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| Question | Consider the following statements about Temperature Inversion.1. It is the increase in temperature with increasing height temporarily or locally.2. Short winter nights, cloudy sky, cold air and the presence of winds lead to temperature inversion.3. During a temperature inversion, the temperature may fall below freezing point in the valleys leading even to the occurrence of frost.Which of the above statements are correct? |
| Type | multiple-choice |
| Option | 1 and 2 |
| Option | 2 and 3 |
| Option | 1 and 3 |
| Option | 1, 2 and 3 |
| Answer | 3 |
| Solution | Long winter nights, clear skies, dry air, and the absence of winds are ideal for temperature inversion. These situations lead to rapid radiation of heat from the earth's surface and the lower layers of the atmosphere, resulting in the cooling of the air near the earth's surface. The upper layers, which lose their heat not so rapidly, are comparatively warm. Hence the normal condition in which temperature decreases with increasing height is reversed. The cooler air is nearer the earth, and the warmer air is aloft. In other words, temperature increases with increasing height temporarily or locally. This phenomenon is termed inversion of temperature. **So, Statement 1 is correct**The presence of cloudy sky traps the terrestrial radiation near the earth surface because of which it prevents the earth surface from getting cooled.Thus short winter nights and cloudy sky does not lead to Temperature Inversion. **So, Statement 2 is not correct.**During winters, the mountain slopes cool very rapidly due to the quick heat radiation. The air resting above them also becomes cold, and its density increases. Hence, it moves down the slopes and settles down in the valleys. This air pushes the comparatively warmer air of valleys upwards and leads to the phenomenon of inversion of temperature. Sometimes the temperature falls below freezing point in the valleys leading even to the occurrence of frost. **So, Statement 3 is correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | What are the disadvantages of green hydrogen as a fuel?1. Colorless and Odourless fuel, which is light in weight.2. Highly flammable fuel.3. Very high energy density, which is about 3 times of hydrocarbons.4.Hydrogen embrittlement.Choose the correct answer from the options below. |
| Type | multiple-choice |
| Option | 1 and 2 only |
| Option | 2 and 4 only |
| Option | 1 and 3 only |
| Option | 1,3 and 4 |
| Answer | 2 |
| Solution | Green hydrogen is defined as hydrogen produced by splitting water into hydrogen and oxygen using renewable electricity. It is a colorless and odorless gas.The Advantages of Green Hydrogen as a fuel are,* 100 % eco-friendly and non-polluting.
* Green hydrogen is easy to store as it is light in weight.
* It has a high energy density.
* It can be transformed into electricity or synthesis gas and has multiple
* It can be mixed with natural gas and transported through the presently available pipelines and gas infrastructures.

So, Statements 1 and 3 are not correct.The Disadvantages of Green Hydrogen as a fuel are as follows,* High cost of production.
* Highly volatile and flammable element.
* The production of green hydrogen requires more energy than other fuels.
* The problem of Hydrogen embrittlement. This is the phenomenon in which when the introduction and diffusion of hydrogen take place into the material makes the metals brittle.

So, Statements 2 and 4 are correct. |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | With reference to the Coriolis force, consider the following statement:* + 1. It is responsible for the formation of meandering in the river.
		2. It helps sustain the cyclonic circulation in the Doldrum region.
		3. It is maximum at the pole as compared to the equator and inversely proportional to the velocity of the wind.

Which of the statement given above is/are correct? |
| Type | multiple-choice |
| Option | 1 only |
| Option | 2 and 3 only |
| Option | 1 and 3 only |
| Option | 2 only |
| Answer | 1 |
| Solution | A river flows bend to Earth's surface; the Coriolis Effect adds rotation to the water's flow. The rivers of the northern hemisphere tend to erode chiefly on the right side. The Coriolis effect makes planes and air currents that travel long distances around the earth appear to move at a curve instead of a straight line.The Baer–Babinet law, sometimes called Baer's law, identifies a way in which the process of formation of rivers is influenced by the rotation of the Earth and because of the rotation of the Earth, erosion occurs mostly on the right banks of rivers in the Northern Hemisphere, and in the Southern Hemisphere on the left banks. Hence in the course of the erosion, an advance of the wave-line of the meander formation is bound to take place in the direction of the current. **So, Statement 1 is correct.**Doldrums is a region of low atmospheric pressure between five degrees north and south of the equator. The Coriolis force of this region is zero and increases with latitude. Coriolis force at 5° latitude is significant enough to create a storm [cyclonic vortex]. About 65 percent of cyclonic activity occurs between 10° and 20° latitude. The cyclonic wind movements are anti-clockwise in the northern hemisphere and clockwise in the southern hemisphere, and it is due to the Coriolis force.Because of zero Coriolis force, the Doldrums region lacks cyclone formation. **So, Statement 2 is not correct.**The magnitude of Coriolis force is directly proportional to wind speed (velocity). The higher the wind speed, the greater the deflection. The Coriolis effect is maximum at the poles and zero at the equator. Coriolis force always acts in a direction that is perpendicular to the moving object's axis.Thus, the coriolis force is not inversely but directly proportional to the velocity of the wind. **So, Statement 3 is not correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Which of the following statements about volcanoes are correct?* + 1. Volcanoes are responsible for creating more than 80 percent of the Earth's surface.
		2. A volcano that has remained dormant for decades can never become active again.
		3. Over the years, volcanic materials have formed the most fertile Earth soil. Select the correct answer using the code given below:
 |
| Type | multiple-choice |
| Option | 1 and 2 only |
| Option | 2 and 3 only |
| Option | 1 and 3 only |
| Option | 1, 2 and 3 |
| Answer | 3 |
| Solution | **OPTION ELIMINATION STRATEGY**Volcanoes that are dormant even for a century can become active again. **So, Statement 2 could be eliminated.**Volcanoes have played a key role in forming and modifying the surface of the planet Earth. More than eighty percent of the Earth's surface, above and below sea level, is of volcanic origin. Numerous volcanic eruptions have produced majestic landscapes like mountains, plateaus, and plains. **So, Statement 1 is correct.**A volcano that has remained dormant even for a century can become active again. It was witnessed in the United States on March 27, 1980. Mount St. Helens Volcano in the Cascade Range, southwesternWashington, reawakened after more than a century of dormancy and provided a dramatic and tragic reminder that there are active volcanoes in the "lower 48" States as well as in Hawaii and Alaska. Mount St. Helens is expected to remain intermittently active for months or years, possibly even decades. **So, Statement 2 is not correct.**Over the years, volcanic eruptions have caused subsequent erosion and weathering of landmasses, leading to the break-down of even the volcanic materials to form some of the most fertile soils on Earth, cultivation of which fostered and sustained civilizations. **So, Statement 3 is correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Recent discoveries of ancient rock paintings in Bargur have led to many inferences. Consider the following statements regarding Bargur cave Paintings.* + 1. These are found in the forest area of Madhya Pradesh.
		2. The paintings are monochrome in fashion with human and animal figurines.
		3. These paintings depict the worship of God during ancient times. Which of the statements given above are ***not*** correct?
 |
| Type | multiple-choice |
| Option | 1 and 2 only |
| Option | 2 and 3 only |
| Option | 1 and 3 only |
| Option | 1, 2 and 3 |
| Answer | 1 |
| Solution | Recently, over 200 prehistoric paintings were identified at a cave in the forest area of Bargur Hills in Erode district of Tamil Nadu. The painting was spotted in a collapsed cave called Rukkal Muniyappan, where the deity Muneeswar worshipped by tribal people, is found. **So, Statement 1 is not correct.**The paintings aren't monochrome (made of a single color); it is done using red ochre and white on a rock that is 30 feet high and 250 feet in length and depicts humans and animals such as deer, elephant, tiger, along with other signs and symbols. **So, Statement 2 is not correct.**In one of its cave, an anthropomorphic painting four feet high can be witnessed which looks similar to the Mother Goddess of megalithic structures that were identified in Tiruvannamalai district of Tamil Nadu. **So, Statement 3 is correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Consider the statements regarding Ocean waters:* + 1. The continuous flow of large volumes of water in a definite direction is referred to as Waves.
		2. Ocean water level is higher near the equator than at the middle latitudes.

Which of the statements given above is/are correct? |
| Type | multiple-choice |
| Option | 1 only |
| Option | 2 only |
| Option | Both 1 and 2 |
| Option | Neither 1 nor 2 |
| Answer | 2 |
| Solution | The horizontal and vertical motions are common in ocean water bodies. Horizontal motion refers to ocean currents and waves. Vertical motion refers to tides. Ocean currents are the continuous flow of a huge amount of water in a definite direction from one place to another. At the same time, waves are the horizontal motion of water, and there is no movement of water from one place to another. **So, Statement 1 is not correct.**Heating by solar energy causes the water to expand (thermal expansion of water). That is why the ocean water is about 8 cm higher near the equator than in the middle latitudes. This causes a slight gradient, and water flows down the slope. **So, Statement 2 is correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Which of the following statements about ocean currents are correct?* + 1. Cold currents are found on the west coast of the continents, both in low and higher latitudes
		2. The velocity of an ocean current is higher at the surface than at the depths.
		3. Fishing is an important economic activity in regions where warm and cold currents meet.

Select the correct answer using the code given below: |
| Type | multiple-choice |
| Option | 1 and 2 only |
| Option | 2 and 3 only |
| Option | 1 and 3 only |
| Option | 1, 2 and 3 |
| Answer | 2 |
| Solution | Those currents which flow from polar regions towards the equator have a lower surface temperature and are called cold currents.In tropical and sub-tropical latitudes of both hemispheres, these cold currents are found on the western side of the continents.But in the middle and higher latitudes of the northern hemisphere, the cold currents are found on the eastern sides of the continents.Warm currents flow parallel to the east coasts of the continents in tropical and subtropical latitudes. So, statement 1 is not correct.The strength of the ocean current is dependent on the temperature, density and salinity of ocean water. The strength of a current refers to the speed of the current. A fast current is considered strong. The higher the temperature of the water, the lower its density. The lower the density, the higher the strength or speed. A current is usually strongest at the surface and decreases in strength (speed) with depth.Hence, the Velocity of an ocean current is higher at the surfaces than at depth. So, statement 2 is correct.When the warm and cold ocean currents meet, upwelling and downwelling occur. Due to this, the nutrients in the sub-surface are bought to the surface. These nutrients encourage the growth of algae and phytoplankton, which act as food for the fish. Hence, fishes come to these regions more and breed here. So, fishing became an important economic activity in regions where warm and cold currents meet. So, statement 3 is correct. |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Consider the following statements.* + 1. The climate is characterized by warm, moist summer and cool, dry winter.
		2. Well-distributed rainfall throughout the year but maximum in June, July and August.
		3. Wet paddy or swamp rice is cultivated majorly in this type of climate.

The above features are distinct characteristics of which among the following climate? |
| Type | multiple-choice |
| Option | The Tropical Monsoon Climate |
| Option | The Warm temperate eastern margin |
| Option | The Cool temperate western margin |
| Option | The Temperate continental climate |
| Answer | 2 |
| Solution | The warm temperate eastern margin climate is characterized by a warm, moist summer & a cool, dry winter strongly modified by maritime influences. Occasionally, the penetration of cold air from the continental interiors may bring down the temperature to the freezing point, but most of the time, it is pleasantly warm.Warm Temperate Eastern Margin – Distribution Map:Rainfall graph of Warm Temperate Eastern Margin Climate:It is clear from the graph that it receives rainfall throughout the year, with the maximum amount of rainfall observed in June, July, August and September.The area under the China type of climate is the world's largest rice-growing area. The peasants grow Wet Paddy or Swamp Rice here because of the flooding water bought by the monsoon. This availability of flooding water provides the necessary irrigation, which is very much required for the growth of paddy. So, Option (b) is correct. |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Consider the following statements regarding Ocean gyres:* + 1. They are large circulations in the ocean caused due to planetary winds and the Coriolis effect.
		2. The Sargasso Sea is associated with the north Atlantic gyre and is known for its biodiversity.
		3. The Great Pacific Garbage Patch is the largest collection of marine pollutant materials associated with North Pacific gyre circulation.

Which of the statements given above are correct? |
| Type | multiple-choice |
| Option | 1 and 3 only |
| Option | 1 and 2 only |
| Option | 2 and 3 only |
| Option | 1, 2 and 3  |
| Answer | 4 |
| Solution | An ocean gyre is a large system of circular ocean currents formed by global wind patterns and forces created by Earth's rotation (Coriolis Force). The movement of the world's major ocean gyres helps drive the “ocean conveyor belt.” The ocean conveyor belt circulates ocean water around the entire planet. The ocean conveyor belt is essential for regulating temperature, salinity, and nutrient flow throughout the ocean. **So, Statement 1 is correct.**The Sargasso Sea is a fundamentally important part of the world ocean, located within the North Atlantic sub-tropical gyre with its boundaries defined by the surrounding currents.Its importance derives from a combination of physical and oceanographic structure, complex pelagic ecosystems, and its role in global ocean and earth system processes. It is home to an iconic pelagic ecosystem with the floating Sargassum seaweeds, the world's only holopelagic algae, as its cornerstone. It hosts a diverse community of associated organisms that includes ten endemic species and provides essential habitat for key life stages of a wide diversity of species, many of which are endangered or threatened.A variety of oceanographic processes impact productivity and species diversity, and the area plays a disproportionately large role in global ocean processes of oxygen production and carbon sequestration. **So, Statement 2 is correct.** The Great Pacific Garbage Patch is a collection of marine debris in the North Pacific Ocean. Also known as the Pacific trash vortex, the garbage patch is two distinct collections of debris bounded by the massive North Pacific Subtropical Gyre. **So, Statement 3 is correct** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Millets are considered the Future Super Food for India. In this context, consider the following statements about Millets production in India.* + 1. Millets are low cost and are rich in iron, calcium, magnesium, and antioxidants.
		2. They are drought-resistant crops with a short growing season and lower water requirements.
		3. Jowar is known to have the highest calcium content among all the food grains.
		4. Currently, India is the largest exporter of Millet in the world.

Which of the statements given above are correct? |
| Type | multiple-choice |
| Option | 1 and 2 |
| Option | 2 and 3 |
| Option | 3 and 4 |
| Option | 1, 2, 3 and 4 |
| Answer | 1 |
| Solution | Millets are less expensive than rice or wheat. Millets are highly nutritious, gluten-free, and rich in dietary fiber. They are rich in micronutrients, including calcium, iron, phosphorus, copper, zinc, magnesium, potassium, etc. All millets possess high antioxidant activities and play an important role in aging and metabolic diseases. So, Statement 1 is correct.Millets are highly tolerant to drought and other extreme weather conditions and are grown with low chemical inputs such as fertilizers and pesticides. They have low requirements for water and fertility when compared to other popular cereals. Millets have a short growing season and are ready to harvest about 65 days from seeding. So, Statement 2 is correct.Calcium is one of the most important minerals required by the human body that is essential for healthy bone formation. Finger millet (Ragi) is the richest source of calcium (300-350 mg/100g). So, Statement 3 is not correct.Currently, India is the fifth largest exporter of millets in the world, according to 2020 data. Major exporters of millets are the USA, Russian Federation, Ukraine, India, China, Netherlands, France, Poland, and Argentina. Nepal, UAE, and Saudi Arabia were the top three importers of millets from India in 2020-21. **So, Statement 4 is not correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Consider the following pairs: Types of lakes Associated Physical Feature1. Kettle lake - Karst region2. Oxbow lake - River meanders3. Lagoon lake - Coastal region4. Playa lake - Wind erosionHow many of the above pairs are correctly matched? |
| Type | multiple-choice |
| Option | One pair |
| Option | Two pairs |
| Option | Three pairs |
| Option | Four pairs |
| Answer | 3 |
| Solution | A kettle (also known as a kettle lake, kettle hole, or pothole) is a depression/hole in an outwash plain formed by retreating glaciers or draining floodwaters. The kettles are formed as a result of blocks of dead ice left behind by retreating glaciers, which become surrounded by sediment deposited by melt water streams as there is increased friction. In contrast, the Karst region is related to the Underground topography. **So, Pair 1 is not correct.**An oxbow lake starts as a curve, or meander, in a river. A lake forms as the river finds a different, shorter course. The meander becomes an oxbow lake along the side of the river. So, Pair 2 is correct.A lagoon is a shallow body of water protected from a larger body of water (usually the ocean) by sandbars, barrier islands, or coral reefs around the Coastal region. They are often called estuaries, sounds, bays, or even lakes. **So, Pair 3 is correct.**The playa, also called pan, flat, or dry lake**,** is a flat-bottom depression that is caused by Wind erosion and is found in interior desert basins and adjacent to coasts within arid and semi-arid regions, periodically covered by water that slowly filtrates into the groundwater system or evaporates into the atmosphere, causing the deposition of salt, sand, and mud along the bottom and around the edges of the depression. **So, Pair 4 is correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Which of the following statem |
| Type | multiple-choice |
| Option | They are high-velocity stratospheric winds present in both hemispheres. |
| Option | They shift Southwards during summer and blow in Southern Asia. |
| Option | The westerly Jet streams are more extensive and stronger during the summer season. |
| Option | Tropical Easterly Jet Stream are established during the summer season and plays an important role in the onset of the Indian monsoon. |
| Answer | 4 |
| Solution | Jet streams are the strongest high-velocity winds that blow in the atmospheric layer of the Troposphere, exactly in Tropopause and not in the Stratosphere. They occur in both the hemispheres of the Earth. So, Option (a) is not correct.The jet streams are a narrow belt of fast-blowing winds located generally at 12,000-meter height above sea level. They bring western cyclonic disturbances along with them. These cyclonic winds originate near the Mediterranean Sea and move eastwards. On their way, they collect moisture from the Persian Gulf and shed it in the North western part of India during the winter seasons. These Jet streams shift northwards during the summer season and blow in Central Asia, which helps in the onset of monsoons. So, Option (b) is not correct.Jet streams are stronger in winter in the northern and southern hemispheres because air temperature differences that drive them tend to be most pronounced due to the expansion of polar cells towards the south. For example, in India, subtropical westerly jet streams, which are more extensive and stronger, blow south of the Himalayas all through the year except in summer. The western cyclonic disturbances experienced in the north and north-western parts of the country are brought in by this westerly flow. In summer, the subtropical westerly jet stream moves north of the Himalayas with the sun's apparent movement. So, Option (c) is not correct.An easterly jet stream, called the sub-tropical easterly jet stream, blows over peninsular India, approximately over 14°N during the summer months, only after the western jet stream has withdrawn itself from the region. This easterly jet stream is held responsible for the burst of the monsoon in India. |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Among the following climatic conditions, identify the one which is ***not*** related to El-Nino circulation in the Pacific Ocean. |
| Type | multiple-choice |
| Option | More frequent hurricanes in the north Atlantic Ocean |
| Option | Higher sea surface temperature in the tropical eastern Pacific Ocean |
| Option | Dry conditions in Southeast Asian countries |
| Option | Floods in Peru and Ecuador |
| Answer | 1 |
| Solution | * The change in winds with height is referred to as vertical wind shear. Hurricane formation requires that winds be fairly uniform throughout the atmosphere. In other words, hurricanes cannot form if the vertical wind shear is too high.
* El Nino produces stronger westerly wind at upper levels of the atmosphere across the tropical Atlantic than in normal non-El Nino seasons. El Nino increases the total vertical wind shear, shearing the tops from developing storms before a healthy circulation can form. El Nino events generally suppress Atlantic hurricane activity, so fewer hurricanes than normal form in the Atlantic from August to October, the peak of Atlantic hurricane season.
* During La Nina, westerly winds high in the atmosphere weaken. La Nina results in an expanded area of low vertical wind shear, allowing more Atlantic hurricanes to develop during the La Nina events. La Nina increases the number of developing hurricanes and allows stronger hurricanes to form.
* The chances for the continental U.S. and the Caribbean Islands (North Atlantic Ocean) to experience a hurricane increase substantially during La Nina and decrease during El Nino. **So, Option (a) is not correct.**

During El Nino, the surface winds across the entire tropical Pacific are weaker than usual. Ocean temperatures in the central and eastern tropical Pacific Ocean are warmer or higher than average, and rainfall is below average over Indonesia and above average over the central or eastern Pacific. **So, Option**(b) is correct.Rising air motion (linked to storms and rainfall) increases over the central or eastern Pacific, and surface pressure there tends to be lower than average. Meanwhile, increased sinking air motion over Southeast Asian nations like Indonesia leads to higher surface pressure and dryness. **So, Option (c) is correct.**El Nino also produces widespread and sometimes severe changes in the climate. Convection above warmer surface waters brings increased precipitation. Rainfall increases drastically in Ecuador and northern Peru, contributing to coastal flooding and erosion. **So, Option (d) is correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Consider the following statement regarding soils:* + 1. Generally, plants grow well in mild alkaline soil.
		2. Adding sulfur to the soil reduces the alkalinity of the soil.
		3. Black soils are well aerated but poor in the water holding capacity.
		4. Maximum humus content is found in the subsoil region due to dead and decaying organisms.

 How many of the above statement(s) are correct? |
| Type | multiple-choice |
| Option | One statement |
| Option | Two statements |
| Option | Three statements |
| Option | Four statements |
| Answer | 1 |
| Solution | Generally, plants grow well in Loamy soil with a pH of 4 to 6 (acidic). It has a mixture of sand, clay, and soil particle known as silt and humus. It has a good water-holding capacity for the growth of plants, whereas, for alkaline soil, the pH has to be more than 7. **So, Statement 1 is not correct.**The cheapest way to lower the soil pH (alkalinity) is to add elemental sulphur to the soil. Soil bacteria change the sulphur to sulfuric acid, lowering the soil pH. If the soil pH exceeds 5.5, apply elemental sulphur (S) to decrease the soil pH to 4.5. **So, Statement 2 is correct.**Black soils (also called as Regur soil) are clayey soil in which water can be held in the tiny gaps between the clay particles. So they have less air but are heavy as they hold more water than the sandy soils. At the same time, the Sandy soil is well aerated but poor in water holding capacity due to large sand particles. **So, Statement 3 is not correct.**The uppermost horizon is generally dark in color and rich in humus and minerals. The humus makes the soil fertile and provides nutrients to growing plants. This layer is generally soft and porous and can retain more water. It is called the topsoil or the A-horizon. This provides shelter for many living organisms, such as worms, rodents, moles, and beetles. The roots of small plants are embedded entirely in the topsoil.The next layer has a lesser amount of humus but more minerals. This layer is generally harder and more compact and is called the B-horizon, the middle layer, or the subsoil. **So, Statement 4 is not correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Zmiinyi island was in the news due to the ongoing war between Ukraine and Russia. On which of the below sea is this island located? |
| Type | multiple-choice |
| Option | Caspian Sea |
| Option | Dead Sea |
| Option | Black Sea |
| Option | Azov Sea |
| Answer | 3 |
| Solution | Zmiinyi Island, also known as Snake or Serpent Island, is a small piece of rock less than 700 meters from end to end that has been described as being “X-shaped.” It is located 35 km from the coast of the Black Sea, to the east of the mouth of the Danube, and roughly southwest of the port city of Odesa and belongs to Ukraine. **So, Option (c) is correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Which of the following statement best explains the significance of the Clarion-Clipperton Zone? |
| Type | multiple-choice |
| Option | A submarine region in the Pacific Ocean is estimated to contain abundant metallic nodules. |
| Option | A convergent plate boundary near Tonga island in the Pacific Ocean. |
| Option | A dead zone resulted from oxygen depletion in oceanic water in the Gulf of Mexico. |
| Option | A disputed exclusive economic zone between Brazil and Argentina |
| Answer | 1 |
| Solution | Polymetallic nodule resources contain nickel, cobalt, manganese and copper. In the Pacific Islands region, the manganese nodule deposits with the greatest abundance and concentration of metals are found. While they occur in all oceans, the Clarion-Clipperton Fracture Zone – CCZ (a submarine region in the Pacific Ocean) deposits are among the richest, containing high grade and high abundance nodules. **So, Option (a) is correct.**The Tonga-Kermadec subduction system is an intra- oceanic convergent plate margin in the southwestern Pacific that extends 2550 km between Tonga and New Zealand. **So, Option (b) is not correct.**A dead Zone is an area of low oxygen that can kill fish and marine life near the bottom of the sea.The Gulf of Mexico dead zone is primarily caused by excess nutrient pollution from human activities in urban and agricultural areas throughout the Mississippi River watershed. When the excess nutrients reach the Gulf, they stimulate an overgrowth of algae, which eventually die and decompose,depleting oxygen as they sink to the bottom. Low oxygen levels near the bottom of the Gulf cannot support most marine life. The Gulf of Mexico dead zone occurs every summer. So, Option (c) is not correct.There is no dispute over the exclusive economic zone between Brazil and Argentina. So, Option (d) is not correct. |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Which of the following are considered natural mechanisms responsible for climate change?* + 1. Sunspots causing the difference in solar radiation
		2. Variations in distance and tilt of Earth with respect to the Sun
		3. Major volcanic eruption
		4. Changes in magnetic field strength of Earth.

Choose the correct answer from the options below: |
| Type | multiple-choice |
| Option | 1 and 3 |
| Option | 1, 2 and 4 |
| Option | 2 and 3 |
| Option | 1, 2, 3 and 4  |
| Answer | 4 |
| Solution | Sunspots are dark, planet-size regions of strong magnetic fields on the sun's surface. They can spawn eruptive disturbances such as solar flares and coronal mass ejections (CMEs). When sunspots interact with each other, they cause explosions of energy. Solar flares are large eruptions of energy coming off the Sun containing several different forms of energy: heat, magnetic energy, and ionizing radiation. The ionizing radiation released during solar flares includes x-rays and gamma rays. Thus Sunspots cause a difference in sun radiation and play a role in climate change. **So, Statement 1 is correct.**According to Milankovitch's theory, there are three changes in the Earth's orbit around the Sun —eccentricity, axial tilt, and precession.* When the Earth is closer to the Sun, our climate is warmer, and this cycle also affects the length of the seasons. The measure of a shape's deviation from being a circle, in this case, the Earth's orbit, is called ‘eccentricity.'
* The amount of solar heat that reaches the Earth's surface subsequently influences climatic patterns,

including periods of glaciation (ice ages).* Small changes in the angle of Earth's tilt and the shape of its orbit around the Sun cause changes in

climate over a span of 10,000 to 100,000 years**. So, Statement 2 is correct**.The movement of the plates also causes volcanoes and mountains to form, which can also contribute to a change in the climate. Volcanoes affect the climate through the gases and particles (ash) thrown into the atmosphere during eruptions. During major explosive volcanic eruptions, large amounts of volcanic gas, aerosol droplets, and ash are released. **So, Statement 3 is correct.**Earth's magnetic fields contribute to global warming and can cause catastrophic climate change. The magnetic field protects our planet from cosmic radiation and the charged particles emitted by our Sun. It also provides the basis for navigation with a compass. **So, Statement 4 is correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| Question | Which of the following is **not** true about the phenomenon of South Atlantic Anomaly (SAA)? |
| Type | multiple-choice |
| Option | It is the behavior of Earth's Geo-Magnetic field in an area between Africa and South America. |
| Option | The area where the Earth's inner Van Allen radiation belt comes closest to the Earth's surface. |
| Option | The SAA is the near-Earth region where the Earth’s magnetic field is strongest. |
| Option | This leads to an increased flux of energetic particles in this region. |
| Answer | 3 |
| Solution | The behavior of earth's geomagnetic field in an area between Africa and South America is being termed the 'South Atlantic Anomaly,' and it is an area where Earth's inner Van Allen radiation belt comes closest to Earth's surface, dipping down to an altitude of 200 kilometers. This leads to an increased flux of energetic particles in this region and exposes orbiting satellites to higher-than-usual radiation levels. The effect is caused by the non-concentricity of Earth and its magnetic dipole.Earth has two such belts, and sometimes others may be temporarily created. The belts are named after James Van Allen, credited with their discovery. Van Allen radiation belt is a zone of energetic charged particles, most of which originate from the solar wind, that are captured by and held around a planet by that planet's magnetosphere.The SAA is the near-Earth region where Earth's magnetic field is weakest, protecting the planet from high doses of solar wind and cosmic radiation. **So, Option (c) is not correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| --- | --- |
| Question | Which of the following is ***not*** caused due to gravitational force of Earth? |
| Type | multiple-choice |
| Option | River flow |
| Option | Landslide |
| Option | Tides |
| Option | Lahar flow |
| Answer | 3 |
| Solution | OPTION ELIMINATION STRATEGYTides are caused due to the pulling effect of the Sun and moon, where the role of Earth's GravitationalPull could be ruled out.River Water flows downwards from the mountains (most of the time, unless otherwise) because of the Gravitational Pull of the Earth. So, Option (a) is not correct.A landslide occurs because the force of gravity becomes greater than either friction or the internal strength of the rock, soil, or sediment. So, Option (b) is not correct.Tides are defined as the periodic rise and fall of the sea level once or twice a day, mainly due to the attraction of the sun and the moon.The moon's gravitational pull, to a great extent and a lesser extent, the sun's gravitational pull, are themajor causes of tides' occurrence.Another factor is centrifugal force, which is the force that acts to counterbalance gravity. Together, the gravitational pull (Moon and Sun) and the centrifugal force are responsible for creating the two major tidal bulges on the earth.The earth's gravity only keeps the water on the planet's surface. However, the moon (to an extent sun) is large enough and close enough that its gravitational force has a noticeable effect on large bodies of water on Earth. So, Option (c) is correct.Lahar is an Indonesian term that describes a hot or cold mixture of water and rock fragments flowing down the slopes of a volcano and (or) river valleys.These lahars always flow downstream because of the Gravitational Pull of the Earth. So, Option (d) is not correct. |
| Positive Marks | 1 |
| Negative Marks | 0.25 |

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| --- | --- |
| Question | A huge sunspot directly facing Earth has grown to be twice the size of Earth, and its width has doubled in just 24 hours. In this context, consider the following statements about Sunspots.* + 1. Sunspots are areas that appear dark on the surface of the Sun.
		2. They are cooler than other parts of the Sun's surface.
		3. Solar flares are a sudden explosion of energy caused by tangling, crossing or reorganizing magnetic field lines near sunspots.

Which of the statements given above are correct? |
| Type | multiple-choice |
| Option | 1 and 2 only |
| Option | 2 and 3 only |
| Option | 1 and 3 only |
| Option | 1, 2 and 3  |
| Answer | 4 |
| Solution | A Sunspot consists of a dark region called the umbra, surrounded by a lighter region known as the penumbra. The sunspots are spotted on the photosphere layer of the Sun and appear relatively dark because the surrounding surface of the Sun is about 10,000 degrees F, while the umbra is about 6,300 degrees F. **So, Statement 1 is correct.**Sunspots are areas where the magnetic field is about 2,500 times stronger than Earth's, much higher than anywhere else on the Sun. Because of the strong magnetic field, the magnetic pressure increases while the surrounding atmospheric pressure decreases. This, in turn, lowers the temperature relative to its surroundings because the concentrated magnetic field inhibits the flow of hot, new gas from the Sun's interior to the surface. Therefore, they are cooler than other parts of the Sun. **So, Statement 2 is correct.**The magnetic field lines near sunspots often tangle, cross, and reorganize. This can cause an explosion of energy called a solar flare. Solar flares release a lot of radiation into space. **So, Statement 3 is correct.** |
| Positive Marks | 1 |
| Negative Marks | 0.25 |