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CUET · GEOGRAPHY · CLASS XII · CODE 313

Mineral and Energy Resources

CUET unit: Mineral and Energy Resources (Unit III, India: People and Economy)

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

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📌 Snapshot

- India's mineral wealth is mostly of **pre-Palaeozoic age** and is concentrated in the **metamorphic and igneous rocks of peninsular India**; the **alluvial plain of north India is devoid of economic minerals**. (NCERT Ch. 5, p. 53)
- Minerals are classified into **metallic** (ferrous & non-ferrous) and **non-metallic** (fuel & other), spread across three major mineral belts — **North-Eastern Plateau, South-Western Plateau and North-Western Region** (pp. 53-54), with the Himalayan belt as a fourth.
- Energy resources are divided into **conventional** (coal, petroleum, natural gas, nuclear) and **non-conventional** (solar, wind, tidal, geothermal, bio-energy) sources (pp. 57-63).
- Key state-mineral associations — **Odisha → iron ore & bauxite**, **Jharkhand → coal & mica**, **Rajasthan → copper & uranium**, **Kerala → monazite & thorium**, **Maharashtra → Tarapur nuclear** — are CUET favourites.
- Conservation, recycling of metals and use of inexhaustible energy alternatives are stressed in the closing section (p. 64).

📖 Detailed Notes

2.1 Core concepts

- A **mineral** is a natural substance of organic or inorganic origin with definite chemical and physical properties. India is endowed with a rich variety of mineral resources due to its varied geological structure; bulk of valuable minerals are of **pre-Palaeozoic age** and associated with metamorphic and igneous rocks of peninsular India. (NCERT §Intro, p. 53)
- **Classification (Fig. 5.1, p. 53):**
- **Metallic → Ferrous** (iron ore, manganese, chromite — those with iron content) and **Non-ferrous** (copper, bauxite, gold — without iron content).
- **Non-metallic → Fuel/mineral fuels** (coal, petroleum — organic origin, derived from buried animal and plant life) and **Other non-metallics** (mica, limestone, graphite — inorganic origin).
- **Three characteristics of minerals:** (i) **uneven distribution** over space; (ii) **inverse relationship between quality and quantity** — good quality minerals are less in quantity than low-quality ones; (iii) **all minerals are exhaustible** — they take

long geological time to develop and cannot be replenished; they have "no second crop" and must be conserved. (NCERT p. 54)

Distribution of Minerals in India

- Most **metallic minerals occur in the peninsular plateau region in old crystalline rocks**. Over **97% of coal reserves** occur in the valleys of **Damodar, Sone, Mahanadi and Godavari**. Petroleum reserves lie in the sedimentary basins of **Assam, Gujarat and Mumbai High** (offshore Arabian Sea); newer reserves have been located in **Krishna-Godavari and Kaveri basins**. **Most major mineral resources lie to the east of a line linking Mangaluru and Kanpur.** (NCERT §Distribution, p. 54)
- **Three mineral belts:**
- **(i) North-Eastern Plateau** — covers **Chhotanagpur (Jharkhand), Odisha Plateau, West Bengal and parts of Chhattisgarh**; varied minerals — **iron ore, coal, manganese, bauxite, mica** — the reason the major iron-and-steel industry is located here. (p. 54)
- **(ii) South-Western Plateau** — extends over **Karnataka, Goa and contiguous Tamil Nadu uplands and Kerala**; rich in **ferrous metals and bauxite**, also high-grade iron ore, manganese and limestone; **lacks coal except Neyveli lignite**. Less diversified than the NE belt. **Kerala has monazite and thorium**; bauxite clay; **Goa has iron ore**. (p. 54)
- **(iii) North-Western Region** — extends along the **Aravali in Rajasthan and parts of Gujarat**; minerals associated with the **Dharwar system of rocks**. **Copper and zinc** are major; **Rajasthan** is rich in **sandstone, granite, marble**; extensive **gypsum and Fuller's earth**; **dolomite and limestone** for cement; **Gujarat known for petroleum**. Both Gujarat and Rajasthan have rich **salt** sources. (p. 54)
- **Himalayan belt** (fourth belt) — copper, lead, zinc, cobalt, tungsten on both eastern and western parts; **Assam valley** has mineral oil deposits; **Mumbai High** off the Mumbai coast. (NCERT pp. 54-55)

Iron Ore

- India has the **largest reserve of iron ore in Asia**. The two main types found are **haematite and magnetite**. Indian ore has great demand in the international market due to its **superior quality**. Iron ore mines lie close to coal fields in the NE plateau region — adding to their advantage. (NCERT §Iron Ore, p. 55)
- **About 95% of total reserves** are in **Odisha, Jharkhand, Chhattisgarh, Karnataka, Goa, Telangana, Andhra Pradesh and Tamil Nadu**.
- Key mines:
- **Odisha** — Gurumahisani, Sulaipet, Badampahar (Mayurbhanj); Kiruburu (Kendujhar); Bonai (Sundergarh).

- **Jharkhand** — Noamundi, Gua in Poorbi and Pashchimi Singhbhum districts (some of the oldest iron-ore mines).
- **Chhattisgarh** — Durg, Dantewara, Bailadila; Dalli, Rajhara in Durg.
- **Karnataka** — Sandur-Hospet area of Ballari district; Baba Budan hills and Kudremukh in Chikkamagaluru district; parts of Shivamogga, Chitradurg, Tumakuru.
- **Maharashtra** — Chandrapur, Bhandara, Ratnagiri.
- **Telangana** — Karimnagar, Warangal.
- **Andhra Pradesh** — Kurnool, Cuddapah, Anantapur.
- **Tamil Nadu** — Salem, Nilgiris.
- **Goa** has emerged as an important producer. (NCERT p. 55)

Manganese

- Used in **smelting of iron ore and manufacturing ferro-alloys**. Mainly associated with the **Dharwar system**.
- **Madhya Pradesh and Odisha are the leading producers**. Major Odisha mines: Bonai, Kendujhar, Sundergarh, Gangpur, Koraput, Kalahandi, Bolangir.
- MP belt: **Balaghat-Chhindwara-Nimar-Mandla-Jhabua** districts.
- Karnataka: Dharwar, Ballari, Belagavi, Shivamogga, Chitradurg, Tumakuru.
- Maharashtra: Nagpur, Bhandara, Ratnagiri.
- Minor producers — Telangana, Goa, Jharkhand. (NCERT pp. 55-57)

Bauxite

- Ore for **aluminium**; deposits formed by laterite-weathering. **Odisha is the largest producer** — Kalahandi, Sambalpur leading; Bolangir and Koraput rising.
- Jharkhand — **Lohardaga patlands**.
- Gujarat — Bhavanagar, Jamnagar.
- Chhattisgarh — Amarkantak, Katni-Jabalpur.
- MP — Balaghat.
- Maharashtra — Kolaba, Thane, Ratnagiri, Satara, Pune, Kolhapur. (NCERT p. 57)

Copper

- Indispensable in the electrical industry — wires, electric motors, transformers, generators. Reserves are **meagre**, making conservation important.
- Leading districts: **Singhbhum (Jharkhand), Balaghat (MP), Jhunjhunu and Alwar (Rajasthan)**.
- Minor sources: Agnigundala (Guntur, AP), Chitradurg and Hasan (Karnataka), South Arcot (TN). (NCERT p. 57)

Mica

- Important non-metallic for electrical and electronic industries.
- **Jharkhand** — 150 km belt, 22 km wide in the lower **Hazaribagh plateau** — high-quality mica.
- **Andhra Pradesh** — Nellore mines (**best-quality mica**).
- **Rajasthan** — Jaipur to Bhilwara, around Udaipur (320 km belt).
- Other producers — TN, West Bengal, MP, Karnataka, Kerala (Alleppey), Maharashtra (Ratnagiri), West Bengal (Purulia, Bankura). (NCERT p. 57)

Coal

- Occurs in **Gondwana (older, higher grade) and Tertiary (younger, lignite) deposits**. **About 80% of coal deposits in India are bituminous and non-coking.**
- **Gondwana coal** in **Damodar Valley** — Raniganj, Jharia, Bokaro, Giridih, Karanpura. **Jharia is the largest coal field, followed by Raniganj.**
- Other Gondwana fields — Godavari, Mahanadi and Sone valleys. **Singrauli (MP, extending to UP)**, **Korba (Chhattisgarh)**, Talcher and Rampur (Odisha), Chanda-Wardha, Kamptee, Bander (Maharashtra), **Singareni (Telangana)**, Pandur (AP).
- **Tertiary coal** in NE — Darangiri, Cherrapunji, Mewlong, Langrin (Meghalaya); **Makum, Jaipur, Nazira** in upper Assam; Namchik-Namphuk (Arunachal Pradesh); Kalakot (J&K).
- **Lignite (brown coal)** — **Neyveli (TN)**, Puducherry, Gujarat, J&K. (NCERT §Coal, p. 59)

Petroleum

- Crude oil occurs in **tertiary sedimentary rocks**. Often called **"liquid gold"** in the NCERT Do-You-Know box because of its scarcity and diversified uses. Systematic exploration began after **ONGC was set up in 1956**; before that, **Digboi (Assam) was the only producing region**.
- **Assam** — Digboi, Naharkatiya, Moran (the oldest oil-producing state).
- **Gujarat** — Ankaleshwar, Kalol, Mehsana, Nawagam, Kosamba, Lunej.
- **Mumbai High** — discovered in **1973**, production commenced **1976**; lies **160 km off Mumbai**.
- **New finds** — oil and natural gas in **Krishna-Godavari** and **Kaveri** basins (east coast).
- Refineries are of two types — **field-based (e.g., Digboi)** and **market-based (e.g., Barauni)**. (NCERT §Petroleum, p. 59)

Natural Gas

- Found with petroleum; used as domestic/industrial fuel, for power generation, fertiliser manufacture, and as **CNG (Compressed Natural Gas)** and **PNG (Piped Natural Gas)**.
- Major reserves — **Mumbai High and allied west-coast fields, Cambay basin, Krishna-Godavari basin**.
- **HVJ pipeline (Hazira-Vijaipur-Jagdishpur)** is the main cross-country gas pipeline shown in Fig. 5.4 (p. 60).

Nuclear Energy

- The key minerals are **uranium** and **thorium**.
- **Uranium occurrences: Dharwar rocks**; **Singhbhum copper belt (Jharkhand)** is the principal source; also Udaipur, Alwar and Jhunjhunu (Rajasthan); Durg (Chhattisgarh); Bhandara (Maharashtra); Kullu (HP).
- **Thorium:** mainly from **monazite and ilmenite sands** of **Kerala and Tamil Nadu coasts**; richest monazite at **Palakkad and Kollam (Kerala)**; also near **Visakhapatnam (AP)** and the **Mahanadi delta (Odisha)**.
- **Atomic Energy Commission** set up in **1948**; **Atomic Energy Institute, Trombay (1954)** was renamed **Bhabha Atomic Research Centre (BARC) in 1967**.
- **Important nuclear power projects: Tarapur (Maharashtra)** — first; **Rawatbhata near Kota (Rajasthan)**; **Kalpakkam (Tamil Nadu)**; **Narora (Uttar Pradesh)**; **Kaiga (Karnataka)**; **Kakarapara (Gujarat)**. (NCERT §Nuclear, pp. 60-61)

Non-Conventional Energy Sources

- **Solar Energy** — both **photovoltaic technology** (direct conversion to electricity) and **solar-thermal technology**. NCERT states solar thermal is **7% more effective than coal/oil and 10% more effective than nuclear**. **Western India (Gujarat and Rajasthan)** has greater solar potential. (NCERT §Solar, p. 61)
- **Wind Energy** — pollution-free and inexhaustible; **favourable in Rajasthan, Gujarat, Maharashtra, Karnataka**. (NCERT §Wind, p. 63)
- **Tidal and Wave Energy** — **large tidal waves along the west coast** of India give great potential for tidal energy, **not yet utilised**. (NCERT §Tidal/Wave, p. 63)
- **Geothermal Energy** — heat from earth's magma and geyser hot water; **a geothermal energy plant has been commissioned at Manikaran in Himachal Pradesh**. (NCERT §Geothermal, p. 63)
- **Bio-energy** — from agricultural, municipal and industrial wastes; helps **waste disposal + electricity + cooking gas (biogas) + bio-fertiliser**. **Okhla (Delhi)** is the cited project converting municipal waste into energy. (NCERT §Bio-energy, p. 64)

Conservation

- All conventional mineral and energy resources are exhaustible — must be **conserved** and not misused.
- **Alternative non-conventional sources (solar, wind, wave, geothermal) are inexhaustible** and should be developed to substitute exhaustible resources.
- **Recycling of metals** — especially **copper, lead and zinc** whose reserves are meagre — and use of **scrap** is critical. Export of strategic and scarce minerals must be reduced. (NCERT §Conservation, p. 64)

2.2 Definitions to memorise

Term	Definition	Page
Mineral	Natural substance of organic or inorganic origin with definite chemical and physical properties	53
Ferrous mineral	Metallic mineral containing iron (e.g., iron ore, manganese, chromite)	53, 55
Non-ferrous mineral	Metallic mineral without iron content (e.g., copper, bauxite)	53, 57
Mineral fuels	Non-metallic minerals of organic origin (coal, petroleum)	53
Inverse quality-quantity rule	Good-quality minerals are less in quantity than low-quality ones	54
"Second crop" principle	Minerals cannot be replenished — they are exhaustible	54
Haematite & Magnetite	Two main types of iron ore in India	55
Dharwar system	Rock system most associated with manganese and copper	55, 57
Liquid gold	Petroleum — so called for its scarcity and diversified uses	59
Field-based refinery	Refinery located at the oil field (e.g., Digboi)	59
Market-based refinery	Refinery located near the consumption market (e.g., Barauni)	59
HVJ pipeline	Hazira-Vijaipur-Jagdishpur gas pipeline	60
Gondwana coal	Older, higher-grade coal — Damodar valley	59
Tertiary coal / Lignite	Younger, lower-grade brown coal — Neyveli, NE	59
CNG / PNG	Compressed / Piped Natural Gas	60
Uranium	Nuclear mineral from Dharwar rocks; Singhbhum-Jaduguda principal source	60-61
Thorium	Nuclear mineral from monazite sands of Kerala/TN coasts	61

Term	Definition	Page
BARC	Bhabha Atomic Research Centre, Trombay — Atomic Energy Institute renamed in 1967	61
Conventional energy	Coal, petroleum, natural gas, nuclear — exhaustible	57, 60
Non-conventional energy	Solar, wind, tidal, geothermal, biomass — inexhaustible	61
Manikaran	Site of India's commissioned geothermal energy plant (HP)	63
Okhla	Delhi-based project converting municipal waste into energy	64
Mumbai High	Offshore oil field 160 km off Mumbai; discovered 1973, production 1976	59
Neyveli	Tamil Nadu lignite (brown coal) field	59
Jaduguda	Uranium mining site in Singhbhum copper belt	60

2.3 Diagrams / processes to remember

- **Fig. 5.1 — Classification of Minerals (p. 53):** Minerals → Metallic (Ferrous/Non-ferrous) and Non-metallic (Fuel/Other). The branching is the canonical map-the-mineral CUET item.
- **Fig. 5.2 — India: Metallic Minerals (Ferrous) (p. 56):** Iron ore fields and manganese symbols across Mayurbhanj, Sundergarh, Kendujhar, Durg, Bailadila, Ballari, Chitradurg, Kudremukh, Goa; iron-ore exporting ports — Paradwip, Visakhapatnam, Marmagao, Mangaluru.
- **Fig. 5.3 — India: Minerals (Non-Ferrous) (p. 58):** Copper at Khetri, Alwar, Bhilwara, Singhbhum, Balaghat, Hazaribagh, Udaipur; Bauxite at Katni, Amarkantak, Bilaspur, Malkala Hill, Koraput.
- **Fig. 5.4 — India: Conventional Energy Resources (p. 60):** Coal fields and mines (Raniganj, Jharia, Bokaro, Korba, Singrauli, Talcher, Singareni, Neyveli); oil fields (Mumbai High, Bassien, Ankaleshwar, Kalol, Digboi, Moran, Naharkatia); HVJ pipeline route from Hajira through Vijaipur to Jagdishpur.
- **Fig. 5.5 — India: Oil Refineries (p. 62):** Digboi, Numaligarh, Guwahati, Bongaigaon, Barauni, Haldia, Paradwip, Visakhapatnam, Tatipaka, Chennai, Nagapattinam, Cochin, Mangaluru, Mumbai, Koyali, Jamnagar, Vadinar, Bina, Mathura, Panipat, Bathinda.
- **Three-belt mental map:** Belt 1 (NE) — Chhotanagpur + Odisha + WB + Chhattisgarh = iron + coal + manganese + bauxite + mica. Belt 2 (SW) — Karnataka + Goa + TN uplands + Kerala = high-grade iron + manganese + limestone + Kerala thorium. Belt 3 (NW) — Aravali Rajasthan + Gujarat = copper + zinc + sandstone + gypsum + Gujarat petroleum + salt.

- **Coal classification flow:** Coal → Gondwana (Damodar valley, Jharia largest, Raniganj 2nd, 80% bituminous non-coking) and Tertiary (Assam-Meghalaya brown coal, Neyveli lignite). Energy use by industry, railways and thermal power.
- **Petroleum refinery sequence:** Crude oil from sedimentary basin → pipeline / tanker → field-based refinery (Digboi) OR market-based refinery (Barauni) → petrol, diesel, kerosene, naphtha, bitumen → end-users.
- **Nuclear energy chain:** Uranium (Singhbhum/Jaduguda) + Thorium (Kerala monazite) → BARC R&D → fuel rods → reactors at **Tarapur (1st) + Rawatbhata + Kalpakkam + Narora + Kaiga + Kakarapara** → electricity.

2.4 Common confusions / NTA trap points

- **Mumbai High year confusion: Discovered 1973, production commenced 1976** — NTA often swaps these years (1970/1973 distractor common).
- **Largest vs leading producers: Odisha is the largest producer of bauxite**; **Jharia is the largest coal field, followed by Raniganj**; **MP and Odisha lead in manganese**; **Odisha leads in iron ore**.
- **Iron ore types:** India's main iron ores are **haematite and magnetite** — not limonite or siderite (common distractors).
- **Nuclear plants vs uranium mines: Tarapur, Kalpakkam, Narora, Kaiga, Kakarapara, Rawatbhata** are power **stations**; **Singhbhum, Jaduguda, Udaipur, Alwar, Jhunjhunu** are uranium **mineral sources**.
- **Conventional vs non-conventional: Nuclear is conventional** per NCERT; **solar, wind, tidal, geothermal, biomass are non-conventional**. Hydel is renewable but commonly grouped with conventional in exercises.
- **First atomic power station: Tarapur (Maharashtra)** — not Kalpakkam or Narora.
- **Neyveli is lignite (Tertiary)**, not Gondwana coal — exam favourite.
- **Petroleum "liquid gold" reason:** scarcity AND diversified uses; not "because of its colour" or "because it must be refined."
- **97% of coal reserves** are in Damodar, Sone, Mahanadi and Godavari valleys — not Cauvery or Narmada.
- **Most major minerals lie east of the Mangaluru-Kanpur line**, not west — students often invert.
- **Manganese is associated with the Dharwar system**, not Gondwana.
- **Mica's best quality** comes from **Nellore (AP)**; **Jharkhand** has the largest belt (Hazaribagh, 150 km × 22 km).
- **BARC = Bhabha Atomic Research Centre**, renamed in 1967 (from the 1954 Atomic Energy Institute, Trombay) — not founded in 1967.
- **Geothermal plant: Manikaran, HP** — not Tarapur or Kalpakkam.
- **Bio-energy waste-to-energy demo: Okhla, Delhi** — not Mumbai or Chennai.

- **Solar thermal effectiveness: 7% more than coal/oil; 10% more than nuclear** — specific NCERT figures, often distorted.

2.5 Key data table (NCERT figures only)

Parameter	Figure / fact	Source (NCERT p.)
Coal reserves in Damodar, Sone, Mahanadi, Godavari valleys	>97%	54
Iron ore reserves in 8 listed states	~95% of total	55
India's iron ore reserve rank in Asia	Largest	55
Bituminous coal share of Indian deposits	~80%	59
Largest coal field in India	Jharia (Jharkhand)	59
Second-largest coal field	Raniganj	59
Mumbai High distance from Mumbai	160 km offshore	59
Mumbai High discovery year	1973	59
Mumbai High production commencement	1976	59
Year ONGC was set up	1956	59
Atomic Energy Commission established	1948	60-61
BARC renaming year	1967 (from Atomic Energy Institute, Trombay 1954)	61
First nuclear power station	Tarapur, Maharashtra	61
Geothermal plant site	Manikaran, Himachal Pradesh	63
Municipal-waste-to-energy project site	Okhla, Delhi	64
Solar thermal vs coal/oil effectiveness	7% more effective	61
Solar thermal vs nuclear effectiveness	10% more effective	61
Two main iron-ore types	Haematite & Magnetite	55
Leading manganese producers	Madhya Pradesh & Odisha	55
Bauxite largest producer	Odisha	57
Best-quality mica	Nellore (Andhra Pradesh)	57
Largest mica belt (size)	Hazaribagh — 150 km × 22 km	57

🎯 Practice MCQs

📊 PYQ Alignment

This chapter is among the highest-yielding Geography chapters in CUET (UG) — typically 6-9 MCQs per year. Recurring formats include: direct factual recall (largest producer of bauxite — Odisha, types of iron ore — haematite & magnetite, Mumbai High dates 1973/1976, 97% coal in four valleys), match-the-following on state-mineral pairings (Manganese — MP/Odisha; Mica — Jharkhand-Nellore-Rajasthan; Thorium — Kerala), and statement-based items on coal fields (Jharia largest, Neyveli lignite), refineries (field vs market) and nuclear plants (Tarapur first, six total). Map-based location items on Figs. 5.2-5.5 — mines, oil fields and refineries — and assertion-reason items on conservation and non-conventional energy (Manikaran geothermal, Okhla bio-energy) appear nearly every shift.

CUET 2025 — Actual PYQs from this chapter

Q.28 (CUET 2025) Mumbai High is famous for:

- A) Petroleum reserves B) Coal reserves C) Iron ore reserves D) Copper reserves Tests: Mumbai High — offshore oil fields Answer: Not in extracted key

Q.46 (CUET 2025) Which natural resource is renewable?

- A) Coal B) Petroleum C) Solar energy D) Natural gas Tests: Renewable vs non-renewable energy resources Answer: Not in extracted key

CUET 2024 — Actual PYQs from this chapter

Q.5 (CUET 2024) Pykara Hydroelectric Plant was built in _____.

- A) 1929 B) 1931 C) 1932 D) 1942 Tests: Early hydroelectric plants in India Answer: Not in extracted key

Q.14 (CUET 2024) Arrange copper mines from north to south. (A) Alwar (B) Bhilwara (C) Khetri (D) Udaipur

- A) B, D, C, A B) C, B, A, D C) B, C, D, A D) C, A, B, D Tests: Location of copper mines in Rajasthan Answer: Not in extracted key

Q.16 (CUET 2024) Match energy types with locations. Energy — Location: (A) Nuclear — (I) Gujarat & Rajasthan; (B) Wind — (II) West Coast of India; (C) Tidal — (III) Tarapur; (D) Geothermal — (IV) Manikaran.

- A) A-I, B-III, C-II, D-IV B) A-III, B-I, C-II, D-IV C) A-III, B-IV, C-I, D-II D) A-II, B-IV, C-III, D-I Tests: Locations of nuclear, wind, tidal and geothermal energy sites in India Answer: Not in extracted key

Q.23 (CUET 2024) Identify correct statements about oil refineries in India. (A) Digboi is market-based refinery (B) Tatipaka refinery in Andhra Pradesh (C) Numaligarh refinery in North-East India (D) Bina refinery in Madhya Pradesh

- A) A, B, D only B) A, B, C only C) A, C, D only D) B, C, D only Tests: Field-based vs market-based oil refineries in India Answer: Not in extracted key

CUET 2023 — Actual PYQs from this chapter

Q.26 (CUET 2023) Which one of the following is a metallic mineral?

- A) Copper B) Limestone C) Mica D) Graphite Tests: Classification of minerals — metallic vs non-metallic Answer: Not in extracted key