SHAPING OF THE EARTH'S SURFACE

Class 09 - Social Science (Understanding Society)

Time Allowed: 1 hour and 28 minutes **Maximum Marks: 152**

1. A "Mushroom Rock" is a unique landform typically found in deserts. Which agent of gradation is primarily responsible for its formation? **[1]**

   a) Wind
   b) Sea waves
   c) Moving ice (Glaciers)
   d) Running water (Rivers)

2. Which of the following is NOT listed as a factor influencing the weathering process? **[1]**

   a) Magnetic fields
   b) Change in temperature and pressure
   c) Air loaded with sand
   d) Action of water

3. While looking at a world map, which tectonic plate would you identify as being almost entirely oceanic? **[1]**

   a) African Plate
   b) Eurasian Plate
   c) Pacific Plate
   d) Indo-Australian Plate

4. What is the primary cause of a Glacial Lake Outburst Flood (GLOF)? **[1]**

   a) Tectonic plates sliding past each other
   b) The failure of a natural dam (moraine) containing a glacial lake
   c) Excessive wind erosion in arid regions
   d) Deposition of sand by sea currents

5. What is the process called when water in rock cracks freezes, expands, and widens the cracks, ultimately breaking the rocks? **[1]**

   a) Exfoliation
   b) Frost-action
   c) Chemical weathering
   d) Pressure release

6. What is the innermost shell of the Earth called? **[1]**

   a) Inner core
   b) Crust
   c) Mantle
   d) Outer core

7. Stacks, Stumps, and Sea Caves are prominent landforms created by the erosional activity of: **[1]**

   a) Glaciers
   b) Underground water
   c) Sea waves and currents
   d) Wind

8. Sudden movements within the Earth’s crust caused by the release of energy along a fault line result in: **[1]**

   a) Weathering
   b) Glacial Lake Outburst Floods
   c) Earthquakes
   d) Dust storms

9. At what rate does the temperature rise as one moves down the Earth's surface? **[1]**

a) $1^{O}C$ for every 10 meters
b) $1^{O}C$ for every 100 meters
c) $1^{O}C$ for every 50 meters
d) $1^{O}C$ for every 32 meters

10. Which of the following internal Earth layers is primarily responsible for driving tectonic movements through processes like mantle convection? **[1]**

a) Crust
b) Mantle
c) Inner core
d) Outer core

11. What is the definition of erosion? **[1]**

a) The dissolution of minerals in rocks by water.
b) The breaking down of rocks in place.
c) The carrying away of weathered particles.
d) The gradual movement of bulk soil and rock debris.

12. What is the name of the single landmass that Alfred Wegener suggested all continents were once joined together as? **[1]**

a) Laurasia
b) Pangaea
c) Gondwanaland
d) Columbia

13. Which of the following processes works beneath the earth's crust? **[1]**

a) Erosion
b) Weathering
c) Volcanic activity
d) Mass movements

14. Which type of weathering involves the disintegration of rocks without any change in their chemical composition? **[1]**

a) Chemical weathering
b) Physical weathering
c) Oxidation weathering
d) Biological weathering

15. What is another common name for a plateau, which is described as a broad and more or less level stretch of upland that rises sharply above the neighboring lowland? **[1]**

a) Ridge
b) Basin
c) Valley
d) Tableland

16. Which type of mountains are created due to internal movements in the earth, where crustal folds result from the cooling and contracting of molten magma? **[1]**

a) Volcanic Mountains
b) Block Mountains
c) Erosional Mountains
d) Fold Mountains

17. The formation of cavities, sinkholes, and caverns in rocks due to the dissolution of certain minerals by water or air is characteristic of which type of weathering? **[1]**

a) Physical weathering
b) Chemical weathering
c) Biological weathering
d) Mechanical weathering

18. What is the term for natural processes that occur gradually on the Earth's surface? **[1]**

a) External processes
b) Internal processes

c) Tectonic activities
d) Subterranean processes

19. What are the three main types of plate boundaries described in the modern Plate Tectonic Theory? **[1]**

a) Divergent, convergent, and transform
b) Convergent, divergent, and subduction
c) Rifting, spreading, and uplifting
d) Erosional, depositional, and transform

20. The process where rocks are broken down into smaller fragments due to temperature changes or frost action, without changing their chemical composition, is known as: **[1]**

a) Erosion
b) Chemical Weathering
c) Biological Weathering
d) Mechanical (Physical) Weathering

21. According to the Theory of Plate Tectonics, the Earth's crust is divided into several large and small plates. Which layer of the Earth do these plates float upon? **[1]**

a) The semi-molten Asthenosphere
b) The liquid Outer Core
c) The solid Inner Core
d) The rigid Lower Mantle

22. The Pamir and Himalayan ranges in Asia, the Alpine mountain ranges in Europe, the Rockies in North America, and the Andes in South America are examples of which major landform? **[1]**

a) Mountains
b) Deserts
c) Plains
d) Plateaus

23. The Rhine Valley and the Vosges Mountains are examples associated with the formation of which type of mountains? **[1]**

a) Young Mountains
b) Block Mountains
c) Volcanic Mountains
d) Fold Mountains

24. Which layer of the Earth is about 2,900 km thick? **[1]**

a) Inner Core
b) Outer Core
c) Crust
d) Mantle

25. Which of the following landforms is a result of the depositional work of a river? **[1]**

a) Delta
b) Meander
c) Waterfall
d) V-shaped Valley

26. Match the items in List I with those in List II. **[1]**

List I	**List II**
(A) Crust	(I) Nickel and iron
(B) Mantle	(II) 5 to 70 km thick
(C) Outer core	(III) About 2,900 km thick
(D) Inner core	(IV) Mainly iron, liquid state

a) A-II, B-III, C-IV, D-I
b) A-II, B-IV, C-III, D-I

c) A-I, B-III, C-II, D-IV

d) A-IV, B-II, C-I, D-III

27. Match the items in List I with those List II. **[1]**

List I	List II
(A) Pangaea	(I) Mid-ocean ridges
(B) Seafloor spreading	(II) 1912
(C) Continental Drift Theory year	(III) Single landmass
(D) Asthenosphere	(IV) Semi-fluid layer

a) A-IV, B-III, C-I, D-II

b) A-I, B-II, C-IV, D-III

c) A-II, B-I, C-III, D-IV

d) A-III, B-I, C-II, D-IV

28. Match the items in List I with those in List II. **[1]**

List I	List II
(A) Fold Mountains	(I) Andes
(B) Block Mountains	(II) Himalayas
(C) Volcanic Mountains	(III) Rhine Valley
(D) Young Mountains	(IV) Mt. Fujiyama

a) A-I, B-II, C-III, D-IV

b) A-II, B-III, C-IV, D-I

c) A-IV, B-II, C-I, D-III

d) A-III, B-I, C-II, D-IV

29. Match the items in List I with those List II. **[1]**

List I	List II
(A) Weathering	(I) Carrying weathered particles away
(B) Erosion	(II) Rocks broken into smaller pieces in situ
(C) Mass Movements	(III) Underground water dissolving rocks
(D) Rainwater Agent	(IV) Gravity-driven material flow

a) A-II, B-I, C-IV, D-III

b) A-IV, B-III, C-II, D-I

c) A-III, B-IV, C-I, D-II

d) A-I, B-II, C-IV, D-III

30. Match the items in List I with those List II. **[1]**

List I	List II
(A) Physical Weathering	(I) Mass of ice on mountains
(B) Chemical Weathering	(II) Landslides, earth flows
(C) Glaciers	(III) Exfoliation, frost-action
(D) Mass Movements	(IV) Cavities, sinkholes

a) A-III, B-IV, C-I, D-II

b) A-I, B-II, C-IV, D-III

c) A-IV, B-III, C-I, D-II

d) A-II, B-I, C-III, D-IV

31. Match the items in List I with those in List II. **[1]**

List I	List II
(A) Mohorovicic Discontinuity	(I) Layer composed of nickel and iron
(B) Inner core characteristic	(II) Delineates crust from mantle
(C) Temperature increase rate	(III) 1°C for every 32 meters
(D) Outer core composition	(IV) Mainly iron, liquid state

a) A-IV, B-II, C-I, D-III
b) A-II, B-I, C-III, D-IV
c) A-I, B-III, C-IV, D-II
d) A-III, B-I, C-II, D-IV

32. **Assertion (A):** Landslides, earth flows, and mud flows are all types of mass movements. **[1]**
Reason (R): These movements are primarily caused by gravity pulling materials downwards.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

33. **Assertion (A):** Plate tectonics is crucial for understanding Earth's dynamic surface features. **[1]**
Reason (R): It explains the interactions of moving plates causing volcanism and mountain building.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

34. **Assertion (A):** Earthquake prediction is highly challenging despite scientific advancements. **[1]**
Reason (R): No instrument can yet predict the sudden outburst of seismic energy.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

35. What is the name of the supercontinent proposed by Alfred Wegener that existed before the continents drifted apart, and what specific evidence supported his idea? **[2]**
36. Describe the key components of the Earth's interior and how they collectively influence tectonic activity. **[2]**
37. Explain the role of water in the mechanical breakdown of rocks in cold environments. **[2]**
38. Explain the term 'Agents of Gradation'. **[2]**
39. Distinguish between Weathering and Erosion. **[2]**
40. Describe the distinct ways in which earthquakes and landslides are triggered, highlighting any common contributing factors. **[2]**
41. Describe how plants facilitate the breakdown of rock material. **[2]**
42. What is the primary mechanism that drives the movement of tectonic plates, and how does it relate to the Earth's internal structure? **[2]**
43. Explain how the Earth's internal structure contributes to its magnetic field, considering the composition and state of its innermost layers. **[2]**

44. Explain how understanding the causes and effects of natural disasters aids in formulating effective strategies for disaster preparedness and risk reduction. **[2]**
45. How does the formation of a delta occur in the lower course of a river? **[2]**
46. Define a Glacial Lake Outburst Flood (GLOF). **[2]**
47. Explain the role of weathering and erosion in reshaping the Earth's surface and the diverse landforms that result from these external forces. **[2]**
48. Name the three distinct types of plate boundaries described by the modern Plate Tectonic Theory, based on their interaction. **[2]**
49. Explain why early warning systems for natural hazards like avalanches and GLOFs are critical, despite the challenges in completely preventing these events. **[2]**
50. How do human activities contribute to the degradation of land surfaces? **[2]**
51. What primary geological features and activities result from the interactions of the Earth's moving lithospheric plates? **[2]**
52. Briefly describe how a 'V-shaped Valley' is formed. **[2]**
53. Explain how varying temperatures contribute to the breakdown of rocks, detailing the physical mechanisms involved. **[3]**
54. How do sea waves create 'Sea Arches' and 'Stacks'? **[3]**
55. Analyze the long-term environmental consequences of indiscriminate human building activities and deforestation on the Earth's surface. **[3]**
56. Discuss two reasons why life in mountain regions is considered challenging, contrasting it with the advantages of inhabiting plain regions. **[3]**
57. Explain how the interaction between internal and external forces collectively shapes the Earth's surface and influences natural phenomena. **[3]**
58. Identify two distinct types of glaciers based on their size and movement characteristics. **[3]**
59. Explain the 'Convergent Boundary' of tectonic plates and the landforms associated with it. **[3]**
60. How do biological elements, specifically plants and animals, contribute to the process of rock disintegration? **[3]**
61. Describe the characteristic layering of Earth's interior and briefly explain the primary distinction between any two of these layers based on their composition or physical state. **[3]**
62. Analyze the statement: 'The surface of the earth is neither even nor regular.' How do the major landforms (mountains, plateaus, and plains) provide evidence for this assertion, and what are the primary forces contributing to this unevenness? **[3]**
63. Locate the following tectonic plates on a world map. **[3]**
    A. Pacific Plate
    B. North American Plate
    C. South American Plate
64. Locate the following tectonic plates on a world map. **[3]**
    A. Indo-Australian Plate
    B. African Plate
    C. Pacific Plate
65. On the outline map of the World **[3]**

(a) Mark and label the **Indian Plate**.

(b) Mark and label the **Eurasian Plate**.

(c) Draw and label the **collision zone between the Indian Plate and the Eurasian Plate**,

66. On the outline map of the World **[3]**

(a) Mark and label the **Pacific Plate**, the largest tectonic plate on Earth.

(b) Mark and label the **North American Plate**.

(c) Draw and label the **boundary between the Pacific Plate and the North American Plate**

67. Locate the following tectonic plates on a world map. **[3]**

A. African Plate

B. Eurasian Plate

C. Antarctic Plate

68. **Read the given source carefully and answer the questions that follow:** **[4]**

Rocks exposed to the atmosphere undergo constant in situ breakdown through three distinct mechanical and chemical categories: physical, chemical, and biological weathering. Physical weathering modifies the structural layout of rocks without altering their foundational chemical composition. This is frequently observed in arid landscapes where rapid diurnal temperature fluctuations cause the outer layers of granitic rocks to expand during the day and contract rapidly at night, leading to a peeling phenomenon known as exfoliation. In cold alpine climates, physical disintegration is dominated by frost-action, where water fills rock fractures, freezes, and exerts immense outward pressure as it expands. Conversely, chemical weathering alters the rock material itself as water dissolves soluble minerals like rock-salt or limestone, creating subsurface cavities, caverns, and sinkholes that eventually destabilize the rock under its own weight. Finally, biological weathering introduces organic factors; burrowing animals loosen subterranean materials, while plant roots physically wedge open cracks and secrete acidic organic juices that chemically corrode mineral matrices.

Questions:

a. What specialized term describes the physical peeling away of a rock's outer layers due to alternating day-and-night temperature changes? **(1)**

b. Which specific type of weathering alters the internal mineral structure of rocks, resulting in subsurface features like caverns and sinkholes? **(1)**

c. Analyze how physical frost-action and biological root growth collaborate mechanically to accelerate the destruction of solid rock faces. **(2)**

69. **Read the given source carefully and answer the questions that follow:** **[4]**

The conceptual evolution of modern geology relies heavily on a sequence of historical hypotheses that gradually unveiled how the Earth's surface deforms. In 1912, Alfred Wegener introduced the Continental Drift Theory, proposing that global landmasses were originally aggregated into a singular supercontinent named Pangaea before separating. While Wegener supplied compelling empirical evidence through matching geographical coastlines, identical fossil distributions, and synchronized rock strata across vast oceans, he was unable to clarify the exact physical mechanism responsible for propelling solid continents across the globe. This major conceptual gap was filled during the 1950s by Harry Hess and Robert S. Dietz through their Seafloor Spreading Theory. They demonstrated that volcanic activity along mid-ocean ridges

continuously introduces fresh magma which cools to form new oceanic crust, systematically pushing older crust away from the ridge crests. Today, modern Plate Tectonic Theory integrates these milestones, establishing a comprehensive framework that explains how both continental and oceanic plates interact along divergent, convergent, and transform boundaries.

Questions:

a. Name the researcher who initially conceptualized that all modern continents were originally unified within a single supercontinent. **(1)**

b. What vital geological mechanism was missing from the Continental Drift Theory that was later explained by the Seafloor Spreading Theory? **(1)**

c. Analyze how the interaction of tectonic plates along their three distinct boundary types validates the modern Plate Tectonic Theory. **(2)**

70. **Read the given source carefully and answer the questions that follow:** **[4]**

The Earth behaves as a dynamic planetary system continually reshaped by internal and external mechanical forces. Geologically, the rigid outer crust and the uppermost solid portion of the mantle form a unified structural layer known as the lithosphere. This outer shell is fractured into numerous large and small segments termed tectonic plates, which slide horizontally over a highly ductile, semi-fluid zone of the upper mantle called the asthenosphere. The horizontal movement of these massive blocks is primarily driven by deep-seated thermal convection currents operating within the mantle, where intense heat originating from the core causes hot material to rise and cooler mass to sink recursively. This continuous, slow circulation generates structural instabilities along plate boundaries where plates actively diverge, converge, or slide laterally past one another. The mechanical stresses accumulating at these geological boundaries are directly responsible for producing catastrophic natural phenomena, including powerful earthquakes, explosive volcanic eruptions, deep ocean trenches, and high mountain ranges.

Questions:

a. Identify the two distinct components of the Earth's interior that collectively comprise the lithosphere and name the semi-fluid layer directly beneath it. **(1)**

b. Explain how thermal energy originating from the Earth’s core actively drives the horizontal movement of tectonic plates across the planetary surface. **(1)**

c. Differentiate between the mechanical behaviors occurring at divergent and convergent plate boundaries, and analyze how these contrasting interactions create distinct topographical features on the Earth's surface. **(2)**

71. Discuss the causes and impacts of Dust Storms. Suggest three mitigation strategies to reduce their intensity. **[5]**

72. Evaluate the effectiveness of modern scientific advancements in mitigating earthquake risks, considering both predictability and structural resilience. **[5]**

73. Describe the distinct roles of weathering and erosion in reshaping the Earth's landscape, providing examples of how different agents of gradation contribute to these processes. **[5]**

74. How do changes in temperature and pressure contribute to the disintegration of rocks over time? **[5]**

75. Analyze the internal structure of the Earth with the help of a neat diagram. Mention the characteristics of each layer. **[5]**

Solution
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1. **(a)** Wind
Explanation:
Wind

2. **(a)** Magnetic fields
Explanation:
Magnetic fields are not listed as a factor influencing the weathering process. The listed factors are change in temperature and pressure, action of water, air loaded with sand, plant roots, and actions of animals and humans.

3. **(c)** Pacific Plate
Explanation:
Pacific Plate

4. **(b)** The failure of a natural dam (moraine) containing a glacial lake
Explanation:
The failure of a natural dam (moraine) containing a glacial lake

5. **(b)** Frost-action
Explanation:
When water in the cracks of rocks freezes and expands, leading to the development of cracks and eventual breakage of rocks, it is called frost-action.

6. **(a)** Inner core
Explanation:
The innermost shell is called the inner core.

7. **(c)** Sea waves and currents
Explanation:
Sea waves and currents

8. **(c)** Earthquakes
Explanation:
Earthquakes

9. **(d)** $1^{o}C$ for every 32 meters
Explanation:
If one were to move down the Earth's surface, there will be a rise in temperature at the rate of $1^{o}C$ for every 32 meters.

10. **(b)** Mantle
Explanation:

The mantle is the internal layer of the Earth where convection currents are generated, which in turn drive the movement of tectonic plates.

11. **(c)** The carrying away of weathered particles.
Explanation:
Erosion is defined as the act of carrying away the weathered particles from one place to another.

12. **(b)** Pangaea
Explanation:
Alfred Wegener proposed that all continents were once united in a supercontinent named Pangaea.

13. **(c)** Volcanic activity
Explanation:
Volcanic activity is one of the processes mentioned that works beneath the earth's crust.

14. **(b)** Physical weathering
Explanation:
Physical weathering occurs when the disintegration of rocks takes place without any change in their chemical composition.

15. **(d)** Tableland
Explanation:
A plateau is also called a tableland, as it's a broad, level stretch of upland.

16. **(d)** Fold Mountains
Explanation:
Fold Mountains are explicitly described as being created due to internal movements in the earth, resulting from the cooling and contracting of molten magma that causes crustal folds.

17. **(b)** Chemical weathering
Explanation:
Chemical weathering is characterized by the chemical reaction of water or air dissolving portions of rocks, producing features like cavities, sinkholes, and caverns.

18. **(a)** External processes
Explanation:
Natural processes which take place gradually on the surface of the earth are called external processes.

19. **(a)** Divergent, convergent, and transform
Explanation:
The modern Plate Tectonic Theory describes three types of plate boundaries: divergent (plates move apart), convergent (plates collide), and transform (plates slide past each other).

20. **(d)** Mechanical (Physical) Weathering

Explanation:
Mechanical (Physical) Weathering

21. **(a)** The semi-molten Asthenosphere
Explanation:
The semi-molten Asthenosphere

22. **(a)** Mountains
Explanation:
The Pamir, Himalayan, Alpine, Rocky, and Andes ranges are all major mountain ranges found on different continents. Therefore, they are examples of the landform called mountains.

23. **(b)** Block Mountains
Explanation:
Block Mountains are created when large masses of land are broken and displaced vertically, and the Rhine Valley and Vosges Mountains are cited as examples of such a system.

24. **(d)** Mantle
Explanation:
The mantle is a thicker layer of rocks whose average thickness is about 2,900 km.

25. **(a)** Delta
Explanation:
Delta

26. **(a)** A-II, B-III, C-IV, D-I
Explanation:
- Crust: Earth's outermost layer, about 5-70 km thick.
- Mantle: Lies below the crust and is about 2,900 km thick.
- Outer core: Composed mainly of liquid iron and nickel.
- Inner core: Consists mainly of iron and nickel in a solid state due to immense pressure.

27. **(d)** A-III, B-I, C-II, D-IV
Explanation:
Pangaea was described as a single landmass. Seafloor spreading occurs at mid-ocean ridges. The Continental Drift Theory was proposed in 1912. The asthenosphere is a semi-fluid layer.

28. **(b)** A-II, B-III, C-IV, D-I
Explanation:
- Fold Mountains are formed by compression and folding of rock layers; the Himalayas are a classic example.
- Block Mountains are formed by faulting; the Rhine Valley region is associated with block mountain formation.
- Volcanic Mountains are built by volcanic activity; Mt. Fujiyama (Mount Fuji) is a famous example.
- Young Mountains are geologically recent mountains; the Andes are among the world's young fold mountains.

29. **(a)** A-II, B-I, C-IV, D-III
Explanation:
Weathering refers to rocks breaking into smaller pieces in the same place. Erosion is the act of carrying away these particles. Mass Movements are driven by gravity. Rainwater as an agent of

denudation involves underground water dissolving rocks.

30. **(a)** A-III, B-IV, C-I, D-II
Explanation:
Physical weathering involves mechanical breakdown like exfoliation and frost-action. Chemical weathering creates features like cavities and sinkholes. Glaciers are moving masses of ice on mountains. Mass movements include phenomena like landslides and earth flows.

31. **(b)** A-II, B-I, C-III, D-IV
Explanation:
- Mohorovicic Discontinuity (Moho) is the boundary between the crust and mantle.
- The inner core is mainly composed of nickel and iron and is solid.
- Inside the Earth, temperature generally increases by about 1°C for every 32 m of depth (average geothermal gradient near the surface).
- The outer core consists mainly of liquid iron (with some nickel), giving rise to Earth's magnetic field.

32. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
Gravity is the fundamental force responsible for initiating and driving all forms of mass movements, including landslides, earth flows, and mud flows.

33. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
Plate tectonics indeed explains how the movement and interaction of lithospheric plates lead to volcanic activity and mountain formation, thus confirming its importance in understanding Earth's dynamic surface.

34. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
The passage states that man has not yet been able to invent any instrument to predict the sudden outburst of energy, making earthquakes 'sudden-onset hazards'.

35. Alfred Wegener proposed the supercontinent Pangaea, suggesting all continents were once a single landmass. His concept of continental drift was supported by evidence including matching coastlines of continents, the distribution of similar fossils across different landmasses, and comparable rock formations found on widely separated continents, indicating a past connection.
36. The Earth's interior consists of the crust, mantle, outer core, and inner core. The mantle, a semi-fluid layer, is crucial for tectonic activity due to the process of mantle convection. Heat from the Earth's core drives these convection currents, causing hot material to rise and cooler material to sink. This circular motion exerts drag and push on the overlying lithospheric plates, thereby driving their movement and subsequent tectonic events.
37. In cold environments, water seeps into cracks and pores within rocks. When temperatures drop below freezing, this water transforms into ice and expands. This expansion exerts significant pressure on the rock, widening the cracks. Repeated cycles of freezing and thawing, known as frost-action, lead to the progressive disintegration of the rock into smaller fragments.
38. Agents of gradation are natural forces that continuously wear down the Earth’s surface through erosion and deposition. These agents help in reducing uneven landforms and creating a more level surface over time. Running water, glaciers, wind, and sea waves are the main agents of gradation that shape and modify the Earth’s landscape.
39. Weathering is the process in which rocks are broken down at the same place by natural forces such as temperature changes, water, and plant roots. It is a static process because the materials remain in place. Erosion, on the other hand, involves the removal and transportation of weathered materials by agents like rivers, wind, glaciers, and sea waves.
40. Earthquakes originate from the sudden shift of the Earth's tectonic plates, causing violent ground shaking due to the release of accumulated energy. Landslides, conversely, involve the rapid downward

movement of soil, rock, or snow on a slope. While often triggered by heavy rainfall, temperature changes, or ground saturation leading to instability, they can also be initiated by seismic activity. Therefore, a common contributing factor is an earthquake, which can destabilize slopes and subsequently induce landslides.

41. Plants contribute to rock breakdown in two primary ways. Firstly, their roots, especially those growing deep into rock cracks, exert mechanical pressure as they expand, widening the fissures and breaking the rock. Secondly, plant roots can produce acidic juices that chemically react with and dissolve rock material, further contributing to its slow disintegration.
42. The primary mechanism driving tectonic plate movement is mantle convection. Heat generated within the Earth's core causes material in the mantle to form convection currents. Hot, less dense material rises towards the surface, cools, becomes denser, and then sinks. This continuous circulation creates a viscous drag and push beneath the lithospheric plates, causing them to move horizontally across the asthenosphere, leading to various geological phenomena.
43. The Earth's magnetic field is influenced by the composition of its core. The core is largely made up of metals, specifically iron in the outer core (in a liquid state) and nickel and iron in the inner core. The presence and movement of these metallic elements, particularly in the liquid outer core, are believed by scientists to generate the geodynamo effect, which in turn produces the Earth's magnetic field.
44. Understanding the causes and effects of natural disasters helps governments and communities identify vulnerable areas and potential risks. This knowledge enables better planning, such as developing early warning systems, constructing disaster-resistant infrastructure, and preparing evacuation plans. It also promotes public awareness and efficient resource management. As a result, loss of life, property damage, and economic disruption can be significantly reduced, improving overall disaster preparedness and resilience.
45. In the lower course, as the river approaches the sea, its speed slows down considerably, making it unable to carry its sediment load. This leads to rapid deposition, causing the riverbed to rise. The river then divides into multiple channels, called distributaries, before entering the sea. The accumulated alluvial deposits form fertile landforms known as deltas.
46. A Glacial Lake Outburst Flood (GLOF) is a sudden and massive release of water from a lake formed by melting glaciers. It usually occurs when the natural dam made of ice or moraine breaks due to pressure, earthquakes, or heavy rainfall. GLOFs can cause severe flooding, destruction of property, and loss of life in nearby areas.
47. Weathering is the process of breaking down rocks into smaller fragments without transport, while erosion involves the transportation of these weathered materials. Agents like rivers, wind, glaciers, and waves carry these particles, depositing them elsewhere. This continuous cycle sculpts the landscape, forming distinct features such as river valleys, glacial valleys, and sand dunes in deserts, demonstrating the intricate connection between these forces and landform creation.
48. The modern Plate Tectonic Theory identifies three distinct types of plate boundaries based on their interaction: divergent boundaries, where plates move apart from each other; convergent boundaries, where plates collide; and transform boundaries, where plates slide horizontally past each other. Each type of boundary is associated with specific geological phenomena.
49. Early warning systems are crucial for managing the risks associated with natural hazards like avalanches and GLOFs, even if complete prevention is impossible. For avalanches, predictable factors like heavy snowfall and temperature changes can be monitored to assess instability, allowing for timely warnings and controlled triggering to prevent larger, more dangerous events. Similarly, for GLOFs, monitoring glacial lake water levels and dam integrity, combined with downstream sensors, enables alerts for rapid water release. Such systems provide valuable time for evacuation, reducing loss of life and mitigating property damage.
50. Human activities degrade land surfaces in various ways. Indiscriminate tree cutting leads to wasteland formation and reduced rainfall. Uncontrolled construction projects consume land and degrade surrounding areas. The discharge of dirty and poisonous industrial effluents contaminates and renders land unusable. Additionally, the unregulated dumping of city waste significantly degrades land.
51. The interactions of the Earth's moving lithospheric plates primarily lead to earthquakes, volcanic activity, and the formation of mountains and ocean basins. These phenomena directly reflect the dynamic

nature of plate boundaries, where plates converge, diverge, or slide past each other, releasing immense energy and shaping the planet's surface over geological timescales.

52. A V-shaped valley is formed by the action of a river during its youthful stage or upper course. In this stage, the river flows swiftly and cuts deeply into the mountain floor through vertical erosion. As the river erodes downward, the valley sides become steep, forming a narrow valley shaped like the letter “V”.
53. Varying temperatures lead to rock breakdown primarily through expansion and contraction. Continuous heating during the day causes the outer layers of rocks to expand, while rapid cooling at night makes them contract. This repeated stress loosens the outer parts, causing them to peel off in a process called exfoliation, common in rocks like granite. Additionally, water freezing in rock cracks expands, widening these fissures, and repeated freezing and thawing cycles gradually disintegrate the rock through frost action.
54. Sea waves continuously strike coastal rocks, creating cracks that gradually widen into sea caves through erosion. When erosion cuts through both sides of a headland, a sea arch is formed. Over time, the roof of the arch collapses due to continuous wave action, leaving behind an isolated vertical rock called a stack.
55. Indiscriminate human building activities and deforestation have profound long-term environmental consequences. Deforestation leads to land degradation by removing vegetation cover, which is crucial for soil stability and moisture retention. Without trees, rainfall decreases, increasing the risk of desertification and soil erosion. Building activities not only consume fertile land but also contribute to landscape degradation by altering natural drainage patterns and increasing surface runoff. Both activities can lead to habitat loss, reduced biodiversity, increased frequency and intensity of natural disasters like landslides, and diminished capacity of ecosystems to provide essential services, ultimately impacting human well-being and environmental sustainability.
56. Life in mountain regions is challenging primarily due to the hard and rocky terrain, which significantly impedes the construction of essential infrastructure like roads and railway lines. Additionally, the climate in these areas is often very harsh, making survival difficult. In contrast, plain regions, with their relatively flat and low-lying expanses, are highly suitable for human habitation. River deposits in plains create very fertile soil, making them ideal for agriculture and supporting dense populations. The ease of construction and more hospitable climate further enhance their appeal for human settlements.
57. The Earth's surface is shaped by a continuous interplay of internal (endogenic) and external (exogenic) forces. Internal forces, such as plate tectonics driven by mantle convection, are responsible for large-scale features like mountain ranges, ocean basins, and volcanic activity. External forces, including weathering and erosion by agents like rivers, wind, and glaciers, then modify these features by breaking down and transporting materials. This combined action creates diverse landforms and also leads to natural disasters such as earthquakes from plate collisions, and landslides or floods exacerbated by landform development and weather patterns, demonstrating the Earth's dynamic equilibrium.
58. Two distinct types of glaciers are **valley glaciers** and **continental glaciers**. Valley glaciers are smaller ice masses that move slowly through mountain valleys under the influence of gravity. They carve valleys and transport rock debris. Continental glaciers, also called ice sheets, are vast ice masses that cover large land areas and move outward in all directions from their center. Both play an important role in shaping the Earth's surface.
59. A convergent boundary is formed when two tectonic plates move toward each other. In many cases, one plate is forced beneath the other in a process called subduction. This movement creates intense pressure, leading to earthquakes, volcanic activity, and the formation of fold mountains such as the Himalayas.
60. Biological elements contribute to rock disintegration through various actions. Plant roots growing into rock cracks exert mechanical pressure, widening them and eventually breaking the rock. These roots can also release acidic juices that chemically alter and decompose the rock material. Animals, especially burrowing types like rabbits and rats, create tunnels and disturb soil, weakening rock structures. Even human activities, through mechanical actions, can contribute to breaking down rocks.
61. Earth's interior is structured into distinct concentric layers: the crust, mantle, and core. The crust is the outermost, solid, and thinnest layer, varying from 5 to 40 km in thickness and composed of diverse rocks. The mantle, beneath the crust, is a thicker layer of rocks, approximately 2,900 km thick, with

increasing density with depth. The innermost part is the core, about 3,500 km thick and the densest layer, made of metals. A key distinction is between the crust, which is relatively thin and comprises all continents and oceans, sustaining life, and the mantle, which is significantly thicker and characterized by its increasing density with depth, separating from the crust by the Mohorovicic Discontinuity.

62. The statement is strongly supported by the existence and characteristics of mountains, plateaus, and plains. Mountains, like the high, sharply sloping Himalayas or the rounded Appalachians, demonstrate significant vertical variations and ruggedness. Plateaus, such as the elevated Deccan or Tibet plateaus, introduce broad, flat uplands that rise sharply above surrounding lowlands, creating pronounced steps in the landscape. Plains, though relatively flat, still exhibit subtle undulations or vast expanses that contrast sharply with mountainous or plateau regions. The primary forces contributing to this unevenness include internal earth movements like folding and faulting, responsible for mountains, and external processes like erosion and deposition by wind and water, which sculpt and flatten areas over geological timescales.
63. Do it yourself.
64. Do it yourself.
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67. Do it yourself.
68. a. The specialized term for this peeling process is exfoliation.
    b. The process that alters internal mineral structures to produce cavities and caverns is chemical weathering.
    c. Both processes rely on mechanical wedging. Physical frost-action expands water inside rock fractures during freezing cycles to widen the gaps. Biological root growth exploits these weakened cracks, pushing deeper into the rock and exerting continuous structural pressure alongside acidic secretions, causing the solid rock to split apart much faster.
69. a. The researcher who initially proposed the unified supercontinent (Pangaea) was Alfred Wegener in 1912.
    b. The missing mechanism was the physical explanation of how the crust actually moved. The Seafloor Spreading Theory provided this by demonstrating that upwelling magma at mid-ocean ridges forms new crust, which systematically pushes older crustal layers away.
    c. The modern theory successfully unifies continental drift and seafloor spreading by classifying plate movements into three dynamic boundaries: divergent (moving apart), convergent (colliding), and transform (sliding past each other). This explains all major global surface changes-such as mountain building, trench formation, and seismic activity-within a single, verified framework.
70. a. The lithosphere is collectively composed of the Earth's outermost crust and the uppermost solid section of the mantle. The highly ductile, semi-fluid layer located directly underneath this rigid structural shell is formally known as the asthenosphere, over which tectonic plates slide horizontally.
    b. Intense thermal energy radiating from the core heats the lower mantle, lowering its density and causing it to rise toward the crust. As this material cools near the surface, it sinks back down, establishing a continuous circular motion known as a mantle convection current that drags the overlying plates.
    c. Divergent and convergent boundaries display opposing mechanical operations that form distinct geological landscapes. At divergent boundaries, tectonic plates move away from each other, allowing molten magma to rise, cool, and form new oceanic crust along mid-ocean ridges. Conversely, convergent boundaries involve plate collisions, where the denser plate is forced downward into the mantle through subduction, melting the rock to trigger explosive volcanic activity and creating deep ocean trenches. Alternatively, when two buoyant continental masses collide, the crust buckles upward to form immense mountain ranges.
71. Dust storms are caused by strong winds lifting loose and dry soil particles into the atmosphere. Drought, lack of vegetation, overgrazing, and poor farming practices increase soil exposure and make dust storms more frequent. These storms reduce visibility, damage crops, pollute the air, and cause respiratory diseases such as asthma and bronchitis. They also disrupt transportation and daily life. To reduce their intensity, afforestation and shelterbelts should be developed to block wind movement. Conserving soil

moisture through proper irrigation and mulching can reduce loose dust. Sustainable farming practices such as crop rotation and controlled grazing also help maintain soil stability and reduce the chances of severe dust storms.

72. Modern scientific advancements have shown varying degrees of effectiveness in mitigating earthquake risks. In terms of predictability, while geological studies have accurately mapped earthquake-prone zones globally, providing macro-level risk assessment and insights into the 'when' and 'where' of future quakes, the ability to predict the exact timing and location of a sudden-onset earthquake remains elusive. Despite research into seismic activity and potential early warning systems like sirens, precise short-term prediction is not yet a reality, limiting the immediate evacuation or preparation possible. However, significant progress has been made in structural resilience. Engineering inputs, improved building designs, and construction practices now allow for the creation of 'engineered structures' that are capable of withstanding significant ground shaking. Analysis of soil types before construction prevents building on vulnerable soft soils. Additionally, non-structural measures like public awareness campaigns and clear 'do's and don'ts' during and after an earthquake, disseminated through media, significantly enhance community preparedness and reduce panic-related damages. Therefore, while prediction remains a challenge, science has substantially improved our capacity for structural and community-level mitigation, thereby reducing the physical and human impact of earthquakes.
73. Weathering and erosion are important processes that continuously reshape the Earth's landscape. Weathering is the breakdown of rocks into smaller pieces at or near the Earth's surface without moving them. It can occur through physical, chemical, or biological processes. For example, temperature changes may crack rocks, while plant roots can break them apart. Erosion, on the other hand, involves the removal and transportation of weathered materials from one place to another. Agents of gradation such as rivers, wind, glaciers, and sea waves carry and deposit sediments. Rivers create valleys and floodplains, glaciers carve U-shaped valleys, wind forms sand dunes, and sea waves shape coastlines, collectively modifying the Earth's surface.
74. Changes in temperature and pressure contribute significantly to the disintegration of rocks through a process called physical or mechanical weathering. When rocks are exposed to high daytime temperatures and cool nights, repeated heating and cooling causes expansion and contraction. This leads to cracks and eventually breaks the rocks into smaller pieces, a process known as exfoliation. Similarly, when rocks formed under high pressure deep within the Earth are exposed at the surface, the pressure decreases suddenly, causing them to expand and fracture. This is called pressure release or unloading. Over time, these repeated stress changes weaken rocks and help them disintegrate into soil and sediments.
75. The Earth is made up of three main layers: the crust, mantle, and core. The crust is the outermost and thinnest layer, made mainly of silica and aluminium (Sial) on continents and silica and magnesium (Sima) beneath oceans. Below it lies the mantle, which is very thick and composed of dense rocks rich in iron and magnesium. The upper mantle includes the lithosphere and the semi-molten asthenosphere on which tectonic plates float. The innermost layer is the core, also called the barysphere, mainly composed of nickel and iron (Nife). The outer core is liquid, while the inner core is solid due to immense pressure. Temperature and density increase toward the Earth’s centre.