Geography

for

Civil Services Examinations

CENGAGE

Australia • Brazil • India • Mexico • Singapore • United Kingdom • United States

CENGAGE

Geography
for
Civil Services
Examinations

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Cengage Learning India Pvt. Ltd.
418, F.I.E., Patparganj
Delhi 110092

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UNIT – 2 INDIAN PHYSICAL AND POLITICAL GEOGRAPHY

Preface

If you ever happen to be walking down the streets of places where preparation for Civil Services is done, it will not be uncommon for you to come across or make the acquaintance of 'several' starry eyed yet completely committed IAS aspirants. Yet, 'several' would be an understatement given the number that runs into lakhs! But when we say committed, we mean it; these young men and women are ready to sacrifice almost all their youthful follows including sleep, comfort and even a semblance of a normal life to achieve one goal—IAS!

Sadly, this dream remains a distant one for a large majority of these aspirants in spite of the endless hours of study and sleep forsaken nights. When we tried to unravel WHY, the responses were almost synchronous:

"The subject was so vast that there was too much to cover and I could never complete it."

"I read so much but could not retain it."

"I studied something but was quizzed on something else in the exam."

"I kept reading but did not attempt to solve the past year papers or give a mock exam."

"Subscribing to several sources of information/preparation such as a coaching class, the internet and books was futile; after all there are only 24 hours in a day."

"My almirah was full of too many books, but I could barely complete a few."

And while the candid answers stated above clearly gave us a challenging problem—we did not attempt to solve it. We instead focused on a holistic solution—the synchronizing of effort i.e. Learning and Positive Results!

It is with this aim that we—PrepMate collaborated with Cengage India—are continuously striving to develop a comprehensive learning model that is a combination of online and offline so as to effectively address the issues that most aspirants grapple with.

About the Online–Offline Learning Model

The learning model initiates the process with a series of books targeted at cracking the UPSC exam. The books stand apart from others available because of the following unique features:

- We use a conceptual approach, simple language, explain concepts with diagrams, cite sufficient examples, pose pertinent questions in a reader friendly format—to ensure that the contents of these books can be read and assimilated in a time-bound manner.
- The content is specially designed taking into account the trend in UPSC exams in recent years. We have also included the previous years' questions (with solutions) after every chapter.

- The Practice Questions at the end of each chapter are exhaustive to provide sufficient preparation to crack the exams.
- The book series also contains additional information on 'how to write answers' along with what your approach should be for the mains—here too we have explained by solving questions and showing you the 'preferred answering style'.
- We have tried to encapsulate all that is required to be learnt for a particular subject into a single book.

Usually, an aspirant purchases a book, but never gets a chance to contact the authors. We believe that the contact among aspirants and authors is important for learning and motivation of the aspirants. That is precisely why we have developed an application and a web portal to answer your queries and provide you with continuous support during your preparation.

It is through this online system that we provide the following services:

1. Videos covering important and difficult topics
2. Answer writing practice sessions
3. Daily prelims quiz
4. Assistance in interview preparation
5. Regular updates
6. Daily currentaffairs
7. Monthly current affairs magazine
8. Radio news analysis
9. Educational videos
10. Previous years' papers and solutions
11. Free study materials

Looking forward to being your partner in the journey towards achieving your dream!

In case you have any specific queries or constructive feedback you can always share the same with us via e-mail at info@prepmate.in.

PrepMate

Acknowledgements

"We cannot accomplish all that we want to do without working together"

The complete UPSC learning module by Prepmate has been the culmination of more than a year of ideation and brain storming with a lot of people. It is only natural that we should gratefully acknowledge their valuable contribution sincerely. Nirmal Singla, Ramnik Jindal, Sharat Gupta, Subhash Singla and Vijay Singla—thank you for your continuous support and motivation.

We would also like to thank Maninder Mann, Rajinder Paul Singla and Sundeep Singh Garha who helped us in first conceiving and later developing the synergistic online–offline model of the project—without you we would be missing our competitive edge.

Implementation of strategy can more often than not prove challenging and the development of the online module did prove to be tougher than we had envisaged. But our technical team was focused on enabling our dream and delivering the best and they surely did. With a specific mention to the testing of both the website and the application, we would like to thank Parth, Tanvir and Surabhi who did their job patiently and effectively in spite of the road blocks.

Our videos and books could not have been possible without the help of our graphics design team—Sandeep, Manjeet, Sukhjinder, Roshni and Uday toiled endlessly to ensure the best designed audio-visuals.

It is an understatement to state that the sourcing and reviewing of existing content and the generation of missing content was the most crucial part of this project and the backbone of our Learning Module. This would just not have been possible without our team of content contributors: Isha Gupta, Shelly Jindal, Gurdeep, Surabhi, Shantnu, Tanvir, Anmol, Kriti, Tanya, Sahil, Suraj and Dilshad, who left no stone unturned in their pursuit of excellence—your pivotal contributions are gratefully acknowledged.

We would like to extend a special thanks to our staff members Geeta, Jitender, Manoj and Pinki, who helped us in the most laborious job i.e. typing through the several manuscripts of our books—your contribution is sincerely appreciated.

It is imperative that we thank Isha Gupta, Shelly Jindal, Anjum Diwan, Rajesh Goel, Shikha Sharma and Ravinder Indoura, for their critical yet constructive feedback that identified and subsequently rectified the errors that crept in during the development process. We will never be able to thank them enough for this—you fortified the very foundation of our model.

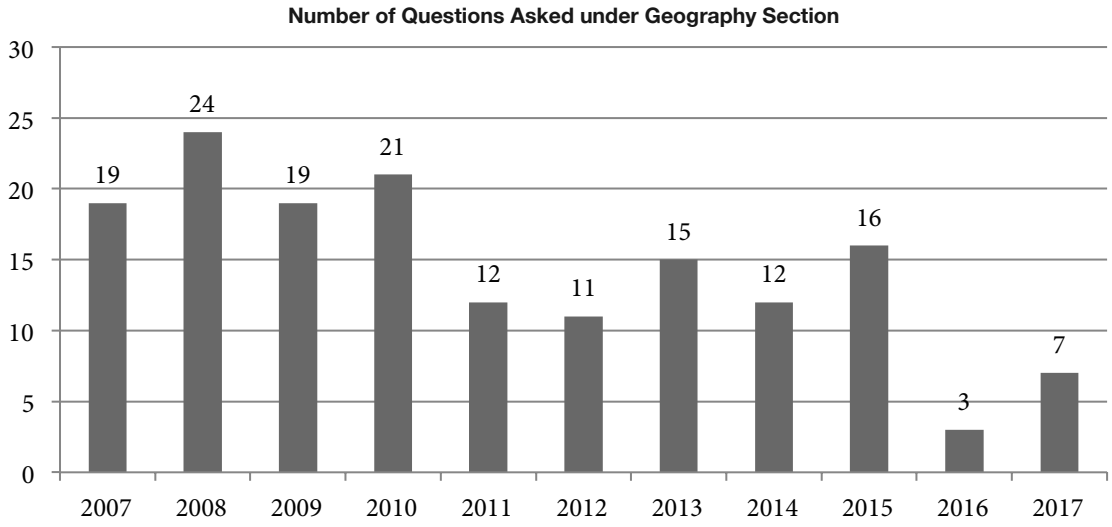
We sincerely acknowledge the initiatives and support from the entire editorial team of Cengage India in the process of publishing this book.

PrepMate

List of Videos

Chapter-wise Break Up of Previous Year's Questions (Prelims)

Chapter name	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	Total
1 Universe			1			2	1		1	1		6
2 Earth					1				1		2	4
3 The Lithosphere				1							1	2
4 The Atmosphere	1		2		2	1	3	2	1	1	2	15
5 Hydrosphere			2		3	1		1				7
6 World Climate Types			1	1	2	1	1	2				8
7 Continents	1		2	2	1		1	1	4	4	3	19
8 India Political	1		2	1		1		1		2	1	9
9 Structure and Relief	2	1	1	1		1				1	2	9
10 Drainage System	1	2	1	1	1		1	3	5	5	2	22
11 Soils				1	2		2	2				7
12 Climate						1		1	1			3
13 Natural Vegetation			3	1			2	2		1		9
14 Natural Disasters												
15 Economic Activities and Location Factors						1		1				2
16 Agriculture				1	1	2	1	2		1	1	9
17 Mineral and Energy Resources			1		1			2	1	2	3	10
18 Industries in India											1	1
19 Transport and Communication	1								1			2
20 Population				2	1			1	3	5	1	13
21 World Economic Geography									1	1		2
Total	7	3	16	12	15	11	12	21	19	24	19	159


Number of Questions Asked under Geography Section
30
25
20
15
10
5
0
19
24
19
21
12
11
15
12
16
3
7
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

Unit - 1

World Physical Geography

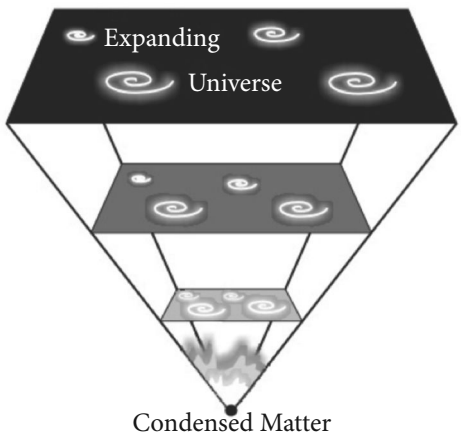
Chapter 1 UNIVERSE

1 ORIGIN OF UNIVERSE

The universe was formed about 13.77 billion years ago. Our planet Earth is much younger and was formed around 4.5 billion years ago.

Big Bang Theory

The most acceptable theory regarding the origin of the universe is the Big Bang Theory. It is also called the **expanding universe hypothesis**. Edwin Hubble, in 1920, provided evidence that the universe is expanding.



The Big Bang

The Big Bang Theory considers the following stages in the development of the universe:

1. In the beginning, all the matter forming the universe existed in one place in the form of a "compact ball" of condensed matter with an unimaginably small volume.
2. The compact ball exploded violently due to continuous contraction. This huge explosion is popularly known as the Big Bang.
3. As a result of explosion, universe is continuously expanding ever since.

The argument for expansion of the universe is supported by the phenomenon of red shift.

Red shift

The frequency of a wave appears to be higher when a source approaches the observer and it is lower when a source moves away from the observer. In the spectrum of visible light, red has the lowest frequency and the longest wavelength, while violet has the highest frequency and the shortest wavelength.

It is observed that light coming from distant galaxies shift towards the red-end of the light spectrum and this shift of light is called red shift.

Thus, red shift of the light emerging from other galaxies proves that galaxies are moving away from each other. In other words, the universe is expanding.

Oscillating Universe Theory

The oscillating universe theory is built upon the Big Bang Theory. It affirms that at present, the universe is in the state of expansion because of the force generated due to the big bang explosion.

However, the theory predicts that when the magnitude of repulsive force, on account of big bang, will be lesser than the gravitational pull of the matter (after 29 billion years), the matter would again start moving towards the centre of the universe and there would be another big bang. This process of contraction and expansion would continue forever.

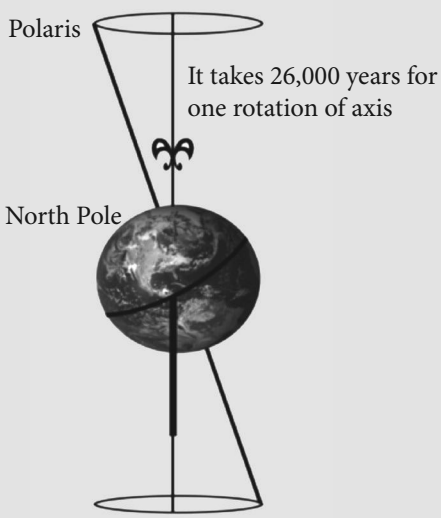
2 COMPONENTS OF UNIVERSE: CELESTIAL BODIES

1. **Galaxies:** A galaxy is the congregation of millions of stars held together by their own gravitational force. Our galaxy is called the Milky Way.
2. **Star:** It generates energy in the form of light through the process of nuclear fusion in which lighter elements, particularly hydrogen, fuse to form heavier elements such as helium. Sun and Polaris are popular stars.
3. **Constellation:** Cluster of stars organized into different shapes is called constellation. Saptarishi or the Big Dipper is one of the most popular pattern of stars visible in the sky, consisting of the seven brightest stars of the large constellation Ursa Major. The constellation's most recognizable stars (group of seven stars) are commonly known as "the Big Dipper". The Big Dipper and the constellation as a whole have mythological significance in numerous world cultures, including India.

Polaris: It is commonly known as the North Star or the Pole Star. Its position appears fixed in the sky, while all other stars appear to be moving. This is because it lies directly over the Earth's North Pole, making it the current northern Pole Star.

This position, however, is not permanent. The orientation of the Earth's axis too undergoes a change with time. The Earth's axis takes 26,000 years to complete one cycle.

So after some hundreds of years from now, Polaris may no longer be the "static" Pole Star as the Earth's axis may point towards a new star.



Formation of Galaxies and Stars

A galaxy starts to form by accumulation of hydrogen gas in the form of a very large cloud called nebula. Eventually, growing **nebula** develops localized clumps of gas. These clumps continue to grow into even denser gaseous bodies, giving rise to stars.

The formation of stars is believed to have taken place some 5–6 billion years ago.

4. **Asteroids:** These are the remains of matter or space debris that could not become part of any planet. In our solar system, asteroids are mainly found, in the form of **asteroid belt**, between Mars and Jupiter.
5. **Comets:** These are loose collections of ice, dust, and small rocky particles, found in the outer fringes of the solar system. As a comet approaches the inner solar system, solar radiation causes the volatile materials within the comet to vaporize. These vaporized materials carry away dust with them leading to formation of a tail. Under the influence of solar winds, the tail always points away from the Sun. Comets follow an eccentric path but have a definite periodicity. Haley's Comet is a popular comet, which is seen from the Earth after a period of 76 years.
6. **Meteors or shooting stars:** A meteor or a shooting star is the flash of light that appears when a small chunk of interplanetary debris burns up as it passes through our atmosphere. It is to be noted that "meteor" refers to the flash of light caused by the debris, not the debris itself.

   The debris is called a meteoroid. Most **meteoroids** are only a few millimetres in size. Most meteoroids that enter the Earth's atmosphere are so small that they vaporize completely and never reach the planet's surface.

   If any part of a meteoroid survives the fall through the atmosphere and lands on Earth, it is called a meteorite. Although the vast majority of **meteorites** are very small, their size can range from about a fraction of a gram (the size of a pebble) to 100 kg or even more.

Practice Questions I

1. A meteorite is:
   (a) A comet with a bright gaseous tail.
   (b) A piece of matter that burns and gets converted into ash as it enters the Earth's atmosphere from outer space.
   (c) A piece of matter that does not burn completely and reaches the surface of the Earth.
   (d) None of the above.

2. What is the difference between asteroids and comets?
   1. Asteroids are found between Mars and Jupiter, whereas comets are in the outer fringes of the solar system.
   2. Asteroids are gaseous in nature, whereas comets are not.
   3. Comets have a tail, while asteroids do not.

   Which of the statements given above is/are correct?
   (a) 1 and 2 only
   (b) 1 and 3 only
   (c) 3 only
   (d) 1, 2, and 3

3. Which of the following statements about our universe is/are correct?
   1. Our universe is in the state of expansion.
   2. Light waves are used to study the distant galaxies present in the universe.
   3. Sound waves are used to measure the distance among various celestial bodies.

   Select the correct answer using the codes given below:
   (a) 2 and 3 only
   (b) 1 and 2 only
   (c) 1 only
   (d) 1, 2, and 3

4. Consider the following statements:
   1. Comets have highly elliptical orbits that bring them close to the Sun, often beyond the orbit of Pluto.
   2. Solar wind is responsible for the formation of tails in comets.

   Which of the statements given above is/are correct?
   (a) 1 Only
   (b) 2 Only
   (c) Both 1 and 2
   (d) Neither 1 nor 2

5. Consider the following statements about our universe:
   1. Our universe was formed 9 billion years ago.
   2. Light waves help in determining the distance among celestial bodies.
   3. Our solar system is in a continuous state of expansion.

   Which of the statements given above is/are correct?
   (a) 2 and 3 only
   (b) 1 and 2 only
   (c) 2 only
   (d) 1, 2, and 3

3 THE SOLAR SYSTEM

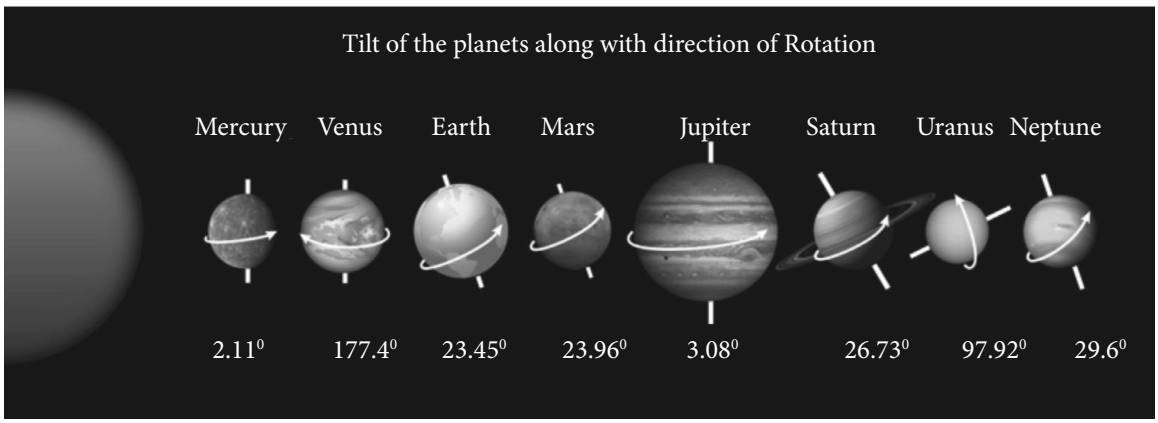
The solar system consists of the Sun, eight planets and their satellites, asteroids, meteors, and comets.

The Sun

- Sun constitutes 99.85% of the mass of our solar system.
- Rotation time of the Sun is 25 days.
- Revolution time of the Sun is 250 million years.
- Surface temperature is 6000°C.
- Core temperature is 15~20 million °C.
- Composition: Hydrogen 71%, helium 27%.
- **Age:** 5 billion years.
- **Solar wind:** The solar wind is a stream of energized, charged particles, primarily electrons and protons, flowing outward from the Sun, covering the whole solar system at a speed as high as 400 km/s and having temperature of 1 million degree Celsius.
- **Solar flare:** A solar flare is a sudden, rapid, and intense increase in the brightness of the Sun. It occurs when the energy that builds up in the solar atmosphere is suddenly released.

Planets

Under the impact of the Sun's gravitational force, all the planets revolve around the Sun in an elliptical orbit. All planets, except Venus and Uranus, rotate in the anti-clockwise direction.



Planets can be classified into two categories:

1. **Terrestrial or Earth-like planets:** Mercury, Venus, Earth, and Mars are called terrestrial planets as they are composed primarily of silicate rocks or metals. They are the inner planets. These planets are dense and smaller in size. The largest terrestrial planet is Earth.
2. **Jovian planets or Jupiter-like planets:** These are outer planets, which are gaseous and giant with large satellite families. They have high rotational velocities. The largest Jovian planet is Jupiter.

Facts about planets

1. **Mercury**
   - It has no satellite.
   - It is the smallest planet in the solar system.
   - It has the fastest orbital motion and, thus, the shortest period of revolution. Its fast speed protects it from being drawn towards the Sun.
   - It has no atmosphere. Thus, it is characterized by maximum diurnal range of temperature.
2. **Venus**
   - It has no satellite.
   - Venus is closest to the Earth and is called **Earth's twin** because of similar size, density, and mass.
   - It is popularly called the evening star or morning star as it is visible in the evening and morning from the Earth.
   - Venus is covered by a thick cloud cover, and its atmosphere consists primarily of carbon dioxide (nearly 90–95%), making Venus the hottest planet.
   - It has the slowest rotational velocity.
3. **Earth**
   - It is known as a blue planet due to the presence of water.
   - It is the densest planet.

Our planet occupies, what scientists call, the **Goldilocks zone**. Its adequate distance from the Sun means it is neither too hot nor too cold and hence supports liquid water, which is a key ingredient for life. Astronomers are searching for rocky planets like ours in the Goldilocks zones of other stars. Both Venus and Mars are considered to be within the solar system's habitable zone.

4. **Mars**
   - It is known as the red planet due to the presence of argon and nitrogen.
   - The two satellites of Mars are Phobos and Deimos.

- The angle of inclination and period of rotation of Mars are almost similar to that of the Earth. Hence, Mars has seasons similar to the seasons on Earth.
- The evidence of water has been found on Mars, and there are chances that the planet, in the future, may be able to sustain life.

5. **Jupiter**
   - It is the largest planet in the solar system, nearly 1400 times in volume compared to Earth.
   - Its atmosphere consists largely of hydrogen and helium, which account for low density.
   - Jupiter has the fastest rotational velocity. This means that the length of a day on Jupiter is the shortest among all planets in the solar system.
   - Since Jupiter is a gaseous planet, it does not rotate as a solid sphere.
   - Jupiter has no solid surface. Thus, there is no record of geological history of Jupiter.
   - There are 67 satellites of Jupiter. **Ganymede**, one of the satellites, is the largest moon in the solar system. It is even larger than Mercury.
6. **Saturn**
   - It is the second largest planet.
   - It is famous as the ringed planet as it possesses seven rings around it, identified by letters A–G.
   - Saturn has 62 satellites. **Titan** is the largest among all its satellites. It is the only satellite in the solar system that has atmosphere of its own.
   - Saturn has least density among all the planets.
7. **Uranus**
   - It is known as the green planet due to the presence of methane.
   - The rotational motion has the appearance of rolling, unlike other planets, which spin on their axis. The rolling effect is due to the perpendicular inclination (97.92°) of the planet around its axis.
   - It has 27 satellites.
8. **Neptune**
   - Neptune's atmosphere contains a dark spot similar to the size of the Earth. This dark spot is known as the great spot.
   - It is considered a twin of Uranus because of similar size, density, and appearance of pale green colour on account of methane.

The case of Pluto

Pluto was known as the smallest planet in the solar system and the ninth planet from the Sun. In 2006, it was relegated to the status of a dwarf planet by the **International Astronomical Union (IAU).**

This was done because of the discovery of large objects (such as Sedna and Eris) in the Kuiper Belt. Eris, in particular, appeared to be larger than Pluto, giving rise to its informal designation as the solar system's "tenth planet".

The gravitational pull of a planet must "clear the neighbourhood" as per the definition of IAU. This means that the planet should either "vacuum up" or "eject" other large objects in its vicinity of space on account of its gravitational pull.

Pluto shares its orbital neighbourhood with other icy Kuiper Belt objects (failing to clear them), thus could no longer be considered a planet. (The presence of asteroid belt and other bodies in the vicinity of other planets is used as a counterpoint by those supporting Pluto's case as a planet!)

- **The International Astronomical Union** is an international association of professional astronomers. It acts as an internationally recognized authority for assigning designations to celestial bodies (stars, planets, asteroids, etc.).
- A **dwarf planet** orbits the Sun just like other planets, but it is much smaller compared to them. It is so small that it cannot clear other objects out of its path.
- **The Kuiper Belt** is a disc-shaped region of hundreds of icy objects beyond the orbit of Neptune. Pluto and Eris are the best known among these. The belt is similar to the asteroid belt found between Mars and Jupiter, although the objects in the Kuiper Belt tend to be icy rather than rocky.

4 MEASUREMENT UNITS OF SPACE

1. **Light year:** It is the distance travelled by light in vacuum in 1 year. Speed of light is 3×10^5 km/s. A light year consists of 60,000 AU.
2. **Astronomical unit (AU):** It is equal to the distance between the Earth and the Sun, which is 1.49×10^8 km. Time taken by light to cover 1 AU is 8 min. Time taken by light to travel from the moon to Earth is 1.25 s.
3. **Parsec:** A parsec is a unit of length used to measure large distances to objects outside the solar system. A parsec is equal to about 3.26 light years (31 trillion kilometres or 19 trillion miles) in length. The nearest star, Proxima Centauri, is about 1.3 parsecs (4.2 light years) from the Sun. Most of the stars visible to the unaided eye in the night are within 500 parsecs of the Sun.

Practice Questions II

1. Which of the following represents the inner planets?
   (a) Planets between the Sun and the Earth.
   (b) Planets between the Sun and the belt of asteroids.
   (c) Planets in gaseous state.
   (d) Planets without satellites.

2. Match the two lists.

Planet	**Moon**
1. Mars:	A. Ganymede
2. Jupiter:	B. Titan
3. Saturn:	C. Miranda
4. Uranus:	D. Phobos

   Select the correct answer using the codes given below:
   (a) 1-B, 2-A, 3-C, 4-D
   (b) 1-D, 2-C, 3-A, 4-B
   (c) 1-D, 2-A, 3-B, 4-C
   (d) 1-B, 2-C, 3-D, 4-A

3. Consider the following statements:
   1. Terrestrial planets are much larger than the Jovian planets.
   2. Jovian planets have relatively high densities.
   3. Terrestrial planets have higher gravity than the Jovian planets.

   Which of the statements given above is/are correct?
   (a) 1 and 3 only (b) 3 only
   (c) 1, 2, and 3 (d) None

4. Venus is considered Earth's twin because:
   (a) Its period of revolution is same as that of the Earth.
   (b) It has abundant amount of water.
   (c) It has approximately the same size, mass, and density as the Earth.
   (d) It completes one rotation on its axis in 24 h.

5. Which of the following groups of planets in our solar system are part of the Goldilocks zone?
   (a) Venus and Earth only
   (b) Earth and Mars only
   (c) Earth, Mars, and Jupiter
   (d) Venus, Earth, and Mars

6. Among the various reasons cited for the absence of ability to develop and sustain life on Mars, which among the following are **incorrect?**
   1. Mars has magnetosphere.
   2. The atmosphere of Mars is very thin.
   3. Mars is beyond the habitable zone of our solar system.
   4. Mars has no water, ice, and oxygen.

   Select the correct answer using the codes given below:
   (a) 1 and 2
   (b) 2, 3, and 4
   (c) 3 and 4
   (d) 1, 2, and 3

Note: Unlike the Earth, Mars has no inner dynamo to create a major global magnetic field. This, however, does not mean that Mars does not have a magnetosphere. The magnetosphere of Mars exists, but it is less extensive than that of the Earth.

PERFECTING PAST PRELIMS

1. In the order of their distances from the Sun, which of the following planets lie between Mars and Uranus? **(2008)**
   (a) Earth and Jupiter
   (b) Jupiter and Saturn
   (c) Saturn and Earth
   (d) Saturn and Neptune

2. Which of the following planets has the largest number of natural satellites or moons? **(2009)**
   (a) Jupiter
   (b) Mars
   (c) Saturn
   (d) Venus

3. What is the difference between asteroids and comets? **(2011)**
   1. Asteroids are small rocky planetoids, while comets are formed of frozen gases held together by rocky and metallic material.
   2. Asteroids are found mostly between the orbits of Jupiter and Mars, while comets are found mostly between Venus and Mercury.
   3. Comets show a perceptible glowing tail, while asteroids do not.

   Which of the statements given above is/are correct?
   (a) 1 and 2 only
   (b) 1 and 3 only
   (c) 3 only
   (d) 1, 2, and 3

4. A person stood alone in a desert on a dark night and wanted to reach his village, which was situated 5 km east of the point from where he was standing. He had no instruments to find the direction, but he located the Pole Star. The most convenient way now to reach his village is to walk in the direction **(2012)**
   (a) Facing the Pole Star.
   (b) Opposite to the Pole Star.
   (c) Keeping the Pole Star to his left.
   (d) Keeping the Pole Star to his right.

5. Which of the following is/are cited by scientists as evidence/evidences for the continued expansion of universe? **(2012)**
   1. Detection of microwaves in space.
   2. Observation of red shift phenomenon in space.
   3. Movement of asteroids in space.
   4. Occurrence of supernova explosions in space.

   Select the correct answer using the codes given below:
   (a) 1 and 2 only
   (b) 2 only
   (c) 1, 3, and 4
   (d) None

6. The term "Goldilocks zone" is often seen in news in the context of **(2015)**
   (a) The limits of habitable zone above the surface of the Earth.
   (b) Regions inside the Earth where shale gas is available.
   (c) Search for Earth-like planets in the outer space.
   (d) Search for meteorites containing precious metals.

ANSWER KEYS

Practice Questions I

1. (c)	**2.** (b)	**3.** (b)	**4.** (c)	**5.** (c)

Practice Questions II

1. (b)	**2.** (c)	**3.** (d)	**4.** (c)	**5.** (d)
6. (c)				

Perfecting Past Prelims

1. (b)	**2.** (a)	**3.** (b)	**4.** (c)	**5.** (a)
6. (c)				

Chapter 2 EARTH

1 SHAPE

The equatorial diameter of the Earth is 12,757 km (7926 miles), whereas the polar diameter is 12,714 km (7900 miles). Thus, the Earth is not a perfect sphere. It is flattened by 0.3% at both the poles. This imperfect sphere shape of Earth is referred to as the "geoid" shape. Geoid literally means **Earth like**.

1 mile = 1.60934 (1.6 km)

1 nautical mile = 1.852 km

Nautical miles are used to measure distance in large waterbodies such as seas and oceans.

The official system in India measures distance over land in kilometres and over large waterbodies in nautical miles.

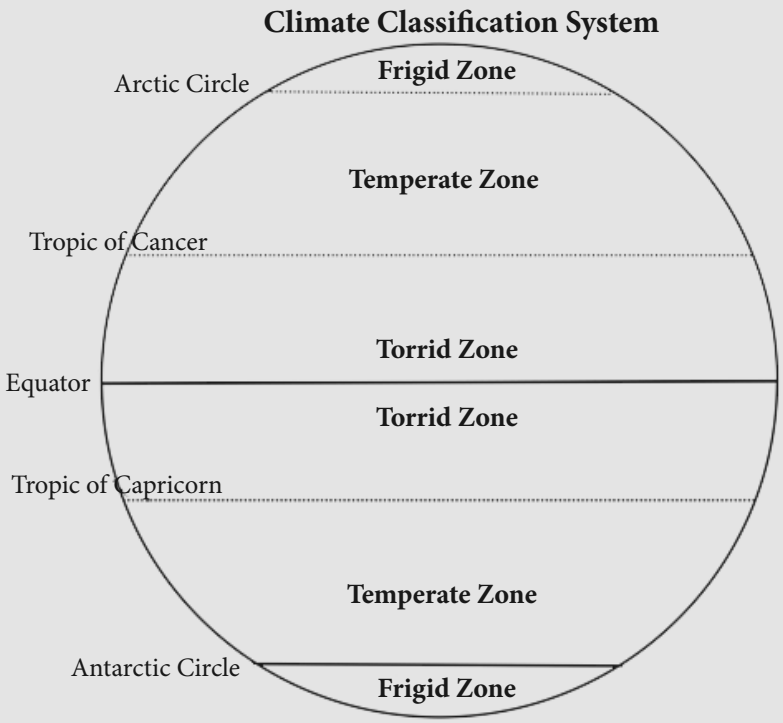
2 LATITUDE

Latitude is the angle made by a point on the surface of the Earth from the centre of the Earth, in the north–south direction. Latitudes are also known as **parallels** because they are parallel to each other. Two latitudes separated by 1° in angle are 111 km (69 miles) apart.

Thus, latitudes can be used to measure distance between two places.

Some important latitudes are as follows:

- Equator—passing through 0°.
- Tropic of Cancer—passing through 23½° north.
- Tropic of Capricorn—passing through 23½° south.
- Arctic Circle—passing through 66½° north.
- Antarctic Circle—passing through 66½° south.
- North Pole at 90° north.
- South Pole at 90° south.



According to basic climate classification system, regions of the world can be classified into three climatic zones based on their location. All the three zones are located in both northern and southern hemispheres.

Torrid zone: The torrid zone is also called the tropical zone. It is located between the Tropic of Cancer and the Tropic of Capricorn. The word "torrid" literally means "very hot". This zone experiences very hot climate.

Temperate zone: The temperate zone is located between the Tropic of Cancer and the Arctic Circle in the northern hemisphere and between the Tropic of Capricorn and the Antarctic Circle in the southern hemisphere. The word "temperate" literally means "mild".

Frigid zone: The frigid zone is also called the polar zone. It is located between the Arctic Circle and the North Pole in the northern hemisphere and the Antarctic Circle and the South Pole in the southern hemisphere. The word "frigid" literally means "very cold". This zone experiences very cold climate.

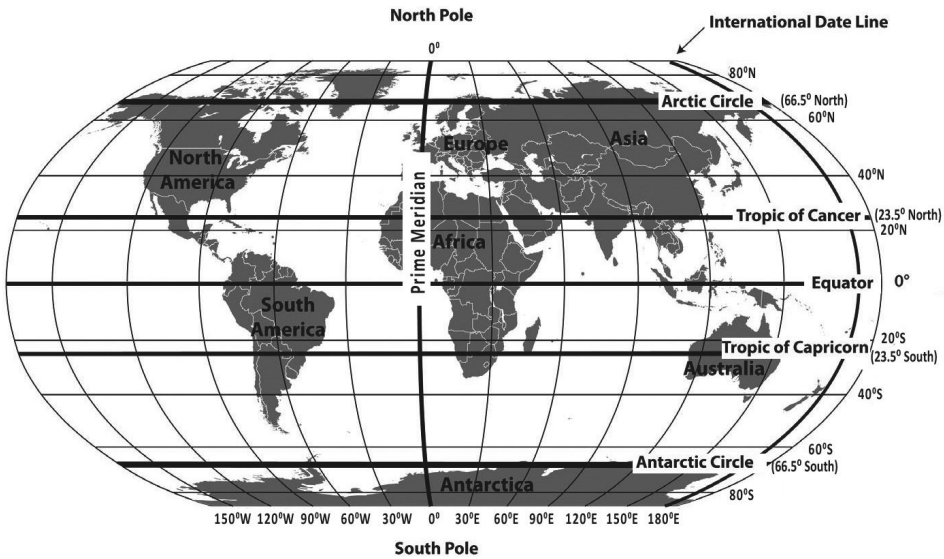
To conclude, the torrid, temperate, and frigid zones experience very hot, mild, and very cold climates, respectively.

3 LONGITUDE

Longitude refers to the angle of a point on the surface of the Earth from the centre of the Earth in the east–west direction. Longitudes are also known as **meridians**.

For reference, the 0° longitude is assumed to pass through the Royal Astronomical Observatory in Greenwich near London. The meridian at 0° is also called the Prime Meridian. Meridians radiate from the centre of the Earth both eastwards and westwards up to 180°.

The distance between two longitudes 1° apart is 111 km (69 miles) at the equator, 78 km (49 miles) at 45°, 29 km (18 miles) at 75°, and 0 km at the poles. This is because, unlike latitudes, which are parallel, meridians converge at the poles. A single latitude intersects all the longitudes.



Longitude and Time

Longitude can be used to determine the time of any place on Earth. The Earth rotates 360° in 24 h. Thus, it rotates $\frac{360°}{24}$ = 15° per hour.

As the Earth rotates from west to east, the places east of Greenwich see the Sun earlier, whereas places west of Greenwich see the Sun later.

In other words, areas to the east of the Prime Meridian have local time greater than that at the Prime Meridian and areas to the west of the Prime Meridian have local time less than the time at the Prime Meridian.

For example, London is at 0° and India is at 82°30' or 82½°. Therefore, time in India when it is 00:00 in London is $\frac{82° 30'}{15°}$ = 5½, i.e. 05:30.

India has adopted the standard time on the basis of the 82°30' (or 82½°) meridian passing through Mirzapur near Allahabad.

Demand for Separate Time Zone in India

India has such a vast geographical extent that there is a time gap of nearly 2 h between North-East India and Gujarat. Thus, people of North-East are demanding a separate time zone for the region so that they can schedule their daily activities according to daylight. Many countries in the world have multiple time zones.

	Countries	Number of time zones
1.	Canada	5
2.	USA	5
3.	Former USSR	11

International Dateline

When one goes eastwards from the Prime Meridian, one gains time, until reaching 180°E, where he/she will be 12 h ahead of the Greenwich Mean Time (GMT). Similarly, going westwards, one loses 12 h on reaching 180°W. There is a total difference of 24 h or a whole day between the two sides of the 180° meridian. However, both the points (i.e. 180°E and 180°W) correspond to the same place.

Therefore, the 180° meridian is referred to as the International Dateline where date changes by exactly a day when it is crossed.

A traveller loses a day while crossing the dateline from east to west and gains a day while crossing the dateline from west to east.

The International Dateline curves from normal 180° meridian at the Bering Strait, Fiji, and other islands to prevent confusion of date. If the International Dateline in the mid-pacific would have been straight, then it would have crossed from the centre of islands located in the Pacific Ocean.

4 MOTIONS OF THE EARTH AND THEIR EFFECTS

The Earth moves in two distinct ways:

1. **Rotation:** The Earth rotates on its own axis from west to east in every 24 h, causing day and night. The speed of rotation at the equator is

$$\frac{\text{Distance}}{\text{Time}} = \text{Circumference at the equator} = \frac{(2\pi r)}{24} = 1670.55 \text{ km/h}$$

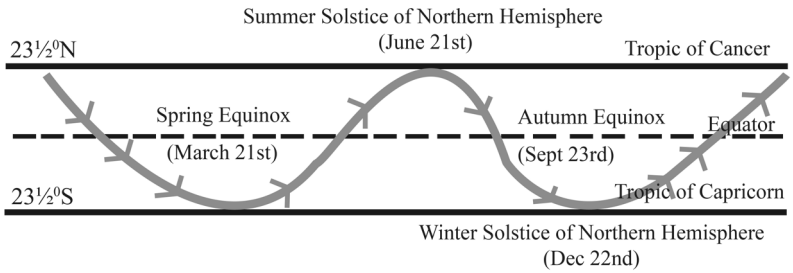
   The speed of rotation will reduce as we move from the equator to the poles.

2. **Revolution:** The Earth revolves around the Sun in an orbit once in every 365¼ days, causing seasons of a year. The speed of revolution of the Earth is 29.6 km/s.

   The average distance of the Earth from the Sun is 149.6 million km. The Earth's orbit is elliptical. The Sun is farthest from the Earth (152 million km) on 4 July. This position of the Earth is called **aphelion**. On 3 January, the Earth is nearest to the Sun (147 million km). This position is called **perihelion**.

5 INCLINATION OF THE EARTH'S AXIS AND ITS EFFECTS

The axis is an imaginary line connecting the North Pole and the South Pole. The axis of the Earth is inclined by 23½°, thus subtending an angle of 66½° over its plane. The revolution of the Earth around the Sun and the tilt of the Earth's axis give rise to different seasons.



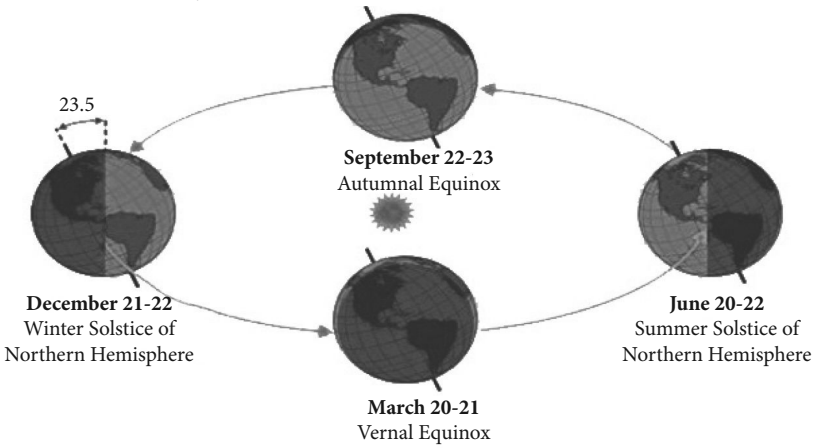
On 21 June, the Sun's rays are maximum over the Tropic of Cancer. Thus, in the northern hemisphere, it is the longest and hottest day. In the southern hemisphere, 21 June is the coldest and shortest day. The direct rays of the Sun start shifting towards the equator. Thereafter, on 23 September, the direct rays fall on the equator. Thus, all the regions on the Earth enjoy equal length of day and night in the world. September 23 is called the **autumn equinox** because of equal length of day and night.

The Sun's rays shift further south, towards the Tropic of Capricorn, and on 22 December, maximum direct rays fall over the Tropic of Capricorn. Thus, 22 December is the hottest and longest day in the southern hemisphere and the coldest and shortest day in the northern hemisphere.

After 22 December, the Sun's direct rays start shifting towards the equator. On 21 March, the direct rays are again over the equator. This is known as the **vernal (spring) equinox**.

During summers in the northern hemisphere, there are six months of daylight over the North Pole, whereas there is complete darkness during winters. The lengths of day and night vary with increase in latitude.

Thus, if the axis were perpendicular (i.e. no tilt) to the orbit, all parts of the Earth would have equal days and nights at all times of the year.



Summer Solstice of Northern Hemisphere and Winter Solstice of Southern Hemisphere take place on the same day.

Similarly, Winter Solstice of Northern Hemisphere and Summer Solstice of Southern Hemisphere take place on the same day.

Practice Questions I

1. With reference to time zones, consider the following statements:
   1. Antarctica does not have a fixed time zone as every line of longitude passes through it.
   2. The International Dateline perfectly coincides with the 180° meridian.

   Which of the statements given above is/are correct?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2

2. Consider the following statements:
   1. Places at different latitudes have different times.
   2. Countries with smaller north–south extent are bound to have a single time zone.

   Which of the statements given above is/are correct?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2

3. Which of the following is/are necessary for different seasons on the Earth?
   1. Earth's revolution.
   2. Earth's rotation.
   3. Inclination of the Earth's axis.

   Select the correct answer using the codes given below:
   (a) 1 and 2 only
   (b) 3 only
   (c) 1 and 3 only
   (d) 1, 2, and 3

4. With reference to the International Dateline, which of the following statements is/are correct?
   1. A traveller crossing it from east to west gains a day.
   2. When one crosses it, there is always a change in date.
   3. It deviates from the normal 180° meridian at various places.

   Select the correct answer using the codes given below:
   (a) 1 and 3 only (b) 1 and 2 only
   (c) 2 and 3 only (d) 1, 2, and 3

5. If the time in London is 10:30 pm, then the time in New Delhi is
   (a) 5:00 pm (b) 6:00 pm
   (c) 3:00 am (d) 4:00 am

6 THE MOON

The Moon is the only natural satellite of the Earth. The formation of the Moon is believed to be an outcome of a "giant impact" called "the big splat". Shortly after the Earth was formed, a body of the size of Mars collided with the Earth. As a result, a large part of the Earth blasted off. This portion of blasted material then continued to orbit the Earth and eventually formed the present Moon, about 4.44 billion years ago.

The rotation and revolution periods of Moon are same (29 days). Thus, every time the same side of the Moon is exposed to the Earth.

Phases of the Moon

The phases of the Moon are the different ways the Moon appears from the Earth. As the Moon orbits around the Earth, the half of the Moon that faces the Sun lights up. The different shapes of the lit portion of the Moon that can be seen from the Earth are known as phases of the Moon. Each phase repeats itself every 29.5 days.

The same half of the Moon always faces the Earth, so the phases will always occur over the same half of the Moon's surface.

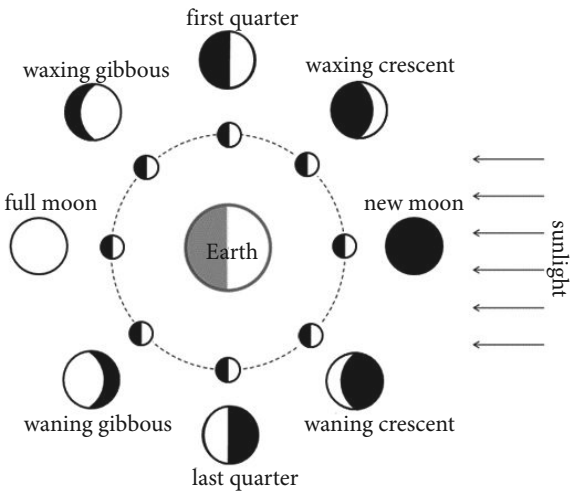
There are eight phases of the Moon:

- A New Moon is when the Moon cannot be seen because we are looking at the unlit half of the Moon. The New Moon phase occurs when the Moon is directly between the Earth and the Sun. A solar eclipse can happen at New Moon only.

- A waxing crescent Moon is when the Moon looks like a crescent and the crescent increases (waxes) in size.
- The first quarter Moon (or a Half Moon) is when half of the lit portion of the Moon is visible after the waxing crescent phase.
- A waxing gibbous Moon occurs when more than half of the lit portion of the Moon can be seen and the shape increases (waxes) in size. The waxing gibbous phase occurs between the first quarter and the Full Moon phase.
- A Full Moon is when we can see the entire lit portion of the Moon. The Full Moon phase occurs when the Moon is on the opposite side of the Earth from the Sun, called opposition. A lunar eclipse can happen at Full Moon only.
- A waning gibbous Moon occurs when more than half of the lit portion of the Moon can be seen and the shape decreases (wanes) in size. The waning gibbous phase occurs between the Full Moon and the third quarter phase.
- The last quarter Moon (or a Half Moon) is when half of the lit portion of the Moon is visible after the waning gibbous phase.
- A waning crescent Moon is when the Moon looks like a crescent and the crescent decreases (wanes) in size.

Blue Moon

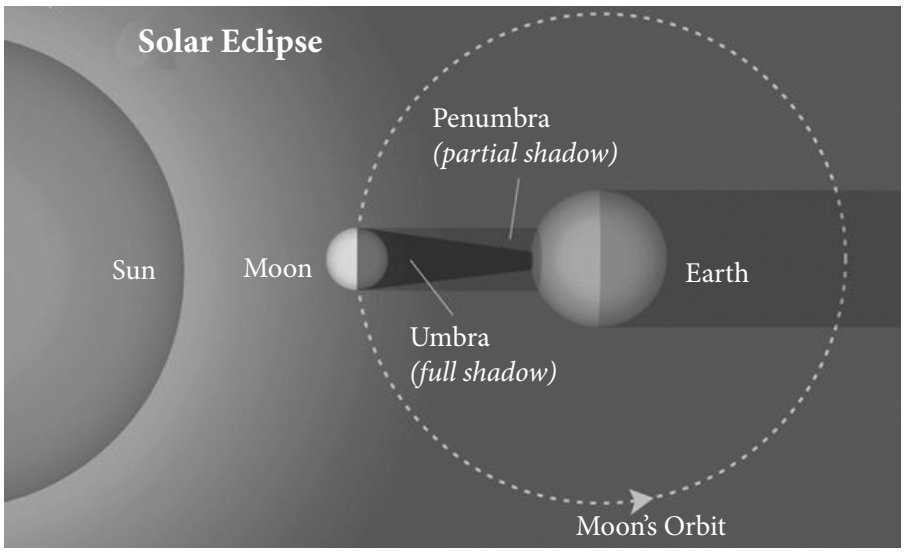
The second Full Moon in one calendar month is called a "Blue Moon", and this occurs approximately every 3 years. The saying "once in a blue moon" refers to something that does not happen often (like a Blue Moon).



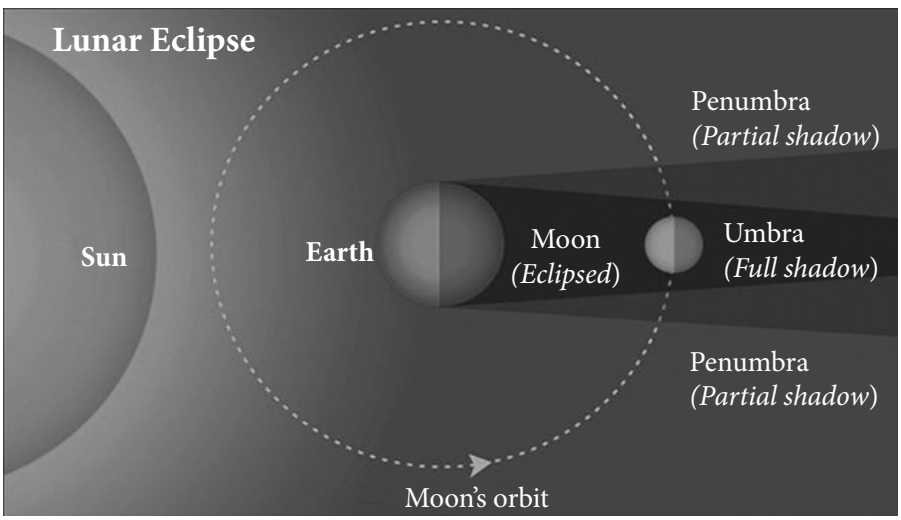
The Earth is at the centre of the diagram, and the Moon is shown orbiting (dotted circle). The Sun lights half of the Moon and the Earth from the right side. The phase of the Moon is shown next to the corresponding position of the Moon in its orbit around the Earth.

7 ECLIPSES (SOLAR AND LUNAR)

Solar eclipse: It is a position when the Moon comes between the Sun and the Earth, as a result of which, the Sun is not visible from the Earth, resulting into darkness over the Earth.



Lunar eclipse: It occurs when the Earth is between the Sun and the Moon. As a result, sunlight is blocked by the Earth from reaching the Moon. A lunar eclipse takes place during the Full Moon phase.



8 STRUCTURE OF THE EARTH

Formed 4500 million years ago, the Earth is made up of several concentric layers:

1. **Crust/outer layer:** The thickness of the crust varies between 5 and 70 km. The crust consists of two layers:

   i. **Upper layer or SiAl:** It mainly consists of silica and aluminium. It forms the surface of continents. It has an average density of 2700–2800 kg/m^3.

   ii. **Lower layer or SiMa:** It largely consists of silica and magnesium. SiMa constitutes the ocean floor. It has an average density of 2800–3300 kg/m^3.

   SiAl has lower density than SiMa primarily due to the increased amounts of light elements such as aluminium, and decreased amounts of heavy elements such as iron and magnesium. The thickness of SiAl is much more than that of SiMa because SiAl forms the surface of continents, whereas SiMa constitutes only ocean floors. The base of SiAl is not a strict boundary; the SiAl grades into the denser rocks of the SiMa.

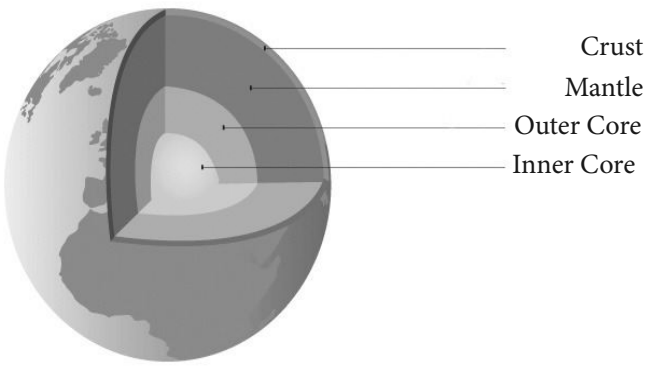
   Mohorovicic discontinuity distinguishes the crust from the mantle.

Composition of Earth's Crust

Earth's crust is made up of several elements: oxygen, 47 percent; silicon, 27 percent; aluminum, 8 percent; iron, 5 percent; calcium, 4 percent; magnesium, potassium and sodium, 2 percent. It is to be noted that Oxygen is very reactive. Thus, it forms stable compounds with most of the other metals. For instance; Silicon dioxide, also known as silica, is an oxide of silicon with the chemical formula SiO_2.

2. **Middle layer/mantle:** It lies beneath the crust and extends to a depth of 2890 km, making it the thickest layer of the Earth. Mantle consists of dense rocks. The upper part is called asthenosphere, which is up to 400 km and is the main site of volcanoes.

   Gutenberg discontinuity is a zone that separates the mantle from the core.



The **lithosphere** is the solid outer section of the Earth, which includes the Earth's crust as well as part of the upper mantle.

3. **Innermost layer/core:**
   - Also known as **Barysphere**, this layer is about 3470 km in radius and is mainly made up of iron and nickel, thus called NiFe.
   - The core has the maximum density, with a temperature of nearly 1900°C and is subjected to extremely high pressure.
   - The outer core extends from a depth of 2890 km to 5150 km (2260 km thick) and is in liquid state, whereas the inner core extends from a depth of 5150 km to 6360 km (1210 km thick) and is in solid state. The outer core is in liquid state on account of high temperature. The inner core is in solid state on account of high pressure of the outer layers of the Earth.

Effect of Temperature and Pressure on the Nature of Material

High temperature causes material to melt (and even diffuse) and low temperature causes material to turn solid. On the other hand, high pressure causes material to turn solid and low pressure causes material to melt.

The interior of the Earth has high pressure and high temperature. High pressure causes the material to solidify and high temperature causes the material to melt. Thus, the nature of the material is a result of both pressure and temperature.

The outer core is liquid because high temperature plays a larger role than high pressure in determining the nature of the outer core. The inner core is solid because high pressure plays a larger role than high temperature in determining the nature of the inner core.

9 GEOMAGNETISM

Geomagnetism refers to the properties of a magnet exhibited by the Earth. The Earth behaves like a magnet because its core consists of iron. The rotation of the Earth causes the iron core to generate electric and magnetic fields. More than 90% of magnetic properties exhibited by the Earth are because of the presence of iron in its core. Other important sources of geomagnetic field include electric current flowing in the ionosphere (explained later).

Effect of the Earth's Magnetic Field on Life Forms

The Sun continuously ejects high-energy charged particles, called solar winds. These winds can cause large damage to various life forms on the Earth. The Earth's geomagnetic field acts as a shield and deflect these charged particles from entering into its atmosphere.

Application of Geomagnetic Knowledge

Migratory birds and animals such as sea turtles use the Earth's magnetic field for navigation. The discovery of geomagnetism led to the development of magnetic compass. Compass enabled exploration of different regions and facilitated global connectivity.

Geomagnetic direction is not the same as geographical direction. The north indicated by the compass differs from the North Pole of the Earth. The difference between these two points is called **magnetic declination**.

10 EARTHQUAKES

Vibrations on the surface of the Earth due to seismic waves resulting from a sudden release of energy in the Earth's crust is called an earthquake.

Seismology is the study of earthquakes. A seismologist is a scientist who studies earthquakes.

Seismic Waves

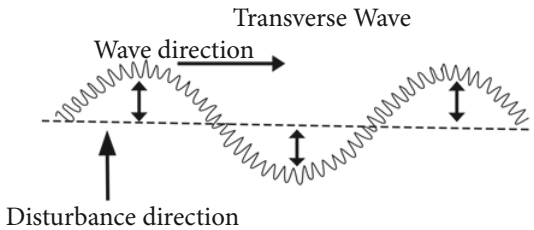
Seismic waves are waves of energy that travel through the Earth's layers and are a result of earthquakes, volcanic eruptions, large landslides, and large man-made explosions.

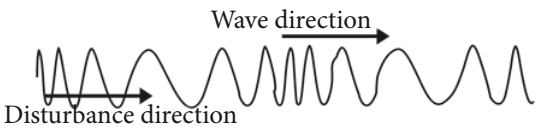
The propagation velocity of a wave depends on the density of a medium. Velocity tends to increase with depth and ranges from approximately 2 to 8 km/s in the Earth's crust, up to 13 km/s in the deep mantle.

Types of seismic waves

1. **Body waves:** These waves travel through the body or layers of the Earth. They are generated inside the Earth. They are of two types: P- and S-waves.
    i. **P-waves/primary waves:** These waves can pass through solids, liquids as well as gases. They are the first to reach the surface of the Earth. Vibration caused by these waves is parallel to the direction of propagation. Thus, these waves are in nature of longitudinal waves.

ii. **S-waves/secondary/shear waves:** These waves cannot pass through liquids (or gases) and can propagate only through solids. The speed of P-waves is almost 60% more than that of S-waves. Vibration caused by these waves is perpendicular to the direction of propagation. Thus, these waves are in nature of transverse waves.





Use of two types of waves: When earthquakes take place in the inner core of the Earth, only P-waves are recorded at the surface of the Earth. This is because S-waves cannot pass through liquid state and the outer core of the Earth is in the liquid state. Thus, the study of two types of waves helps in concluding about the structure of the Earth. Man-made vibrations are also used to investigate shallow, subsurface structures.

2. **Surface waves:** The body waves interact with the surface of the Earth and generate a new set of waves called surface waves. These waves travel on the surface of the Earth. Travelling only through the crust, surface waves are of a lower frequency than body waves and are easily distinguished on a seismogram. Surface waves are almost entirely responsible for the damage and destruction associated with earthquakes. The damage and strength of surface waves are reduced in deeper earthquakes. Almost all earthquakes experienced on the surface of the Earth take place up to a depth of 200 km.

   Though surface waves are in nature of transverse waves, they can be further classified based on their pattern of movement into **Love** and **Rayleigh waves.**

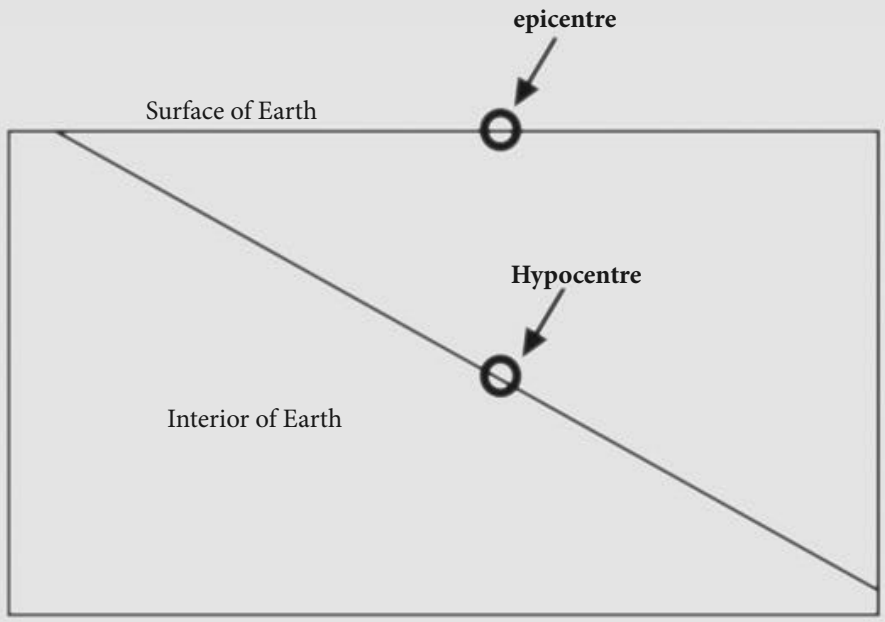
   i. **Love waves:** The first kind of surface waves is Love waves, named after the mathematician who identified it. It is the fastest surface wave and moves the ground from side to side. Confined to the surface of the crust, Love waves produce entirely horizontal motion.

   ii. **Rayleigh waves:** The other kind of surface waves is Rayleigh waves, named after the mathematician who predicted the existence of this kind of waves. A Rayleigh wave rolls along the ground just like a wave rolls across a lake or an ocean. As the wave rolls, it moves the ground up and down, and side to side in the same direction that the wave is moving. Most of the shaking felt from an earthquake is due to the Rayleigh waves.

Difference between Hypocentre and Epicentre

The hypocentre (focus) is the point within the Earth where an earthquake starts. The epicentre is the point directly above the hypocentre at the surface of the Earth.

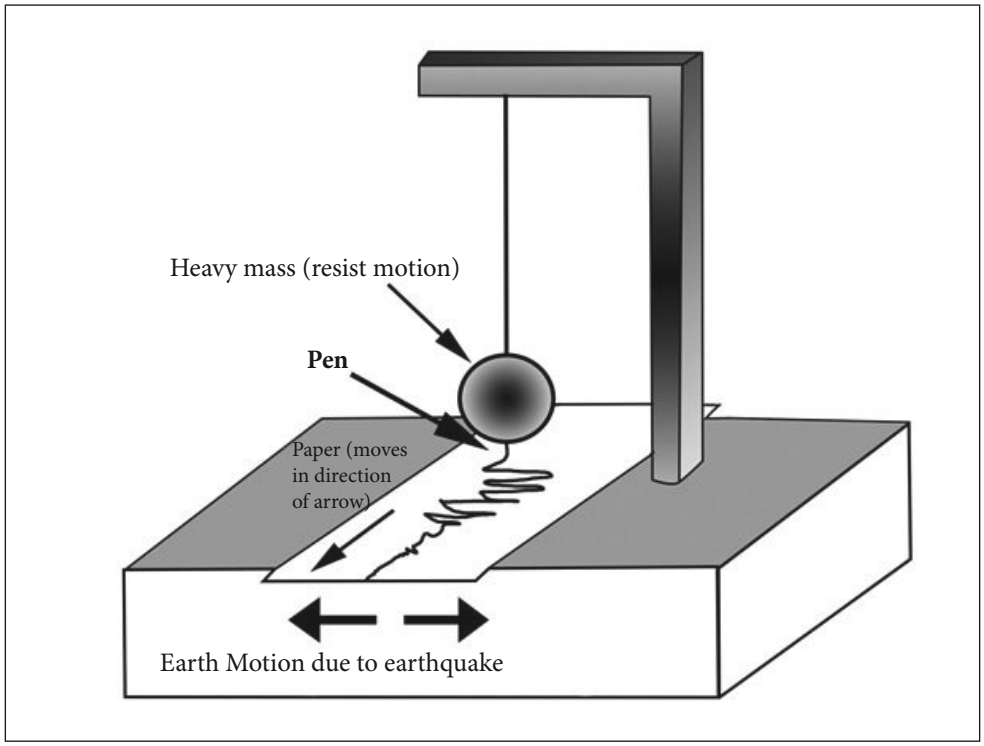
The different travel times of the body waves, P-waves and S-waves, help scientists to locate the source of the hypocentre.



Measurement of Earthquake

The seismograph and the seismoscope are the two main instruments used to measure the strength of earthquakes. The seismoscope is a simple instrument that measures the time that an earthquake takes place. The seismograph records the motion of the ground during an earthquake.

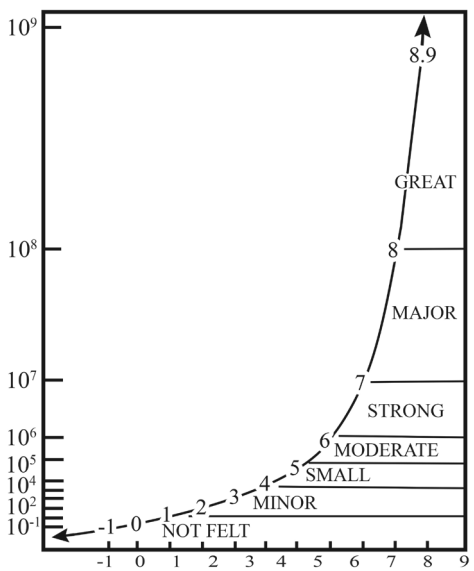
A seismograph's main component is a hanging mass that is connected to a pen, and this pen is situated just above a paper surface. When the ground moves, so does the paper, which rubs against the pen and marks the movement. Seismographs are isolated and connected to bedrock to ensure that the data they receive are not affected by the movement of surrounding objects. Advanced technology improves the accuracy of the seismograph and makes it sensitive to minute ground movements.



Scale Used to Measure Earthquakes

The Richter scale (also called the Richter magnitude scale) assigns a magnitude number to quantify the size of an earthquake. The Richter scale is a logarithmic scale. Because of the logarithmic basis of the scale, each whole-number increase in magnitude represents a tenfold increase in measured amplitude. For example, earthquake recorded in a Richter scale at magnitude 6 would be 10 times more intense than the earthquake recorded at magnitude 5.

Intensity of earthquake: It refers to the severity of ground shaking or visible damage caused by event. Intensity may or may not be dependent of magnitude. It is measured on the Mercalli scale. The Mercalli scale is a 12-point scale for expressing the local intensity of an earthquake, ranging from I (virtually imperceptible) to XII (total destruction).



Practice Questions II

1. The existence of S-wave shadow zone is an evidence of which of the following?
   (a) The outer core is liquid.
   (b) The outer core is composed of iron and nickel.
   (c) The inner core is solid.
   (d) P-waves travel faster than S-waves.

2. Consider the following statements regarding P-waves:
   1. These waves are similar to sound waves.
   2. The particles, on account of these waves, vibrate perpendicular to the direction of the waves.
   3. These waves exert pressure on the material in the direction of the propagation.

   Which of the statements given above is/are correct?
   (a) 1 and 2 only (b) 1 and 3 only
   (c) 2 and 3 only (d) 1, 2, and 3

3. In the structure of planet Earth, above the mantle, the surface is mainly made up of which one of the following?
   (a) Aluminium (b) Chromium
   (c) Oxygen (d) Silicon

4. Consider the following statements:
   1. Solar eclipse occurs during a New Moon.
   2. Lunar eclipse occurs during a Full Moon.
   3. During a total solar eclipse, the entire Sun is invisible from all parts of the Earth.

   Which of the statements given above is/are correct?
   (a) 1 and 2 only (b) 1 and 3 only
   (c) 3 only (d) 1, 2, and 3

5. With reference to seismic waves, consider the following statements:
   1. P-waves travel through a solid rock faster than the sound waves travelling through air.
   2. P-waves travel faster than S-waves.

   Which of the statements given above is/are correct?
   (a) 1 only
   (b) 2 only
   (c) Both 1 and 2
   (d) Neither 1 nor 2

6. Which of the following statements is/are correct with regard to earthquake waves?
   1. P-waves can travel through solid, liquid, and gaseous materials.
   2. S-waves can travel only through liquid material.
   3. The velocity of P-waves increases as it enters from a denser to a rarer medium.

   Select the correct answer using the codes given below:
   (a) 1 only (b) 3 only
   (c) 1 and 2 only (d) 1, 2, and 3

7. Which of the following statements is/are correct regarding earthquakes?
   1. The point where energy is released during an earthquake is called hypocentre.

2. All the earthquakes take place in asthenosphere.

Select the correct answer using the codes given below:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

8. Which of the following statements is/are correct regarding the interior structure of the Earth?

1. Moho's discontinuity forms the boundary between the mantle and the core of the Earth.
2. Lithosphere is the main source of magma that erupts to form a volcano.
3. The outer core is liquid, while the inner core is solid in state.

Select the correct answer using the codes given below.

(a) 1 and 2 only (b) 3 only
(c) 1 and 3 only (d) 1, 2, and 3

9. Which of the following help in understanding the internal structure of the Earth?

1. Study of seismic waves.
2. Study of comets.

Select the correct answer using the codes given below.

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

10. With reference to earthquakes, consider the following statements:

1. The Richter scale is used to measure the intensity of earthquakes.
2. The Richter scale is a linear scale with the maximum of 10.
3. Seismograph is used to record the earthquake waves.

Which of the statements given above is/are correct?

(a) 1 only (b) 1 and 3
(c) 2 and 3 (d) 1, 2, and 3

11. Consider the following statements with regard to the Earth's crust:

1. The oceanic crust is younger than the continental crust.
2. The oceanic crust is thinner than the continental crust.
3. The oceanic crust is less dense than the continental crust.

Which of the statements given above is/are correct?

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2, and 3

Note: The oceanic crust is younger than the continental crust because the oceanic crust is destroyed at the subduction zones, while the continental crust is not. When two tectonic plates collide, one is forced down the other. This process is called subduction. This process is dependent on density, with the denser plate subducting under the less dense plate. The continental crust is less dense than the oceanic crust, and so the oceanic crust always subducts, which is why the oldest ocean basin is much younger than the oldest continent.

Subduction also occurs when oceanic plates collide. The older plate is colder, which makes it denser and it subducts under the younger plate. So even if the oceanic plates only collided with each other, older rock would still be subducted and destroyed.

PERFECTING PAST PRELIMS

1. What is the average distance (approximate) between the Sun and the Earth? **(2007)**
   (a) 70×10^5 km
   (b) 100×10^5 km
   (c) 110×10^6 km
   (d) 150×10^6 km

2. Which of the following cities does **not** have the same clock time as that of the other three cities at any given instant? **(2007)**
   (a) London (UK)
   (b) Lisbon (Portugal)
   (c) Accra (Ghana)
   (d) Addis Ababa (Ethiopia)

3. In the structure of the planet Earth, below the mantle, the core is mainly made up of which of the following? **(2009)**
   (a) Aluminium
   (b) Chromium
   (c) Iron
   (d) Silicon

4. Variations in the length of daytime and night time from season to season are due to **(2013)**
   (a) The Earth's rotation on its axis.
   (b) The Earth's revolution around the Sun in an elliptical manner.
   (c) Latitudinal position of the place.
   (d) Revolution of the Earth on a tilted axis.

ANSWER KEYS

Practice Questions I

1. (a)	**2.** (d)	**3.** (c)	**4.** (c)	**5.** (d)

Practice Questions II

1. (a)	**2.** (b)	**3.** (c)	**4.** (a)	**5.** (c)	**6.** (a)
7. (a)	**8.** (b)	**9.** (c)	**10** (b)	**11** (a)	

Perfecting Past Prelims

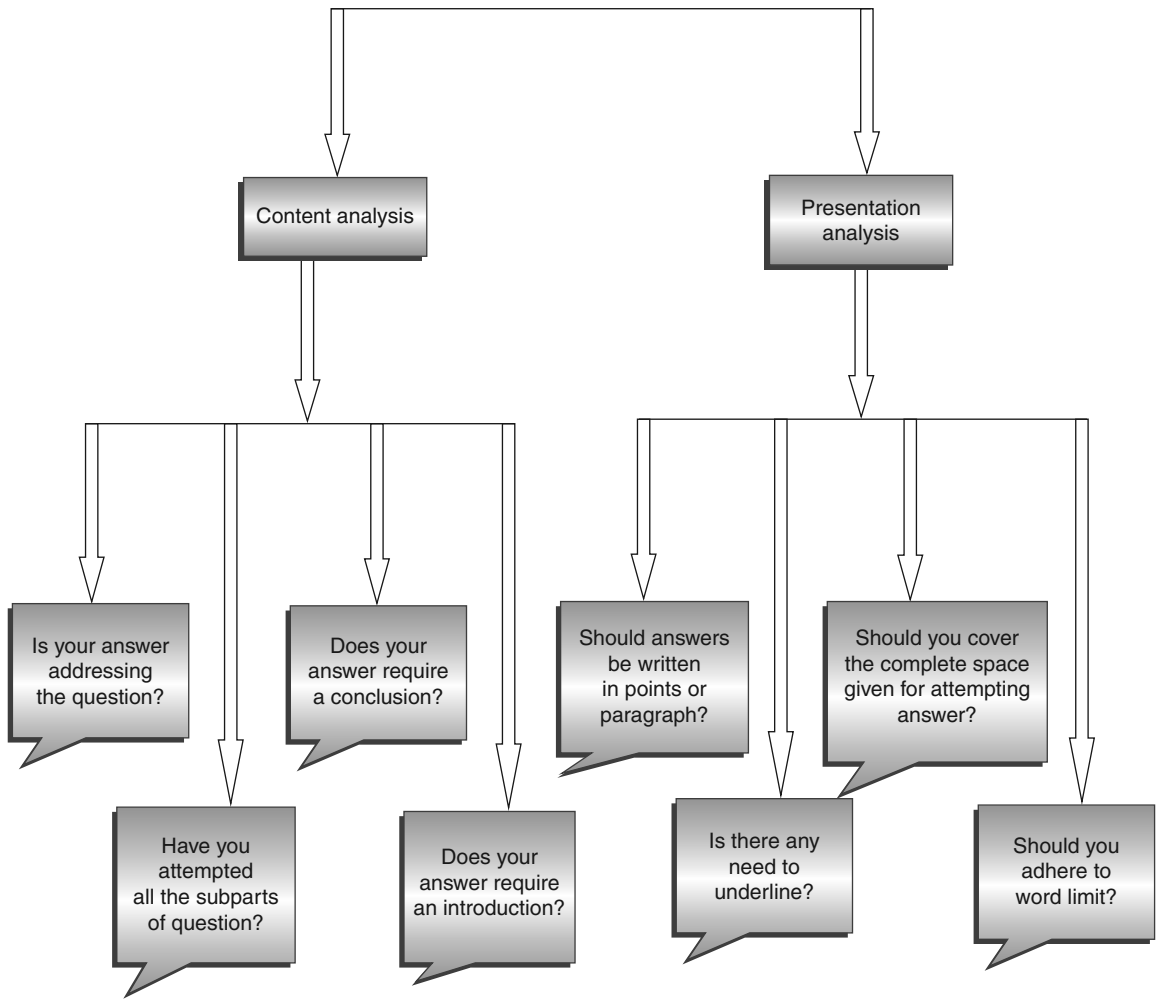
1. (d)	**2.** (d)	**3.** (c)	**4.** (d)	

Solutions for

Practice Questions and Perfecting Past Prelims

Introduction to Writing Answers for Mains

A good answer is based on the following aspects



Previous Years' Questions (Mains) with Solutions

1. What do you understand by the theory of continental drift? Discuss the prominent evidences in its support. **(2013)**

Sol.

Analysis of Question	
Discuss	Write about the topic in detail, taking into account different ideas.
Number of parts	Two sub-parts Part I—Explanation of theory of continental drift Part II—Evidences that support the theory
Mode of presentation	Mix of paragraph and point form
Importance of conclusion	Not necessary

Continental drift theory

According to this theory, there existed one single landmass called Pangaea which was surrounded by one big ocean called Panthalassa. A sea called Tethys divided Pangaea into two huge landmasses, namely, Laurasia in the north and Gondwanaland in the south. Laurasia consisted of present continents of Asia, Europe, and North America.

Gondwanaland consisted of continents of Africa, South America, Antarctica, Australia, and Indian sub-continent.

The single landmass began to break and the various parts formed, began drifting away from each other 200 million years ago.

Evidence in support of continental drift theory

1. **Similarity of physical features:** The bulging part of Brazil seems to fit into Gulf of Guinea (part of Africa), suggesting that South America and Africa were part of single landmass.
2. Far landmasses such as Australia, India, South Africa, etc., share similar rocks and plant species.
3. The drift of continents is also proved by the fact that old magnetic rocks show different directions of magnetism as compared to newly formed magnetic rocks.

Conclusion

The continental drift theory is accepted without any doubt. The theory formed the basis of later theories such as sea floor spreading and plate tectonics theory.

2. There is no formation of deltas by rivers of the Western Ghats. Why? **(2013)**

Sol.

Analysis of Question	
Discuss	Write about the topic in detail, taking into account different ideas.
Number of parts	One part
Mode of presentation	Point form
Importance of conclusion	Not necessary