. The corals and shells walked or crawled all the way up the mountain from the distant ocean while they were still alive long ago
- B. The area was once covered by an ocean, and the rock containing the marine fossils later was uplifted to form the mountain over time
- C. The marine fossils prove that the ocean has always been located exactly where the mountain stands today and has never moved at all
- D. The fossils reveal nothing about the area's past, since marine fossils are found equally in every rock everywhere regardless of past conditions

26. Scientists determine the age of the Earth largely by radiometric dating of meteorites and the oldest known minerals on Earth. Why are meteorites useful for estimating the age of the Earth?

- A. Meteorites are far younger than the Earth, having formed only within the last few thousand years, which makes them ideal for dating the planet
- B. Meteorites are made of a material that cannot be dated at all, so scientists use them only as a backup when no other method is available
- C. Meteorites formed long after the planets and so reveal only the age of the most recent events, rather than the age of the Earth itself
- D. Meteorites formed at the same time as the rest of the solar system, so dating them reveals the age of the material from which Earth also formed

27. The principle of faunal succession states that fossil organisms appear, change, and disappear in the rock record in a definite, recognizable order. How do geologists use this principle?

- A. They use the recognizable order of fossils to determine the relative ages of rock layers and to match layers of the same age in different locations
- B. They use it to prove that all fossils formed at exactly the same time, so that fossils can never be used to compare the ages of any rock layers
- C. They use it to show that fossils appear in a completely random order, which means that fossils provide no useful information about a rock's age
- D. They use it to determine the exact age of a rock in years, since the order of fossils directly reveals the precise numerical age of every layer

28. When a ball is dropped, it falls toward the ground rather than floating away or rising upward. What causes the ball to fall toward the Earth?

- A. The air in the room pushes down on the ball from above, which is the only force capable of moving the ball downward toward the floor
- B. The ball is naturally attracted to the floor's surface by magnetism, since all dropped objects are pulled downward by magnetic forces alone
- C. The gravitational pull of the Earth attracts the ball toward the planet's center, which is what causes the ball to fall toward the ground
- D. The spinning of the Earth flings the ball downward, since it is the planet's rotation rather than gravity that causes objects to fall to the ground

29. Saturn is the least dense planet in the solar system, with an average density even lower than that of water. What does this very low density tell us about what Saturn is made of?

- A. Saturn is made almost entirely of solid heavy metals such as iron and lead, which is the reason its average density is so extremely low
- B. Saturn is composed mostly of light gases such as hydrogen and helium, which gives it an average density lower than that of liquid water
- C. Saturn is made of solid rock that is far denser than water, and its rings are the only part of the planet that has any low density at all

D. Saturn is completely hollow and empty inside, containing no material of any kind, which is the only possible reason its density is so low

30. When a very massive star runs out of fuel, its core collapses suddenly and the star explodes in one of the most powerful events in the universe. What is this explosive death of a massive star called?

A. A solar eclipse, which occurs when the Moon passes directly between the Earth and the Sun and temporarily blocks the Sun from view

B. A meteor shower, the many bright streaks of light seen when the Earth passes through a trail of dusty debris that was left behind by a comet

C. A lunar phase, one of the regularly changing shapes of the lit portion of the Moon as seen from Earth over the course of about a month

D. A supernova, the powerful explosion that occurs when a very massive star runs out of fuel and its core suddenly collapses and rebounds

31. The Moon's surface is covered with craters formed by impacts, while the Earth has far fewer visible impact craters even though it has been struck many times. Why does the Earth show far fewer craters than the Moon?

A. Earth's weathering, erosion, and active geology erase craters over time, while the Moon lacks these processes, so its craters remain for ages

B. The Earth has actually never been struck by any object from space, which is the simple reason that it has no impact craters on its surface at all

C. The Moon is struck billions of times more often than the Earth is, which is the only reason the Moon has so many more craters than the Earth

D. Earth's craters are all hidden underground beneath the surface, while the Moon's craters float on top of its surface where they remain easy to see

32. The four planets closest to the Sun are small and rocky, while the four farther out are large and gaseous. Why are the inner planets rocky while the outer planets are made mostly of gas?

A. The inner planets formed billions of years after the outer planets, and by then only rocky material was left over near the Sun to build them

B. The outer planets are rocky and the inner planets are gaseous, the exact opposite of what is described, since gas always gathers closest to the Sun

C. Near the Sun it was too hot for ices and gases to remain, so mostly rock and metal could form planets there, while the cold outer region kept gases

D. The Sun pulls all of the rock toward itself and pushes all of the gas away, which is why the rocky planets and gas planets are completely identical

33. In the 1920s, astronomer Edwin Hubble observed that distant galaxies are moving away from us, and that more distant galaxies are moving away faster. What major conclusion did this observation lead to?

A. The conclusion that the universe is completely static and unchanging, since the galaxies were found to be standing perfectly still in space

B. The conclusion that the Earth sits at the exact center of a small, fixed universe around which all of the distant galaxies slowly revolve

C. The conclusion that the universe is steadily shrinking, since the galaxies were observed to be drawing closer and closer together over time

D. The conclusion that the universe is expanding, with galaxies moving apart, which supports the idea that it began in a Big Bang long ago

34. A common misconception is that Earth is warmer in summer because it is closer to the Sun. In fact, Earth is actually slightly closer to the Sun during the Northern Hemisphere's winter. What does this fact demonstrate about the cause of the seasons?

A. It demonstrates that the seasons are caused entirely by Earth's changing distance from the Sun, exactly as the common misconception claims

B. It demonstrates that the seasons cannot be caused mainly by distance from the Sun, and are instead caused by the tilt of Earth's axis

C. It demonstrates that the Earth never actually changes its distance from the Sun at all, since its orbit around the Sun is a perfect circle

D. It demonstrates that the Northern and Southern Hemispheres always experience exactly the same season as each other at the same time of year

35. An object that weighs 100 newtons on Earth would weigh much less on the Moon but much more on Jupiter. What determines how much an object weighs on a particular planet or moon?

- A. The strength of that planet or moon's gravity, since weight is the force of gravity acting on the object's mass and varies with local gravity
- B. The color of the object, since darker objects always weigh more on every planet while lighter-colored objects always weigh much less
- C. The temperature of the planet or moon, since weight increases on hot worlds like Jupiter and decreases on cold worlds like the Moon
- D. The distance of the planet or moon from the Sun alone, since weight depends only on how far a world is from the Sun and nothing else

36. Besides visible light, astronomers build telescopes that detect other forms of energy, such as radio waves, infrared, and X-rays, coming from space. Why do astronomers study objects in these other forms of energy in addition to visible light?

- A. These other forms of energy are completely identical to visible light, so studying them simply provides the exact same information twice over
- B. Visible light is the only form of energy that carries any real information, so the other telescopes are built purely for decoration and never used
- C. Different objects and processes give off different forms of energy, so studying many forms reveals features that visible light alone would miss
- D. These other forms of energy come only from the Earth and never from space, so the telescopes that detect them reveal nothing about the universe

37. Beyond Neptune lies a region containing Pluto and many other icy bodies orbiting the Sun. This distant ring of icy objects at the outer edge of the solar system is known as the:

- A. Asteroid belt, the region of many rocky bodies located between the orbits of Mars and Jupiter in the inner part of the solar system
- B. 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. Corona, the outermost layer of the Sun's atmosphere, which extends far out into space and is normally visible only during a solar eclipse

D. Kuiper belt, the distant ring of icy bodies, including Pluto, that orbit the Sun beyond Neptune at the outer edge of the solar system

38. Astronomers sometimes observe dark spots on the surface of the Sun that are cooler than the areas around them. What are these dark, cooler areas on the Sun's surface called?

A. Craters, the bowl-shaped pits that form on the Sun's surface where asteroids and comets have crashed into the Sun over billions of years

B. Sunspots, the dark areas on the Sun's surface that appear darker because they are cooler than the brighter regions surrounding them

C. Eclipses, the dark shadows that appear on the Sun whenever a planet passes directly between the Sun and an observer here on the Earth

D. Phases, the regularly changing dark and light areas of the Sun's surface that cycle through different shapes over the course of one month

39. Loose layers of sand and mud at the bottom of a lake are slowly buried, squeezed together by the weight above, and glued together by dissolved minerals to form solid rock. Which two processes turn loose sediment into solid sedimentary rock?

A. Compaction, which squeezes the sediment grains together, and cementation, which glues them into solid rock with dissolved minerals

B. Melting, which turns the sediment into magma, and crystallization, which cools the magma back into a solid rock made of crystals

C. Weathering, which breaks the sediment into pieces, and erosion, which carries those pieces far away to be deposited somewhere else

D. Evaporation, which dries the sediment out, and condensation, which adds water back to it, neither of which forms any solid rock at all

40. On the Mohs hardness scale, talc is the softest mineral at 1 and diamond is the hardest at 10. Based on this scale, what does it mean to say that quartz has a hardness of 7?

- A. Quartz is the softest mineral of all, since a hardness of 7 on the Mohs scale indicates the lowest possible resistance to being scratched
- B. Quartz can be scratched by talc but cannot scratch diamond, since a hardness of 7 places quartz below talc on the Mohs hardness scale
- C. Quartz can scratch any mineral softer than 7 and is scratched by any mineral harder than 7, placing it in the middle-to-upper range of the scale
- D. Quartz has no measurable hardness at all, since a value of 7 on the Mohs scale indicates that a mineral cannot be ranked for hardness

41. Scientists use an instrument that records the shaking of the ground during an earthquake as a wavy line on a moving chart or screen. What is this instrument that detects and records earthquake waves called?

- A. A barometer, the instrument that measures the pressure of the atmosphere and whose readings change when stormy weather is approaching
- B. A seismograph, the instrument that detects and records the ground shaking produced by earthquake waves as a wavy line of motion
- C. A thermometer, the instrument that measures temperature, often by the expansion and contraction of a liquid sealed inside a glass tube
- D. A telescope, the instrument that gathers and focuses light from distant objects so that faint and far-away things can be seen more clearly

42. Mechanical weathering breaks rock into smaller pieces without changing its chemical makeup, while chemical weathering changes the minerals in the rock into new substances. Which of the following is an example of chemical weathering?

- A. Water freezing in a crack in a rock, expanding as it turns to ice, and prying the rock apart into smaller pieces over many freeze-thaw cycles
- B. A river tumbling rocks against one another so that their edges are gradually worn down and smoothed into rounded pebbles over time
- C. The roots of a growing tree slowly widening a crack in a rock until the rock is finally split apart into two or more separate pieces
- D. Acidic rainwater reacting with the minerals in a limestone statue and slowly dissolving them, changing the rock into new dissolved substances

43. When two oceanic plates collide, one plate is forced down beneath the other, and over time a chain of volcanoes can build up on the seafloor and rise above the surface. What landform results from this kind of ocean-ocean convergence?

A. A chain of volcanic islands, formed as one oceanic plate subducts beneath another and the rising magma builds volcanoes up above the sea

B. A deep, flat plain with no features at all, formed as the collision of the two oceanic plates smooths the seafloor completely level and bare

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

D. A tall continental mountain range made entirely of folded sedimentary rock, formed far inland from where the two oceanic plates collide

44. In a meandering river, the water flows faster around the outside of each bend and slower around the inside. What happens along the bends of a meandering river as a result of these different flow speeds?

A. The river deposits sediment on the fast outer bank and erodes the slow inner bank, which is the opposite of what actually occurs in a meander

B. The river neither erodes nor deposits anywhere along its bends, since the speed of the water has no effect at all on the banks of the river

C. The river erodes the faster outer bank and deposits sediment on the slower inner bank, so the shape of the meander slowly changes over time

D. The river erodes both banks equally and deposits sediment on both banks equally, so the meander keeps exactly the same shape forever

45. A well is dug or drilled down into the ground until it reaches a layer that is saturated with groundwater, allowing water to be pumped to the surface. To provide a steady supply of water, a well must reach below which underground level?

A. The topsoil layer, the dark uppermost layer of soil rich in organic matter, since wells draw nearly all of their water from just below the topsoil

B. The water table, the level below which the spaces in the soil and rock are completely filled with water, since a well must reach the saturated zone

C. The bedrock surface, the top of the solid unbroken rock, since groundwater is found only in a thin film resting directly on top of the bedrock

D. The cloud base, the bottom of the clouds in the sky, since the water pumped from a well actually comes directly from the clouds overhead

46. A geologist examines a rock made of interlocking mineral crystals with no layering and no fossils, and determines that it formed from cooled molten material. Which type of rock is this?

A. A sedimentary rock, since the interlocking crystals and absence of any layers or fossils are the defining features of rocks formed from sediment

B. A metamorphic rock, since cooling from molten material is the specific process that always produces metamorphic rather than any other rock

C. A fossil-rich limestone, since rocks made of interlocking crystals that cooled from molten material are a common variety of fossil-bearing limestone

D. An igneous rock, since rocks made of interlocking mineral crystals that form from cooled molten material are classified as igneous rocks

47. Earth has several layers, and the one we live on is a thin, rocky shell that is broken into the moving tectonic plates. Which layer of the Earth is this outermost, thinnest layer?

A. The crust, the thin, rocky, outermost layer of the Earth on which we live, which is broken into the large, slowly moving tectonic plates

B. The inner core, the solid sphere of extremely hot iron and nickel located at the very center of the Earth far beneath all the other layers

C. The mantle, the thick layer of hot, slowly flowing rock that lies between the crust and the core and makes up most of Earth's volume

D. The outer core, the layer of churning liquid iron and nickel surrounding the inner core, whose motion generates Earth's magnetic field

48. When some minerals break, they split along smooth, flat surfaces, while others break along rough, uneven surfaces. A mineral that breaks along rough, irregular surfaces rather than smooth flat planes is said to show:

- A. Cleavage, the tendency of a mineral to break along one or more smooth, flat planes that are determined by its internal atomic structure
- B. Luster, the way the surface of a mineral reflects light, which is described using terms such as metallic, glassy, pearly, dull, or earthy
- C. Fracture, the way a mineral breaks along rough, irregular, or curved surfaces rather than along smooth, flat, well-defined planes
- D. Streak, the color of the powder that a mineral leaves behind when it is firmly scraped across a rough, unglazed porcelain tile surface

49. An engineering team designing a new playground must keep the total cost under a fixed budget and finish before the school year begins. In the language of the engineering design process, these limits on cost and time are best described as the project's:

- A. Criteria, the requirements or goals that a successful design must achieve, such as the features and performance the finished playground must provide
- B. Constraints, the limitations or restrictions within which the design must be developed, such as the fixed budget and the deadline that must be met
- C. Prototypes, the early working models of a design that are built so that the team can test how well the design performs before it is finalized
- D. Hypotheses, the testable proposed explanations that a scientist forms at the start of an experiment to predict and explain its expected results

50. After collecting data in an experiment, a scientist organizes the measurements into a table and graph and looks for patterns before drawing a conclusion. Why is it important to analyze the data in this way before forming a conclusion?

- A. Organizing and analyzing the data helps reveal patterns and relationships, so the conclusion is based on evidence rather than on guesswork
- B. Analyzing the data has no real purpose, since a scientist should always form the conclusion first and then ignore whatever the data actually show
- C. Organizing the data into tables and graphs guarantees that the experiment's results will exactly match whatever the scientist hoped to find
- D. Analyzing the data is done only to make the experiment look more complicated, since conclusions are best formed by guessing without any data

## Practice Exam 46: Answer Key with Explanations

1. D — Using sunlight entering through windows to directly warm a building and reduce other heating is passive solar heating. It harnesses incoming solar energy without active mechanical systems, lowering fossil-fuel demand.
2. B — Eating more locally grown plant-based foods and less resource-intensive meat lowers food-related greenhouse gas emissions because meat production generally generates more emissions per calorie. Shifting toward plant foods reduces the land, feed, and methane involved in livestock.
3. C — All water in a watershed drains toward the same river or lake, so pollutants are carried downstream by the flowing water. This connectivity is why pollution upstream can affect places far away within the same basin.
4. A — Removing a key plant food source can cause the animals that depend on it to decline, and species connected to them in the food web may also be affected. This cascading impact shows how interlinked food webs are.
5. D — Coal takes millions of years to form from buried plant remains, so it cannot be replaced anywhere near as fast as it is used. This mismatch between formation rate and consumption rate makes it nonrenewable on a human timescale.
6. C — Extinction is permanent, and each species plays a role in its ecosystem, so protecting endangered species helps preserve biodiversity. Conservation acts before that loss becomes irreversible.
7. B — Acid rain can lower the pH of lakes and streams and damage forests, harming the plants and animals living in those ecosystems. Acidifying water and stressing trees disrupts entire communities.
8. A — Reusable items reduce the amount of plastic waste produced and the resources needed to make new single-use items, cutting both waste and resource use. Each refill avoids the manufacture and disposal of a disposable item.
9. D — The loss or damage of the natural environment that organisms depend on is habitat destruction, which can reduce or eliminate local populations. Clearing forest for housing is a clear example of this loss.
10. C — Nitrogen and oxygen together make up about 99 percent of dry air, with nitrogen being by far the most abundant. The remaining gases, including argon and carbon dioxide, make up only a small percentage.
11. D — Hailstones grow as strong updrafts carry ice up and down repeatedly through the storm cloud, adding a new layer each time until the stone is heavy enough to fall. This cycling produces the characteristic layered structure.
12. B — A tall, towering storm cloud with a dark base and anvil top that produces heavy rain, lightning, and thunder is a cumulonimbus cloud. Its vertical development fuels strong updrafts and severe weather.
13. D — Heat transfer by direct contact between two touching substances, such as hot pavement warming the air against it, is conduction. The energy moves from the hotter to the cooler substance through their point of contact.
14. A — Warm air expands and becomes less dense than the cooler air around it, and less dense air rises above denser air. This density difference drives the upward motion that produces convection and clouds.

15. C — A warm front typically brings gradually thickening clouds and steady, widespread light rain, followed by warmer temperatures once it passes. Warm air rides up gently over cooler air, producing a long, slow change in weather.
16. B — A thermometer measures temperature, often by the expansion and contraction of a liquid or an electronic sensor. It is the standard instrument for tracking how hot or cold the air is.
17. D — Oceans help moderate Earth's climate because they absorb, store, and slowly release heat, smoothing out temperature changes over time. This buffering action reduces extremes in global and coastal climates.
18. A — Lightning tends to strike tall or isolated objects and can travel through water, so open areas, lone trees, and water greatly increase the risk of being struck. Sturdy buildings and hard-topped vehicles shield people from this current.
19. C — Decreasing Arctic summer sea ice provides evidence of a warming global climate, since rising temperatures cause more ice to melt and reduce what remains. This trend is consistent with other measures of warming.
20. B — In an undisturbed sequence, each new layer is deposited on top of older layers, so the youngest layer is at the very top. This follows directly from the law of superposition.
21. A — Preservation in which heat and pressure drive off most of an organism's material and leave a thin film of carbon in its shape is carbonization. It commonly preserves detailed outlines of ferns and fish on rock surfaces.
22. D — One-fourth remaining means two halvings have occurred ( $1 \rightarrow 1/2 \rightarrow 1/4$ ), so two half-lives have passed. Two times the 250-million-year half-life gives about 500 million years.
23. C — The era often called the Age of Reptiles, when dinosaurs dominated and the first birds and flowering plants appeared, is the Mesozoic Era. It lies between the Paleozoic and Cenozoic in geologic time.
24. A — Ocean crust that is youngest at the ridge and older with distance shows that new crust forms at the ridge and moves outward, aging as it travels. This pattern is direct evidence of seafloor spreading.
25. B — Marine fossils in mountain rocks indicate the area was once covered by an ocean, and the rock containing them was later uplifted to form the mountains. Plate tectonic processes can lift seafloor rocks to high elevations over time.
26. D — Meteorites formed at the same time as the rest of the solar system, so dating them reveals the age of the material from which Earth also formed. Their pristine record helps anchor Earth's age near 4.6 billion years.
27. A — Geologists use the recognizable order of fossils to determine the relative ages of rock layers and to correlate layers of the same age in different locations. Faunal succession lets fossils serve as time markers across regions.
28. C — A dropped ball falls because Earth's gravitational pull attracts it toward the planet's center. Gravity, not magnetism or rotation, draws objects with mass toward Earth.
29. B — Saturn's very low density indicates it is composed mostly of light gases such as hydrogen and helium. These light elements give it an average density even lower than that of liquid water.
30. D — The explosive death of a very massive star when its core collapses and rebounds is a supernova. It is one of the most powerful events in the universe and disperses heavy elements into space.
31. A — Earth shows fewer craters because weathering, erosion, and active geology erase them over time, while the Moon lacks these processes, preserving its craters. This is why the lunar surface looks so heavily cratered by comparison.

32. C — Near the Sun it was too hot for ices and gases to remain, so mostly rock and metal formed planets there, while the cold outer region let gases and ices gather into the gas giants. This temperature-driven sorting explains the inner-outer planet contrast.
33. D — Hubble's observation that more distant galaxies recede faster led to the conclusion that the universe is expanding, supporting the Big Bang. The expansion of space carries galaxies apart over time.
34. B — That Earth is closer to the Sun during the Northern Hemisphere's winter shows the seasons cannot be caused mainly by distance, and instead result from the tilt of Earth's axis. Axial tilt changes the angle and duration of sunlight on each hemisphere.
35. A — Weight is the force of gravity acting on an object's mass, so it depends on the strength of the local gravity. Stronger gravity on Jupiter increases weight, while weaker gravity on the Moon decreases it.
36. C — Different objects and processes give off different forms of energy, so studying many wavelengths reveals features that visible light alone would miss. This is why astronomers build telescopes for radio, infrared, X-ray, and other bands.
37. D — The distant ring of icy bodies beyond Neptune, including Pluto, is the Kuiper belt. It lies at the outer edge of the planetary region of the solar system.
38. B — Dark, cooler areas on the Sun's surface that appear darker against the brighter surroundings are sunspots. Their lower temperature relative to the surrounding photosphere is what makes them look dark.
39. A — Loose sediment becomes solid sedimentary rock through compaction, which squeezes the grains together, and cementation, which glues them with dissolved minerals. These two processes together are called lithification.
40. C — A Mohs hardness of 7 means quartz can scratch any mineral softer than 7 and is scratched by any mineral harder than 7. This places quartz in the middle-to-upper range of the scale.
41. B — The instrument that detects and records earthquake-wave ground shaking as a wavy line is a seismograph. Its trace lets scientists analyze the timing, strength, and source of seismic events.
42. D — Acidic rainwater reacting with limestone and dissolving its minerals into new substances is chemical weathering, since the rock's composition is changed. The other examples merely break rock physically without altering its chemistry.
43. A — When one oceanic plate subducts beneath another, rising magma builds volcanoes that grow into a chain of volcanic islands above the sea. Island arcs like Japan form by this ocean-ocean convergence.
44. C — In a meander, the river erodes the faster outer bank and deposits sediment on the slower inner bank, so the meander shape shifts over time. This combination of erosion and deposition migrates the bends across the floodplain.
45. B — A well must reach below the water table—the level beneath which the soil and rock spaces are completely filled with water. Above this saturated zone there is not a steady supply of water to draw from.
46. D — A rock made of interlocking mineral crystals that formed from cooled molten material is igneous. The interlocking crystal texture is a hallmark of magma or lava solidifying.
47. A — The thin, rocky outermost layer on which we live, broken into the tectonic plates, is the crust. It lies above the mantle and is the layer directly involved in plate tectonic motion.
48. C — A mineral that breaks along rough, irregular, or curved surfaces rather than smooth flat planes shows fracture. Cleavage, by contrast, refers to breakage along smooth planes controlled by atomic structure.

49. B — Limits like a fixed budget and a deadline are constraints—restrictions within which the design must be developed. Criteria, by contrast, define the goals the finished design must achieve.
50. A — Organizing and analyzing data helps reveal patterns and relationships, so the conclusion rests on evidence rather than guesswork. Tables and graphs make those patterns visible and support sound interpretation.