General Principles and Process of Isolation of Elements

Metallurgy (Subtopic-I)

2011

1. **Which one of the following does not occur as sulphide ore?** [Kerala CEE]

   1. Zn   2. Cr   3. Ag   4. Fe

2. **Which of the following is not an ore of magnesium?** [RPMT]

   1. Gypsum   2. Dolomite   3. Magnesite   4. Carnallite

3. **Formula of gypsum is** [OJEE]

   1. $CaSO_4.2H_2O$ 2. $CaSO_4.\frac{1}{2}H_2O$ 3. $3CaSO_4.2H_2O$ 4. $2CaSO_4.2H_2O$

4. **Which of the following metals has the largest abundance in the earth's crust?** [WB JEE]

   1. Aluminium   2. Calcium   3. Magnesium   4. Sodium

5. **Solder is an alloy of** [CMC Lundhiana]

   1. Pb + Sn   2. Pb + Sn + Zn   3. Pb + Zn   4. Sn + Zn

6. **A major constituent of Portland cement (except lime) is** [BVP]

   1. silica   2. alumina   3. iron oxide   4. magnesia

7. **Calcium ammonium nitrate is known as** [VMMC]

   1. Nangal fertilizer   2. Chile salt petre   3. Thomas slag   4. Sindri

2009

8. **German silver is an alloy of** [CPMT]

   1. Cu and Zn   2. Cu and Ag   3. Cu and Sn   4. Cu, Zn and Ni

9. **The temperature of the salg zone in the metallurgy of iron using blast furnace is** [KCET]

   1. 1500-1600^{0}C   2. 400-700^{0}C   3. 800-100^{0}C   4. 1200-1500^{0}C

10. The approximate percentage of iron in mischmetal is   [Kerala CEE]

1. 10   2. 20   3. 50   4. 95   5. 5

11. **Match the following**   [EAMCET]

List-I	List-II
A) Felspar	I) $[Ag_3SbS_3]$
B) Absestos	II) $Al_2O_3.H_2O$
C) Pyrargyrite	III) $MgSO_4.H_2O$
D) Diaspore	IV) $KAlSi_3O_8$
	V) $CaMg_3(SiO_3)_4$

The correct answer is

	A	B	C	D
1)	IV	V	II	I
2)	IV	V	I	I
3)	IV	I	III	II
4)	II	V	IV	I

12. **Willemite is**   [MHT CET]

1. Zn_2SiO_4 2. H_2PtCl_6 3. ZnO 4. $ZnOFe_2O_3$

13. **Cerrusite is an ore of**   [Manipal]

1. Na   2. Cu   3. Pb   4. Fe

14. **The composition of bell metal is**   [J&K CET]

1. Cu (80%), Zn (20%)   2. Cu (60%), Ni (40%)

3. Cu (90%), Sn (10%)   4. Cu (80%), Sn (20%)

15. The percentage of carbon in cast iron is   **[J&K CET]**

1. 5 – 10   2. 0.250 – 2.5   3. 2.5 – 4.5   4. 0.12 – 0.2

16. "Electron" is an alloy of   **[WB JEE]**

1. Mg and Zn   2. Fe and Mg   3. Ni and Zn   4. Al and Zn

2008

17. What are the metal ions present in carnallite?   **[AFMC]**

1. Mg,K   2. Al,Na   3. Na,Mg   4. Zn,Mg

18. Calamine is   **[MHT CET]**

1. $CaCO_3$ 2. $MgCO_3$ 3. $ZnCO_3$ 4. $CaCO_3 + CaO$

2007

19. Argentite is a mineral of   **[AMU]**

1. copper   2. silver   3. platinum   4. aluminium

20. Which of the following does not contain silicon?   **[MHT CET]**

1. Kaoline   2. Agate   3. Ruby   4. Quartz

21. Which of the following ore is not an ore of Al?   **[Guj.CET]**

1. Mica   2. Anglesite   3. Orthoclase   4. Beryl

22. The composition of malachite is   **[J&K CET]**

1. $CuFeS_2$ 2. $CuCO_3$ 3. $CuCO_3.Cu(OH)_2$ 4. $Cu(OH)_2$

### PREVIOUS QUESTIONS METALLURGY

SUBTOPIC-I (KEY)

1) 2   **2)** 1   **3)** 1   **4)** 1   **5)** 1   **6)** 1   7) 1   8) 4   9) 3   10) 5

11) 2   12) 1   13) 3   14) 4   15) 3   16) 1   17) 1   18) 3   19) 2   20) 3

21) 2   22) 3

SUBTOPIC-I (SOLUTIONS)

1. Chromium does not exist as sulphide ore.

2. Dolomite $(MgCO_3.CaCO_3)$, Magnesite $(MgCO_3)$ and carnallite $(KCl.MgCl_2.6H_2O)$ are ores of magnesium.

    Note Gypsum $(CaSO_4.2H_2O)$ is an ore of calcium.

3. Formula of gypsum is $CaSO_4.2H_2O$.

4. Aluminum is the most abundant metal and third most abundant element in earth's crust.

5. Solder is an alloy of lead with tin.

6. Except lime (50-60%), the major constituent of Portland cement is silica (20-25%).

7. Calcium ammonium nitrate (CAN), $Ca(NO_3)_2.NH_4NO_3$ is known as nitrolime stone or Nangal fertilizer.

8. German silver, an alloy of copper, contains copper, zinc and nickel in the ratio of 2:1:1. It is used in untensils and resistance coils etc.

9. Slag formation zone is the central zone in the blast furnace where the temperature varies form 800-1000^{0}C. Here, limestone decomposes into CaO and CO_2.

    $$CaCO_3 \xrightarrow{1000^0 C} CaO + CO_2.$$
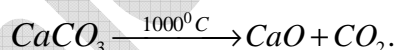
    CaO acts as a flex as it combines with silica present as an impurity (gangue) to form a fusible slag of CaSiO$_3$.

    $$CaO + SiO_2 \xrightarrow{1000^0 C} \underset{slag}{CaSiO_3}$$
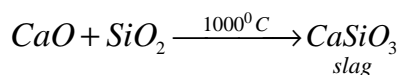
10. Mischmetal is a pyrohoric alloy which coanis 95% lanthanoid elements such as Ka, Nd and Ce and 5% Fe.

12. Willemite, a are zinc silicate mineral, is Zn_2SiO_4. It has trigonal symmetry and is strongly fluorescent green.

13. Cerrusite is an ore of lead (Pb). Its chemical formula is PbCO$_3$.

14.   The composition of bell metal is Cu-80% and Sn-20%.

15.   Cast iron has 2.5-5.0 per cent of carbon.

17.   Formula of carnallite is KCl.MgCl$_2$.6H$_2$O so, carnallite contains K and Mg.

18.   Calamine (ZnCO$_3$) is the carbonate ore of zinc.

19.   The chemical formula of argentire or silver glace is $Ag_2S.$ Hence, argentite is a mineral of silver.

20.   Ruby is an mineral of aluminium i.e.m Al_2O_3.

       It does not contain silicon.

21.   Anglesite $\left(PbSO_4\right)$ is not an ore of aluminium. It is ore of lead

22.   Malachite is an ore of copper. Its composition is $CuCO_3.Cu\left(OH\right)_2$.

METALLURGY (SUBTOPIC-II)

SUBTOPIC-II (PRACTICE QUESTIONS)

1.   Purest form of iron is

       1. Cast iron   2. Hard steel   3. Stainless steel   4. Wrought ion

2.   Which of the following relations is correct?

       1. Gangue + Flux = Slag   3. Gangue + Slag = Flux

       3. Slag + Flux = Gangue   4. All are correct

3.   Specific gravity of slag is

       1. same as molten metal

       2. Always greater than molten metal

       3. always less than molten metal

       4. May be greater or less depending upon the nature of the metal

4. **In metallurgical process Coke is chiefly used as**

1. flux   2. Reducing agent   3. Slag   4. Oxidizing agent

5. **Malachite is an ore of**

1. Iron   2. Copper   3. Mercury   4. Zinc

6. **Formula of ruby copper is**

1. Cu_2O 2. Cu_2S 3. $CuCO_3.Cu(OH)_2$ 4. $CuFeS_2$

7. **After partial roasting the sulphide of copper reduced by**

1. Cyanide process   2. Electrolysis

3. Reduction with carbon   4. Self reduction

8. **In the extraction of copper, the slag formed in the balst furnace is**

1. $CaSiO_3$ 2. $FeSiO_3$ 3. $Ca_3(PO_4)_2$ 4. $MnSiO_3$

9. **Blister copper is**

1. Pure copper   2. Alloy of copper

3. Copper containing some impurity   4. Ore of copper

10. **In the metallurgy of Zn the Zn dust obtained from roasting and reduction of zinc sulphide contains some ZnO. It is removed by:**

1. Absprnamce pf ultraviolet light-and reemission of white light

2. Shock cooling by contact with a shower of molten lead

3. X-ray method

4. Smelting

11. **The fuel used in Belgain process is**

1. Water gas   2. Producer gas   3. Coke   4. Coal

12. **Granulated Zn is obtained by**

1. Suddenly cooling molten Zinc

2. Adding molten Zn to H_2O

3. Heating Zn to 100-500^{0}C

4. Dropping molten Zn drop by drop

13. **Spelter is**

1. Impure Cu   2. Impure Zn   3. ZnO   4. CuO

14. **The magnetic oxdie of iron is**

1. Heamatite   2. Magnetite   3. Siderite   4. Limonite

15. **Before introducing. FeO in blast furnace, it is converted to Fe_2O_3 by roasting so that**

1. It may not be removed as slag with silica   2. It may not evaporate in the furnace

3. Presence of it may increase the m.pt. of charge   4. None

16. **The flux used in the extraction of iron from haematite in the blast furnace is**

1. Silica   2. Limestone   3. Calcium phosphate   4. PCl_5

17. **The most impure form of iron is**

1. Wrought iron   2. Mild steel   3. Hadrd steel   4. Cast iron

18. **Silver is displaced when zinc is added to aqueous sodium argento cyanide This method of extracting silver is an example for**

1. Leaching   2. Hydro metallurgy   3. Pyrometallurgy   4. Liquation

19. **Horn silver ore is leached with aqueous NaCN solution. The product formed is**

1. Silver metal   2. Silver chloride

3. Silver cyanide   4. Sodium argento cyanide

20. **From $Na\left[Ag\left(CN\right)_2\right]$ solution silver can be displaced by**

1. Zn   2. Al   3. Ca   4. All

21. In blast furmace haematite is reduced to iron mainly by

1. Coke   2. H_2 gas   3. CO gas   4. Water gas

22. A mixture of Haematite, coke and limestone on heating in blast furnace gives molten iron metal. This is known as

1. Smelting   2. Calcination   3. Roasting   4. Liquation

23. The Cu_2O impurity present in bilster copper is removed by

1. liquation   2. Distillation   3. Poling   4. Zone refining

24. In the extraction of copper, metal is formed in the Bassemer converter due to reaction

1. $Cu_2S + 2Cu_2O \rightarrow 6Cu + SO_2$ 2. $Cu_2S \rightarrow 2Cu + S$

3. $Fe + Cu_2O \rightarrow 2Cu + FeO$ 4. $2Cu_2O \rightarrow 4Cu + O_2$

25. Bilster copper is refined by stirring molten impure metal with green logs of wood because such a wood liberates hydrocarbon gases (like CH_4). The process X is called ……. and the metal contains impurities of Y is…..

1. X = cupellation, Y = CuO_2 2. X = polling, Y = CuO_2

3. X = polling, Y = CuO   4. X = cupellation, Y = CuO

26. In the Bessemer coverter to get the steel from iron, a calculated amount of carbon is added in the form of an alloy called

1. stainless   2. Wrought iron   3. Spiegeleisen   4. Cast iron

27. In the extraction of iron from haematite, the charge used is haematite, coke and lime stone in the following weight ratio.

1. 1 : 1 : 1   2. 8 : 4 : 1   3. 8 : 1 : 4   4. 1 : 4 : 8

28. In the blast furnace the reaction that occurs in the zone of heat absorption is

1. $CO_2 + C \rightarrow 2CO$ 2. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

3. $C + O_2 \rightarrow CO_2$ 4. $FeO + SiO_2 \rightarrow FeSiO_3$

29. **Puddling process is used in the manufacture of**

1. Wrought iron   2. Pig iron   3. Steel   4. Cast iron

30. **Which of the following is not a correct statement**

1. White cast iron contains carbon in the form of Fe_3C

2. Grey cast iron contain carbon in the form of graphite.

3. The quality of steel produced in Beassemer converter is very high

4. The quality of steel produced in open hearth process can be checked form time to time.

31. **Which of the following statement is wrong**

1. The fibrous nature of Wrought iron is due of the slag present in it.

2. The loss of iron is Bessemer process is due to the formation of $FeSiO_3$ slag

3. In Bessemer process carbon monoxide formed burns with blue flame at the mouth of the furnace.

4. In, blast furnace Fe_2O_3 is reduced to iron mainly by coke

32. $2Ag_2S + 8NaCN + 4O_2 \rightarrow 4Na\left[Ag\left(CN\right)_2\right] + 2Na_2SO_4$

This reaction involves

1. Smelting   2. Leaching   3. Calcination   4. Roasting

33. **In the the cyanide process when Na_2S is formed with Ag_2S, to stop the reverse reaction Na_2S is converted finally to**

1. $Na_2S_2O_3$ 2. Na_2SO_4 3. Na_2SO_3 4. $NaNO_3$

34. **In the leaching of Ag_2S with NaCN, a stream of air is also passed. It is because of**

1. reversible nature of reaction between Ag_2S and NaCN

2. to oxidize Na_2S formed into Na_2SO_4 and sulphur.

3. both (1) and (2)   4. Both are not suitable

35. **The method of zone refining of metals is based on the principal of**

1. Greater melting of the pure metal than that of impurity

2. Higher melting point of the impurity than that of the pure metal

3. Greater noble character of the solid metal than that of the impurity

4. Greater solubility of the impurity in the molten state than in the solid

36. **Match the following**

List-I	**List-II**
Process	**Metal extraction involved**
A) Smelting in blast furnace to get metal	1) aluminium
B) Auto reduction in Bessemer converter	
to get blister metal	2) sodium
C) Refining by Hoope's process	3) iron
D) Down's process	4) magnesium
	5) copper

	A	B	C	D
1)	3	5	1	2
2)	2	4	3	5
3)	4	2	1	5
4)	5	2	4	1

37. **Assertion:** Nitriding is the process of heating steel presnence of N_2 to form iron nitrides.

Reason: The surface of steel becomes hard after nitriding process.

1. If both assertion and reason are correct, and reason is the correct explanation of the assertion

2. If both assertion and reason are correct, but reason is not the correct explanation of the assertion

3. If assertion is correct but reason is incorrect

4. If assertion is incorrect but reason is correct

38.   **Assertion:** In the extraction of Ag, complex $Na[Ag(CN)_2]$ is reacted with Zn.

   Reason: Zn is d-block transition metal.

   1. If both assertion and reason are correct, and reason is the correct explanation of the assertion

   2. If both assertion and reason are correct, but reason is not the correct explanation of the assertion

   3. If assertion is correct but reason is incorrect

   4. If assertion is incorrect but reason is correct

39.   **Assertion:** $CuFeS_2$ is concentrated by froth floatation method.

   Reason: $CuFeS_2$ is main ore of copper.

   1. If both assertion and reason are correct, and reason is the correct explanation of the assertion

   2. If both assertion and reason are correct, but reason is not the correct explanation of the assertion

   3. If assertion is correct but reason is incorrect

   4. If assertion is incorrect but reason is correct

40.   **Assertion:** Wrought iron is more malleable and ductile than steel.

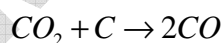   **Reason:** It contains slightly less percentage of carbon

   1. If both assertion and reason are correct, and reason is the correct explanation of the assertion

   2. If both assertion and reason are correct, but reason is not the correct explanation of the assertion

   3. If assertion is correct but reason is incorrect

   4. If assertion is incorrect but reason is correct

SUBTOPIC-II KEY

1) 4	2) 1	3) 3	4) 2	5) 2	6) 1	7) 4	8) 2	9) 3	10) 2
11) 2	12) 2	13) 2	14) 2	15) 1	16) 2	17) 3	18) 2	19) 4	20) 4
21) 3	22) 1	23) 3	24) 1	25) 2	26) 3	27) *	28) 1	29) 1	30) 3
31) 4	32) 2	33) 2	34) 3	35) 4	36) 1	37) 4	38) 3	39) 2	40) 1

(SUBTOPIC-II (SOLUTIONS)

1. Wrpught iron is the purest form of iron.

2. Gangue + Flux = Slag

5. Malchite – $CuCO_3$ $Cu(OH)_2$

9. Blistor copper 98% Pure copper.

11. In the Belgian process producer gas is used as fuel.

13. Impure Zn is called spelter.

16. $\underset{Flux}{CuO} + SiO_2 \rightarrow \underset{Slag}{CuSiO_3}$

19. $AgCl + 2NaCN \rightarrow Na\left[Ag\left(CN\right)_2 \right] + NaCl$

24. $Cu_2S + 2Cu_2O \rightarrow 6Cu + SO_2$

28. The reaction occur is zone of heat obsorption is

    $CO_2 + C \rightarrow 2CO$

34. $2Ag_2S + 8NaCN + 4O_2 \rightarrow 4Na\left[AgC\left(CN\right)_2 \right] + 2NCl_2SO_4$

PREVIOUS QUESTIONS METALLURGY

SUBTOPIC-III

2011

1. **Which of the following element is present as the impurity to the maximum extent in the pig iron?**   **[CBSE AIPMT]**

    1. Phosphorus   2. Manganese   3. Carbon   4. Silicon

2010

2. **In which process, fused sodium hydroxide is electrolysed for the extraction of sodium?**
                                                                                 [AFMC]

    1. Castner's process   2. Cyanide process   3. Down's process   4. Both (b) and (c)

3. **In the electrolytic refining of zinc**   **[KCET]**

    1. graphite is at the anode   2. the impure metal is at the cathode

    2. the metal ion gets reduced at the anode   4. acidified zinc sulphate is the electrolyte

4. **These are the extraction process of silver except**   **[Manipal]**

    1. as a side product in electrolytic refining of copper.

    2. Park's process in which Zn is used to extract silver by solvent extraction from molten lead

    3. by reaction of silver sulphide with KCN and then reaction of soluble complex with Zn.

    4. by heating $Na\left[Ag\left(CN\right)_2\right]$

5. **Mention the type of reaction to obtain Au (sol).**

    $2AuCl_3 + 3HCHO + 3H_2O \rightarrow 2Au\left(sol\right) + 3HCOOH + 6HCl$

                                                                                 [Guj.CET]

    1. Hydrolysis   2. Oxidation   3. Reduction   4. Doubledecomposition

6. **When AgCl is treated with KCN,** **[WB JEE]**

1. Ag is precipitated

2. a complex ion is formed

3. double decomposition takes place

4. no reaction takes place

7. **Mark the wrong statement.** **[BVP]**

1. K boils at the melting point of KCl.

2. K is insoluble in molten KCl

3. K is extracted by the electrolysis of fused KOH

4. K is extracted by reduction of molten KCl by metallic Na

2009

8. **The minimum voltage required to electrolyse alumina in the Hall-Heroult process is**

(Given, $\Delta G_f^0 (Al_2O_3) = -1520$ kJ mol^{-1}; $(\Delta G_f^0 (CO_2) = -394$ kJ mol^{-1})

[AIIMS]

1. 1.575 V

2. 1.60 V

3. 1.312 V

4. – 2.62 V

9. **Which of the following is the purest commercial form of iron?** **[CPMT]**

1. Cast iron

2. Steel

3. Wrought iron

4. Pig iron

10. **The most active metals are extracted from their ores by the reduction of** **[Manipal]**

1. hydrogen

2. aluminium

3. electrolysis

4. carbon

11. **The slag formed in extraction of copper is** **[CG MPT, Harayana PMT]**

1. $CuFeS_2$

2. $Cu_2O + FeS$

3. $Cu_2S + FeO$

4. $FeSiO_3$

12. **The autoreduction process is not used in the metallurgy of** **[J&K CET]**

1. Hg

2. Cu

3. Pb

4. Fe

2008

13. **Which of the following metal is not manufactured by electrolysis?** **[Kerala CEE]**

1. Na

2. Mg

3. Al

4. Fe

5. Li

14. One of the following metals form a volatile compound and this property is taken advantage for its extraction. This metal is [Manipal]

1. iron 2. nickel 3. cobalt 4. tungsten

15. Roasted tin stone ore after washing with water is known as [Manipal]

1. block tin 2. white tin 3. black tin 4. granulated tin

16. The purest zinic is made by [MHT CET]

1. electrolytic refining 2. zone refining

3. the van Arkel method 4. the Mond process

17. Metallic silver may be obtained form AgCl by [J&K CET]

1. heating it in the current by H_2 2. fusing it with sand

3. treating with carbon monoxide 4. fusing it with Na_2CO_3

18. Which one of the following metals is extracted by a caron reduction process?

[J&K CET]

1. Copper 2. Iron 3. Aluminium 4. Magnesium

2007

19. Blister copper is [CPM]

1. impure Cu 2. Cu alloy 3. pure Cu 4. Cu having 1% impurity

20. Reagent used to extract silver from Ag_2S is [RPMT]

1. NaCN 2. NaCN in presence of O_2

3. NaCl 4. AgNO₃

21. Which one of the following metals, is extracted on smelting of its ore in blast furnace?

[J&K CET]

1. Iron 2. Sodium 3. Potassium 4. Magnesium

PREVIOUS QUESTIONS METALLURGY

SUBTOPIC-III (KEY)

1) 3	2) 1	3) 4	4) 4	5) 3	6) 2	7) 2	8) 2	9) 3	10) 3
11) 4	12) 4	13) 4	14) 2	15) 3	16) 2	17) 4	18) 2	19) 4	20) 2
21) 1									

PREVIOUS QUESTIONS METALLURGY

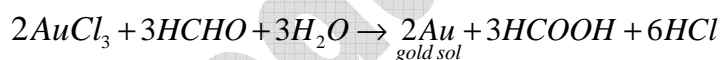## SUBTOPIC-III (SOLUTIONS)

1. Caron is present as an impurity in the pig iron (4%). Many other impurities such as S,P, Si and Mn are present in smaller amount

4. Silver is not obtained by heating $Na\left[Ag\left(CN\right)_2\right]$.It is obtained by treating $Na\left[Ag\left(CN\right)_2\right]$ with more electropositive metal Zn, which replaces Ag from it.

$$2Na\left[Ag\left(CN\right)_2\right]+Zn \rightarrow Na_2\left[Zn\left(CN\right)_4\right]+2Ag \downarrow$$
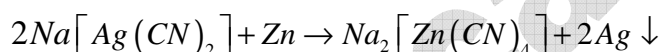
5. The gold sol is obtained by the reduction of $AuCl_3$.

$$2AuCl_3+3HCHO+3H_2O \rightarrow \underset{gold\,sol}{2Au}+3HCOOH+6HCl$$

6. $$AgCl+2KCN \rightarrow K\left[Ag\left(CN\right)_2\right]+KCl$$

7. Potassium is highly soluble in molten KCl, thus it is not prepared by the electrolysis of moleten KCl. All other given statements are correct.

9. Wrought iron is the purest form of iron as it contains minimum amount of carbon (0.12-0.25%).

10. The most active metals are extracted form their ores by electrolytic reduction.

11. In the extraction of copper, the impurities of iron oxide combine with silica (Flux) and form insoluble slag.

$$FeO+SiO_2 \rightarrow \underset{slag}{FeSiO_3}$$
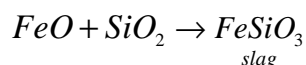
14. The reduction potential of Fe less negative than that of H_2O, so it is not manufactured by electrolysis

16. Tin stone $\left(SnO_2 \right)$ after roasting and washing is called black tin.

17. The purest zinc is made by zone refining.

19. The less electropositive metals such as Fe, Zn, Sn etc. are extracted from their oxides by reduction with carbon or coal.

$$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$$

$$Fe_2O_3 + 3CO \rightarrow \underset{iron}{2Fe} + 3CO_2$$
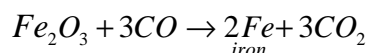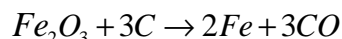
20. Blister copper is obtained by the process of bessemerisation form the copper matte in the metallyrgy of Cu. It is impure. Blister copper contain about 99% pure copper and 1 to 2% impurtities like Ag, Au, Ni, etc.

21. The process of extraction of metal by heating roasted ore with coke in the presence of a flux is called smelting. It is done in blast furnace. Iron is extracted by this process.

$$Fe_2O_3 + 3C \xrightarrow{\;>1123\,K\;} 2Fe + 3CO$$

$$Fe_2O_3 + 3CO \xrightarrow{\;>1123\,K\;} 2Fe + 3CO_2$$