ANSWERS & EXPLANATIONS
GENERAL STUDIES (P) TEST – 4716 (2025)

Q 1.C

- **Recently, Rules have been notified by Department of Telecommunication (DoT) in exercise of powers conferred by the Telecommunications Act, 2023 to operationalize the Digital Bharat Nidhi (DBN).**
  - **DBN was established through the Telecommunications Act, 2023 for funding telecom schemes in underserved remote/rural areas at affordable prices. Hence, option (c) is the correct answer.**
- It replaced the Universal Service Obligation Fund (USOF) created under the erstwhile Indian Telegraph Act, 1885.USOF was a non-lapsable pool of funds generated by a Universal Access Levy through the license fee charged on licensee of DoT @ 5% of the Adjusted Gross Revenue.
- **Key Highlights of the Notified Rules-**
  - **Criteria for undertaking Schemes and Projects:** To provision telecom services in underserved rural, remote, and urban areas; to introduce next-gen telecom technologies; to encourage startups; to promote sustainable and green technologies; etc.
  - **Sharing of telecom networks established under DBN:** DBN implementer shall share and make available such network andservices on an open and non-discriminatory basis.
- **Process of allocation of funds under DBN**
  - **Bidding:** To promote and support Telecommunication services for promoting access to and delivery of established telecommunication services in underserved areas.
  - **Selection by Application:** To promote and support R&D of new or emerging telecommunication technologies or products or services, through co-funding, Viability Gap Funding (VGF), etc.

Q 2.C

- **Recently, Union Cabinet approved continuation of Centrally Sponsored Scheme of Integrated Development of Wildlife Habitats (IDWH) for the 15th Finance Commission cycle.** While strengthening existing fundamental & core components of scheme, the scheme envisages boosting technological interventions in different thematic areas in tiger and wildlife-bearing forests.
- **About Integrated Development of Wildlife Habitats (IDWH)**
  - **It is a centrally sponsored umbrella scheme launched by Ministry of Environment for development of wildlife habitat in India. Hence, statement 1 is correct.**
  - **It aims to provide support to protected areas (national parks, wildlife sanctuaries, conservation reserves, and community reserves) and protection of wildlife outside protected areas. Hence, statement 3 is correct.**
  - So far, 22 species have been identified under the Species recovery program.
- **Sub-schemes Under IDWH**
  - **Project Tiger (1973):** It benefits a total of 55 TRs spread across 18 tiger range states, distributed in 5 landscapes of the country. **Hence, statement 2 is correct.**
  - It also supports the ambitious **Project Cheetah** in the country.

- **Development of Wildlife Habitats:** Project Dolphin and Project Lion are implemented under this sub-scheme.
- **Project Elephant (1992):** To protect elephants, their habitat, & corridors to address issues of human-animal conflict and welfare of captive elephants.
- It is being implemented in 22 elephant range states/UTs.

- **Note: Project Tiger and Project Elephant schemes have been merged w.e.f. FY 2023-24 and now known as Project Tiger & Elephant.**

Q 3.C

- **Recently, Union Cabinet approved the Pradhan Mantri Janjatiya Unnat Gram Abhiyan (PM-JUGA)**
- The PMJUGA **envisions the comprehensive development of tribal areas and communities by addressing critical gaps in infrastructure, healthcare, education, and livelihoods.** Through a coordinated approach and convergence of various Government of India schemes, the mission aims to ensure holistic, sustainable, and inclusive growth, empowering tribal communities to thrive and flourish in a saturation mode. **Hence option (c) is the correct answer.**
- The mission **seeks to develop enabling infrastructure and enhance socio-economic conditions in selected tribal-majority villages (with a population of 500 or more, and at least 50% tribal residents as well as villages in Aspirational Districts with a tribal population of 50 or more).** By adopting a whole-of-government approach, the mission aims to improve access to education, healthcare, and skills, driving progress toward the specific goals outlined below.

Household and Community Level Infrastructure	*Health and Nutrition*	*Education and Training*	*Electrification*	*Economic Empowerment*	*Connectivity*
• Housing • Road • Tap Water • Homestays • TMMC • LPG	• MMUs • CoC for Sickle Cell Disease • AWCs • Poshan Vatikas • Ayushman Card	• Hostels • Ashram & Govt. Schools for Tribals • JSS	• On grid power connections • Off-grid solar connection • Solar Rooftops for institutions	• IFR/CFR Claim Support & capacity building, • FRA cell, Support for agriculture, allied activities • Marketing support via TMMC and value addition	• 4G Mobile Connectivity • Digital Initiatives

- **Coverage:** 63,000 villages benefitting more than 5 crore tribal people, covering 549 districts across 30 States/UTs.
- **Implementation:** It comprises 25 interventions to be implemented by 17 line ministries through funds allocated under Development Action Plan for Scheduled Tribes (DAPST) in next 5 years.
  - Tribal villages covered will be mapped and progress will be monitored on PM Gati Shakti platform.
  - It is a unique example of cooperative Federalism and whole of Government approach.

- **Mission's Four Goals**:
  - **Goal-I:** Developing Enabling Infrastructure such as Pucca house for households and improving Village Infrastructure.
  - **Goal-2:** Promotion of Economic Empowerment through Skill Development Entrepreneurship promotion and enhanced livelihood (self-employment).
  - **Goal-3:** Universalization of Access to Good Education.
  - **Goal-4:** Healthy lives and Dignified Ageing.

Q 4.D

- **US Food and Drug Administration granted breakthrough device status to Neuralink 'Blindsight'.**
  - Blindsight is an experimental vision-restoring implant which aims to assist individuals who have lost their sight or were born blind (Initially offering low-resolution vision).
  - Breakthrough device designation is intended to accelerate development of devices that offer promising new treatments or diagnostic capabilities for life-threatening conditions.
- **Neuralink, founded by Elon Musk in 2016, is a company working on Brain Computer Interfaces (BCIs) with a focus on healthcare applications.**

  About BCIs:
- **It allows users to communicate or control external devices using brain signals without any physical movement. Hence, option (d) is the correct answer.**
- **Types of BCIs:**
  - **Invasive:** Chips/Sensors are placed directly into the cortex E.g. Neuralink's Implant.
  - **Non-Invasive:** Sensors are placed on scalp.\
  - **Partially invasive:** implanted inside skull but rest outside brain.
- **Applications of BCIs:**
  - **Medical:** Help restore lost functions e.g. controlling prosthetic limbs or aiding patients with neurological disorders like paralysis.
  - **Mental wellness:** Real-time feedback on users' mental well-being and facilitates effective mental health practices.
  - **Defense:** Improved battlespace awareness, enhanced management of autonomous systems etc.
  - **Gaming and entertainment:** Immersive gaming experiences through uni- or bi-directional neural communication.
- **Issues with BCIs:**
  - Cybersecurity risks: E.g. Brain tapping (intercepting signals transmitted from brain).
  - Ethical Concerns: concerns regarding informed consent.
  - Safety Issues: E.g. tissue damage, seizures, cognitive impairment etc.

Q 5.A

- **Recently, Type 1 diabetic woman was treated by using cells extracted from her own body after reprogrammed stem cell transplant.**

  Stem Cells
- **Undifferentiated and unspecialised cells and have capacity to self-renew. Hence statement 1 is correct.**
- **Major sources of stem cells are embryos and adult tissues (adult stem cells). Hence statement 2 is not correct.**
- Three types depending on their potency:
  - **Totipotent cells:** Able to differentiate into all possible cell types in an organism. E.g. zygote formed after fertilization and asexual spore.
  - **Pluripotent cells:** Differentiated into most tissues of body but are unable to produce all tissue.
  - **Multi-potent cells:** Cells have limited range of tissues into which they can differentiate.

Q 6.A

- Landslides are relatively rapid and perceptible movements. The materials involved are relatively dry. The size and shape of the detached mass depends on the nature of discontinuities in the rock, the degree of weathering and the steepness of the slope.
- Depending upon the type of movement of materials several types are identified in this category like:
  - **Slump is slipping of one or several units of rock debris with a backward rotation with respect to the slope over which the movement takes place. Hence statement 1 is correct.**
  - **Rapid rolling or sliding of earth** debris without backward rotation of mass is known as debris slide.
  - **Debris fall is nearly a free fall of earth debris from a vertical or overhanging face. Hence statement 2 is not correct.**
  - **Sliding of individual rock masses down bedding, joint or fault surfaces is rockslide.** Over steep slopes, rock sliding is very fast and destructive. Slides occur as planar failures along discontinuities like bedding planes that dip steeply. **Hence statement 3 is correct.**
  - **Rock fall** is free falling of rock blocks over any steep slope keeping itself away from the slope. Rock falls occur from the superficial layers of the rock face, an occurrence that distinguishes it from rockslide which affects materials up to a substantial depth.

Q 7.D

- **World Meteorological Organisation (WMO) released 2nd Edition of WMO Ozone and UV Bulletin.**The release of the Bulletin coincides with **World Ozone Day(16 September).** World Ozone Day celebrates the implementation of the Montreal Protocol and the later amendment to the pact, known as the Kigali Agreement.
- **Theme for this year is Montreal Protocol:** Advancing Climate Actions.

Key findings

- **The ozone layer is recovering, with ozone-depleting substances (ODS) decreasing.**
- Full recovery to **1980 levels is expected by 2066 over Antarctica;by 2045 over the Arctic and by 2040 for the rest of the world.**
- The Kigali Amendment could potentially reduce global heating by 0.5°C by 2100.

Initiatives Taken

- **Global**
  - **Vienna Convention (1885) and Montreal Protocol (1987):** The landmark multilateral environmental agreement that regulates the production and consumption of man-made chemicals referred to as ODS.
    - ✓ **India is a party**
  - **The Kigali Amendment:** Decision made to phase down Hydrofluorocarbons (HFCs) in 2016, in Kigali, Rwanda.
- **India**:
  - India launched the Cooling Action Plan in 2019 to address cooling demand, refrigerants, and energy efficiency.
  - **India has phased out Chlorofluorocarbons, Carbon tetrachloride, Halons, Methyl Bromide and Methyl Chloroform.**
  - **Hence, option (d) is the correct answer.**

Q 8.D

- **Recently, Srinagar has earned the World Craft City (WCC) tag from the World Crafts Council (WCC).**
- The **World Craft City designation is awarded by World Crafts Council. Hence statement 1 is not correct**
- The **WCC-World Craft City Programme, a groundbreaking initiative launched in 2014 by the World Crafts Council AISBL (WCC-International)** in recognition of the pivotal role local authorities, craftspeople, and communities play in cultural, economic, and social development worldwide.

- **Recently, Srinagar has become the fourth Indian city to be recognised as a 'World Crafts City' by the World Craft Council (WCC). Under the World Craft City Programme, Jaipur (Rajasthan), Mammalapuram (Tamil Nadu) and Mysore (Karnataka)have been added as craft cities from India. Hence statement 2 is not correct.**
- It recognizes the role of local authorities, craftspeople, and communities in cultural, economic, and social development worldwide. It establishes a dynamic network of craft cities across the globe, aligning with the principles of the creative economy.

Q 9.B

- **Recent Context: International Telecommunication Union (ITU) releases Global Cybersecurity Index (GCI) 2024. Hence, option (b) is the correct answer.**
- GCI 2024 assesses country-level cybersecurity commitments across five pillars: legal, technical, organizational, capacity development, and cooperation.
  - It uses a new five-tier analysis (Tier 1 to Tier 5) to assess each country's advances with cybersecurity commitments and resulting impacts.

Key highlights

- **India among role model countries:** 46 countries (including India) are in Tier 1 i.e., "role modelling" countries demonstrating a strong commitment to all five cybersecurity pillars.
- **Global Improvement in Cybersecurity:** Since 2021 (last GCI was published), all regions have shown improvement and Africa has advanced the most on cybersecurity
- **Expansion of digital services:** Most countries are either "establishing" (Tier 3) or "evolving" (Tier 4).
  - These countries have largely expanded digital services and connectivity but must integrate cybersecurity measures.

Q 10.B

Brunei Darussalam (Capital : Bandar Seri Begawan)

- Recently, PM of India embarked on a first ever bilateral visit to Brunei Darussalam
- India- Brunei have elevated bilateral ties to 'Enhanced Partnership'. Enhanced Partnership' symbolizes a new phase in India-Brunei relations, with a focus on mutual cooperation and shared strategic interests.
- **Location: Brunei is a southeast Asian country consisting of two unconnected parts with a total area of 5,765 square kilometres (2,226 sq mi) on the island of Borneo. Hence, statement 1 is correct.**
- **It has 161 kilometres (100 mi) of coastline next to the South China Sea, and it shares a 381 km (237 mi) border with Malaysian state of Sarawak.** It lies above the equator. **Hence, statement 2 is not correct.**
- **It is a member of Commonwealth and ASEAN. Hence, statement 3 is correct.**

Q 11.C

- Recently the Supreme Court has criticized the Union Ministry of AYUSH for its notification requesting state licensing authorities not to take action under Rule 170 of the Drugs and Cosmetics Rules, 1945.
    - **Rule 170 of the Drugs and Cosmetics Rules, 1945 governs the manufacture, storage, and sale of medicines in the country, "specifically for controlling inappropriate advertisements of Ayurvedic, Siddha, and Unani medicines". Hence, statement 3 is correct.**
- As prescribed in Drugs and Cosmetics Act 1940 and Rules 1945 made there under, enforcement of the legal provisions pertaining to Quality Control and **issuance of drug license of Ayurveda, Siddha, Unani and Homoeopathic drugs, is vested with the State Drug Controllers/ State Licensing Authorities** appointed by the concerned State/ Union Territory Government. **Hence, statement 1 is not correct.**
- Most AYUSH drugs can be approved simply based on the rationale provided in authoritative texts of that particular stream.
- Safety trials are required only for formulations that use around 60 specific ingredients listed in the act, such as snake venom,heavy metals such as arsenic and mercury, etc.

  Hence, statement 2 is not correct.

Q 12.A

- **Recent Context:** Joint Action Plan 2024-2028 was adopted at the recently held first ever India–Gulf Cooperation Council (GCC) Joint Ministerial Meeting for Strategic Dialogue.
- **Key Outcomes of the Ministerial Meeting**
    - **Joint Action Plan 2024-2028:** for undertaking various joint activities in diverse areas including health, trade, security, agriculture and food security, transportation, energy, culture, amongst others.
        - ✓ More areas of cooperation can be included in the Joint Action Plan, based on mutual consensus, later on.
    - **3P Framework:** India affirmed framework of 3Ps—People, Prosperity and Progress to enhance partnership between India & GCC.
    - **Humanitarian crisis in Gaza:** External Affairs Minister states that India's position has been principled and consistent and any response must take into account the principles of humanitarian law.
- **India-GCC Relations**
    - **Political:** 1st India-GCC Political Dialogue was held in 2003. Currently, India has strategic partnerships with Saudi Arabia, UAE, & Oman.
    - **Trade & Investment:** Bilateral trade stood at USD 161.59 billion in FY 2023-24.
    - **Diaspora:** Approximately 8.9 million Indian expats (66% of NRIs) reside in GCC countries.
        - ✓ **Share of inward remittances from the GCC region are about 30% (2020-21). Hence, statement 1 is correct.**
    - **Energy: GCC countries contribute to 35% of India's oil imports and 70% of gas imports. Hence, statement 2 is not correct.**

Q 13.D

- **Recent Context: Elongated Tortoise (Indotestudo elongata) was spotted during a research survey in Aravallis, Haryana.**
  - **Physical Characteristics**: Medium-sized having yellowish brown or olive shell and distinct black blotches at the centre.
  - **Habitat:** Sal deciduous and hilly evergreen forests, distributed across northern India, Nepal, Bhutan, Bangladesh, Myanmar, Thailand, China and Malaysia. **Hence, statement 1 is not correct.**
  - **Threat:** Heavily exploited and hunted for food and traditional medicines.
- **Conservation Status:**
  - **IUCN Red List: Critically Endangered. Hence, statement 2 is not correct.**
  - **WPA, 1972: Schedule I (mentioned as Sal forest tortoise).**

Q 14.B

- **Recent Context: Securities and Exchange Board of India (Foreign Venture Capital Investors) Amendment) Regulations, 2024**
  - Regulations seek to amend existing SEBI (FVCI) Regulations, 2000 to streamline the framework for the registration of Foreign Venture Capital Investors (FVCIs).
  - New Regulations align the FVCI framework with Foreign Portfolio Investors providing for a clear oversight.
- **About Foreign Venture Capital Investors FVCI:**
  - It is an investor incorporated outside India, registered under FVCI Regulations.
  - FVCI make investments in venture capital funds (registered with SEBI) or venture capital undertakings in India (company not listed in major stock exchanges).
    - ✓ **Venture Capital fund (VCF) is used for high-risk,high-return investment in return for equity stakes in business. Hence, option (b) is the correct answer.**
    - ✓ VCFs are governed by SEBI (VCF) Regulations, 1996.
  - FVCI fill gap between capital needs of technology/knowledge based startups and available funding from traditional sources like banks.

Key Highlights of New Regulations

- Requires FVCI applicant to obtain a registration certificate from Designated Depository Participant (DDP).
  - DDP means a person authorized by SEBI for issuing registration certificates.
- Individuals or entities must obtain a certificate from theDDP before dealing with FVCI.
- Broadened eligibility criteria for FVCIs with some conditions from existing entities like investment companies, pension funds, etc. to Resident Indians, NRIs, and OCI, (contributing to FVCI's corpus without having control over it).
- An FVCI or its global custodian must enter into an agreement with both DDP and custodian before making any investments in India.

Q 15.D

- **Recently, Multilateral Investment Guarantee Agency (MIGA) and International Solar Alliance (ISA) have announced the establishment of MIGA-ISA Solar Facility, a multi-donor trust fund.**
    - **MIGA, part of World Bank Group, aims to promote cross-border investment in developing countries by providing guarantees (political risk insurance and credit enhancement) to investors and lenders. (India is a member). Hence, both statements 1 and 2 are not correct.**

About MIGA-ISA Solar Facility

- It will combine ISA's technical expertise and MIGA's capacity to mobilise financing, creating an innovative mechanism to accelerate global adoption of solar energy, including cutting- edge solar energy technologies.
- **Applicability:** Initially, focus on Sub-Saharan Africa, with plans for global expansion.
- **Funding:** ISA has committed seed-funding of $2 million, with a goal of raising $10 million for facility.
    - This is the first program under guarantee component of ISA's Global Solar Facility (GSF), which aims to raise $200 million for projects in Africa.
        - ✓ GSF aims to catalyse solar investments (through payment guarantees, insurance and investment funds) across the world, starting with Africa's underserved segments.
- **Significance**
    - Provides cost-effective risk mitigation instruments to support growth of solar projects in ISA member countries.
    - Attract private investment by providing concessional financing (including first-loss instruments and reinsurance capacity), helping to lower costs and close energy gap in underserved regions.

Q 16.C

- **Recently, the Ministry of Home Affairs released the Guidelines on Recovery and Reconstruction (R&R) Funding Window within National Disaster Response Fund (NDRF) and State Disaster Response Fund (SDRF).**
- **Originally, the guidelines for constitution and administration of National Disaster Response Fund (NDRF) and State Disaster Response Fund (SDRF) were issued by the Ministry of Home Affairs (MHA) in 2022.**

About R&R Funding Window-

- **Aim:** To address gaps in funding for states affected by natural disasters, reallocating resources within existing disaster relief frameworks to support recovery efforts better.
    - **It has been created on recommendations of 15th Finance Commission (FC).**
- **Activities Under R & R:** Housing, education, infrastructure,etc.
- The coverage of the funds recommended by 15th Finance Commission goes beyond the disaster response funds that already exist at the national (NDRF) and state (SDRF) levels. Hence, **15th Finance Commission has recommended the creation of funds for disaster mitigation along with disaster response, which will now together be called National Disaster Risk Management Fund (NDRMF) and State Disaster Risk Management Funds (SDRMF).**
    - The Commission has also recommended an allocation of Rs. 1,60,153 crores in the SDRMF for the years 2021-26, out of which Rs. 1,28,122 crore (80% of SDRMF) is for State Disaster Response Fund and Rs. 32,031 crore (20% of SDRMF) is for State Disaster Mitigation Fund.
    - Similarly, an amount of Rs. 68,463 crore has been allocated for NDRMF for the period of 2021-22 to 2025-26 out of which Rs. 54,770 crore(80% of NDRMF) is for National Disaster Response Fund and Rs. 13,693 crore (20% of NDRMF) is for National Disaster Mitigation Fund.
- **About State Disaster Response Fund (SDRF)**
    - It is **constituted under Section 48 (1) (a) of the Disaster Management Act, 2005**, is the primary fund available with State Governments for responses to notified disasters.
    - SDRF shall be used only for meeting the expenditure for providing immediate relief to the victims.

- **Disaster (s) covered under SDRF:** Cyclone, drought, earthquake, fire, flood, tsunami, hailstorm, landslide, avalanche, cloudburst, pest attack, frost and cold waves.
- **Local Disaster:** A **State Government may use up to 10 percent of the funds available under the SDRF for providing immediate relief to the victims of natural disasters that they consider to be 'disasters' within the local context in the State and which are not included in the notified list of disasters of the Ministry of Home Affairs** subject to the condition that the State Government has listed the State specific natural disasters and notified clear and transparent norms and guidelines for such disasters with the approval of the State Authority, i.e., the State Executive Authority (SEC).

- **About National Disaster Response Fund (NDRF)**
  - It is constituted under **Section 46 of the Disaster Management Act, 2005, supplements SDRF of a State, in case of a disaster of severe nature, provided adequate funds are not available in SDRF.**
- The **allocation of funds under SDRF and NDRF is based on the recommendations of the successive Financial Commissions**.
  - For **SDRF, the contribution is made by the Central Government and State Governments in the ratio of 75:25 to all states, except for the North-Eastern and Himalayan States, for which it is 90:10 ratio, while in NDRF, the entire contribution in the fund comes from the Central Government.**
  - In order to ensure **additional source of funding to National Disaster Response Fund (NDRF),** the Central Government has laid out the modalities for receipt of **contributions/ grants from any person or institution for the purpose of disaster management** in the National Disaster Response Fund (NDRF), as per Section 46 (1) (b) of the Disaster Management Act, 2005, as an additional source of funding to NDRF.
- **Hence option (c) is the correct answer.**

Q 17.B

- **Recent Context:** The **Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry, is set to launch a groundbreaking digital platform aimed at strengthening India's startup ecosystem.**
- The **Bharat Startup Knowledge Access Registry (BHASKAR) initiative, under the Startup India program, is a platform designed to centralize, streamline, and enhance collaboration among key stakeholders within the entrepreneurial ecosystem, including startups, investors, mentors, service providers, and government bodies.**

  Hence, option (b) is the correct answer.
- This initiative aligns with the Government of India's vision to transform India into a global leader in innovation and entrepreneurship, reinforcing the country's commitment to the startup movement.
- **Key Features of BHASKAR**
  - **Networking:** It will bridge gap between startups and other stakeholders, allowing for seamless interaction across sectors.
  - **Centralized Access to Resources:** By providing startups immediate access to critical tools and knowledge, it will enable faster decision-making and more efficient scaling.
  - **Creating Personalized Identification:** Every stakeholder will be assigned unique BHASKAR ID, ensuring personalized interactions and tailored experiences across platform.
  - **Enhancing Discoverability:** Through powerful search features,users can easily locate relevant resources, collaborators, and opportunities, ensuring faster decision-making and action.
  - **Supporting India's Global Brand:** It will promote India's global reputation as a hub for innovation, making cross-border collaborations more accessible to startups and investors alike.
- **India' Startup Ecosystem:**
  - **India has 3rd largest startup ecosystem in the world** and has over 1,46,000 DPIIT-recognized startups.
  - **Department for Promotion of Industry and Internal Trade (DPIIT) recognize business as a startup.**

Q 18.C

- **Recent Context:** The habitat rights are formally provided to Mankidia of Odisha under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.
- **About Mankidia Tribes**
  - They are one of the seventy-five Particularly Vulnerable Tribes
  - They are a semi-nomadic section of the Birhor tribe.
  - The community is famed for its skill in catching monkeys and trapping small birds and animals.
  - They live in dome shaped leaf huts, known as Kumbha.
  - Speak a language of their own that belongs to the Munda branch of Austro-Asiatic language group.

Q 19.B

Why in the News?

- Recent research indicates that pigs may act as a transmission vehicle for a strain of the hepatitis E virus (HEV) commonly found in rats, known as Rocahepevirus ratti, or rat HEV.

Role of Pigs in Transmission

- **HEV Reservoir: Pigs naturally carry hepatitis E virus (HEV), particularly strains that can infect humans. Hence, statement 2 is correct.**
- **Transmission via Pork:** Humans can contract HEV by consuming raw or undercooked pork from infected pigs.
- **Environmental Contamination:** Infected pigs shed HEV in faeces, contaminating the environment and water sources, potentially spreading the virus to humans. Poor sanitation in pig farms facilitates HEV transmission between pigs and increases the risk of human infection through the food chain.
- **Cross-Species Transmission:** Pigs may also act as intermediaries for rat HEV, transmitting the virus from rats to humans in farm environments.

About Hepatitis E Virus (HEV):

- **Hepatitis E is caused by the Hepatitis E Virus (HEV), which is a positive-sense, single-stranded, non-enveloped RNA virus.** HEV is classified under the family Hepeviridae, genus Orthohepevirus. **Hence, statement 1 is not correct.**
- It was first identified during an outbreak among Soviet soldiers in Afghanistan in 1983.
- The earliest well-documented HEV epidemic occurred in New Delhi, India, in 1955, retrospectively identified as HEV.

Transmission:

- **The primary route of transmission is fecal-oral, especially through contaminated water and food. Hence, statemnt 3 is correct.**
- **Zoonotic transmission** is possible with genotypes 3 and 4, commonly spread through undercooked meat or direct animal contact.

Symptoms:

- Jaundice, nausea, fatigue, and elevated liver enzymes.
- Severe cases can lead to liver failure, especially in pregnant women and immunocompromised individuals.

Prevention and Cure:

- A vaccine, HEV 239, is approved for use in China, but no vaccine is widely available or approved in most countries, including the United States.
- **There is no specific antiviral treatment for acute HEV. Hence, statement 4 is not correct.**
- Prevention relies on improved sanitation, safe drinking water, and proper food handling.

Q 20.B

Polaris Dawn Mission Successfully Completes World's First Private Spacewalk

- Recently, Polaris Dawn has travelled through Earth's regions of high radiation, i.e., South Atlantic Anomaly and Van Allen Radiation Belt, to study space radiation's impact on human health.

Van Allen Radiation Belt (Discovered in 1958 by astrophysicist James Van Allen)

- Earth's magnetosphere traps the high energy radiation particles and shields the Earth from solar storms and solar winds that can damage technology as well as people living on Earth.
    - These trapped particles form two belts of radiation (inner and outer), known as Van Allen Belts, that surround the Earth.
        - ✓ **Inner belt results from interactions of cosmic rays with Earth's atmosphere and Outer belt is made up of billions of high-energy particles that originate from Sun. Hence, statement 1 is not correct.**
- **The Van Allen belts are most intense over the Equator and are effectively absent above the poles. Hence, statement 3 is correct.**
- **Astronauts and spacecraft must fly through Van Allen Belts to reach outer space, so it is important to fly through this region quickly to limit their radiation exposure. Hence, statement 2 is correct.**
- NASA plans to use its upcoming Artemis missions to send astronauts beyond Van Allen Radiation Belt to land on South Pole of Moon by end of 2025, and eventually on to Mars.

Q 21.A

- **Recently, an observation paper by Economic Advisory Council to the PM (PM-EAC) highlighted the prevalence of Dutch disease in India.**
- **Key Observations of the Paper**
    - **Regional disparities:** While western states have consistently performed well, southern states have performed well post-1991 economic liberalization (5 southern states account for 30% of GDP in 2023-24).
    - **Maritime states:** They have clearly outperformed the other states, with the exception of West Bengal.
    - **West Bengal**'s share of GDP has fallen in 2023-24 (5.6%) in comparison to 1960-61 (10.5%).
    - **Diverging growth trajectories of Punjab and Haryana:** However, post-1990s Punjab's contribution to GDP declined whereas Haryana's contribution has grown robustly. The paper questions this as a form of **Dutch disease.**
- **Dutch Disease in economics refers to a phenomenon wherein a country witnesses uneven growth across sectors due to the discovery of natural resources, especially large oil reserves. Hence option (a) is the correct answer.**
    - According to the concept, when a country discovers natural resources and starts exporting them to the rest of the world, it causes the exchange rate of the currency to appreciate significantly and this, in turn, discourages the exports from other sectors while encouraging the import of cheaper alternatives.
- **How to combat Dutch Disease?**
    - **Role of Fiscal Policy:** According to the researchers, the role of fiscal policy is important to control the boom following the discovery of natural resources. Rising income due to the export of natural resources should be adjusted with cautious spending on public welfare.
    - **Promote public spending policies:** Public spending such as concentrating on imports of tradeables rather than non-tradables would help slow the impact of the Dutch disease. Private spending in order to improve the productivity of private firms would also help reduce the impact.
    - **Role of Monetary Policy:** With the discovery of natural resources, the country sees a huge inflow of money, especially foreign currency. The export of natural resources tends to affect the equilibrium in the money and exchange rate markets. The Dutch disease can be prevented if the central bank raises the banking system reserve's requirement, which decreases domestic credit.

Q 22.B

- **Square Kilometer Array (SKA), world's largest radio telescope in making, has carried out its first observations and became partially functional.**
- **About SKA**
    - SKA project aims at building world's largest radio telescope, with eventually over a square kilometre of collecting area.

- SKA will consist of one global observatory, operating two large telescopes **(South Africa and Australia).**

- **Objectives of SKA Telescopes**:
  - **Understand about the birth of Universe.**
  - **Detect Gravitational Waves.**
  - **Understand evolution of Galaxies, Dark matter and Cosmic Magnetism.**
- **India joined SKA Organization in 2012 as an Associate Member** and has actively participated in the pre-construction phase of the SKA telescopes.
- **Hence, option (b) is the correct answer.**

Q 23.C

- According to Ministry of Housing & Urban Affairs' Data, only 16% of land is reclaimed under 'legacy waste management project of Swachh Bharat Mission (SBM) 2.0'.SBM 2.0 mandates all cities to clear legacy waste sites.

  Legacy Waste

  - **Definition: It typically refers to the aged municipal solid waste (MSW) in landfills or dumpsites. Hence, option (c) is the correct answer.**
  - **Impact:** Releases greenhouse gases, contamination of soil and groundwater, etc.
  - **Ways to deal:** Sustainable SWM management plan, maximum utilisation of recovered fractions, building capacity of urban departments, reusing reclaimed land sustainably.

Q 24.B

G4 Nations

- The Minister of External Affairs meets foreign ministers of G4 nations in New York. The group reaffirmed its commitment to urgent reform of the United Nations Security Council through text-based negotiations.

About G4 Nations

- **It includes Brazil, Germany, India, and Japan.**
- **The G4 nations support each other's bids for permanent seats on the United Nations Security Council.**
- Group has proposed that Council's membership shall be increased from 15 to 25-26, by adding six permanent and four or five non-permanent members.
- **Hence , option (b) is the correct answer.**

Q 25.A

Union Health Ministry releases National Health Accounts Estimates for India 2020-21 and 2021-22

- The methodology taken for these NHA estimates has improved over the last 9 years and has resulted in a more robust and accurate account of the government's expenditure on Health.
- **"The decline in Out-of-Pocket expenditure out of Total Health Expenditure from 64.2% in 2013-14 to 39.4% in 2021-22 reflects a very positive indicator".Hence, statement 1 is not correct.**
- **Government Health Expenditure's share in the country's total GDP increases from 1.13% (2014-15) to 1.84% (2021-22). Hence, statement 2 is correct.**
- Share of Government Health Expenditure in Total Health Expenditure increases from 29.0% (2014-15) to 48.0% (2021-22).
- **Per capita Government spending on healthcare triples. Hence, statement 3 is not correct.**
- The Union Health Ministry released the National Health Account (NHA) estimates for India 2020-21 and 2021-22. These estimates are the eighth and ninth in the series of reports released annually by the Union Ministry of Health & Family Welfare.

Q 26.A

- El Niño is a climate pattern that describes the unusual warming of surface waters in the eastern tropical Pacific Ocean. El Niño is the "warm phase" of a larger phenomenon called the El Niño-Southern Oscillation (ENSO). El Niño and La Niña are considered the ocean part of ENSO, while the Southern Oscillation is its atmospheric changes. **Hence statement 1 is not correct.**
- El Niño can lead to below-average rainfall, drought conditions, and crop failures in India. The impact of El Niño on the Indian monsoon is not uniform throughout the country. Central and northern India are more prone to experiencing below-average rainfall during El Niño years, while some areas in southern India may receive near-normal or even above-normal rainfall. **Hence statement 2 is correct.**
- Episodes of El Niño and La Niña typically last nine to 12 months, but can sometimes last for years. El Niño and La Niña events occur every two to seven years, on average, but they don't occur on a regular schedule. Generally, El Niño occurs more frequently than La Niña. **Hence statement 3 is not correct.**

Q 27.A

The Sun generates energy, which is transferred through space to the Earth's atmosphere and surface. The earth after being heated by insolation transmits the heat to the atmospheric layers near to the earth in long wave form. Hence statement 1 is correct.

There are three ways energy is transferred into and through the atmosphere:

- **Radiation:** Most of the solar radiation is absorbed by the atmosphere, and much of what reaches the Earth's surface is radiated back into the atmosphere to become heat energy. Dark-colored objects, such as asphalt, absorb radiant energy faster than light coloured objects. However, they also radiate their energy faster than lighter-colored objects. (The variations in how Earth's surface absorbs heat from the Sun is called differential heating.)
- **Conduction: The air in contact with the land gets heated slowly and the upper layers in contact with the lower layers also get heated. This process is called conduction**. Conduction takes place when two bodies of unequal temperature are in contact with one another, there is a flow of energy from the warmer to cooler body. The transfer of heat continues until both the bodies attain the same temperature or the contact is broken. Conduction is important in heating the lower layers of the atmosphere. **Hence statement 2 is not correct.**
- **Convection:** The air in contact with the earth rises vertically on heating in the form of currents and further transmits the heat of the atmosphere. This process of vertical heating of the atmosphere is known as convection. The convective transfer of energy is confined only to the troposphere. **The transfer of heat through horizontal movement of air is called advection**. The horizontal movement of the air is relatively more important than the vertical movement. In middle latitudes, most of the diurnal (day and night) variations in daily weather are caused by advection alone. In tropical regions particularly in northern India during the summer season local winds called 'loo' is the outcome of the advection process.

  Hence option (a) is the correct answer.

Q 28.B

Factors Controlling Temperature Distribution

The temperature of air at any place is influenced by (i) the latitude of the place; (ii) the altitude of the place; (iii) distance from the sea, the air-mass circulation; (iv) the presence of warm and cold ocean currents; (v) local aspects.

- **The latitude**: The temperature of a place depends on the insolation received. It has been explained earlier that the insolation varies according to the latitude hence the temperature also varies accordingly. **Hence point 3 is correct.**
- **The altitude:** The atmosphere is indirectly heated by terrestrial radiation from below. Therefore, the places near the sea-level record higher temperature than the places situated at higher elevations. In other words, the temperature generally decreases with increasing height. The rate of decrease of temperature with height is termed as the normal lapse rate. It is 6.5°C per 1,000 m. **Hence point 5 is correct.**

- **Distance from the sea:** Another factor that influences the temperature is the location of a place with respect to the sea. Compared to land, the sea gets heated slowly and loses heat slowly. Land heats up and cools down quickly. Therefore, the variation in temperature over the sea is less compared to land. The places situated near the sea come under the moderating influence of the sea and land breezes which moderate the temperature. **Hence point 2 is correct.**
- **Air-mass and Ocean currents:** Like the land and sea breezes, the passage of air masses also affects the temperature. The places, which come under the influence of warm airmasses experience higher temperature and the places that come under the influence of cold air-masses experience low temperature. Similarly, the places located on the coast where the warm ocean currents flow record higher temperature than the places located on the coast where the cold currents flow. **Hence point 4 is correct.**
- **Hence option (b) is the correct answer.**

Q 29.C

- **Jet streams are long, narrow, high-speed, meandering, circumpolar winds that typically flow north-eastward, eastward, and south-eastward in the middle and upper troposphere or lower stratosphere.** The Sun doesn't heat the whole Earth evenly. That's why areas near the equator are hot and areas near the poles are cold. So, when Earth's warmer air masses meet cooler air masses, the warmer air rises up higher in the atmosphere while cooler air sinks down to replace the warm air. This movement creates an air current, or wind. A jet stream is a type of air current that forms high in the atmosphere. **Hence statement 1 is not correct.**
- **Jet streams are narrow bands of strong wind that generally blow from west to east all across the globe. But the band often shifts north and south because jet streams follow the boundaries between hot and cold air.** Earth has four primary jet streams: two polar jet streams, near the north and south poles, and two subtropical jet streams closer to the equator. **Hence statement 2 is correct.**
- Within jet streams, the winds blow from west to east, but the band often shifts north and south because jet streams follow the boundaries between hot and cold air. Since these hot and cold air boundaries are most pronounced **in winter, jet streams are the strongest during both the northern and southern hemisphere winters. Hence statement 3 is correct.**

Q 30.B

Distribution of Rainfall

The average annual rainfall in India is about 125 cm, but it has great spatial variations. i.e.

- **Areas of High Rainfall:** The highest rainfall occurs along the west coast, on the Western Ghats, as well as in the sub-Himalayan areas is the northeast and the hills of Meghalaya. Here the rainfall exceeds 200 cm. In some parts of Khasi and Jaintia hills, the rainfall exceeds 1,000 cm. **In the Brahmaputra valley and the adjoining hills, the rainfall is less than 200 cm. Hence, pair 1 is not correctly matched.**
- **Areas of Medium Rainfall:** Rainfall between 100-200 cm is received in the southern parts of Gujarat, east Tamil Nadu, northeastern Peninsula covering Odisha, Jharkhand, Bihar, eastern Madhya Pradesh, **northern Ganga plain along the sub-Himalayas** and the Cachar Valley and Manipur. **Hence, pair 2 is correctly matched.**
- **Areas of Low Rainfall: Western Uttar Pradesh,** Delhi, Haryana, Punjab, Jammu and Kashmir, eastern Rajasthan, Gujarat and Deccan Plateau receive rainfall between 50-100 cm. **Hence, pair 3 is correctly matched.**
- Areas of Inadequate Rainfall: Parts of the Peninsula, especially in Andhra Pradesh, Karnataka and Maharashtra, Ladakh and most of western Rajasthan receive rainfall below 50 cm. Snowfall is restricted to the Himalayan region.

Q 31.A

Local Winds

Local winds are those kinds of winds that are solely caused by local conditions. Local winds are caused by the air moving between high and low-pressure systems in confined spaces. Each form of wind differs somewhat from the others since there are various sorts of winds. These local winds play an important role in the weather and climate of a particular location.

- **Bora: Cold and dry Hence, pair 1 is not correctly matched**
- **Sirocco: Hot and dry Hence, pair 2 is correctly matched**
- **Harmattan: Hot and dry Hence, pair 3 is not correctly matched**

Hot Local Winds

Wind Name	Region	Characteristics	Impact on Local Weather
Loo	Northern India and Pakistan	Hot, dry, strong, blows from west to east	High temperatures (45-50°C), heatwaves, reduced visibility
Foehn	Leeward side of Alps	Warm, dry, strong	Snow melt, early pasture growth, increased fire risk
Chinook	Eastern slopes of Rockies	Hot, dry, strong, "snow eater"	Rapid snowmelt, increased temperatures
Sirocco	Sahara Desert	Hot, dry, dusty	Brings hot, dry conditions, sometimes cooled by Mediterranean Sea
Harmattan	Northwest Africa	Hot, dry, dusty, strong	Relief from moist heat, health benefits, dry climate

Cold local winds

Wind Name	Region	Characteristics	Impact on Local Weather
Mistral	Alps, France	Cold, dry, high velocity	Low temperatures, freezing conditions
Bora	Adriatic Sea region	Cold, dry, high speed	Low temperatures, strong winds

Hence option (a) is the correct answer.

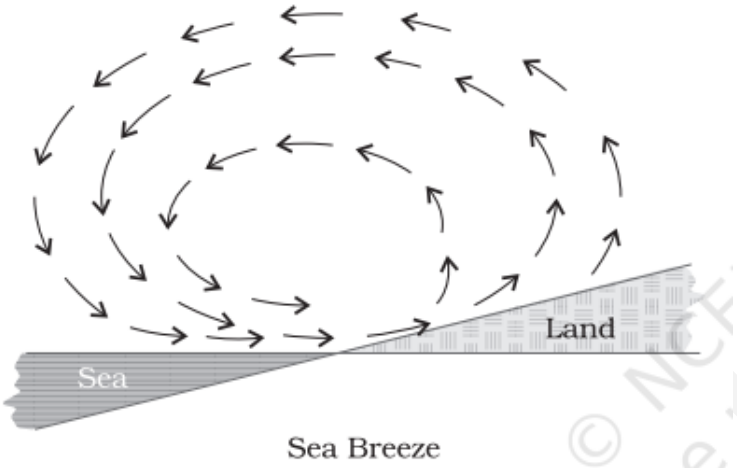
Q 32.B

Layer	Height Range (km)	Key Features
Troposphere	0 - 13 (Thicker at equator, thinner at poles)	Contains 75% of atmospheric mass. Responsible for all weather phenomena. Clouds, precipitation, and wind all occur here. **Hence, pair 1 is correctly matched.**
Stratosphere	13 - 50	Contains the ozone layer, which protects us from harmful UV radiation. Ideal for air travel due to stable conditions. Some cirrus clouds may be present **Hence, pair 2 is correctly matched**
Mesosphere	50 - 85	Most meteors burn up here due to thin air. Polar mesospheric noctilucent clouds form due to extreme cold
Thermosphere	85 - 600	The International Space Station and satellites orbit here. Kármán Line (100 km) defines the edge of space. **Hence, pair 3 is not correctly matched**
Ionosphere	80 - 400	Electrically charged particles (ions) present.
Exosphere	400+	Very thin and sparse atmosphere. Transition zone to outer space.

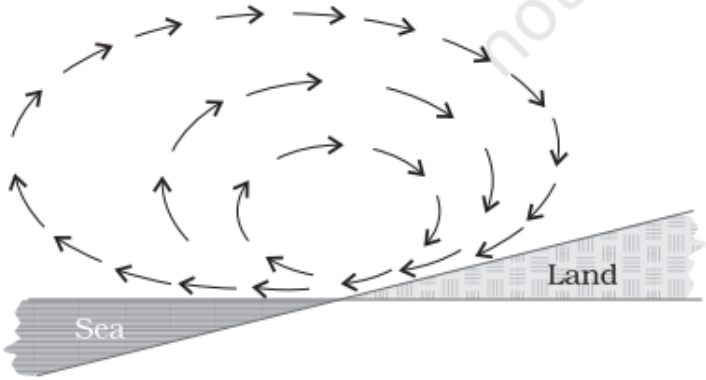
Q 33.D

- The land and sea absorb and transfer heat differently. During the day the land heats up faster and becomes warmer than the sea. Therefore, over the land the air rises giving rise to a low pressure area, whereas the sea is relatively cool and the pressure over sea is relatively high. Thus, pressure gradient from sea to land is created and the wind blows from the sea to the land as the sea breeze. In the night the reversal of condition takes place. The land loses heat faster and is cooler than the sea. T**he pressure gradient is from the land to the sea and hence land breeze results. Hence statement 1 is not correct.**

- **Land breezes are normally experienced during winter and autumn. This is due to the cooler nights. Hence statement 2 is not correct.**
- Sea breezes occur during hot, summer days because of the unequal heating rates of land and water. During the day, the land surface heats up faster than the water surface. Therefore, the air above the land is warmer than the air above the ocean. Now, recall that warmer air is lighter than cooler air. As a result, warm air rises. Therefore, the warmer air over the land surface is rising. As the warm air over the land is rising, the cooler air over the ocean is flowing over the land surface to replace the rising warm air. This is the sea breeze. **Sea breeze activity exists more or less throughout the year, though it is most prominent in winter and rather weak during summer monsoon season. Hence statement 3 is not correct.**



Sea Breeze



Land Breeze

Q 34.B

- Water is constantly cycling through the atmosphere. Water evaporates from the Earth's surface and rises on warm updrafts into the atmosphere. It condenses into clouds, is blown by the wind, and then falls back to the Earth as rain or snow. This cycle is one important way that heat and energy are transferred from the surface of the Earth to the atmosphere, and transported from one place to another on our planet.
- **Water Vapour absorbs not only the long-wave terrestrial radiation (infrared or heat emitted by earth during nights), but also a part of the incoming solar radiation.** It is an important component of the atmosphere. If not for water vapour, the Earth will not receive rain as rain is condensation of water vapour. **Hence statement 1 is correct.**
- Water vapour is also a variable gas in the atmosphere, which decreases with altitude. In the warm and wet tropics, it may account for four per cent of the air by volume, while in the dry and cold areas of desert and polar regions, it may be less than one per cent of the air. **Water vapour also decreases from the equator towards the poles. It also absorbs parts of the insolation from the sun and preserves the earth's radiated heat. It thus, acts like a blanket allowing the earth neither to become too cold nor too hot. Water vapour also contributes to the stability and instability in the air. Hence statements 2 is not correct and statement 3 is correct.**

Q 35.C

Cold Front:

- A cold front is the leading edge of a cooler mass of air at ground level that replaces a warmer mass of air and lies within a pronounced surface trough of low pressure. It often forms behind an extratropical cyclone, at the leading edge of its cold air advection pattern—known as the cyclone's dry "conveyor belt" flow. **Hence statement 1 is correct.**
- These fronts tend to move quickly, often at double the speed of warm fronts, resulting in dramatic weather shifts.
- As a cold front moves into an area, the heavier (more dense) cool air pushes under the lighter (less dense) warm air, causing it to rise up into the troposphere. Lifted warm air ahead of the front produces cumulus or cumulonimbus clouds and thunderstorms. As the cold front passes, winds become gusty. **Hence statement 2 is correct.**
- There is a sudden drop in temperature, and also heavy rain, sometimes with hail, thunder, and lightning. Atmospheric pressure changes from falling to rising at the front. After a cold front moves through your area, you may notice that the temperature is cooler, the rain has stopped, and the cumulus clouds are replaced by stratus and stratocumulus clouds or clear skies.

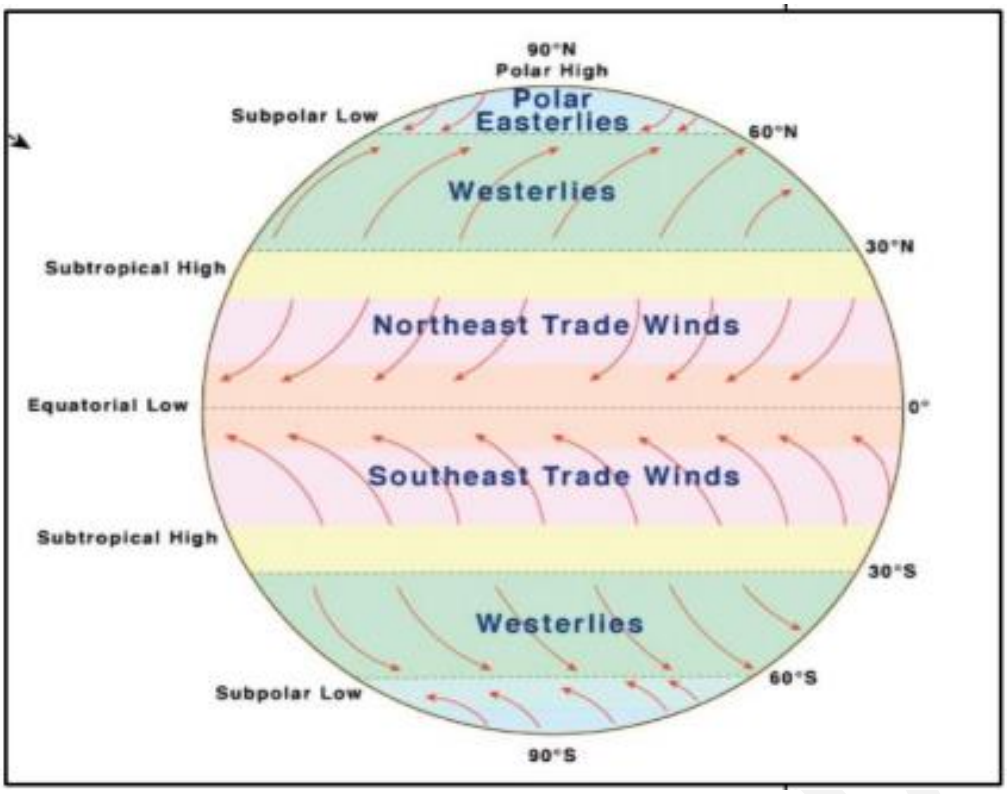
Q 36.A

- **Orographic rainfall occurs when moist air is forced to rise over a mountain range,** causing the air to cool and condense into precipitation. As moist air moves up the side of a mountain, the temperature drops, causing the water vapor in the air to cool and condense. This process creates clouds and precipitation on the windward side of the mountain. **Hence statement 1 is not correct.**
- **The side of the mountain that receives the rain is called the windward side, while the side that doesn't receive rain is called the leeward side or rain shadow region.** Orographic rainfall is more likely to occur when a prominent mountain range is oriented across a prevailing wind from a warm ocean. Orographic rainfall can be characterized by thunder and lightning, and unstable air can lead to showers and thunderstorms. Stable air can lead to more general and steady precipitation. **Hence statement 2 is not correct.**
- The Western Ghats in India provide favourable conditions for orographic rainfall. Due to orographic rainfall, the western side of the western ghats receives heavy rainfall, more than 250cm rainfall per year. **Western slopes of Anaimalai, Palni, and Nilgiri ranges Mahabaleshwar, situated on the Western Ghats receives very heavy rainfall whereas Pune lying on rain shadow area receives less amount of rainfall only about 70 cm. Hence statement 3 is correct.**

Q 37.A

- **Trade winds can be defined as the wind that flows towards the equator from the north-east in the Northern Hemisphere or from the south-east in the Southern Hemispher**e. These are also known as tropical easterlies and are known for their consistency in force and direction. Trade wind persistent blows westward and toward the **Equator from the subtropical high-pressure belts toward the intertropical convergence zone (ITCZ). Hence statement 1 is correct and statement 2 is not correct.**
- These are the winds which blow in the same direction throughout the year, especially over the oceanic regions. During the ancient times these winds helped traders to sail their ships in seas for business purposes for quite long distances. That has given the name "trade wind" to these steady winds.

  On account of Coriolis force or Ferrel's law, they are deflected from their path (towards right in northern hemisphere and towards left in southern hemisphere).
- It is stronger and more consistent over the oceans than over land and often produces partly cloudy sky conditions, characterized by shallow cumulus clouds, or clear skies that make trade-wind islands popular tourist resorts. Its average speed is about 5 to 6 metres per second (11 to 13 miles per hour) but can increase to speeds of 13 metres per second (30 miles per hour) or more. **Hence statement 3 is not correct.**
- As the wind blows to about five degrees north and south of the equator, both air and ocean currents come to a halt in a band of hot, dry air. This 10-degree belt around Earth's midsection is called the Inter-Tropical Convergence Zone, more commonly known as the doldrums.



Q 38.B

The horizontal winds near the earth surface respond to the combined effect of three forces – the pressure gradient force, the frictional force and the Coriolis force. In addition, the gravitational force acts downward.

- **Pressure Gradient Force:** The differences in atmospheric pressure produce a force. The rate of change of pressure with respect to distance is the pressure gradient. T**he pressure gradient is strong where the isobars are close to each other and is weak where the isobars are apart. Hence statement 1 is correct.**
- **Frictional Force:** It affects the speed of the wind. It is greatest at the surface and its influence generally extends up to an elevation of 1 - 3 km. Over the sea surface, the friction is minimal.
- **Coriolis Force:** The rotation of the earth about its axis affects the direction of the wind. This force is called the Coriolis force after the French physicist who described it in 1844. It deflects the wind to the right direction in the northern hemisphere and to the left in the southern hemisphere. The deflection is more when the wind velocity is high. **The Coriolis force is directly proportional to the angle of latitude. It is maximum at the poles and is absent at the equator. Hence statement 2 is not correct.**
- The Coriolis force acts perpendicular to the pressure gradient force. The pressure gradient force is perpendicular to an isobar. The higher the pressure gradient force, the more is the velocity of the wind and the larger is the deflection in the direction of wind. As a result of these two forces operating perpendicular to each other, in the low-pressure areas the wind blows around it. A**t the equator, the Coriolis force is zero and the wind blows perpendicular to the isobars.** The low pressure gets filled instead of getting intensified. That is the reason why tropical cyclones are not formed near the equator. **Hence statement 3 is correct.**

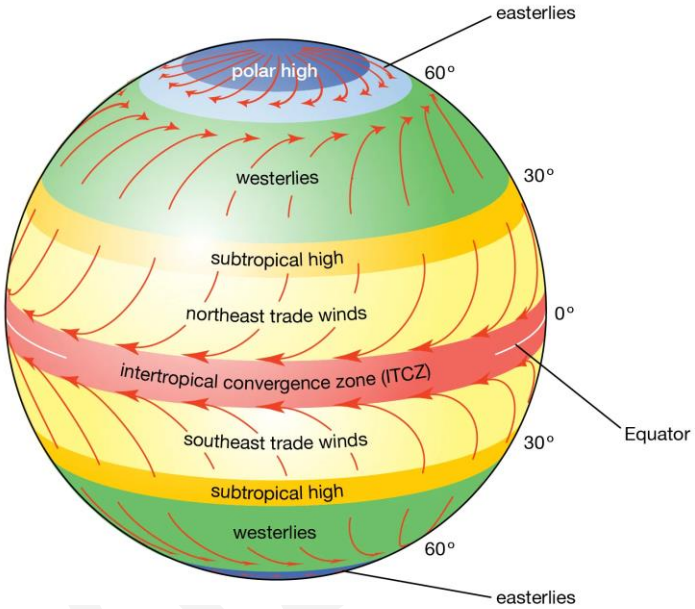
Q 39.B

- The Isotherms are lines joining places having equal temperatures. In general, the effect of the latitude on temperature is well pronounced on the map, **as the isotherms are generally parallel to the latitude. Hence statement 1 is correct.**
- The deviation from this general trend is more pronounced in January than in July, especially in the northern hemisphere. In the northern hemisphere, the land surface area is much larger than in the southern hemisphere. Hence, the effects of land mass and the ocean currents are well-pronounced. In January the isotherms deviate to the north over the ocean and to the south over the continent.

- **During summer, isotherms bend towards the poles over landmasses and towards the equator while crossing oceans. This is because landmasses in the Northern Hemisphere change temperature more quickly than water, causing the isotherms to bend towards the poles. Hence statement 2 is not correct.**
- The effect of the ocean is well pronounced in the southern hemisphere. **In the southern hemisphere, the isotherms are more or less parallel to the latitudes and the variation in temperature is more gradual than in the northern hemisphere. T**he isotherm of 20° C, 10° C, and 0° C runs parallel to 35° S, 45° S and 60° S latitudes respectively. In July the isotherms generally run parallel to the latitude. The equatorial oceans record warmer temperature, more than 27°C. **Hence statement 3 is correct.**

Q 40.B

- The "doldrums" is a popular nautical term that refers to the belt around the Earth near the equator where sailing ships sometimes get stuck on windless waters. The doldrums, also known as the Inter-Tropical Convergence Zone (ITCZ), **is a low-pressure region near the equator that is characterized by little to no wind.**
- The northeast and southeast trade winds meet there; this meeting causes air uplift and often produces clusters of convective thunderstorms. They occur along the Equator in the Indian and western Pacific oceans and slightly north of the Equator off the African and Central American west coasts. The crews of sailing ships dreaded the doldrums because their ships were often becalmed there; the designation for the resultant state of depression was apparently thus extended to these geographic regions themselves. In spite of high temperatures, cyclones are not formed at the equator because of 'zero' coriolis force.

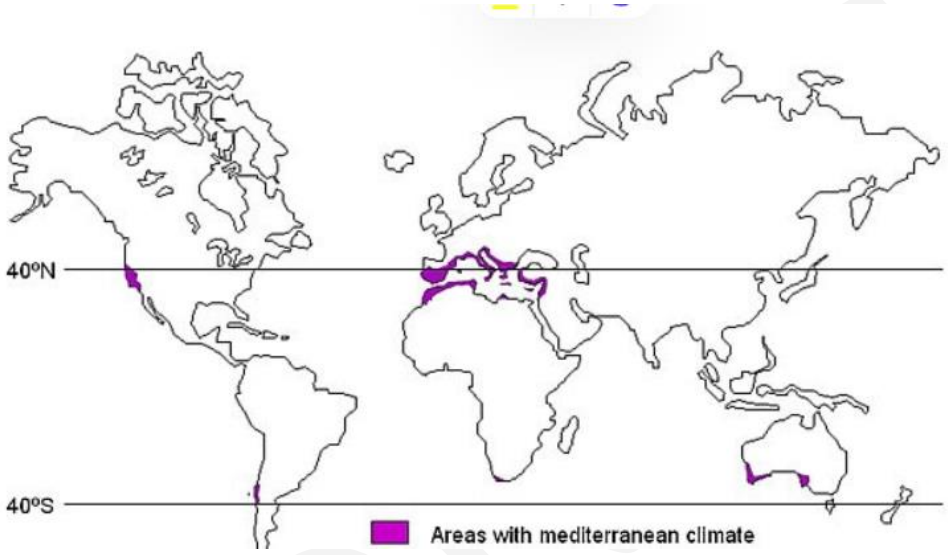


- **Hence option (b) is the correct answer.**

Q 41.C

- Warm Temperate (Mid-Latitude) Climates-C Warm temperate (mid-latitude) climates extend from 30° - 50° of latitude mainly on the eastern and western margins of continents. These climates generally have warm summers with mild winters. They are grouped into four types: (i) Humid subtropical, i.e. dry in winter and hot in summer (Cwa); (ii) Mediterranean (Cs); (iii) Humid subtropical, i.e. no dry season and mild winter (Cfa); (iv) Marine west coast climate (Cfb)
- It is **generally accepted that the mediterranean climate occurs in southern and southwestern Australia, central Chile, coastal California, the Western Cape of South Africa and around the Mediterranean Basin. The largest area with a mediterranean climate is the Mediterranean Basin, which has given the climate its name, although stretches of the Mediterranean coast (in Egypt, Libya and part of Tunisia) are too dry to be thus classified**. More than half of the total mediterranean-climate regions on earth occur on the Mediterranean Sea.

- Mediterranean-climate regions are found, roughly speaking, between 30 and 40 degrees latitude north and south of the equator, on the western side of continents.
- These areas come under the influence of sub-tropical high in summer and westerly wind in winter. Hence, the climate is characterised by hot, dry summer and mild, rainy winter. Monthly average temperature in summer is around 25° C and in winter below 10°C. The annual precipitation ranges between 35 - 90 cm.
- **Natural Vegetation in the Mediterranean Climate**
  - Trees with small broad leaves are widely spaced and never very tall.
  - The absence of shade is a distinct feature of Mediterranean lands.
  - Plants are in a continuous struggle against heat, dry air, excessive evaporation and prolonged droughts. They are, in short xerophytic [drought tolerant], a word used to describe the drought-resistant plants in an environment deficient in moisture.



Hence option (c) is the correct answer.

Q 42.B

- Karst, the terrain is usually characterized by barren, rocky ground, caves, sinkholes, underground rivers, and the absence of surface streams and lakes. It results from the excavating effects of underground water on massive soluble limestone. **The term originally applied to the Karst (or Kras) physiographic region, a limestone area northeast of the Gulf of Trieste in Slovenia, but has been extended to mean all areas with similar features.**
- **Karsts are found in widely scattered sections of the world, including the Causses of France; the Kwangsi area of China; the Yucatán Peninsula; and the Middle West, Kentucky, and Florida in the United States.**
- **Conditions that promote karst development:**
  - **well-jointed,**
  - **dense limestone near the surface;**
  - **moderate to heavy rainfall;**
  - **and good groundwater circulation.**
- **Limestone (calcium carbonate) dissolves relatively easily in slightly acidic water, which occurs widely in nature. Hence option (b) is the correct answer.**
- **Rainwater plays a major role in the formation of karst features because it percolates along both horizontal and vertical cracks, dissolving the limestone and carrying it away in solution.** Limestone pavements are produced by the removal of surface material, and the vertical fissures along joints are gradually widened and deepened, producing a grooved and jagged terrain.
- it flows along cracks underground, the water continues to widen and deepen the cracks until they become cave systems or underground stream channels into which narrow vertical shafts may open. Most, but not all, of the principal cave areas of the world are areas of karsts. **Features such as lapiés, natural bridges, and Pepino hills are characteristic of karsts.**

Q 43.A

- The following countries share their borders with the Mediterranean Sea: Spain, France, Monaco, Italy, Malta, Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Albania, Greece, Turkey, Cyprus, Syria, Lebanon, Israel, Egypt, Libya, **Tunisia**, **Algeria** and **Morocco.**

Q 44.B

- **River Meanders:** River meanders refer to the **bends of longitudinal courses of the rivers**.Each bend of a meander belt has two types of slopes of valley sides.
- 1.One side is characterized by concave slope where the channel strikes the valley sides directly,with the result concave side is subjected to severe erosion resulting into the formation of vertical cliffs.This side of meander belt is also called as **cliff-slope side.**
- 2. The other side of the meander belt is characterized by convex slope which receives deposition mostly of sands and gravels but some times alluvium deposited.This convex side is characterized by gentle slope and is called the side of **slip-off slope.**
- Meandering is most pronounced in the **regions characterized by even surface** and **gentle slope,alluvial deposits and sufficient stream discharge**.**Mature streams are more capable of forming meanders** because they resort to **lateral erosion** and consequently valley widening more than valley deepening.The most ideal conditions required for development of meanders are alluvial plains,gentle slope,sufficient amount of precipitation and general absence of vegetation.**Hence, statement 3 is correct.**
- Meanders are **result of erosion and deposition both**.**Hence, statement 1 is correct.**
- Meanders are divided into two major types on the basis of the nature of fluvial erosion e.g.
  - 1.Meanders developed through **lateral erosion** (normal meanders) and
  - 2.Meanders developed by **vertical erosion** or valley deepening (incised meanders) .**Hence, statement 2 is not correct.**
  - 3.**Misfit or unfit meanders** is also identified as the third type of meanders.
- **Morphologically**,river meanders are divided into 3 types viz. (1) wavy type of meanders, (2) horse-shoe type of meanders and (3) ox-bow or bracelet type of meanders

Q 45.B

Soil Erosion is the process that erodes, breaks or gradually diminishes things down. The process of erosion usually takes place on the surface of soil, rock, or dissolved material from one location on the Earth's crust and with the help of the wind or water flow, it gets to settle down at another location.

- **Stream Bank Erosion**: Bank erosion is nothing but **washing up away from the banks of a stream or a river.** It is different from the erosion of the bed of a watercourse, which is referred to as scouring. This type of erosion is also termed as Stream Bank Erosion.
- **Gully Erosion: Gully erosion occurs due to the runoff of surface water causing the removal of soil with drainage lines.** Gullies when started once, will move by headward erosion or even by slumping of side walls unless and until proper steps will be taken in order to stabilize the disturbance.

- **Rill Erosion: Rill erosion is a form of water erosion** in which the erosion takes place through numerous narrow and more or not so straight channels called streamlets, or head cuts. Rill is the most common form of erosion, which you can also observe during heavy rain.
- **Leaching: It is the loss of soluble substances and colloids from the top layer of soil by percolating precipitation.** The materials lost are carried downward (eluviated) and are generally redeposited (illuviated) in a lower layer. This transport results in a porous and open-top layer and a dense, compact lower layer.
- **Wind erosion** is a common cause of land degradation in arid and semi-arid grazing lands. Significant wind erosion occurs when strong winds blow over light-textured soils that have been heavily grazed during periods of drought. The three processes of wind erosion are a **surface creep, saltation and suspension.** Characteristics of each are outlined below.
    - **Surface creep**—in a wind erosion event, large particles ranging from 0.5 mm to 2 mm in diameter, are rolled across the soil surface. This causes them to collide with, and dislodge other particles. Surface creep wind erosion results in these larger particles moving only a few metres.
    - **Saltation**—occurs among middle-sized soil particles that range from 0.05 mm to 0.5 mm in diameter. Such particles are light enough to be lifted off the surface but are too large to become suspended. These particles move through a series of low bounces over the surface, causing an abrasion on the soil surface and attrition (the breaking of particles into smaller particles).
    - **Suspension**—tiny particles less than 0.1 mm in diameter can be moved into the air by saltation, forming dust storms when taken further upwards by turbulence. These particles include very fine grains of sand, clay particles and organic matter. However, not all dust ejected from the surface is carried in the air indefinitely. Larger dust particles (0.05 to 0.1 mm) may be dropped within a couple of kilometres of the erosion site. Particles of the order of 0.01 mm may travel hundreds of kilometres and 0.001 mm sized particles may travel thousands of kilometres.
- **Scalding occurs when water or wind erosion removes the topsoil layer.** This exposes the sodic or saline soils in the subsoil layers. Raindrop impacts can also result in the soil being moved since the internal layer is exposed to erosion. However, wind and water are the biggest contributors to removing even more soil.
- **Abrasion is a process of erosion by glaciers** that occurs when the material being transported wears away at a surface over time. Abrasion is defined as the erosion that occurs when particles scrape against each other. The enormous weight of the glacier, along with rocks and sediment plucked up and clinging to its belly scratched and carve the rock surface below. It's almost as if the moving glacier is sanding the rocks with abrasive sandpaper. As the glacier sands the rock, it leaves behind long scratches that form in the direction of the glacial movement called glacial striations.

  Hence option (b) is the correct answer

Q 46.C

- **Terrigenous materials:** The continental rocks are disintegrated and decomposed due to various types of weathering and thus fine to coarse sediments are formed.These sediments of continental origin are called terrigenous materials which are brought to the rivers through surface wash,which are brought to the rivers through surface wash,rainwash,rills,gullies and small rivulets.Ultimately terrigenous sediments are brought by the rivers to the oceans and the seas.
- **Terrigenous deposits** are: **Gravels,sand,silt,clay,mud (blue mud,green mud and red mud).Hence, option (c) is the correct answer.**
- Examples of **abiotic deposits: red clay**, meteoric dust.
- Examples of **biotic deposits** are: neretic deposit,pelagic deposit (calcareous oozes,**siliceous oozes**)

Q 47.A

- **Koeppen's Classification of Climatic Regions of India** : It is an empirical classification based on mean annual and mean monthly temperature and precipitation data.
- Koeppen identified a close **relationship between the distribution of vegetation and climate**.He selected certain values of temperature and precipitation and related them to the distribution of vegetation and used these values for classifying the climates.Koeppen recognized f**ive major climatic groups, four of them are based on temperature and one on precipitation.**

- The capital letters: **A, C, D and E delineate humid climates and B dry climates.**
- The climatic groups are subdivided into types, designated by small letters, based on seasonality of precipitation and temperature characteristics. The seasons of dryness are indicated by the small letters : f, m, w and s, where
  - **f** – no dry season,
  - **m** – monsoon climate,
  - **w** – winter dry season and
  - **s** – summer dry season.
- The above mentioned major climatic types are further subdivided depending upon the seasonal distribution of rainfall or degree of dryness or cold.
  - a: hot summer, average temperature of the warmest month over 22°C
  - c: cool summer, average temperature of the warmest month under 22°C
  - f: no dry season
  - w: dry season in winter
  - s: dry season in summer
  - g: Ganges type of annual march of temperature; hottest month comes before the solstice and the summer rainy season.
  - h: average annual temperature under 18°C
  - m (monsoon): short dry season.
- The capital letters S and W are employed to designate the two subdivisions of dry climate: **semi-arid or Steppe (S) and arid or desert (W).**
- Capital letters T and F are similarly used to designate the two subdivisions of polar climate : **tundra (T) and icecap (F).**
- **Note:** As per Koppen's classification of climate,humid sub-tropical climate with dry winter **(Cwg)** is the most suitable description of **North-East India,including Bengal,Ganga plain**.**Hence option (a) is the correct answer.**

Q 48.C

- Tropical thorn forests **occur in the areas which receive rainfall less than 50 cm. These consist of a variety of grasses and shrubs. It includes semi-arid areas of south west Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh and Uttar Pradesh. In these forests, plants remain leafless for most part of the year and give an expression of scrub vegetation. Important species found are babool, ber, and wild date palm, khair, neem, khejri, palas, etc**. Tussocky grass grows upto a height of 2 m as the under growth. **Hence option (c) is the correct answer.**
- The Moist deciduous forests are more pronounced in the regions which record rainfall between 100-200 cm. These forests are found in the northeastern states along the foothills of Himalayas, eastern slopes of the Western Ghats and Odisha. Teak, sal, shisham, hurra, mahua, amla, semul, kusum, and sandalwood etc. are the main species of these forests.
- Dry deciduous forest covers vast areas of the country, where rainfall ranges between 70 -100 cm. On the wetter margins, it has a transition to the moist deciduous, while on the drier margins to thorn forests. These forests are found in rainier areas of the Peninsula and the plains of Uttar Pradesh and Bihar. In the higher rainfall regions of the Peninsular plateau and the northern Indian plain, these forests have a parkland landscape with open stretches in which teak and other trees interspersed with patches of grass are common. As the dry season begins, the trees shed their leaves completely and the forest appears like a vast grassland with naked trees all around. Tendu, palas, amaltas, bel, khair, axlewood, etc. are the common trees of these forests. In the western and southern part of Rajasthan, vegetation cover is very scanty due to low rainfall and overgrazing.
- Montane Forests In mountainous areas, the decrease in temperature with increasing altitude leads to a corresponding change in natural vegetation. Mountain forests can be classified into two types, the northern mountain forests and the southern mountain forests.

Q 49.C

- Different places on the earth's surface receive different amounts of rainfall in a year and that too in different seasons. **In general, as we proceed from the equator towards the poles, rainfall goes on decreasing steadily.** The coastal areas of the world receive greater amounts of rainfall than the interior of the continents. H**ence statement 1 is correct.**
- The rainfall is more over the oceans than on the landmasses of the world because of being great sources of water. **Between the latitudes 35° and 40° N and S of the equator, the rain is heavier on the eastern coasts and goes on decreasing towards the west.** But, between 450 and 650 N and S of equator, due to the westerlies, the rainfall is first received on the western margins of the continents and it goes on decreasing towards the east. **Hence statement 2 is not correct.**
- Wherever mountains run parallel to the coast, the rain is greater on the coastal plain, on the windward side and it decreases towards the leeward side. Seasonal distribution of rainfall provides an important aspect to judge its effectiveness. **In some regions rainfall is distributed evenly throughout the year such as in the equatorial belt and in the western parts of cool temperate regions. Hence statement 3 is correct.**
- On the basis of the total amount of annual precipitation, major precipitation regimes of the world are identified as follows.
    - The equatorial belt, the windward slopes of the mountains along the western coasts in the cool temperate zone and the coastal areas of the monsoon land receive heavy rainfall of over 200 cm per annum.
    - Interior continental areas receive moderate rainfall varying from 100 - 200 cm per annum. The coastal areas of the continents receive moderate amount of rainfall.
    - The central parts of the tropical land and the eastern and interior parts of the temperate lands receive rainfall varying between 50 - 100 cm per annum.
    - Areas lying in the rain shadow zone of the interior of the continents and high latitudes receive very low rainfall-less than 50 cm per annum.

Q 50.C

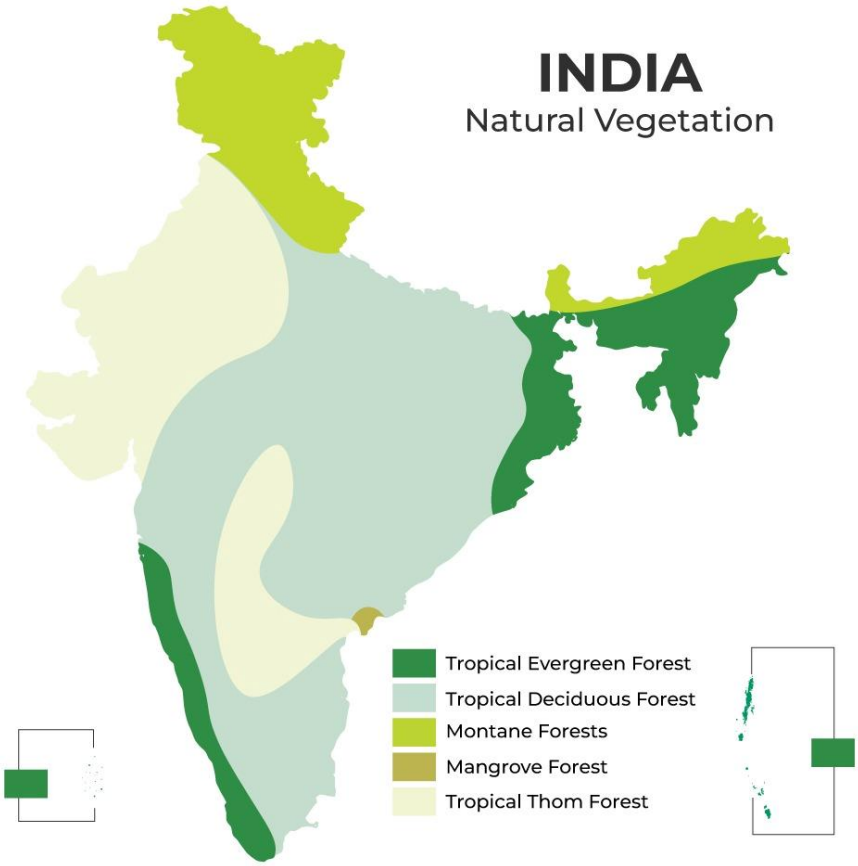
- **The earth's surface receives most of its energy in short wavelengths.** The energy received by the earth is known as incoming solar radiation which in short is termed as insolation. As the earth is a geoid resembling a sphere, the sun's rays fall obliquely at the top of the atmosphere and the earth intercepts a very small portion of the sun's energy. On average, the earth receives 1.94 calories per sq. cm per minute at the top of its atmosphere. **Hence statement a is not correct.**
- **Generally, at the same latitude, the insolation is higher over the continent than over the oceans. In winter, the middle and higher latitudes receive less radiation than in summer. Hence statement b is not correct.**
- The insolation received at the surface varies from about 320 watts/m2 in the tropics to about 70 watts/m2 in the poles. Maximum insolation is received over the subtropical deserts, where the cloudiness is the least. **The Equator receives comparatively less insolation than the tropics. Hence statement c is correct.**
- The solar output received at the top of the atmosphere varies slightly in a year due to the variations in the distance between the earth and the sun. During its revolution around the sun, the earth is farthest from the sun (152 million km) on 4th July. This position of the earth is called aphelion. On 3rd January, the earth is the nearest to the sun (147 million km). **This position is called perihelion. Therefore, the annual insolation received by the earth on 3rd January is slightly more than the amount received on 4th July. Hence statement d is not correct.**

  Hence option (c) is the correct answer.

Q 51.D

- Tropical thorn forests occur in areas which receive rainfall less than 50 cm. These forests are commonly found in the semi-arid and arid regions of India.
- These consist of a variety of grasses and shrubs. In these forests, plants remain leafless for most part of the year and give an expression of scrub vegetation. Important species found are babool, ber, wild date palm, khair, neem, khejri, palas, etc.

- **Parts of Madhya Pradesh**, particularly in its western and northwestern regions have dry conditions suitable for tropical Thron Forest. The Malwa plateau and the areas near Gwalior and Chambal experience relatively low rainfall and our home to thorny vegetation.
- **Haryana, especially in the regions bordering Rajasthan**, experiences dry conditions. Areas near Hisar, Bhiwani, and Mahendragarh are semi-arid and support Tropical Thorn Forest.
- I**n Uttar Pradesh, the Bundelkhand region** and areas adjoining Rajasthan such as Agra and Mathura experience arid and semi-arid conditions
- **The dry regions of Maharashtra, especially in the Vidarbha region and parts of the Deccan Plateau**, experience low rainfall and house Tropical Thorn Forest.
- **In Karnataka, the Northern dry zone, particularly the areas around Bijapur,** Raichur, and Gulbarga, are part of the semi-arid Deccan Plateau and receive limited rainfall. **Hence option (d) is the correct answer.**



Q 52.B

- **Sea water naturally tends to move from a region of high pressure (or high sea level) to a region of low pressure (or low sea level)**. The force pushing the water towards the low pressure region is called the **Pressure gradient force.**
- The rotation of the earth results in a "force" being felt by the water moving from the high to the low, known as **Coriolis force**. **The Coriolis force acts at right angles to the flow, and when it balances the pressure gradient force**, the resulting flow is known as geostrophic. Hence a geostrophic current is an oceanic current in which the pressure gradient force is balanced by the Coriolis effect. **Hence statement 1 is not correct.**
- In a geostrophic flow, instead of water moving from a region of high pressure (or high sea level) to a region of low pressure (or low sea level), **it moves along the lines of equal pressure (isobars). Hence statement 2 is correct.**
- The direction of flow is with the **high pressure to the right of the flow in the Northern Hemisphere,** and the **high pressure to the left in the Southern Hemisphere.** The direction of the flow depends on the hemisphere, because the direction of the Coriolis force is opposite in the different hemispheres.

Q 53.A

- A Landlocked country is an independent sovereign state that does not have direct access to an ocean, such as the Atlantic, or to a sea that is not landlocked, such as the Mediterranean. Countries such as Kazakhstan, in Central Asia, that only have access to a landlocked sea such as the Caspian are considered landlocked.
- There are currently 44 landlocked countries. The largest by area is Kazakhstan, in Central Asia, while the smallest is the Vatican, in Europe.
- **Two countries—Liechtenstein and Uzbekistan—are double-landlocked, making them the only ones to be exclusively surrounded by other landlocked countries.**
- Afghanistan is a landlocked country between the central Asian countries, Iran and the Indian subcontinent. It has to depend on other countries to have decent trade. The Chabahar port built by India and Iran is supposed to improve the landlocked country's trade by bypassing Pakistan.

- **Iran opens up to the Persian Gulf and the Gulf of Oman connected to the Indian Ocean. Hence, it is not a landlocked country. But Armenia and Azerbaijan, the two countries recently engaged in conflict are landlocked countries around the Caspian Sea.** While Armenia is surrounded by Turkey, Georgia, Azerbaijan and Iran, Azerbaijan has the Caspian sea to its east and is surrounded by Armenia, Iran, Georgia and Russia. **Hence, option (a) is the correct answer.**

Q 54.D

- Understanding why the sea is salty begins with knowing how water cycles among the ocean's **physical states: liquid, vapor, and ice.**
  - As a liquid, water dissolves rocks and sediments and reacts with emissions from volcanoes and hydrothermal vents. This creates a complex solution of mineral salts in our ocean basins.
  - **Conversely, in other states such as vapor and ice**, **water and salt are incompatible i.e water vapor and ice are essentially salt free**. In other words, when ocean water turns into ice, the salt is left behind. This leads to increase in salinity of oceans as existing volume of water decreases and salt content increases. **Evaporation of ocean water and formation of sea ice both increase the salinity of the ocean. Hence statement 2 is not correct**.
  - By tracking ocean surface salinity we can directly monitor variations in the water cycle: land runoff, sea ice freezing and melting, and evaporation and precipitation over the oceans.
- The salinity patterns of the surface waters are influenced largely **by wind, by precipitation and evaporation patterns**.
  - The waters within the belt of calm and variable winds **near the Equator have lower salinities** than those in the trade-wind belts.
  - In the equatorial belt, **relatively large amounts of rain fall and little evaporation occurs,** both because of low wind speeds and because of the **generally cloudy skies;** salinity in the equatorial belt runs as low as 34 parts per thousand. **Hence statement 1 is not correct.**
- **FACTORS INFLUENCING SALINITY**
  - **Evaporation:** A very sunny weather can make the evaporation process faster, which increases salinity.
  - **The ocean currents:** They helps in the mixing of the water of the ocean.
  - **The wind** also influences salinity of an area by moving water to other areas.
  - **Temperature**:High temperature around the water will make the space between the water molecules to be further apart. Thus, warm ocean water tends to become less dense. Dense water contains higher salinity as it has more salt in its components.
  - **Rain:** Rain can decrease the level of salinity in the ocean because it adds fresh water to oceans.
  - **Proximity to Land**:The part of the ocean water that is closest to lands may have higher salinity because salt continuously adds from land through river flow.
  - **Freezing and Melting of ice influence the salinity**.

Q 55.B

- **The Cool Temperate Eastern Margin (Laurentian) Climate is an intermediate type of climate between the British and the Siberian type of climate. It has features of both the maritime and the continental climates.**
- Laurentian type of climate is found only in two regions. One is north-eastern North America, including eastern Canada, north-east U.S.A., (i.e. Maritime Provinces and the New England states), and Newfoundland. This may be referred to as the North American region.
  - The other region is the eastern coastlands of Asia, including eastern Siberia. North China. Manchuria. Korea and northern Japan. It may be referred to as the Asiatic region.
- **In the southern hemisphere, this climatic type is absent because only a small section of the southern continents extends south of the latitude of 40°S.**
- **The Laurentian type of climate has cold, dry winters and warm, wet summers. Winter temperatures may be well below freezing-point and snow falls to quite a depth.**
- Summers are as warm as the tropics (70° - 80°F.) and if it were not for the cooling effects of the off-shore cold currents from the Arctic, the summer might be even hotter.
- **Though rain falls throughout the year, there is a distinct summer maximum from the easterly winds from the oceans.** Of the annual precipitation of 30 to 60 inches, twothirds come in the summer. Winter is dry and cold, because the winds are dry Westerlies that blow out from the continental interiors.
- **Hence option (b) is the correct answer.**

Q 56.C

- **The Nagi and Nakti bird sanctuaries are located in Bihar** and were recently recognized as Ramsar sites under the Ramsar Convention of 1971. **Hence option (c) is the correct answer.**
- Due to their importance for migratory bird species, these sites were recognized as a bird sanctuary in 1984 and internationally as an Important Bird and Biodiversity Area (IBA) by Birdlife International.
- The catchment area of these sites is surrounded by the hills. But it is mainly of deciduous forest rather than rainforest.
- Both sanctuaries are man-made reservoirs (Nagi Dam and Nakti Dam).
- **Ramsar Convention**
  - **An intergovernmental treaty for the conservation and wise use of wetlands and their resources.**
  - **Adopted at Ramsar (Irani) in 1971 and came into force in 1975.**
  - **India became a party in 1982 (Maximum Ramsar sites are in Tamil Nadu followed by Uttar Pradesh).**
  - **'List of wetlands of international importance' or the Ramsar List contains wetlands which hold significant value for humanity as a whole.**

Q 57.A

- Reh and Kollar referred to saline or alkaline fluorescence (deposit of salts) in dry and arid regions, particularly in areas like Haryana, Uttar Pradesh, and Rajasthan. It forms due to the evaporation of saline water in the soil leading to infertile land. **Hence pair 1 is not correctly matched.**
- Karewas are indeed thick lacustrine deposits found in Kashmir Valley. They are composed of glacial clay, silt, and other materials. They were deposited in the ancient lake during the Pleistocene Epoch and are associated with moraines, which are glacial landforms created by the accumulation of debris. **Hence pair 2 is correctly matched.**
- Bhur refers to sandy rich or elevated land along the Ganga-Yamuna Doab, particularly in Uttar Pradesh. These are created by wind-blown sand and are not saline in nature. **Hence pair 3 is not correctly matched.**

Q 58.A

- The Ghaghara (also known as the Karnali in Nepal) originates from the Mapchachungo glacier in the Tibetan plateau, near Lake Mansarovar. Its important tributaries include Sarju, Rapti, Seti, Sarda, Bheri, Dahawar, Kuwana, etc. **Hence pair 1 correctly matched.**
- The Krishna River originates from north of Mahabaleshwar in the Satara district of Maharashtra. It does not originate from Trimbakeshwar, which is the origin of the Godavari River. The important tributaries of the Krishna Rivers are Ghatparbha, Malprabha, Tungabhadra, Sina, Koyna, Bima, Musi, etc. **Hence pair 2 is not correctly matched.**
- The Mahanadi River originates from dandakaranya in Chhattisgarh. The tributaries of Mahanadi include Seonath, Ib, Tel, Jonk, Mand, Hasdeo, etc. Hirakund dam and Talchir thermal power plant are located on the Mahanadi River. **Hence pair 3 is not correctly matched.**
- However, **Konar, Barakar, and Nunia** are tributaries of the Damodar River in Eastern India, not the Mahanadi.

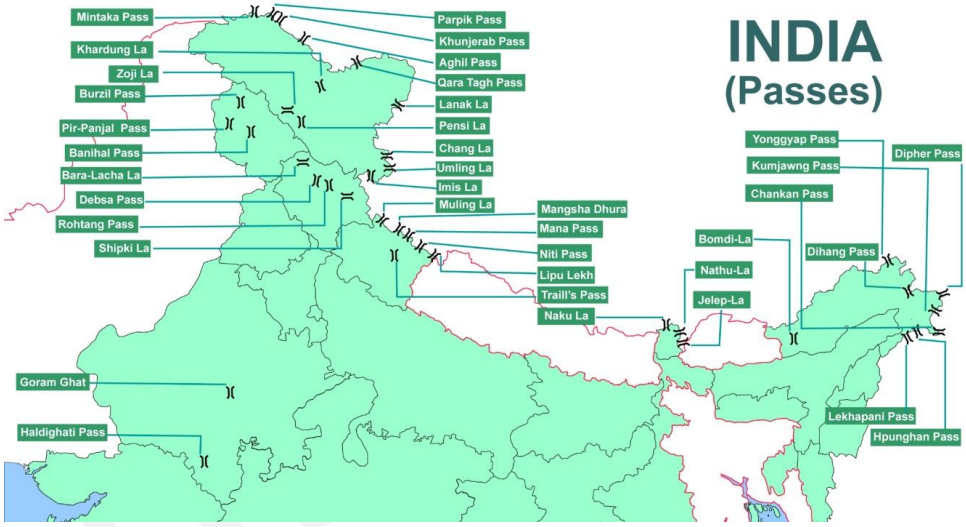
Q 59.B

- Alluvial soil is one of the most fertile types of soil found in river valleys, especially in the Indo-Gangetic plain. **However, it is typically young and immature in nature because it is constantly replenished by rivers through deposition. Hence statement 1 is not correct.**
- Alluvial soil often lacks well-developed soil profiles (horizon) due to continuous deposition of new material. A well-developed soil profile indicates maturity, but alluvial soil is typically transported soils that like the young immature soils with poor profile.
- Red soils are typically derived from the weathering of ancient crystalline and metamorphic rocks such as gneisses, granites, and quartzite. These rocks form the parent material for red soils, especially in regions with a hot climate. The red color comes from the high iron content in these rocks, which oxidized in the soil to give it a reddish color. **Hence statement 2 is correct.**

- Red soil is poor in lime, magnesia, phosphate, nitrogen, and humus but rich in potash and potassium. It is mostly loamy which has a low water retentive capacity compared to black soil.Laterite soil is formed under conditions of intense leaching in areas with high rainfall and temperatures. During this process soluble minerals like lime (calcium carbonate) and silica are leached out of the soil, leaving behind **iron and aluminum oxides. Hence statement 3 is not correct.**
- Laterite soil provides valuable building material as it results in hardened rock after losing moisture and it is the end product of weathering.

Q 60.B

- A pass is a gap or break in a mountain range or ridge that allows for passage through the area. Passes are formed when glaciers or streams erode the land between higher areas of terrain.
- Bom Di La is located in Arunachal Pradesh it is situated near the India-China border and is known for its scenic views and strategic importance. Other important passes in Arunachal Pradesh are the Dihang pass, Yong Yap Pass, Diphar Pass, etc. **Hence pair 1 is correctly matched.**
- Jalep La is located in Sikkim. It serves as a pass connecting Sikkim with Tibet, China. It is situated at an altitude of about 4200 meters and is an important trade route. Nathu la is another important pass of Sikkim. **Hence pair 2 is correctly matched.**
- Mana Pass is not located in Himachal Pradesh, it is located in Uttarakhand. Mana Pass was an ancient trade route between Uttarakhand and Tibet. The Portuguese Jesuits Antonio de Andrade and Manuel Marques became the first known Europeans to enter Tibet across Mana Pass in 1624. Other important passes of Uttrakhand are Lipu Lekh, Niti Pass, Muling La, etc. **Hence pair 3 is not correctly matched.**
- Shipki La connects India with Tibet and is located in the Kinnaur district of Himachal Pradesh. The Sutlej River enters India from Tibet near this pass. Other important passes of Himachal Pradesh are Baralacha La, Rohtang Pass, etc. **Hence pair 4 is not correctly matched.**



Q 61.C

- Pench National Park is spread across both Madhya Pradesh and Maharashtra, with the majority of the park lying in Madhya Pradesh. The Pench River flows through the park, playing a crucial role in sustaining the biodiversity of the area.
- **Pench National Park is located on the Southern slope of the Satpura hills. Hence statement 1 is correct.**
- The doob grass (Cynodon daxctylon) grows during the late winter and early summer months, which provides highly nutritious forage to the herbivores. **Pench tiger reserve has the highest density of herbivores (90.3 animals per sq km)** and the second-highest prey base in India. **Hence statement 2 is correct.**
- The forests in Pench Tiger Reserve are classified into three types:
  - South Indian Tropical Moist Deciduous (slightly moist)
  - Southern Tropical Dry Deciduous Teak Forests and
  - Southern Dry Mixed Deciduous Forest

- **So, the area is dominated by a fairly open canopy mixed deciduous forest with considerable shrub covers and open grassy patches. Hence statement 3 is correct.**

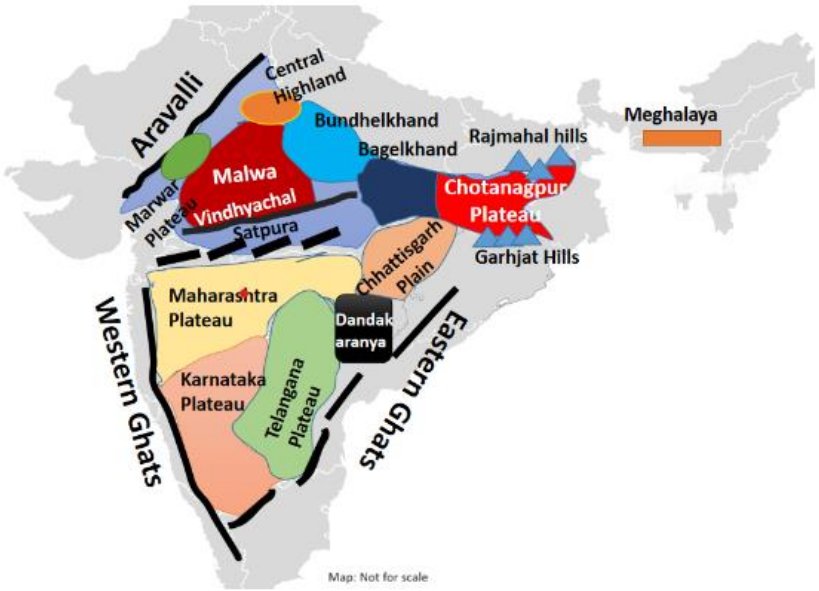
- **Pench National Park is believed to be the inspiration for Rudyard Kipling's "The Jungle Book", which was based on the region's flora and fauna.**

Q 62.C

- **Duns are longitudinal valleys located between the lesser Himalayas and Shivalik.**
- The Shivalik range was uplifted as a result of the collision between the Indian Plate and The Eurasian Plate. As the Shivalik range rises, the land between the Shivalik and the lesser Himalayas becomes compressed. **This compression creates longitudinal fault and due to tectonic activity depression or valley begins to form between these two ranges. These valleys are the beginning of the dunes.**
- **Several rivers such as Yamuna, Ganga and their tributaries flow down from the higher Himalayan range and enter the dun valley. These rivers actively erode the valley floor and walls, carrying away sediments and widening the valley over time.**
- In addition to eroding the valley, the rivers deposit alluvium (fine sediments like silt, clay, and sand) in the duns, creating fertile plains. The deposition process is intensified during the monsoon season when rivers swell and carry large amounts of sediment downstream.
- Over time, with the combined effect of the tectonic activity and river erosion, these valleys become broader and flatter, forming the characteristic flat-bottomed duns. The valleys become ideal locations for human habitation due to their fertile soil and relatively mild topography compared to the rugged Himalayan terrain surrounding them. **Hence option (c) is the correct answer.**

Q 63.A

- The Chotanagpur region is a plateau in eastern India, covering the states of Jharkhand, Orissa, West Bengal, Bihar, and Chhattisgarh.
- The Chottanagpur plateau is one of the oldest landmasses on the earth. **It is composed of Precambrian rocks that are more than 540 million years old. Hence statement 1 is correct.**
- **Geohistorically, it was part of the Deccan Plate**, which broke free from the southern continent during the Cretaceous period to embark upon a 50-million-year journey that was violently interrupted by the northern Eurasian continent. **Hence statement 2 is correct.**
- **To the north of Chottanagpur lie the Rajmahal Hills,** which are very important on account of their fossiliferous deposits (containing knowledge about the richness of floristic diversity, phylogeny, and plant evolution). **Hence statement 3 is not correct.**
- The plateau in its entirety lies between the basins of the Ganges and the Son Rivers to the north, and the Mahanadi River to the south.
- Ecologically, the Chotanagpur region lies between the moist deciduous forests of the Eastern Ghats and the Satpura Range and the lower reaches of the Gangetic Plains in eastern India.



Q 64.B

- Kayals are shallow lagoons or inlets of sea that are parallel to the coastline. **They are a unique feature of the Malabar coast rather than that of the Konkan coast and are commonly found in the state of Kerala. Hence statement 1 is not correct.**
- Kayals are formed by waves and shore currents that create low barrier islands across the mouth of rivers that flow from the Western Ghat range. They are the zone where freshwater meets seawater which results in a diverse range of flora and fauna. They are used for fishing, inland navigation, and also due to their special attraction for tourists
- Every year the famous Nehru Trophy Vallamkali (boat race) is held in Punnamada Kayal in Kerala. **Hence statement 2 is correct.**
- In 2013 the Food and Agriculture Organisation (FAO) of the United Nations formally declared the below-sea-level farming system in Kuttanad as a Globally Important Agricultural Heritage System (GIAHS). **Hence statement 3 is correct.**
- The Globally Important Agricultural Heritage Systems (GIAHS) are agroecosystems inhabited by communities that live in an intricate relationship with their territory. These evolving sites are resilient systems characterized by remarkable agrobiodiversity, traditional knowledge, invaluable cultures and landscapes, sustainably managed by farmers, herders, fisherfolk, and forest people in ways that contribute to their livelihoods and food security
- **Other GIAS in India:**
  - **(Kashmir-Saffron): Jammu and Kashmir**
  - **Odisha: Koraput, mixed farming.**

Q 65.C

- **Soil conservatio**n refers to a set of practices and strategies aimed at protecting soil from erosion, degradation, and loss of fertility. It involves managing soil in a sustainable way to maintain its health, productivity, and ecological balance, ensuring that it can continue to support agriculture, forestry, and natural vegetation.
- **IPM (Integrated Pest Management)** emphasizes the use of a variety of techniques (including soil solarization, crop rotation, use of organic agents, etc) to manage pest populations in a sustainable and environmentally friendly way, thus reducing the negative impact on ecosystems, including soil health.
- **Monocropping** (also known as monoculture) refers to the agricultural practice of growing the same crop on the same piece of land year after year, without rotating with other crops. When the same crop is grown repeatedly, it continuously draws the same nutrients from the soil. This leads to nutrient depletion, as the soil does not get replenished naturally. Over time, the soil becomes infertile.
- **Terrace farming** is an agricultural practice that involves creating flat areas (terraces) on steep or hilly terrain to cultivate crops. By flattening the land into steps, terrace farming decreases the velocity of water runoff. This significantly reduces the erosion of topsoil, which is essential for maintaining soil fertility.
- **Strip cropping** is an agricultural practice that involves planting crops in alternating strips or bands, usually consisting of different types of crops. The presence of different crops helps maintain continuous soil cover throughout the growing season, reducing the risk of erosion from wind and water.
- **Tilling** is an agricultural practice that involves turning and loosening the soil to prepare it for planting crops. **Tilling can lead to increased soil erosion by wind and water, especially on sloped land.** The removal of protective crop residues and the loosening of soil structure make the topsoil more vulnerable to erosion.
- **Hence option (c) is the correct answer.**

Q 66.B

- Polymetallic nodules, also known as manganese nodules, are rock concretions found on the deep-sea floor. They contain economically valuable concentrations of manganese, nickel, copper, cobalt, iron, silicon, aluminium, etc
- Papua New Guinea is one of the few places where nodules are located in shallow water otherwise mostly, they are located in deep-sea. **Hence statement 1 is not correct.**
- The chemical and mineralogical composition of polymetallic nodules are primarily controlled by their formation process.

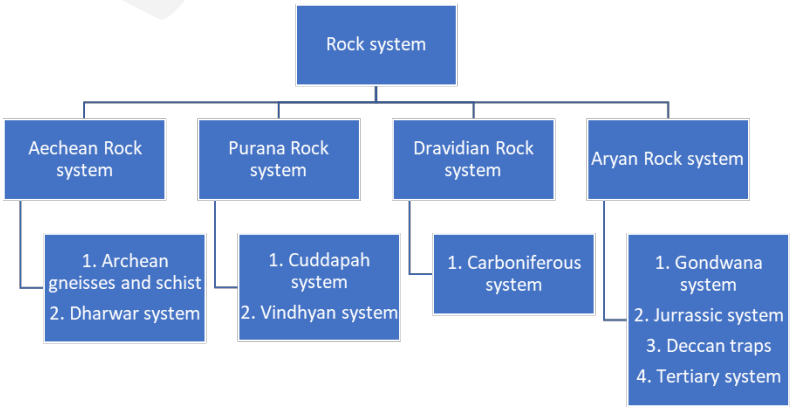
- They are formed from the **hot springs associated with volcanic activity and metal Hydroxide through the activity of microorganisms. Hence statement 2 is correct.**
- A unique characteristic of deep-ocean nodules compared to terrestrial deposits is the presence of multiple commodities in one deposit.
- They are most commonly found in:
  - the Clarion-Clipperton zone in the Pacific Ocean
  - The Peru basin in the Pacific Ocean
  - The central Indian Ocean basin
- Polymetallic nodules are considered a potential source of metals that are critical for various Industries, including the production of batteries, and electronic and renewable energy technologies.

Q 67.B

- The hydrological cycle is the circulation of water within the Earth's Hydrosphere in different forms. The distribution of water on Earth is quite uneven about 71% of the planetary water is found in the ocean, among which the Pacific Ocean comprises 35.4%, the Atlantic Ocean comprises 18.4%, the Indian Ocean 14.5%, the Arctic Ocean 3% and the land surface for about 29%.
- The Northern hemisphere is called the continental hemisphere as it contains about 40% of continents and 60% ocean. Whereas, the southern hemisphere is called the oceanic hemisphere as oceans cover about 81% of the total surface.
- Nearly 59% of the water that falls on the land returns to the atmosphere through evaporation from over the ocean as well as other places. The remainder run-offs on the surface, infiltrate to the ground or a part of it becomes glaciers.
- The distribution of water on the Earth's surface is (Reservoir % of total):
  - Ocean 97.25
  - Ice caps and glaciers 2.05
  - Groundwater 0.68
  - Lakes 0.01
  - Soil moisture 0.005
  - Atmosphere 0.001
  - Streams and rivers 0.0001
  - Biosphere 0.00004
- Thus, in terms of the percentage of water the increasing order is streams and rivers, atmosphere, groundwater, and ice caps and glaciers.
- **Hence option (b) is the correct answer.**

Q 68.D

- India has a complex and diverse geological structure that can be classified into different rock systems based on their age, formation, and characteristics. These rock systems range from some of the oldest rock on Earth to relatively young formations.



- The Archean gneisses and schist are the oldest rocks and form the base for new layers. They are crystalline and volcanic in origin. They are azoic and unfossiliferous. **Hence statement 3 is not correct.**
- The Vindhya rock system comprises ancient sedimentary rock superimposed on the Archean base. This belt is covered by the Deccan traps. They are devoid of metalliferous minerals but provide large quantities of durable stone limestone, glassmaking sand, shale, slate, etc. **Hence statement 1 is correct.**
- **Dravidian Rock systems are sedimentary rocks and are abundant in fossils.** Dravidian Rock system exists in extra peninsular region or a continuous sequence of the Himalayas instead of existing in the peninsular region. **Hence statement 2 is not correct.**
- Tertiary rocks are formed from the Eocene to Pliocene period. They are associated with the birth of the Himalayas. T**he Bhangar and Khadar region of the Great Indian Northern Plain contains significant Tertiary rocks. Hence statement 4 is correct.**

Q 69.C

- Kallanai Dam (also known as Grand Anicut) is one of the oldest water-regulator structures in the world and the oldest in India that is still in use today. It is located on the Cauvery River in the Thanjavur district of Tamil Nadu. The dam was built around 150CE by the Chola King Karikala Chola and has played a crucial role in irrigation and water management in the region for nearly two millennia.
- The dam is about 329 meters long and 20 meters wide and it has a height of 5.4 metres. The dam provides water for irrigating over 1 million acres of farmland, particularly in the fertile Cauvery Delta region.
- Kallanai Dam is a popular tourist spot due to its historical significance and its scenic location on the bank of the Cauvery River its stands as a symbol of ancient Indian Engineering and the Chola dynasty's contribution to agriculture and water management.
- Somasila Dam located on the Pennar River in Andhra Pradesh, was built in modern time.
- Idukki Dam is a hydroelectric dam in Kerala across the Periyar River and was built in the 20th century.
- **Mettur Dam was built on the Cauvery River in the early 20th century (1934) and is there for not ancient or related to the Chola dynasty.**
- **Hence option (c) is the correct answer.**

Q 70.D

- The Luni River originates from the Aravali Range, especially near Pushkar in the Ajmer district of Rajasthan.
- While it is true that the river becomes saline as it flows through the arid region of Rajasthan, the salinity is not due to limestone at its origin. Instead, the river flows through a desert region with high salinity in the soil and an arid environment, which contributes to the increasing salt content in the water.
- As the river flows through the Thar Desert, the evaporation rate is high due to extreme heat, leading to more concentration of salt in the river water making it saline. **So, the salinity is a result of the geography and climate of the region rather than the presence of limestone at the origin. Hence statement 1 is not correct.**
- **The Luni River does not flow into the Gulf of Khambhat.** Instead, it disappears into the Rann of Kutch, a salt marsh in Gujarat. The river does not reach the sea and does not form an estuary, saline or otherwise. **Hence statement 2 is not correct.**
- The Rann of Kutch itself is a saline area, and the Luni's water contributes to the overall salinity of the Marshland, but this is not an estuary. An estuary is a coastal area where fresh and saltwater mix, typically formed where a river meets the sea, which is not the case with the Luni River.

Q 71.C

- The process of soil formation is known as Pedogenesis. It includes a variety of processes like translocation, leaching, eluviation, calcification, etc.
- **Eluviation refers to the removal of soil materials like clay, iron, or organic matter from the upper layer or horizons of the soil to the lower layer due to the downward movement of water. So, eluviation involves leaching or the removal of materials, not accumulation. Hence statement 1 is not correct.**

- Whereas, illuviation involves the process of accumulations of material that have been washed down from the upper layer to the lower horizon of the soil through the process of eluviation.
- **Calcification** is a process where calcium carbonate accumulates in the soil. **This process is more common in warm and dry regions, where evaporation exceeds precipitation, leading to an upward moment of water and the deposition of calcium salts. Hence statement 2 is not correct.**
- In cool and humid regions, bacterial activity is lower, but calcification is not a dominant process there, instead, podzolization is more common in the humid climate.
- Alkalization occurs when sodium salt accumulates in the soil, leading to an increase in soil alkalinity. **In areas with high evaporation, salts from the groundwater are drawn to the surface and left behind as a whitish efflorescence.** This process typically occurs in arid and semi-arid regions with poor drainage. **Hence statement 3 is correct.**
- Gleying occurs in waterlogged soils where oxygen is limited. In such conditions, the iron compounds in the soil undergo reduction (instead of oxidation), leading to the formation of bluish-grey or greenish-grey soil colors.

Q 72.C

- The periodical rise and fall of the sea level mainly due to the attraction of the sun and moon is known as tide
- The moon exerts a gravitational pull on the earth and its effect is strong on the side of the Earth facing the moon. This gravitational attraction causes the water in the oceans to be pulled toward the moon forming a tidal bulge. This is known as the direct tidal bulge, which is the bulge of water closest to the moon.
- At the same time, there is a second tidal bulge on the opposite side of the Earth away from the Moon. This occurs due to the inertial force, often described as a centrifugal force, resulting from the Earth-moon system's rotation around their common center of mass.
- The Earth and the Moon do not rotate around the Earth's Centre, but rather around a point called the barycentre, which is located about 4600 km from the center of the Earth inside the Earth's mantle. This rotation creates a slight outward or centrifugal force across the entire Earth
- The centrifugal force is the same everywhere on Earth because the Earth and moon move as a system. However, on the side of the Earth opposite the moon, this outward force is stronger than the moon's gravitational pull, because the moon is further away on this side. As a result, the water on the far side of the Earth is pulled outward, forming the second bulge.
- **Hence the option (c) is the correct answer.**

Q 73.B

- Ocean temperature is a measure of energy due to the motion of molecules in the ocean.
- Factors that influence the oceanic temperature include insolation, prevailing winds, ocean currents, unequal distribution of land and sea, salinity, etc.
- The enclosed seas in high latitudes have weaker ocean currents and reduced mixing with the warmer waters of the open ocean resulting in stagnant conditions that maintain cold temperatures. **Thus, in high latitudes enclosed seas record lower temperatures than the open seas. Hence statement 1 is not correct.**
- Water has a higher heat capacity than land, meaning it can store and distribute heat more effectively. In the southern hemisphere, the vast expense of the ocean absorbs and retains more heat from the sun. This leads to a more uniform distribution of heat across the hemisphere and contributes to higher average ocean temperature.
- I**n the Northern hemisphere, the larger land masses heat up and cool down more quickly than the oceans, causing great temperature variability and lower average ocean temperatures.**
- The equatorial regions receive maximum solar radiation due to the high angle of the sun throughout the year. This intense insolation heats the surface waters to much higher temperatures than those at the greater depth creating a strong temperature gradient. **This results in the rate of decrease of temperature with depth in the ocean being greater at the equator compared to the poles. Hence statement 2 is correct.**

Q 74.A

- Oceanic currents are the general movement of a mass of water in a fairly defined direction over a great distance. There are multiple factors that influence the movement and direction of ocean currents. These factors include atmospheric circulation, Coriolis force, temperature and salinity difference, etc.
- The oceanic currents in the Indian Ocean are not as permanent and systematic as those in the Atlantic and Pacific Oceans. **Indian Ocean is blocked by Continental masses in the north which affect the pattern of oceanic currents.**
- The oceanic current in the North Indian Ocean flows under the influence of the northeast and the Southwest monsoon winds. **Thus, the ocean current changes the direction of flow twice a year.**
- **Even due to monsoonal wind and the landlocked nature of the North Indian Ocean counter equatorial current has not developed as strongly as it developed in the Atlantic Ocean and the Pacific Ocean.** Both Statement I and Statement II are correct and Statement II is the correct explanation for Statement I.
- However, the currents in the South Indian Ocean follow the general pattern of the Other Oceans and are not affected by seasonal changes in the direction of monsoon winds.
- **Hence the option (a) is the correct answer.**

Q 75.A

- An oceanic basin is the land surface under an ocean that includes the topography under the water. It can be divided into two parts major relief and minor relief.
- The major reliefs include the Continental shelf, Continental slope, Continental rise, and deep sea plain or abyssal plain.
- A continental shelf is the submerged, gently sloping extension of a continent. It extends from the shoreline to the self-break where the slopes steepen significantly.
    - The continental slope is the steeply inclined section of the ocean floor that lies between the continental shelf and the continental rise.
    - The continental Rise is a gently sloping area at the base of the continental slope, where sediment accumulates forming a thick wedge of material
    - The minor reliefs include trenches, seamounts, guyots, submarine canyons, atolls, banks, shoals, etc
- **Trenches are deep-sided narrow depressions. They are normally formed at the ocean-ocean convergent boundary and ocean-continent convergent boundary. Hence pair 3 is not correctly matched.**
- Seamounts are underwater pointed volcanic mountain that rises from the ocean floor but does not reach the surface of the water
- **Guyots are flat-topped mountains** that were once volcanic Island but have been eroded by wave action and subsided below the surface. **Hence the pair 2 is correctly matched.**
- Submarine Canyon a deep, steep-sided valleys cut into the continental slope, often extending from the edge of the continental shelf
- Atolls are ring-shaped coral reefs that encircle a lagoon, often formed around a sinking volcanic Island.
- Banks are flat-topped elevations located in the continental margin. The depth of the water here is shallow but enough for navigational purposes
- **Shoals are detached elevations with shallow depth.** They are projected out of water with moderate height, which is **dangerous for navigation. Hence the pair 1 is not correctly matched.**

Q 76.C

- **Drumlins** are smooth oval shaped ridge-like features composed mainly of glacial till with some masses of gravel and sand. The long axes of drumlins are parallel to the direction of ice movement. They may measure up to 1 km in length and 30 m or so in height. One end of the drumlins facing the glacier called the stoss end is blunter and steeper than the other end called tail. The drumlins form due to dumping of rock debris beneath heavily loaded ice through fissures in the glacier. The stoss end gets blunted due to pushing by moving ice. Drumlins give an indication of direction of glacier movement. **Hence, pair 1 is correctly matched.**

- **Cliff:** Cliffs and terraces are two landform forms usually found where wave erosion is the dominant shore process. Almost all sea cliffs are steep and may range from a few m to 30 m or even more. At the foot of such cliffs there may be a flat or gently sloping platform covered by rock debris derived from the sea cliff behind. Such platforms occurring at elevations above the average height of waves is called a wavecut terrace. The lashing of waves against the base of the cliff and the rock debris that gets smashed against the cliff along with lashing waves create hollows and these hollows get widened and deepened to form sea caves. **Hence, pair 2 is not correctly matched.**
- **Spits:** A ridge of sand and shingle formed in the sea in the off-shore zone (from the position of low tide waterline to seaward) lying approximately parallel to the coast is called an off-shore bar. An off-shore bar which is exposed due to further addition of sand is termed a barrier bar. The off-shore bars and barriers commonly form across the mouth of a river or at the entrance of a bay. Sometimes such barrier bars get keyed up to one end of the bay when they are called spits. Spits may also develop attached to headlands/hills. The barriers, bars and spits at the mouth of the bay gradually extend leaving only a small opening of the bay into the sea and the bay will eventually develop into a lagoon. The lagoons get filled up gradually by sediment coming from the land or from the beach itself (aided by wind) and a broad and wide coastal plain may develop replacing a lagoon. **Hence, pair 3 is correctly matched.**

Q 77.D

- **Statement 1 is not correct**: Intrusive landforms are formed when magma cools within the crust.When the lava makes its way through cracks and the fissures developed in the land, **it solidifies almost perpendicular to the ground. It gets cooled in the same position to develop a wall-like structure. Such structures are called dykes.**
- **Statement 2 is not correct: The cinder cones are small volcanoes with steep sides.** They are very explosive and made of ash and rock. They constitute the andesitic lava flow which is less viscous in nature. Most of the cinder cones are small and less than 500 meters high. A famous cinder cone is Sunset Crater Volcano in Arizona.
- **Statement 3 is correct:** Fissure landforms are extrusive in Nature: They are formed by thin magma escaping through cracks and fissures in the earth's surface and flowing after intervals for a long time, spreading over a vast area, finally producing a layered, undulating (wave like), flat surface. Example: Deccan traps (peninsular India),

Q 78.D

- **Lhonak Lake is a glacier-moraine-dammed lake situated in the northwestern region of Sikkim, India, at an elevation close to about 5,200 m above sea level. It has gained attention for being one of the fastest-growing lakes in the Sikkim Himalaya due to significant glacial retreat.** The lake was formed by the melting of glaciers, and its vulnerability to GLOF had been earlier monitored. Heavy rainfall in October 2023 caused the lake to breach its embankments, thus causing extensive flooding in the Teesta River basin. It resulted in damage to property, many deaths, and other disprivileges.
- **Pampa Lake, also known as Pampa Sarovar, is the one near Hampi, Karnataka, in India. This is one of the five hallowed lakes of Hindu mythology, called Panch Sarovar**. There are many myths related to this lake that have history, and among them is its mention in the Ramayana as the place where Shabari waited for Lord Rama. This place is surrounded by hills and temples and finds praise for its beauty and cultural importance which attracts pilgrims and tourists alike.
- **Vembanad Lake, the longest in India, crosses districts of Kerala.** This gigantic water body is a site of great biodiversity and has unique ecosystems that support flora and fauna types that thrive only on such an extensive scale water body. Vembanad contributes to the local economy through fishing and tourism, mainly through houseboat tourism. It's of immense importance for its ecological significance as it accommodates many species of flora and fauna.
- **Pangong Lake is a saline lake in the Ladakh region of India, extending to Tibet.** It lies at an altitude of about 4,350 meters or 14,270 feet above sea level. Its unique ecosystem has supported numerous species of migratory birds and has always been a crucial source of natural wealth to the local community.
- **Hence option (d) is the correct answer.**

Q 79.D

- **Geomorphic processes refer to the physical and chemical changes that shape the Earth's landscape, driven by two primary forces: endogenic and exogenic.**
- **Exogenic forces** refer to those forces that work on the Earth's surface. These forces are mainly solar energy-driven. They involve processes such as weathering, erosion, transportation, and deposition which wear down and modify existing landscapes.
- **Internal forces, also known as endogenic forces, are forces working from within the Earth's crust that help shape the surfaces.** Endogenic forces can be generally divided into two types: slow movements that take time to occur, like Epeirogenic and Orogenic Movements, and sudden movements such as earthquakes and volcanic eruptions.
- **Mechanisms Behind Endogenic Forces: The primary drivers of endogenic forces include:**
  - **Earth's Internal Heat: The internal heat generated by the Earth's interior brings convection currents in the mantle to flame and pushes the tectonic plate to move. Internal heat is part of many geological processes.**
  - **Convectional Currents in the Mantle: These currents play an important role in transporting heat inside the Earth, as well as in the movement of tectonic plates.**
  - **Coriolis Effect:** Though it is often thought of as a driver of atmospheric and oceanic circulation because of the Earth's rotation, **it is not a direct driver of the endogenic motion.**

    Hence option (d) is the correct answer.

Q 80.D

- **Geomorphic processes refer to the physical and chemical changes that shape the Earth's landscape, driven by two primary forces: endogenic and exogenic.**
- **Exogenic forces** refer to those forces that work on the Earth's surface. These forces are mainly solar energy-driven. They involve processes such as weathering, erosion, transportation, and deposition which wear down and modify existing landscapes.
- **Internal forces, also known as endogenic forces, are forces working from within the Earth's crust that help shape the surfaces. These movements are primary driven by the heat generated from the Earth's interior that causes convection currents in the mantle, which drive tectonic plate movements.**
- **Endogenic forces can be generally divided into two types: slow movements and sudden movements.**
  - **Slow Movements (Diastrophic Forces):** Slow movements occur gradually and can be further divided into:
    - ✓ **Epeirogenic Movements:** These are movements related to vertical displacement of large parts of the Earth's crust that lead to either rising of areas or subsidence. They do not cause significant alterations in the horizontal layering of rock strata. Epeirogenic movements are related to the building of plateaus and continental landforms.
      - **These movements show little folding of rock layers. They are often related to isostatic adjustments, by which Earth's crust responds to a shift in load caused by melting of ice or deposition of sediments by rising or sinking. The effects of these movements can be permanent, resulting in long-lasting changes, or transient, leading to temporary changes that may reverse.**
    - ✓ Orogenic Movements: These horizontal movements cause very considerable distortion in the crust of the Earth. Some examples include:
      - Compression: Friction causes the rock strata to push against each other; this creates fold mountains, for example, the Himalayas, and the Andes.
      - Tension: The forces pull rock strata apart and eventually create faults and rift valleys, for example, the East African Rift.
  - **Sudden Movements: Sudden movements occur rapidly and include:**
    - ✓ **Earthquakes**: These occur due to sudden release of energy in the Earth's crust and thus begin the seismic waves.
    - ✓ **Volcanic Eruptions**: These occur when magma from within the Earth works its way through the crust and reaches the surface. It typically makes a rather dramatic change in the landscape.

    Hence option (d) is the correct answer.

Q 81.C

- **Geomorphic processes are the physical and chemical interactions between the Earth's surface and natural forces that cause changes to the Earth's surface.** These processes are caused by a combination of internal and external factors, known as endogenic and exogenic forces respectively.
- **Endogenic forces are those, which work from within the Earth's crust to shape the surfaces.** Endogenic forces can be broadly categorized into two types: slow movements like Epeirogenic and Orogenic Movements, and sudden movements such as earthquakes and volcanic eruptions.
- **Exogenic forces refer to all those forces that act at the Earth's surface. These forces originate from the Earth's exterior and include various natural processes that lead to the erosion, weathering, and deposition of materials.**
- **The primary energy sources for exogenic processes on the Earth's surface are solar radiation and atmospheric circulation. Solar radiation provides the energy that fuels many of the exogenic processes,** which include:
  - Evaporation of water, leading to the water cycle and erosion by water
  - Driving atmospheric circulation and wind patterns, which cause erosion by wind.
  - It supplies energy to several biological activities that consequently result in the initiation of weathering.
- **Types of Exogenic Forces: Exogenic forces can be categorized into following types depending on their action and effects to the landscape:**
  - **Physical Weathering:** Involves mechanical processes that break rocks with no chemical change in the rocks. The most common examples include freeze-thaw cycles and thermal expansion.
  - **Chemical Weathering:** It involves chemical processes that change minerals composition existing within a rock, such as, oxidation or hydrolysis.
  - **Biological Weathering:** This process is caused by living organisms like plant roots growing into rock fractures.
  - **Erosional Forces:**
    - ✓ Water: Erodes banks of rivers and streams and transports the sediments away.
    - ✓ Wind: Erodes surfaces in desert regions and creates some landforms such as dunes.
  - **Ice:** Carves out V-type valleys; moves large volumes of debris.
  - **Gravity:** This is among the strongest forces involved during mass wasting situations, where materials slide along slopes due to the pull of gravity.

  Hence option (c) is the correct answer.

Q 82.A

- **Geomorphic processes are the physical and chemical interactions between the Earth's surface and natural forces that cause changes to the Earth's surface. These processes are caused by a combination of internal and external factors, known as endogenic and exogenic forces respectively.**
- **Endogenic forces** are those, which work from within the Earth's crust to shape the surfaces. Endogenic forces can be broadly categorized into two types: slow movements like Epeirogenic and Orogenic Movements, and sudden movements such as earthquakes and volcanic eruptions.
- **Exogenic forces are defined as those that derive their energy from external sources, primarily the sun and atmospheric conditions. They are responsible for the gradual wearing down of landforms and can be classified into several key processes:**
  - **Weathering**: The actual breakdown of rocks into smaller particles due to physical, chemical, or biological action.
  - **Erosion**: The process of removal and transportation of weathered materials through agents such as water, wind, and ice.
  - **Deposition**: Sediments carried away by the erosions get deposited at an alternate location.
- **These processes collectively contribute to what is termed denudation, which means to strip away or uncover layers of the Earth**.

- **Isostasy** is the balance of the Earth's lithosphere as it floats on the asthenosphere, adjusting to changes in weight from sediment accumulation or erosion.
- **Stratification**: Stratification is defined as the layering of sediments in sedimentary rocks, created by variations in deposition over time.
- **Lithification**: Lithification is the process of compacting and cementing of loose sediments together to form a solid rock.

Hence option (a) is the correct answer.

Q 83.A

- **Weathering is defined as the process of breakdown and dissolution of rocks and minerals on the Earth's surface due to various agents, including water, ice, acids, salts, plants, animals, and temperature changes.**
- **Types of Weathering:** There are three major types of weathering:
  - **Physical (Mechanical) Weathering: Physical Weathering is the process of breaking down rocks through mechanical processes and without chemical composition alteration.** The reasons for physical weathering include:
    - ✓ Freeze-thaw cycles: Water penetrates cracks in the rocks and freezes to expand and widen the cracks.
    - ✓ Thermal stress: The expansion and contraction of rocks due to temperature variations.
    - ✓ Crystallization of salts: Saltwater evaporates in rock cracks, and the produced salt crystals expand and exert pressure on the rock.
    - ✓ **Prevalent in environments with significant temperature fluctuations.**
  - **Chemical Weathering: Chemical weathering alters the molecular structure of rocks and minerals by undergoing several chemical reactions.** Examples include:
    - ✓ Carbonation: Carbon dioxide reacts with water to form carbonic acid, which dissolves rocks like limestone.
    - ✓ Oxidation: Oxygen reacts with minerals that contain iron to create rust and causes them to expand. When this happens, it cuts the rock apart.
    - ✓ Hydrolysis: Water reacts with minerals to form new compounds.
    - ✓ **It is more rapid in warm, humid climates where moisture and temperature facilitate chemical reactions.**
  - **Biological Weathering:** Biological weathering is where living organisms interact with the rocks. Examples include:
    - ✓ Vegetation roots grow into fractures and widen them as they expand
    - ✓ Rock burrowing animals expose rocks to more extreme weathering processes.
    - ✓ Lichens and other microorganisms produce substances that facilitate mineral dissolution.
- **Thus, Physical weathering is indeed characterized by the mechanical disintegration of rocks without changing their chemical composition, whereas chemical weathering involves chemical reactions that alter the minerals in the rocks. Hence statement 1 is correct.**
- **Chemical weathering is more prevalent in warm, humid climates, whereas Physical weathering occurs rapidly in environments with significant temperatures. Hence statement 2 is not correct.**

Q 84.D

- **Plains are extensive flat or gently rolling areas of land that cover a significant portion of the Earth's surface. They are classified based on their formation processes into three main types: structural plains, erosional plains, and depositional plains.**
  - **Structural Plains:** Structural plains are basically a result of tectonic action, like uplift or subsidence in the Earth's crust. These plains exhibit little relief and therefore essentially consist of extensive flat ground surfaces. They normally feature faulting as well as folding.
    - ✓ Examples: Great Plains of North America, and Central Lowlands of Australia

- **Depositional Plains**: Depositional plains are formed when sediments are deposited through different agents, which include rivers, glaciers, and wind. The type of depositional plain depends on the geomorphic agents responsible for depositing sediments. Types of Depositional Plains:
  - ✓ **Alluvial Plains**: These are formed by deposits due to the deposition of sediments from rivers. These plains are generally fertile; thus, they are suitable for agriculture. Example: Indo-Gangetic Plain, India, and Hwang-Ho Plain, China.
  - ✓ **Floodplains**: These are low-lying areas alongside rivers, which flood periodically, providing fertile alluvial deposits. They are of extreme importance for agricultural purposes as they are fertile.
  - ✓ **Scroll Plains**: Changes in the course of a meandering river, create a series of ridges and valleys on the landscape due to which a scroll-like shape is presented on the landscape.
  - ✓ **Lacustrine Plains: They are formed from sediments deposited in lake environments. Prominent examples include the Valley of Kashmir and Manipur in India.**
  - ✓ **Lava Plains:** These are formed from volcanic activity where lava flows cover great areas, thus spreading over large areas and resulting in flat terrains. The Columbia River Plateau in the United States is an example.
  - ✓ **Outwash Plains: These are formed by glacial melt-water sediments deposited in front of the glacier. Outwash plains have, typically, layered sand and gravels and, often, are found in regions such as parts of Canada and Scandinavia.**
- **Erosional Plains**: Erosional plains are formed because of prolonged erosion of the upland areas. These are also called peneplains, which means almost a plain, as they have almost flat surfaces due to extensive weathering and erosion.
  - ✓ **Pediplains: It is a kind of erosional plain, which is formed due to the coalescence of pediments, due to the effect of erosion. These generally have a broad, flat landscape with a slight slope.**
  - ✓ **A peneplain is defined as a geomorphological term indicating a low-relief plain that has been formed by extensive erosion over geological time. Basically, peneplains are formed by fluvial erosion, like rivers and streams, through the gradual wearing away of existing elevated forms.**

- **Hence option (d) is the correct answer.**

Q 85.A

- **A plateau is an extremely large area of relatively flat high ground standing clearly above the surrounding landscape with steep slopes on one or more sides.** The height can range from a few hundred meters to several thousand meters in height. Plateaus are formed through different geological processes, such as volcanic activity, erosion, and the uplifting of land by tectonic forces.
- **Plateaus can be classified into following types based on formation and physical appearance :**
  - **Volcanic Plateaus:**
    - ✓ **A plateau formed by volcanic activity, where eruptions of lava keep piling up in time and give a flat or gently sloping surface.**
    - ✓ **Examples: Columbia Plateau (northwestern United States), Deccan Traps (India).**
  - Dissected Plateaus
    - ✓ **Formed by tectonic uplift, through which the earth crust is pushed upward, resulting in the emergence of an elevated landform.**
    - ✓ Intensive wind, water, and ice erosion lead to the development of deep valleys and canyons, which dissect the surface of the plateau. Examples include:
      - **Colorado Plateau (western United States)**
      - **Tibetan Plateau (Asia): This uplift is caused by the slow collision of the Indo-Australian and Eurasian tectonic plates. It is the largest and the highest plateau in the world. This plateau is sufficiently high enough to reverse the Hadley cell convection cycles in the atmosphere causing monsoon in the Indian subcontinent.**
- **Hence option (a) is the correct answer.**

Q 86.B

- **Foliation is a geological term that refers to the planar arrangement of mineral grains in a rock that is caused by differential pressure and temperature effects during metamorphism.**
- **Foliation is an orientation of minerals in rock parallel to a set of planes. There is often differential stress in such conditions where forces are greater in one direction than another, causing the minerals to flatten and elongate That characteristic is particularly associated with metamorphic rocks.**
- **Metamorphic Rocks** form from the alteration of existing rocks (igneous, sedimentary, or other metamorphic rocks) due to high temperature, pressure, or chemically active fluids without melting. Common metamorphic rocks include marble (from limestone) and schist.
- Other types of rocks:
  - **Igneous Rocks:** They are the product of magma or lava cooling and solidifying. They do not typically exhibit foliation since they cool and solidify rapidly and are less subjected to pressure conditions associated with foliation.
  - **Sedimentary rocks:** These are created from the accumulation and compaction of mineral and organic particles over time. They may contain fossils. Some sedimentary rocks do display layering created by the workings of deposition, but that is not foliation in the geologic sense of something that forms through metamorphism. Common types include sandstone, limestone, and shale.
- **Hence option (b) is the correct answer.**

Q 87.C

- **Continental drift theory was devised by Alfred Wegener in the year 1912. The theory refers to the distribution of the oceans and continents. Hence statement 1 is correct.**
- **According to Wegener's Continental Drift theory, all the continents were one single continental mass (called a Supercontinent) called Pangaea and a Mega Ocean surrounded this supercontinent. The mega ocean is known by the name Panthalassa. Hence statement 2 is not correct.**
- Although Wegener's initial theory did not cover mantle convection until Arthur Holmes later proposed the theory.
- It is reported that the supercontinent, Pangaea, began breaking off two hundred million years ago. Pangaea first fragmented into 2 large continental blocks referred to as Gondwanaland and Laurasia that formed the southern and northern modules respectively. Later, Gondwanaland and Laurasia continued to fragment into several smaller continents that exist today.
- **Wegener supported the theory through several lines of evidence:**
  - **Geological Similarities:** Similar rock formations and mountain ranges on different continents suggest that they were once connected.
  - **Fossil Distribution:** The same fossils of plants and animals, such as the freshwater reptile Mesosaurus, were found on continents that are now separated by oceans, indicating these species could not have crossed vast distances.
  - **Glacial Deposits**: Glacial tillites were also found in some tropical regions, which led to the conclusion that all these regions were former polar ones.
- **Wegener suggested that various forces, including gravity, pole-fleeing force (the centrifugal force due to Earth's rotation), and tidal forces contributed to the movement of continents. Hence statement 3 is correct.**
- Despite all this evidence, Wegener's theory was greeted with skepticism. One of the most significant criticisms was the absence of a clear mechanism to explain how continents could move across the Earth's surface. He did propose centrifugal force, tidal forces, and others as responsible forces to explain this tremendous displacement but these were considered to be inadequately strong to cause such enormous movements.
- The significance of the continental drift theory lies in its foundational role in explaining the movement of continents, which led to the development of plate tectonics and enhanced our understanding of Earth's geological history and processes.
- **Hence option (c) is the correct answer.**

Q 88.C

- **ECLIPSES:**
  - Anywhere from four to seven times a year, our Earth, Moon and Sun line up just right to create the cosmic-scale shadow show known as an eclipse.
  - The Moon's orbit around Earth is tilted relative to Earth's orbit around the Sun. **This tilt is the reason why we have occasional eclipses instead of eclipses every month.**
- There are two types of eclipses: lunar and solar. During a lunar eclipse, Earth's shadow obscures the Moon. During a solar eclipse, the Moon blocks the Sun from view.
  - **Solar Eclipse and the New Moon Phase**
    - ✓ A solar eclipse happens when the Moon passes between the Earth and the Sun. It occurs **only during the new moon phase** because this is when the Moon is positioned between the Earth and the Sun. **Hence statement 1 is correct.**
    - ✓ During a new moon, the Sun, Moon, and Earth are aligned, with the Moon blocking sunlight from reaching Earth, casting a shadow on the surface.
    - ✓ There are **three** types of solar eclipses: total, partial, and annular.
      - A total solar eclipse occurs when the Moon completely covers the Sun, creating a rare and spectacular sight.
      - A partial solar eclipse occurs when the Moon only partially covers the Sun, while an annular solar eclipse occurs when the Moon is too far from the Earth to fully cover the Sun, leaving a ring of light visible around the edge.
      - Solar eclipses can only be seen from certain parts of the Earth, as the Moon's shadow is relatively small compared to the Earth's surface.
  - **Lunar Eclipse and the Full Moon Phase**
    - ✓ A lunar eclipse occurs when the Earth comes between the Sun and the Moon. It happ**ens only during the full moon phase** because this is when the Earth comes between the Sun and the Moon.
    - ✓ The Sun's light is blocked by the Earth, casting Earth's shadow onto the Moon, causing the eclipse. **Hence statement 2 is also correct.**
    - ✓ During a lunar eclipse, the Moon can appear reddish in colour due to the Earth's atmosphere refracting sunlight around the planet and onto the Moon. This is sometimes referred to as a "blood moon."
    - ✓ Lunar eclipses can be seen from anywhere on the night side of the Earth, as the Earth's shadow is much larger than the Moon. Unlike solar eclipses, lunar eclipses are safe to view with the naked eye.

Q 89.C

- **Primordial Atmosphere Composition**
  - In Earth's early formation, the primordial atmosphere was composed mainly of **light gases such as hydrogen and helium**. These gases were prevalent because they are abundant in the universe and were part of the initial gas cloud from which the Sun and planets formed.
- **Solar Winds and Atmospheric Loss**
  - **The primary reason for the loss of this early atmosphere was the influence of solar winds. Hence option (c) is the correct answer.**
  - Solar winds are streams of charged particles (mostly protons and electrons) emitted from the Sun. In the early stages of the solar system, the young Sun was much more active, emitting stronger and more frequent bursts of these high-energy particles.
  - These solar winds had enough force to push the light gases, such as hydrogen and helium, out of Earth's gravitational field.
  - The Earth's gravitational pull was not strong enough at the time to retain these light gases, allowing them to escape into space.
  - This phenomenon didn't just occur on Earth but also affected other terrestrial planets like Venus and Mars, which also lost their primordial atmospheres due to solar winds.

- **Degassing and the Second Atmosphere**
  - Once the primordial atmosphere was lost, the Earth's second atmosphere began forming through processes like degassing from volcanic activity, which released heavier gases such as water vapor, carbon dioxide, and nitrogen.
- **Oxygen appeared much later, mainly due to photosynthesis by early life forms.**

Q 90.B

- **Nebular Hypothesis:**
  - The Nebular Hypothesis is a widely accepted theory that explains the formation of the solar system.
  - **It posits that the Sun and planets formed from a large cloud of gas and dust, known as the solar nebula**. Over time, this cloud, under the influence of gravity, began to collapse and spin, leading to the creation of the Sun and, eventually, the planets. **Hence option (b) is the correct answer.**
- **Explanation:**
  - The nebula was mainly made up of hydrogen and helium, along with some heavier elements.
  - As the nebula collapsed due to gravity, most of the material gathered at the center to form the Sun.
  - The leftover material in the surrounding disc began to come together into small objects called **planetesimals.**
  - Over time, these **planetesimals collided and stuck together through a process called accretion, eventually forming the planets, moons, and other objects in the solar system.**
- **Analysis:**
  - The Nebular Hypothesis explains the orderly and somewhat flat structure of the solar system, where the planets revolve around the Sun in nearly the same plane, a feature we observe today.
  - The inner planets, being closer to the Sun, are primarily composed of heavier elements, while the outer planets formed from lighter gases and ices, further from the Sun's heat.

Q 91.B

- **Formation of Planets**
  - The following are considered to be the stages in the development of planets :
    - ✓ The stars are localised lumps of gas within a nebula. The gravitational force within the lumps leads to the formation of a core to the gas cloud and a huge rotating disc of gas and dust develops around the gas core.
    - ✓ In the next stage, **the gas cloud starts getting condensed and the matter around the core develops into small- rounded objects. These small-rounded objects by the process of cohesion develop into what is called planetesimals. Hence option (b) is the correct answer.**
      - Larger bodies start forming by collision, and gravitational attraction causes the material to stick together. Planetesimals are a large number of smaller bodies.
    - ✓ In the final stage, these large number of small planetesimals accrete to form a fewer large bodies in the form of planets.

Q 92.B

- **Mars and Earth: A Comparative Analysis**
  - Mars and Earth, while different in many ways, share some important physical and environmental characteristics. Understanding these similarities is key to determining the potential for Mars to support life or human exploration in the future. The major aspects to compare include the magnetic field, day length, and axial tilt, as these determine planetary protection, surface conditions, and seasonal variations, respectively.
    - ✓ **Magnetic Field and Solar Radiation Protection**
      - A magnetic field serves as a crucial protective shield for a planet, deflecting harmful solar wind and radiation. On Earth, the magnetic field is generated by the movement of molten iron in the planet's outer core. This strong magnetic field protects Earth from solar radiation, enabling life to thrive on its surface.

- **Mars, however, does not have a global magnetic field.** Scientific research indicates that Mars once had a strong magnetic field, but it disappeared billions of years ago as its core cooled and became mostly solid. Without a magnetic field, Mars is exposed to high levels of solar radiation, which has stripped away much of its atmosphere over time. The lack of a magnetic field leaves the surface unprotected from solar wind and cosmic radiation. **Hence Statement 1 is not correct.**

✓ **Day Length on Mars and Earth**

- The rotation period of a planet—how long it takes to complete one full rotation on its axis—determines the length of its day. Earth's rotation period is about 24 hours.
- Interestingly, Mars has a very similar day length, with a period of about 24.6 hours. This similarity means that the daily cycles on Mars closely resemble those on Earth, with day and night cycles that are nearly the same in duration.
- This similarity is significant for potential human missions to Mars, as the adjustment to a Martian day would be relatively easy compared to other planets in the solar system. **Hence Statement 2 is correct.**

✓ **Axial Tilt and Seasonal Changes**

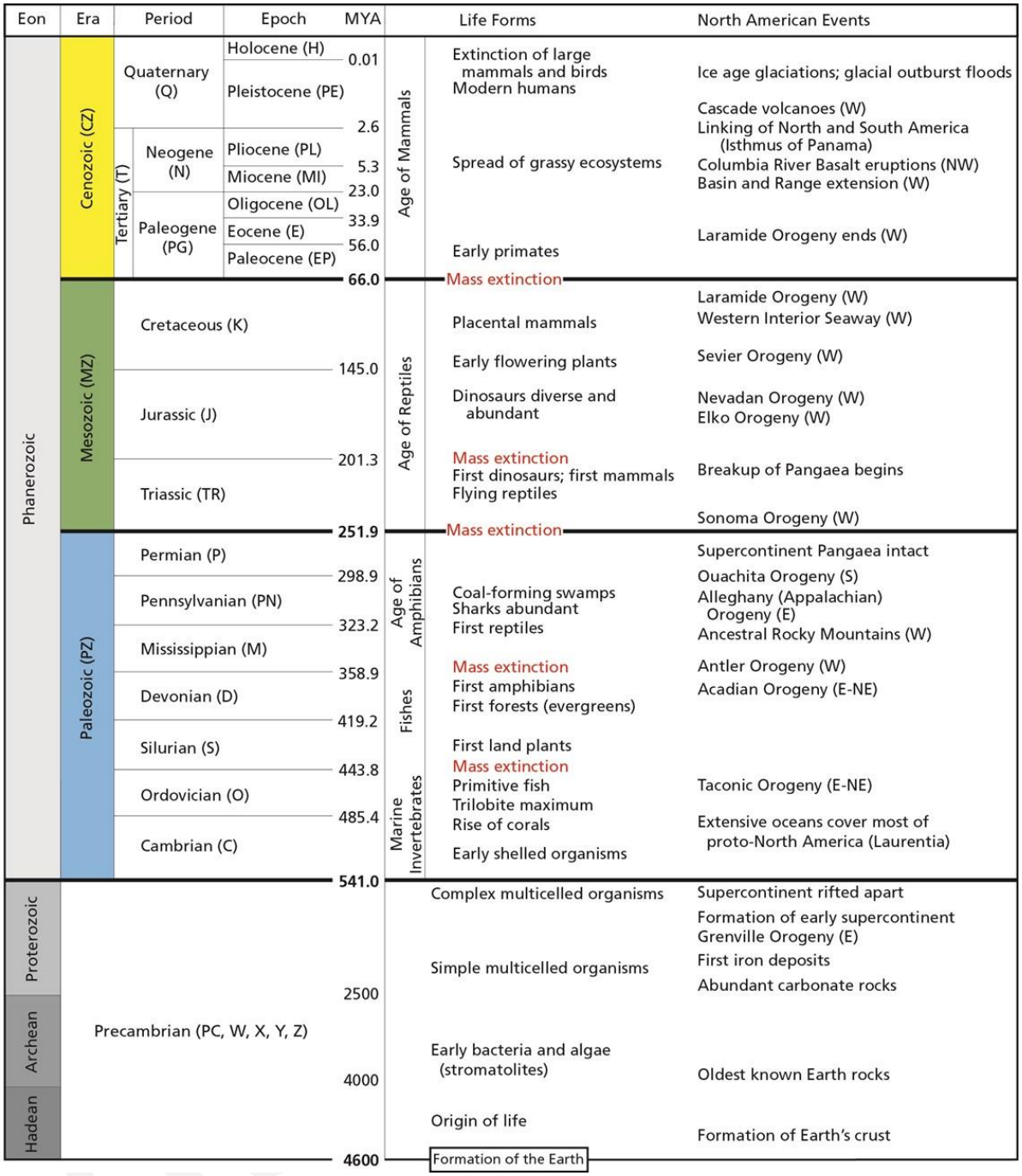
- The axial tilt of a planet is the angle at which it tilts on its axis relative to its orbit around the Sun. This tilt determines the seasons experienced by the planet. Earth's axial tilt is about 23.5 degrees, which gives rise to the distinct seasonal changes we experience throughout the year.
- **Mars has a very similar axial tilt of about 25 degrees**, which also results in seasonal changes. While the atmosphere on Mars is much thinner and its surface much colder, the axial tilt means that Mars, like Earth, experiences seasonal variations in temperature and sunlight distribution. However, due to Mars' longer orbit around the Sun, its seasons last nearly twice as long as those on Earth. **Hence Statement 3 is correct.**

- **Other Similarities Between Mars and Earth**
  - ✓ **Presence of Polar Ice Caps:** Both Mars and Earth have polar ice caps.
  - ✓ **Surface Features:** Mars and Earth share some similar geological features, such as Mountains, Canyons, Deserts e.t.c
  - ✓ **Atmospheric Composition (in Terms of Gases):** While Earth's atmosphere is rich in nitrogen and oxygen, both planets share the presence of carbon dioxide in their atmospheres. On Mars, carbon dioxide makes up over 95% of the atmosphere, while on Earth, it is present in much smaller quantities (about 0.04%).
- **Key Differences Between Mars and Earth**
  - ✓ **Atmosphere and Air Pressure:** Mars has a thin atmosphere, composed mostly of CO_2, with less than 1% of Earth's air pressure and almost no oxygen. This results in little protection from solar radiation and poor heat retention, contributing to Mars' cold temperatures. In contrast, Earth has a dense atmosphere with 21% oxygen, supporting life and maintaining a stable climate.
  - ✓ **Temperature:** Mars is much colder than Earth. The average temperature on Mars is about -60°C (-80°F), whereas Earth's average temperature is around 15°C (59°F).
  - ✓ **Gravity:** Mars' gravity is about 38% of Earth's gravity

Q 93.B

- **Understanding Geological Time: Eras, Periods, and Epochs**
  - Geological time is divided into units that help scientists understand Earth's history. These divisions include eras, periods, and epochs, which represent specific times during Earth's development based on major geological, climatic, and biological events.
  - **Currently, we are living in the Cenozoic Era, within the Quaternary Period and the Holocene Epoch. Hence option (b) is the correct answer.**

- **Geological Time scale:**



Q 94.B

- On the basis of the location and active geomorphological processes, it can be broadly divided into two: (i) the western coastal plains; (ii) the eastern coastal plains.
- The western coastal plains are an example of submerged coastal plains. It is believed that the city of Dwaraka which was once a part of the Indian mainland situated along the west coast is submerged under water. **Because of this submergence, it is a narrow belt and provides natural conditions for the development of ports and harbours. Hence, statement 2 is correct.**
- **As compared to the western coastal plain, the eastern coastal plain is broader and is an example of an emergent coast.** There are well-developed deltas here, formed by the rivers flowing eastward into the Bay of Bengal. These include the deltas of the Mahanadi, the Godavari, the Krishna and the Kaveri. **Because of its emergent nature, it has less number of ports and harbours. The continental shelf extends up to 500 km into the sea, which makes it difficult for the development of good ports and harbours. Hence, statement 1 is not correct.**

Q 95.B

- **Earth's Rotation:**
  - The Earth completes one full rotation on its axis every 24 hours, which creates the day and night cycle. If the Earth's rotation were to slow down, it would take longer for the Earth to complete a single rotation.
  - **As a result, the Days and nights would become longer,** not shorter. **Both day and night would be extended because the Earth would take more time to complete its rotation. Hence, Statement 1 is not correct.**
  - The variation in day length is due to several factors, including the tidal effects of the Moon and Sun, core-mantle coupling inside the Earth, and the overall distribution of mass on the planet. Seismic activity, glaciation, the weather, the oceans, and the Earth's magnetic field may also affect the length of the day. **Hence Earth's Rotation does not affect the day's length and therefore both day and night are longer if Earth rotates at a lower speed.**
- **Axial Tilt and the Variation of Seasons**
  - As the earth spins on its axis, producing night and day, it also moves about the sun in an elliptical (elongated circle) orbit that requires about 365 1/4 days to complete.
  - **The earth's spin axis is tilted with respect to its orbital plane. This is what causes the seasons**. **Hence, Statement 2 is correct.**
  - When the earth's axis points towards the sun, it is summer for that hemisphere. When the earth's axis points away, winter can be expected.
  - Since the tilt of the axis is 23 1/2 degrees, the North Pole never points directly at the Sun, but on the summer solstice, it points as close as it can, and on the winter solstice as far as it can.
  - Midway between these two times, in spring and autumn, the spin axis of the earth points 90 degrees away from the sun. This means that on this date, day and night have about the same length: 12 hours each, more or less.
- **The Coriolis Effect and Its Cause**
  - **The Coriolis effect is caused by the rotation of the Earth**, **not its revolution around the Sun**. **Hence, Statement 3 is not correct.**
  - This effect influences the movement of air and ocean currents, causing them to deflect to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. It plays a crucial role in determining wind patterns and ocean currents on Earth.

Q 96.B

- **Explanation of Solstices and Equinoxes**
  - The Earth's tilt (23.5 degrees) and its orbit around the Sun cause solstices and equinoxes, which determine the variation in the length of days and seasons.
  - **Solstices occur when the Earth's tilt is most inclined towards or away from the Sun**, **while equinoxes happen when the tilt is neither towards nor away from the Sun, resulting in equal day and night.**
- **There are two solstices in a year:**
  - Winter Solstice (Northern Hemisphere: December 21, Southern Hemisphere: June 21)
  - Summer Solstice (Northern Hemisphere: June 21, Southern Hemisphere: December 21)
- **Equinoxes also occur twice:**
  - Autumnal Equinox (Around September 23)
  - Spring Equinox (Around March 21)
- **Winter Solstice in the Northern Hemisphere**
  - During the winter solstice in the Northern Hemisphere (around December 21), **the Northern Hemisphere is tilted away from the Sun**. This results in the shortest day of the year for this hemisphere, with the least amount of sunlight. This tilt away from the Sun explains why the Northern Hemisphere experiences winter at this time. **Hence statement 1 is correct.**

- **Summer Solstice in the Southern Hemisphere**
  - The summer solstice in the Southern Hemisphere occurs around December 21. During this solstice, the Southern Hemisphere is tilted toward the Sun, and the **Sun is directly over the Tropic of Capricorn (23.5° south latitude).** This causes the longest day of the year for the Southern Hemisphere.
  - **Hence statement 2 is correct, as the Sun is directly over the Tropic of Capricorn during the Southern Hemisphere's summer solstice.**
- **Autumnal Equinox in the Northern Hemisphere**
  - The autumnal equinox occurs around September 23 in the Northern Hemisphere. During the equinox, the Sun is directly above the equator, and day and night are nearly equal in length across the globe. The longest days happens during the summer solstice.
  - **Hence statement 3 is incorrect, as the autumnal equinox does not cause the longest days of the year.**

Q 97.C

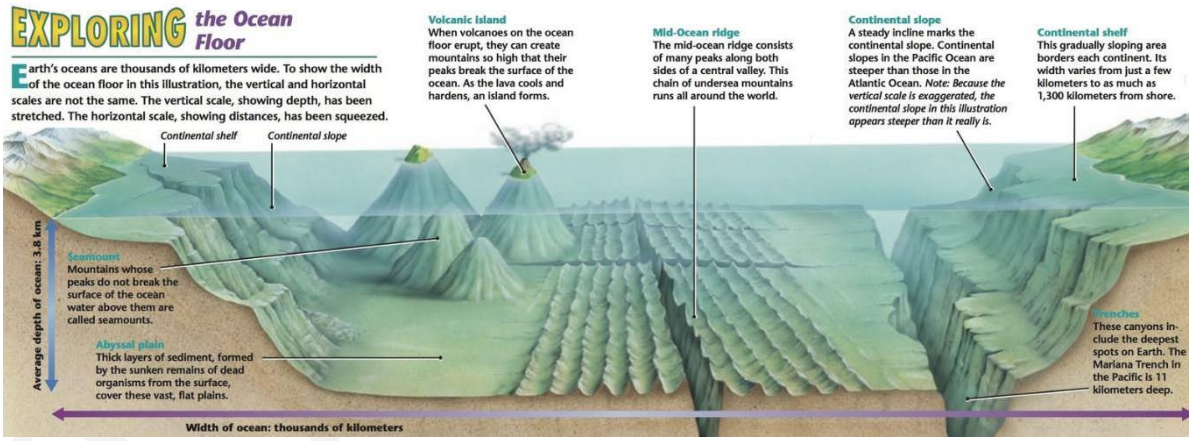
- **Understanding Earth's Core**
  - The Earth's core is divided into two main parts: the inner core and the outer core, both playing crucial roles in the planet's geology and magnetic field.
  - **Inner Core:**
    - ✓ It is solid and primarily composed of iron and nickel. **Hence statement 1 is correct.**
    - ✓ Despite extremely high temperatures, the immense pressure keeps it in a solid state. **Hence statement 3 is correct.**
  - **Outer Core:**
    - ✓ It is liquid, also made up of iron and nickel, and its movement generates Earth's magnetic field. **Hence statement 2 is correct.**
- **Earth's Crust:**
  - The crust is the Earth's outermost layer and is thin compared to other layers, about 5-70 km thick.
  - It is composed of continental and oceanic crust.
  - Continental crust: Thicker (up to 70 km), made up mostly of granite.
  - Oceanic crust: Thinner (about 5-10 km), primarily composed of basalt.
  - The crust forms the lithosphere along with the upper part of the mantle.
- **Earth's Mantle:**
  - The mantle lies below the crust, extending to a depth of about 2,900 km.
  - It is composed of silicate minerals and is divided into the upper and lower mantle.
  - The upper mantle is partly solid and partly molten, contributing to plate tectonics.
  - Convection currents in the mantle drive the movement of tectonic plates.

Q 98.B

- Red soil develops on **crystalline igneous rocks** in areas of **low rainfall** in the eastern and southern part of the Deccan Plateau. **Hence statement 1 is correct.**
- The soil develops a reddish colour due to a **wide diffusion of iron** in crystalline and metamorphic rocks.
- It looks yellow when it occurs in a hydrated form. The fine-grained red and yellow soils are normally fertile, whereas coarse-grained soils found in dry upland areas are poor in fertility.
- They are generally **poor** in nitrogen, phosphorous and humus. **Hence statement 3 is not correct.**
- It is the **Black soils** that reatins the moisture for a very long time due to its self ploughing property.
- The available water capacity and maximum water holding capacity in all the soils were in the order of black soils > transported black soils over the native red soils > red soils > red lateritic soils. **Hence statement 2 is not correct.**

Q 99.A

- **Continental Shelf:**
  - It is the **extended margin of each continent** occupied by relatively shallow seas and gulfs.
  - It is the **shallowest part** of the ocean showing an average gradient of 1° or even less. The shelf typically ends at a very steep slope, called the **shelf break**. **Hence statement 1 is correct.**
  - The width of the continental shelves varies from one ocean to another.
    - ✓ The average width of continental shelves is about 80 km.
    - ✓ The shelves are almost absent or very narrow along some of the margins like the coasts of Chile, the west coast of Sumatra, etc. On the contrary, the Siberian shelf in the Arctic Ocean, the largest in the world, stretches to 1,500 km in width.
  - The depth of the shelves also varies. It may be as shallow as 30 m in some areas while in some areas it is as deep as 600 m.
  - The continental shelves are covered with variable thicknesses of sediments brought down by rivers, glaciers, wind, from the land and distributed by waves and currents. Massive sedimentary deposits received over a long time by the continental shelves become the source of fossil fuels.
- **Deep-Sea Plain:**
  - Deep-sea plains are gently sloping areas of the ocean basins.
  - These are the **flattest and smoothest** regions of the world.
  - The depths vary between 3,000 and 6,000m. Moreover, **oceanic deeps or trenches are the deepest part** of the oceans. **Hence statement 2 is not correct.**
  - These plains are covered with fine-grained sediments like clay and silt.



Q 100.A

- **Geothermal Gradient: It is the rate at which temperature rises with depth. On average the geothermal gradient is approximately 25-30 °C/km, that is, a rise of 1°C for every 32 meters in the continental crust.**
  - **However, the rate at which temperature increases with depth is not linear. The temperature gradient in the upper 100 kilometers is between 15° and 30°C per kilometer. After that, it significantly lowers through the mantle, increases faster near the mantle's base, and then gradually increases through the core. Hence statement 1 is not correct.**
  - The temperature is held within the range from 1000°C at the bottom of the crust, 3,500 °C at the base of the mantle, and approximately 5,000 °C close to the Earth's center.
  - Some of the important variables that affect the geothermal gradient are internal heat from sources such as radioactive decay; geological conditions, such as tectonic activity, that create steeper gradients near boundaries in plates or even negative geothermal gradients due to subduction zones or very deep aquifers in which temperature drops with depth. Altogether, these elements produce a complex and variable geothermal gradient across different geological settings.

- **Pressure Gradient: The Earth's internal pressure increases dramatically with depth due to the immense weight of the overlying rock layers. Hence statement 2 is correct.**
    - At the Earth's center, the pressure may reach 360 GPa (3.6 million atmospheres). The pressure gradient is indeed one of the major factors determining the earth's interior physical state:
    - High pressure is dominant deep within the crust and the upper part of the mantle. This suppresses rocks at higher temperatures but keeps them in a solid state.
    - The pressure in this outer core is so extreme that the iron-nickel alloy remains liquid.
    - At the boundary between the liquid outer core and solid inner core, the pressure reaches 330-360 GPa, high enough to solidify the inner core.
- **Density increases towards the Earth's center. Although temperature does rise with depth, it is primarily the increase in pressure that causes materials to become denser as one approaches the core. Hence statement 3 is not correct.**