

METALLURGY

- Which of the following ore is concentrated using group 1 cyanide salt ?
 (1) Sphalerite (2) Calamine
 (3) Siderite (4) Malachite
- 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 :
 (1) $X = Na[Al(OH)_4]$, $Y = SO_2$, $Z = Al_2O_3$
 (2) $X = Na[Al(OH)_4]$, $Y = CO_2$, $Z = Al_2O_3 \cdot xH_2O$
 (3) $X = Al(OH)_3$, $Y = CO_2$, $Z = Al_2O_3$
 (4) $X = Al(OH)_3$, $Y = SO_2$, $Z = Al_2O_3 \cdot xH_2O$
- The major components in "Gun Metal" are :
 (1) Cu, Zn and Ni (2) Cu, Sn and Zn
 (3) Al, Cu, Mg and Mn (4) Cu, Ni and Fe
- 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:
 (1) (a)–(iv), (b)–(iii), (c)–(ii), (d)–(i)
 (2) (a)–(ii), (b)–(iv), (c)–(i), (d)–(iii)
 (3) (a)–(i), (b)–(ii), (c)–(iii), (d)–(iv)
 (4) (a)–(iii), (b)–(i), (c)–(iv), (d)–(ii)
- Ellingham diagram is a graphical representation of:
 (1) ΔH vs T (2) ΔG vs T
 (3) ΔG vs P (4) $(\Delta G - T\Delta S)$ vs T
- The major components of German Silver are :
 (1) Ge, Cu and Ag (2) Zn, Ni and Ag
 (3) Cu, Zn and Ni (4) Cu, Zn and Ag
- The method used for the purification of Indium is :
 (1) van Arkel method
 (2) liquation
 (3) zone refining
 (4) vapour phase refining

- Match List -I with List - II

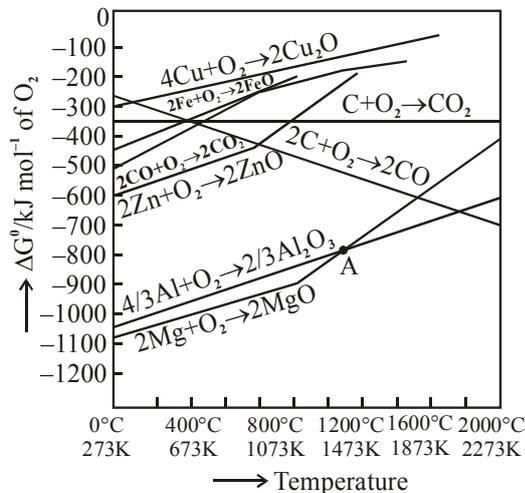
List - I (Ore)	List - II (Element Present)
(a) Kernite	(i) Tin
(b) Cassiterite	(ii) Boron
(c) Calamine	(iii) Fluorine
(d) Cryolite	(iv) Zinc

Choose the most appropriate answer from the options given below.
 (1) (a) → (i), (b) → (iii), (c) → (iv), (d) → (ii)
 (2) (a) → (ii), (b) → (i), (c) → (iv), (d) → (iii)
 (3) (a) → (ii), (b) → (iv), (c) → (i), (d) → (iii)
 (4) (a) → (iii), (b) → (i), (c) → (ii), (d) → (iv)
- 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 :
 (1) (a)→(iii), (b)→(i), (c)→(v), (d)→(ii)
 (2) (a)→(i), (b)→(ii), (c)→(v), (d)→(iii)
 (3) (a)→(iii), (b)→(v), (c)→(i), (d)→(iv)
 (4) (a)→(i), (b)→(ii), (c)→(iii), (d)→(iv)
- The process that involves the removal of sulphur from the ores is :
 (1) Smelting (2) Roasting
 (3) Leaching (4) Refining
- Which of the following reduction reaction CANNOT be carried out with coke ?
 (1) $Al_2O_3 \rightarrow Al$ (2) $ZnO \rightarrow Zn$
 (3) $Fe_2O_3 \rightarrow Fe$ (4) $Cu_2O \rightarrow Cu$

12. The point of intersection and sudden increase in the slope, in the diagram given below, respectively, indicates :



- (1) $\Delta G = 0$ and melting or boiling point of the metal oxide
- (2) $\Delta G > 0$ and decomposition of the metal oxide
- (3) $\Delta G < 0$ and decomposition of the metal oxide
- (4) $\Delta G = 0$ and reduction of the metal oxide

13. 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 :

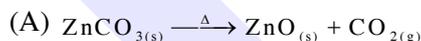
- (1) (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)
 - (2) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)
 - (3) (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)
 - (4) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)
14. The chemical that is added to reduce the melting point of the reaction mixture during the extraction of aluminium is :
- (1) Cryolite
 - (2) Bauxite
 - (3) Calamine
 - (4) Kaolite

15. 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 :

- (1) a-i, b-iv, c-ii, d-iii
 - (2) a-ii, b-iii, c-i, d-iv
 - (3) a-ii, b-iii, c-iv, d-i
 - (4) a-ii, b-iv, c-iii, d-i
16. The metal that can be purified economically by fractional distillation method is :
- (1) Fe
 - (2) Zn
 - (3) Cu
 - (4) Ni
17. Consider two chemical reactions (A) and (B) that take place during metallurgical process :



The **correct** option of names given to them respectively is :

- (1) (A) is calcination and (B) is roasting
 - (2) Both (A) and (B) are producing same product so both are roasting
 - (3) Both (A) and (B) are producing same product so both are calcination
 - (4) (A) is roasting and (B) is calcination
18. Sulphide ion is soft base and its ores are common for metals.

(a) Pb (b) Al (c) Ag (d) Mg

Choose the **correct** answer from the options given below :

- (1) (a) and (c) only
 - (2) (a) and (d) only
 - (3) (a) and (b) only
 - (4) (c) and (d) only
19. In the leaching of alumina from bauxite, the ore expected to leach out in the process by reacting with NaOH is :

(1) TiO_2 (2) Fe_2O_3
 (3) ZnO (4) SiO_2

20. Match List I with List II : (Both having metallurgical terms)

	List-I		List-II
(a)	Concentration of Ag ore	(i)	Reverberatory furnace
(b)	Blast furnace	(ii)	Pig iron
(c)	Blister copper	(iii)	Leaching with dilute NaCN solution
(d)	Froth floatation method	(iv)	Sulfide ores

Choose the correct answer from the options given below :

- (1) (a)–(iii), (b)–(ii), (c)–(i), (d)–(iv)
- (2) (a)–(iii), (b)–(iv), (c)–(i), (d)–(ii)
- (3) (a)–(iv), (b)–(i), (c)–(iii), (d)–(ii)
- (4) (a)–(iv), (b)–(iii), (c)–(ii), (d)–(i)

21. The statement that is INCORRECT about Ellingham diagram is

- (1) provides idea about the reaction rate.
- (2) provides idea about free energy change.
- (3) provides idea about changes in the phases during the reaction.
- (4) provides idea about reduction of metal oxide.

22. The addition of silica during the extraction of copper from its sulphide ore :-

- (1) converts copper sulphide into copper silicate
- (2) converts iron oxide into iron silicate
- (3) reduces copper sulphide into metallic copper
- (4) reduces the melting point of the reaction mixture

23. Given below are two statements.

Statement I: The choice of reducing agents for metals extraction can be made by using Ellingham diagram, a plot of ΔG vs temperature.

Statement II: The value of ΔS increases from left to right in Ellingham diagram.

In the light of the above statements, choose the **most appropriate** answer from the options given below:

- (1) Both **Statement I** and **Statement II** are true
- (2) **Statement I** is false but **Statement II** is true
- (3) Both **Statement I** and **Statement II** are false
- (4) **Statement I** is true but **Statement II** is false

24. Given below are two statements :

Statement I : Sphalerite is a sulphide ore of zinc and copper glance is a sulphide ore of copper.

Statement II : It is possible to separate two sulphide ores by adjusting proportion of oil to water or by using 'depressants' in a froth floatation method.

Choose the **most appropriate** answer from the options given below :

- (1) **Statement I** is true but **Statement II** is false.
- (2) Both **Statement I** and **Statement II** are true.
- (3) **Statement I** is false but **Statement II** is true.
- (4) Both **Statement I** and **Statement II** are false.

25. Which refining process is generally used in the purification of low melting metals ?

- (1) Chromatographic method
- (2) Liquation
- (3) Electrolysis
- (4) Zone refining

26. Match List-I with List – II :

List-I (Name of ore/mineral)	List-II (Chemical formula)
(a) Calamine	(i) Zns
(b) Malachite	(ii) FeCO_3
(c) Siderite	(iii) ZnCO_3
(d) Sphalerite	(iv) $\text{CuCO}_3 \cdot \text{Cu(OH)}_2$

Choose the **most appropriate** answer from the options given below :

- (1) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)
- (2) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)
- (3) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)
- (4) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)

27. In the electrolytic refining of blister copper, the total number of main impurities, from the following, removed as anode mud is _____

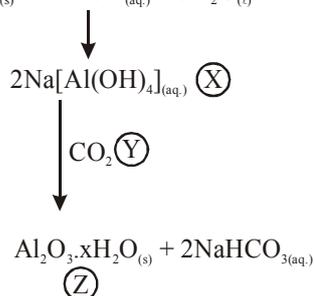
Pb, Sb, Se, Te, Ru, Ag, Au and Pt

28. Calamine and Malachite, respectively, are the ores of :

- (1) Nickel and Aluminium
- (2) Zinc and Copper
- (3) Copper and Iron
- (4) Aluminium and Zinc

SOLUTION**1. Official Ans. by NTA (1)****Sol.** Sphalerite ore : ZnSCalamine ore : ZnCO₃Siderite ore : FeCO₃Malachite ore : Cu(OH)₂·CuCO₃

It is possible to separate two sulphide ores by adjusting proportion of oil to water or by using 'depressants'. In case of an ore containing ZnS and PbS, the depressant used is NaCN.

2. Official Ans. by NTA (2)**Sol.** Al₂O_{3(s)} + 2NaOH_(aq.) + 3H₂O_(l)

So

X : Na[Al(OH)₄]Y : CO₂Z : Al₂O₃·xH₂O**3. Official Ans. by NTA (2)****Sol.** The major components in "Gun Metal" are

Cu : 87%

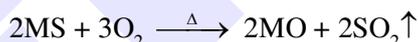
Zn : 3%

Sn : 10%

4. Official Ans. by NTA (4)**Sol.** Siderite – FeCO₃Calamine – ZnCO₃Kaolinite – Al₂(OH)₄·Si₂O₅Malachite – Cu(OH)₂·CuCO₃**5. Official Ans. by NTA (2)****Sol.** Ellingham diagram is a graphical representation of ΔG vs T when metal heated with oxygen to form metal oxide**6. Official Ans. by NTA (3)****Sol.** Major components of German silver are:

Cu, Zn, Ni

(50%) (30%) (20%)

7. Official Ans. by NTA (3)**Sol.** Zone refining is used for the purification of indium.**8. Official Ans. by NTA (2)****Sol.** Kernite = Na₂B₄O₇·4H₂OCassiterite = SnO₂Calamine = ZnCO₃Cryolite = Na₃AlF₆**9. Official Ans by NTA (3)****Sol.** (a) Siderite = FeCO₃ = Fe-metal(b) Calamine = ZnCO₃ = Zn-metal(c) Malachite = Cu(OH)₂·CuCO₃ = Cu-metal(d) Cryolite = Na₃AlF₆ = Al-metal**10. Official Ans. by NTA (2)****Sol.** In roasting process, metal sulphide (MS) ore are converted into metal oxide and sulphur is removed in the form of SO₂ gas.**11. Official Ans. by NTA (1)****Sol.** Reduction of Al₂O₃ → Al is carried out by electrolytic reduction of its fused salts.ZnO, Fe₂O₃ & Cu₂O can be reduced by carbon.**12. Official Ans. by NTA (2)****Sol.** i = 10A, A = 5 mm² = 5 × 10⁻⁶ m²and v_d = 2 × 10⁻³ m/s

We know, i = neAvd

$$\therefore 10 = n \times 1.6 \times 10^{-19} \times 5 \times 10^{-6} \times 2 \times 10^{-3}$$

$$\Rightarrow n = 0.625 \times 10^{28} = 625 \times 10^{25}$$

13. Official Ans. by NTA (4)

Sol.	Ore	Formula
(a)	Haematite	Fe ₂ O ₃
(b)	Bauxite	Al ₂ O ₃ ·xH ₂ O
(c)	Magnetite	Fe ₃ O ₄
(d)	Malachite	CuCO ₃ ·Cu(OH) ₂

14. Official Ans. by NTA (1)**Sol.** To reduce the melting point of reaction mixture, cryolite is added.**15. Official Ans. by NTA (3)**

Sol. (a) Mercury → Distillation refining
 (b) Copper → Electrolytic refining
 (c) Silicon → Zone refining
 (d) Nickel → Vapour phase refining

