1. Answer: a) 1 only

Explanation:

Statement 1:

- The **Earth rotates 360° in 24 hours**, i.e., **15° per hour**.
- Hence, **every 15° longitude = 1 hour difference**.
- 180° is exactly halfway around the globe from 0° (Prime Meridian), so the **time difference = 12 hours** (180 ÷ 15 = 12).
- Therefore, **Statement 1 is correct.**

Statement 2:

- When moving **eastward across the IDL (180° E → 180° W)**, the **date moves backward by one day** (Tuesday becomes Monday).
- Conversely, moving **westward**, the **date goes forward by one day** (Tuesday becomes Wednesday).
- Therefore, **Statement 2 is incorrect.**

Infographic: Time and the International Date Line

WEST (Add a day) **EAST** (Go back a day)

←---------- **IDL** ----------→

Wednesday, 11 PM Tuesday, 11 PM

179° E 179° W

Sources:

- NCERT Class 9 – Contemporary India-I, Chapter 2: Physical Features of India
- **NCERT Class 6

2. **Answer:** a) 1 and 2 only

Explanation

What is Biological Weathering?

It refers to **disintegration and decomposition of rocks by living organisms** — plants, animals, bacteria, fungi, etc.

It overlaps with both physical and chemical weathering.

Agent	Type of Action	Example
Plant roots	Physical (pressure)	Roots grow into cracks → exert pressure → rock splits.
Lichens/mosses	Chemical	Secrete weak acids → dissolve minerals → discoloration and pitting.
Burrowing animals (rabbits, termites, earthworms)	Physical	Loosen soil and expose rocks → facilitate further weathering.

Statement 1: Correct — includes both mechanical (root wedging, burrowing) and chemical (acid secretion) aspects.

Statement 2: Correct — lichens/mosses secrete organic acids (e.g., oxalic acid).

Statement 3: Incorrect — burrowing animals primarily cause **physical** disintegration, not chemical.

Infographic (conceptual)

Biological Weathering
│
├─ Plant roots → crack expansion (physical)
├─ Lichens/mosses → acid secretion (chemical)
└─ Animals → burrowing/exposure (physical)

Current link (2024–25):

- *The Hindu* (March 2025) — reported increased biological weathering in Western Ghats due to invasive root-heavy vegetation accelerating slope instability.
- *MoEFCC* 2024 Biodiversity Report highlighted **bioweathering impact** on stone monuments (Ellora Caves – UNESCO site).

Sources:

- NCERT XI (Geomorphic Processes, Ch. 6)
- Goh Cheng Leong, Ch. 5 ("Agents of Weathering")

3. **Answer: (b) 2 and 3 only**

Explanation:

Shield volcanoes are formed by **basaltic (mafic) lava**, which is **fluid and low in silica**, allowing it to spread over wide areas. Hence, they are broad and gently sloping.

- Example: **Mauna Loa** (Hawaii).
- Eruptions are **non-explosive** due to less gas buildup.

Major Types of Volcanoes

Type	Lava Type	Viscosity	Eruption Style	Example
Shield	Basaltic (Mafic)	Low	Gentle, effusive	Mauna Loa (Hawaii)
Stratovolcano (Composite)	Andesitic/Felsic	High	Explosive	Mt. Fuji, Mt. St. Helens
Cinder Cone	Basaltic to Andesitic	Moderate	Short-lived, explosive	Parícutin (Mexico)
Dome Volcano	Felsic	Very High	Explosive	Mt. Pelée (Caribbean)

Sources:

- NCERT Class 11 Geography – "Fundamentals of Physical Geography."
- G.C. Leong – "Volcanoes and Earthquakes."

4. **Answer:** (c) NW-3

Explanation:

- **NW-3 (West Coast Canal)** connects **Kottapuram to Kollam** through a network of canals, backwaters, and lakes in **Kerala**.
- It is India's **first National Waterway with 24-hour navigation facilities.**
  (Source: NCERT Class 12, *India: People and Economy*; IWAI Portal 2025)**

MAJOR NATIONAL WATERWAYS

NW-1 → GANGA (Haldia–Varanasi)
NW-2 → BRAHMAPUTRA (Dhubri–Sadiya)
NW-3 → WEST COAST CANAL (Kerala)
NW-4 → GODAVARI–KRISHNA (Andhra Pradesh)
NW-5 → BRAHMANI (Odisha)
NW-10 → AMBA (Maharashtra)

5. **Answer:** (c)

Explanation:

- **Solstice (June & December)** marks the **longest or shortest days** in the respective hemispheres.
- **Perihelion:** Earth closest to Sun (around Jan 3).
- **Aphelion:** Earth farthest from Sun (around July 4).
- **Equinox:** Equal day and night globally (March 21 & Sept 23).

(Source: NCERT Class 9; G.C. Leong)**

Visual Summary Diagram

EARTH'S AXIS TILT (23.5°)
|
Summer Solstice (June 21)
Northern Hemisphere faces Sun
|
Equinox (March/Sept)
Equal day and night
|
Winter Solstice (Dec 22)
Southern Hemisphere faces Sun

6. **Answer: (b)** Narrow belts of high-velocity winds found in the upper troposphere around 9–14 km altitude

Explanation:

- **Jet Streams** are **high-speed westerly air currents** (200–300 km/h) occurring near the **tropopause** (~10–14 km altitude).
- They strongly influence **weather systems**, **monsoon onset**, and **air traffic patterns**.
- In India, the **Subtropical Westerly Jet (STWJ)** and **Tropical Easterly Jet (TEJ)** are key.

(Source: NCERT Class 11; IMD Monsoon Report 2025; The Hindu, April 2025)**

Summary Table: Major Wind Types

Category	Examples	Characteristics
Planetary Winds	Trade winds, Westerlies, Polar Easterlies	Permanent, global-scale
Seasonal Winds	Monsoon	Reverses with season

Local Winds	Foehn, Mistral, Loo, Chinook	Regional, short-duration
Upper-level Winds	Geostrophic, Jet Streams	Flow parallel to isobars, influence weather

7. **Answer:** (b)

Explanation:

- The **Big Bang Theory**, proposed by **Georges Lemaître (1927)** and supported by **Edwin Hubble's (1929)** redshift observations, states that the **Universe began about 13.8 billion years ago** from a **singularity** — an extremely dense and hot point.
- The explosion led to continuous **expansion** and **cooling**, forming galaxies, stars, and planets.

(Sources: NCERT Class 11; *NASA Cosmology Data 2024; The Hindu Science Section, 2024*)

Theory	**Proponent(s)**	**Key Concept**
Big Bang Theory	Georges Lemaître, Edwin Hubble	Universe began from a singularity and is expanding.
Steady State Theory	Bondi, Gold, Hoyle	Universe is eternal; new matter continuously created.
Nebular Hypothesis	Kant & Laplace	Solar System evolved from a rotating nebula.
Protoplanet Hypothesis	Otto Schmidt, Safronov	Planets formed from dust and gas around proto-Sun.

8. **Answer:**

(a) Laterite soil	Tea and coffee

Explanation:

- **Laterite soils** occur in **high rainfall areas of Western Ghats, Eastern Ghats, and Meghalaya**.
- Due to leaching, they are **poor in nitrogen and lime** but **good for plantation crops** like **tea, coffee, and cashew** when manured.

(Sources: NCERT Class 10; G.C. Leong; *Indian Express – Plantation Sector Report 2025*)

Soil Type	**Regions**	**Main Crops**	**Key Properties**
Alluvial	Northern Plains, Coastal Areas	Rice, Wheat, Sugarcane	Fertile, rich in potash
Black (Regur)	Deccan Plateau	Cotton, Jowar	Clayey, moisture-retentive

Red	Tamil Nadu, Karnataka	Millets, Groundnut	Low fertility, iron-rich
Laterite	Kerala, Meghalaya	Tea, Coffee	Leached, acidic
Arid	Rajasthan, Gujarat	Bajra, Jowar	Sandy, saline, kankar nodules
Peaty/Marshy	Kerala, Sundarbans	Rice	Organic, waterlogged

9. **Answer:** (a) One high tide and one low tide each day

Explanation:

- **Diurnal tides** occur **once daily** (one high and one low tide), seen in parts of the **Gulf of Mexico** and **Southeast Asia**.
- Other types include **semi-diurnal** (twice daily) and **mixed tides** (unequal heights).

(Source: G.C. Leong; NOAA, 2024)**

Infographic Summary: Types of Tides

Tide Type	Tidal Cycle	Example Region	Tidal Range
Semi-diurnal	2 high & 2 low tides/day	Atlantic coasts	Moderate
Diurnal	1 high & 1 low tide/day	Gulf of Mexico	Low
Mixed	Unequal highs/lows	Pacific coasts	Variable

Visual Summary – Tide Formation Diagram (Conceptual)

SPRING TIDE
Sun, Moon, Earth in line

NEAP TIDE
Sun and Moon at right angle

Sources Summary:

- **NCERT Class 11 – Fundamentals of Physical Geography, Chapter 13**
- **G.C. Leong – Certificate Physical and Human Geography**, Chapter 13

10. **Answer: c. Both 1 and 2**

Explanation:

- **Statement 1** — *Standard time* ensures a **uniform reference time** for the entire country despite longitudinal differences. Earth rotates 15° per hour (360° ÷ 24), so local times vary by 4 minutes per degree. A common "standard meridian" avoids confusion for transport, administration, and communication.
- **Statement 2** — India's **Standard Meridian (82° 30′ E)** passes through **Mirzapur (U.P.)**. The east–west longitudinal extent of India is roughly 29°, corresponding to

about **116 minutes (~2 hours)** of time difference between Arunachal Pradesh (east) and Gujarat (west). Hence both are correct.

Longitude	Difference from 82° 30′ E	Approx. Local Time Difference
97° E (Arunachal Pradesh)	+14.5°	+58 min
68° E (Gujarat)	−14.5°	−58 min
Total difference	≈ 29°	≈ 116 min ≈ 1 h 56 min

Sources:

1. **NCERT Class 11 – Fundamentals of Physical Geography**, Chapter 2 *"The Earth"*.
2. **Goh Cheng Leong (2017 Ed.) – *Certificate Physical and Human Geography***, Ch. 3 "The Earth's Movements and Time."

11. **Answer:** b) 1 and 3 only

Explanation

Process	Description	Example	Result
Oxidation	Reaction of oxygen with minerals (especially iron-bearing).	Formation of iron oxides (hematite, limonite) → red/yellow coloration.	Alters mineral composition → rock weakens.
Carbonation	Reaction of carbonic acid (H_2CO_3, from $CO_2 + H_2O$) with minerals like calcite.	Formation of calcium bicarbonate ($Ca(HCO_3)_2$).	Leads to **karst topography** (stalactites, stalagmites, limestone caves).

Statement 1: Correct — oxidation forms oxides and weakens rocks (e.g., red soils in humid tropics).

Statement 2: Incorrect — carbonation is **more effective in humid, CO_2-rich regions**, not dry climates.

Statement 3: Correct — both processes **chemically alter** the parent rock's composition.

Diagram:

CO_2 (atmosphere)

↓

Dissolves in rainwater → Carbonic acid (H_2CO_3)

↓

Acts on limestone → $CaCO_3 + H_2CO_3 \rightarrow Ca(HCO_3)_2$ (soluble)

Current relevance (2024–25):

- *The Hindu* (June 2024) reported increased **karst sinkholes in Meghalaya** due to accelerated carbonation from acid rain.
- *Indian Express* (2024 August) highlighted oxidation's role in **iron ore weathering** affecting mining productivity in Odisha and Chhattisgarh.

Sources:

- NCERT XI (Geomorphic Processes, pp. 52-55)

- Goh Cheng Leong, *Physical Geography*, Ch. 5 ("Chemical Weathering")

12. **Answer: (d) 3 only**

Explanation:

- **Pumice:** Produced in **explosive eruptions**; very light, can float on water.
- **Pyroclasts:** Include ash (<2 mm), lapilli (2–64 mm), volcanic bombs (>64 mm).
- **Basalt:** Formed from **mafic lava**, rich in iron and magnesium.

Sources:

- NCERT Class 11, "Minerals and Rocks."
- G.C. Leong – "Volcanoes and Earthquakes."

13. Answer: (b) Deposition by groundwater

Explanation:

- Formed in **limestone caves** by the action of **groundwater rich in calcium carbonate ($CaCO_3$)**.
- **Stalactite:** Hangs from the roof.
- **Stalagmite:** Rises from the floor.
- Both formed by **precipitation of $CaCO_3$** as water drips and evaporates.

Sources:

- *NCERT Class XI – Fundamentals of Physical Geography.*
- *GSI (Geological Survey of India, 2024)* documentation of natural limestone caves in Meghalaya.

Landforms by Major Agents

Agent	Erosional Landforms	Depositional Landforms
River	Gorge, Waterfall	Floodplain, Delta
Glacier	Cirque, Arete	Moraine, Drumlin
Wind	Deflation Hollow, Mushroom Rock	Dune, Loess
Sea Waves	Cliff, Cave	Beach, Spit
Groundwater	Sinkhole	Stalactite, Stalagmite

Consolidated Source List:

- NCERT Geography (Class 7, 9, 11)
- Goh Cheng Leong (Chapters 6–11)

14. **Answer:** (b) New Moon and Full Moon

Explanation:

During **New Moon** and **Full Moon**, the Sun, Moon, and Earth align in a straight line (syzygy), producing **spring tides** with the **highest tidal range**.

(Source: NCERT, NOAA, The Hindu – *Tidal Research Updates 2024*)**

Tides Overview

Type of Tide	Sun-Moon Alignment	Gravitational Effect	Tidal Range
Spring Tide	Sun, Moon, Earth in line (New Moon, Full Moon)	Forces combine	Highest
Neap Tide	Sun and Moon at right angles (First, Third Quarter)	Forces oppose	Lowest

- **Tides** are periodic rise and fall of sea level due to **gravitational forces**.
- **Spring tides** → Strongest (alignment).
- **Neap tides** → Weakest (right-angle position).
- **Tidal energy potential** is significant in **Gulf of Khambhat, Gulf of Kutch, and Sunderbans**.
- Recent government focus (2024–25): **National Tidal and Wave Energy Mission (Draft Policy under MNRE).**

15. Answer: (c) 1, 3 and 4

Detailed Explanation

1. Earth's Rotation and Time Zones
   - The Earth **rotates 360° in 24 hours**, so it covers **15° per hour** (360 ÷ 24 = 15).
   - Hence, **every 15° longitude** corresponds to **a difference of 1 hour** between standard times of two places.
   - For example, when it's 12:00 noon at Greenwich (0° longitude), it's **5:30 p.m. in India (82.5° E)**.
   - **Statement 1 is correct.**
2. International Date Line (IDL)
   - The **IDL (180° longitude)** is an **imaginary line opposite the Prime Meridian**.
   - The rule:
     - **If you cross the IDL eastward**, you **subtract a day (go back one calendar day)**.
     - **If you cross westward**, you **add a day (advance one calendar day)**.
   - The question reverses this
   - **Statement 2 is incorrect.**
3. Daylight Saving Time (DST)
   - DST is adopted in some countries (mainly temperate zones) to **maximize daylight hours** during summer.
   - Clocks are **advanced by one hour** from standard time during warmer months.
   - India **does not follow DST**, but countries like the **USA, UK, and most of Europe** do.
   - **Statement 3 is correct.**
4. Moon's Rotation and Revolution
   - The **Moon rotates on its axis and revolves around the Earth** in about **27.3 days**, both in the **same (counterclockwise) direction** as Earth revolves around the Sun.
   - This **synchronous rotation** causes **the same side of the Moon** to always face the Earth.

- **Statement 4 is correct.**

Concept Table: Earth's Movements and Time Effects

Concept	Description	Key Example
Rotation	Spinning of Earth on its axis (24 hrs)	Causes day & night
Revolution	Movement of Earth around Sun (365 days)	Causes seasons
Time Zones	Each 15° = 1 hour difference	India = GMT + 5:30
International Date Line	180° meridian where date changes	Pacific Ocean
Daylight Saving Time	Clock advanced by 1 hour	USA, Europe
Moon's Rotation	27.3 days (same as revolution)	Same face visible from Earth

Sources:

- **NCERT Class 11 – Fundamentals of Physical Geography (Ch. 3: Rotation and Revolution)**
- **G.C. Leong – Certificate Physical & Human Geography (Ch. 2: The Earth and the Universe)**

16. **Answer:** (b) Climate

Explanation:

- Among the five main factors of soil formation (**parent material, climate, biotic activity, topography, and time**), **climate** (temperature and precipitation) plays the **most dominant role**, as it affects **weathering rate** and **organic matter decomposition**.
  (Source: NCERT Class 11 – *Soils*, G.C. Leong)**

17. **Answer: (a)** 1 and 2 only

Explanation:

- **Alluvial soils** are **depositional soils** formed by riverine action, found across **Indo-Gangetic plains, deltas, and coastal regions**.
- Rich in **potash and phosphoric acid**, suitable for **rice, wheat, sugarcane**.
- Found beyond plains too — e.g., **coastal Andhra, Assam valley**, etc. Hence statement 3 is false.
  (Sources: NCERT Class 10; *The Hindu Agriculture Supplement 2024; Soil Health Mission Data 2025*)

18. **Answer: (a)** 1 and 2 only

Explanation:

All four are **local winds** occurring in specific regions:

- **Bora:** Cold, dry wind from NE across the Adriatic Sea.

- **Mistral:** Cold wind from north over Rhône valley, France.
- **Sirocco:** Hot, dry, dusty wind from Sahara towards Mediterranean.
- **Chinook:** Warm, dry wind descending from the Rockies.
  (Source: G.C. Leong; NCERT Class 11 Ch. 10; WMO Wind Atlas 2024)**

19. Answer: (a) 1, 2 and 4 only
Explanation:

- **Laterization** → Silica leached; Fe and Al oxides remain (tropical regions).
- **Calcification** → Calcium carbonate accumulation (semi-arid regions).
- **Gleization** → Anaerobic, waterlogged conditions (subarctic/tundra).
- **Podsolization** is *not* base accumulation—it involves *acidic leaching*.
  (Source: NCERT, FAO Soil Classification 2024)**

20. Answer: (b) O → A → B → C → R
Explanation:

- **O (organic layer)** – decaying leaves, humus
- **A (topsoil)** – mineral-rich with organic matter
- **B (subsoil)** – accumulation of leached materials (illuviation zone)
- **C (parent material)** – weathered rock fragments
- **R (bedrock)** – unweathered parent rock
  (Source: NCERT Class 11; G.C. Leong, FAO Soil Structure Notes 2024)**

21. **Answer:** (a) 1 and 2 only
Explanation:

- India hosts **~7–8% of global biodiversity**
- ranking among **17 megadiverse countries** (as per *CBD 2024*).
- **Highest diversity** occurs in **tropical forests (Western Ghats, North-East) — not in the Indo-Gangetic plains** which are highly modified by human activity.
  (Source: MoEFCC India State of Forest Report 2024; The Hindu Environment Section 2025)**

22. **Answer:** (a) Nokrek – Red Panda
Explanation:

- **Nokrek (Meghalaya)** → Red panda and citrus genetic diversity
- **Gulf of Mannar** → Marine species (dugong, corals)
- **Sundarbans** → Royal Bengal tiger
- **Nilgiri** → Lion-tailed macaque
  (Source: Goh Cheng Leong; MoEFCC Biodiversity Report 2024)**

As per **UNESCO-MAB 2024**, India now has **12 internationally recognized biosphere reserves** under the *World Network of Biosphere Reserves (WNBR)*

Biosphere Reserve	Location	Key Features / Species	Biodiversity Highlights (Approx. No. of Species)

Nilgiri	Tamil Nadu, Kerala, Karnataka	Evergreen forests; tiger, lion-tailed macaque	~3,500 species
Sundarbans	West Bengal	Mangroves, Bengal tiger, estuarine crocodile	~2,200 species
Nokrek	Meghalaya	Red panda, citrus gene pool	~1,500 species
Gulf of Mannar	Tamil Nadu	Coral reefs, dugongs, sea grass	~3,700 species
Great Nicobar	Andaman & Nicobar Islands	Leatherback turtle, Nicobar megapode	~2,000 species

23. Answer: (b)
Explanation:

- **Abyssal plains** are **extensive, flat regions** of the ocean floor between 3,000–6,000 m deep.
- They are **covered by fine sediments** transported by turbidity currents.
- Usually found **between continental rises and mid-ocean ridges**, **not at convergent boundaries**.
  (Source: G.C. Leong; NOAA Ocean Topography Report 2024)**

Major Oceanic Features

Feature Type	Examples	Associated Plate Boundary
Ocean Trench	Mariana, Java, Tonga	Convergent
Mid-Ocean Ridge	Mid-Atlantic Ridge	Divergent
Abyssal Plain	Atlantic Basin Floor	Passive Margin
Seamounts	Emperor–Hawaiian Chain	Hotspots

24. **Answer:** (b)
Explanation:

- The ocean floor profile generally follows this order:
  Continental Shelf → Continental Slope → Abyssal Plain → Oceanic Trench
- This progression shows the increasing depth from land to the deep ocean basin.
  (Source: NCERT Class 11, Ch. 12: *Structure of the Earth*; *NOAA Seafloor Atlas 2024*)**

25. Answer: b) 1 and 2 only
Explanation: As detailed earlier — expansion and crystallization of salts cause **mechanical disintegration** of rocks without altering their composition.
→ Hence, **physical weathering**, not chemical.

Sources:

- NCERT XI (Geomorphic Processes, Ch. 6)
- Goh Cheng Leong, *Physical and Human Geography*, Ch. 4

26. ANSWER

The correct answer is **c. 2 and 4** (Mudflow and Slump).

Explanation & breakdown

1. Classification of mass movements

Mass movements (also called mass wasting) are the downslope movement of earth material (soil, rock, regolith) under the influence of gravity, without a transporting medium like a river or glacier.

They can be classified by many criteria — material type, mechanism, slope, water content — but one important classification is by **speed** of movement (slow vs rapid).

According to **NCERT (Class XI)** for example:

> "The movements of mass may range from slow to rapid, affecting shallow to deep columns of materials and include creep, flow, slide and fall."

2. Slow movements vs rapid movements

- **Slow movements**: These are very gradual, often imperceptible in human time-scales. Examples include **creep** (soil gradually moving downslope mm/year to cm/year) and **solifluction** (a special type of very slow movement in periglacial environments where saturated soil flows slowly over a frozen layer).
- **Rapid movements**: These are comparatively fast, can pose hazards, often involve large masses, steep slopes, or saturated materials moving quickly. Examples include **mudflows**, **debris flows**, **slides**, **slumps**, etc

27. Answer: **c) 2, 3 and 4 only**

Explanation:

Additional Table for learner clarity

Factor	**Effect on slope stability**
Vegetation removal	Less root-reinforcement → weaker soil mass
Base undercutting (river/road)	Loss of support → steeper slope or undermined toe
High water infiltration / saturation	Increased pore pressure → lowered shear strength
Bedding or joint orientation favourable to slip	Pre-existing planes of weakness → easier slide

28. Answer: (b) Glacier — Moraine

Explanation:

- **Moraine** is a **ridge or mound of glacial till** (unsorted debris) deposited by a **glacier**.
- Other options:
  - Cirque → formed by **glaciers**, not wind.
  - Loess → formed by **wind**, not waves.

- Mushroom Rock → wind-eroded form, not river.

Sources:

- *NCERT Class XI, Chapter 7 – Landforms and their Evolution.*
- *Goh Cheng Leong – Physical Geography*, Ch. 10 "Glacial Landforms."

29. Answer: (a) Gorge → Meander → Delta

Explanation:

- Rivers evolve through **three stages**:
  1. **Youth Stage:** Erosional, forming **gorges, waterfalls**.
  2. **Mature Stage:** Lateral erosion dominates → **meanders, floodplains**.
  3. **Old Stage:** Deposition dominates → **deltas, ox-bow lakes**.

Sources:

- *NCERT Class XI – Fundamentals of Physical Geography.*
- *Goh Cheng Leong – Physical Geography (Work of Rivers).*

30. Answer: (c) Wind

Explanation:

- **Deflation** means removal of loose particles by wind.
- When wind continuously removes fine particles, **deflation hollows** form.
- **Mushroom rocks** are shaped by **abrasion**, where the wind erodes the base more than the top.

Infographic: Desert Landforms by Wind

Process	Landform
Deflation	Hollows
Abrasion	Mushroom Rock
Deposition	Sand Dune, Loess

Sources:

- *NCERT Class XI Geography – Landforms and their Evolution.*
- *IMD 2024 Desertification Atlas of India.*

31. **Answer:** (b)

Explanation:

- **Nebula** → Cloud of gas and dust (birthplace of stars).
- **Galaxy** → Vast system of stars bound by gravity (e.g., Milky Way).
- **Supernova** → Explosion of a dying massive star.

  (Sources: G.C. Leong; NCERT Class 8–11 Geography; *NASA Astrophysical Database 2025*)

32. **Answer: (b)** 1 and 3 only

Explanation:

- **Statement 1:** Correct — During *summer monsoon*, currents flow *westward*; during *winter monsoon*, they flow *eastward* in the **northern Indian Ocean**.
- **Statement 2:** Incorrect — *West Australian Current* is *cold*, flowing northward along western Australia.
- **Statement 3:** Correct — *Agulhas Current* is a *warm current* along southeast Africa.
  (Source: INCOIS India 2025; *NCERT Class 11 – Movements of Ocean Water*; *The Hindu, June 2024*)**

Important Currents

Ocean	Warm Currents	Cold Currents
Pacific	Kuroshio, North Equatorial	Oyashio, Peru (Humboldt)
Atlantic	Gulf Stream, North Atlantic Drift	Labrador, Canary
Indian	Agulhas, Monsoon Drift	West Australian
Southern/Antarctic	—	East Wind Drift (Cold)

33. **Answer: (c)** Continentality

Explanation:

- **Continentality** (distance from the sea) causes larger temperature variations in inland areas due to lack of moderating effect of the ocean.
- Coastal areas experience **maritime climate**; interiors experience **continental climate**.
  (Source: *G.C. Leong, Chapter – Temperature; NCERT Class 9 & 11 Geography*)

34. **Answer: (c) Armenia**

Explanation:

- The **Black Sea** is bordered by **Ukraine, Russia, Georgia, Turkey, Bulgaria, and Romania.**
- **Armenia** is **landlocked** and lies to the **south of Georgia**, without a coastline.
  (Sources: NCERT Class 9 – Contemporary India, *The Hindu (April 2025)* – "NATO and Black Sea Security", *CIA World Factbook 2025*)**

35. **Answer: (a)** 1 and 2 only

Explanation:

- **Kandla (Deendayal Port, Gujarat)** – India's **first free trade zone**, *tidal port* built on a creek of the Gulf of Kachchh.
- **Cochin Port (Kerala)** – *Natural lagoon harbour*, situated on the **Arabian Sea**.
- **Paradip Port (Odisha)** – *Artificial port* built on the coast, **not riverine**.

(Sources: NCERT Class 12 Geography, *Indian Express 2025*, *Ministry of Ports, 2024–25*)**

Port	Coast	Type	Recent Update (2024–25)
Visakapatnam	East	Natural deep port	Cruise & trans-shipment hub
Chennai	East	Artificial port	Major automobile export hub
Kandla (Deendayal)	West	Tidal port	Green Hydrogen bunkering facility
Vizhinjam	West	Deep-water port	India's first ITP
Paradip	East	Artificial port	LNG terminal commissioned
Cochin	West	Natural lagoon port	Cruise terminal operational

36. **Answer: (b)**

Explanation:

- The **India State of Forest Report (ISFR 2023)** shows **0.93% rise** in mangrove cover, led by **West Bengal, Gujarat, and Andhra Pradesh**.
- Driven by **community-based afforestation**, **mangrove plantation projects**, and **CSR-led coastal ecosystem restoration**.
- Supported by **National Coastal Mission and Blue Carbon initiatives (2024 updates)**.

(Sources: *ISFR 2023, The Hindu Jan 2025, MoEFCC Coastal Zone Management Report 2024*)**

Summary Table: Major Vegetation Types of India

Type	Rainfall Range (cm)	Representative Areas	Key Species
Tropical Evergreen	>200	Western Ghats, NE India	Ebony, Mahogany
Tropical Deciduous	100–200	MP, Odisha, Chhattisgarh	Teak, Sal
Thorn & Scrub	<75	Rajasthan, Gujarat	Acacia, Cactus
Montane	Variable	Himalayas, Nilgiris	Oak, Pine
Littoral/Mangrove	Coastal Deltas	Sundarbans, Mahanadi	Rhizophora, Avicennia

Indian Forest Distribution

🌳 = Evergreen 🌾 = Deciduous 🌵 = Thorn
❄️ = Montane 🌊 = Mangrove

🌳 Western Ghats 🌾 Central India 🌵 Rajasthan Desert
🌊 Sundarbans ❄️ Himalayas 🌳 NE States

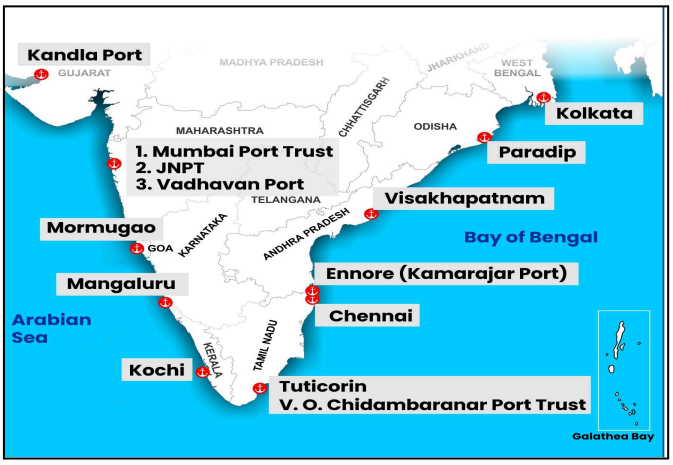
37. **Answer: (c) Vizhinjam**

Explanation:

- **Vizhinjam Port (Kerala)**, near Thiruvananthapuram, is India's **first deep-water trans-shipment port**.
- Developed by **Adani Ports** under PPP model.
- Natural depth of **20–24 metres**, capable of handling **Ultra Large Container Vessels (ULCVs)**.
- Strategic location: close to **East-West global shipping route**, reducing dependence on Colombo/Singapore hubs.
- Trial operations began in **2024**, commercial operation expected by **2025**.

(Sources: *Ministry of Ports 2024–25, The Hindu – Maritime Special, January 2025, Indian Express – Infrastructure 2025*)**

Major Ports of India:



38. Answer: (b) 2 only

Explanation:

All three mechanisms are distinct forms of precipitation.

Type	Mechanism	Example (India)
Convectional	Heating of land → air rises → condensation	Pre-monsoon thunderstorms (Kalbaisakhi in Bengal)
Orographic	Moist air lifted by mountain barriers	Western Ghats, Meghalaya
Cyclonic (Frontal)	Air convergence in low-pressure systems	Monsoon depressions
Hailstorms	Strong updrafts in cumulonimbus clouds	Central India (March–May)

39. **Answer: (b)** 2 and 3 only

Explanation:

- **Marble** is **metamorphic**, not igneous.
- **Sandstone → Sedimentary**
- **Slate → Metamorphic** (formed from shale).

  (Source: NCERT Class 11 – *Minerals and Rocks*)**

40. **Answer: (b)** The ratio of reflected radiation to incident solar radiation

Explanation:

- **Albedo = (Reflected Solar Radiation / Incoming Solar Radiation)** × 100
- **Fresh snow** has high albedo (~80–90%), oceans low (~10%).
- Global average albedo ≈ **30% (NASA 2025)**.

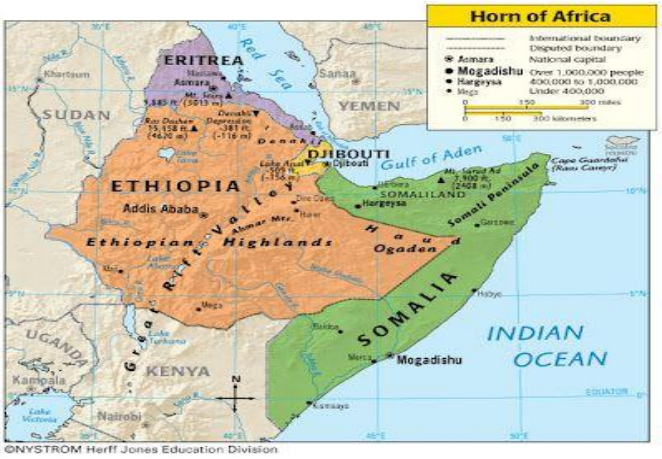
  (Sources: *NASA Earth Observatory 2025, NCERT Class 11 Ch. 11*)

41. **Answer: (a) 1, 2 and 3 only**

Explanation:

- **Horn of Africa = Somalia, Ethiopia, Eritrea, and Djibouti.**
- Lies in the **easternmost projection of Africa**, adjacent to **Gulf of Aden and Red Sea**.

- **Sudan** lies farther northwest and isn't part of the Horn.
  (Sources: *G.C. Leong – Africa: Regional Geography*, *The Hindu – Red Sea Conflict Coverage 2025*, *UN OCHA Humanitarian Atlas 2024*)**



42. **Answer: (b)** A–3, B–1, C–4, D–2
Explanation:

- **Littoral Forests** → *Sundarbans Delta (mangroves)*
- **Montane Forests** → *Nilgiri, Himalayas* (mixed conifers & broadleaf)
- **Thorn Forests** → *Rajasthan, Gujarat (xerophytes)*
- **Tropical Evergreen** → *Western Ghats, NE states (rainforest type)*
  (Source: *NCERT Class 11, G.C. Leong, ISFR 2023*)**

43. **Answer: (b)** 2 only
Explanation:

- **Humboldt (Peru) Current** – *Cold current* along the west coast of South America.
- **Gulf Stream** – *Warm current* flowing from the Gulf of Mexico toward Europe.
- **Labrador Current** – *Cold current* flowing southward along Canada's coast.
  (Source: NCERT Class 11, Ch. 13; *NOAA Oceanographic Atlas 2024*)**

44. **Answer: (b)** Gujarat
Explanation:

- **Khavda Renewable Park (Kutch, Gujarat)** – World's **largest renewable energy project**, expected capacity **30 GW**.
- Developed by **Adani Green Energy Ltd**; covers **538 sq km** in the **Rann of Kutch** region.
- Aligns with India's **National Green Hydrogen Mission (2023–2030)**.
  (Sources: *The Hindu, Jan 2025; Ministry of New and Renewable Energy Reports 2024–25*)**

45. **Answer: (b)** It is an extrusive igneous rock formed from rapid cooling of lava.
Explanation:

- **Basalt** forms when **lava cools rapidly on Earth's surface**, producing **fine-grained texture**.
- It covers the **Deccan Plateau** (Deccan Traps).
  (Source: *G.C. Leong, The Hindu 2024: "Volcanic landforms of the Deccan"*)**

46. **Answer: (a)** 1 only
Explanation:

- **Foliation** (banding due to pressure) is typical of **metamorphic rocks** like **gneiss**.
- Sedimentary rocks are **layered**, not crystalline.
  Igneous rocks form by **solidification**, not deposition.
  (Source: *NCERT Class 11, GSI Geological Atlas 2024*)**

Feature	Igneous	Sedimentary	Metamorphic
Origin	Magma/Lava solidification	Deposition of sediments	Transformation under heat & pressure
Texture	Crystalline	Layered	Foliated or banded
Examples	Basalt, Granite	Sandstone, Shale	Marble, Slate

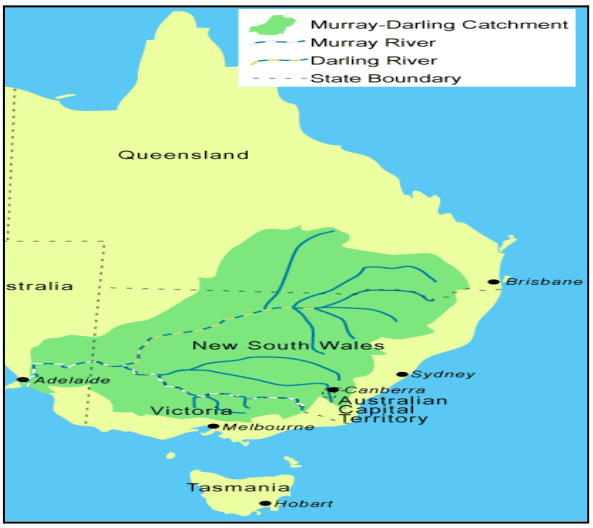
47. **Answer: (d)** 1, 2 and 3
Explanation:

- **Temperature inversion** occurs when the normal lapse rate is reversed.
- Common in winter or valleys → cold surface, warm air above.
- Causes **smog formation** in cities like Delhi (IMD, 2024).
  (Sources: *NCERT Class 11, G.C. Leong, The Hindu Air Quality Reports 2024*)

48. **Answer: (b)**
Explanation:

- The **Murray-Darling Basin** covers parts of **New South Wales, Victoria, and South Australia**.
- It drains **interior plains**, supporting **irrigated agriculture**—notably **wheat, barley, and sheep grazing**.
- Ends in a **lagoonal estuary** near **Lake Alexandrina (South Australia)**

Sources: *NCERT Class 11 Geography (World Rivers)*; *Australian Bureau of Agriculture and Water Resources 2024*; *Indian Express (Feb 2025) – "Australia's Water Policy Reforms."*



49. **Answer: (a)** 1 and 2 only

Explanation:

- **Tropical Deciduous (Monsoon) Forests** are the **most widespread forests in India**, found in areas with **100–200 cm rainfall** (Central India, foothills of Himalayas, Odisha, Chhattisgarh, Jharkhand).
- Dominant species: **Teak, Sal, Bamboo, Shisham**.
- They **shed leaves during dry summer**, *not monsoon*.

(Source: *NCERT Class 9, ISFR 2023, G.C. Leong*)**

50. **Answer: (b)** Tropical evergreen forests

Explanation:

- **Tropical Evergreen Forests** (Western Ghats, Andaman-Nicobar, NE India) store the **maximum carbon** due to dense biomass.
- Continuous canopy and year-round photosynthesis enhance **carbon sequestration capacity**.
- India's **Forest Survey Report 2023** identifies **Western Ghats and NE states** as **major carbon sinks**.

(Sources: *MoEFCC ISFR 2023, The Hindu Feb 2025, NCERT Class 11*)**

51. **Answer: (b)** 1 and 3 only

Explanation:

- **Cirque** (corrie) – Armchair-shaped depression at the glacier head formed by plucking and abrasion.
- **U-shaped valley** – Carved by glacier erosion, replacing a V-shaped river valley.
- **Esker** – A *depositional* feature (not erosional), formed by meltwater streams under glaciers depositing sediments.

Glacial Landforms

Type	Landform	Key Characteristic	Indian Example / Relevance
Erosional	Cirque	Bowl-shaped hollow	Gangotri glacier head

	U-shaped Valley	Deep trough	Pindari Valley, Uttarakhand
	Arete / Horn	Sharp ridge / peak	Nanda Devi region
Depositional	Moraine	Ridge of debris	Zemu Glacier, Sikkim
	Drumlin	Streamlined hill of till	Ladakh (localized)
	Esker	Long winding ridge	Arctic & Ladakh analogs

52. **Answer: (b) Great Lakes Region of North America**
Explanation:

- **Rust Belt** refers to the **declining industrial areas** of **USA's Great Lakes region — Pittsburgh, Cleveland, Detroit, Buffalo**.
- Once famous for **steel, automobiles, and manufacturing**, the region faced **deindustrialization** post-1970s.
- Revival efforts include **green tech, robotics, and electric vehicles (EV manufacturing 2024–25)**

Industrial cities: Detroit (cars), Pittsburgh (steel), Cleveland (engineering).
(Sources: *G.C. Leong, UNIDO Industrial Outlook 2024, The Hindu – Global Industry Trends 2025*)**

53. **Answer: (a) 1 and 3 only**
Explanation:

Type	Key Traits	Example Regions
Intensive Farming	High labour, high productivity, small landholdings	India, China, Japan
Extensive Farming	Mechanized, large-scale, low labour per hectare	USA, Australia, Canada

Visual Summary (Agricultural Intensity Gradient)

↑
Labour & Capital per unit area
|
| Intensive → Densely Populated (Asia)
|
| Extensive → Sparsely Populated (USA, Canada)
↓

Sources:

- NCERT Class 10: *Agriculture*
- G.C. Leong: *Agriculture*

54. **Answer: (a) Plantation Agriculture – Assam and Kerala**
Explanation:

Agricultural Type	Region	Key Features
Plantation	Assam (Tea), Kerala (Rubber)	Single crop, capital-intensive, export-oriented
Dairy Farming	Temperate regions of Europe	Milk & livestock products
Nomadic Herding	Desert, tundra regions	Movement in search of pastures
Mixed Farming	Temperate zones (Europe, USA)	Crop + Livestock

Plantation Agriculture in India (2024–25 Highlights):

- **Tea:** Assam, Darjeeling (India = 2nd largest global producer, after China)
- **Coffee:** Karnataka, Kerala
- **Rubber:** Kerala, Tamil Nadu
- **Oil Palm Missions (PIB 2024):** Promoting commercial plantations in NE India

Sources:

- NCERT Class 10, Ch. 4: *Agriculture*
- G.C. Leong, Ch. 15: *Agriculture*

55. **Answer: (d)** 1 and 3 only

Explanation:

- The **Peninsular Plateau** (Aravalli–Chotanagpur–Deccan region) is **Archaean in origin** (>2.5 billion years old).
- **Western Ghats** average 900–1600 m, higher than **Eastern Ghats (600–900 m)**.
- Predominantly composed of **igneous (basaltic Deccan Traps)** and **metamorphic rocks (gneiss, schist)**.

Sources: NCERT Class 9, Class 11 (*India Physical Environment*), G.C. Leong.

56. **Answer: (b)** The Great Northern Plains

Explanation:

- The **Indus and its tributaries** (Jhelum, Chenab, Ravi, Beas, Sutlej) form the **Punjab–Haryana plains**, a part of the **Great Northern Plains**.
- They carry alluvium from the Himalayas and deposit it to form fertile plains.

Sources: NCERT Class 9 (*Drainage*), G.C. Leong, *The Hindu (2024)* article on *Indus Water Treaty updates.*

57. **Answer: (b)** The inclination of the Earth's axis causes variation in the angle of sunlight.

Explanation:

- Due to the **axial tilt (23.5°)**, sunlight strikes the Earth at different angles across latitudes.

- Near the **Equator**, the Sun's rays are almost vertical → **little difference** in day and night.
- Near the **Poles**, sunlight arrives at a shallow angle, and the **tilt amplifies this difference**, causing **polar days and nights** during solstices.

Concept Table

Latitude	Solar Angle	Day-Night Difference
0° (Equator)	Direct (90°)	~12 hours each
45°	Moderate	Noticeable difference
66.5° (Polar Circles)	Very low	Extreme difference (24-hour day/night)

Sources:

- **NCERT Class 11 – Fundamentals of Physical Geography (Ch. 2)**
- **G.C. Leong – The Earth and the Universe**

Key Earth Movements and Their Effects

Movement	Period	Effect	Example/Observation
Rotation	24 hours	Day and Night	Different time zones
Revolution	365¼ days	Seasons	Summer, Winter, Spring, Autumn
Axial Tilt (23.5°)	Constant	Unequal solar radiation	Polar days/nights
Precession	26,000 years (approx.)	Slow change in axis direction	Affects pole star position

58. **Answer: (b)** Traditional practice in areas with dense forests and tribal populations

Explanation:

Shifting Cultivation (Jhuming):

- Practiced in **hilly and forested regions** (e.g., Nagaland, Mizoram, Meghalaya).
- Farmers clear a patch of forest by **slash and burn**, cultivate for a few years, then move to another patch.
- Soil fertility is restored naturally over years.
- Environmentally unsustainable due to **shortened fallow periods**.

Region	Local Name
North-East India	Jhum
Central America	Milpa
Indonesia	Ladang
Africa	Chitemene

Sources:

- **NCERT Class 10**, Ch. 4: *Agriculture*
- **G.C. Leong**, Ch. 15: *Agriculture*

59. **Answer: (c) 1 and 3 only**
Explanation:

Region	Resource Base	Notes
Ruhr (Germany)	Coal & Iron	Traditional heavy industries
Osaka–Kobe (Japan)	**Imported resources**, not hydropower	Relies on trade & technology
Eastern China (Shanghai–Beijing belt)	Coal, iron, manganese	Rapid industrial growth post-2000
Po Basin (Italy)	Agricultural + Hydro, **not petroleum**	Known for textiles & machinery

Concept: Industrial growth depends on **resource base, capital, market access, and transport connectivity.**
(Sources: *NCERT Class 12, G.C. Leong, The Hindu – World Economic Geography 2025 Edition*)**

60. **Answer: (a) 1 and 3 only**
Explanation:

Region	Location	Key Industries	Remarks
Ruhr	Germany	Iron, steel, machinery	Heart of European industry; near Rhine River
Donetsk	**Ukraine**, not USA	Coal and metallurgical industries	Part of the Donbas industrial belt
Kuznetsk	Russia	Iron & steel, engineering	Located in Siberia
Great Lakes	**USA–Canada**, not Japan	Automobiles, engineering, steel	Chicago–Detroit–Cleveland industrial zone

Concept: Industrial regions are concentrated where **power, raw materials, transport & markets** converge.
(Sources: *G.C. Leong; NCERT Class 12: Human Geography; The Hindu Business Review, July 2024*)**

61. Answer: (b) Ganga Plains and Brahmaputra Plains
Explanation:

- The **Malda Fault Zone (or Rajmahal–Garo Gap)** lies between the **Ganga** and **Brahmaputra plains** in **West Bengal**.
- It is a zone of crustal weakness, marking a transition between the two river systems.

Sources: NCERT Class 11 (*India Physical Environment*), G.C. Leong, Geological Survey of India (2024).

62. **Answer: (a) Origin**

Explanation:

- **Fold Mountains** (e.g., Himalayas, Alps) are formed by **compression** and folding of crustal rocks.
- **Block Mountains** (e.g., Vindhyas, Sierra Nevada) form due to **faulting** and **vertical movement** of crustal blocks.
- Both are **tectonic landforms**.
  (Sources: NCERT Class 9 & 11; G.C. Leong Ch. 5 – Landforms of the Earth)**

63. **Answer: (b) Pampas — South America**

Explanation:

- **Downs** are in **Australia**, **Pampas** in **Argentina (South America)**, **Prairies** in **North America**, and **Steppes** in **Eurasia**.
- Pampas are known for **extensive wheat cultivation and cattle ranching**.
  (Sources: *NCERT Class 11, G.C. Leong, UNEP 2024*)**

NORTH AMERICA	- PRAIRIES
EURASIA	- STEPPES
SOUTH AMERICA	- PAMPAS
SOUTH AFRICA	- VELDT
AUSTRALIA	- DOWNS
NEW ZEALAND	- CANTERBURY PLAINS

64. **Answer: (a) A–2, B–3, C–1**

Explanation:

- **Pampas (Argentina):** cattle ranching (extensive meat exports).
- **Prairies (North America):** wheat cultivation on mechanized farms.
- **Veldt (South Africa):** sheep rearing and mixed farming.
  (Sources: *NCERT Class 11 Geography, FAO Global Agricultural Patterns 2025, G.C. Leong*)**

Summary Table: Temperate Grasslands of the World

Name	Continent	Climate	Main Occupation	Notable Features
Prairies	North America	Continental	Wheat, Maize	“Granary of the World”
Steppes	Eurasia	Semi-arid	Pastoralism	Longest continuous grassland
Pampas	South America	Humid temperate	Cattle Ranching	Fertile black soils
Veldt	South Africa	Subtropical	Sheep farming	Mixed farming on plateau
Downs	Australia	Temperate	Sheep rearing	Wool production

65. **Answer: (b)** Tropical Rainforest → Tropical Deciduous → Temperate Grassland → Coniferous → Tundra

Explanation:

Latitude Zone	Vegetation Type	Examples
Equatorial	Tropical Rainforest	Amazon, Congo
Tropical	Deciduous & Savanna	India, Africa
Mid-latitude	Temperate Grasslands	Prairies, Steppes
High-latitude	Coniferous (Taiga)	Siberia, Canada
Polar	Tundra	Arctic, Greenland

Sources: *NCERT Class 11: Life on the Earth; G.C. Leong – Natural Vegetation Chapter; WWF Biome Atlas 2025*

66. **Answer: (a) 1 and 2 only**

Explanation:

- India ranks among the **top three producers of oilseeds** (after the USA and China).
- **Groundnut (Kharif), Mustard (Rabi), and Soybean (Kharif)** dominate output (~80%).
- Oilseeds are **both Kharif and Rabi**, not just Rabi crops.
  (Sources: *PIB 2025; The Indian Express Agricultural Review 2024; NCERT Class 10, Chapter: Agriculture*)**

Summary Table: Key Crops and Their Properties

Crop	Type	Major States	Notable Property
Rice	Kharif	West Bengal, UP	Water-intensive, tropical crop
Wheat	Rabi	Punjab, Haryana, UP	Temperate, high yield
Bajra	Kharif	Rajasthan, Gujarat	Drought-resistant
Ragi	Kharif	Karnataka, TN	Calcium-rich millet
Sugarcane	Annual	UP, Maharashtra	Cash crop, high sucrose
Groundnut	Kharif	Gujarat, TN	Oilseed, nitrogen-fixing
Cotton	Kharif	Maharashtra,Gujarat	Fibre crop, needs black soil

Agricultural Seasons in India (Infographic)

| Rabi: October – March (Winter) |
| → Wheat, Barley, Mustard, Pea |
| Zaid: March – June (Summer) |
| → Watermelon, Cucumber, Muskmelon |

67. **Answer: (a)** 1 and 3 only
Explanation:
- The **Western Coastal Plains** (50–80 km wide) are **narrower** and steeper than the **Eastern Plains (100–120 km)**.
- The **Konkan Coast** extends from **Mumbai to Goa**, not Goa to Kochi (that's the Malabar Coast).
- Formed by **fluvial and marine deposition** of short, swift west-flowing rivers.

Sources: NCERT Class 9, G.C. Leong, *The Hindu (2024)* – Coastal erosion studies.

68. **Answer: (c) Himalayas**
Explanation:
- **Himalayas** are **Tertiary fold mountains**, formed about **50 million years ago** by the **collision of the Indian and Eurasian plates**.
- **Aravallis** are **Precambrian (oldest)**.
- **Western Ghats** are **faulted block mountains** formed in **Cretaceous** period.
  (Sources: NCERT Class 11 – Ch. 6; Geological Survey of India 2024)**

69. **Answer: (d)** Indo-Australian and Sunda Plates
Explanation:
- The **Andaman–Nicobar Islands** lie along the **subduction zone** where the **Indian Plate** is subducting beneath the **Sunda Plate (part of the Eurasian Plate system)**.
- This zone is seismically active and associated with the **Andaman Trench** and **volcanic activity (Barren Island volcano)**.

Sources: NCERT Class 11 (*India Physical Environment*), *G.C. Leong – Earthquakes and Volcanoes*, *The Hindu (2025)* – "Earthquake Swarm near Andaman Sea".

70. **Answer: (b) 3 and 4 only**
Explanation:
All are **major fold mountains** of different continents:
- **Andes (South America)** – along the Pacific Ring of Fire.
- **Rockies (North America)** – Cordilleran system.
- **Atlas (Africa)** – NW Africa, Morocco to Tunisia.
- **Alps (Europe)** – between Italy, Switzerland, and France.
  (Sources: G.C. Leong; NCERT Class 11 Atlas; The Hindu, "World Geophysical Mapping Project", 2024)**

71. **Answer: (c)** 1 and 3 only

Elaborated Explanation (≈180 words):

The **adiabatic lapse rate** defines how temperature changes when air parcels **rise or descend** without exchanging heat with the surrounding environment.

- The **Dry Adiabatic Lapse Rate (DALR) = 10°C/km** (when air is unsaturated).
- The **Saturated Adiabatic Lapse Rate (SALR) = 5–6°C/km** (when air is saturated).

The **SALR is lower** because condensation releases **latent heat of vaporization**, which partly offsets cooling during ascent. This process plays a key role in **cloud formation, convection currents**, and **thunderstorm development**.

Thus— adiabatic processes govern weather phenomena, influence vertical stability, and affect rainfall distribution.

Sources:

- NCERT Class 11 – *Atmospheric Processes*
- G.C. Leong – *Temperature, Pressure, and Air Movement*

Atmospheric Temperature Lapse Rates

Type	Rate (°C/km)	Condition	Remarks
Normal Lapse Rate	6.5	Average global rate	Standard condition
Dry Adiabatic	10.0	Unsaturated air	Faster cooling
Saturated Adiabatic	5.0–6.0	Moist air	Slower cooling (latent heat released)
Inversion	–	Temp increases with height	Winter, stable air

72. **Answer: (b) Great Circle routes represent the shortest distance between two points on a sphere.**

Explanation:

The **Earth's surface** is spherical, not flat. Therefore, the **shortest distance** between any two points on it is **not a straight line (as on a map)** but an **arc of a great circle**. Airlines use these **Great Circle routes** to **minimize flight time, reduce fuel consumption**, and optimize efficiency.

For example, a flight from **New Delhi to San Francisco** doesn't follow a straight path on the Mercator map but arcs over the **Arctic region**, following a **Great Circle path**. This saves hundreds of kilometres and several hours of flight time.

Such routes are also used by **shipping lines** and **long-haul submarines**. However, practical routes may slightly deviate due to **airspace restrictions, weather, or jet streams**.

This principle is derived from **spherical trigonometry**—a field of study in **cartography and navigation**.

Thus, Great Circles serve as the **shortest and most energy-efficient routes** on the globe.

Sources:

- NCERT Class 11 – *Fundamentals of Physical Geography*
- G.C. Leong – *Earth as a Planet*

73. **Answer: (a) 1 and 3 only**

Explanation:

- **Thematic maps** are designed to represent **specific geographical phenomena or themes** — such as population density, literacy, crop distribution, or rainfall. Unlike physical or political maps, which show general geography, thematic maps reveal **spatial patterns and regional variations**.
- **Statement 1** is correct — they highlight a *particular subject* over an area.
- **Statement 2** is incorrect — thematic maps can represent **quantitative data** (numerical, like population per km²) and **qualitative data** (categories, like soil types)
- **Statement 3** is correct — *choropleth maps* use different shades or colors to show statistical variation (e.g., Census of India maps depicting literacy rates).

  These maps are crucial for **policy-making, environmental studies**, and **development planning**.

Example Table:

Type of Map	Focus	Example
Physical	Relief, terrain	Himalayas, Rivers
Political	Boundaries	States, Capitals
Thematic	Specific data	Population Density

Sources:

- NCERT Class 12 – *Practical Work in Geography Part II*
- Census of India (2024) – Population Atlas

74. **Answer: (a) Intense leaching of bases and iron under acidic conditions**

Explanation:

Podzolization occurs in **cold, humid climates**, typically under **coniferous forest cover** (Taiga biome). Organic acids from decomposed needles **leach iron, aluminium, and bases** from the upper layer (A-horizon), leaving it **ash-grey and acidic**. These leached materials deposit in the **B-horizon**, forming a **dark illuvial layer** rich in iron and humus.

The resulting **podzolic soils** are **infertile and acidic**, needing liming for cultivation. They occur in **Northern Europe, Russia, Canada**, and at **high-altitude Himalayan regions** in India.

Podzolization contrasts with:

- **Laterization** (oxidation under warm climate),
- **Gleization** (waterlogging reduction),
- **Calcification** ($CaCO_3$ accumulation).

Thus, it reflects the **interplay between cold climate, vegetation type, and acidic weathering** — a classic example of **climatic soil zonation** in geography.

Sources:

- *NCERT Class 11 – Fundamentals of Physical Geography (Ch. 6)*
- *G.C. Leong – Ch. 3: Weathering and Soils*

Major Soil Formation Processes

Process	Climate	Main Mechanism	Resulting Soil Type
Laterization	Hot & Wet	Intense leaching	Laterite Soil
Podzolization	Cold & Humid	Acid leaching	Podzols
Calcification	Semi-arid	$CaCO_3$ accumulation	Calcareous Soils
Gleization	Waterlogged	Reduction (anaerobic)	Gley Soils

75. **Answer: (b) 2 and 3 only**

Explanation:

All three are correctly matched:

- **Khavda Renewable Park** (30 GW capacity, Gujarat) – world's largest hybrid solar-wind park (Adani Green, 2025).
- **Kudankulam** – India's largest nuclear plant (2,000 MW operational, 2,000 MW under construction).
- **Teesta** – Major hydropower project in Sikkim on the Teesta River.

(Sources: The Hindu 2025; MNRE, NPCIL; CEA Project List 2024)**

76. **Answer: (a) Connects Buenos Aires in Argentina to Santiago in Chile across the Andes Mountains**

Explanation:

- **Trans-Andean Railway** connects **Buenos Aires (Argentina)** to **Santiago (Chile)** across the **Andes Mountains**, making it one of the **highest-altitude railway routes** in the world.
- Constructed in the early 20th century; partly modernized in recent decades for **South American integration projects (Mercosur connectivity)**.

(Sources: *NCERT Class 12: Transport and Communication; The Hindu – "South America's Cross-Andean Projects", 2024; UNASUR Infrastructure Report, 2024*)**

Summary Table – Major International Transport Routes

Route / Corridor	Connects	Key Geography / Feature
Trans-Siberian Railway	St. Petersburg – Vladivostok	Ural Mountains, Ob & Yenisei Rivers
INSTC	Mumbai – Moscow via Iran	Multimodal: Ship + Rail + Road
Panama Canal	Atlantic – Pacific	Isthmus of Panama
Suez Canal	Mediterranean – Red Sea	Egypt, avoids Cape Route
Cape Route	Europe – Asia via South Africa	Cape of Good Hope

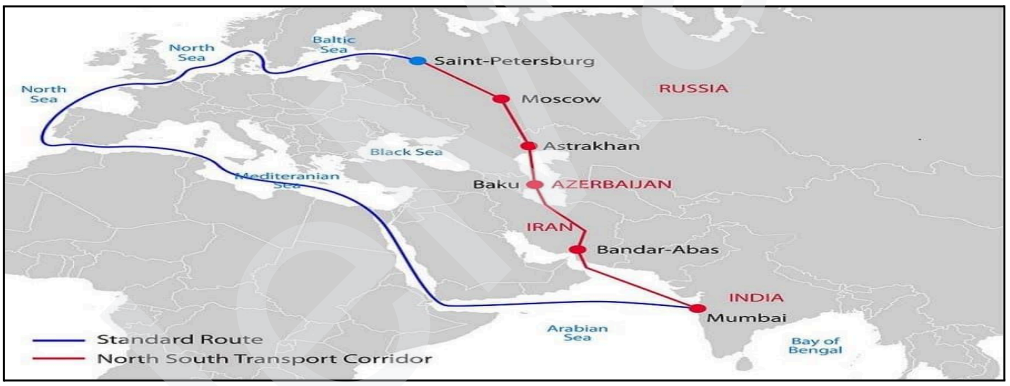
Trans-Andean Railway	Buenos Aires – Santiago	Crosses Andes Mountains

GLOBAL TRANSPORT ROUTES

Trans-Siberian – Eurasia (Russia)
INSTC – India–Iran–Russia (Caspian Corridor)
Suez Canal – Mediterranean–Red Sea
Panama Canal – Atlantic–Pacific
Cape Route – Around Africa
Trans-Andean – Argentina–Chile

77. **Answer: (a) India, Iran, Russia**
Explanation:

- **INSTC (International North–South Transport Corridor)** is a **7,200 km multi-modal network** (ship, rail, road) connecting **Mumbai (India)** to **Moscow (Russia)** via **Iran (Bandar Abbas, Chabahar)** and **Caspian Sea ports**.
- Aims to reduce transport cost by ~30% and time by ~40%.
- Includes participation from **13 countries** (India, Russia, Iran, Azerbaijan, etc.).
  (Sources: *The Hindu, June 2024; Ministry of External Affairs, INSTC Update 2025; NCERT Class 12: Transport and Communication*)**



78. **Answer: (a) 1 and 2 only**
Explanation:

- **Rice** needs >25°C and 100–200 cm rainfall.
- **Wheat** prefers 10–15°C during growth and bright sunlight for ripening.
- **Cotton** requires high temperature but **moderate rainfall (50–100 cm)** and dry conditions at picking time; humid conditions all year are not suitable.
  (Source: NCERT Class 10; G.C. Leong; IMD Agricultural Bulletin 2024)**

79. **Answer: (a)** The Andes were formed by oceanic–continental convergence, while the Himalayas were formed by continental–continental convergence
Explanation:

Aspect	Himalayas	Andes

Plate Type	Continental–Continental (Indian + Eurasian)	Oceanic–Continental (Nazca + South American)
Origin	Collision	Subduction
Age	Young Fold Mountains (~50 million years)	Young Fold Mountains (~65 million years)
Volcanism	Absent	Present (many active volcanoes)
Example Peak	Mt. Everest	Mt. Aconcagua

Concept Summary:

- The **Andes** are a **volcanic fold mountain range** running along South America's Pacific coast — part of the **"Ring of Fire."**
- The **Himalayas** are **non-volcanic fold mountains** formed by the collision of two continental plates.

Sources:

- NCERT Class 11 – *Fundamentals of Physical Geography*, Ch. 4
- G.C. Leong – *Mountains of the World*

80. **Answer: (d)** 1, 2, 3 and 4

Explanation:

The **horizontal distribution of temperature** varies due to several interacting factors:

- **Latitude:** Solar insolation decreases from equator to poles, lowering temperature.
- **Altitude:** Higher areas are cooler due to the lapse rate.
- **Ocean Currents:** Warm currents (e.g., Gulf Stream) raise coastal temperatures; cold currents (e.g., Labrador Current) lower them.
- **Vegetation Cover & Land Use:** Forested areas moderate temperature by increasing humidity, whereas urban surfaces amplify heat through the "urban heat island effect."

Together, these factors create **isotherm patterns** (lines joining places of equal temperature) that reveal global climatic variation.

Sources:

- NCERT Class 11 – *Temperature Distribution and Heat Balance*
- G.C. Leong – *World Climate & Temperature Patterns*

81. **Answer: (c) They do not share the same centre as the Earth.**

Explanation:

A **small circle** is any circle drawn on the Earth's surface whose **centre does not coincide with the centre of the Earth**. Therefore, they **do not divide the Earth into equal halves**. All **latitudes except the Equator** (such as the Tropic of Cancer, Arctic Circle, etc.) are small circles.

Small circles are **smaller in radius** than the great circle and have **lesser circumference**. They are primarily used for **defining zones of climate** and **solar radiation belts**, rather than

navigation. For instance, the **Tropic of Cancer (23.5°N)** marks the northernmost latitude where the Sun can be directly overhead.
Hence, option (c) is correct.
Sources:

- NCERT Class 11 – *Fundamentals of Physical Geography*, Ch. 2
- G.C. Leong – *Earth as a Planet*

82. **Answer: (a) 1 and 2 only**
Explanation:
Modern **cartography** has evolved from manual map-making to **digital mapping**, combining **remote sensing, GIS, and GPS** technologies.
Statement 1 is correct — GIS integrates multiple layers of spatial data (satellite images, topography, census data) to analyze patterns in urban planning, agriculture, and disaster management.
Statement 2 is correct — the **Survey of India**, under the **Department of Science & Technology**, is India's **national mapping agency**, producing topographic and thematic maps, including **Open Series Maps (OSM)** for civilian use.
Statement 3 is incorrect — *remote sensing* is integral to cartography. It collects data from **satellites, drones, and aircraft**, producing high-resolution imagery for mapping land use, vegetation, and terrain.
Infographic Summary:

Tool	Function	Example
GIS	Data integration & analysis	Urban planning
GPS	Positioning	Navigation
Remote Sensing	Earth observation	ISRO's Cartosat-3

Sources:

- NCERT Class 12 – *India: People and Economy*, Ch. 2 "The World Population: Density and Distribution"
- *Survey of India Annual Report 2024–25*

83. **Answer: (b)** The three-stage nuclear programme aims at long-term energy sustainability using thorium
Explanation:
India's **three-stage nuclear power programme**, formulated by **Dr. Homi Bhabha**, is aimed at achieving **energy self-reliance** using **thorium reserves** (India holds ~25% of global thorium).

- **Stage 1:** Pressurised Heavy Water Reactors (PHWRs) using natural uranium (e.g., Tarapur, Kakrapar).
- **Stage 2:** Fast Breeder Reactors (FBRs) using plutonium from Stage 1 reactors.

- **Stage 3:** Advanced reactors using thorium to produce uranium-233 as fuel.

  The programme reduces dependence on imported uranium. The **Prototype Fast Breeder Reactor (PFBR)** at **Kalpakkam** (operational trials in 2024–25) is a significant milestone in Stage 2.

  This long-term approach complements India's **commitment to clean energy** under the **Net Zero 2070** goal.

  Sources:
- *G.C. Leong – Energy Resources*
- *PIB (2024): DAE and NPCIL Annual Report*

84. **Answer: (a) Thermal > Renewable > Hydro > Nuclear**
Explanation:
As per the **CEA report (2025)**, India's total installed capacity (about 440 GW) is dominated by:

- **Thermal power (~50%)**
- **Renewables (~35%)**
- **Hydropower (~12%)**
- **Nuclear (~2%)**

  This reflects India's transition to a greener energy mix while maintaining reliability.

  (Source: Central Electricity Authority, *Monthly Report 2025*)**

85. **Answer: (b) Atlantic Ocean and Pacific Ocean**
Explanation:

- **Panama Canal** (opened 1914, expanded 2016) connects **Atlantic (Caribbean Sea)** and **Pacific Ocean** through the **Isthmus of Panama** in Central America.
- Vital for global trade — avoids long Cape Horn route around South America.
- 2024 news: drought conditions in Panama caused **shipping delays** due to low canal water levels.

  (Sources: *G.C. Leong; NCERT Class 12; The Hindu, Aug 2024 – "Panama drought disrupts trade"*)**

86. **Answer: (a) 1 and 2 only**
Explanation:

- **Ragi:** Karnataka produces over **40% of India's output** (2024 data, Ministry of Agriculture).
- **Tea:** Assam remains India's largest tea producer.
- **Sugarcane:** Major producers are **Uttar Pradesh and Maharashtra**, not Gujarat.
  (Sources: The Hindu – Agri Economy 2024; NCERT Class 10; Tea Board of India Annual Report 2024)**

87. **Answer: (c)**
Explanation:

- **Tropical Monsoon Region** – Found in India, Southeast Asia, and parts of Africa.
- Characterized by **tropical deciduous forests** (sal, teak, bamboo).
- Trees shed leaves in dry season to conserve water.
- **Equatorial regions** → Evergreen rainforests; **Mediterranean** → Sclerophyllous shrubs; **Tundra** → Mosses & lichens.
  Sources: *NCERT Class 9 – Contemporary India I, G.C. Leong, WWF Global Biome Map (2024)*

88. **Answer: (b)** Grasslands with scattered trees, alternating wet and dry seasons
Explanation:

- **Savanna** → Tropical grasslands found between **10°–20° latitude** in Africa, Brazil, Australia, India.
- Rainfall: **500–1000 mm**, wet and dry seasons alternate.

- Vegetation: Tall grasses, acacia, and baobab trees.
  Sources: *NCERT Class 7, G.C. Leong, The Hindu (Aug 2024) – "African Grassland Ecosystems and Climate Resilience"*

89. **Answer: (a) 1 and 2 only**
Explanation:
Key Findings (2025 Report):

Region	Trend	Reason
Western Himalayas	Moderate retreat	Lesser monsoon influence
Central Himalayas	Fast retreat	Higher temperature, snow melt
Eastern Himalayas	**Fastest retreat**	Strong monsoonal warming
Karakoram	**Stable or advancing**	Known as **"Karakoram Anomaly"**

Scientific Note:

- Glacial retreat affects **river systems** (Ganga, Brahmaputra), **hydropower**, and **disaster vulnerability**.
- The Karakoram Anomaly reflects **regional climatic variation** due to **western disturbances** and **local cooling patterns.**

Source References:

- Geological Survey of India (GSI) – *Himalayan Glacier Status Report 2025*
- *The Hindu (Jan 2025)* – "Eastern Himalayas melting fastest, GSI finds"

Visual Infographic: Glacial Change Trend (2024–25)

```
Himalayan Glacier Retreat Trend
-----------------------------------------
Region            | Retreat Status
-----------------------------------------
Karakoram Range   | Stable / Slight Advance  ↑
Western Himalayas | Moderate Retreat         ↓
Central Himalayas | Significant Retreat      ↓↓
Eastern Himalayas | Rapid Retreat            ↓↓↓
-----------------------------------------
```

90. **Answer: (b) 2 only**
Explanation:

- The **Trans-Himalayas**, **north** of the **Great Himalayas**, include **Karakoram, Ladakh, and Zaskar ranges**.
- Features **cold desert climate**, sparse vegetation, and **tectonic uplift** zones.
- The **Siachen Glacier** lies in this zone.
  (Sources: NCERT Class 11 – India Physical Environment, Ch. 6; Geological Survey of India, 2024; The Hindu – "Glacial Studies in Ladakh", 2025)**

91. **Answer: (a) 1 and 3 only**

Explanation:

- **Chambal** is a right-bank tributary of the Yamuna, which in turn is a major tributary of the Ganga. Originating in the Vindhyan Range (Madhya Pradesh), the Chambal is famous for its deep ravines and alluvial badlands.
- **Gandak and Ghaghara** are both tributaries of the Ganga, not the Brahmaputra. They rise in the Nepal Himalayas and flow through Bihar and Uttar Pradesh before joining the Ganga.
- **Indravati**, originating in the Western Ghats of Chhattisgarh, is a major tributary of the Godavari River, which ultimately drains into the Bay of Bengal.
  Sources: NCERT Class 9 & 11 Geography, G.C. Leong, *The Hindu*, March 2025, Ministry of Jal Shakti Annual Report 2024–25)**

92. **Answer: (c) 1 and 3 only**

Explanation:

- **Statement 1: Correct**. The **Sutlej** originates from **Rakshastal Lake** near Mount Kailash in Tibet and enters India through Himachal Pradesh.
- **Statement 2: Incorrect**. The **Beas River** does **not** join the Chenab; it meets the **Sutlej** near Harike in Punjab.
- **Statement 3: Correct**. The **Jhelum River**, originating from **Verinag Spring in the Kashmir Valley**, flows through **Wular Lake** — one of Asia's largest freshwater lakes — before entering Pakistan.
  The **Indus River System**, shared between India and Pakistan under the **Indus Waters Treaty (1960)**, is vital for irrigation, hydroelectricity, and ecology in the northwestern Himalayas.
  It consists of **five main tributaries** — Jhelum, Chenab, Ravi, Beas, and Sutlej — forming the "Punjab" (land of five rivers).
  Sources: NCERT Class 9 & 11; G.C. Leong; *The Indian Express*, March 2025 – "Hydropolitics of Indus Basin"; Ministry of Jal Shakti Report, 2024–25

93. **Answer: (a) 1 and 3 only**

Explanation:

Peninsular rivers are **older**, **mature**, and **geologically stable** compared to the Himalayan rivers.

- **Statement 1:** Correct. These rivers are **rain-fed** and become **seasonal**, flowing fully during the monsoon. Examples: Godavari, Krishna, and Cauvery.
- **Statement 2: Incorrect**. Meandering and ox-bow lake formation are typical of **young, alluvial Himalayan rivers**, not the **hard rock terrains** of the Peninsular Plateau.
- **Statement 3:** Correct. Peninsular rivers have **short courses**, **narrow basins**, and **steep gradients** due to the **hard crystalline rocks** of the Deccan Plateau.

This distinction helps in explaining regional disparities in water availability and hydropower potential.

Sources:

- NCERT Class 11 – *India: Physical Environment*, Chapter 3
- G.C. Leong – *River Erosion and Deposition*

94. **Answer:** (a) Khichan Wetland and Menar Wetland — both in Rajasthan
Explanation:

- Option (a) is correct: India added **Khichan (Phalodi, Rajasthan)** and **Menar (Udaipur district, Rajasthan)** as Ramsar Sites on the eve of World Environment Day (June 5) in 2025.
- Options (b) and (c) mention other wetlands: Indeed, in February 2025, four more wetlands were declared (including two in Tamil Nadu, one in Sikkim, one in Jharkhand) – but the specific "first half and just before World Environment Day" context corresponds to Khichan & Menar in Rajasthan. (**The Times of India)**
- The Ramsar designation carries significance for conservation, biodiversity – and is part of the geography syllabus under wetlands and water bodies **(G.C. Leong, Ch.11 *Water & Wetland Systems*)**.

95. **Answer: (d) 1, 2 and 3**
Explanation :

- The **Deccan Traps** represent one of the **largest volcanic provinces on Earth**, formed about **66 million years ago (Late Cretaceous period)**.
- They are composed of **horizontal sheets of basaltic lava** spread across **Maharashtra, Madhya Pradesh, Gujarat, and parts of Karnataka**.
- The eruptions were of the **fissure type**—lava oozed out through **cracks (fissures)** in the Earth's crust rather than from a single volcanic cone.
- The **total thickness** of the basaltic layer reaches **up to 2,000 metres** in some areas.
- Geological evidence correlates these eruptions with the **Cretaceous–Paleogene extinction event**, which caused the extinction of dinosaurs — possibly due to **sulphur aerosols and CO_2-induced climate change**.
- The region's **black cotton soil (Regur)** owes its origin to the **weathering of basalt**.

Sources:

- *NCERT Class 11 – India: Physical Environment, Chapter 2*
- *G.C. Leong – Landforms of Volcanic Origin*

96. **Answer: (a) Srinagar and Leh**
Explanation :

- **Zoji La (3,528 m)** is situated in the **Greater Himalayas**, connecting **Srinagar (Kashmir Valley)** with **Leh (Ladakh)** through the **Zoji La Tunnel Project**.
- It remains closed for almost six months due to heavy snowfall, making it crucial for **all-weather connectivity** to Ladakh.
- The **Zoji La Tunnel (13.5 km)** under construction (as of 2025) will be the **longest highway tunnel in Asia** once completed.

- This pass lies between **Dras and Sonamarg** and holds immense **strategic importance** for defence and logistics, particularly post-2020 border tensions.
  (Sources: *The Hindu, Feb 2025 – "Zoji La Tunnel nearing completion"*; NCERT Class 11; BRO Annual Report 2024–25)*

Pass	State/Region	Linked Areas	Key Feature / Importance
Zoji La	J&K (Kashmir–Ladakh)	Srinagar–Leh	Longest all-weather tunnel (under construction)
Bara Lacha La	Himachal Pradesh	Lahaul–Ladakh	Part of Manali–Leh highway
Shipki La	Himachal Pradesh	Kinnaur–Tibet	Sutlej River enters India
Lipulekh	Uttarakhand	Pithoragarh–Tibet	Kailash Mansarovar route
Nathu La	Sikkim	Gangtok–Tibet	Border trade route
Bomdi La	Arunachal Pradesh	Tawang–Bhutan Border	Strategic military zone

97. **Answer: (b) 2 only**
Explanation:

- **Frost Heaving** occurs in **cold climates**, not deserts. It is caused by **expansion of ice in soil pores**, pushing soil upward.
- **Solifluction** happens in **periglacial regions** (cold zones bordering glaciers) where **frozen ground thaws seasonally**, causing **soil to flow downhill**.
- **Karstification** occurs in **limestone regions** under **humid tropical to temperate climates**, where **chemical weathering (solution process)** dissolves calcium carbonate.
  Thus, only **Solifluction–Periglacial** pair is correct.
  (Sources: NCERT Class 11, G.C. Leong, *The Hindu – Geomorphic Studies 2024*)**

98. **Answer: (c) 1, 2 and 3**
Explanation:

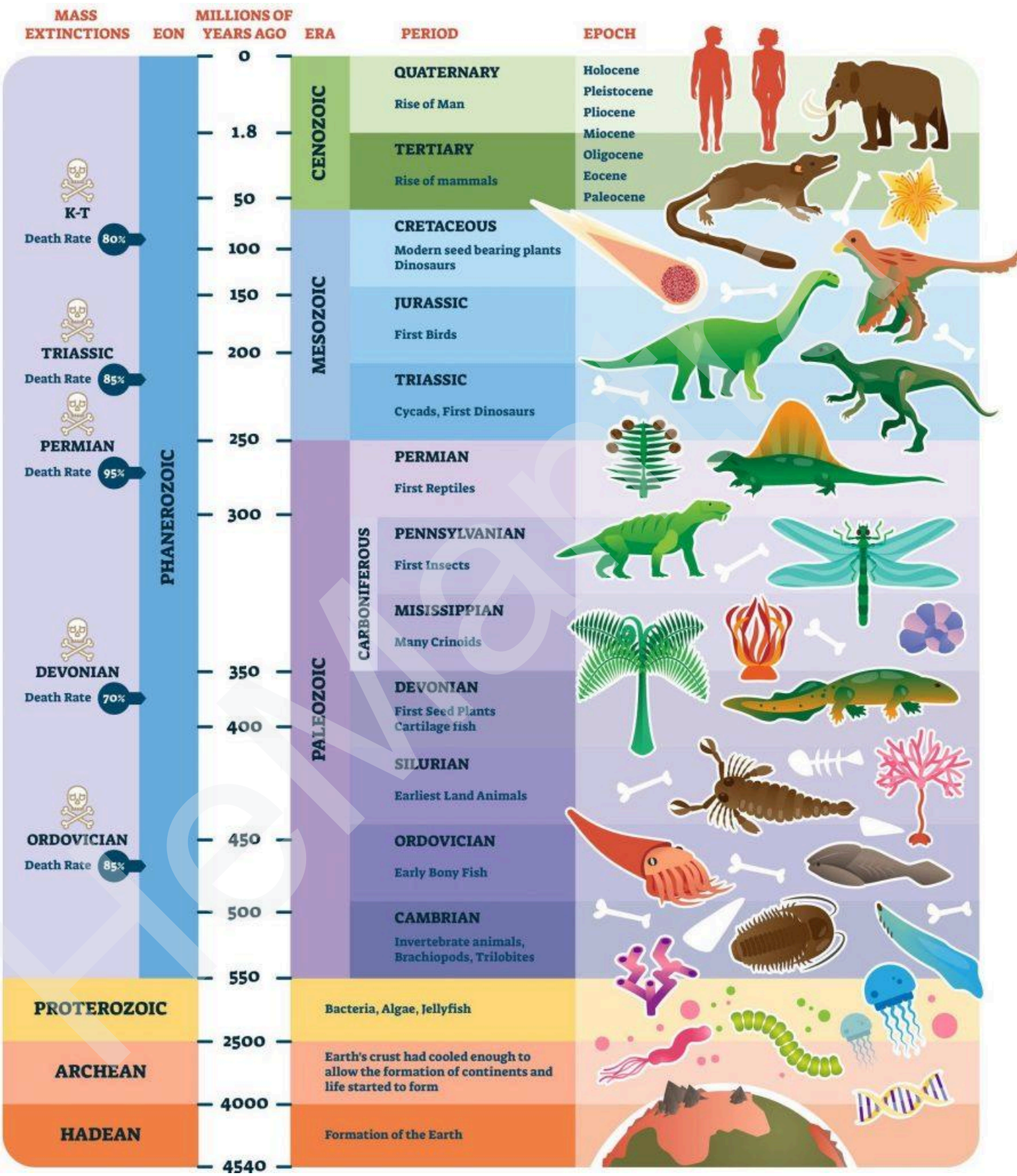
- The **Mesozoic Era (252–66 million years ago)** is divided into **Triassic, Jurassic, and Cretaceous** periods.
- It is called the **"Age of Reptiles"** because **dinosaurs** dominated land ecosystems.
- During the **Late Triassic**, the **first mammals and birds** appeared.
- The era ended with the **mass extinction (Cretaceous–Paleogene event)**, caused possibly by an **asteroid impact (Chicxulub Crater, Mexico)**, wiping out dinosaurs.
- This event allowed mammals to diversify during the **Cenozoic Era**.
  (Sources: NCERT Class 11 Geography, NCERT Class 12 Biology, *The Hindu Science 2024*)**

99. **Answer: (b) Radiation of mammals and birds**

Explanation

- The **Cenozoic Era (66 MYA – Present)** is known as the **"Age of Mammals."**
- After the extinction of dinosaurs, mammals diversified rapidly into various ecological niches — herbivores, carnivores, and primates.
- Birds also evolved from **theropod dinosaurs** and flourished.
- Modern continents took their present form, and climatic fluctuations led to the evolution of **grasslands and modern flora**.
- Human ancestors (hominins) appeared during the **Quaternary Period** of the Cenozoic.

(Sources: NCERT Class 12 Biology; *The Hindu – Science Journal 2025*; *G.C. Leong*)



100. **Answer: (b) Low agricultural productivity**
Explanation:

- **Push factors** are negative circumstances that compel people to leave their origin area.
- In India, rural migration is heavily influenced by **agrarian distress** — fragmented landholdings, soil degradation, droughts, and declining farm incomes.
- **Low agricultural productivity** acts as a push factor as farmers cannot sustain livelihoods.
- According to **NITI Aayog's Rural Development Report (2024)**, over **37% of internal migrants** cited **agricultural stagnation** as their reason for moving to cities.
- Urban areas like **Delhi NCR and Pune** act as magnets (pull factors) offering better jobs, while rural push factors like poor infrastructure and lack of irrigation push them out.

  (Sources: NCERT Class 12 – Fundamentals of Human Geography; The Hindu 2024; NITI Aayog 2024)

101. Answer: (c) 1 only
Explanation:

- Statement 1: **Correct**. The Yamuna joins the Ganga at Prayagraj (Allahabad), forming the sacred *Triveni Sangam* with the mythical Saraswati.
- Statement 2: **Incorrect**. The Son River is a right-bank tributary of the Ganga, rising near Amarkantak (Madhya Pradesh).
- Statement 3: **Incorrect**. Both Gandak and Kosi originate in the Nepal Himalayas, not Tibet.

  These tributaries contribute to frequent flooding in Bihar due to heavy siltation and dynamic river courses.

  The Ganga system supports over 43% of India's population, making it one of the most important river basins in the world.

  Sources: NCERT Class 11, *India: Physical Environment*; G.C. Leong; *The Hindu*, 2024 Flood Report; PIB 2025 "Namami Gange Programme Updates

102. **Answer: (a) 1 and 3 only**
Explanation:

- The **Godavari**, often called the *Dakshin Ganga (Ganga of the South)*, is India's **second-longest river** after the Ganga. It rises in the **Trimbak Plateau near Nashik (Maharashtra)** and flows eastward into the Bay of Bengal. Its major tributaries are **Manjira, Penganga, Pranhita, Indravati, and Sabari**.
- The **Krishna River**, originating from the **Mahabaleshwar Range (Maharashtra)**, flows through Karnataka and Andhra Pradesh. Its main tributaries include **Bhima, Ghataprabha, Malaprabha, Tungabhadra**, but **not Bhavani**, which belongs to the **Cauvery system**.
- The **Cauvery (Kaveri)** originates from **Talakaveri in the Brahmagiri Range (Karnataka)**. Important tributaries include **Hemavati, Arkavati, Kabini, and Bhavani** — all crucial for southern India's irrigation.

Sources:

- NCERT Class 9 & 11 Geography
- G.C. Leong – *Rivers and Drainage Patterns*

103. **Answer:** (c) 1 and 3 only

Explanation:

1. Statement 1 is correct: India indeed added two wetlands in Bihar — Gokul Jalashay (Buxar district) and Udaipur Jheel (West Champaran district) — to the list of wetlands of international importance under the Ramsar Convention in 2025. **(The Times of India)**
2. Statement 2 is partly **incorrect**: While India crossed the **90-mark** of Ramsar sites in 2025 (e.g., 91 sites when Khichan & Menar were added) the ranking and number need precise mention. For these additions the number reached about **93** by September 2025. **(The Times of India)**
3. Statement 3 is correct: The two new Bihari wetlands are indeed ox-bow lakes (or oxbow/oxbow-type wetlands) lying alongside river courses.

Broader context:

Under the Ramsar Convention (adopted in 1971 in the Iranian city of Ramsar), wetlands of international importance are recognized for their role in biodiversity, hydrology and human livelihoods. India acceded in 1982 and has been adding increasingly many such sites.

104. **Answer: (a) Krishna and Godavari**

Explanation:

- The **Telangana Plateau** forms the **northern part of the Deccan Plateau**, lying between the **Krishna and Godavari rivers**.
- It covers parts of **Telangana and Andhra Pradesh**, with an **average elevation of 500–600 m**.
- The **Krishna River** flows from **Maharashtra through Telangana**, while the **Godavari River** originates in the **Western Ghats** and flows eastward, both draining into the **Bay of Bengal**.
- The region is mostly composed of **granite and gneissic rocks**, forming a **dissected plateau** due to erosion.
- Major irrigation projects such as **Kaleshwaram Lift Irrigation Scheme** and **Nagarjuna Sagar** depend on these river systems.
- **Soil:** Predominantly **black cotton (Regur)** and **red soils**, supporting **cotton, pulses, and millets** cultivation.

Sources:

- *NCERT Class 11 – India: Physical Environment, Chapter 3*
- *G.C. Leong – Drainage of Peninsular India*

105. **Answer: (a) 1 only**

Explanation :

- **Nathu La (Sikkim):** Connects India with China's Tibet Autonomous Region via Chumbi Valley; reopened for trade in 2006.
- **Rohtang Pass:** Lies in **Himachal Pradesh**, not Uttarakhand; connects Kullu Valley to Lahaul-Spiti.
- **Lipulekh Pass:** Lies in **Uttarakhand (Pithoragarh district)** near Nepal–Tibet trijunction, part of **Kailash Mansarovar Yatra route**.
- **Bomdi La:** Located in **Arunachal Pradesh**, not Himachal.

  Thus, only **Nathu La–Sikkim** is correctly matched.

  (Sources: NCERT Class 11, *Indian Express, Dec 2024 – "Border Connectivity Projects in Himalayas"*)

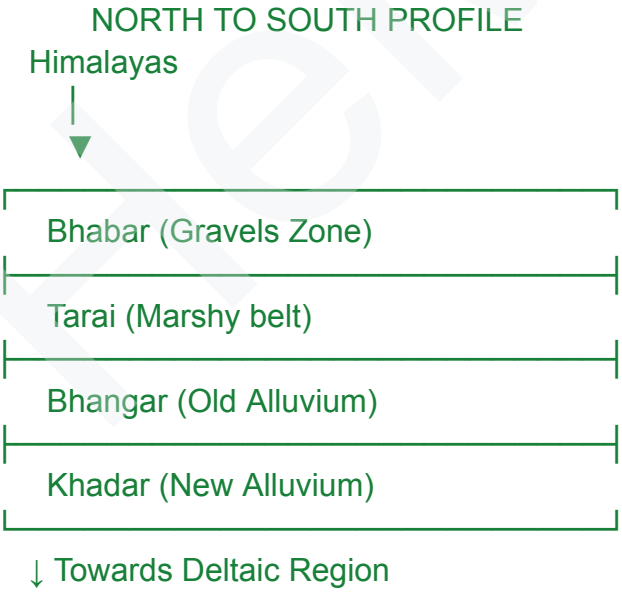
106. **Answer: (b) 1 and 2 only**

Explanation (150+ words):

- The **Bhabar belt**, a narrow zone (8–16 km wide), forms along the **Shiwalik foothills** from Punjab to Assam. Rivers descending from mountains deposit **coarse sediments like pebbles and gravels**, forming porous soils.
- **Tarai** lies **immediately south of Bhabar** and is **marshy and swampy** due to **re-emergence of groundwater** that percolates underground in the Bhabar zone. It supports dense vegetation and wildlife (e.g., Jim Corbett and Dudhwa National Parks).
- The **streams disappear underground in Bhabar**, not Tarai. In Tarai, they reappear, making it waterlogged and fertile.

  Sources: NCERT Class 9, *The Hindu (2024)* article on "Hydrology of Shiwalik Region," GSI Field Report (2024).

The Northern Plains of India



107. **Answer: (d) Tundra or periglacial**

Explanation:

- **Frost wedging** involves water entering rock cracks, freezing, and expanding by about **9%**, causing the rock to break apart — a process known as **freeze–thaw weathering**.
- **Solifluction**, on the other hand, occurs when **frozen subsoil (permafrost)** prevents water infiltration, causing the saturated upper soil to flow downhill.
- Both these processes are most intense in **tundra or periglacial regions** (e.g., northern Canada, Alaska, Siberia), where **seasonal freeze–thaw cycles** dominate geomorphic activity.
- These processes together shape the **periglacial landscape**, forming **block fields, patterned ground, and solifluction lobes.**

  (Sources: NCERT Class 11, G.C. Leong, *NOAA 2024 – Permafrost and Climate Change*

108. **Answer: (b) Paleozoic → Mesozoic → Cenozoic**

Explanation:

- The **geologic time scale** divides Earth's 4.6-billion-year history into eras:
  1. **Precambrian (4600–541 MYA)** – Origin of life, unicellular organisms.
  2. **Paleozoic (541–252 MYA)** – Marine life flourished; first fish, amphibians, and land plants.
  3. **Mesozoic (252–66 MYA)** – Reptiles and dinosaurs dominant; first birds and mammals.
  4. **Cenozoic (66 MYA–present)** – Mammalian dominance; human evolution.
- Hence, the correct chronological order is **Paleozoic → Mesozoic → Cenozoic**.

(Sources: NCERT Class 11 Geography; *G.C. Leong – Earth's History*; *USGS Geological Survey 2024*)**

109. **Answer: (c) Declining total fertility rate below replacement level**

Explanation :

- The **replacement-level fertility rate** is **2.1 children per woman** — the rate at which a population exactly replaces itself without migration.
- When **Total Fertility Rate (TFR)** falls **below 2.1**, population growth slows, marking transition to the **low stationary stage**.
- As per **NITI Aayog's Population Report 2024**, **India's TFR = 2.0**, meaning India is approaching population stabilization.
- **Kerala (1.7)**, **Tamil Nadu (1.8)**, and **Delhi (1.6)** have entered this stage.
- Falling fertility reflects **urbanization, female education, contraception use, and rising living costs**.
- In contrast, **Bihar and Uttar Pradesh** still record TFR >2.5, remaining in the late expanding stage.

  Sources: NITI Aayog Population Report 2024; NFHS-5; NCERT Class 12; The Indian Express (2025).

110. **Answer: (c) Life expectancy and literacy rate**

Explanation:

- As societies progress through demographic transition, **death rates decline** due to **better healthcare, sanitation, and nutrition**, leading to **longer life expectancy**.
- Simultaneously, **education and literacy rates rise**, especially among women, promoting **family planning** and reducing fertility.
- Example: India's **life expectancy rose** from 63 (2000) to **70.2 years (2024)** (UNDP Human Development Report 2024).
- **Female literacy (NFHS-5)** has crossed **77%**, further driving demographic maturity.
- Conversely, **fertility and mortality** rates decline over the transition.
- Thus, **life expectancy and literacy rate increase**, reflecting social and economic progress.

Sources: NCERT Class 12; UNDP HDR 2024; The Indian Express (2025); NITI Aayog Reports (2024).

Stage	Birth Rate	Death Rate	Natural Increase	Typical Economy
I. High Stationary	High	High	Low	Pre-industrial (Tribal societies)
II. Early Expanding	High	Rapidly falling	Very high	Developing (Sub-Saharan Africa)
III. Late Expanding	Falling	Slowly falling	Moderate	Transitional (India)
IV. Low Stationary	Low	Low	Low or Zero	Developed (Europe, Japan)

111. **Correct Answer: (b) A basin where river water flows into a lake or disappears inland without reaching the sea**

Explanation :

- An **endorheic basin** (from Greek *endo* = within, *rhein* = to flow) is a **closed drainage system** where water does not reach an ocean.
- Instead, rivers **terminate in inland lakes, salt flats, or evaporate** in deserts.
- India's best examples:
  - **Luni River Basin (Rajasthan)**
  - **Rupen and Banas in Gujarat**
  - **Ghaggar Basin** (intermittent flow ending inland).
- Globally, major endorheic basins include the **Caspian Sea**, **Dead Sea**, and **Lake Chad** regions.
- Such basins are typical of **arid to semi-arid regions** with **high evaporation and low rainfall**.

Sources: NCERT Class 11, G.C. Leong, *CWC Report 2024*, *The Hindu – Climate Desk (2025)*.

112. **Answer: (a) 1, 2 and 3 only**

Explanation :

- The **Eastern Ghats** are **discontinuous hill ranges** running from **northern Odisha to Tamil Nadu**, parallel to the east coast.
- Major ranges include:
  - **Nallamala Hills** (Andhra Pradesh)
  - **Shevaroy and Javadi Hills** (Tamil Nadu)
  - **Similipal and Mahendragiri Hills** (Odisha)
- **Cardamom Hills** belong to the **Western Ghats**, not the Eastern Ghats.
- The Eastern Ghats are **older and more eroded**, with rivers like the **Godavari, Krishna, and Kaveri** cutting through them.

  (Sources: NCERT Class 11, *The Hindu 2024 – Eastern Ghats Degradation Report*)

113. **Answer: (c) It allows moist winds to enter Tamil Nadu from the Arabian Sea**

Explanation (≈170 words):

- The **Palghat Gap (about 30 km wide)** is a **low mountain pass** in the **Western Ghats**, lying between the **Nilgiri Hills (north)** and **Anaimalai Hills (south)**.
- It connects **Palakkad (Kerala)** with **Coimbatore (Tamil Nadu)** and serves as a **natural corridor for communication and monsoon winds**.
- During the **Southwest Monsoon**, the gap allows **moist winds from the Arabian Sea** to reach interior Tamil Nadu, making the **Coimbatore plateau** relatively wetter than surrounding areas.
- It is also a **major transport route** (rail and road corridor) between the two states.

  (Sources: *NCERT Class 11 – India: Physical Environment*, *Indian Express 2024: Climate Studies on Western Ghats*)**

114. **Answer: (c) Thick bark to retain moisture**

Explanation:

- **Thick bark** is an adaptation of **dry deciduous forests**, not rainforests.
- In **humid rainforests**, the bark is **thin and smooth** because there is **no need to conserve moisture.**
- **Buttress roots** provide stability in shallow, waterlogged soils.
- **Drip-tip leaves** help shed rainwater and prevent fungal growth.
- **Epiphytes (orchids, ferns)** grow on other plants to access light.

  Hence, (c) is not correct.

  Sources: NCERT Class 11, The Hindu Science Section (2024).

115. **Answer:** (c) 1, 2, 3 and 4

Explanation:

- **Semiconductors** are elements with electrical conductivity between that of conductors and insulators.
- The main **semiconducting elements** include **Silicon (Si), Germanium (Ge), Gallium (Ga), and Arsenic (As)** — used in **microchips, diodes, and transistors.**

- **Silicon Valley (USA)** was named for this metal; India's semiconductor push (under **India Semiconductor Mission 2024**) focuses on **Fab manufacturing in Gujarat and Karnataka**.
- **Gallium** and **Arsenic** form compounds like **Gallium Arsenide (GaAs)** — crucial in high-speed electronics and solar cells.

Source: MeitY (Semiconductor Mission 2025); NCERT Class 11 Chemistry Unit 1; *The Hindu* Science & Tech (July 2024).

116. **Answer: (b) Temporary movement linked to demand for labour**

Explanation:

- **Seasonal migration** is a **temporary movement** of labour from one region to another depending on **seasonal employment**.
- Common examples include:
  - Agricultural labourers moving for **harvest seasons**.
  - Construction workers moving to cities during **dry seasons**.
  - Tribal communities moving for **forest-based work**.
- It's prevalent in **states like Odisha, Madhya Pradesh, Bihar, and Rajasthan**, where rural livelihood depends on **rainfed agriculture**.
- Seasonal migration helps sustain families during lean agricultural months but also leads to **social vulnerability** due to lack of legal protections.

(Sources: NCERT Class 12; The Indian Express, Feb 2025 – "Seasonal Migrant Labour in India")

117. **Answer: (a) Ravenstein**

Explanation:

- The **Push-Pull Theory of Migration** was proposed by **Ernst Georg Ravenstein** (19th century).
- He introduced the **"Laws of Migration"**, explaining that migration is influenced by **push factors** (negative conditions at origin) and **pull factors** (positive conditions at destination).
- Example: Unemployment (push) → Job opportunity (pull).
- This theory laid the foundation for **modern migration studies** and **labour economics**.
- Ravenstein's model has evolved into contemporary frameworks such as **"Gravity Models of Migration"** and **"Neo-Classical Economic Theories"**.

(Sources: G.C. Leong; NCERT Class 12; The Hindu – Human Geography Analysis, 2024)

Summary Table: Push vs. Pull Factors of Migration

Push Factors	Pull Factors
Poverty	Higher wages
Unemployment	Job opportunities

Natural disasters	Safety & stability
Political unrest	Better governance
Poor healthcare	Modern facilities

118. **Answer: (b) Hygrometer**
Explanation (≈160 words):

- A **hygrometer** measures **moisture (humidity)** in the air.
- **Relative humidity (RH)** is expressed as a **percentage** — the ratio of the actual water vapour present to the maximum possible at that temperature.
- Types include:
  - **Dry and wet bulb hygrometer** (psychrometer)
  - **Hair hygrometer** (uses human hair's length change with humidity)
  - **Electronic sensors** (used in IMD AWS stations).
- High humidity indicates **moist air** (common in coastal or monsoon regions); low humidity → **dry air** (deserts).
- Humidity is vital for understanding **cloud formation**, **monsoon onset**, and **human comfort index**.

  (Sources: NCERT Class 11, IMD AWS Manual 2024, *G.C. Leong*)

Element	**Instrument**	**Measured Unit**
Wind Speed	Anemometer	m/s or km/h
Wind Direction	Wind Vane	Cardinal Directions
Pressure	Barometer	hPa or mb
Temperature	Thermometer	°C
Humidity	Hygrometer	% RH
Solar Radiation	Pyrheliometer	W/m²

119. **Answer: (a) Andes – Brazilian Highlands – Patagonia Plateau**
Explanation (≈170 words):

- **Andes Mountains** run **along the western margin** of South America from Venezuela to Chile.
- To their **east lie the Brazilian Highlands**, forming the central plateau region.
- The **Patagonia Plateau** lies in the **southernmost part**, primarily in Argentina.
- This north–south orientation results from **plate convergence** between the **Nazca and South American plates**.
- The Andes are the **youngest**, while the **Brazilian Highlands** are **oldest**, formed from **Precambrian rocks**.

  Sources: NCERT Class 11, G.C. Leong, *NASA Earth Data 2024*, *The Hindu* –

Geography Feature Series (2025).

120. **Answer: (a) 1 and 2 only**

Explanation :

- The **Andes** were formed by the **subduction of the oceanic Nazca Plate beneath the continental South American Plate**.
- This process created a **series of fold and volcanic mountains** — the **Andean orogeny**.
- The range extends **~7,000 km** along the Pacific coast, from **Venezuela to Chile**.
- Rich in **metallic minerals** like **copper (Chile & Peru), silver (Bolivia), and tin**, making it a key mining region globally.
- However, the **Himalayas** are geologically **younger** (50 million years) than the Andes (100 million years).

  Hence, statement 3 is incorrect.

  Sources: NCERT Class 11, G.C. Leong, *USGS Andes Tectonic Profile 2024*, *The Hindu – "Chile's Copper Belt" (2025)*.

121. **Answer: (b) Australia**

Explanation:

- **Australia** continues to be the **world's largest producer and exporter of iron ore** in 2025, contributing about **37% of global production**.
- The **Pilbara region in Western Australia** (Hamersley Range, Mount Whaleback) holds some of the **world's richest hematite reserves**.
- **Brazil** (Carajás region) and **China** follow next.
- **India** ranks **fourth globally**.
- Rising demand from **China and Southeast Asia** sustains high global prices (The Hindu, 2025).

  (Sources: World Steel Association 2025, USGS Mineral Commodity Summaries 2025, The Hindu BusinessLine April 2025)**

122. **Answer: (b) 2 and 3 only**

Explanation:

- **Bauxite** (aluminium ore) is mainly found in **Koraput (Odisha)**, **Katni (Madhya Pradesh)**, and **Jharkhand**, not Balaghat.
- **Copper** is mined in **Khetri Belt (Rajasthan)** and **Singhbhum (Jharkhand)**.
- **Mica**, used in electronics, is found in **Nellore (Andhra Pradesh)** and **Giridih (Jharkhand)**.
- India was once the **largest mica exporter**, though now declining due to synthetic substitutes.

  (Sources: NCERT Class 10, G.C. Leong, Indian Bureau of Mines, 2024 Report)

123. **Answer: (a) Rajasthan**

Explanation :

- **Zawar Mines**, located near **Udaipur in Rajasthan**, are among the **oldest zinc-lead mines in the world**, dating back to the **Mauryan era (3rd century BCE)**.
- Operated today by **Hindustan Zinc Limited (HZL)**, a subsidiary of **Vedanta Resources**.
- Rajasthan accounts for over **80% of India's zinc and lead production** (Ministry of Mines, 2025).
- **Zawar, Rampura-Agucha, and Rajpura-Dariba** are key mining centers.
- **Zinc** is used in **galvanization, batteries, alloys, and fertilizers**.
- India ranks **6th globally in zinc production**.
- Recent expansions (2024–25) increased India's zinc smelting capacity to **1 million tonnes/year**.
- **Rajasthan's Aravalli ranges** host polymetallic ores (lead, zinc, copper, silver).
- The **UNESCO-listed Zawar Mines** are also studied for **ancient metallurgy** practices.

Sources: G.C. Leong, NCERT Class 11, Ministry of Mines 2024–25, *The Hindu (March 2025): "Zawar heritage and India's zinc dominance"*

124. **Answer: (c) Zinc – Canada**

Explanation :

- **Chile** is indeed the **largest producer of copper**, primarily from the **Atacama Desert (Chuquicamata Mine)**.
- **Guinea** has emerged as the **top producer of bauxite (2024)**, surpassing Australia.
- **Australia** remains the **top producer of iron ore**.
- However, **Zinc** is mainly produced by **China**, **Peru**, and **Australia**, not Canada.
- Canada produces zinc but not at top global levels.

(Sources: USGS 2025, World Mining Data 2024, The Indian Express Business 2025)

125. **Answer:** (a) 2 and 3 only

Explanation:

- **Gondwana coal (about 98% of India's reserves)** is **bituminous**, suitable for **iron and steel industries**. Found mainly in **Jharkhand, Chhattisgarh, Odisha, West Bengal, and Madhya Pradesh**.
  Lignite (brown coal) of tertiary age occurs in **Neyveli (Tamil Nadu)**, **Barsingsar (Rajasthan)**, and parts of **Assam and Gujarat**. It has low carbon content and moisture-rich.
- As per **Ministry of Coal's Provisional Coal Statistics 2025**, **Jharkhand (26%) and Odisha (24%)** together hold over **50% of India's coal reserves**.

Source: NCERT Class 10 Geography Ch. 5; Goh Cheng Leong (Energy Resources); Ministry of Coal 2025 Data Portal.