FREE EDITION · NOTES + 3 SAMPLE MCQS

CUET · GEOGRAPHY · CLASS XI · CODE 313

Water (Oceans)

CUET unit: Water (Oceans)

By **UniDrill** · NCERT-grounded study material

WWW.UNIDRILL.IN

📌 Snapshot

- The hydrological cycle is the engine that continuously circulates water among oceans, atmosphere, land surface, subsurface, and organisms — foundational to Earth's water budget.
- The ocean floor has four major divisions (continental shelf, continental slope, deep sea plain, oceanic deeps) plus minor features (ridges, seamounts, guyots, atolls, submarine canyons), which CUET tests through identification and matching questions.
- Temperature distribution (horizontal and vertical, including the three-layer model and the thermocline) is a high-frequency CUET topic tested via statement-based and reason–assertion formats.
- Salinity — its definition, measurement unit, controlling factors, horizontal variation across major oceans, and the halocline concept — is another standard CUET testing area, often using specific numerical values as distractors.
- CUET frequently frames questions around the specific data points in this chapter: average widths, depths, salinity values of named seas, and the distribution of oceanic deeps across oceans.

📖 Detailed Notes

2.1 Core concepts

- **Earth as the Blue Planet:** Earth has an abundant supply of water on its surface; water is absent on the Sun and elsewhere in the solar system. About 91 per cent of all planetary water is held in the oceans. (NCERT §Hydrological Cycle, p. 100)
- **Hydrological Cycle defined:** The hydrological cycle is the circulation of water within the earth's hydrosphere in different forms — liquid, solid, and gaseous. It is the continuous exchange of water between the oceans, atmosphere, land surface, subsurface, and organisms. Water is a cyclic resource that can be used and re-used. (NCERT §Hydrological Cycle, p. 100)
- **Water distribution on land:** Nearly 59 per cent of the water that falls on land returns to the atmosphere through evapotranspiration. The remainder runs off on the surface, infiltrates into the ground, or becomes glacier. Renewable water on

Earth is constant while demand is increasing, leading to water crises spatially and temporally. (NCERT §Hydrological Cycle, p. 101)

- **Components of the Water Cycle (Table 12.1):** Key components include water storage in oceans (processes: evaporation, evapotranspiration, sublimation), water in the atmosphere (condensation, precipitation), water storage in ice and snow (snowmelt runoff), surface runoff (stream flow, infiltration), and groundwater storage (groundwater discharge, springs). (NCERT Table 12.1, p. 101)
- **Ocean floor divisions — Continental Shelf:** Extended margin of each continent occupied by relatively shallow seas and gulfs; shallowest part of the ocean with average gradient of 1° or less. Average width is about 80 km; depth ranges from 30 m to 600 m. Ends at a steep shelf break. The Siberian shelf in the Arctic Ocean (1,500 km wide) is the largest in the world. Sedimentary deposits on shelves are sources of fossil fuels. (NCERT §Continental Shelf, p. 101)
- **Continental Slope:** Connects the continental shelf to ocean basins. Gradient varies between 2–5°. Depth varies between 200 and 3,000 m. Marks the end of continents. Canyons and trenches are observed here. (NCERT §Continental Slope, p. 102)
- **Deep Sea Plain:** Gently sloping, flattest and smoothest regions of the world. Depths vary between 3,000 and 6,000 m. Covered with fine-grained sediments like clay and silt. (NCERT §Deep Sea Plain, p. 102)
- **Oceanic Deeps or Trenches:** Deepest parts of the oceans; relatively steep-sided, narrow basins, 3–5 km deeper than surrounding ocean floor. Found at bases of continental slopes and along island arcs; associated with active volcanoes and strong earthquakes. 57 deeps explored: 32 in Pacific Ocean, 19 in Atlantic Ocean, 6 in Indian Ocean. (NCERT §Oceanic Deeps or Trenches, p. 102)
- **Minor relief features — Mid-Oceanic Ridges:** Two chains of mountains separated by a large depression; peaks can reach 2,500 m and some emerge above the ocean's surface. Iceland is part of the mid-Atlantic Ridge. (NCERT §Mid-Oceanic Ridges, p. 102)
- **Seamount:** Mountain with pointed summits rising from the seafloor but not reaching the ocean surface; volcanic in origin; 3,000–4,500 m tall. The Emperor seamount (extension of Hawaiian Islands, Pacific Ocean) is a key example. (NCERT §Seamount, p. 102)
- **Submarine Canyons:** Deep valleys cutting across continental shelves and slopes, often extending from mouths of large rivers. Hudson Canyon is the best-known example. (NCERT §Submarine Canyons, p. 102–103)
- **Guyots:** Flat-topped seamounts showing evidence of gradual subsidence. More than 10,000 seamounts and guyots exist in the Pacific Ocean alone. (NCERT §Guyots, p. 103)
- **Atolls:** Low coral-reef islands in tropical oceans surrounding a central depression (lagoon), sometimes enclosing fresh, brackish, or highly saline water. (NCERT §Atoll, p. 103)

- **Factors affecting ocean temperature:** (i) Latitude — insolation decreases poleward so surface temperature decreases from equator to poles; (ii) Unequal distribution of land and water — northern hemisphere oceans receive more heat due to greater land contact; (iii) Prevailing winds — offshore winds cause upwelling of cold water (lower temperature); onshore winds pile up warm water (higher temperature); (iv) Ocean currents — warm currents raise temperature in cold areas (e.g., Gulf Stream raises temperature on eastern coast of North America and West Coast of Europe); cold currents lower temperature in warm areas (e.g., Labrador current lowers temperature near north-east coast of North America). (NCERT §Factors Affecting Temperature Distribution, p. 103)
- **Three-layer temperature structure (mid and low latitudes):** Layer 1 — top 500 m, 20°–25°C; present year-round in tropics, only in summer at mid-latitudes. Layer 2 — the thermocline (500–1,000 m thick), rapid temperature decrease with depth. Layer 3 — very cold, extends to deep ocean floor. In Arctic and Antarctic circles, only one cold layer exists from surface to floor. (NCERT §Horizontal and Vertical Distribution of Temperature, p. 103–104)
- **Thermocline:** Boundary region beginning around 100–400 m below the sea surface where temperature decreases rapidly. About 90 per cent of the total volume of ocean water is found below the thermocline; temperatures approach 0°C. (NCERT §Horizontal and Vertical Distribution of Temperature, p. 103)
- **Surface temperature data:** Average surface water temperature of oceans is about 27°C; decreases at ~0.5°C per degree of latitude. At 20° latitude: ~22°C; at 40° latitude: ~14°C; near poles: ~0°C. Highest temperature is slightly north of the equator, not at the equator. Northern hemisphere average: ~19°C; southern hemisphere: ~16°C. (NCERT §Horizontal and Vertical Distribution, p. 104)
- **Salinity definition and measurement:** Total content of dissolved salts in sea water. Calculated as grams of salt dissolved in 1,000 gm (1 kg) of sea water. Expressed as parts per thousand (o/oo or ppt). Salinity of 24.7 o/oo is the upper limit for 'brackish water'. (NCERT §Salinity of Ocean Waters, p. 104)
- **Factors affecting salinity:** (i) Evaporation and precipitation (main factors for surface layer); (ii) Fresh water inflow from rivers (coastal) and freezing/thawing of ice (polar); (iii) Wind (transfers water to other areas); (iv) Ocean currents. Salinity, temperature, and density are interrelated. (NCERT §Salinity of Ocean Waters, p. 104)
- **Horizontal distribution of salinity:** Normal open ocean: 33–37 o/oo. Red Sea (land-locked): up to 41 o/oo. Arctic and estuaries: 0–35 o/oo seasonally. Hot dry regions: up to 70 o/oo. Atlantic Ocean average: ~36 o/oo; maximum (37 o/oo) between 20°N–30°N. Indian Ocean average: 35 o/oo; Bay of Bengal has low salinity (river inflow); Arabian Sea has higher salinity (high evaporation, low fresh water). North Sea: higher salinity despite high latitude (North Atlantic Drift). Baltic Sea: low salinity (river inflow). Mediterranean Sea: higher salinity (high evaporation). Black Sea: very low salinity (river inflow). (NCERT §Horizontal Distribution of Salinity, p. 105)

- **Vertical distribution of salinity and halocline:** Salinity increases with depth. There is a distinct zone called the halocline where salinity increases sharply. Higher salinity, denser water sinks below lower salinity water — this leads to stratification by salinity. (NCERT §Vertical Distribution of Salinity, p. 106)
- **Highest salinity water bodies:** Lake Van, Turkey (330 o/oo); Dead Sea (238 o/oo); Great Salt Lake (220 o/oo). (NCERT §Salinity of Ocean Waters, p. 104)
- **Salinity in higher latitudes and enclosed seas:** The North Sea, despite its high latitude, shows higher salinity than expected because of the inflow of warm saline water of the North Atlantic Drift; the Baltic Sea, by contrast, shows abnormally low salinity (around 7 o/oo) because of heavy fresh-water influx from rivers draining the Scandinavian and Baltic catchments. The Mediterranean records consistently higher values than the open Atlantic because evaporation outpaces precipitation and river inflow over its enclosed basin. The Black Sea is one of the least saline marginal seas anywhere in the world owing to the giant Danube–Volga inflow (NCERT p. 105).
- **Polar regions and ice formation:** In high latitudes, sea-water salinity is modified by the seasonal freezing and thawing of sea ice. Freezing expels salts into the surrounding water, raising the salinity of the residual water column and triggering sinking of dense brine; thawing in summer adds fresh meltwater and lowers surface salinity. This is the primary mechanism of thermohaline circulation in the world ocean, of which NCERT covers only the precursor concepts.
- **Density of sea water as a derived property:** Sea-water density is a function of temperature, salinity and pressure. Cold, salty, deep water is denser than warm, less-saline, surface water. NCERT notes that "salinity, temperature and density are interrelated" (p. 104) and that "any change in temperature or density of a layer of sea water affects the vertical mobility" of the water column. This underlies the formation of the halocline and the deep thermohaline conveyor.
- **Why oceans matter for the global heat budget:** Oceans cover 71 per cent of the Earth's surface and store roughly 1,000 times more heat than the atmosphere. They redistribute solar energy from the equator toward the poles through warm and cold currents, moderate coastal climates, and act as a long-term sink for atmospheric CO_2. Hence ocean temperature and salinity patterns are not abstract numbers — they directly influence monsoonal vigour, cyclone formation, and biological productivity along Indian coasts.

2.2 Definitions to memorise

Term	Definition	Page
Hydrological Cycle	Circulation of water within the earth's hydrosphere in liquid, solid, and gaseous phases; continuous exchange between oceans, atmosphere, land, subsurface, and organisms	100
Continental Shelf		101

Term	Definition	Page
	Extended margin of each continent occupied by relatively shallow seas and gulfs; average gradient 1° or less; ends at the shelf break	
Shelf Break	The very steep slope at which the continental shelf ends	101
Continental Slope	Zone connecting continental shelf to ocean basin; gradient 2–5°; depth 200–3,000 m; marks end of continents	102
Deep Sea Plain	Flattest and smoothest regions of the ocean basin; depths 3,000–6,000 m; covered with clay and silt	102
Oceanic Deep / Trench	Deepest parts of the ocean; steep-sided, narrow basins; 3–5 km deeper than surrounding floor; associated with volcanoes and earthquakes	102
Mid-Oceanic Ridge	Two chains of mountains on the ocean floor separated by a large depression; peaks can reach 2,500 m	102
Seamount	Volcanic, pointed-summit mountain rising from the seafloor without reaching the ocean surface; 3,000–4,500 m tall	102
Guyot	Flat-topped seamount; evidence of gradual subsidence	103
Atoll	Low coral-reef island in tropical ocean surrounding a central depression (lagoon)	103
Submarine Canyon	Deep valley cutting across the continental shelf and slope, often from mouths of large rivers	102–103
Thermocline	Boundary region (100–400 m depth) where ocean temperature decreases rapidly with depth; 90% of ocean water volume is below it	103
Halocline	Distinct zone in the ocean where salinity increases sharply with depth	106
Salinity	Total dissolved salt content of sea water; expressed in parts per thousand (o/oo); calculated per 1,000 gm of sea water	104
Brackish Water	Water with salinity above 24.7 o/oo	104
Hydrosphere	The total water envelope of the Earth — oceans, lakes, rivers, groundwater, glaciers, and atmospheric moisture	100
Evapotranspiration	Combined loss of water from the land surface through evaporation and plant transpiration; returns ~59% of land precipitation to the atmosphere	101
Sublimation	Direct transformation of ice into water vapour, bypassing the liquid phase; an arrow in the water cycle diagram	101
Infiltration	Downward movement of surface water into the soil and rock matrix, recharging groundwater	101
Abyssal plain		102

Term	Definition	Page
	Flat, sediment-covered region of the deep ocean floor at depths of 3,000–6,000 m	
Continental rise	Gentle slope at the base of the continental slope, formed by sediment apron grading into the abyssal plain	102
Isohaline	A line on a map joining places of equal ocean-surface salinity	106
Lagoon	Shallow water body of an atoll, partially enclosed by a coral ring; can be fresh, brackish or saline	103

2.3 Diagrams / processes to remember

- **Figure 12.1 — Hydrological Cycle (p. 100):** Shows the full cycle — evaporation from ocean, condensation, precipitation over land, runoff, underground flow, penetration into soil, and transport by wind (advection). Useful for identifying which processes belong to which component of the cycle.
- **Figure 12.2 — Relief features of ocean floors (p. 102):** Three panels showing (a) Continental Margin with shelf, shelf break, submarine canyon, continental slope, continental rise; (b) Deep Ocean Basin with deep-sea trench, abyssal plain, abyssal hills, guyot, seamounts; (c) Mid-Ocean Ridge with rift and fracture zones. Study depth scales carefully — CUET may test depth values.
- **Figure 12.3 — Thermocline (p. 104):** Graph of depth (0–4,500 m) vs. temperature (0–24°C) — shows that temperature falls rapidly in the thermocline zone and becomes nearly constant below it. Note that 90% of ocean volume lies below the thermocline.
- **Figure 12.4 — Spatial pattern of surface temperature (p. 105):** Isotherms on world map; note that temperature decreases poleward and highest temperatures are slightly north of the equator.
- **Figure 12.5 — Surface salinity of the World's Oceans (p. 106):** Shows salinity isohalines; note high salinity in subtropical Atlantic (37 o/oo), lower in equatorial and polar zones.
- **Table 12.1 — Components and Processes of the Water Cycle (p. 101):** Match table — each storage component paired with its associated process (e.g., groundwater storage → groundwater discharge/springs). Frequently tested in match-the-following format.

2.5 Key data table (NCERT figures to memorise)

#	Quantity	Value	NCERT page
1	Share of planetary water in oceans	91%	100
2		~59%	101

#	Quantity	Value	NCERT page
	Land precipitation returned to atmosphere via evapotranspiration		
3	Average gradient of the continental shelf	1° or less	101
4	Average width of continental shelf	~80 km	101
5	Depth range of continental shelf	30–600 m	101
6	Width of Siberian shelf (largest)	1,500 km	101
7	Gradient of continental slope	2°–5°	102
8	Depth range of continental slope	200–3,000 m	102
9	Depth range of deep-sea plain	3,000–6,000 m	102
10	Excess depth of trench over surrounding floor	3–5 km	102
11	Number of oceanic trenches explored (Pacific / Atlantic / Indian)	32 / 19 / 6 (total 57)	102
12	Height of mid-oceanic ridge peaks	up to 2,500 m	102
13	Average ocean surface temperature	~27°C	104
14	Rate of surface-temperature decrease per latitude	~0.5°C per degree	104
15	Salinity of Red Sea / Dead Sea / Lake Van	41 / 238 / 330 o/oo	104

2.4 Common confusions / NTA trap points

- **Thermocline vs. Halocline:** Thermocline = zone of rapid temperature decrease with depth; halocline = zone of rapid salinity increase with depth. CUET may swap definitions or ask which property each zone refers to.
- **Seamount vs. Guyot:** Both are submarine volcanic mountains. Seamount has a pointed summit; guyot has a flat top (due to subsidence/erosion). Students often confuse or reverse these.
- **Highest temperature slightly north of equator, NOT at equator:** NCERT explicitly states this. NTA may offer "equator" as a distractor for where maximum ocean surface temperature is recorded.
- **Distribution of oceanic deeps:** 32 in Pacific, 19 in Atlantic, 6 in Indian Ocean — these specific numbers are favourite NTA data points. Students mix up Atlantic and Pacific counts.
- **Salinity units:** Salinity is per 1,000 gm (1 kg) of sea water, not per 100 gm or per 10 gm. NTA directly tests this as a MCQ (confirmed by NCERT exercise question iv).

- **Bay of Bengal vs. Arabian Sea salinity:** Bay of Bengal has lower salinity (river inflow); Arabian Sea has higher salinity (high evaporation, low fresh water). Students commonly invert these.
- **Continental shelf depth vs continental slope depth:** Shelf = 30–600 m; slope = 200–3,000 m; deep-sea plain = 3,000–6,000 m. NTA likes to swap "200–3,000" for the shelf range.
- **Atlantic vs Indian Ocean average salinity:** Atlantic ≈ 36 o/oo; Indian ≈ 35 o/oo. Indian Ocean is slightly less salty because of higher precipitation and the major Asian river inflow (Indus, Ganga, Brahmaputra, Irrawaddy).
- **'Surface water' vs '90 per cent of ocean volume':** Only the surface and the thermocline (top ~1,000 m) hold the warm and warm-cool transition water. 90 per cent of the ocean's volume lies below the thermocline and is uniformly cold (~0–4°C). NTA mis-cites this as "90 per cent above the thermocline."
- **Mid-oceanic ridge — two chains, not one:** A mid-ocean ridge is composed of two chains of mountains separated by a central rift valley. Students often pick "a single chain" as the answer.

🎯 Practice MCQs

📊 PYQ Alignment

This chapter is one of the most consistently tested in CUET Geography (subject code 313), typically contributing 2–4 MCQs per year, with questions concentrated on the definitions and numerical data related to ocean floor divisions (especially continental shelf dimensions and trench distribution), salinity values for specific oceans and seas, and the thermocline concept. Assertion–reason and statement-based formats are frequently used for the temperature distribution and salinity sections. The full set of solved CUET PYQs on oceans is at `/pyq/geography`.