

SECTION-I(i) : (Maximum Marks : 33)

- This section contains **ELEVEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
Full Marks : +3 If only the bubble corresponding to the correct option is darkened.
Zero Marks : 0 If none of the bubbles is darkened.
Negative Marks : -1 In all other cases

1. Which of the following reduction reaction CANNOT be carried out with coke ?

- (A) $\text{Al}_2\text{O}_3 \rightarrow \text{Al}$ (B) $\text{ZnO} \rightarrow \text{Zn}$
 (C) $\text{Fe}_2\text{O}_3 \rightarrow \text{Fe}$ (D) $\text{Cu}_2\text{O} \rightarrow \text{Cu}$

2. The process that involves the removal of sulphur from the ores is :

- (A) Smelting (B) Roasting (C) Leaching (D) Refining

3. Match List-I and List-II :

- | List-I | List-II |
|---------------|---|
| (a) Haematite | (i) $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ |
| (b) Bauxite | (ii) Fe_2O_3 |
| (c) Magnetite | (iii) $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$ |
| (d) Malachite | (iv) Fe_3O_4 |

Choose the correct answer from the options given below :

- (A) (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)
 (B) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)
 (C) (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)
 (D) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

4. Match list-I with list-II :

- | List-I | List-II |
|---------------|-----------------------------|
| (a) Mercury | (i) Vapour phase refining |
| (b) Copper | (ii) Distillation refining |
| (c) Silicon | (iii) Electrolytic refining |
| (d) Nickel | (iv) Zone refining |

Choose the most appropriate answer from the option given below :

- (A) a-i, b-iv, c-ii, d-iii (B) a-ii, b-iii, c-i, d-iv
 (C) a-ii, b-iii, c-iv, d-i (D) a-ii, b-iv, c-iii, d-i

5. The chemical that is added to reduce the melting point of the reaction mixture during the extraction of aluminium is :

- (A) Cryolite (B) Bauxite (C) Calamine (D) Kaolite

6. Match List-I with List-II.

- | List-I
(Metal) | List-II
(Ores) |
|--------------------------|--------------------------|
| (a) Aluminium | (i) Siderite |
| (b) Iron | (ii) Calamine |
| (c) Copper | (iii) Kaolinite |
| (d) Zinc | (iv) Malachite |

Choose the correct answer from the options given below :

- (A) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
 (B) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)
 (C) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)
 (D) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

7. Which of the following ore is concentrated using group 1 cyanide salt ?
 (A) Sphalerite (B) Calamine (C) Siderite (D) Malachite
8. Al_2O_3 was leached with alkali to get X. The solution of X on passing of gas Y, forms Z. X, Y and Z respectively are :
 (A) $\text{X} = \text{Na}[\text{Al}(\text{OH})_4]$, $\text{Y} = \text{SO}_2$, $\text{Z} = \text{Al}_2\text{O}_3$
 (B) $\text{X} = \text{Na}[\text{Al}(\text{OH})_4]$, $\text{Y} = \text{CO}_2$, $\text{Z} = \text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$
 (C) $\text{X} = \text{Al}(\text{OH})_3$, $\text{Y} = \text{CO}_2$, $\text{Z} = \text{Al}_2\text{O}_3$
 (D) $\text{X} = \text{Al}(\text{OH})_3$, $\text{Y} = \text{SO}_2$, $\text{Z} = \text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$
9. Match List-I with List-II.

List-I	List-II
(a) Siderite	(i) Cu
(b) Calamine	(ii) Ca
(c) Malachite	(iii) Fe
(d) Cryolite	(iv) Al
	(v) Zn

Choose the correct answer from the options given below :

- (A) (a)→(iii), (b)→(i), (c)→(v), (d)→(ii)
 (B) (a)→(i), (b)→(ii), (c)→(v), (d)→(iii)
 (C) (a)→(iii), (b)→(v), (c)→(i), (d)→(iv)
 (D) (a)→(i), (b)→(ii), (c)→(iii), (d)→(iv)
10. Match List-I with List-II.

List-I	List-II
(a) Sodium Carbonate	(i) Deacon
(b) Titanium	(ii) Castner-Kellner
(c) Chlorine	(iii) Van-Arkel
(d) Sodium hydroxide	(iv) Solvay

Choose the correct answer from the options given below :

- (A) (a)→(iv), (b)→(iii), (c)→(i), (d)→(ii)
 (B) (a)→(i), (b)→(iii), (c)→(iv), (d)→(ii)
 (C) (a)→(iv), (b)→(i), (c)→(ii), (d)→(iii)
 (D) (a)→(iii), (b)→(ii), (c)→(i), (d)→(iv)
11. Match List -I with List - II

List - I (Ore)	List - II (Element Present)
(a) Kernite	(i) Tin
(b) Cassiterite	(ii) Boron
(c) Calamine	(iii) Fluorine
(d) Cryolite	(iv) Zinc

Choose the most appropriate answer from the options given below.

- (A) (a) → (i), (b) → (iii), (c) → (iv), (d) → (ii)
 (B) (a) → (ii), (b) → (i), (c) → (iv), (d) → (iii)
 (C) (a) → (ii), (b) → (iv), (c) → (i), (d) → (iii)
 (D) (a) → (iii), (b) → (i), (c) → (ii), (d) → (iv)

SECTION-I(ii) : (Maximum Marks: 12)

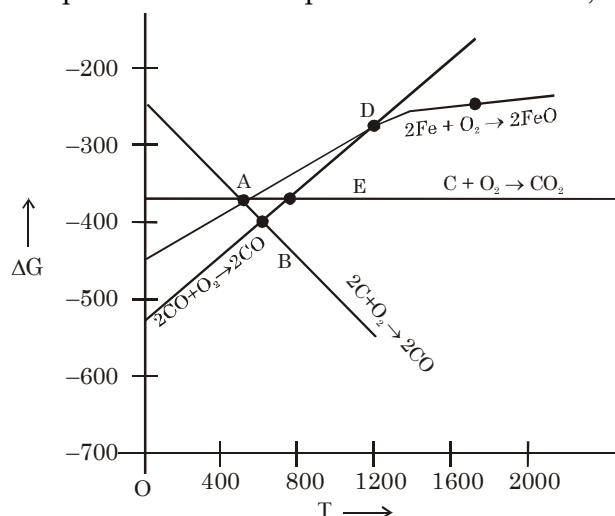
- This section contains **THREE** question.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +4 If only (all) the correct option(s) is (are) chosen.
Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen.
Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct options.
Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered).
Negative Marks : -2 In all other cases.

12. **CORRECT** statement(s) is/are :-
- (A) Cyanide process generally carried out for silver and gold
 (B) In Hall's process leaching agent is NaOH
 (C) In Serpeck's process Coke and N_2 act as leaching agent
 (D) Bayer's process is used for red bauxite ore in which main impurity is iron oxide
13. In Mc Arthur Forest process of Ag, the soluble complex of Ag :
- (A) have hybridisation dsp^2 and is planar in shape
 (B) contains synergic bonding and have 4 $p_\pi-p_\pi$ bonds
 (C) reacts with more electropositive metal Pt to give pure Ag
 (D) is diamagnetic and does not show geometrical and optical isomerism
14. Select the **CORRECT** statement(s)?
- (A) In Hall Heroult's process, BaF_2 helps in lowering the melting point whereas in Hoop's process, CaF_2 helps in maintaining density difference
 (B) In ellingham diagram, ΔG° v/s T graph always have positive slope for a metal because $M \rightarrow MO$ have negative entropy change
 (C) In Mond's process, the nickel complex have sp^3 hybridisation, diamagnetic nature and stereochemically inactive
 (D) In Batte's electrolysis, $PbSiF_6 + H_2SiF_6$ is used as electrolyte because $PbSO_4$ is a precipitate

SECTION-I(iii) : (Maximum Marks : 6)

- This section contains **ONE** paragraph.
- Based on each paragraph, there are **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D) **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
Full Marks : +3 If only the bubble corresponding to the correct answer is darkened.
Zero Marks : 0 In all other cases.

Ellingham diagram showing the variation in ΔG of metallurgically important reaction with temperature. For a spontaneous reaction, the free energy change ΔG must be negative.



15. Choose the correct option of temperature at which carbon reduces FeO to iron and produces CO.
(A) Below temperature at point A
(B) Above temperature at point A
(C) Approximately at temperature corresponding to point A
(D) None of these
16. Below point 'A' FeO can :-
(A) Reduced by CO only
(B) Reduced by both CO and Carbon
(C) Reduced by Carbon only
(D) Not reduced by both Carbon and CO

SECTION-II : (Maximum Marks: 16)

- This section contains **FOUR** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the **second decimal place**; e.g. 6.25, 7.00, -0.33, -0.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darkening the corresponding bubbles in the ORS.

For Example : If answer is -77.25, 5.2 then fill the bubbles as follows.

+					-				
0	0	0	0	0	0	0	0	0	
1	1	1	1	1	1	1	1	1	
2	2	2	2	2	2	2	2	2	
3	3	3	3	3	3	3	3	3	
4	4	4	4	4	4	4	4	4	
5	5	5	5	5	5	5	5	5	
6	6	6	6	6	6	6	6	6	
7	7	7	7	7	7	7	7	7	
8	8	8	8	8	8	8	8	8	
9	9	9	9	9	9	9	9	9	

- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +4 If **ONLY** the correct numerical value is entered as answer.
Zero Marks : 0 If none of the bubbles is darkened.
Negative Marks : -1 In all other cases.

- From the following ores, how many oxide ores contain metal in +2 oxidation number only – Magnetite, Cinnabar, Tinstone, Chromite ore, Carnelite, Siderite, Zincite
- Find the number of oxide ores.
Zincite, Magnetite, Argentite, sphalerite, Chalcocite, Malachite, Azurite, Cerrusite
- How many following metals are purified by vapour [phase refining method](#)?
Cu, Sn, Pb, Ni, Ag, Ti, Zr
- Find the total number of combination which are correctly matched.

Ore	Extracted Metal	Step used
Sphalerite	Zn	Roasting, Smelting, Distillation
Galena	Pb	Roasting, Smelting, Liquation
Argentite	Ag	Leaching, Metal displacement, Amalgamation
Copper pyrite	Cu	Roasting, Smelting, Auto/self reduction, Poling
Cassiterite	Sn	Magnetic separation, Roasting, Smelting, Poling, Liquation