

PRACTICE EXAM 34: EARTH AND SPACE SCIENCES REGENTS SIMULATION (50 QUESTIONS)

1. A power plant discharges warm water into a river, and this warm water holds less dissolved oxygen than cool water does. What is this type of pollution called, and what is its main effect?

A. Sediment pollution, which clouds the water and blocks sunlight from reaching the aquatic plants below the surface

B. Thermal pollution, which lowers the dissolved oxygen in the river and can stress or kill aquatic organisms

C. Acidic pollution, which dissolves the protective shells of organisms by lowering the pH of the river water

D. Plastic pollution, which entangles animals and breaks down into tiny particles that are consumed by fish

2. A major challenge of relying on solar and wind power is that their output varies with the weather and the time of day. Which approach best addresses this challenge?

A. Storing excess electricity in batteries or other systems so it can be used when the Sun and wind are not available

B. Shutting down all solar and wind facilities permanently and returning entirely to burning much more fossil fuel

C. Building solar and wind farms only in places where the Sun shines and the wind blows at exactly all times

D. Ignoring the variation entirely, since the demand for electricity never changes at any hour of the day or night

3. A non-native fish is introduced into a lake where it has no natural predators. It rapidly multiplies and outcompetes the native fish for food. This non-native fish is best described as:

- A. A keystone species, whose presence holds the entire ecosystem together and supports many other species
- B. An endangered species, whose numbers are so low that it is now at serious risk of disappearing entirely
- C. A native species, one that has lived in balance within the lake ecosystem for many thousands of years
- D. An invasive species, a non-native organism that spreads rapidly and harms the native ecosystem

4. A leaking underground storage tank at a single gas station contaminates the groundwater beneath it. Because the pollution comes from one identifiable location, it is classified as:

- A. Nonpoint-source pollution, which enters the environment from many scattered and diffuse locations at once
- B. Natural background pollution, which is present everywhere and does not come from any human activity at all
- C. Point-source pollution, which can be traced back to a single, identifiable point of origin
- D. Atmospheric pollution, which is released into the air and later settles down onto the land and the water

5. A farmer plants legumes such as beans one year and corn the next year in the same field, rotating the crops. How does this practice of crop rotation benefit the soil?

- A. It removes all of the nutrients from the soil so that weeds become unable to grow there during the next season
- B. It helps replenish soil nutrients such as nitrogen and reduces the buildup of pests and plant diseases
- C. It permanently seals the surface of the soil so that no water can ever evaporate from the field again
- D. It heats the soil to very high temperatures, which completely kills every living organism in the ground

6. After scientists discovered that certain chemicals were destroying stratospheric ozone, nations agreed to phase out those chemicals. This international response demonstrates that:

- A. Environmental problems caused by human activity can never be reduced once they have already begun
- B. Individual countries acting completely alone can solve any global environmental problem without cooperation
- C. Scientific evidence has no real influence on the decisions that governments and policymakers actually make
- D. Coordinated human action guided by scientific evidence can help address a global environmental problem

7. Which change in daily habits would most reduce the total amount of energy a household consumes over a year?

- A. Leaving every appliance plugged in and running continuously to avoid the effort of switching them on again later
- B. Improving home insulation and using energy-efficient appliances to reduce the energy needed for heating and cooling
- C. Setting the heating and cooling system to run at its maximum power throughout both the day and the night
- D. Replacing all of the energy-efficient light bulbs with older bulbs that consume far more electricity per hour

8. When a forested hillside is completely cleared of trees, the rate of soil erosion on that hillside usually increases sharply. Why does removing the trees lead to more erosion?

- A. The roots of trees actually loosen the soil, so removing the trees allows the soil to pack down and wash away faster
- B. Trees add weight that holds the soil down, and without that weight the soil simply floats away on the surface water
- C. Tree roots bind the soil and the canopy shields it from rain, so removing the trees leaves the soil exposed and loose
- D. Trees release chemicals that dissolve nearby rock into soil, and without them no new soil is ever created at all

9. Which of the following best describes a renewable resource?

- A. A resource that is naturally replenished on a human timescale, such as sunlight, wind, or sustainably harvested timber
- B. A resource that exists in a fixed amount and cannot be replaced once it has all been completely used up by people
- C. A resource that is found only deep underground and must be extracted through mining or drilling operations
- D. A resource that is harmful to the environment and should therefore never be used by people under any circumstances

10. Warm air can hold more water vapor than cold air. Because of this, what often happens when a mass of warm, humid air is cooled?

- A. The cooling air becomes able to hold even more water vapor than before, so the humidity in it simply disappears
- B. The water vapor in the air is permanently destroyed and is converted into dry nitrogen and oxygen gas instead
- C. Nothing happens at all, because the amount of water vapor that air can hold does not depend on its temperature
- D. The air may reach saturation and release some of its water vapor as condensation, forming clouds or dew

11. The station model below shows a wind barb. The staff points toward the northeast and has one full barb and one half barb. What wind is being reported?

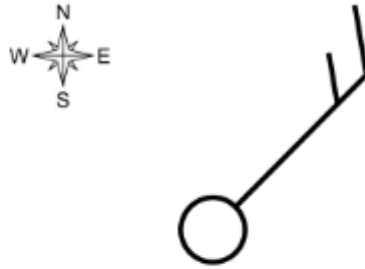


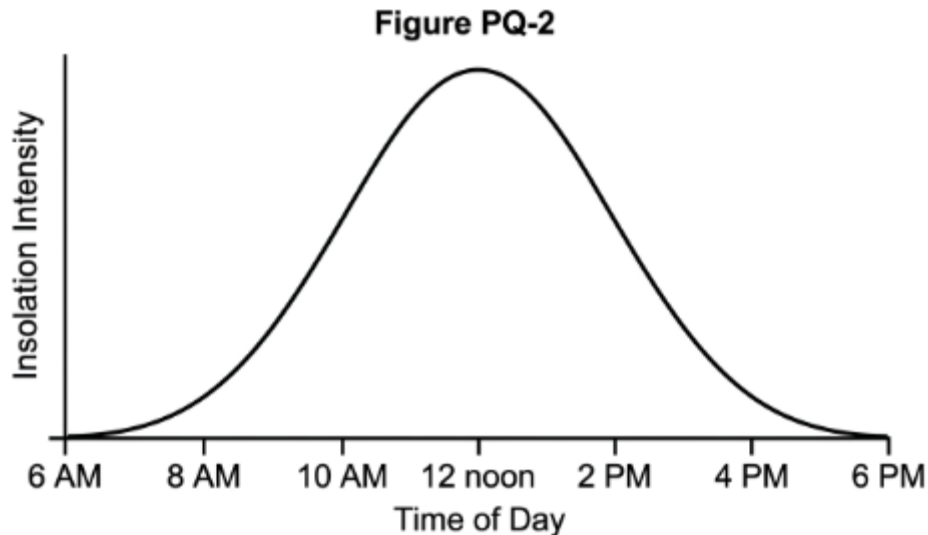
Figure PQ-1

- A. A wind blowing toward the northeast at a speed of 5 knots, shown by the single half barb on the staff
- B. A wind blowing from the southwest at a speed of 50 knots, shown by a single solid pennant flag on the staff
- C. A wind blowing from the northeast at a speed of 15 knots, shown by one full barb and one half barb
- D. A wind blowing from the north at a speed of 10 knots, shown by one full barb pointing straight downward

12. As water vapor condenses inside a developing hurricane, the storm intensifies. What is the source of the energy that powers the hurricane's strengthening?

- A. Friction between the hurricane's winds and the surface of the ocean, which generates heat as the storm spins
- B. Latent heat released into the atmosphere when water vapor that evaporated from the warm ocean later condenses
- C. Sunlight directly heating the center of the storm, which is the only available energy source for the hurricane
- D. The rotation of Earth, which physically adds energy of motion to the hurricane's winds as the planet spins

13. The graph below shows the intensity of insolation at a location over the course of one day. At approximately what time is the insolation greatest?



- A. Around 12:00 noon, when the Sun reaches its highest point in the sky and its rays strike most directly
- B. Around 6:00 in the morning, just as the Sun is first rising above the eastern horizon at the start of the day
- C. Around 6:00 in the evening, just as the Sun is setting below the western horizon at the end of the day
- D. The insolation remains exactly the same at every hour throughout the entire daylight period shown on the graph

14. A large high-pressure system settles over a region, and in such a system air slowly sinks toward the surface. What kind of weather is most commonly associated with this sinking air?

- A. Heavy rain and thunderstorms, because the sinking air forces moisture upward to form towering storm clouds
- B. Strong, gusty winds and rapidly falling temperatures as cold fronts repeatedly sweep through the region
- C. Thick fog and steady snowfall that persist for many days as moisture is trapped beneath the sinking air
- D. Generally clear skies and fair, calm weather, because sinking air discourages cloud formation and rising motion

15. Fresh snow reflects most of the sunlight that strikes it, while a dark forest absorbs most of the sunlight that strikes it. The fraction of sunlight that a surface reflects is called its:

- A. Insolation, the total amount of solar radiation that arrives at a surface over a given period of time
- B. Albedo, the fraction of incoming sunlight that a surface reflects rather than absorbs
- C. Convection, the transfer of heat by the circulation of warmed material rising and cooler material sinking
- D. Conduction, the transfer of heat by direct contact between the particles of two materials touching each other

16. On the weather map below, a boundary is drawn as a line with solid triangles pointing in the direction of its movement. What does this symbol represent?



- A. A warm front, which is normally drawn as a line with solid semicircles pointing in the direction it is moving
- B. A stationary front, which is normally drawn as a line with triangles and semicircles pointing in opposite directions
- C. A cold front, drawn as a line with solid triangles pointing in the direction that the cold air is advancing
- D. An isobar, a line that connects all of the points on the map that happen to share the very same air pressure value

17. At night, the land cools faster than the nearby ocean, and a breeze develops blowing from the land out toward the sea. What is this nighttime breeze called?

- A. A land breeze, which blows from the cooler land toward the warmer water as cool dense air sinks over the land
- B. A sea breeze, which blows from the cooler water toward the warmer land during the cool hours of the night
- C. A monsoon, a seasonal wind that completely reverses its direction between the summer and the winter months
- D. A chinook, a warm dry wind that descends the leeward side of a mountain range and heats the valley below it

18. Global sea level has been rising over the past century. Which two processes are the main contributors to this rise?

- A. An increase in the total amount of water on Earth and a gradual slowing of the planet's rotation over time
- B. The sinking of the ocean floor and a decrease in the amount of rain that falls over the open oceans each year
- C. A reduction in evaporation from the oceans and the construction of large dams that hold back river water inland
- D. The melting of land-based ice such as glaciers and ice sheets, and the thermal expansion of warming seawater

19. Tornadoes most often form in association with which type of severe weather?

- A. Gentle warm fronts, where warm air rises very slowly and steadily over a retreating mass of cold dense air
- B. Light winter snowstorms, in which cold dry air moves slowly across a region under calm and stable conditions
- C. Severe thunderstorms, particularly powerful rotating storms called supercells that develop in unstable air
- D. High-pressure systems, in which sinking air produces clear skies and calm, fair weather over a wide area

20. Loose sand on a beach is buried, compacted, and cemented together over long periods of time. What does this process produce, and what is the process called?

- A. It produces an igneous rock through a process called crystallization as the molten sand slowly cools down
- B. It produces a sedimentary rock through a process called lithification as the sediment is compacted and cemented
- C. It produces a metamorphic rock through a process called foliation as the grains align under great pressure
- D. It produces no rock at all, since loose sand can never become solid rock under any natural conditions at all

21. In East Africa, the continent is slowly splitting apart, forming a long, deep valley bounded by faults. Which plate tectonic process is creating this feature?

- A. A divergent boundary on land, where the continental crust is being pulled apart to form a rift valley
- B. A convergent boundary, where two continental plates are colliding and pushing the crust upward into mountains
- C. A transform boundary, where two plates are sliding horizontally past one another without pulling apart at all
- D. A subduction zone, where a dense oceanic plate is sinking down beneath the lighter continental crust above it

22. A geologist rubs a mineral across an unglazed porcelain plate and observes the color of the powder it leaves behind. Which property is being tested?

- A. Cleavage, the tendency of a mineral to break along smooth flat surfaces determined by its atomic structure
- B. Luster, the way that the surface of a mineral reflects light, often described as metallic, glassy, or dull
- C. Hardness, the resistance of a mineral to being scratched, measured on a scale that runs from one through ten
- D. Streak, the color of a mineral in its powdered form, which is often more reliable than the mineral's surface color

23. A mountain stream flows down a steep slope, while a lowland river flows across a nearly flat plain. How do their gradients and velocities most likely compare?

- A. The lowland river has a steeper gradient and a faster velocity than the mountain stream flowing downhill
- B. Both streams have exactly the same gradient and velocity, since all flowing water moves at one fixed speed
- C. The mountain stream has a steeper gradient and a faster velocity than the lowland river crossing the flat plain
- D. The mountain stream has a gentle gradient and a slow velocity, because steep slopes always slow the water down

24. A geologist finds sediment made of well-rounded, well-sorted grains. What does this tell the geologist about how the sediment was transported?

- A. The sediment was not transported at all and formed exactly where it is found, directly from the local bedrock
- B. The sediment was transported a long distance, which rounded the grains and sorted them by size along the way
- C. The sediment was deposited instantly by a glacier, which always produces well-rounded and well-sorted material
- D. The sediment was transported only a very short distance, which is why the grains became rounded and well sorted

25. On the moment magnitude scale, each whole-number increase represents a roughly 32-fold increase in the energy released. Based on this, how does a magnitude 7 earthquake compare to a magnitude 5 earthquake?

- A. The magnitude 7 earthquake releases vastly more energy, since two whole steps each multiply the energy about 32 times
- B. The magnitude 7 earthquake releases only slightly more energy, since the two quakes differ by just two small numbers

C. The magnitude 7 earthquake releases exactly twice as much energy as the magnitude 5 earthquake releases

D. The magnitude 7 earthquake releases less energy than the magnitude 5 earthquake, since higher numbers mean weaker quakes

26. A volcano is built from many thin, fluid lava flows that spread out widely, producing a broad, gently sloping mountain. What type of volcano is this?

A. A composite volcano, a steep cone built from alternating layers of thick lava and explosive ash deposits

B. A cinder cone, a small steep-sided hill built from loose fragments thrown out during explosive eruptions

C. A shield volcano, a broad, gently sloping volcano built from many thin, fluid, runny lava flows

D. A caldera, a large basin-shaped depression that forms when the summit of a volcano collapses inward on itself

27. As a glacier melts and retreats, it leaves behind a ridge of unsorted rock debris that had been carried within and beneath the ice. What is this landform called?

A. A delta, a fan-shaped deposit of well-sorted sediment that forms where a river flows into a calm body of water

B. A sand dune, a mound of well-sorted sand built up and shaped by the prevailing winds in a dry environment

C. An alluvial fan, a sloping deposit of sediment laid down where a fast stream emerges onto a flat valley floor

D. A moraine, a ridge of unsorted rock debris deposited directly by a glacier as the ice melts and retreats

28. During a long drought with little rain, what is most likely to happen to the water table in a region that depends on groundwater?

A. The water table will drop, because little rain is available to recharge the groundwater that continues to be used

B. The water table will rise sharply, because drought conditions cause the groundwater to expand and move upward

C. The water table will remain exactly the same, since the water table is completely unaffected by rainfall amounts

D. The water table will disappear entirely within a few days, leaving the rock layers permanently dry forever after

29. Two regions have the same type of bedrock, but one is hot and rainy while the other is cold and dry. In which region will a thick soil most likely develop more quickly, and why?

A. The cold, dry region, because freezing temperatures speed up the chemical reactions that break rock into soil

B. The hot, rainy region, because warmth and abundant water speed up the weathering that breaks bedrock into soil

C. Soil forms at exactly the same rate in both regions, since the climate has no effect on how quickly soil develops

D. Neither region will form soil, because soil can develop only from sediment that is carried in from somewhere else

30. Where two oceanic plates converge and one subducts beneath the other, a curving chain of volcanic islands often forms. What is this feature called?

A. A mid-ocean ridge, an underwater mountain chain that forms where two plates pull apart and create new crust

B. A continental shelf, the gently sloping submerged edge of a continent extending out beneath the shallow seawater

C. A rift valley, a deep valley that forms on land where the continental crust is being slowly pulled apart

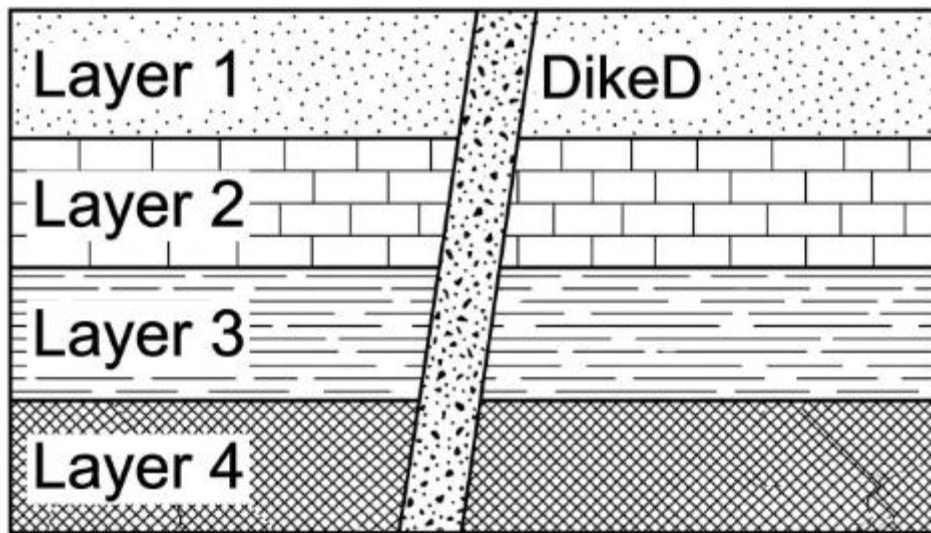
D. A volcanic island arc, a curved chain of volcanic islands formed above a subduction zone between two oceanic plates

31. Slate, schist, and gneiss all show a layered or banded texture in which their minerals are arranged in roughly parallel alignment. This texture, produced by directed pressure during metamorphism, is called:

A. Cementation, the binding of loose sediment grains together by minerals that crystallize in the spaces between them

- B. Vesicular texture, the presence of many small holes left behind by gas bubbles trapped in cooling volcanic lava
- C. Foliation, the parallel alignment of mineral grains into layers or bands produced by directed pressure during metamorphism
- D. Conchoidal fracture, the smooth, curved breakage surfaces that are characteristic of glassy materials such as obsidian

32. The cross-section below shows horizontal sedimentary layers cut by a vertical igneous intrusion. Using the principle of cross-cutting relationships, what can be said about the age of the intrusion?



- A. The igneous intrusion is younger than all of the sedimentary layers that it cuts across, since it must have formed after them
- B. The igneous intrusion is older than all of the sedimentary layers, since it must have already existed before they were deposited
- C. The igneous intrusion and the sedimentary layers all formed together at exactly the same single moment in time
- D. The age of the intrusion cannot be determined in any way from a cross-section like the one that is shown here

33. Earth's present-day atmosphere is composed mostly of two gases. Which two gases make up the great majority of the air we breathe today?

- A. Carbon dioxide and water vapor, which together account for nearly all of the modern atmosphere by total volume
- B. Hydrogen and helium, the same two light gases that make up the bulk of the Sun and the giant outer planets
- C. Oxygen and carbon dioxide, in roughly equal amounts, with only small traces of all of the other gases present
- D. Nitrogen and oxygen, which together make up about 99 percent of the dry air in Earth's modern atmosphere

34. Footprints, burrows, and other preserved signs of an organism's activity, rather than the organism's actual body, are known as:

- A. Index fossils, the preserved remains of organisms used specifically to determine the relative age of rock layers
- B. Trace fossils, preserved evidence of an organism's activity such as footprints, burrows, or feeding marks
- C. Cast fossils, formed when a mold left by a buried organism is later filled in with minerals or fine sediment
- D. Petrified fossils, formed when the original tissues of an organism are gradually replaced by hardened minerals

35. An unconformity in a sequence of rock layers represents:

- A. A layer of volcanic ash that was deposited very rapidly during a single large explosive eruption somewhere nearby
- B. A place where two layers of the very same age and composition happen to lie directly on top of one another
- C. A gap in the rock record, representing a period during which rock was eroded away or no new rock was deposited
- D. A boundary where an igneous intrusion has cut completely across several older sedimentary rock layers below

36. After a mass extinction wipes out many species, the fossil record often shows the surviving groups expanding and diversifying into many new forms. Why does this diversification tend to occur after a mass extinction?

- A. The extinction empties many ecological roles, and the surviving organisms evolve to fill the now-vacant niches over time
- B. Mass extinctions add brand-new species instantly to the planet, which is why the diversity rises right after each event
- C. The surviving organisms are forced to leave the Earth entirely, so the new diversity instead appears on other planets
- D. Diversification after extinctions is impossible, since the fossil record shows that life never recovers from such events

37. Carbon-14 dating is useful for finding the age of materials up to about 50,000 years old, but it cannot be used to date a rock that is hundreds of millions of years old. Why not?

- A. Carbon-14 is found only in rocks that formed on other planets and is never present in any of the rocks found on Earth
- B. Carbon-14 dating works only on metals, and rocks that are hundreds of millions of years old never contain any metal
- C. Carbon-14 has such a long half-life that hundreds of millions of years are far too short a span to measure any decay
- D. Carbon-14 has a short half-life, so after tens of thousands of years almost none remains to be measured accurately

38. During the most recent ice ages of the Pleistocene Epoch, large mammals such as woolly mammoths and saber-toothed cats roamed the continents. The Pleistocene falls within which era of geologic time?

- A. The Paleozoic Era, the era during which trilobites and the first fish and amphibians appeared in the ancient seas
- B. The Cenozoic Era, the most recent era, often called the Age of Mammals, which continues right up to the present day

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

D. The Precambrian, the vast early span of time during which only simple single-celled life existed in the oceans

39. Geologists find evidence of ancient glaciers, including scratched bedrock and glacial deposits, in regions of Africa, South America, and India that today have warm tropical climates. How does this finding support continental drift?

A. These now-tropical lands were once joined together near the South Pole, where a single ice sheet covered them all

B. The glaciers prove that the entire Earth, including the tropics, was completely frozen over during that one period

C. The scratched bedrock was actually caused by rivers, and it has nothing at all to do with the idea of continental drift

D. The glacial deposits were carried to the tropics by ocean currents long after the glaciers themselves had melted away

40. What holds the planets, asteroids, and comets of the solar system in orbit around the Sun?

A. The powerful magnetic field of the Sun, which grips the metallic cores of the planets and pulls them along

B. The pressure of the solar wind, a stream of particles that pushes the planets and keeps them circling the Sun

C. The Sun's gravity, which is by far the strongest in the solar system because the Sun contains most of its mass

D. The rotation of the Milky Way galaxy, which swings the planets and the Sun around together as a single unit

41. Observers on Earth always see the same side of the Moon and never the far side. What explains this fact?

- A. The Moon does not rotate at all, so the same fixed side is permanently turned toward the Earth at all times
- B. The Moon rotates many times faster than it revolves, which keeps blurring the far side out of our view from Earth
- C. The far side of the Moon is permanently dark and never lit, so it simply cannot be seen by observers on Earth
- D. The Moon rotates once on its axis in exactly the same time it takes to revolve once around Earth, keeping one side facing us

42. Astronomers describe stars using both apparent magnitude and absolute magnitude. What is the difference between these two measures?

- A. Apparent magnitude is a star's true energy output, while absolute magnitude is how bright the star happens to look from far away
- B. Apparent magnitude is how bright a star looks from Earth, while absolute magnitude is how bright it would look at a standard distance
- C. Apparent magnitude measures a star's color, while absolute magnitude measures the temperature of the star's surface
- D. Apparent magnitude and absolute magnitude are simply two different names for exactly the same quantity measured the same way

43. Of the planets in our solar system, which takes the longest time to complete one full orbit around the Sun, and why?

- A. Neptune, the most distant planet, because planets farther from the Sun travel along longer orbital paths at slower speeds
- B. Mercury, the closest planet, because the planets closest to the Sun are pulled around their orbits the most slowly of all
- C. Earth, because it is the only planet that takes any measurable amount of time at all to travel once around the Sun
- D. All of the planets take exactly the same amount of time, since they all orbit around the same central Sun together

44. A small chunk of rock from space enters Earth's atmosphere, burns brightly as a streak of light, and a surviving fragment lands on the ground. What is the fragment found on the ground called?

- A. A meteoroid, the term used for the chunk of rock only while it is still traveling through space before entering the air
- B. A comet, an icy body that develops a long glowing tail whenever its orbit carries it close to the heat of the Sun
- C. A meteor, the term used for the bright streak of light produced as the rock burns up while crossing the sky
- D. A meteorite, the term used for the fragment that survives its fiery passage and actually reaches Earth's surface

45. Galaxies are classified by their shapes. Our own Milky Way, with a flattened disk and curving arms winding outward from a central bulge, is which type of galaxy?

- A. An elliptical galaxy, a smooth, rounded ball of older stars with no spiral arms and very little gas or dust
- B. An irregular galaxy, a galaxy that has no definite or organized shape, often the result of a past collision
- C. A spiral galaxy, a galaxy with a flattened disk, a central bulge, and curving arms winding outward from the center
- D. A dwarf galaxy, a very small galaxy containing only a few thousand stars and almost no gas, dust, or structure

46. According to current scientific evidence, approximately how long ago did the universe begin in the event known as the Big Bang?

- A. About 13.8 billion years ago, based on the observed expansion of the universe and the cosmic background radiation
- B. About 4.6 billion years ago, the same time that the Sun and the rest of our solar system first formed together
- C. About 6,000 years ago, an age determined by carefully counting the layers of sediment at the bottom of the oceans
- D. About 65 million years ago, the same time that the dinosaurs became extinct near the end of the Mesozoic Era

47. Spacecraft and rovers have found dried-up riverbeds, channels, and certain minerals on the surface of Mars. What do these features suggest about the planet's past?

- A. That Mars has always been exactly as it is today, a cold dry desert that has never once had any water at its surface
- B. That liquid water once flowed across the surface of Mars in the distant past, even though that surface is dry today
- C. That Mars is currently covered by deep liquid oceans hidden completely beneath a thin layer of red surface dust
- D. That the channels on Mars were carved entirely by flowing lava and have no connection at all to water of any kind

48. Elements heavier than hydrogen and helium, such as carbon and oxygen, were not present in large amounts in the early universe. Where were most of these heavier elements produced?

- A. They were all created during the first few minutes of the Big Bang, when the entire early universe was extremely hot
- B. They formed through the slow weathering and chemical breakdown of rocks on the surfaces of the rocky planets
- C. They were manufactured artificially by living organisms over billions of years of biological activity here on Earth
- D. They were forged by nuclear fusion inside stars and scattered into space when massive stars exploded as supernovae

49. An engineering team has several possible designs for an earthquake-resistant building, each with different costs, safety levels, and construction times. Before choosing, the team ranks how important each of these factors is. Why is ranking the factors a useful step?

- A. Ranking the factors guarantees that the chosen design will cost nothing at all to actually build and then maintain
- B. Ranking the factors is unnecessary, because the design that is best in one single factor is always the best one overall

C. Ranking the factors helps the team make trade-offs and choose the design that best balances its most important goals

D. Ranking the factors removes the need to ever test any of the designs, since the ranking alone proves which one works

50. A company claims its new sea wall design will completely eliminate all flooding in a coastal town forever. How should engineers and scientists best respond to this claim?

A. Evaluate the claim critically by testing the design and examining the evidence, since no real-world design works perfectly under all conditions

B. Accept the claim immediately without any testing at all, because a company would never make a statement that is not completely true

C. Reject the claim outright without any investigation, since new engineering designs are never worth seriously considering at all

D. Ignore the claim completely, because the real-world performance of a sea wall design cannot be studied or measured in any way

ANSWERS KEY WITH EXPLANATIONS

1. B — Thermal pollution is the discharge of heated water into a waterway, and because warm water holds less dissolved oxygen, it can stress or kill fish and other aquatic organisms. Recognizing heat itself as a pollutant is important, since it harms life without adding any chemical contaminant.
2. A — Storing surplus electricity in batteries or other systems lets solar and wind energy be used when the Sun is down or the wind is calm, smoothing out their natural variability. Energy storage is the key strategy for making intermittent renewable sources reliable enough to meet steady demand.
3. D — An invasive species is a non-native organism that spreads rapidly and harms the native ecosystem, often because it lacks natural predators in its new home. Identifying such species matters because they can outcompete natives and disrupt the balance of an ecosystem.
4. C — Point-source pollution comes from a single identifiable origin, such as one leaking storage tank, which makes it easier to locate and address than diffuse nonpoint sources. Distinguishing point from nonpoint pollution guides how cleanup and regulation are targeted.
5. B — Rotating legumes with other crops replenishes soil nutrients, since legumes help add nitrogen, and alternating crops also disrupts pests and diseases. This practice sustains soil fertility naturally and reduces the need for added fertilizer over time.
6. D — The international phase-out of ozone-destroying chemicals shows that coordinated human action guided by scientific evidence can address a global environmental problem. This response demonstrates how scientific findings can successfully shape effective worldwide policy.

7. B — Improving insulation and using energy-efficient appliances most reduces a household's yearly energy use, because heating and cooling are major energy demands that better insulation and efficiency directly lower. Targeting these large loads yields the greatest savings.
8. C — Tree roots bind soil and the canopy shields it from the impact of rain, so clearing a forest leaves the soil loose and exposed, sharply increasing erosion. This link explains why deforestation often leads to rapid loss of fertile topsoil on slopes.
9. A — A renewable resource is one naturally replenished on a human timescale, such as sunlight, wind, or sustainably harvested timber. The defining feature is that natural processes refill the supply about as fast as it is used, unlike finite nonrenewable resources.
10. D — Because cooler air holds less water vapor, cooling warm humid air can bring it to saturation, at which point excess vapor condenses into clouds, dew, or fog. This cooling-to-saturation process is the basis of most cloud and dew formation.
11. C — A wind barb reports the direction the wind comes from and its speed, so a staff pointing northeast with one full barb (10 knots) and one half barb (5 knots) indicates a wind from the northeast at 15 knots. Reading both the staff direction and the barbs gives the full wind report.
12. B — A hurricane is powered by latent heat released when water vapor, evaporated from the warm ocean, condenses inside the storm. This release of stored heat fuels the rising air and intensification, which is why hurricanes weaken once cut off from warm water.
13. A — Insolation peaks around solar noon, when the Sun is highest and its rays strike the surface most directly, concentrating energy over the smallest area. The bell-shaped daily curve peaks at midday for exactly this reason.
14. D — Sinking air in a high-pressure system suppresses cloud formation and rising motion, producing generally clear skies and fair, calm weather. Associating high pressure with settled weather is a basic forecasting principle.
15. B — Albedo is the fraction of incoming sunlight a surface reflects rather than absorbs, so bright snow has a high albedo and dark forest a low one. Albedo is important to climate because reflective surfaces absorb less solar energy and stay cooler.
16. C — A cold front is drawn as a line with solid triangles pointing in the direction the cold air is advancing. Recognizing the triangle symbol lets a reader identify a cold front and anticipate the brief, intense weather that accompanies its passage.
17. A — A land breeze blows from the cooler land toward the warmer water at night, because the land cools faster, and the cool dense air over it sinks and flows seaward. This nighttime reversal is the counterpart of the daytime sea breeze.
18. D — Sea level rises mainly from the melting of land-based ice such as glaciers and ice sheets, which adds water to the oceans, and from thermal expansion as warming seawater takes up more volume. These two warming-driven processes are the primary contributors.
19. C — Tornadoes form most often within severe thunderstorms, especially rotating supercells that develop in unstable air with strong wind shear. The intense updrafts and rotation of these storms provide the conditions tornadoes require.
20. B — Burial, compaction, and cementation of loose sediment such as beach sand produce sedimentary rock through the process of lithification. Understanding lithification clarifies how loose particles become solid rock without any melting.
21. A — The East African feature is a continental rift, formed at a divergent boundary on land where the crust is pulled apart, dropping a long fault-bounded valley. This shows that divergent boundaries can split continents, not just create seafloor.

22. D — Rubbing a mineral on an unglazed porcelain plate tests its streak, the color of its powdered form, which is often more reliable for identification than the surface color. Streak is a consistent diagnostic property because the powder color does not vary as surface color can.
23. C — A steeper slope gives a stream a higher gradient and therefore a faster velocity, so the mountain stream flows faster than the lowland river on its near-flat plain. Gradient strongly controls stream velocity, which in turn affects erosion and transport.
24. B — Well-rounded, well-sorted grains indicate long-distance transport, during which collisions round the grains and the sorting action of moving water or wind separates them by size. Grain shape and sorting therefore record the transport history of sediment.
25. A — Since each whole magnitude step multiplies energy by about 32, a magnitude 7 quake releases roughly 32×32 , or about 1,000 times more energy than a magnitude 5. This explains why even a two-point difference in magnitude represents an enormous difference in released energy.
26. C — A shield volcano is a broad, gently sloping mountain built from many thin, fluid lava flows that spread widely before cooling. Its low-viscosity lava, rather than explosive ash, produces the wide, gentle profile.
27. D — A moraine is a ridge of unsorted rock debris deposited directly by a glacier as it melts and retreats. The lack of sorting distinguishes glacial deposits like moraines from water- or wind-sorted deposits such as deltas and dunes.
28. A — During a prolonged drought, little rain recharges the groundwater while it continues to be withdrawn, so the water table drops. This is why extended droughts can lower wells and strain communities that rely on groundwater.
29. B — A hot, rainy climate speeds the weathering of bedrock, because warmth accelerates chemical reactions and abundant water drives them, so thick soil develops faster there than in a cold, dry region. Climate is a major control on the rate of soil formation.
30. D — Where one oceanic plate subducts beneath another, the rising magma builds a curved chain of volcanoes called a volcanic island arc. This landform is the surface signature of ocean-ocean subduction.
31. C — Foliation is the parallel alignment of mineral grains into layers or bands caused by directed pressure during metamorphism, as seen in slate, schist, and gneiss. This banded texture is a key clue that a rock is metamorphic and formed under directed stress.
32. A — By cross-cutting relationships, a feature that cuts across others must be younger, so the dike that slices through all four layers formed after them. This principle lets geologists order an intrusion relative to the rocks it cuts.
33. D — Earth's modern atmosphere is about 99 percent nitrogen and oxygen by volume of dry air, with nitrogen the most abundant. Knowing this composition is fundamental to understanding atmospheric processes and the gases life depends on.
34. B — Trace fossils are preserved evidence of an organism's activity, such as footprints, burrows, and feeding marks, rather than its body. They are valuable because they reveal how ancient organisms behaved, not just what they looked like.
35. C — An unconformity represents a gap in the rock record, a span during which rock was eroded away or none was deposited. Recognizing unconformities is essential because they show that the rock record at a site is incomplete.
36. A — A mass extinction empties many ecological niches, and the surviving organisms evolve over time to fill those vacant roles, producing a burst of new diversity. This adaptive radiation explains the recovery and diversification seen after major extinctions.

37. D — Carbon-14 has a short half-life of about 5,700 years, so after only tens of thousands of years too little remains to measure, making it useless for rocks hundreds of millions of years old. Longer-lived isotopes are required to date very old rocks.
38. B — The Pleistocene ice ages fall within the Cenozoic Era, the most recent era and the Age of Mammals, which extends to today. Placing the Pleistocene in the Cenozoic situates familiar ice-age mammals in the correct part of geologic time.
39. A — Glacial evidence in now-tropical Africa, South America, and India indicates those lands were once joined near the South Pole under a single ice sheet, supporting continental drift. The mismatch between past glaciers and present tropics is explained by continents that have since moved.
40. C — The Sun's gravity holds the solar system together because the Sun contains the overwhelming majority of the system's mass, giving it by far the strongest gravitational pull. This dominant gravity keeps planets, asteroids, and comets in orbit.
41. D — The Moon keeps one side facing Earth because it rotates once on its axis in the same time it takes to revolve once around Earth, a state called synchronous rotation. This matched timing, not a lack of rotation, is why the far side stays hidden.
42. B — Apparent magnitude is how bright a star looks from Earth, while absolute magnitude is how bright it would appear at a standard distance, reflecting its true luminosity. Separating the two distinguishes how bright a star seems from how bright it actually is.
43. A — Neptune, the most distant planet, has the longest orbital period because planets farther from the Sun travel longer paths at slower speeds, as Kepler's laws describe. Greater distance therefore means a much longer year.
44. D — A meteorite is the fragment that survives passage through the atmosphere and reaches the ground, distinct from the meteoroid in space and the meteor streak in the sky. Using the right term depends on where the object is in its journey.
45. C — The Milky Way is a spiral galaxy, identified by its flattened disk, central bulge, and curving arms winding outward. Classifying galaxies by shape places the Milky Way among the spirals rather than the elliptical or irregular types.
46. A — Current evidence, including the universe's observed expansion and the cosmic microwave background, places the Big Bang about 13.8 billion years ago. This age is far older than the Sun and dwarfs any figure from a young-universe view.
47. B — Dried riverbeds, channels, and water-formed minerals on Mars indicate that liquid water once flowed across its surface in the distant past, even though the surface is now dry. These features are key evidence for a wetter early Mars.
48. D — Elements heavier than hydrogen and helium were forged by nuclear fusion inside stars and dispersed into space when massive stars exploded as supernovae. This stellar nucleosynthesis is the origin of the carbon, oxygen, and other heavy atoms now found in planets and living things.
49. C — Ranking the importance of cost, safety, and construction time helps the team make trade-offs and select the design that best balances its most important goals. Prioritizing criteria is essential when no single design is best in every category.
50. A — Engineers and scientists should evaluate the sweeping claim critically by testing the design and examining the evidence, since no real-world design performs perfectly under all conditions. Skeptical, evidence-based evaluation guards against accepting overstated performance claims.