1. Give a brief description of the distribution and characteristics of the grasslands of the world.

Approach:

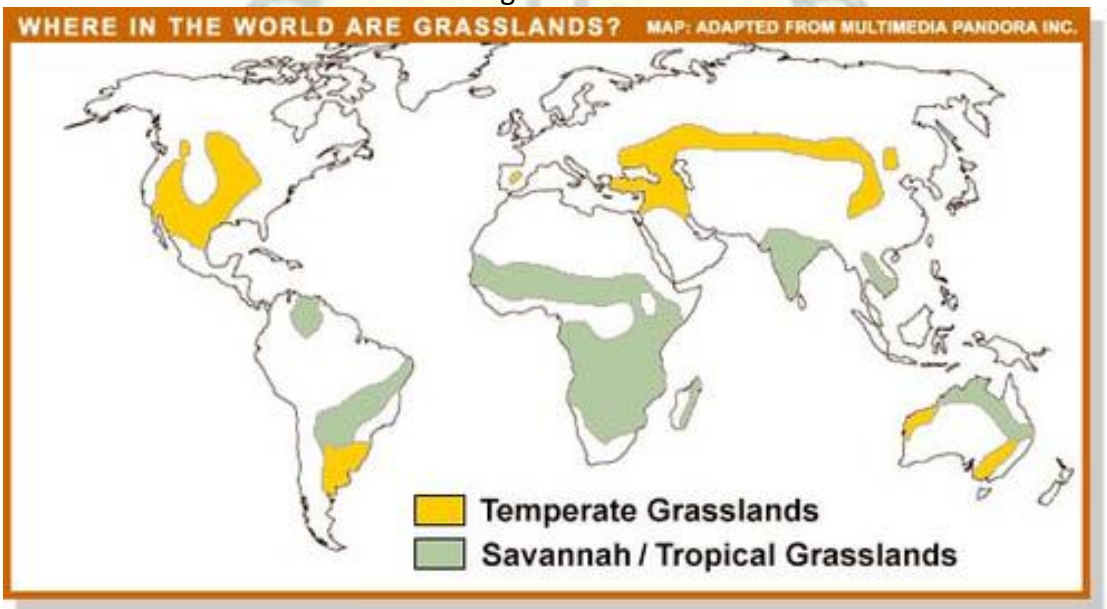
It expects students to write about – in first part write about distribution of grassland (you can also draw map) – in second part write about characteristics of grassland of world.

Introduction:

Grasslands are areas where the vegetation is dominated by grasses. However, sedge and rush can also be found along with variable proportions of legumes, like clover, and other herbs. Grasslands occur naturally on all continents except Antarctica and are found in most ecoregions of the Earth.

Body:

Distribution and characteristics of the grasslands of the world:



The grasslands of the world are classified into two categories:
Temperate Grassland Areas of Livestock:

- Temperate grasslands are widespread in temperate regions across North and South America, Oceania and South Africa. These are known as mid-latitude or temperate or intermediate grasslands.
- These grasslands are known by different names in various continents such as Steppes in Russia, Prairies in North America, Pampas in Argentina, Veld in South Africa and Downs in Southern Australia.
- Generally, these are found in areas of moderate to heavy rainfall on land once occupied by natural forest. Soils in these areas are well supplied with moisture

during much of the year, with some leaching occurring due to the percolation of excess water.

Tropical Grassland Areas of Livestock:

- Intervening between the tropical forests and the dry deserts of the trade-wind belts, occur stretches of warm country with a moderate rainfall only. Here there are very few trees but grasses of various kinds which afford abundant food to herds of grazing animals. Such Savannas include the African Sudan, the Venezuelan Lanos of the Orinoco basin, the Brazilian Campos or Selvas of Amazon and Shola of India.
- These Savanna grasslands generally occupy those areas between the climatic extremes of humid woodlands and dry desert shrub, the transition belts, therefore, between typical grass Prairie and either of these extremes contain more or less tree growth on the one hand, or desert shrub on the other.
- Soil moisture, rather than total rainfall, usually determines the extent of natural grassland. If the upper layers of soil are moist during part of the year, but the deeper layers remain dry, tree growth cannot complete with grass.

There are many different types of grasslands that can be categorised into prairies, savannas, veld, steppe and pampas based on the physical features of the grass in different areas.

- Prairies - This type of grassland is generally located in the Americas. There are many different types of grasses that grow in this grassland and colours can range from gold to green. Grasses grown in prairies can vary between different types however on average, grasses are 150 centimetres.
- Steppe - This grassland is similar to prairie, however, the grass in this grasslands a lot shorter. This type of grasslands is found commonly in Asia and Europe. This grassland is located between a rainforest and a desert. It cannot receive too much rain because it will turn into a rainforest and if it doesn't receive enough rain, this grassland will turn into a desert through the process of desertification. The soil in steppes are very dry and not very fertile so many plants do not grow in this area and with very few trees scattered. Also, steppe is separated into two categories: meadow and dry steppes in the North and South respectively.
- Veld - A Dutch word for field, this temperate grassland is located in South Africa. This grassland has a very large variety of plants. Velds could be found at different types of altitude. Highvelds is covered with sweet grass which could be a food source for animals.
- Pampas - This temperate grassland is located in South America, Spanish word for plains. The land in this grassland is flat and is home to approximately 20 different types of species. The grass in pampas are usually found to be in clumps (small groups of plants grown closely to each other)

Conclusion:

Grasslands are the common lands of the community and while there have been robust traditional institutions ensuring their sustainable management in the past, today due to take-over by government or breakdown of traditional institutions, they are the responsibility of none. They are the most productive ecosystems in world, but they

belong to all, but are controlled by none. The prevailing view of looking at grasslands as a single use should be replaced by looking them for multiple uses, incorporating sustainable use, ecosystem functions and biodiversity conservation.

2. What role does geology play in the resource endowment of a region? Explain with the help of suitable examples.

Approach:

It expects student to write about role played by geology in resource endowment in particular region - explain it with particular example.

Introduction:

Geology is the study of the Earth, the materials of which it is made, the structure of those materials, and the processes acting upon them. It includes the study of organisms that have inhabited our planet. An important part of geology is the study of how Earth's materials, structures, processes and organisms have changed over time.

Body:

Role played by geology in the resource endowment of a region:

- An understanding of local hydrogeology and environmental conditions is essential to managing water supply and quality. Hydrogeologists and other geoscientists investigate and map the subsurface in order to model and understand the movement of water, and to quantify and characterise aquifer resources. Seasonal and long-term groundwater monitoring can help predict and manage periods of aquifer depletion due to low rainfall. This information can then be used to design strategic drought, flooding and water provision plans. Eg: Chennai water crisis
- Geothermal energy - Integrated heating systems for modern building developments Using ground source heat and cooling can deliver reductions in CO2 emissions of up to 10%. Development of these resources requires the expertise of geologists to locate and test for viable geothermal capacity, and understanding of the sub-surface to design and engineer the necessary infrastructure, Geologists help meet this need, through their understanding of water movement and aquifer behaviour, as well as identifying and mitigating water contamination. Eg: Puga, Manikaran
- Nuclear power is likely to constitute an important part of the future energy mix. It depends on a reliable source of uranium, extracted from economically recoverable uranium ore – again, a process dependent on geological expertise.
- Many of the raw materials required for renewable energy technologies, including wind turbines, hybrid motors and solar panels, include critical raw materials such as the Rare Earth Elements, all of which rely on geological research and skilled personnel to locate and extract safely. Eg: Orissa, Andhra Pradesh
- It is now possible to extract shale gas economically, using horizontal drilling and hydraulic fracturing ('fracking'), in which water, sand and small quantities of added chemicals are used to open up fractures in the rock, allowing the gas to flow more freely. Geological expertise is vital to locate shale gas resources, and

to understand and manage possible risks linked with their extraction, such as induced seismicity or aquifer contamination due to poor well construction. Eg: Cambay, Krishna-Godavari, Cauvery, Damodar Valley, Upper Assam

- Geoscience skills are essential at every step of the energy cycle, from the location of energy resources through to their safe, reliable extraction and use, and the subsequent disposal or recycling of wastes
- Today, geologists use a variety of tools and instruments to help locate mineral resources. Airplanes and helicopters with photographic equipment are used by geologists. They also use magnetic and gravity-detecting equipment. This equipment gives information about the Earth's subsurface. Geologists sometimes use pictures taken from satellites in their search for hidden mineral resources.
- By examining different kinds of rock formations and by studying the Earth's surface, geologists know the geologic environments in which mineral resources may be found.
- It helps in defining the balance between society's demand for natural resources and the need to sustain healthy ecosystems.

Conclusion:

Today's resource endowments reflect the past course of private investment decisions and public policies. Ensuring adequate and appropriate resources to promote future innovation and growth is the task of today's decision-makers. Natural resource endowment offers great opportunities for achieving high levels of growth and development if properly managed.

3. What are gyres? What role do they play in shaping the coastal climate? Explain with the help of suitable examples.

Approach:

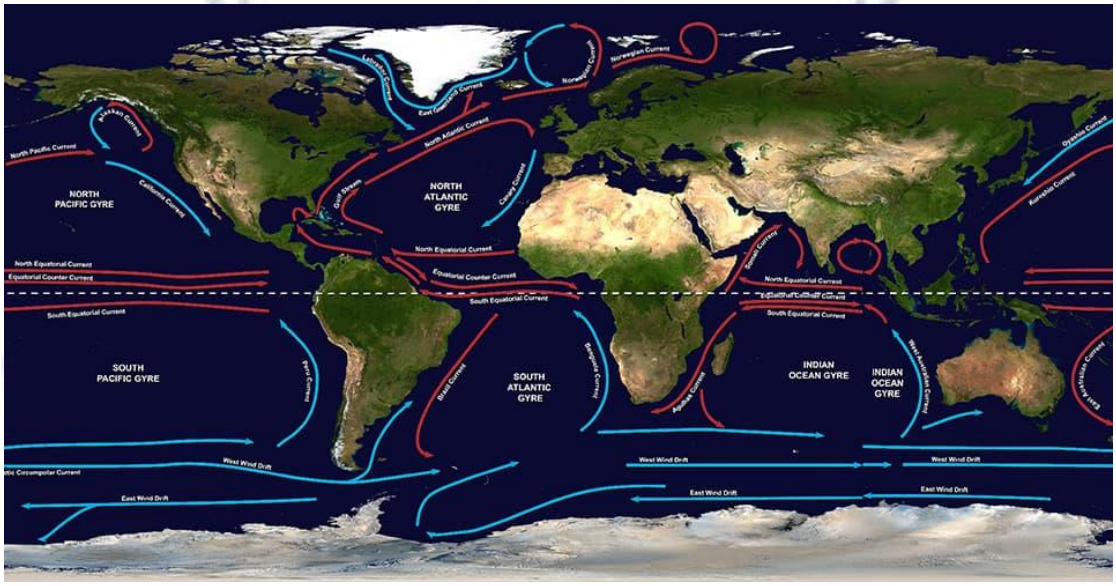
As the directive here is explain, it is expected from a candidate to look at the subject in the deep and mention details. In the introduction part one needs to explain what are gyres besides mentioning names of major gyres. In the main body part it is expected to specifically point out the role of gyres in shaping the coastline climate. While explaining their role it is necessary to cite examples in different parts of the world to show how gyres affect coastal climate differently. One can conclude by showing importance of gyres. For value addition one needs to add map and tag the locations of major gyres.

Introduction:

Gyres are large system of circular ocean currents formed by global wind patterns and forces created by Earth's rotation. The five major circulation patterns formed by the currents are the world's five major ocean gyres: North Atlantic, South Atlantic, Indian, North Pacific, and South Pacific.

Body:

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. Also known as Thermohaline circulation, the ocean conveyor belt is essential for regulating temperature, salinity and nutrient flow throughout the ocean. Following Map 1 shows the five major ocean gyres across the planet.



Map 1: Five major ocean gyres and their locations

Role of gyres in shaping the coastal climate:

- There are three major types of ocean gyres: Tropical, Subtropical, and Sub-polar. Sub-polar gyres form in the polar regions of the planet, tropical gyres

form near the equator whereas Subtropical gyres form between the polar and equatorial regions of Earth.

- Ocean gyres are present in every ocean and move water from the poles to the equator and back again. The water warms at the equator and cools at the poles. Because ocean water temperatures can transfer to the air, the cold and warm waters circulated by the gyres influence the coastal climate.
- Along wind-blown coastlines, we may see areas of upwelling. Upwelling is the rising of cold, nutrient-rich water to the surface. As winds blow along the coast, they move the relatively warm surface water. This allows colder and nutrient-rich waters from the ocean floor to rise up and take its place.
- The ocean's bottom waters are rich in nutrients because sea plants and creatures decay and release their nutrients onto the ocean floor. As these waters rise up, they feed marine organisms in the area, so upwelling areas are usually rich in marine life.
- Along coastlines, the direction of movement of a gyre has a significant impact on continental climate. For example, a current moving from south to north in the northern hemisphere, or north to south in the southern hemisphere, will generally deliver warmer water to the coastal region, whereas a current moving from the north to south in the northern hemisphere or south to north in the southern hemisphere will generally deliver colder water.
- The flow of warm water will generally cause a larger moderating influence on coastal climate than will the flow of cold water. Take, for example, the Gulf Stream in the North Atlantic. This warm current has a major heating effect on the shores of Great Britain and other parts of Northern Europe, keeping these regions relatively balmy compared to locations at comparable latitudes.
- After it bathes the shores of Britain, the North Atlantic gyre bends towards the south, thus bringing relatively cold waters to the shores of Spain, Portugal, and Morocco further to the south, keeping these areas cooler than areas not influenced by the currents.
- In addition, the Coriolis force results in gyres, rotational systems in each of the ocean basins that are clockwise in the northern hemisphere, for example, the North Atlantic gyre, and counter clockwise in the southern hemisphere, for example, the South Atlantic gyre. These gyres move warm waters from the south towards the north and in addition, they move cool waters from the north towards the south. Each gyre has a major effect on ocean circulation in that part of the ocean basin.
- The Indian Ocean Gyre is a complex system of many currents extending from the eastern coast of Africa to the western coast of Australia. The northern part of the system circulates between the Horn of Africa and the Indonesian archipelago. It is sometimes called the Indian monsoon current.
- The Indian monsoon current takes its name from the wind—the monsoon—that drives it. It is one of the very few currents in an ocean gyre that change direction. In the summer, the current flows clockwise, as the monsoon blows in from the south western Indian Ocean. In the winter, the current flows counter clockwise, as the wind blows in from the Tibetan plateau in the northeast. As a result monsoon cycle over the Indian subcontinent takes place.

This monsoon cycle in its initial stages leaves an impact on coastal climate by bringing heavy rains to the region.

Conclusion:

The role played by ocean gyres in impacting coastal climate is of pivotal importance. However, Climate change may be driving changes in large-scale wind patterns that are causing ocean gyres to migrate. It might result in over all change in the climate of coastal areas. Hence, it becomes necessary to deeply understand gyres functions and their subsequent effect on climate of coastal regions to avoid large scale loss, damage in the near future which might get aggravated by climate change.

4. Explain the geomorphic processes leading to the formation of plateaus. How do plateaus affect the climate of a region? Illustrate.

Approach - It expects students to write about how geomorphic processes leading to the formation of plateaus and how different plateaus are affecting the local climate in the region with examples.

Introduction

The endogenic and exogenic forces causing physical stresses and chemical actions on earth materials and bringing about changes in the configuration of the surface of the earth are known as geomorphic processes. Formation of plateau is due to geomorphic process such as volcanism (Deccan Plateau), crustal shortening (Tibet) and thermal expansion (Ethiopian Highlands).

Body

Plateau is extensive area of flat upland usually bounded by an escarpment (i.e., steep slope) on all sides but sometimes enclosed by mountains. Geomorphic process leading to the formation of plateaus are discussed below:

- Thermal expansion - Thermal expansion of the lithosphere means the replacement of cold mantle lithosphere by hot asthenosphere. Those caused by thermal expansion of the lithosphere are usually associated with hot spots. Uplift of the overlying surface creates plateau. The high plateaus of East Africa and Ethiopia were formed this way.
- Crustal shortening - The great heights of some plateaus, such as the Plateau of Tibet or the Altiplano, are due to crustal shortening. In this process thickening of crusts creates high mountains that will be margin of such plateaus. In most mountain ranges, streams and rivers transport eroded material from the mountains to the neighbouring plains.
- Volcanic Flood Basalts – Traps - A third type of plateau can form where extensive lava flows (called flood basalts or traps) and volcanic ash bury pre-existing terrain, as exemplified by the Columbia Plateau in the north western United States, Deccan Traps of peninsular India, Laurentian plateau or The Canadian Shield and the Siberian Traps of Russia.

The effects of topography on the climate of any given region are powerful. Plateau affects the climate of a region as seen below:

- Tibetan plateau - Tibet Plateau is an enormous block of a high ground has huge impact on local climate. It acts as a formidable barrier as well as a heat source. It accents the northward displacement of the jet stream in the middle of the October.
- Deccan plateau - The climate of the region varies from semi-arid in the north to tropical in most of the region with distinct wet and dry seasons. The Deccan plateau is about 2,000 feet above sea level, so it's pretty high up. Because it's

so high above the sea, the climate of the Deccan plateau is a lot drier than the climate in the rest of India.

- Potwar plateau - This physiography relief of Potwar plateau affects temperature, air pressure, winds speed and direction also affect the rainfall distribution in area around Delhi ridge.
- Chota-Nagpur plateau – Chota-Nagpur Plateau has effect on local climate receives less amount of an annual average rainfall, which is less than the rain forested areas of much of India. Due to upheaval of plateau in central India.
- Meghalayan plateau - Rainfall on the Meghalaya plateau in north-eastern India has the interaction between large-scale circulation and the local topography. This monsoonal climate circulation causes a rain shadow effect on the northern Meghalaya.
- Colorado Plateau - The combination of high elevation of Colorado and a semi-arid climate makes Climate models predict that over the next 100 years, the Southwest will become warmer and even more arid, with more extreme droughts than the region has experienced in the recent past.
- Patagonian plateau - The ENSO phenomenon has a significant impact on regional precipitation which also depend on upliftment of Patagonian plateau in region. Spring precipitation, La Nina events has further impact on seasonal temperature.

Conclusion

India's Peninsular Plateaus are one of its major physical features. These plateaus are one of the ancient landmasses on the surface of the earth. It has great economic significance such as grassland ecosystem, storehouse of minerals and importance for agriculture. Therefore, there is need for study and research related to plateaus for better understanding in policy making procedures.

5. If you send a probe to explore the ocean floor off the Pacific coast, what surface features would you see? Discuss.

Approach:

It expects students to write about the surface features of the Pacific Ocean floor in detail.

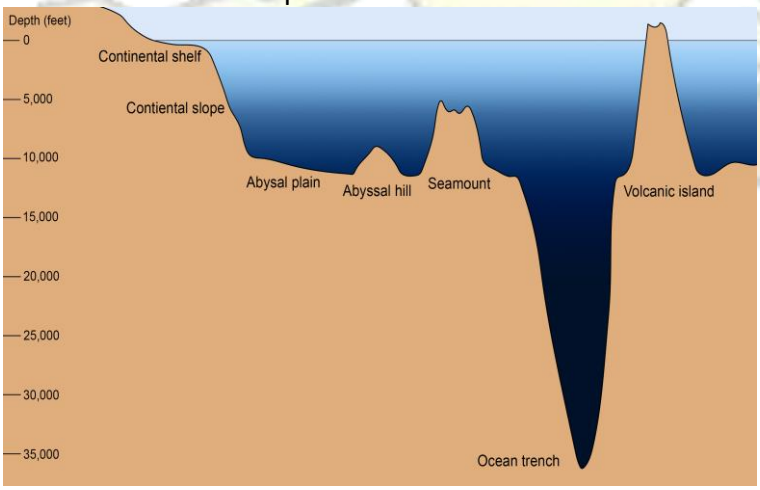
Introduction:

The Pacific Ocean is the largest and deepest ocean on Earth. It spans 60 million square miles from California to China, and in certain regions extends tens of thousands of feet below the surface of the water. Much of the ocean is still waiting to be explored, but human activities like industrial fishing, deep-sea mining, and fossil fuel burning are already changing it in a significant way. The vast body of water is home to some of the unique life forms on Earth and contains the deepest trenches known to humankind.

Body:

The Pacific basin can be divided into three major physiographic regions: Eastern, western, and central Pacific regions.

- Eastern region: The eastern Pacific region, which extends southward from Alaska to Tierra del Fuego, is relatively narrow and is associated with the American cordilleran system of almost unbroken mountain chains, the coastal ranges of which rise steeply from the western shores of North and South America.
- Western region: The seaward boundary of the western Pacific region is marked by a broken line of oceanic trenches, extending from the Aleutian Trench in the north through the Kuril and Japan trenches and southward to the Tonga and Kermadec trenches, terminating close to the northeast of North Island, New Zealand.
- Central region: The central Pacific region lies between the boundaries of the eastern and western regions. The largest and the most geologically stable of the structural provinces of the Earth's crust.



When we send the probe to explore Ocean floor, beneath the smooth ocean surface extends an underwater landscape as complex as anything we might find on land.

- Continental Shelf: Along the Pacific shore, generally, the coast rises abruptly from a deep seafloor to mountain heights on land, and there is a narrow continental shelf. Example are the Baltic on North Sea, Yellow and East China sea.
- Continental Slope: The main features of the Pacific Ocean floor is the continental slopes. It is an area of relatively shallow water, usually less than a few hundred feet deep, that surrounds land. The waters along the continental shelf are usually productive, both from light and nutrients from upwelling and runoff.
- Deep Sea Plain: The floor of the Pacific, like those of the other oceans, is actually very flat, even in areas with seamounts or deep trenches. The vast sediment-covered abyssal plains of the oceans are much flatter than any similar-sized areas on the continents.
- Seamounts: The Pacific Ocean contains the vast majority of the world's seamounts. In part, this is because the Pacific is much larger than the other ocean basins. Example Tuamotus and Austral Seamounts.
- Guyots: Guyots are most commonly found in the Pacific Ocean it's also known as a table mount, is an isolated underwater volcanic mountain with a flat top more than 200 m below the surface of the sea. Example Kuko Guyot, Suiko Guyot and the Pallada Guyot.
- Islands in the Pacific Ocean: The approximately 20,000 islands in the Pacific Ocean are concentrated in the south and west. Most of the larger islands are structurally part of the continent and rise from the continental shelf. Example Japanese island arc, the Malay Archipelago and Hawaiian Islands.
- Mid-Oceanic Ridges: The mountain ranges can have peaks as high as 2,500 m and some even reach above the ocean's surface. Example East Pacific Rise.
- Submarine Canyons: These are deep valleys, some comparable to the Grand Canyon of the Colorado river. They are sometimes found cutting across the continental shelves and slopes, often extending from the mouths of large rivers. Example Astoria Canyon.
- Ocean Trenches: The deepest ocean trenches ring the Pacific as part of the so-called "Ring of Fire" that also includes active volcanoes and earthquake zones. Examples are Middle America Trench, Chile Trench in the South Pacific and Marianas trench.

Conclusion:

The Pacific is not always peaceful. The lands around the Pacific Rim are full of volcanoes and often affected by earthquakes. Tsunamis, caused by underwater earthquakes, have devastated many islands and changed the surface structure of the Ocean. Also due to the effects of plate tectonics, the Pacific Ocean is currently shrinking which is directly affecting the overall flora and fauna of Pacific Ocean floor.