CBSE CLASS X

Social Science (087)

ANSWER KEY

AI-generated question paper

Code: 0ELZ5B	Questions: 57	Maximum Marks: 136	Generated: 2026-06-26 10:07

SELECTIONS USED

Subject	Social Science
Lessons	5 Minerals and Energy Resources
Level of understanding	Thorough understanding
Question selection	Curated chapter coverage (~5 questions per section + 8 synthesis)
Model	claude-sonnet-4-6

Composition — Difficulty: 3 straightforward · 32 medium · 22 deep | Types: 38 Short · 10 MCQ · 7 Very short · 2 Long

Q1. deep · thorough-understanding · § Introduction **[3]**

Geologists define a mineral as a homogenous, naturally occurring substance with a definable internal structure. Given this definition, why does the same element — say, carbon — exist as both the hardest and the softest mineral on Earth?

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Model Answer

Carbon exists as both diamond (hardest) and graphite (softest) because **the physical and chemical conditions under which a mineral forms determine its internal structure**, even when the element is the same.

- Diamond forms under extremely high temperature and pressure deep within the Earth, resulting in a very hard, tightly bonded structure.
- Graphite forms under different conditions, producing a soft, layered structure.

As the textbook states, "a particular mineral formed from a certain combination of elements depends upon the physical and chemical conditions under which the material forms," resulting in wide variation in hardness and other properties.

Source: Chapter 5, 'What is a Mineral?' section

Explanation

- The examiner wants you to use the key idea from the passage: **formation conditions (physical and chemical) determine mineral properties**, not just the elements present.
- Mention both diamond and graphite explicitly — the question names carbon as the example.
- Quoting or closely paraphrasing the textbook line about "physical and chemical conditions" earns the definition-based mark.
- Do **not** go into atomic bonding details (that is Chemistry/Class 11 content) — keep it at the textbook level.

Q2. medium | thorough-understanding | § Introduction **[3]**

A geologist studies the physical and chemical properties of a mineral like iron ore, while a geographer focuses on its spatial distribution, availability, and economic significance across regions. Using iron ore as an example, explain how the two perspectives lead to different but complementary understandings of the same mineral.

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Model Answer

A **geologist** studies iron ore's physical and chemical properties — its colour, hardness, crystal structure, and composition — to understand how and when it was formed, for example, in sedimentary layers under heat and pressure.

A **geographer**, however, focuses on its spatial distribution, availability, and economic significance — identifying where iron ore reserves are located, their accessibility, and their role in industrial development across regions.

Both perspectives are complementary: geological knowledge tells us *what* the mineral is and *how* it formed, while geographical knowledge tells us *where* it is found and *why* it matters economically. Together, they enable informed extraction and sustainable use of iron ore.

Source: Chapter 5 — Minerals and Energy Resources

Explanation

- The passage directly states: "A geologist is interested in the formation of minerals, their age and physical and chemical composition," while "the distribution of mineral resources and associated economic activities are of interest to geographers." Use these lines as your anchor.
- The examiner expects you to apply both perspectives specifically to iron ore with a concluding line showing they are **complementary** (not competing).
- Avoid writing a general essay — keep it crisp and exam-focused. The word "complementary" from the question is a cue; address it explicitly.

Q3. medium | thorough-understanding | § Introduction **[1]**

Which of the following best explains why most rocks consist of several minerals in varying proportions rather than a single mineral?

A Rocks are formed only from metallic elements, which naturally combine in different ratios.

B Different combinations of elements form under varying physical and chemical conditions, producing different minerals within the same rock.

C Minerals are always evenly mixed across all rock types because they originate from the same source material.

D Only sedimentary rocks contain multiple minerals; igneous and metamorphic rocks consist of a single mineral.

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Model Answer

Answer: B

Different combinations of elements form minerals under varying physical and chemical conditions, producing different minerals within the same rock, resulting in most rocks containing several minerals in varying proportions.

Source: What is a mineral?, Chapter 5

Explanation

The passage directly states: *"A particular mineral that will be formed from a certain combination of elements depends upon the physical and chemical conditions under which the material forms."* This rules out all other options:

- **A** is wrong — rocks are not formed only from metallic elements.
- **C** is wrong — minerals are not evenly mixed across all rock types.
- **D** is wrong — the passage itself gives limestone (sedimentary) as the exception with *one* mineral; it does not restrict multiple minerals to sedimentary rocks only.

Examiners expect you to pick **B** and, if asked to justify, quote the physical and chemical conditions reason from the text.

Q4. medium | thorough-understanding | § Introduction **[3]**

Minerals are considered indispensable to modern civilisation. Using specific examples from industry, agriculture, construction, and daily life, justify this statement and explain why the depletion of mineral resources is a matter of serious concern.

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Model Answer

Minerals are indispensable to modern civilisation because industry and agriculture strongly depend on mineral deposits and substances manufactured from them.

- **Industry/Construction:** Limestone is the basic raw material for cement and essential for smelting iron ore in blast furnaces.
- **Electrical/Daily life:** Copper, being a good conductor, is used in electrical cables and electronics.
- **Agriculture:** Minerals form raw materials for fertilisers and farm equipment.

Depletion is a serious concern because minerals are finite and non-renewable — geological processes of formation are so slow that replenishment is infinitely small compared to present rates of consumption. Rich mineral deposits are short-lived possessions.

Source: Conservation of Minerals, Chapter 5

Explanation

- Examiners expect **specific examples** (limestone, copper, etc.) — vague statements lose marks.
- The passage directly states minerals are finite and non-renewable; quote/paraphrase this for full credit on the "concern" part.
- For 3 marks: ~1 mark for justified examples, ~1 mark for finite/non-renewable nature, ~1 mark for slow replenishment / short-lived possessions.
- Keep it crisp — no need to list all minerals, 2–3 well-explained examples suffice.

Q5. medium | thorough-understanding | § What is a mineral? **[3]**

A geologist examines two rock samples: one is a block of pure limestone and another is a granite containing feldspar, quartz and mica. How do these samples differ in their mineral composition, and what does this tell us about the relationship between rocks and minerals?

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Model Answer

Limestone consists of only a **single mineral**, making it a monomineralic rock. In contrast, **granite** is composed of **multiple minerals** — feldspar, quartz, and mica — combined in varying proportions.

This difference illustrates the key relationship between rocks and minerals: **rocks are combinations of homogenous substances called minerals.** While most rocks consist of several minerals, some like limestone consist of just one. Minerals are homogenous, naturally occurring substances with a definable internal structure, and rocks are essentially their assemblages.

Source: Chapter 5 — What is a mineral?

Explanation

- The examiner expects you to use the textbook definition of both 'mineral' and the rock–mineral relationship directly.
- Key phrase to include: *"rocks are combinations of homogenous substances called minerals."*
- Contrast the two samples clearly (single mineral vs. multiple minerals) — that is the core of the question.
- Do not over-explain; 3 marks = ~2 short paragraphs or 3–4 crisp points.

Q6. deep | thorough-understanding | § What is a mineral? **[3]**

[short_answer] Diamond and graphite are both made of pure carbon, yet they have strikingly different physical properties such as hardness and appearance. Similarly, talc and quartz are both silicate minerals but differ greatly in hardness. Using these examples, explain what factor — beyond chemical composition — determines the physical properties of a mineral.

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Model Answer

Beyond chemical composition, the **physical and chemical conditions under which a mineral forms** determine its physical properties.

Diamond and graphite are both pure carbon, but form under vastly different temperature and pressure conditions, resulting in different crystal structures — making diamond the hardest natural substance and graphite very soft. Similarly, talc and quartz are both silicates but their contrasting formation conditions produce very different hardness.

Thus, it is the **internal structure** (crystal form) shaped by formation conditions — not composition alone — that determines properties like hardness, lustre, colour, and density.

Source: Chapter 5 — What is a Mineral?

Explanation

The key phrase examiners look for is **"physical and chemical conditions under which the material forms"** leading to a **definable internal structure** — directly from the passage. Mentioning both examples (diamond/graphite + talc/quartz) and linking conditions → structure → properties earns full marks. Avoid vague answers like "they are different minerals" — be specific about formation conditions and crystal structure.

Q7. medium | thorough-understanding | § MODE OF OCCURRENCE OF MINERALS **[1]**

[mcq] Molten magma cools slowly deep within the Earth, and hot solutions rich in dissolved minerals are forced into cracks in surrounding rocks. Which of the following correctly describes the type of mineral deposit most likely to result from this process? (A) Placer deposits in river valleys (B) Mineral veins and lodes in igneous and metamorphic rocks (C) Beds of evaporite minerals in arid basins (D) Alluvial deposits in floodplains

A Sedimentary rocks are too soft to contain metallic minerals.
B Molten and gaseous minerals are forced upward through cracks and solidify as they cool, a process associated with igneous and metamorphic activity.
C Sedimentary rocks are always found at the surface, so minerals evaporate before they can solidify.
D Igneous rocks are formed by evaporation, which concentrates minerals into veins.

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Model Answer

(B) — Molten and gaseous minerals are forced upward through cracks and solidify as they cool, a process associated with igneous and metamorphic activity.

Source: Mode of Occurrence of Minerals, Chapter 5

Explanation

The passage clearly states that in igneous and metamorphic rocks, minerals in liquid/molten and gaseous forms are forced upward through crevices, cool, and solidify as veins and lodes. Option B directly reflects this explanation. Options A, C, and D describe sedimentary/evaporite or alluvial processes, which are unrelated to the scenario described.

Q8. medium | thorough-understanding | § MODE OF OCCURRENCE OF MINERALS **[3]**

Gypsum and potash salt are found in arid regions, while coal is found in valley basins. Both form in sedimentary rocks yet through different processes. Explain the contrasting processes by which these two groups of sedimentary minerals are formed.

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Model Answer

Gypsum & Potash Salt (Evaporation Process):
These minerals are formed as a result of **evaporation** in arid regions. When water bodies in dry areas evaporate, dissolved salts and minerals are left behind, accumulating and concentrating in horizontal strata to form beds or layers of gypsum, potash salt, and sodium salt.

Coal (Heat & Pressure Process):
Coal is formed by the **compression of plant material** over millions of years in valley basins (e.g., swamps). Buried plant matter is subjected to great heat and pressure over long periods, which concentrates it into coal deposits found in sedimentary rock strata.

Thus, evaporation forms one group, while heat and pressure over geological time forms the other.

Source: Chapter 5, Mode of Occurrence of Minerals

Explanation

- The examiner wants two clearly contrasted processes — **evaporation** (for gypsum/potash) vs. **heat and pressure/compression** (for coal).
- Both are described under point (ii) of sedimentary rock minerals in the textbook — keep answers grounded there.
- Use keywords: *evaporation*, *arid regions*, *beds/layers*, *compression*, *heat and pressure*, *valley basins* — these fetch marks.
- Avoid mixing up the two groups; the contrast is the core of the question.

Q9. medium | thorough-understanding | § MODE OF OCCURRENCE OF MINERALS **[3]**

Bauxite is not found in veins and lodes, nor in sedimentary beds formed by compression. What process leads to the formation of bauxite deposits, and what does this tell us about the type of rocks from which it originates?

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Model Answer

Bauxite deposits are formed through the **decomposition of surface rocks**. Soluble constituents are removed during weathering, leaving behind a residual mass of weathered material that contains the ore. This process tells us that bauxite originates from rocks **rich in aluminium silicates** — a wide variety of such rocks undergo decomposition to produce bauxite, a clay-like substance. Therefore, bauxite is a product of surface weathering rather than volcanic activity or sedimentary deposition.

Source: Chapter 5 — Minerals and Energy Resources, Mode of Occurrence of Minerals / Bauxite section

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Explanation

- The examiner wants two things: (1) the **process** — decomposition/weathering of surface rocks, removal of soluble parts, leaving residual mass; (2) the **rock type** — rocks rich in aluminium silicates.
- Do not confuse this with sedimentary minerals (formed by deposition) or igneous/metamorphic minerals (veins and lodes). Bauxite's formation mode is unique — it is a **residual deposit**.
- Keywords to use: *decomposition, soluble constituents, residual mass, weathered material, aluminium silicates*.

Q10. medium | thorough-understanding | § MODE OF OCCURRENCE OF MINERALS **[2]**

Gold and platinum are recovered from valley floors and hill bases as placer deposits rather than from mines dug into rock. Why are these particular minerals suited to survival as placer deposits, while many other minerals are not found this way?

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Model Answer

Gold and platinum are found as placer deposits because they are **not corroded by water**. When surface rocks weather and erode, these heavy, chemically resistant minerals are transported by water and settle in valley floors and hill bases. Other minerals corrode or dissolve during this process and cannot survive as placer deposits.

Source: Chapter 5 – Mode of Occurrence of Minerals, point (iv)

Explanation

The key phrase from the textbook is "minerals which are not corroded by water." Examiners expect you to:

1. State the defining property (resistance to corrosion/water).
2. Briefly explain the process (weathering → transport by water → settling).

Avoid writing about veins/lodes or sedimentary beds — those are different modes of occurrence and will waste words here.

Q11. medium | thorough-understanding | § MODE OF OCCURRENCE OF MINERALS **[1]**

[very_short_answer] The ocean contains vast quantities of dissolved minerals, yet only common salt, magnesium and bromine are commercially extracted from seawater in significant amounts. Give TWO reasons why most other minerals dissolved in ocean water are not economically extracted.

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Model Answer

Most minerals in ocean water are **too widely diffused** (present in very low concentrations), making extraction costly and technologically difficult, and the process is not economically viable.

Source: Mode of Occurrence of Minerals, Chapter 5

Explanation

The passage directly states: "most of these are too widely diffused to be of economic significance." For a 1-mark question, identify the **two embedded reasons**: (1) very low/diffused concentration, and (2) therefore not economically viable to extract. Keep it to one line.

Q12. deep | thorough-understanding | § MODE OF OCCURRENCE OF MINERALS **[3]**

[short_answer] A mining engineer discovers two deposits of the same mineral — one occurring as a vein within metamorphic rock and the other as a placer deposit in a nearby river valley. Compare these two deposits in terms of (i) how the mineral came to be concentrated in each location, and (ii) the likely method of extraction used for each.

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Model Answer

(i) Concentration of Mineral:

- **Vein deposit (metamorphic rock):** Minerals in liquid/molten or gaseous form were forced upward through cracks and crevices in metamorphic rock. They cooled and solidified, forming veins and lodes. (e.g., copper, tin, zinc)
- **Placer deposit (river valley):** Minerals resistant to water corrosion were weathered from rocks and transported by water, settling and accumulating in valley floors and bases of hills. (e.g., gold, platinum)

(ii) Method of Extraction:

- **Vein deposit:** Requires underground shaft mining to access deep-seated mineral veins.
- **Placer deposit:** Extracted by surface/alluvial methods such as panning or dredging, as minerals lie in loose sand and gravel.

Source: Chapter 5, Mode of Occurrence of Minerals

Explanation

Examiners look for a clear comparison of **both** types in **both** aspects. Key terms to use: *veins/lodes*, *molten/gaseous forms*, *cool and solidify*, *alluvial/placer*, *not corroded by water*. The extraction method follows logically from the deposit type — deep veins need underground mining; surface alluvial deposits allow simpler surface extraction. Don't mix up sedimentary beds with veins.

Q13. deep | thorough-understanding | § MODE OF OCCURRENCE OF MINERALS **[3]**

India's vast alluvial plains of north India are described as almost devoid of economic minerals, whereas the peninsular rocks are mineral-rich. Using your understanding of how minerals form in different rock types, explain why the alluvial plains are so poor in mineral deposits.

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Model Answer

The alluvial plains of north India are formed by deposition of sediments carried by rivers from the Himalayas. These plains lack the igneous and metamorphic rock formations where metallic minerals (like copper, zinc, tin) occur in veins and lodes through cooling of molten magma. They also lack the ancient peninsular rock systems where minerals concentrate over geological time. The loose alluvial sediments do not support the heat, pressure, or chemical processes needed to form economic mineral deposits, making the region almost devoid of minerals.

Source: Chapter 5 – Minerals and Energy Resources, Mode of Occurrence of Minerals

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Explanation

- The key is linking **rock type → mineral formation process**:
- Igneous/metamorphic rocks → veins and lodes (metallic minerals)
- Peninsular rocks → ancient, subjected to heat and pressure over millions of years
- Alluvial plains → recent sediment deposits, no such geological processes
- Examiners want you to explicitly state **why** alluvial regions lack minerals, not just **that** they lack them.
- Quote or closely paraphrase: *"These variations exist largely because of the differences in the geological structure, processes and time involved in the formation of minerals."*
- Do not list minerals found elsewhere — focus on the formation logic for the plains.

Q14. medium | thorough-understanding | § MODE OF OCCURRENCE OF MINERALS **[3]**

[short_answer] Distinguish between a 'mineral' and an 'ore'. A company finds two deposits of iron-bearing rock — one in a thin scattered vein deep underground and another in a thick surface-accessible sedimentary bed. Using your understanding of ore occurrence, explain which deposit is more likely to be mined commercially and why.

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Model Answer

Mineral vs Ore:
A **mineral** is a homogenous, naturally occurring substance with a definable internal structure. An **ore** is an accumulation of a mineral mixed with other elements, where the mineral content is in sufficient concentration to make extraction **commercially viable**.

Which deposit will be mined?
The thick, surface-accessible sedimentary bed is more likely to be mined commercially. The thin, deep vein would be costly and difficult to extract. As the textbook states, the type of formation determines ease of mining and cost of extraction. A surface sedimentary bed (like iron ore concentrated in horizontal strata) allows cheaper, easier extraction, making it economically viable, whereas a scattered deep vein increases extraction costs significantly.

Source: Chapter 5, Mode of Occurrence of Minerals

Explanation

- Examiners expect a **clear one-line distinction** between mineral and ore — don't write lengthy definitions.
- The key phrase for "ore" is **"commercially viable"** — examiners look for this.
- For the applied part, link your answer to the textbook concepts: **formation type → ease of extraction → cost → commercial viability**. This is explicitly stated in the passage.
- Avoid vague answers like "easier to mine" without explaining *why* (cost, accessibility, concentration, sedimentary layering).

Q15. deep thorough-understanding § Ferrous Minerals **[3]**

Magnetite has a higher iron content than hematite, yet hematite is described as the most important industrial iron ore. Why might an ore with slightly lower iron content be more industrially significant than one with higher iron content?

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Model Answer

Although magnetite has a higher iron content (up to 70%), hematite is the most important **industrial** iron ore because of the **quantity used**. Hematite (50–60% iron) is far more abundantly available and widely distributed across major belts in India — Odisha-Jharkhand, Durg-Bastar-Chandrapur, Ballari-Chitradurga, and Maharashtra-Goa. Industrial significance depends not only on iron content but also on **availability, ease of extraction, and commercial viability**. Hematite's large reserves and suitability for steel-making make it more valuable industrially despite its slightly lower iron content.

Source: Chapter 5, Iron Ore section

Explanation

Examiners want students to move beyond the simple comparison of iron percentages. The key insight is that **industrial importance = quantity available + commercial viability + ease of extraction**, not just ore grade. Mention hematite's wide distribution and large reserves. You can name the four major belts for extra credit. Magnetite's special value is limited to the electrical industry due to its magnetic properties — that's a niche use, not mass industrial use.

Q16. deep thorough-understanding § Ferrous Minerals **[3]**

Iron ore from the Bailadila range in Chhattisgarh is exported to Japan and South Korea. Name the port through which this export takes place and explain what this example reveals about the role of infrastructure in determining the commercial viability of a mineral deposit.

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Model Answer

The iron ore from the Bailadila range in Chhattisgarh is exported to Japan and South Korea via **Vishakhapatnam port**.

This example shows that a mineral deposit, however rich in quality, cannot be commercially viable without supporting infrastructure. The super high-grade hematite of Bailadila is valuable, but its economic exploitation depends on transport links connecting the landlocked mines to Vishakhapatnam port, from where overseas export becomes possible. Without such infrastructure — roads, railways, and port facilities — even the finest mineral deposits remain inaccessible and unviable.

Source: Chapter 5 — Minerals and Energy Resources, Durg-Bastar-Chandrapur belt

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Explanation

- The port name (**Vishakhapatnam**) is a direct fact from the passage — must be stated correctly for full marks.
- The second part tests **inference/application**: examiners want students to link the example to the broader principle that infrastructure (transport + ports) determines whether a deposit can actually be mined and sold profitably.
- Avoid just describing Bailadila; the question asks what the *example reveals* — so state the general principle clearly.
- ~75 words fits the 3-mark budget perfectly.

Q17. medium | thorough-understanding | § Ferrous Minerals **[1]**

Which of the following correctly describes why ferrous minerals are considered the foundation of metallurgical industries in India?

(A) They are found only in peninsular India, making them easy to transport.

(B) They account for about three-fourths of the total value of metallic mineral production and support steel manufacturing.

(C) They include minerals like copper and bauxite, which are used in electrical industries.

(D) India imports most of its ferrous minerals to meet industrial demand.

A They are found only in peninsular India, making them easy to transport.

B They account for about three-fourths of the total value of metallic mineral production and support steel manufacturing.

C They include minerals like copper and bauxite, which are used in electrical industries.

D India imports most of its ferrous minerals to meet industrial demand.

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Model Answer

(B) They account for about three-fourths of the total value of metallic mineral production and support steel manufacturing.

Explanation

The passage directly states that ferrous minerals account for about three-fourths of the total value of metallic mineral production and provide a strong base for metallurgical industries. Options C and D are factually wrong (copper/bauxite are non-ferrous; India *exports* ferrous minerals). Option A is incorrect as ferrous minerals are not exclusively peninsular.

Q18. medium | thorough-understanding | § Ferrous Minerals **[3]**

Manganese is used in the manufacturing of steel and ferro-manganese alloy. How does the quantity of manganese required per tonne of steel influence decisions about the ideal location of steel plants in India? Explain with reference to relevant mineral-producing regions.

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Model Answer

Nearly **10 kg of manganese** is required to manufacture one tonne of steel. This relatively small quantity means manganese does not need to be located immediately next to the steel plant — it can be economically transported. However, proximity to manganese-producing regions is still preferred to reduce costs.

Major manganese-producing states include **Madhya Pradesh (33%), Maharashtra (27%), Odisha (16%), and Karnataka (12%)**. Steel plants are often located in regions where iron ore, coal, and manganese are all available nearby — such as in **Odisha and Jharkhand** — ensuring an integrated and cost-efficient supply of raw materials.

Source: Ferrous Minerals, Chapter 5 (Contemporary India II)

Explanation

- The key fact examiners look for: **10 kg per tonne** — state this first.
- Then link it to location: small quantity = transportable, but proximity still preferred.
- Name at least **2–3 specific states** with their percentage shares from the data given.
- Mention the overlap with iron ore regions (Odisha/Jharkhand) to show the "correlation" concept the chapter hints at.
- Do not write about manganese's other uses (bleaching powder, etc.) — not relevant here.

Q19. deep thorough-understanding § Ferrous Minerals **[3]**

The Kudremukh iron ore deposit in Karnataka functions as a 100 per cent export unit. Analyse the factors — including transport technology and market linkages — that determine whether a mineral deposit becomes economically viable, using Kudremukh as your example.

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Model Answer

A mineral deposit becomes economically viable when three key factors align:

1. **Grade/Quality of ore:** Kudremukh deposits are among the largest in the world, justifying extraction costs.
1. **Transport technology:** The ore is transported as *slurry through a pipeline* to a port near Mangaluru — an efficient, cost-effective technology that makes remote Western Ghats deposits commercially feasible.
1. **Market linkages:** Being a 100% export unit, Kudremukh is directly linked to international markets via Mangaluru port, ensuring consistent demand and revenue.

Without the pipeline technology and export market access, the deposit's remote location would make it economically unviable.

Source: Chapter 5, Iron Ore — Ballari-Chitradurga-Chikkamagaluru-Tumakuru belt

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Explanation

Examiners expect you to address **all three factors named in the question** — transport technology, market linkages, and implicitly, ore quality. The key textbook fact is the **slurry pipeline to Mangaluru port** — this is a frequently tested specific detail. Avoid writing generally about minerals; anchor every point to Kudremukh. Three marks = three distinct points, each tied to the example.

Q20. medium | thorough-understanding | § Non-Ferrous Minerals **[3]**

India is described as 'critically deficient' in copper reserves, yet copper remains indispensable to modern industry. What specific properties of copper make it so important, and which industries rely on it most?

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Model Answer

Copper is critically important due to three key properties: it is **malleable** (can be beaten into sheets), **ductile** (can be drawn into wires), and an excellent **conductor of electricity**.

These properties make copper indispensable to:

- **Electrical industry** — manufacturing cables and wires
- **Electronics industry** — circuit components and equipment
- **Chemical industry** — industrial machinery and equipment

Despite its importance, India is critically deficient in copper reserves and production, making it a major challenge for these industries.

Source: Non-Ferrous Minerals, Chapter 5

Explanation

- The examiner expects all **three properties** (malleable, ductile, good conductor) — missing any one costs marks.
- Name all **three industries** directly from the textbook: electrical cables, electronics, chemical industries.
- The phrase "critically deficient" from the question echoes the textbook — use it to frame your answer.
- Avoid padding with state-wise mine locations unless specifically asked; stay focused on properties and industries for this question.

Q21. deep thorough-understanding § Non-Ferrous Minerals **[3]**

Aluminium is described as a versatile metal that combines several superior properties. What are those properties, and why must bauxite ore undergo a refining and smelting process before usable aluminium metal can be obtained? How does this affect the energy requirements of aluminium production?

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Model Answer

Properties of Aluminium: Aluminium combines the strength of metals like iron with extreme lightness, good conductivity, and great malleability. This makes it highly versatile across industries.

Refining and Smelting: Aluminium is not found in pure form. It is extracted from bauxite, a clay-like ore formed by decomposition of aluminium silicate-rich rocks. Bauxite must first be refined to obtain alumina, which is then smelted to produce usable aluminium metal.

Energy Requirements: Since the process involves multiple stages — refining and smelting — aluminium production is energy-intensive. As ore deposits deplete, extraction from greater depths further increases costs and energy demands.

Source: Minerals and Energy Resources, Chapter 5 — Non-Ferrous Minerals (Bauxite)

Explanation

- The question has three parts: properties, reason for processing, and energy impact — address all three.
- The textbook only mentions properties (strength, lightness, conductivity, malleability) and the refining/smelting process. The energy angle is inferred from the Conservation section ("increasing costs as mineral extraction comes from greater depths").
- Do **not** add outside chemistry (Bayer process, Hall-Héroult, etc.) — stick to what the passage states.
- Examiners award marks for: naming correct properties, explaining bauxite → alumina → aluminium, and linking multi-stage processing to high energy use.

Q22. deep | thorough-understanding | § Non-Ferrous Minerals **[3]**

Despite having poor reserves of non-ferrous minerals overall, India has a strong base of ferrous mineral production. What does this imbalance suggest about the likely challenges India would face in developing its electrical and electronics industries? Use your knowledge of the properties and uses of non-ferrous minerals to justify your answer.

◆ Minerals and Energy Resources

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Model Answer

India's poor reserves of non-ferrous minerals pose serious challenges for its electrical and electronics industries:

1. **Copper deficiency:** India is "critically deficient" in copper reserves. Since copper is malleable, ductile and a good conductor, it is essential for electrical cables and electronics. Shortage means heavy dependence on imports, raising production costs.
1. **Limited aluminium/bauxite processing:** Although bauxite reserves exist, their processing into aluminium (used for conductivity and lightweight components in electronics) requires sustained mineral supply — any shortage disrupts manufacturing.
1. **Import dependence:** Scarce non-ferrous minerals force India to import raw materials, making electrical and electronics industries costlier and less self-reliant, hampering industrial competitiveness.

Thus, despite a strong ferrous base, India's electronics growth is constrained by non-ferrous mineral scarcity.

Source: Chapter 5, Non-Ferrous Minerals

Explanation

- The key contrast the question tests: India has abundant **ferrous** minerals (iron ore, manganese) but poor **non-ferrous** mineral reserves (copper, bauxite, lead, zinc).
- Examiners expect you to **name specific minerals** (copper, bauxite/aluminium) and link their **properties** (conductivity, malleability) to **industry uses** (electrical cables, electronics).
- The phrase "critically deficient" from the textbook is a good phrase to quote directly — it shows precise use of source material.
- Aim for 3 distinct points for 3 marks; one property-use link per point earns full credit.

Q23. deep thorough-understanding § Non-Metallic Minerals **[3]**

Mica is described as one of the most indispensable minerals in the electrical and electronic industries. What specific combination of properties makes it so valuable for these industries — and why would a mineral possessing only one or two of these properties be an inadequate substitute?

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Model Answer

Mica is invaluable to electrical and electronic industries because of a **unique combination** of four properties working together:

1. **Excellent di-electric strength** — it resists electric breakdown.
2. **Low power loss factor** — minimal energy is wasted.
3. **Strong insulating properties** — prevents unwanted current flow.
4. **Resistance to high voltage** — remains stable under intense electrical stress.

A mineral possessing only one or two of these properties would be inadequate because all four must act simultaneously in electrical equipment. For example, a material that insulates but cannot withstand high voltage would fail under load, making it unsafe and unreliable.

Source: Non-Metallic Minerals, Chapter 5

Explanation

- The examiner expects you to **list all four properties** from the textbook — missing any costs marks.
- The second part (why one or two properties are insufficient) requires **logical reasoning**: emphasise that these properties must work *together*, not in isolation.
- Use the textbook's exact terms: "di-electric strength," "low power loss factor," "insulating properties," "resistance to high voltage."
- Avoid over-explaining; a crisp example (like voltage failure) is enough to justify the second part.

Q24. medium thorough-understanding § Non-Metallic Minerals **[1]**

[mcq] Which of the following correctly describes the significance of the Koderma–Gaya–Hazaribagh belt for mica production in India?
(A) It is located in the alluvial plains of the Ganga, where mica accumulates as placer deposits carried by rivers from the Himalayas.
(B) It lies along the northern fringe of the Chota Nagpur plateau in Jharkhand and is the leading mica-producing region in the country.
(C) It falls within the Deccan Trap region of Maharashtra, where mica crystallises from volcanic lava flows.
(D) It is part of the Rajasthan desert belt where mica forms as an evaporite mineral in dry lake beds.

A Jharkhand has ideal coastal conditions that allow mica to form through evaporation of seawater.
B The northern edge of the Chota Nagpur plateau, which falls in Jharkhand, hosts the Koderma–Gaya–Hazaribagh belt, the country's leading mica-producing region.
C Jharkhand's alluvial plains deposit mica as placer deposits along river valleys.
D Mica is a by-product extracted from bauxite refining in the Amarkantak plateau.

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Model Answer

Answer: (B)

The northern edge of the Chota Nagpur plateau, which falls in Jharkhand, hosts the Koderma–Gaya–Hazaribagh belt, the country's leading mica-producing region.

Explanation

The textbook (Chapter 5, Non-Metallic Minerals) directly states: *"Mica deposits are found in the northern edge of the Chota Nagpur plateau. Koderma Gaya–Hazaribagh belt of Jharkhand is the leading producer."* All other options introduce incorrect locations or formation processes (alluvial plains, Deccan Trap, evaporite, bauxite refining) that contradict the source. In MCQs, pick the option that matches the textbook statement word-for-word or in meaning.

Source: Chapter 5, Non-Metallic Minerals section

Q25. deep thorough-understanding § Non-Metallic Minerals **[3]**

Limestone is an essential raw material for both the cement industry and the iron-smelting process in blast furnaces. Using your understanding of how limestone is formed and where it occurs geologically, explain why limestone is widely available across India, and why it makes economic sense to locate cement plants close to limestone deposits.

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Model Answer

Limestone is a sedimentary rock formed by deposition and accumulation in horizontal strata over millions of years. Since large parts of India have sedimentary rock formations, limestone deposits are widespread across the country.

Because limestone is a **heavy, bulky raw material**, transporting it over long distances increases production costs significantly. Locating cement plants near limestone deposits reduces transportation costs, making cement production economically viable. This is similar to how coal-based industries are set up near coalfields to minimise costs and maximise efficiency.

Source: Chapter 5 — Minerals and Energy Resources, Mode of Occurrence of Minerals (sedimentary rocks section)

Explanation

- **Key link to mark:** Examiners expect three clear points — (1) limestone is sedimentary in origin, (2) sedimentary rocks are widely found in India, and (3) proximity reduces transport cost/improves economic viability.
- The passage explicitly states minerals in sedimentary rocks occur in **beds/layers** due to deposition — use this to explain wide availability.
- The passage also notes "closeness to the market" and ease of extraction affect **economic viability** — apply this logic to cement plants near deposits.
- Avoid writing general facts about cement; stay focused on geological formation and economic reasoning as asked.

Q26. medium | thorough-understanding | § CONSERVATION OF MINERALS **[3]**

Mineral resources are described as 'finite and non-renewable'. What characteristic of the geological process of mineral formation makes this so, and why does it mean that even a large mineral reserve will eventually be exhausted?

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Model Answer

Mineral formation is an extremely slow geological process taking **millions of years** to create and concentrate mineral deposits. The rates of replenishment are **infinitely small** compared to the present rates of consumption. This makes minerals finite and non-renewable.

Even a large reserve will eventually be exhausted because extraction is continuous and rapid, while nature cannot replenish minerals within any humanly meaningful timeframe. Additionally, continued extraction increases costs as mining moves to greater depths and ore quality decreases, making reserves economically unviable over time.

Source: Conservation of Minerals, Chapter 5

Explanation

- The examiner expects **two linked ideas**: (1) geological formation is extremely slow/takes millions of years, and (2) consumption rate vastly exceeds replenishment rate — this is the core logic of "finite and non-renewable."
- The third point about **increasing costs and decreasing quality** with depth adds the economic angle, explaining why even *large* reserves are eventually exhausted — a direct answer to the second part of the question.
- Avoid vague statements like "minerals take a long time to form" without linking it to the consumption vs. replenishment comparison — that comparison is what the passage stresses.

Q27. deep thorough-understanding § CONSERVATION OF MINERALS **[3]**

As minerals are extracted more and more deeply from the earth, the cost of extraction rises and the quality of ore decreases. How does this economic reality strengthen the case for recycling scrap metals, and why is recycling considered a step in mineral conservation?

◆ **Minerals and Energy Resources**

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Model Answer

As minerals are extracted from greater depths, extraction costs rise and ore quality decreases, making mining increasingly uneconomical. This makes recycling scrap metals a more cost-effective and practical alternative.

Recycling is considered a step in mineral conservation because:

- It reduces the demand for fresh extraction of limited mineral deposits.
- Minerals are finite and non-renewable; geological processes replenish them infinitely slowly compared to consumption rates.
- Using scrap metals extends the life of existing mineral reserves, ensuring their availability for the future.

Thus, recycling helps use mineral resources in a planned and sustainable manner.

Source: Conservation of Minerals, Chapter 5

Explanation

The answer links the economic fact (deeper extraction = higher cost + lower quality) to the logical argument for recycling. Examiners expect: (1) the economic reason stated clearly, (2) recycling as a conservation step explained with reference to finite/non-renewable nature of minerals, and (3) the sustainability angle. The textbook explicitly lists "recycling of metals, using scrap metals" as conservation steps — quote or paraphrase this directly for full marks.

Q28. medium | thorough-understanding | § CONSERVATION OF MINERALS **[1]**

Which of the following best explains why improving technology to use low-grade ores is considered a mineral conservation measure?

(A) It reduces the need to import minerals from other countries.

(B) It allows workable deposits to last longer by making previously unviable ores economically useful.

(C) It speeds up the geological process of mineral formation.

(D) It increases the total volume of mineral deposits in the earth's crust.

A It reduces the need to import minerals from other countries.

B It allows workable deposits to last longer by making previously unviable ores economically useful.

C It speeds up the geological process of mineral formation.

D It increases the total volume of mineral deposits in the earth's crust.

◆ Minerals and Energy Resources

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Model Answer

(B) It allows workable deposits to last longer by making previously unviable ores economically useful.

Explanation

The passage states that "improved technologies need to be constantly evolved to allow use of low grade ores at low costs." Since total mineral deposits are finite and fixed (only ~1% of earth's crust), using low-grade ores extends the life of existing deposits — this is conservation. Options C and D are scientifically impossible; Option A is unrelated to the passage's reasoning.

Q29. medium | thorough-understanding | § Energy Resources **[3]**

Coal-based thermal power stations in India are deliberately located close to coalfields rather than near the cities they supply. Using your knowledge of coal's physical properties, justify this locational decision.

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Model Answer

Coal is a **bulky material** that loses weight on use, as it is reduced to ash after burning. Transporting such heavy, low-value-per-tonne material over long distances to cities would be expensive and inefficient. It is far more economical to generate electricity at the coalfield itself and then transmit the power through transmission lines to cities. Therefore, thermal power stations are deliberately located near coalfields like those in the Damodar Valley, minimising transport costs and logistical difficulties.

Source: Conventional Sources of Energy, Chapter 5

Explanation

The textbook directly states: *"Coal is a bulky material, which loses weight on use as it is reduced to ash. Hence, heavy industries and thermal power stations are located on or near the coalfields."* Examiners expect you to use this specific reasoning — bulky + weight loss on use = costly to transport → locate near source, not consumer. Mention the contrast: electricity (not coal) is then transmitted to cities. Naming a coalfield (e.g., Damodar Valley) adds precision and can earn the third mark.

Q30. deep | thorough-understanding | § Energy Resources **[3]**

India's rural households are being encouraged to shift from burning firewood and cattle dung cakes to using biogas plants. Explain how this single change can produce two agricultural and two environmental benefits simultaneously.

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Model Answer

Shifting to biogas plants provides the following benefits:

Agricultural Benefits:

1. The slurry left after biogas production is **improved quality manure**, which enriches soil fertility better than raw dung.
2. Since dung is no longer burned, the **full nutritive value of cattle waste** is available for use as fertiliser in fields.

Environmental Benefits:

1. Reduced burning of firewood **conserves forest cover** and prevents deforestation.
2. Less burning of dung cakes and firewood means **reduced air pollution** and lower release of harmful gases.

Source: Non-Conventional Sources of Energy, Chapter 5

Explanation

- The passage explicitly states biogas gives "twin benefits: energy and improved quality of manure" — use this phrase.
- The key agricultural point is that burning dung destroys manure value; biogas preserves it AND improves it.
- Environmental benefits come from *not* burning: forests are saved and air pollution is reduced.
- For 3 marks, examiners expect 2 agricultural + 2 environmental points clearly labelled — don't just list vaguely. Four crisp points is the right structure here.

Q31. medium | thorough-understanding | § Conventional Sources of Energy **[1]**

Which of the following correctly explains why thermal power stations are located close to coalfields rather than near cities they supply?

A Coal is a bulky material that loses weight on use as it burns to ash, making long-distance transport costly and inefficient.
B Coal releases toxic gases that make it unsafe to transport through populated areas.
C Electricity cannot travel long distances through transmission lines without losing all its power.
D Water needed for cooling turbines is only available near coalfields.

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Model Answer

Answer: A

Coal is a bulky material that loses weight on use as it burns to ash, making long-distance transport costly and inefficient; hence thermal power stations are located near coalfields.

Source: Conventional Sources of Energy, Chapter 5

Explanation

The textbook explicitly states: *"Coal is a bulky material, which loses weight on use as it is reduced to ash. Hence, heavy industries and thermal power stations are located on or near the coalfields."* Option B is wrong as transport safety isn't the reason given. Option C is incorrect — electricity *can* travel long distances via transmission lines (that's why it's generated centrally). Option D has no textbook support.

Q32. medium | thorough-understanding | § Conventional Sources of Energy **[1]**

Anthracite, bituminous, lignite and peat are all forms of coal. What single factor primarily determines which form is produced?

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Model Answer

The degree of compression, depth of burial, and duration over millions of years primarily determine which form of coal is produced — greater pressure and time producing higher-grade coal like anthracite.

Source: Conventional Sources of Energy, chapter 5

Explanation

The passage states coal is found in different forms "depending on the degrees of compression and the depth and time of burial." Examiners expect you to identify **degree of compression / depth and time of burial** as the single determining factor. Mentioning the progression (peat → lignite → bituminous → anthracite) is not required for 1 mark but citing the factor clearly is essential.

Q33. straightforward | thorough-understanding | § Conventional Sources of Energy **[1]**

Bituminous coal found in India's Gondwana formations is classified into two categories based on industrial use. Which category is specifically valued for smelting iron in blast furnaces, and where are its major reserves located in India?

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Model Answer

Metallurgical coal is valued for smelting iron in blast furnaces. Its major reserves are in the **Damodar Valley** (West Bengal–Jharkhand), with important coalfields at Jharia, Raniganj, and Bokaro.

Source: Conventional Sources of Energy, Chapter 5

Explanation

The examiner expects you to name the category (**metallurgical coal**) and its location (**Damodar Valley / Jharia, Raniganj, Bokaro**). Both parts are needed for full credit. Note that metallurgical coal is high-grade bituminous coal found in **Gondwana formations** — this detail links the question stem to the answer and shows understanding.

Q34. medium | thorough-understanding | § Conventional Sources of Energy **[3]**

Gondwana coalfields and tertiary coalfields are both found in India, yet they differ greatly in age, location and type of coal. Compare the two, explaining where each is found and what makes Gondwana coal particularly significant for industry.

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Model Answer

Gondwana Coalfields:

- Age: Over 200 million years old
- Location: Damodar Valley (West Bengal–Jharkhand) — Jharia, Raniganj, Bokaro; also Godavari, Mahanadi, Son and Wardha valleys
- Type: Mainly **metallurgical (bituminous) coal**, which is high-grade and used for smelting iron in blast furnaces

Tertiary Coalfields:

- Age: About 55 million years old
- Location: North-eastern states — Meghalaya, Assam, Arunachal Pradesh and Nagaland
- Type: Lower-grade coal

Significance of Gondwana Coal: Gondwana coal is metallurgical coal — essential for iron and steel industry. Its high carbon content and great age make it India's most industrially valuable coal resource.

Source: Conventional Sources of Energy, chapter 5

Explanation

- Examiners expect a clear comparison covering **age, location, and type** for both coalfields — tabular or point format saves time and earns full marks.
- The key phrase examiners look for is **"metallurgical coal"** and its use in **blast furnaces** — this directly answers why Gondwana coal is industrially significant.
- Avoid writing general facts about coal formation; focus only on what the question asks.

Q35. medium | thorough-understanding | § Conventional Sources of Energy **[2]**

A refinery is described as a 'nodal industry' for several other industries. Justify this description by explaining what petroleum provides to industries beyond just fuel.

♦ Minerals and Energy Resources

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Model Answer

A petroleum refinery is called a 'nodal industry' because petroleum does not merely serve as fuel — it also supplies **lubricants for machinery** and acts as a **raw material** for several manufacturing industries. Petroleum refineries specifically support synthetic textile, fertiliser, and numerous chemical industries, making them a hub that connects multiple industries.

Source: Conventional Sources of Energy, Chapter 5

Explanation

The key phrase is directly from the textbook: *"Petroleum refineries act as a 'nodal industry' for synthetic textile, fertiliser and numerous chemical industries."* Examiners expect you to mention:

1. Petroleum's role beyond fuel — lubricants and raw materials.
2. The specific industries it supports (synthetic textiles, fertilisers, chemicals).

Do not just write "it provides fuel" — that misses the point of the question entirely.

Q36. medium | thorough-understanding | § Conventional Sources of Energy **[1]**

In petroleum-bearing rock formations, gas is almost always found above oil rather than below it. Why is this so?

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Model Answer

Gas is lighter than oil, so it naturally rises and accumulates above the oil layer in petroleum-bearing rock formations.

Source: Conventional Sources of Energy, Petroleum section, Chapter 5

Explanation

The textbook directly states: **"Gas, being lighter, usually occurs above the oil."** This is the key fact examiners expect. For 1 mark, one crisp sentence stating the reason (gas is lighter → rises above oil) is sufficient. No extra detail needed.

Q37. straightforward | thorough-understanding | § Conventional Sources of Energy **[3]**

Natural gas has grown into a major energy resource in India. Identify any THREE distinct sectors or uses for which natural gas is now employed, and briefly explain why it is considered an environment-friendly fuel compared to coal or oil.

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Model Answer

Three sectors where natural gas is used:

1. **Power sector** – used as fuel to generate electricity.
2. **Industrial/Chemical sector** – used as raw material in chemical, petrochemical, and fertiliser industries.
3. **Transport and domestic sector** – used as CNG (Compressed Natural Gas) for vehicles and PNG (Piped Natural Gas) for cooking at homes.

Environment-friendly fuel: Natural gas burns more cleanly than coal or oil, producing fewer pollutants and lower carbon emissions. It leaves no ash residue unlike coal, making it a comparatively cleaner and environment-friendly fuel.

Source: Conventional Sources of Energy, Chapter 5 — Natural Gas

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Explanation

- The question has two parts — **three sectors** and **why environment-friendly**. Address both clearly or you lose marks.
- The textbook explicitly lists power, industrial/chemical/fertiliser, and transport/domestic (CNG/PNG) as uses — use these directly.
- For the environmental part, the textbook implies cleaner burning compared to coal/oil; link it to fewer emissions and no ash. Keep it concise — this is a 3-mark answer, so 2 marks likely go to the sectors (1 each for any two/three) and 1 mark to the environmental reasoning.

Q38. deep thorough-understanding § Conventional Sources of Energy **[2]**

The per capita consumption of electricity is considered an index of a country's development. Why is electricity — rather than total coal or oil consumption — used as this measure?

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Model Answer

Electricity has such a wide range of applications in today's world that its per capita consumption is considered an index of development. Unlike coal or oil, which are used only for specific purposes (heating, fuel), electricity powers every sector — agriculture, industry, transport, and domestic use. It can also be generated from multiple sources (hydel, thermal, nuclear, solar), making it a more comprehensive and universal measure of development.

Source: Conventional Sources of Energy — Electricity, Chapter 5

Explanation

The textbook directly states: *"Electricity has such a wide range of applications in today's world that its per capita consumption is considered as an index of development."* Your answer must include this reason. The key contrast with coal/oil is that electricity is universally applicable across all sectors and can be produced from both renewable and non-renewable sources — making it a better overall indicator. Examiners expect: (1) wide range of applications, and (2) contrast with limited use of coal/oil.

Q39. deep | thorough-understanding | § Conventional Sources of Energy **[5]**

India depends heavily on coal for commercial energy, yet coal is also a major cause of environmental problems. Using your understanding of both energy resources and mineral conservation, explain why India must develop a strategy that goes beyond simply increasing coal extraction to meet its growing energy needs.

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Model Answer

India depends heavily on coal — the most abundantly available fossil fuel — for power generation, industry, and domestic needs. However, this over-dependence creates serious problems that demand a broader strategy:

1. **Coal is finite and non-renewable.** Formed over millions of years, it cannot be replenished; excessive extraction will exhaust reserves.
1. **Environmental damage.** Increasing use of fossil fuels causes serious environmental problems, making continued coal dependence unsustainable.
1. **Energy inefficiency.** India is presently one of the least energy-efficient countries in the world; judicious use of resources is essential.
1. **Alternatives exist.** India is blessed with abundant sunlight, wind, water, and biomass. Solar, wind, tidal, and biogas energy are renewable and environment-friendly.
1. **Conservation is key.** "Energy saved is energy produced" — promoting energy conservation alongside renewable energy are the twin planks of sustainable energy development.

Therefore, India must combine energy conservation with rapid expansion of non-conventional sources to meet growing needs sustainably.

Source: Chapter 5 — Energy Resources, Conventional Sources of Energy, Non-Conventional Sources of Energy, Conservation of Energy Resources

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Explanation

- The examiner expects you to **link** coal's limitations (non-renewable, polluting) with the **need for alternatives and conservation** — not just describe coal.
- Use textbook phrases like *"twin planks of sustainable energy"* and *"energy saved is energy produced"* — examiners reward accurate textbook language.
- 5 marks = roughly 5 distinct points; bullet format is clean and easier to mark.
- Avoid listing only facts about coal types — the question asks for a **strategy**, so your answer must move from problem → solution.

Q40. deep | thorough-understanding | § Conventional Sources of Energy **[2]**

The Krishna-Godavari basin has emerged as a significant new source of natural gas along India's east coast. Given that petroleum occurrences are associated with anticlines and fault traps in tertiary rock formations, what does the discovery of gas in this basin suggest about its underlying geological structure?

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Model Answer

The discovery of natural gas in the Krishna-Godavari basin suggests that the region contains **tertiary age rock formations** with structural traps such as **anticlines** (upfolds/domes) or **fault traps**. Since gas is lighter than oil and occurs above it in such formations, the basin likely has porous limestone or sandstone layers capped by non-porous rocks, creating conditions suitable for hydrocarbon accumulation.

Source: Conventional Sources of Energy (Petroleum & Natural Gas), Chapter 5

Explanation

- The question links two facts from the textbook: (1) petroleum/gas occurs in anticlines and fault traps in **tertiary rock formations**, and (2) Krishna-Godavari basin has new gas reserves.
- Your answer must connect the discovery to the geological implication — tertiary rocks with structural traps.
- Mention that gas sits above oil (lighter) — this shows understanding of the trap mechanism.
- Don't write more than 50–60 words; examiners award marks for these two key points.

Q41. straightforward | thorough-understanding | § Non-Conventional Sources of Energy **[1]**

[very_short_answer] What does photovoltaic technology do, and how does it differ from solar thermal energy?

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Model Answer

Photovoltaic technology converts sunlight directly into electricity, whereas solar thermal energy uses sunlight to generate heat.

Explanation

The passage explicitly states "Photovoltaic technology converts sunlight directly into electricity." The key distinction examiners expect is: photovoltaic = sunlight → electricity; solar thermal = sunlight → heat. Keep the answer to one crisp line for 1 mark.

Source: Non-Conventional Sources of Energy, Solar Energy section, Chapter 5

Q42. medium | thorough-understanding | § Non-Conventional Sources of Energy **[1]**

Which of the following correctly explains why biogas is considered a more efficient use of cattle dung than burning it as dung cake?

(A) Dung cake produces more heat per kilogram than biogas.

(B) Biogas yields energy AND improves manure quality, while burning dung cake destroys its value as manure.

(C) Biogas plants are cheaper to build than burning dung cake directly.

(D) Burning dung cake releases harmful nuclear radiation.

A Dung cake produces more heat per kilogram than biogas.
B Biogas yields energy AND improves manure quality, while burning dung cake destroys its value as manure.
C Biogas plants are cheaper to build than burning dung cake directly.
D Burning dung cake releases harmful nuclear radiation.

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Model Answer

(B) Biogas yields energy AND improves manure quality, while burning dung cake destroys its value as manure.

Explanation

The textbook states: *"Biogas is by far the most efficient use of cattle dung. It improves the quality of manure and also prevents the loss of trees and manure due to burning of fuel wood and cow dung cakes."* It also notes that using dung cake is discouraged because it "consumes most valuable manure which could be used in agriculture." Option B captures both advantages — dual benefit of energy + manure — making it the correct answer. Options A, C, and D are factually incorrect or unsupported by the text.

Q43. medium | thorough-understanding | § Non-Conventional Sources of Energy **[3]**

Geothermal power plants harness steam from underground to generate electricity. What chain of natural events produces that steam, starting from the Earth's interior?

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Model Answer

The Earth's interior is extremely hot, and temperature increases progressively with depth. Where the **geothermal gradient is high**, these high temperatures occur at shallow depths. **Groundwater** present in such areas seeps down and comes into contact with hot rocks, absorbing their heat. This water becomes so hot that when it rises back to the Earth's surface, it **converts into steam**. This steam is then used to drive turbines, which generate electricity in geothermal power plants.

Source: Non-Conventional Sources of Energy, Chapter 5 — Geo Thermal Energy

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Explanation

- The answer must follow the **chain**: Earth's internal heat → high geothermal gradient → groundwater absorbs heat from rocks → rises as steam → drives turbines.
- Examiners award marks for each link in the chain, so don't skip steps.
- Use textbook terms like "geothermal gradient" and "groundwater" for full marks.
- Avoid adding extra details not in the passage (e.g., plate tectonics) — stick to what's in the source.

Q44. deep | thorough-understanding | § Non-Conventional Sources of Energy **[3]**

Nuclear energy is classified as a non-conventional source, yet it uses mined minerals — uranium and thorium — as fuel. Using what you know about both conventional and non-conventional energy, justify why nuclear energy is placed in the non-conventional category rather than with fossil fuels.

◆ Minerals and Energy Resources

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Model Answer

Nuclear energy is classified as a **non-conventional source** because the textbook explicitly places atomic energy in this category alongside solar, wind, tidal, geothermal, and biogas energy. The key distinction is the **method of energy generation**: conventional sources like coal, petroleum, and natural gas are fossil fuels formed over millions of years by burning carbon-based material. Nuclear energy, however, is obtained by **altering the structure of atoms** (fission), releasing enormous heat to generate electricity — a fundamentally different process. Unlike fossil fuels, it does not involve combustion of organic matter, and its classification is based on the nature of the energy process, not solely whether the fuel is mined.

Source: Energy Resources, Chapter 5

Explanation

- The examiner expects you to use the textbook's own definition: nuclear energy is placed under non-conventional sources in the chapter — **state this directly**.
- The core justification is the **process difference**: fossil fuels burn carbon; nuclear energy works by **altering atomic structure** — quote or paraphrase this from the passage.
- Don't get confused by the fact that uranium/thorium are mined minerals — the classification is based on the **energy conversion method**, not the physical origin of the fuel.
- Avoid writing a long essay; 3 marks = 3 distinct points, tightly stated.

Q45. medium | thorough-understanding | § Non-Conventional Sources of Energy **[1]**

[very_short_answer] India's largest wind farm cluster is located at the southern tip of Tamil Nadu. Identify the specific location and explain the geographical characteristic that makes it exceptionally suitable for wind energy generation.

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Model Answer

India's largest wind farm cluster is located at **Nagarcoil** (southern tip of Tamil Nadu). Its location at the southernmost tip creates a natural wind corridor between two seas, ensuring strong and consistent winds suitable for power generation.

Explanation

The textbook states the largest wind farm cluster runs from **Nagarcoil to Madurai** in Tamil Nadu. For 1 mark, name Nagarcoil and give one geographical reason (coastal/tip location channelling strong winds). Examiners expect both the place name and the geographical reason in one line.

Q46. medium | thorough-understanding | § Non-Conventional Sources of Energy **[3]**

A rural household currently burns firewood and dung cakes for cooking. A biogas plant is installed nearby. Explain TWO specific ways in which switching to biogas would benefit both the environment and agricultural productivity of that household.

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Model Answer

Benefit 1 — Environmental benefit: Burning firewood and dung cakes releases smoke and pollutants, contributing to deforestation and air pollution. Biogas burns more cleanly and prevents the loss of trees, thereby helping conserve forest cover and reducing environmental degradation.

Benefit 2 — Agricultural productivity: When dung cakes are burnt as fuel, valuable manure is wasted. Biogas plants use cattle dung (Gobar gas plants) and the residual slurry left after gas production is **improved quality manure**. This enriched manure can be applied to fields, directly boosting the agricultural productivity of the household.

Thus, biogas provides twin benefits: cleaner energy for cooking and better manure for farming.

Source: Non-Conventional Sources of Energy, Chapter 5

Explanation

- The textbook explicitly states biogas provides **"twin benefits — energy and improved quality of manure"** — examiners expect both points.
- Mention **Gobar gas plant** by name for full marks.
- Do not just say "biogas is clean" — link it specifically to preventing loss of firewood/trees (environment) and preventing burning of dung so manure is preserved (agriculture). These are the two specific angles the question demands.
- At 3 marks, two well-explained points (not just listed) is the right approach.

Q47. deep | thorough-understanding | § Non-Conventional Sources of Energy **[1]**

[very_short_answer] Experimental geothermal energy projects have been set up in Puga Valley (Ladakh) and Parvati Valley (Himachal Pradesh). What geological conditions make these sites suitable for geothermal electricity generation?

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Model Answer

These sites have **high geothermal gradients**, meaning the Earth's interior heat reaches shallow depths. Groundwater absorbs this heat, turns into steam, which is used to drive turbines and generate electricity.

Source: Non-Conventional Sources of Energy, Geo Thermal Energy section

Explanation

The key phrase examiners look for is "high geothermal gradient" — where temperatures are high at shallow depths, heating groundwater into steam. Mentioning the steam-driven turbine mechanism completes the answer. Avoid writing a general definition of geothermal energy; focus on the geological condition (heat gradient) that makes these specific sites suitable.

Q48. medium | thorough-understanding | § Conservation of Energy Resources **[3]**

India's energy consumption has been rising steadily since Independence, placing immense pressure on its finite energy resources. Explain why sustainable energy development is critical for India, and discuss how promotion of energy conservation and use of renewable energy sources together address this challenge.

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Model Answer

India's energy consumption has risen steadily since Independence, putting pressure on finite conventional resources like coal, oil, and gas. This makes sustainable energy development urgent for ensuring long-term economic growth and energy security.

Energy Conservation reduces pressure on limited fossil fuels. Since India is one of the least energy-efficient countries, steps like using public transport, switching off unused electricity, and adopting power-saving devices help conserve resources ("energy saved is energy produced").

Renewable Energy Sources — solar, wind, biogas, tidal, and geothermal — are inexhaustible and environment-friendly. They reduce dependence on fossil fuels, lower import costs, and minimize environmental pollution.

Together, these twin planks ensure energy security, economic growth, and environmental sustainability for India's future.

Source: Chapter 5 — Conservation of Energy Resources, Non-Conventional Sources of Energy

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Explanation

- Examiners expect **two distinct points** — conservation AND renewables — since the question explicitly asks for both. Treat them as separate planks (the textbook uses this exact term).
- Include the textbook phrase **"twin planks of sustainable energy"** — it signals you've read the source.
- Give **one or two concrete examples** under each point; don't just define them abstractly.
- At 3 marks, ~75–80 words is ideal. Avoid bullet overload — 2–3 tight points suffice.

Q49. deep thorough-understanding § Conservation of Energy Resources **[3]**

A student argues: 'Saving energy is not as useful as producing more energy, because saving does not add to the total supply.' Using your understanding of energy resources and their limitations, explain why this argument is flawed.

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Model Answer

The student's argument is flawed because energy conservation directly reduces demand on limited energy resources, effectively extending their supply. India's conventional energy sources — coal, petroleum, and natural gas — are finite and non-renewable. Saving energy means existing reserves last longer, which is equivalent to adding to the available supply.

The textbook states: *"energy saved is energy produced."* Conservation also reduces environmental damage caused by burning fossil fuels. By using public transport, switching off unused electricity, and adopting power-saving devices, we ensure sustainable use of resources — making conservation as valuable as, if not more important than, producing new energy.

Source: Conservation of Energy Resources, Chapter 5

Explanation

- The key phrase examiners expect is **"energy saved is energy produced"** — quote it directly.
- Link conservation to the **finite/non-renewable** nature of conventional sources.
- Mention 1–2 practical examples of conservation (public transport, switching off lights) to show application.
- Avoid writing a long essay — 3 marks = ~3 distinct points in tight sentences.

Q50. deep | thorough-understanding | § ACTIVITY **[3]**

Magnetite is considered the finest iron ore, yet hematite is the most important iron ore industrially. Explain why this apparent contradiction exists.

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Model Answer

Magnetite has a very high iron content (up to 70%) and excellent magnetic properties, making it the *finest* in quality. However, **hematite is the most important industrial iron ore** because of the far greater **quantity** in which it is available and used, even though its iron content is slightly lower (50–60%). Industrial importance depends not just on quality but on **availability and volume of use**. Thus, magnetite is superior in grade, but hematite dominates actual industrial production.

Source: Ferrous Minerals — Chapter 5

Explanation

- The key distinction examiners expect is **quality vs. quantity/availability**.
- Mention the iron percentages: magnetite (up to 70%), hematite (50–60%) — figures show you've read the source.
- The word "industrially" in the question signals that *quantity used* is the deciding factor, not purity alone.
- Avoid writing a lengthy essay; 3 marks = ~3 clear points, which this answer covers: magnetite's quality, hematite's dominance by quantity, and the reason for the apparent contradiction.

Q51. medium | thorough-understanding | § ACTIVITY **[1]**

[mcq] Which of the following correctly pairs a mineral with both its mode of occurrence AND one of its major uses?
(A) Bauxite — formed in veins and lodes — used in making aluminium
(B) Mica — formed as placer deposits — used in electrical and electronic industries
(C) Copper — found in igneous and metamorphic rock veins — used in electrical cables and electronics
(D) Manganese — formed by evaporation of sea water — used in making steel and ferro-manganese alloy

A Bauxite — formed in veins and lodes — used in electrical cables
B Mica — formed as placer deposits — used in electrical and electronic industries
C Copper — found in igneous and metamorphic rock veins — used in electrical cables and electronics
D Gold — formed by decomposition and weathering of surface rocks — used in smelting iron

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Model Answer

(C) Copper — found in igneous and metamorphic rock veins — used in electrical cables and electronics.

Explanation

The passage states that major metallic minerals like copper are obtained from **veins and lodes** in igneous and metamorphic rocks, and copper is "mainly used in **electrical cables, electronics** and chemical industries." Options A and B are incorrect pairings of mode of occurrence; D is wrong because manganese occurs in ocean bed nodules, not by evaporation. Only option C matches both mode of occurrence and use correctly.

Q52. medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

Coal is found in sedimentary rock formations, while metallic minerals like copper, tin and zinc are found in igneous and metamorphic rocks. What does this difference in host rock tell us about the contrasting processes by which these two categories of minerals were formed?

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Model Answer

Coal and metallic minerals like copper, tin, and zinc are formed by entirely different geological processes, which is why they occur in different rock types.

Coal is found in **sedimentary rocks** because it formed through the deposition, accumulation, and compression of plant material in horizontal strata over millions of years — a surface-level, layering process.

Metallic minerals are found in **igneous and metamorphic rocks** because they were formed when minerals in liquid/molten or gaseous forms were forced upward through cracks and crevices, cooling and solidifying to form veins and lodes.

Thus, coal reflects a sedimentary (depositional) origin, while metallic minerals reflect an igneous/metamorphic (heat and pressure-driven, upward-forcing) origin.

Source: Chapter 5 — Minerals and Energy Resources, Mode of Occurrence of Minerals

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Explanation

- The examiner expects you to **link rock type → formation process** for both categories — that's the core of a 3-mark answer.
- Key terms to use: **veins and lodes**, **molten/gaseous forms**, **deposition/accumulation**, **horizontal strata** — these come directly from the textbook and earn marks.
- Don't just list which mineral is where; **explain the process** — that's what the question asks ("what does this tell us *about the processes*").
- Two distinct processes = roughly two points, plus a concluding contrast = 3-mark coverage.

Q53. medium | thorough-understanding | § (whole-chapter synthesis) **[1]**

Consider the following two statements:
Assertion (A): Heavy industries and thermal power stations are preferably located on or near coalfields.
Reason (R): Coal is a bulky material that loses weight on use as it is reduced to ash.
Choose the correct option:
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false, but (R) is true.

A Both (A) and (R) are true and (R) is the correct explanation of (A).
B Both (A) and (R) are true, but (R) is not the correct explanation of (A).
C (A) is true, but (R) is false.
D (A) is false, but (R) is true.

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Model Answer

(A) Both (A) and (R) are true and (R) is the correct explanation of (A).

Explanation

The textbook explicitly states: "Coal is a bulky material, which loses weight on use as it is reduced to ash. Hence, heavy industries and thermal power stations are located on or near the coalfields." This confirms both statements are true and R directly explains A.

Q54. medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

Both bauxite and coal are found in significant quantities in the peninsular plateau region of India, yet their modes of formation are completely different. Explain how each of these minerals is formed, and identify one state in peninsular India where deposits of both are found.

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Model Answer

Formation of Bauxite: Bauxite is formed by the decomposition of surface rocks rich in aluminium silicates. Soluble constituents are removed, leaving behind a residual mass of weathered material. It is thus a product of chemical weathering.

Formation of Coal: Coal is formed by the compression of plant material over millions of years under great heat and pressure in sedimentary rock strata. It is a fossil fuel found in horizontal beds or layers.

State with both: Odisha — it is a major bauxite-producing state (Panchpatmali, Koraput) and also has coal deposits in the Mahanadi valley.

Source: Chapter 5 — Minerals and Energy Resources

Explanation

- The key contrast examiners look for: bauxite = **weathering/decomposition** of rocks; coal = **compression of plant material** over millions of years in sedimentary layers.
- Name a **peninsular** state with both — Odisha fits best from the text (65% bauxite share; Mahanadi valley coalfields explicitly mentioned).
- Don't confuse bauxite's mode (residual weathering) with sedimentary deposition — the MCQ in the exercise directly tests this distinction.

Q55. deep | thorough-understanding | § (whole-chapter synthesis) **[2]**

Mica is prized for its di-electric and insulating properties, while copper is valued for its electrical conductivity. Both are described as indispensable to the electrical and electronics industries. Explain the specific role each mineral plays in this industry, and account for why the industry cannot function without both despite their seemingly opposite electrical properties.

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Model Answer

Mica acts as an **insulator** in electrical devices. Its excellent di-electric strength, low power loss factor, and resistance to high voltage prevent current from leaking between components, protecting circuits.

Copper, being malleable, ductile, and a **good conductor**, is used in electrical cables and electronics to carry current efficiently.

Both are essential: copper *transmits* electricity, while mica *controls and contains* it — making safe, functional electrical systems impossible without either.

Source: Chapter 5 — Non-Metallic Minerals; Non-Ferrous Minerals

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Explanation

The examiner wants you to identify the **specific property** of each mineral and then address the *"why both are needed"* part — that's the analytical step many students skip. The key insight is that an electrical industry needs both **conduction** (copper) and **insulation/control** (mica); they are complementary, not contradictory. Stick to textbook terms: "di-electric strength," "insulating properties," "malleable," "ductile," "good conductor." Don't write general facts about where they are found — the question is about their *role*.

Q56. medium | thorough-understanding | § (whole-chapter synthesis) **[1]**

Which of the following pairings correctly matches a non-conventional energy source with the specific natural condition in India that makes it especially viable?
(A) Geothermal energy — India is a tropical country with abundant sunlight
(B) Tidal energy — fast-flowing Himalayan rivers with large dams
(C) Solar energy — India is a tropical country receiving intense solar radiation
(D) Wind energy — hot springs and high geothermal gradients in peninsular India

A Geothermal energy — India is a tropical country with abundant sunlight
B Tidal energy — fast-flowing Himalayan rivers with large dams
C Solar energy — India is a tropical country receiving intense solar radiation
D Wind energy — hot springs and high geothermal gradients in peninsular India

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Model Answer

(C) Solar energy — India is a tropical country receiving intense solar radiation

Explanation

The textbook explicitly states: "India is a tropical country. It has enormous possibilities of tapping solar energy." Options A and D swap the descriptions (geothermal ≠ sunlight; wind ≠ geothermal gradients). Option B confuses tidal energy with hydroelectric power.

Q57. deep | thorough-understanding | § (whole-chapter synthesis) **[5]**

Minerals are described as indispensable to human life at every level — from basic biological processes to everyday household needs to large-scale industrial and infrastructure development. Justify this statement by giving one example each at the biological, household, and industrial level, explaining in each case why the specific mineral cannot simply be substituted or left out.

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Model Answer

Minerals are truly indispensable at every level of human existence, and no easy substitutes exist for them.

Biological Level: Life processes cannot occur without minerals. Although minerals constitute only about 0.3% of our total nutrient intake, they are so potent that without them we cannot utilise the remaining 99.7% of foodstuffs. For example, iron is essential for haemoglobin formation; no other element can perform this specific biochemical role.

Household Level: Toothpaste contains abrasive minerals like silica and limestone for cleaning, fluorite for fluoride (which prevents cavities), and titanium oxide for whitening. Each mineral performs a distinct function; removing them would make the product ineffective.

Industrial Level: Iron and aluminium minerals are used to manufacture buses, trains, ships, and machinery. Without these metals, large-scale infrastructure and transport would be impossible, as no equally strong and available substitute exists at industrial scale.

Thus, from body functions to daily use to nation-building, minerals remain irreplaceable.

Source: Chapter 5 – Minerals and Energy Resources, Introduction and "All living things need minerals" section

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Explanation

- The examiner expects **one distinct example per level** (biological, household, industrial) — each explained with *why it cannot be substituted*. That's the core of the "justify" demand.
- The source explicitly states minerals make up only 0.3% of nutrients yet are indispensable — use this fact for the biological point; it impresses examiners.
- For household, toothpaste is directly given in the passage — safe and textbook-accurate.
- For industrial, the introduction passage (buses, trains, ships made from minerals) is your anchor.
- Do **not** write general statements without linking back to the "cannot be substituted" part — that's where most students lose marks.

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