

Thoroughly Revised  
& Improved Edition

# GENERAL STUDIES

2024

SSC | RAILWAYS | BANKING | PSUs | UPSC  
State Public Services & State Engineering Exams

*by*

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**General Studies**

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# Preface

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This comprehensive text book on General Studies explains the subject matter in a brief and simple style. The authors are very well aware of the requirements of examinations conducted by UPSC, SSC, State Public Service Examinations, Railways Examinations and Public Sector Examinations. This book has been very well targeted covering all the aspects of subject matter required for various examinations.

Since last one decade, authors have closely studied the marks of various candidates appeared & selected in government sectors and other examinations and found that those who have scored below average or poor marks in General Studies section, are either not able to get selection or get poor ranks, hence it has been realized that general studies section should be given significant importance.

There is no good book available to the readers in the market, which covers all the aspects of Geography, Polity, History, Life Science, Economy, General knowledge, General Science, Environment, Basics of Computer Applications and Science & Technology that may satisfy the requirements of various competitive examinations conducted for aspirants. In this edition authors have put sincere efforts to satisfy all the requirements of various examinations. The book is thoroughly revised and updated. Authors have tried to incorporate previous year questions of UPSC, SSC, State Public Service Examinations, Railways examinations and Public Sector Examinations.

The authors feel that this book will be sufficient and highly useful for all the competitive examinations conducted for graduates from every discipline.

Any suggestions from the readers for the improvement of the book are most welcome.

**B. Singh**  
**A.P. Singh**

# GENERAL STUDIES

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# GENERAL KNOWLEDGE

## Basic General Knowledge of India & World

### NATIONAL SYMBOLS

#### National Flag

- The National Flag of India is a horizontal tricolour of deep saffron (Kesaria) at the top, white in the middle and dark green at the bottom in equal proportion. The ratio of width of the flag to its length is 2:3. In the centre of the white band a navy-blue wheel is located which represents the Chakra.
- It was adopted by Constituent Assembly of India on July 22, 1947.
- A tricolour flag was first accepted by the Indian National Congress in 1931, having Charkha in place of today's Chakra.
- The horizontal colour strip of deep Saffron at top represents courage, sacrifice and renunciation, White at middle shows truth and purity in thoughts and dark Green at the bottom is the symbol of life abundance and prosperity.
- A wheel (Chakra) in centre of the white strip is the symbol of progress and movement. It has 24 spokes.
- Supreme Court declared the right to hoist flag as a Fundamental Right under Article 19 (i) (a) of the Constitution in 2002. Flag hoisting in India is regulated by Flag Code of India, 2002.
- The Flag was designed by **Pingali Venkayya** and first time, the flag was hoisted by **Sacchindra Prasad Bose** in 1906 in Calcutta and later on in the year 1907 another tricolour flag was unfurled by **Madam Bhikaji Cama** in Stuttgart, Germany.
- The first flag committee was headed by **Dr. Rajendra Prasad**.

#### National Emblem

- The National Emblem of India is an adaptation from the Sarnath Lion Capital of Ashoka. It was adopted by the Government of India on January 26, 1950.
- In this emblem, only three lions are visible, the fourth lion being hidden from view. The wheel appears in relief in the centre of the abacus with a **bull on right** and a **horse on left**. The bell shaped lotus (as in the original) has been omitted. The other animals present in the emblem are an Elephant and a Lion.
- The words *Satyameva Jayate* are inscribed below the abacus in Devanagiri script. These words are taken from *Mundaka Upanishad*.

#### National Anthem

- The song *Jana gana mana* is the National Anthem of India which was composed by **Rabindra Nath Tagore**, originally in Bengali.
- It was adopted by Constituent Assembly on January 24, 1950 in its Hindi version.
- The song *Jana gana mana* was first published in January, 1912 under the title '**Bharat Vidhata**' in *Tattva Bodhini Patrika*.
- The song was translated in English in 1919 with the title "**Morning Song of India**".
- It was first sung at the Calcutta Session of Congress on December 27, 1911.
- Playing time of full version of National Anthem is 52 seconds while it is 20 seconds for first and last lines of the stanza.

## National Song

- “*Vande Mataram*” is the National song of India, which was composed by **Bankim Chandra Chatterjee**, originally in Sanskrit.
- It was adopted on January 24, 1950, providing it equal status with National Anthem *Jana gana mana*.
- It is taken from his novel **Anand Math** published in 1882. Its English translation was done by Sri Aurobindo.
- It was sung for the first time at the Congress Session of 1896.

## National Calendar

- National Calendar is based on Saka Era (began on 78 A.D.) with Chaitra as its first month and Phalguna as its last month with a normal year of 365 days adopted from March 22, 1957 along with the Gregorian Calendar.
- First day of Chaitra normally falls on March 22 and on March 21 in leap year.

## National Animal

- The Tiger (*Panthera Tigris*) is the National Animal of India. It has a thick yellow coat of fur with dark stripes.
- Lion was the National Animal of India till 1972. Later on, it was replaced by Tiger.

Other Indian National Symbols	
National Bird	Peacock ( <i>Pavo Cristatus</i> )
National Flower	Lotus ( <i>Nelumbo Nucifera Gaertn</i> )
National River	Ganga
National Tree	Banyan ( <i>Ficus Benghalensis</i> )
National Fruit	Mango ( <i>Mangifera Indica</i> )
National Aquatic Animal	Ganges River Dolphin
National Heritage Animal	Elephant
National Game (De-facto)	Hockey

National Emblems of Countries	
Country	Emblem
India	Sarnath Lion Capital
Australia	Kangaroo
Bangladesh	Water Lily
Canada	White Lily
France	Lily
Germany	Corn flower
Iran	Rose
Italy	White Lily
Japan	Chrysanthemum
Pakistan	Crescent
Spain	Eagle
Sri Lanka	Sword & Lion
Russia	Sickle and Hammer
Norway	Lion
United Kingdom	Rose
USA	Golden Rod

Significance of Signs and Symbols	
Symbol	Meaning
Red triangle	Family planning
Red cross	Hospital/Ambulance
Red light	Danger/Emergency
Green light	Line clear signal
Olive branch	Peace
Black arm-band	Sign of mourning/protest
Dove	Peace
Black flag	Demonstration of protest
Red flag	Sign of danger, revolution
Yellow Flag	Displayed by ship with infectious disease on board or ship in quarantine.
White Flag	Truce
Tricolour	National Flag of India

Significance of Signs and Symbols	
Symbol	Meaning
Union Jack	National Flag of UK
Lotus	Culture and civilization
Wheel	Progress
Flag flown half mast	National mourning
Flag flown upside down	Distress
A blind-folded woman holding a balance	Justice
Pen	Symbol of Culture and Civilization

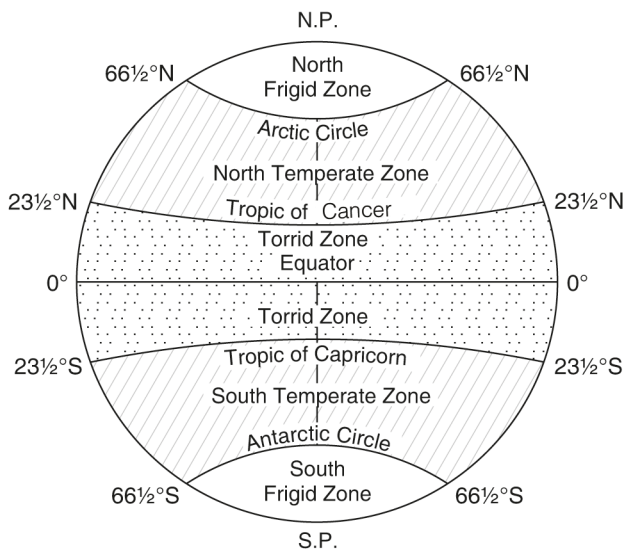
Country Symbols	
Country	Symbol
India	Royal Bengal Tiger
China	Dragon
Russia	Brown Bear
USA	Bald Eagle
Spain	Red Carnation
Japan	Cherry Blossom
England	Rose
Australia	Golden Wattle Flower
South Africa	Blue Crane
Greece	Olive Branch

Official Publications of Countries/Organizations	
Publication	Issued/Released by
Blue Book	Report by the British Government
Green Book	Government of Italy and Iran
Grey Book	Japanese and Belgium Government
Orange Book	Government of the Netherlands
White Book	Official publication of Germany, Portugal and China
White Paper (Shwet Patrika)	Issued by the Government of India
Yellow Book	Issued by the Government of France
Economic Survey	Ministry of Finance (Government of India)
Report on Currency and Finance	Reserve Bank of India
Wholesale Price Index	Ministry of Commerce and Industry
National Accounts Statistics	Central Statistical Organization

## General Aspects of Geography

### Latitude

- It is the angular distance of a point on the earth's surface, measured in degrees from the centre of the earth. It varies from 0 to 90° North and 0 to 90° South.
- Latitudes are circular lines which are parallel to the equator, which lies midway between the poles. Hence, these lines are called **parallels of latitude**. The latitudes are also called as temperature coordinates because with the increase in latitudinal distance towards the poles, the temperature reduces.

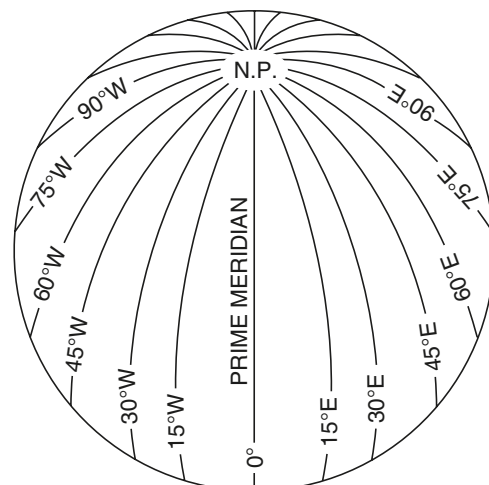


- The most important lines of latitude are the Equator (0°), the Tropic of Cancer (23½°N), the Tropic of Capricorn (23½°S), the Arctic Circle (66½°N) and the Antarctic Circle (66½°S).
- The midday sun is exactly overhead at least once a year on all latitudes in between the Tropic of Cancer and the Tropic of Capricorn. This area, therefore receives the maximum heat and is called the **Torrid Zone** (or Tropical Zone).

- The areas bounded by the Tropic of Cancer and the Arctic Circle in the northern hemisphere, and the Tropic of Capricorn and the Antarctic Circle in the southern hemisphere, have moderate temperature, hence called **Temperate Zones** (or Mild Zone).
- Areas bounded by the Arctic Circle and North Pole, and the Antarctic Circle and South pole are called **Frigid Zones**. These zones are very cold as the sun does not rise above the horizon.

### Longitude

- It is an angular distance measured in degrees along the equator east or west of the Prime Meridian (0°). It varies from 0 to 180° E and 0 to 180° W. It is also called as time coordinates.
- Longitudes are also known as **Great circles** because it divides earth into two equal parts. Each longitude cuts each latitude at 90°.  
1° = 4 minute i.e. 15° = 1 hour
- Meridians are a series of semicircles that run from pole to pole passing through the equator.





- The Prime Meridian is at  $0^\circ$  and is known as the **Greenwich line** as it passes through Greenwich near London, where the British Royal Observatory is located.
- Longitudes have one very important function i.e. they determine Local Time in relation to Greenwich Mean Time (GMT).
- Local Time is the time reckoned by the noon-sun at a given place and Standard Time is the Local Time of the Standard Meridian of a country.
- In India, the longitude of  $82\frac{1}{2}^\circ$  E is treated as the Standard Meridian. The Local Time at meridian is taken as the Standard Time for the whole country. It is known as the **Indian Standard Time (IST)**.

### International Date Line

- It is an imaginary line drawn at  $180^\circ$  longitude, avoiding the continuous land parts.
- International Date Line passes through Arctic Ocean, Bering Strait, Pacific Ocean, Antarctica, Fiji, Tonga and other islands.
- It is also the longitude where the date changes by exactly one day when it is crossed. If a traveller moves westward (from East to West), he gains a day, whereas from eastward (from West to East), he will lose a day.

### Motions of Earth

- The earth is a planet of the solar system. It is not static but has two types of motions:
  - (a) Rotational Motion
  - (b) Revolutions (or Orbital) Motion

#### (a) Rotation of Earth

- The earth spins (or rotates) continuously on its own axis from west to east once in every 24 hours, causing day and night. This motion is called Rotation of the Earth (also called 'Daily Motion').
- **Day and Night:** When the earth rotates on its own axis, only one portion of the earth's surface comes into the rays of the sun and experiences day light whereas the other portion experiences darkness (or night).

#### (b) Revolution of Earth

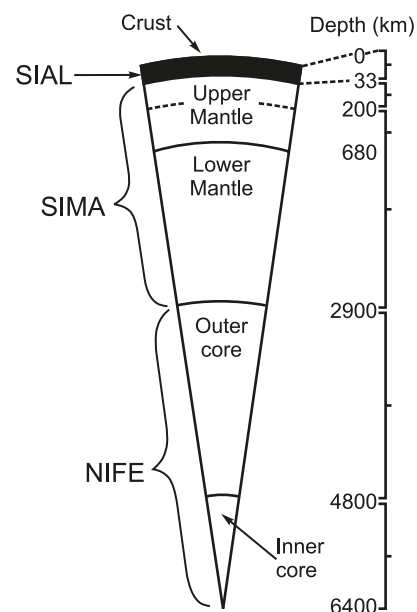
- The earth also revolves around the sun in an orbit once in about 365 days and 6 hours, causing formation of seasons and the year. This motion

is called Revolution of earth (also called annual movement).

### Varying Lengths of Day and Night

- The axis of the earth is inclined to the plane of earth's orbit at an angle of  $66\frac{1}{2}^\circ$  giving rise to different seasons and varying lengths of day & night.
- The earth's revolution round the sun with its axis inclined at  $66\frac{1}{2}^\circ$  to the plane of earth's orbit changes the apparent altitude of the midday sun.
- The sun is vertically overhead at the equator on 21 March and 23 September and these two days are termed as **Equinoxes** (equal length of day & night in both the hemisphere).
- On 21 June, the sun is vertically overhead at the Tropic of Cancer ( $23\frac{1}{2}^\circ$  N). This is known as **summer solstice**, when the northern hemisphere will have its longest day and shortest night.
- On 22 December, the sun is vertically overhead at the Tropic of Capricorn ( $23\frac{1}{2}^\circ$  S). This is known as **winter solstice**, when the southern hemisphere will have its longest day and shortest night.
- Beyond the Arctic Circle ( $66\frac{1}{2}^\circ$  N) and Antarctic Circle ( $66\frac{1}{2}^\circ$  S) darkness lasts for 6 months and daylight is continuous for the remaining 6 months.

### Structure of Earth

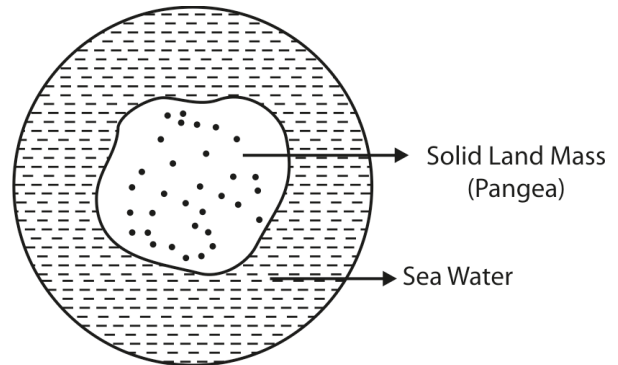


- The earth as a whole has been divided into three broad zones:

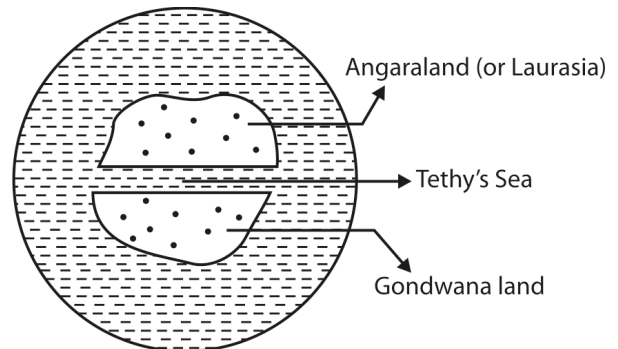
1. **Crust (SIAL) :** The earth is made up of several distinct layers but the outermost layer is called the crust. The crust is not a continuous layer of rocks, but consists of large masses called plates, which are free to drift slowly over a layer called **Asthenosphere**.
  - The crust has a thickness of about 33 km in the continents (Continental crust) and 5-10 km thick in the ocean basins (Oceanic crust). **Silica** and **Aluminium** are the main constituent of the earth therefore it is also known as Sial.
2. **Mantle (SIMA) :** The layer of rock below the crust is called the mantle. It is about 2900 km thick and is divided into the upper and lower mantle. This layer contains most of the mass of the earth, and is where most of the earth's heat is located. The mantle is composed mainly of **Ferro-magnesium silicates**.
  - (a) **Upper Mantle:** The upper mantle is about 650 km thick and has two distinct layers. The top layer of the upper mantle is solid. Combined with the crust, this layer forms the Lithosphere, which makes up the earth's plates. With in this layer is the **Asthenosphere**, where semi molten rock flows slowly.
  - (b) **Lower Mantle :** The lower mantle is solid and is about 2700 km thick. Though temperatures are higher here but the tremendous pressures keep the rock material from melting.
3. **Core :** It is the innermost part of the earth and it comprises of outer core and inner core.
  - (a) **Outer Core :** The outer core is liquid and is about 1900 km thick. It comprises of **molten iron** and **nickel**, formed as a result of the extremely high temperature. This liquid outer core controls the earth's magnetic field.
  - (b) **Inner Core:** The earth's innermost core is about 1600 km thick and is made up of **solid iron** and **nickel**. The inner core is incredibly hot, with temperature reaching about 5,500°C and is subjected to a pressure of about 4 million atmospheres. It is this extreme pressure that keeps the inner core in a solid state.

### Formation of Continents

- The age of earth is about 4500 million years (4.5 billion) and about 70%, of the total surface area of the globe is represented by the oceans (Hydrosphere), whereas remaining, 29.2% is represented by the continents, (Lithosphere).
  - More than 75% of the total land area of the globe is situated to the north of the equator, therefore the northern hemisphere is also known as the '**Land Hemisphere**' and the Southern hemisphere as the '**Water Hemisphere**'. It is believed that the continents are moving away from each other, Several theories have been propounded to explain this phenomenon:
- Continental Drift Theory:**
- This theory was proposed by famous German Geographer, Prof. **Alfred Wagner** in 1924. According to this theory, before 200 million years ago, there was a single land mass surrounded by water which was named as **Pangea**.



- About 200 million years ago, pangea got cracked into two parts i.e. (a) **Angaraland** (or Laurasia) (b) **Gondwana land**, and ocean water filled in it. As a result, a narrow sea was created, known as **Tethy's Sea**.



- During further course of time, Angaraland was cracked into:
  - (i) North American Plate
  - (ii) Eurasian Plate
 Whereas Gondwana land was cracked into 5 plates:
  - (i) African Plate
  - (ii) South American Plate
  - (iii) Indian Plate
  - (iv) Australian Plate
  - (v) Antarctic Plate

## PRACTICE QUESTIONS

## GEOGRAPHY

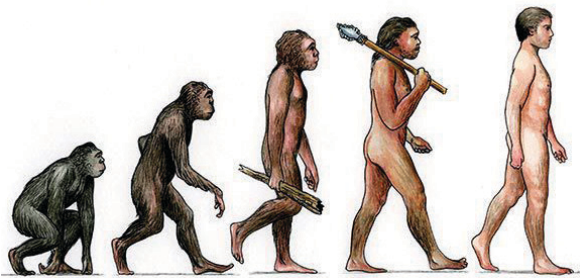
- Q.1** Which of the following will never get the vertical rays of the sun?  
 (a) Srinagar  
 (b) Mumbai  
 (c) Chennai  
 (d) Thiruvananthapuram
- Q.2** If the time of sunrise in Arunachal Pradesh is 6.00 am, what will be the probable time of sunrise in Saurashtra?  
 (a) 6.30 am (b) 5.30 am  
 (c) 8.00 am (d) 7.00 am
- Q.3** What is Durand Line?  
 (a) Boundary line between Afghanistan and Pakistan  
 (b) Boundary line between India and Pakistan  
 (c) Boundary line between India and China  
 (d) Boundary line between India and Burma
- Q.4** Duncan Pass is located between  
 (a) North and Little Andaman  
 (b) North and South Andaman  
 (c) North and Middle Andaman  
 (d) Andaman and Nicobar
- Q.5** The highest dam of India is  
 (a) Bhakra dam  
 (b) Nagarjuna Sagar dam  
 (c) Hirakud dam  
 (d) Tehri dam
- Q.6** Sahyadri is the traditional name of the  
 (a) Western Ghats  
 (b) Eastern Ghats  
 (c) Aravallis  
 (d) Barbar and Nagarjuni hills
- Q.7** The climate of India is mainly tropical because of the  
 (a) Seasonal influence of jet streams  
 (b) Location of the Himalayas in its north  
 (c) Over-powering influence of Indian Ocean  
 (d) Country being a part of Asian landmass
- Q.8** Asiatic wild ass is naturally found in  
 (a) Rann of Kutch  
 (b) Baghelkhand  
 (c) Sunderbans  
 (d) Shivaliks
- Q.9** The hill stations in ascending order of heights are  
 (a) Darjeeling, Srinagar, Leh, Simla  
 (b) Srinagar, Darjeeling, Simla, Leh  
 (c) Srinagar, Leh, Simla, Darjeeling  
 (d) Simla, Srinagar, Leh, Darjeeling
- Q.10** Which group of the rivers form delta?  
 (a) Godavari, Narmada, Mahanadi  
 (b) Narmada, Kaveri, Mahanadi  
 (c) Godavari, Kaveri, Mahanadi  
 (d) Narmada, Krishna, Kaveri
- Q.11** The Baglihar Hydro-power project, is located on which one of the following rivers?  
 (a) Beas (b) Chenab  
 (c) Ravi (d) Satluj
- Q.12** Match **List-I** (Hydel Power Project) with **List-II** (Location) and select the correct answer using the codes given below the lists:
- | <b>List-I</b>      | <b>List-II</b>            |
|--------------------|---------------------------|
| <b>A.</b> Balimela | <b>1.</b> Jammu & Kashmir |
| <b>B.</b> Koyna    | <b>2.</b> Maharashtra     |
| <b>C.</b> Kundoh   | <b>3.</b> Odisha          |
| <b>D.</b> Salal    | <b>4.</b> Tamil Nadu      |
|                    | <b>5.</b> Uttar Pradesh   |
- Codes:**
- |     | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> |
|-----|----------|----------|----------|----------|
| (a) | 3        | 2        | 4        | 1        |
| (b) | 5        | 1        | 2        | 4        |
| (c) | 3        | 1        | 2        | 4        |
| (d) | 5        | 2        | 4        | 1        |
- Q.13** Which one of the following pairs is correctly matched?  
 (a) Gwalior : Betwa  
 (b) Dhaulpur : Chambal

# HISTORY & CULTURE

## Ancient India

### PREHISTORIC PERIOD

- The early prehistoric period was observed before the 8<sup>th</sup> millennium BCE.
- The period of the prehistoric agriculturalists and pastoralists was during approximately the 8<sup>th</sup> to the mid-fourth millennium BCE.



Period/ Age	Remarks
Paleolithic Age	<ul style="list-style-type: none"> <li>• People in Paleolithic age were dependent on hunting for their livelihood and used to travel from one place to another depending on the availability of natural resources for survival. They developed sharp weapons of stone for hunting purpose.</li> </ul>
Mesolithic Age	<ul style="list-style-type: none"> <li>• During Mesolithic age, people were still hunter-gatherers, but were possibly starting to stay in one place.</li> <li>• Domestication of animals can be seen in this age.</li> </ul>
Neolithic Age	<ul style="list-style-type: none"> <li>• During Neolithic age, stone tools and weapons were also further modified and were sharpened by fine shedding of the stones.</li> <li>• It also contributed greatly in the field of transportation by an important invention of the wheel.</li> </ul>
Chalcolithic Age	<ul style="list-style-type: none"> <li>• The people of Chalcolithic age practiced agriculture. They used tools made up of copper and stone.</li> <li>• Painted pottery was the most distinguishing feature of all Chalcolithic cultures.</li> </ul>

### INDUS VALLEY CIVILIZATION

- Indus Valley Civilization is one of the oldest civilizations of the world. It flourished around the Indus river and its tributaries. The area consists of modern Pakistan and Northwestern India. Mohenjodaro is the largest site of the Civilization.
- Indus valley civilization is also called as Harappan civilization because Harappa was the first site to be excavated in 1921 under the supervision of **Daya Ram Sahni**.
- The known extent of this civilization in the west is upto Sutkagendor in Baluchistan; Alamgirpur (UP) in the east; Daimabad (Maharashtra) in South; and Manda (J and K) in the north.
- This civilization belongs to Bronze Age/ Chalcolithic Age. Hence, it is also called Bronze Age civilization.
- Contemporary civilizations of Harappan civilization are Mesopotamian or Sumerian civilization, Egyptian civilization and Chinese civilization.
- John Marshall was the first scholar to use the term "Indus Valley Civilization".

#### Important Sites of Harappan Civilization

##### 1. Harappa

- People of Harappa knew the process of making tarcoal.
- Main gate for the entry in the houses of Harappa was in the north direction.
- R-37 cemetery have been found here.
- Terracotta figurine of Mother Goddess have been found here.

##### 2. Mohenjo-daro

- Mohenjo-daro was discovered in 1922 under the supervision of **R.D. Bannerji**.
- The literal meaning of Mohenjo-daro in Sindhi language is **mound of the dead**.

- The Great Bath, a granary, big halls, a bronze statue of a dancing girl, idol of a yogi and numerous seals have been found here.
- Seven layers of Mohenjo-daro city directs that the city was destroyed and rebuilt seven times.

**3. Lothal**

- In 1954, Lothal was discovered by S.R. Rao in Gulf of Cambay in Gujarat.
- Red & black clay pots, copper tools, brick built tank like structure, a bead making factory and a seal from Iran have been found at Lothal.
- Linear scale of bronze have been found here.
- A dockyard has been found at Lothal.

**4. Kalibangan**

- Kalibangan was discovered in 1953. It is located in upper Rajasthan.
- It did not have a drainage system.
- A number of firepits *agnikundas* (firepits) have been found here.
- It saw two cultural phases viz. pre-Harappan and Harappan.
- A ploughed field have been found here.

**5. Dholavira**

- Dholavira in Gujarat was discovered in 1992 by **J.P. Joshi**.
- Dholavira shows all the three phases of Harappan civilization.
- A script consists of big alphabets has been found on a gate in Dholavira.



Major Harappan Sites and their Excavators					
Site	River	District	Province/ State	Country	Excavators
Harappa	Ravi	Montgomery	Punjab	Pakistan	Daya Ram Sahni (1921), Madho Swaroop Vatsa (1926), Wheeler (1946)
Mohenjodaro	Indus	Larkana	Sindh	Pakistan	Rakhal Das Bannerji (1922), Mackay (1927), Wheeler (1930)
Chanhudaro	Indus	Nawabshah	Sindh	Pakistan	Mackay (1925), N.G. Mazumdar (1931)
Lothal	Sabarmati & Bhogva	Ahmedabad	Gujarat	India	S.R. Rao (1954)
Kalibangan (i.e., the bangles of black colour)	Ghaggar	Sri Gangana-gar	Rajasthan	India	Amalanand Ghosh (1951), B.B. Lai & B.K. Thapar (1961)
Banawali	Saraswati	Fatehabad	Haryana	India	R.S. Bist (1973)
Dholavira	Luni	Kutchh	Gujarat	India	J.P. Joshi (1967-68)



Major Harappan Sites and Archeological Findings	
Site	Archaeological Findings
Harappa	6 Granaries in row, Working floors, Workmen's quarters, Virgin-Goddess (seal), Cemetery (R-37, H), Stone symbols of Lingam (male sex organ) & Yoni (female sex organ), Painted pottery, Clay figures of Mother Goddess, Wheat & Barley in wooden mortar, Copper scale, Crucible for bronze, Copper-made mirror, Vanity box, Dice.
Mohenjodaro	Great Bath, Great Granary (the largest building of civilization), Assembly hall, Shell strips, Pashupati Mahadeva/Proto-Shiva (seal), Bronze Image of a nude woman dancer, Steatite image of bearded man, Human skeletons huddled together, Painted seal (Demi-God), Clay figures of Mother Goddess, A fragment of woven cotton, Brick Kilns, 2 Mesopotamian seals, 1398 seals (57% to total seals of civilization), Dice.
Chanhudaro	City without a citadel, Inkpot, Lipstick; Metal-workers', shell-ornament makers' and bead-makers' shops; Imprint of dog's paw on a brick, Terracotta model of a bullock cart, Bronze toy cart.
Kalibangan	Ploughed field surface (Pre-Harappan), 7 Fire altars, Decorated bricks, Wheels of a toy cart, Mesopotamian cylindrical seal.
Lothal	Dockyard, Rice husk; Metal-workers', shell-ornament makers' & bead-makers' shops; Fire altars, Terracotta figurine of a horse, Double burial (burying a male and a female in a single grave), Terracotta model of a ship, Dying vat, Persian/ Iranian seal, Baharainean seal, Painted jar (bird & fox).
Surkotada	Bones of horse, Oval grave, Pot burials.
Banawali	Lack of chess-board or gridiron pattern town planning, Lack of systematic drainage system, Toy plough, Clay figures of Mother Goddess.
Daimabad	Bronze images (Charioteer with chariot, ox, elephant & rhinoceros)
Dholavira	A unique water harnessing system and its storm water drainage system, a large well and a bath (giant water reservoirs), Only site to be divided into 3 parts, Largest Harappan inscription used for civic purposes, A stadium.

### Important Features of Indus Valley Civilization

- **Town planning** was the most distinguishable feature of the Harappan civilization. Hence, this civilization is also called first urbanisation.
- Towns were divided into parts viz. citadel and lower town. Citadels were occupied by members of ruling class and lower town was inhabited by the common people.
- Harappan cities were developed in **Block Pattern/Chess Board Pattern** because roads of these cities used to cut each other at right angles.
- Most peculiar feature of town planning was their **drainage system**. Drains were built of burnt bricks and covered by stone lids and manholes for cleaning.
- Complete burial was the most common method of the disposal of the dead.
- They grew wheat and barley on a large scale. The other crops grown were pulses, cereals, cotton, dates, melons, pea, sesamum and mustard.
- No clear evidence of rice has been found, except from Rangpur and Lothal where some grains of rice were found, but they may be of later period.
- Harappan people were mostly peasants and thus the Harappan civilization was an agro-commercial civilization.
- Evidences of hoe and plough have been found in kalibangan and Banawali.

## Constitutional Developments

- It was in 1934 when the idea of Constituent Assembly for India was put forward for the first time by M. N. Roy (A pioneer of communist movement in India).
- In 1935, the Indian National Congress (INC) demanded a Constituent Assembly to frame the Constitution of India.
- In 1938, Jawaharlal Nehru, on behalf of INC declared that the Constitution of Free India must be framed without outside interference and by a Constituent Assembly elected on the basis of Adult Franchise. The demand was accepted by British Government during August Offer in 1940.
- In 1942, Sir Stafford Cripps, a member of the British Cabinet came to India with draft proposal of the British Government on the framing of an independent Constitution which to be adopted after the World War II.
- The Cripps Proposals were rejected by the Muslim League which wanted India to be divided into two autonomous States with two separate Constituent Assemblies.
- Finally, the Constituent Assembly was constituted in November, 1946 under the scheme formulated by the Cabinet Mission Plan.

## Important British Acts of Constitutional Significance

### Regulating Act, 1773

- The Regulating Act, 1773 was the first step taken by the British Government to control and regulate the affairs of the East India Company in India.
- It designated the Governor of Bengal as the 'Governor-General of Bengal' and created an Executive Council consisting of four members to

assist him. The first Governor-General of Bengal was Lord Warren Hastings.

- It made a provision of Supreme Court at Fort William in Calcutta, comprising one Chief Justice and three other judges.
- It strengthened the control of the British Government over the East India Company by requiring the Court of Directors which was a governing body of the Company to report on its revenue, civil and military affairs in India.

### Pitt's India Act, 1784

- This Act created a new body called Board of Control to manage the political affairs while Court of Directors were allowed to manage the commercial affairs. Thus, Pitt's India Act made a provision of separation in company's political and commercial activities.
- It empowered the Board of Control to supervise and direct all operations of the civil and military affairs and revenues of the British possessions in India.
- The Company's territories in India were for the first time called **British Possessions in India**.

### Charter Act, 1793

- This Act recognised the courts and redefined their jurisdictions. Accordingly, the revenue administration was separated from the judiciary functions. This provision led to disappearing of the Maal Adalats (Revenue courts).
- Salaries of the members of the Board of Control to be drawn from the Indian exchequer.

### Charter Act, 1813

- The East India Company's monopoly over trade was abolished in India but its monopoly over trade with China and for trade in tea retained.
- This Act asked Company to spend one lakh rupees every year on the education of Indians.
- Christian missionaries were permitted to propagate their religion in India.

**Charter Act, 1833**

- This Act made the Governor-General of Bengal as the Governor-General of India and vested in him all civil and military powers. Lord William Bentinck was made the first Governor-General of India.
- The East India Company lost its monopoly over trade with China also and it was asked to close the commercial business. The Company became a purely administrative body.
- This Act asked government to abolish **slavery** in India.

**Charter Act, 1853**

- This Act had provisions of separation of executive and legislative functions of the Governor General's Council. It provided for addition of six new members called Legislative Councillors to the **Indian (Central) Legislative Council**.
- For the first time, the local representation in the Indian (Central) Legislative Council was allowed.
- An open competition system of selection and recruitment of civil servants was introduced. For the first time, Indians were allowed to take part in Civil Services recruitment process. Consequently, the Macaulay Committee (the Committee on the Indian Civil Service) was appointed in 1854.

**Government of India Act, 1858**

- It brought an end to the Company's rule and transferred all powers to the British crown.
- The system of **Dual government** (Board of Control and Court of Directors) introduced by Pitt's India Act was abolished by this Act.
- A new office of **Secretary of State for India** was created and he was vested with complete authority and control over Indian administration. He was a member of the British Cabinet and was ultimately responsible to the British Parliament. Lord Stanley was the first Secretary of State for India.

**Indian Councils Act, 1861**

- The Viceroy was empowered to issue ordinances in case of emergency without the concurrence of the legislative council. The life span of such ordinances was six months.
- This Act also introduced the 'portfolio' system. Under this, a member of the Viceroy's council

was made in-charge of one or more departments of the government.

**Indian Councils Act, 1892**

- This Act empowered the Universities, district boards, municipalities, zamindars and chambers of Commerce to recommend members to the Provincial Legislative Council which were to be nominated by governors.
- According to this Act, the members of the Legislatures were for the first time entitled to take part in debate over Annual Statement of Revenue and Expenditure i.e. Budget. They could also put questions within certain limitations.

**Indian Councils Act, 1909 (Morley-Minto Reforms)**

- This Act is also known as **Morley-Minto Reforms**. Morley was the then Secretary of State for India and Lord Minto was the then Viceroy of India.
- Muslims were given separate representation and hence Lord Minto came to be known as the **Father of Communal Electorate**.
- A provision was made for the association of Indians with the Executive Council of the Viceroy and Governors. **Satyendra Prasad Sinha** became the first Indian to join the Viceroy's Executive Council. He was appointed as Law Member.

**Government of India Act, 1919 (Montague-Chelmsford Reforms)**

- This Act is also known as **Montague-Chelmsford Reforms or Montford Reforms**. Montague was the then Secretary of State for India and Chelmsford was the then Viceroy of India.
- All administrative subjects were divided into two groups viz. central and provincial subjects. Provincial subjects were further divided into two parts- transferred and reserved. The **transferred subjects** were to be administered by the Governor with the aid of ministers responsible to the Legislative Council whereas Governor was not responsible towards Legislative Council in the discharge of **reserved subjects**.
- This dual scheme of governance was known as 'dyarchy', a term derived from the Greek word diarche, which means double rule.
- For the first time, Indian Central Legislature was made **bicameral** (two Houses).



- For the first time, **direct elections** in the country were introduced. It granted franchise to a limited number of people on the basis of property, tax or education.
- It also provided for the establishment of the Public Service Commission, which was established in 1926.

### Government of India Act, 1935

- The Act divided the powers between the Centre and provinces in terms of three lists, namely Federal List (for Centre, with 59 subjects), Provincial List (for provinces, with 54 subjects) and the Concurrent List (for both, with 36 subjects).
- Council of States having 260 members (156 from British India & 104 from Indian States) was to be permanent House with 1/3 members to retire every three years.
- A Federal Assembly to have 5 years duration consists of 375 members (250 from British India and 125 from provinces).
- This Act introduced bicameralism in six out of eleven provinces. Thus, the legislatures of Bengal, Bombay, Madras, Bihar, Assam and the United Provinces were made bicameral consisting of a legislative council (upper house) and a legislative assembly (lower house).
- It abolished dyarchy in the provinces and introduced provincial autonomy in its place. By these provisions, the provinces were allowed to act as autonomous units of administration in their defined spheres in which the Governor was required to act with the advice of ministers responsible to the provincial legislature.
- The Act provided for the establishment for a Federal Court which was set up in 1937.
- It also provided for the adoption of dyarchy at the Centre.
- It provided for the establishment of Reserve Bank of India to control the currency and credit of the country.
- It also provided for the establishment of Federal Public Service Commission, Provincial Public Service Commission and Joint Public Service Commission for two or more provinces.

### Indian Independence Act, 1947

- The Indian Independence Act, 1947 ended the British rule in India and declared India as an independent and sovereign state from August 15, 1947.

- This Act provided for the partition of India and creation of two independent dominions of India and Pakistan.
- It abolished the office of Viceroy and provided, a Governor General for India and Pakistan separately, who was to be appointed by the British Monarch on the advice of the cabinet of both countries.

### Interim Government 1946

- In the interim government formed in 1946, the Viceroy continued to be the head of Executive Council. However, Jawaharlal Nehru was designated as the Vice-President of the council and he also headed the interim cabinet.
- The members of the Interim Government were members of the Viceroy's Executive Council. The specific portfolios was allotted to each member.

#### Member from Indian National Congress

- (i) Jawaharlal Nehru (External Affairs and Commonwealth relations)
- (ii) Sardar Vallabhbhai Patel (Home, Information and Broadcasting)
- (iii) Dr. Rajendra Prasad (Food and Agriculture)
- (iv) Sardar Baldev Singh (Defence)
- (v) Jagjivan Ram (Labour)
- (vi) C. Rajagopalachari (Education and Arts)
- (vii) Dr. John Mathai (Industries and Supplies)
- (viii) C. H. Bhabha (Works, Mines and Power)
- (ix) Asaf Ali (Railway and Transport)

#### Member from Muslim League

- (i) Liaquat Ali Khan (Finance)
- (ii) Abdur Rab Nishtar (Posts and Air)
- (iii) I. I. Chundrigar (Commerce)
- (vi) Ghazanafar Ali Khan (Health)
- (v) Joginder Nath Mandal (Law)

### Framing of Constitution of India

- The Constituent Assembly which was set up in 1946 as per the Cabinet Mission Plan, was given the task of framing of Constitution of India.
- The members of Constituent Assembly were elected indirectly by the provincial assemblies in the ratio of one member per million population.



## PRACTICE QUESTIONS

## CHEMISTRY

- Q.1** Age of fossil may be found out by determining the ratio of two isotopes of carbon. The isotopes are  
(a) C-12 and C-13  
(b) C-13 and C-14  
(c) C-12 and C-14  
(d) C-12 and carbon black
- Q.2** Which one among the following statement about an atom is not correct?  
(a) Atoms always combine to form molecule.  
(b) Atoms are the basic units from which molecules and ions are formed.  
(c) Atoms are always neutral in nature.  
(d) Atoms aggregate in large numbers to form the matter that we can see, feel and touch.
- Q.3** Which one among the following statements is correct?  
(a) All bases are alkalis.  
(b) None of the bases is alkali.  
(c) There are no more bases except the alkalis.  
(d) All alkalis are bases but all bases are not alkalis.
- Q.4** From which one among the following water source, the water is likely to be contaminated with fluorine?  
(a) Ground water  
(b) Rain water  
(c) River water  
(d) Pond water
- Q.5** Gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) is added to clinker during cement manufacturing to  
(a) decrease the rate of setting of cement  
(b) bind the particle of calcium silicate  
(c) facilitate the formation of colloidal gel  
(d) impart strength to cement
- Q.6** Which one of the following properties change with valency?  
(a) Atomic weight  
(b) Molecular weight  
(c) Density  
(d) Equivalent weight
- Q.7** The polymeric fibre used as substitute for wool in making synthetic blankets, sweater, etc., is  
(a) Nylon (b) Teflon  
(c) Orlon (d) Bakelite
- Q.8** Scuba divers are at high risk due to high concentration of dissolved gases while breathing air at high pressure under water. The tanks used by Scuba divers are filled with  
(a) air diluted with helium  
(b)  $\text{O}_2$   
(c)  $\text{N}_2$   
(d) a mixture of nitrogen and helium
- Q.9** Which one among the following is not a periodic property i.e., does not show any trend on moving from one side to the other in the Periodic Table?  
(a) Atomic size  
(b) Radioactivity  
(c) Valency  
(d) Electronegativity
- Q.10** Which one of the following is used as a mordant in dyeing and tanning industry?  
(a) Magnesium oxide  
(b) Magnesium chloride  
(c) Magnesium sulphate  
(d) Magnesium carbonate
- Q.11** Which one of the following petroleum refinery products has the lowest boiling point?  
(a) Kerosene (b) Gasoline  
(c) Diesel (d) Lubricating oil



# BIOLOGY

## BASICS OF BIOLOGY

### Animals

#### Classification of animals

- When any plane passing through the central axis of the body divides the organism in two halves that are approximately mirror images it is called Radial symmetry and the animals showing radial symmetry are called *Radiata*.
- When the body can be divided into identical left and right halves in only one plane. This kind of symmetry is called bilateral symmetry and such animals are called *Bilateria*.
- Almost 99 percent of animals are invertebrates (animals without backbone) and the remaining represents the vertebrates (animals with backbone). Also, the animals are categorised into two major groups, non-chordates and chordates, on the basis of the presence or absence of *notochord* at some stage in their life.
- The animal kingdom is divided into 35 Phyla (singular: Phylum) of which 11 are considered as major Phyla.

#### 1. Phylum Protozoa (Unicellular Protist Animals)

- They are microscopic organisms in which a single cell performs all the vital activities.
- They are aquatic (fresh water and marine) and cosmopolitan in distribution. Some forms are parasitic. The protozoan cell body is either naked, (for example, amoeba) or surrounded by a non-rigid pellicle (Cellulose is absent in pellicle).
- Different types of locomotory organs are found in protozoans.
- Locomotory organs are absent in the parasitic forms (Sporozoa) of protozoans.
- Most protozoans are free-living and aquatic. They are holozoic and feed largely on bacteria, microscopic algae and minute animals such as rotifers or on other protozoans including members of their own species. Some protozoans are holophytic i.e. they prepare their own food by photosynthesis (e.g. Euglena).

The parasitic protozoans feed on materials obtained from the hosts (e.g. Monocystis).

Examples:

- (i) **Free living:** Euglena, Amoeba, Paramecium, Noctiluca and Elphidium.
- (ii) **Parasitic:** Monocystis, Entamoeba, Plasmodium, Trypanosoma and Giardia.

#### 2. Phylum Porifera (Pore Bearing Animals)

- These are commonly known as *sponges*. They are the most primitive group of multicellular animals. About 5000 species of sponges are known. Most of them are marine and remain attached to rocks. A few live in fresh water.
- The sponges are *diploblastic*.
- Sponges reproduce *asexually* by fragmentation.

#### 3. Phylum Cnidaria

- The phylum name is derived from the *stinging cells* or *cnidoblasts* present on the ectoderm of tentacles and body of the carnivorous animals. Cnidarians have achieved tissue grade of organisation and they exhibit a blind sac body plan and radial symmetry.
- Cnidarians are *diploblastic* animals in which the body wall consists of only two layers or cells, an outer ectoderm and an inner endoderm, separated by a gelatinous layer of mesoglea.
- **Examples:** Hydra, Obelia, Porpita, Vellela, Physalia (Portuguese man of war), Aurelia (Jellyfish), Adamsia (Sea anemone), Pennatula (Sea-pen) and Gorgonia (Sea-fan).

#### 4. Phylum Ctenophora

- Ctenophores are marine animals with transparent and flat or oval body shape. *Polyphase* is absent in their life cycle. These are bilaterally symmetrical and devoid of cnidoblast cells.
- The presence of a *special sense organ* at the opposite end of the mouth (aboral end) is the characteristic of the members of this phylum. They reproduce only by *sexual* means and do not exhibit larval phase in their life cycle.

#### 5. Phylum Platyhelminthes (Flatworms)

- These are dorsoventrally flattened and, hence,



commonly known as *flatworms*. These are mostly parasites.

- These are *triploblastic* and unsegmented animals exhibiting bilateral symmetry.
- They reproduce both *asexually* and *sexually*.
- They are *hermaphrodites* or *bisexual* i.e., both male and female sex cells are produced by the same individual.
- **Examples:** Taenia (Tapeworm), Fasciola (Liver Fluke), Schistosoma (Blood fluke) etc.

#### 6. Phylum Nemathelminthes (Round Worms)

- These are also known as *nematodes*. Their bodies appear circular in cross-section, hence, the name *roundworm*. Though not apparent they are possibly the most abundant and numerous among animals.
- Roundworms are bilaterally symmetrical, triplo-blastic and pseudocoelomate animals with an organ system grade of organization.
- Round worms have a tube within a tube body plan with mouth, faringes, intestine and anus.
- Sexes are usually separate, often with small male and large female individuals.
- **Examples:** Ascaris, Wuchereria (Filaria worm), Ancylostoma (Hook worm), Enterobius (Pin worm) and Rhaditis.

#### 7. Phylum Annelida

- Metamerically segmented animals with a true coelom.
- **Examples:** Nereis, Aphrodite (sea mouse), Phere-tima (Earthworm), Tubifex, Hirudinaria (Leech), Chaetopterus, Erebella, and Bonnellia.

#### 8. Phylum Mollusca (Soft Bodied Animals)

- They are triploblastic coelomates and usually with bilateral symmetry. They are terrestrial, marine and fresh water inhabitants.
- **Examples:** Pilla (apple snail), Achatina (land snail), Lamellidens (mussel), Pinctada (peal oyster), Sepia (cuttlefish), Loligo (squid), Octopus (devilfish), Doris (sea-lemon), Aplysia (sea-hare) and Teredo (shipworm).

#### 9. Phylum Arthropoda

- The phylum Arthropoda constitutes the largest group of animals with about 900,000 species. These are triploblastic, coelomate and bilaterally symmetrical animals.
- Arthropods have a segmented body, each segment bearing a pair of jointed *appendages* covered by a jointed exoskeleton.
- Arthropods are *unisexual*.

- **Examples:** Araneus (garden spider), Limulus (king crab), Buthus (scorpion), Eupagurus (hermit crab), Cancer (common crab), Macrobrachium (prawn), Lepisma (silverfish), Periplaneta (cockroach), Apis (bee), Anopheles (mosquito), Musca (housefly), Leptocorisa (paddy pest: gandhi poka), Triops (tadpole fish), Daphnia (water flea), Cyclops, Squilla, Astacus (crayfish), Lepas and Balanus (Barnacle).

#### 10. Phylum Chordata (Scordates)

- Chordata refers to the group of animals which possess *notochord* either throughout or during early embryonic life. Notochord is a stiff and flexible rod of tissues lying ventral to nerve chord. All the chordates are triploblastic, coelomate and bilaterally symmetrical.
- Phylum Chordata is divided into four subphyla viz. subphylum Hemichordata or stomochordata, subphylum Urochordata or Tunicata, subphylum Cephalochordata or Acrania and subphylum Vertebrata.

Difference between Chordates & Non-chordates	
Chordates	Non-Chordates
1. Notochord Present.	1. Notochord absent.
2. Central nervous system is dorsal, hollow and single.	2. Central nervous system is ventral, solid and double.
3. Pharynx perforated by gill slits.	3. Gill slits are absent.
4. Heart is ventral.	4. Heart is dorsal.
5. A post anal meta-merically segmented tail is present.	5. Terminal part (pygidium) is unsegmented.

#### 11. Phylum Echinodermata (Spiny Skinned Animals)

- Echinoderms bears many spines and hence all are marine, triploblastic and coelomate.
- The most distinctive feature of echinoderms is the presence of *water vascular system*, which is a part of the coelom. Its main function is locomotion and capture of food.
- **Examples:** Asterias (star fish or sea star), Echinus (sea urchin), Echinocardium (heart urchin), Antedon (feature star of sea lily), Cucumaria (sea cucumber) and Ophitura (brittle star).

# SCIENCE & TECHNOLOGY

## INDIAN INSTITUTIONS IN SCIENCE & TECHNOLOGY

### Ministry of Science and Technology

Department of Science and Technology (DST), Department of Scientific & Industrial Research (DSIR) and Department of Biotechnology (DBT) are the departments which work under the Ministry of Science & Technology.

### Department of Science and Technology (DST)

- DST is primarily entrusted with the responsibility of formulation of S&T policies and their implementation, identification and promotion of thrust areas of research in different sectors of S&T; technology information, forecasting and assessment; international collaboration, promotion of science & society programmes and coordination of S&T activities in the country.
- The list of autonomous S&T institutions is
  1. Agharkar Research Institute, Pune.
  2. Aryabhatta Research Institute of Observational-Sciences, Nainital.
  3. Birbal Sahni Institute of Palaeobotany, Lucknow.
  4. Bose Institute, Kolkata.
  5. Centre for Liquid Crystal Research, Jalahalli, Bengaluru.
  6. Indian Association for the Cultivation of Science, Kolkata.
  7. International Advanced Research Centre for Powder Metallurgy and New Materials, Hyderabad.
  8. Indian Institute of Astrophysics, Bengaluru.
  9. Indian Institute of Geomagnetism, Mumbai.
  10. Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru.
  11. National Accreditation Board for Testing & Calibration Laboratories, New Delhi.

12. Raman Research Institute, Bengaluru.
13. S.N. Bose National Centre for Basic Sciences, Kolkata.
14. Sreechitra Tirunal Institute for Medical Sciences & Technology, Thiruvananthapura.
15. Technology Information, Forecasting & Assessment Council (TIFAC), New Delhi.
16. Vigyan Prasar, New Delhi.
17. Wadia Institute of Himalayan Geology, Dehradun.
18. Institute of Advanced Studies in Science & Technology, Guwahati.

### Department of Scientific and Industrial Research (DSIR)

- Council of Scientific and Industrial research (CSIR) and Consultancy Development Centre (CDC) are the two autonomous institutions which work under DSIR.
- The Council of Scientific and Industrial Research (CSIR), with its 39 laboratories dedicated to research and development in well-defined areas and around 50 field stations, is the major organization under DSIR.
- Among the other programmes of DSIR are: support to R&D by industry, programmes aimed at technological self-reliance, schemes to enhance efficacy of transfer of technology and a National Information System for Science and Technology (NISSAT).
- The list of CSIR Laboratories is as follows:
  1. Central Building Research Institute (CBRI), Roorkee
  2. Center for Cellular & Molecular Biology (CCMB), Hyderabad
  3. Central Drug Research Institute (CDRI), Lucknow
  4. Central Electrochemical Research Institute (CECRI), Karaikudi

## PRACTICE QUESTIONS

## ENVIRONMENT

- Q.1** How much forest % is good for ecological balance?  
 (a) 33% (b) 66%  
 (c) 35% (d) 38%
- Q.2** In lake ecosystem, pyramid of biomass is  
 (a) upright  
 (b) inverted  
 (c) anything is possible  
 (d) None of them
- Q.3** Which one of the following is a top carnivore of grassland food chain?  
 (a) snake (b) deer  
 (c) vulture (d) frog
- Q.4** Consider the following statements regarding productivity:  
 1. Primary productivity of ecosystem is the rate at which plants and other photosynthetic organisms produce organic compounds.  
 2. Secondary productivity is the rate at which energy is stored at different levels in consumers.  
 Which of the above statements is/are correct?  
 (a) 1 only (b) 2 only  
 (c) Both 1 and 2 (d) Neither 1 nor 2
- Q.5** Which of the following is the nature's cleaner?  
 (a) Producers (b) Consumer  
 (c) Decomposers (d) Man
- Q.6** Pyramid of energy in a pond ecosystem is always  
 (a) inverted (b) upright  
 (c) irregular (d) linear
- Q.7** Xerosere succession is related to  
 (a) land (b) rocks  
 (c) pond (d) desert
- Q.8** Chipko Movement in Karnataka is known as  
 (a) Appiko movement (b) Sipko movement  
 (c) Assiko movement (d) None of these
- Q.9** If you travel through the Himalayas, you are Likely to see which of the following plants naturally growing there?  
 1. Oak  
 2. Rhododendron  
 3. Sandalwood  
 Select the correct answer using the code given below  
 (a) 1 and 2 only (b) 3 only  
 (c) 1 and 3 only (d) 1, 2 and 3
- Q.10** Consider the following statements:  
 1. Energy flow through the trophic levels from producers to subsequent trophic level is bi-directional.  
 2. Energy level increases from the first trophic level upwards due to addition of energy in the form of heat at each trophic level.  
 Which of the above statements is/are correct?  
 (a) 1 only (b) 2 only  
 (c) Both 1 and 2 (d) Neither 1 nor 2
- Q.11** Snowfall is a  
 (a) biotic factor (b) abiotic factor  
 (c) Both of them (d) None of them
- Q.12** Microbes are a  
 (a) biotic factor (b) abiotic factor  
 (c) edaphic factor (d) None of them
- Q.13** Which one of the following is not an abiotic component of environment?  
 (a) Radiation (b) Geologic substratum  
 (c) Symbionts (d) Gravity
- Q.14** The gas responsible for Bhopal gas tragedy was  
 (a) Methane (b) Methyl isocyanide  
 (c) CO (d) Methyl propane
- Q.15** Photochemical smog mainly contains  
 (a) CFC (b) SO<sub>2</sub>  
 (c) H<sub>2</sub>O (d) NO<sub>2</sub>