



ARIHANTAM ACADEMY

Faith Strength Education

CLASS 12 CHEMISTRY — BIHAR BOARD (BSEB)

METALLURGY — DPP 30 TO 33

Student Workbook + Teacher Answer Key

Arihantam Academy • Faith Strength Education

Bihar Board Class 12 Chemistry: board-oriented daily practice for Metallurgy / General Principles and Processes of Isolation of Elements.

Coverage: DPP 30 ores and concentration; DPP 31 calcination, roasting and reduction; DPP 32 aluminium extraction and refining; DPP 33 full chapter test.



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CLASS 12 CHEMISTRY — BIHAR BOARD (BSEB)

DAILY PRACTICE PROBLEM — DPP 30

Metallurgy | Occurrence of metals, ores and concentration

Student Name: _____	Roll No.: _____
DPP No.: 30 Chapter: Metallurgy	Date: _____
Topic: Occurrence of metals, ores and concentration	Score: ____ / 30

Instructions: Answer all objective questions. Attempt any 3 short-answer questions and any 1 long-answer question.

Section A — Objective Questions (15 × 1 = 15)

- Mineral from which metal can be profitably extracted is:
(A) gangue (B) ore (C) flux (D) slag
- Unwanted earthy impurities with ore are:
(A) slag (B) gangue (C) flux (D) matte
- Removal of gangue from ore is:
(A) refining (B) concentration (C) reduction (D) alloying
- Hydraulic washing is based on difference in:
(A) density (B) melting point (C) boiling point (D) colour
- Froth flotation is mainly used for:
(A) oxide ores (B) sulphide ores (C) halide ores (D) carbonate ores
- In froth flotation, pine oil acts as:
(A) collector/frother (B) flux (C) reductant (D) electrolyte
- Magnetic separation is used when:
(A) ore and gangue differ in magnetic properties (B) both have same density (C) only volatile ore (D) only liquid ore
- Leaching involves:
(A) heating without air (B) selective dissolution in reagent (C) electrolysis only (D) distillation
- Bauxite is concentrated by:
(A) froth flotation (B) leaching with NaOH (C) magnetic separation (D) hydraulic washing only
- Calamine is ore of:
(A) iron (B) zinc (C) aluminium (D) copper
- Haematite formula is:
(A) Fe_2O_3 (B) Fe_3O_4 (C) FeCO_3 (D) FeS_2
- Copper pyrites formula is:
(A) CuFeS_2 (B) Cu_2S (C) Cu_2O (D) CuCO_3
- Cinnabar is ore of:
(A) zinc (B) mercury (C) lead (D) silver
- Cassiterite is ore of:
(A) tin (B) copper (C) zinc (D) aluminium
- Flux combines with gangue to form:
(A) matte (B) slag (C) ore (D) alloy

Section B — Short Answer (Attempt any 3) (3 × 2 = 6)

- Define mineral, ore and gangue.
- What is concentration of ore?
- State principle of hydraulic washing.
- Describe froth flotation process.
- What is leaching? Give one example.

Section C — Long Answer (Attempt any 1) (1 × 5 = 5)

- Explain various methods of concentration of ores.
- Describe Bayer's process for purification/concentration of bauxite.

Teacher record: MCQ ____/15 | Short ____/6 | Long ____/5 | Presentation/Homework ____/4 | Total ____/30



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TEACHER ANSWER KEY — DPP 30

Metallurgy | Occurrence of metals, ores and concentration

MCQ answers: 1-B, 2-B, 3-B, 4-A, 5-B, 6-A, 7-A, 8-B, 9-B, 10-B, 11-B, 12-A, 13-B, 14-A, 15-B

Short-answer marking points

16. Mineral is natural metal-containing material; ore is mineral used profitably; gangue is unwanted earthy impurity.

17. Removal of gangue from crushed ore.

18. Difference in density of ore and gangue; heavier ore settles.

19. Sulphide ore is mixed with water, collector/frother and air; ore particles attach to froth and rise.

20. Selective dissolution, e.g. bauxite in NaOH or Au/Ag in NaCN.

Long-answer marking points

21. Hydraulic washing, magnetic separation, froth flotation and leaching—state principle and suitable ore type.

22. Digest bauxite with hot conc. NaOH to form soluble sodium aluminate; filter red mud, precipitate $\text{Al}(\text{OH})_3$ and heat to Al_2O_3 .

Remedial rule: Score below 15/26: rewrite extraction flows and equations, revise ore formulas and take a 10-MCQ re-test.



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CLASS 12 CHEMISTRY — BIHAR BOARD (BSEB)

DAILY PRACTICE PROBLEM — DPP 31

Metallurgy | Calcination, roasting, reduction and thermodynamics

Student Name: _____	Roll No.: _____
DPP No.: 31 Chapter: Metallurgy	Date: _____
Topic: Calcination, roasting, reduction and thermodynamics	Score: ____ / 30

Instructions: Answer all objective questions. Attempt any 3 short-answer questions and any 1 long-answer question.

Section A — Objective Questions (15 × 1 = 15)

- Heating ore in limited/no air is:
(A) roasting (B) calcination (C) smelting (D) refining
- Heating sulphide ore in excess air is:
(A) calcination (B) roasting (C) leaching (D) electrorefining
- Calcination is mainly used for:
(A) sulphide ores (B) carbonate/hydrated ores (C) native metals only (D) halide ores only
- Roasting converts sulphide ores mainly into:
(A) oxide (B) carbonate (C) hydroxide (D) native metal always
- Reduction of metal oxide using carbon is called:
(A) electrolysis (B) smelting (C) leaching (D) distillation
- CO acts as reducing agent for:
(A) Fe_2O_3 in blast furnace (B) Al_2O_3 in Hall process (C) NaCl only (D) MgO only
- Thermodynamic feasibility of reduction is judged by:
(A) Ellingham diagram (B) phase rule (C) Boyle law (D) Raoult law
- In Ellingham diagram, lower line represents oxide that is:
(A) less stable (B) more stable (C) always gas (D) always liquid
- At intersection of oxide lines:
(A) no reaction possible (B) reduction possibility changes (C) both metals vanish (D) temperature becomes zero
- Aluminium can reduce Cr_2O_3 because:
(A) Al_2O_3 line is lower (B) Cr_2O_3 line lower (C) Al is noble (D) Cr is gas
- Thermite reaction uses:
(A) Al powder (B) NaCl (C) H_2SO_4 (D) CuSO_4
- Self-reduction is also called:
(A) electrolytic reduction (B) auto-reduction (C) leaching (D) distillation
- In copper extraction, Cu_2O reacts with Cu_2S to form:
(A) Cu (B) CuSO_4 (C) CuO only (D) CuCl_2
- Flux added to Fe extraction is:
(A) SiO_2 (B) CaCO_3 (C) NaCl (D) Cu_2S
- Slag in blast furnace is:
(A) FeSiO_3 (B) CaSiO_3 (C) CaCO_3 (D) Fe_2O_3

Section B — Short Answer (Attempt any 3) (3 × 2 = 6)

- Define calcination and roasting.
- Why are carbonate ores calcined?
- What is smelting?
- What is Ellingham diagram?
- Write thermite reaction.

Section C — Long Answer (Attempt any 1) (1 × 5 = 5)

- Explain extraction of iron in blast furnace with reactions.
- Explain extraction of copper from copper pyrites, including self-reduction.

Teacher record: MCQ ____/15 | Short ____/6 | Long ____/5 | Presentation/Homework ____/4 | Total ____/30



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CLASS 12 CHEMISTRY — BIHAR BOARD (BSEB)

TEACHER ANSWER KEY — DPP 31

Metallurgy | Calcination, roasting, reduction and thermodynamics

MCQ answers: 1-B, 2-B, 3-B, 4-A, 5-B, 6-A, 7-A, 8-B, 9-B, 10-A, 11-A, 12-B, 13-A, 14-B, 15-B

Short-answer marking points

- 16. Calcination: heating in absence/limited air; roasting: heating in excess air.
- 17. To convert carbonate to oxide and remove CO_2 ; hydrated ores lose water.
- 18. Reduction of oxide at high temperature using reducing agent, generally with flux.
- 19. Plot of ΔG° for oxide formation versus temperature, used to assess reduction feasibility.
- 20. $\text{Cr}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Cr}$.

Long-answer marking points

- 21. Include concentration, calcination, reduction by CO, flux $\text{CaCO}_3 \rightarrow \text{CaO}$, slag $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$, and iron formation.
- 22. Include froth flotation, roasting, matte, partial oxidation to Cu_2O and self-reduction: $2\text{Cu}_2\text{O} + \text{Cu}_2\text{S} \rightarrow 6\text{Cu} + \text{SO}_2$.

Remedial rule: Score below 15/26: rewrite extraction flows and equations, revise ore formulas and take a 10-MCQ re-test.



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CLASS 12 CHEMISTRY — BIHAR BOARD (BSEB)

DAILY PRACTICE PROBLEM — DPP 32

Metallurgy | Electrolytic reduction, refining and important extractions

Student Name: _____	Roll No.: _____
DPP No.: 32 Chapter: Metallurgy	Date: _____
Topic: Electrolytic reduction, refining and important extractions	Score: ____ / 30

Instructions: Answer all objective questions. Attempt any 3 short-answer questions and any 1 long-answer question.

Section A — Objective Questions (15 × 1 = 15)

- Aluminium is extracted by:
(A) electrolysis of molten Al_2O_3 in cryolite (B) reduction with carbon only (C) roasting bauxite (D) leaching with cyanide
- Cryolite formula is:
(A) Na_3AlF_6 (B) NaAlO_2 (C) AlF_3 (D) NaF
- Cryolite is added to alumina to:
(A) increase melting point (B) lower melting point and increase conductivity (C) act as oxidant (D) form slag only
- In Hall-Héroult process, cathode is:
(A) graphite lining (B) carbon anode only (C) copper plate (D) iron rod
- At cathode in Hall process, Al^{3+} is:
(A) oxidised (B) reduced to Al (C) unchanged (D) converted to Al_2O_3
- In electrolytic refining, impure metal is:
(A) cathode (B) anode (C) electrolyte (D) salt bridge
- Pure metal sheet is:
(A) anode (B) cathode (C) gangue (D) flux
- In electrolytic refining, insoluble impurities collect as:
(A) slag (B) anode mud (C) matte (D) froth
- Blister copper is purified by:
(A) electrolytic refining (B) roasting only (C) hydraulic washing (D) distillation only
- Mond process is used for refining:
(A) Ni (B) Cu (C) Al (D) Fe
- Van Arkel process is used for refining:
(A) Ti and Zr (B) Au and Ag (C) Cu and Fe (D) Al and Mg
- Zone refining is used for:
(A) semiconductors (B) iron (C) mercury (D) sodium
- Distillation is suitable for metals with:
(A) low boiling point (B) high density only (C) high melting point only (D) strong magnetic property
- Poling is used in refining:
(A) Cu (B) Al (C) Na (D) Ca
- Cyanide process extracts:
(A) Au and Ag (B) Fe and Al (C) Na and K (D) Zn and Pb

Section B — Short Answer (Attempt any 3) (3 × 2 = 6)

- What is electrolytic reduction?
- State role of cryolite in Hall-Héroult process.
- Explain electrolytic refining.
- What is anode mud?
- Name metals refined by Mond and Van Arkel processes.

Section C — Long Answer (Attempt any 1) (1 × 5 = 5)

- Describe Hall-Héroult process for extraction of aluminium.
- Explain refining methods: electrolytic refining, zone refining, Mond process and Van Arkel process.

Teacher record: MCQ ____/15 | Short ____/6 | Long ____/5 | Presentation/Homework ____/4 | **Total** ____/30



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TEACHER ANSWER KEY — DPP 32

Metallurgy | Electrolytic reduction, refining and important extractions

MCQ answers: 1-A, 2-A, 3-B, 4-A, 5-B, 6-B, 7-B, 8-B, 9-A, 10-A, 11-A, 12-A, 13-A, 14-A, 15-A

Short-answer marking points

16. Extraction of highly reactive metals by electrolysis of molten salts/oxides.
17. It lowers fusion temperature of alumina and improves conductivity/fluidity.
18. Impure metal as anode, pure metal as cathode, soluble salt solution; metal dissolves at anode and deposits at cathode.
19. Insoluble impurities falling below anode during electrorefining.
20. Mond: Ni; Van Arkel: Ti and Zr.

Long-answer marking points

21. Al_2O_3 dissolved in $\text{NaAlF}_4/\text{CaF}_2$, graphite-lined cathode and carbon anodes; $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$; anode oxygen reacts with carbon to form CO/CO_2 .
22. Give principles and steps: electrorefining; zone refining by moving molten zone; Mond volatile $\text{Ni}(\text{CO})_4$ formation/decomposition; Van Arkel volatile iodide formation/decomposition.

Remedial rule: Score below 15/26: rewrite extraction flows and equations, revise ore formulas and take a 10-MCQ re-test.



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CLASS 12 CHEMISTRY — BIHAR BOARD (BSEB)

DAILY PRACTICE PROBLEM — DPP 33

Metallurgy | Metallurgy: full chapter important-question test

Student Name: _____	Roll No.: _____
DPP No.: 33 Chapter: Metallurgy	Date: _____
Topic: Metallurgy: full chapter important-question test	Score: ____ / 30

Instructions: Answer all objective questions. Attempt any 3 short-answer questions and any 1 long-answer question.

Section A — Objective Questions (15 × 1 = 15)

- Profitable mineral is:
(A) gangue (B) ore (C) flux (D) slag
- Froth flotation is for:
(A) oxide ores (B) sulphide ores (C) halide ores (D) native metals
- Bauxite is concentrated by:
(A) leaching (B) distillation (C) froth only (D) magnetic separation only
- Calcination is heating in:
(A) excess air (B) limited/absence of air (C) water vapour only (D) oxygen-free liquid
- Roasting is for:
(A) carbonate ore (B) sulphide ore (C) oxide ore only (D) native ore
- Thermite reaction uses:
(A) Al powder (B) Cu powder (C) NaCl (D) H₂O
- Blast-furnace flux is:
(A) CaCO₃ (B) SiO₂ (C) Cu₂S (D) FeO
- Blast-furnace slag is:
(A) CaSiO₃ (B) FeSiO₃ (C) CaCO₃ (D) Fe₂O₃
- Cryolite formula:
(A) Na₃AlF₆ (B) NaAlO₂ (C) AlF₃ (D) NaF
- Impure metal in electrorefining is:
(A) cathode (B) anode (C) electrolyte (D) flux
- Anode mud forms in:
(A) electrorefining (B) froth flotation (C) calcination (D) roasting
- Mond process refines:
(A) Ni (B) Cu (C) Al (D) Fe
- Van Arkel process refines:
(A) Ti/Zr (B) Au/Ag (C) Fe/Cu (D) Na/K
- Zone refining is used for:
(A) semiconductors (B) zinc (C) lead (D) sodium
- Gold extraction uses:
(A) cyanide process (B) Hall process (C) Bayer process (D) Mond process

Section B — Short Answer (Attempt any 3) (3 × 2 = 6)

- Define ore and gangue.
- Differentiate calcination and roasting.
- What is slag? Give example from blast furnace.
- Why is cryolite used in Hall process?
- What is electrolytic refining?

Section C — Long Answer (Attempt any 1) (1 × 5 = 5)

- Explain extraction of iron from haematite in blast furnace.
- Describe metallurgical principles from concentration to refining.

Teacher record: MCQ ____/15 | Short ____/6 | Long ____/5 | Presentation/Homework ____/4 | Total ____/30



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CLASS 12 CHEMISTRY — BIHAR BOARD (BSEB)

TEACHER ANSWER KEY — DPP 33

Metallurgy | Metallurgy: full chapter important-question test

MCQ answers: 1-B, 2-B, 3-A, 4-B, 5-B, 6-A, 7-A, 8-A, 9-A, 10-B, 11-A, 12-A, 13-A, 14-A, 15-A

Short-answer marking points

- 16. Ore is a mineral from which metal is profitably extracted; gangue is unwanted impurity.
- 17. Calcination is limited/no air for carbonate/hydrated ore; roasting is excess air for sulphide ore.
- 18. Fusible mass produced by flux and gangue; $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$.
- 19. Lowers melting point and increases conductivity of alumina.
- 20. Purification using impure anode, pure cathode and electrolyte.

Long-answer marking points

- 21. Mention reduction by CO, CaCO_3 decomposition, slag formation and iron collection.
- 22. Cover ore dressing, conversion to oxide, reduction according to reactivity/Ellingham principle and refining methods.

Remedial rule: Score below 15/26: rewrite extraction flows and equations, revise ore formulas and take a 10-MCQ re-test.