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Edited by **- N.N. Ojha**

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ABOUT THIS BOOK

Geography-IAS Mains Q&A (2023 Edition) is revised and updated up to Civil Services Mains Examination 2022. In this book solution to previous 15 years' (2008-2022) papers are segregated into different topics as per the latest syllabus. The wide coverage touches almost all aspects of this subject and serve as good as a valuable study material.

Ideally, going through last 10-15 years papers is enough for an aspirant to get a taste of the pattern of questions being asked and how their answers should be. So, keeping this in view, without compromising on quality of answers, we have provided last 15 years' answers. Further, this has been done to cap the price as well as number of pages i.e. to prevent the book getting bulkier.

Answer writing in this book: We have put forth answers to each question as per the demand of the question. We have adopted an elaborative approach while writing these answers to arm you with relevant knowledge related to all aspects of a particular topic. In most of the answers, we have provided additional information, not necessarily adhering to the prescribed word limit while answering the questions covering all dimensions. This will enrich your knowledge on that topic, enabling you to write better answers in future.

This book will assist you in answer writing practice in two ways– use this book as a source of reference/ study material and write answers in your own unique way or alternatively, you may write previous years' answers and compare them with the standard answers provided in this book.

Importance of Geography as an Optional: Geography is the most preferred optional subject in UPSC CSE. Around 30% of all candidates who write UPSC Mains take this Optional. This subject is scientific (no rote learning needed), high success ratio, overlaps with prelims syllabus (will help in GS 1, GS 3 and Essay papers). It has an important role to play in preliminary exam as around 15 to 20 questions from Geography are asked every year in prelims. Geography integrates prelims and mains preparation - thus, saving time for other topics.

Optional subject has become the deciding factor in getting an interview call. Though UPSC has introduced four GS papers to give a level playing field to all, the dynamic and unpredictable questions of GS papers defeated the purpose and made Optional paper the magic wand. The toppers' score also tells it loudly that optional subject plays a defining role in determining the selection of the candidates.

So, overall this book is an ideal companion for you going to appear the UPSC Mains examination. It is also equally helpful for State Public Service Examinations and such equivalent examinations where descriptive answers in Geography are asked.

To help the aspirants to get acclaimed with the pattern and trend of the exam, this book is a valuable gift to our readers.

We believe that you will find this book very useful while preparing for Main examination. We wish you all the best for your upcoming examinations.

PAPER-I

PRINCIPLES OF GEOGRAPHY

Physical Geography

Geomorphology

Climatology

Oceanography

Biogeography

Environmental Geography

Human Geography

Perspectives in Human Geography

Economic Geography

Population and Settlement Geography

Regional Geography

Models, Theories and Laws in Human Geography

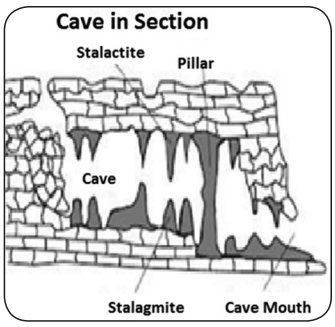
1

GEMORPHOLOGY

Q. Define 'speleothem'. Discuss the various forms and features of speleothems.
(CSE 2022)

Ans. The term 'speleothem' refers to the mode of occurrence of a mineral—i.e., its morphology or how it looks—in a cave, not its composition. For example, calcite, the most common cave mineral, is not a speleothem, but a calcite stalactite is a speleothem. However, a stalactite may be made of other minerals, such as halite or gypsum. There are various types of speleothems and numerous subtypes and varieties found in Karst topography.

- **Stalactites** are the most common and most familiar of all speleothems; they resemble icicles or carrots hanging from cave ceilings. Stalactites range in size from small, slender, soda straws to thick, massive pendants tens of feet long and wide. Stalactites are usually composed of calcite, but they may consist of other minerals also.
- **Stalagmites** are convex floor deposits built up by water dripping from an overhead stalactite or from the cave ceiling. Because falling water droplets tend to splash, stalagmites spread out as they gradually build up from the floor. Hence, they do not have central, hollow tubes like stalactites. Stalagmites are usually larger in diameter than the stalactites above them and they generally have rounded tops instead of pointed tips.
- When water drops flow down a sloped ceiling before dripping to the floor, calcite can build up in a line. These lines gradually form **"draperies"** or **"cave bacon."** This type of speleothem is found in almost every cave in the world and is universally popular because of the close resemblance to its namesake.



Speleothems are characteristics features of Karst topography generally develops in those areas where thick beds of massive limestones lie just below the layer of surficial materials.

Besides, karst topography also develops on dolomite, dolomitic limestones and chalks. karst topography has well developed in Yugoslavia, Causes Region of southern France; Spanish Andalusia; northern Puertorico; western Cuba; Jamaica; southern Indiana, west-central Kerntucky, Virginia, Tennessee and central Florida of the USA.

Q. Explain how various aspects of channel morphology are used in transportation, settlement and land use planning, flood control and flood management?
(CSE 2022)

Ans. Channel can be defined as the path of a river or a stream outlined by its bed and banks. The whole system of river channels with its joining branches in the form of tributaries that dissect the earth's surface is in proportion to the valley size.

Channels are occupied by permanent streams, those that flow throughout the year, some have **intermittent streams** and some have **ephemeral streams**, which are active only during and after the rains.

Although the water of the river flows in its channel but during floods, the water flow exceeds the capacity of the channel and the water spills out of the channel over the floodplain causing **flood**.

Channel Structure consists of three main features such as:

1. **Channel Banks:** The two sides of the river bed are called channel banks.
2. **Channel Bed:** The main path taken by the river, through which it flows, is called the channel bed.
3. **Thalweg:** It is continuous line joining the lowest points in a stream channel.

2

CLIMATOLOGY

Q. With suitable examples describe the impacts of movement of air masses on weather and winds in different parts of the continents. (CSE 2022)

Ans. When the air remains over a homogenous area for a sufficiently longer time, it acquires the characteristics of the area.

The homogenous regions can be the vast ocean surface or vast plains. The air with distinctive characteristics in terms of temperature and humidity is called an air mass.

Air mass is defined as a large body of air having little horizontal variation in temperature and moisture. The homogenous surfaces, over which air masses form, are called the source regions.

The air masses are classified according to the source regions. There are five major source regions:

1. Warm tropical and subtropical oceans;
2. The subtropical hot deserts;
3. The relatively cold high latitude oceans;
4. The very cold snow covered continents in high latitudes;
5. Permanently ice-covered continents in the Arctic and Antarctica.

Accordingly, following types of air masses are recognised:

(i) Maritime tropical (mT);
(ii) Continental tropical (cT);
(iii) Maritime polar (mP);
(iv) Continental polar (cP);
(v) Continental arctic (cA).

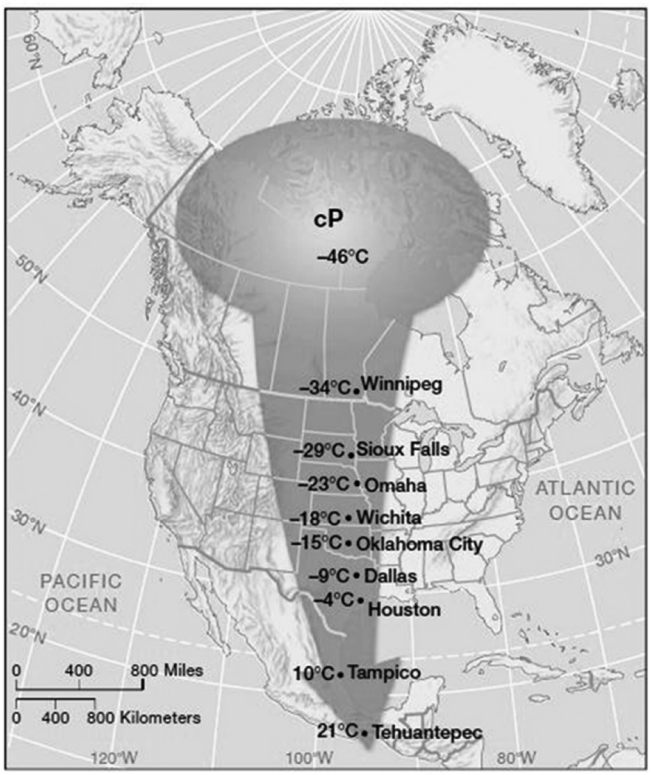
Tropical air masses are warm and polar air masses are cold.

Movement of Air Masses

Some air masses remain in their source region for long periods, even indefinitely. In such cases, the weather associated with the air mass persists with little variation. However, some air masses move into other regions.

When an air mass departs from its source region, its structure begins to change. This change is due in part to thermal modification (warming or cooling from below), in part to dynamic modification (uplift, subsidence, convergence, turbulence), and perhaps also in part to addition or subtraction of moisture. For example, if a continental polar air mass moves into warmer areas and over the ocean the air will warm and moisture may evaporate from the ocean surface into the air, adding humidity.

Also, an air mass modifies the weather of the regions into which it moves: it takes source-region characteristics into other regions.



3

OCEANOGRAPHY

Q. When corals are affected by stress it causes them to turn completely white. Explain the reasons of such an occurrence. (CSE 2022)

Ans. Coral polyps are short-lived microscopic organisms, which live in colonies. They flourish in shallow, mud-free and warm waters. They secrete calcium carbonate.

The coral secretion and their skeletons from coral deposited in the form of reefs.

They are mainly of three kinds

- Barrier reef,
- Fringing reef, and
- Atolls.

The Great Barrier Reef of Australia is a good example of the first kind of coral reefs. Atolls are circular or horse shoe-shaped coral reefs.

Coral Bleaching

When water is too warm, corals will expel the algae (zooxanthellae) living in their tissues causing the coral to turn completely white. This is called coral bleaching. When a coral bleaches, it is not dead. Corals can survive a bleaching event, but they are under more stress and are subject to mortality.

In 2005, the U.S. lost half of its coral reefs in the Caribbean in one year due to a massive bleaching event. The warm waters centered on the northern Antilles near the Virgin Islands and Puerto Rico expanded southward.

In January 2010, cold water temperatures in the Florida Keys caused a coral bleaching event that resulted in some coral death. In 1998 when the El Niño weather pattern caused sea surfaces in the Pacific Ocean to heat up; this event caused 8% of the world's coral to die. Second Mass Bleaching took place in 2002.

In the past decade, however, mass bleaching occurrences have become more closely spaced in time, with the longest and most damaging bleaching event taking place from 2014 to 2017.

Global Coral Reef Monitoring Network (GCRMN), which is supported by the United Nations, showed that 14% of the world's coral on reefs had been lost between 2009 and 2018.

Causes

- **Rise in Sea Temperature:** Most coral species live in waters close to the warmest temperature they can tolerate i.e., a slight increase in ocean temperature can harm corals. El Nino elevates the sea temperature and destroys coral reefs.
- **Ocean Acidification:** Due to rise in carbon dioxide levels, oceans absorb more carbon dioxide. This increases the acidity of ocean water and inhibits the coral's ability to create calcareous skeletons, which is essential for their survival.
- **Solar Radiation and Ultraviolet Radiation:** Changes in tropical weather patterns result in less cloud cover and more radiations which induce coral bleaching.
- **Infectious Diseases:** Penetration of bacterium like vibrio shiloi inhibits photosynthesis of zooxanthellae. These bacteria become more potent with elevated sea temperatures.
- **Chemical Pollution:** Increased nutrient concentrations affect corals by promoting phytoplankton growth, which in turn supports increased numbers of organisms that compete with coral for space.
- **Increased Sedimentation:** Land clearing and coastal construction result in high rates of erosion and a higher density of suspended silt particles which can
  - smother corals when particles settle out (sedimentation),
  - reduce light availability (turbidity) and
  - potentially reduce coral photosynthesis and growth.
- **Human Induced Threats:** Over-fishing, pollution from agricultural and industrial runoff, coral mining, development of industrial areas near coral ecosystems also adversely impact corals.

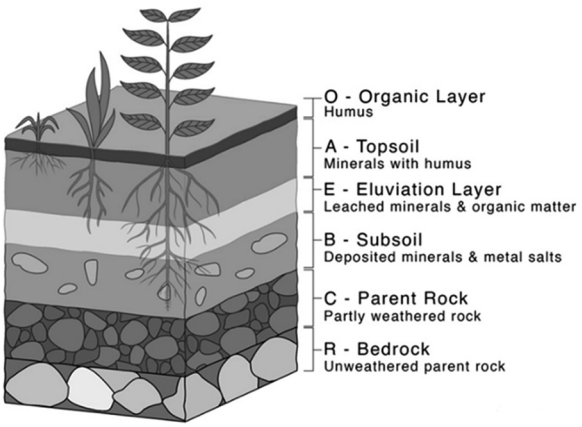
4

BIOGEOGRAPHY

Q. Well-developed soils typically exhibit distinct layers in their soil profile. Elaborate. (CSE 2022)

Ans. Soil as a natural body, consisting of minerals and organic constituents differentiated into horizons of variable depths, which differ from the material below in morphology, physical make-up, chemical properties and composition, and biological characteristics. It is, therefore, the upper loose layer of the earth's crust, which is rich in nutrients and minerals on which plants grow and depend on for nourishment.

Formation of soil from disintegration of parent material is a gradual process. It depends upon several factors like — climate, parent material, topography, plants and animals, life and time. Some soil formed at its parent material source while others are formed by deposition through agent. Those soils formed at parent material source show well developed horizon in comparison to soil deposited by agent. Horizon is soil layer developed during disintegration of parent material. Each horizon differs in feel (texture), colour, depth and chemical composition.



The uppermost horizon is generally dark in colour as it is rich in humus and minerals. This horizon 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 horizon has a lesser amount of humus but more of minerals. This layer is generally harder and more compact and is called the B-horizon or the middle layer. The third layer is the C-horizon, which is made up of small lumps of rocks with cracks and crevices. Below this layer is the bedrock, which is hard and difficult to dig with a spade.

Clear distinct horizons are noticed in black soil formed from basaltic lava, however alluvial soil which are depositing in nature does not show clear horizon or soil profile. Thus, we can say well developed soils typically exhibit distinct layers in their soil profile.

Q. Plants and animals that exist in a particulars ecosystem are those that have been successful in adjusting to their habitat and environmental conditions. Elucidate with examples. (CSE 2022)

Ans. Plant community which has grown naturally without human aid and has been left undisturbed by humans for a long time is termed as a virgin or natural vegetation of that region. Thus, cultivated crops and fruits and orchards form part of vegetation but not natural vegetation. Similarly, animals which are adapted or grown in the natural environment are called native of that region. However, these plants and animals are not uniform over region it varies. Different region with different physical environment possess differ natural vegetation or animals.

Natural vegetation of any region is result of several factors like land, soils, precipitation, temperature etc.

- **Land:** Land affects the natural vegetation directly and indirectly. The nature of land influences the type of vegetation. The undulating and rough terrains are areas where grassland and woodlands develop and give shelter to a variety of wildlife.
- **Soils:** The soils also vary over space. Different types of soils provide basis for different types of vegetation. The sandy soils of the desert support cactus and thorny bushes, while wet, marshy, deltaic soils support mangroves and deltaic vegetation. The hill slopes with some depth of soil have conical trees.

5

ENVIRONMENTAL GEOGRAPHY

Q. What are the high altitude environmental hazards? Explain with suitable examples. (CSE 2022)

Ans. Environmental hazards are defined as extreme events or substances in the Earth and its ecological system that may cause adverse consequences for humans and things they value. Environmental hazards are of different types:

- Physical
- Chemical
- Biological

However, the high altitude environmental hazards are those which occur at hilly or mountain regions. These hazards can be physical, biological and chemical. However, most environmental hazards at high altitude are physical in nature and caused due to extreme weather events. Some of the examples of high altitude environmental hazards are flash floods, earthquakes, volcanic eruptions, landslide, avalanche, etc.

Due to anthropogenic intervention, there are rise of environmental hazards in hilly region. Deforestation, slope cutting, construction of roads and heavy rainfall are highly responsible factors resulting in frequent landslides, flash floods and soil erosion in hilly regions.

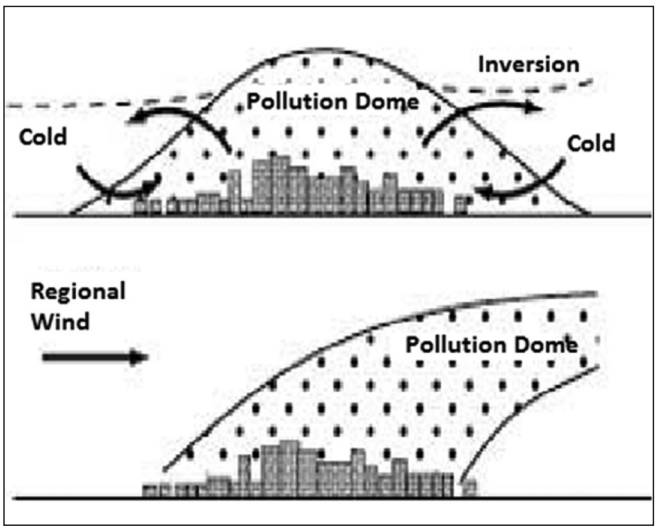
In the flash flood event of Uttarakhand (2013) more than 2000 people have been declared dead and almost 12000 people were disappeared and there was loss of 50 billion dollars to the state.

Mitigation Measures

- **Afforestation:** Forest is the mainstay of a mountainous ecosystem because forest protects the rocks from exposing and keeps these rocks strong through their root system. Forest canopy intercept 60% of rainfall which falls over the forest.
- **Ecological Sensitive Development:** Environmental friendly development should be allowed to complete. The ecological processes and flora and fauna of that region should be allowed to complete.
- **Nature Supportive Roads and Habitats:** The connectivity is dependent on the presence of roads. Therefore, roads should been environmental friendly also, and it should not be on margins of hills. Roads should be constructed according to natural aspect of the region.
- **Risk Assessment System:** Risk assessment comprises the area, intensity of flash floods, assessing of damage, etc.

Q. What is pollution dome? Discuss its formation and impacts. (CSE 2022)

Ans. Pollution dome refers to mass of polluted air in and above a city or industrial complex which is prevented from rising by the presence of an inversion above it.



Formation

Due to human activity, the temperature in an urban microclimate is higher than that of the surrounding areas. Urban areas are said to be urban heat islands as under calm conditions, temperatures are highest in the built up city centre and decrease towards the suburbs and countryside.