

Class 12 General Principles and Processes of Isolation of Elements

Important Questions with Answers

Short Answer Type Questions

Q1. Why is an external emf of more than 2.2V required for the extraction of Cl_2 from brine?

Answer:

For the reaction:



For the given reaction, the value of ΔG° is + 422kJ.

Using the equation $\Delta G^\circ = -nFE^\circ$, the value of E° comes out to be -2.2 V.

Therefore, extracting Cl_2 from brine will require an external emf of greater than 2.2 V.

Q2. At a temperature above 1073K, coke can reduce FeO to Fe. How can you justify this reduction with the Ellingham diagram?

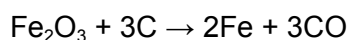
Answer:

According to the Ellingham diagram at temperatures greater than 1073 K $\Delta G(\text{C}, \text{CO}) < \Delta G(\text{Fe}, \text{FeO})$. Hence coke can reduce FeO to Fe.

Q3. Wrought iron is the purest form of iron. Write a reaction used for the preparation of wrought iron from cast iron. How can the impurities of sulphur, silicon and phosphorus be removed from cast iron?

Answer:

Wrought iron is the purest form of commercial iron. It is obtained from cast iron by oxidising the impurities in a reverberatory furnace lined with haematite.

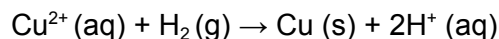


Limestone is added as a flux to remove the impurities of sulphur, silicon and phosphorous. They form a slag that can be easily removed. The metal is removed from the slag by passing through rollers.

Q4. How is copper extracted from low grade copper ores?

Answer:

Copper is extracted from low-grade copper ore using the hydrometallurgy method. For this purpose, the ore is leached out using bacteria. The solution containing Cu^{2+} is treated with scrap iron and H_2 .



Q5. Write two basic requirements for refining of a metal by Mond process and by Van Arkel Method.

Answer:

The two basic requirements for refining metal by Mond process and Van Arkel Method are

- (i): Metal should form a volatile compound with the available reagent.
- (ii) The volatile compound should be easily decomposable to be recovered quickly.

Mond's process includes converting Ni to $\text{Ni}(\text{CO})_4$ and then decomposition of $\text{Ni}(\text{CO})_4$ to Ni.

(b) Van Arkel's method includes converting Zr to volatile ZrI_4 and then decomposition ZrI_4 to Zr and I_2 .

Q6. Although carbon and hydrogen are better reducing agents, they are not used to reduce metallic oxides at high temperatures. Why?

Answer:

Carbon and hydrogen are not used because carbon and hydrogen react with metals at high temperatures to form carbides and hydrides, respectively.

Q7. How Do We Separate Two Sulphide Ores By Froth Floatation Method?

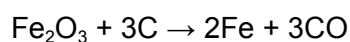
Answer:

To separate two sulphide ores, we should adjust the proportion of oil and water. This can also be done by using depressants such as NaCN. If an ore contains ZnS and PbS, NaCN is added during the process. ZnS forms a complex with NaCN preventing it from coming into a froth. PbS also follows into the froth, and that's how it gets separated.

Q8. The purest form of iron is prepared by oxidising impurities from cast iron in a reverberatory furnace. Which iron ore is used to line the furnace? Explain by giving a reaction.

Answer:

Wrought iron is obtained from cast iron by oxidising the impurities in a reverberatory furnace lined with haematite. Haematite oxidises carbon to carbon monoxide.



Limestone is added as a flux to remove the impurities of sulphur, silicon and phosphorous. They form a slag that can be easily removed. The metal is removed from the slag by passing through rollers.

Q9. The mixture of compounds A and B is passed through a column of Al_2O_3 by using alcohol as eluent. Compound A is eluted in preference to compound B. Which of the compounds A or B, is more readily adsorbed on the column?

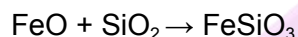
Answer:

Since compound A is eluted in preference to compound B. Compound B is more readily adsorbed on the column.

Q10. Why is sulphide ore of copper heated in a furnace after mixing with silica?

Answer:

Iron oxide is present as an impurity in sulphide ore of copper forms slag, which is iron silicate and copper is produced in the form of copper matte.



Q11. Why are sulphide ores converted to oxide before reduction?

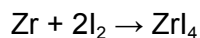
Answer:

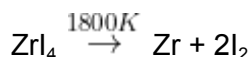
Before reduction, sulphide ores are converted to oxides because sulphide doesn't reduce easily while oxides reduce quickly.

Q12. Which method is used for refining Zr and Ti? Explain with equations.

Answer:

Van Arkel method is used for refining Zr and Ti. In this method, crude metal is heated with iodine.





Generally, two things are considered so that proper precautions are taken.

1. Reactivity of metal produced.
2. Suitability of electrodes.

Q13. What should be the considerations during the extraction of metals by the electrochemical method?

Answer:

The following considerations are to be made during the extraction of metals by the electrochemical method:

1. Reactivity of the metal produced
2. Electrodes to be made of suitable material
3. Addition of flux for making molten mass conducting

Q14. What is the role of flux in metallurgical processes?

Answer:

Flux is any substance introduced in the smelting of ores to promote fluidity and to remove impurities in the form of slag.

Role of flux in the metallurgical process:

Flux is used to remove the gangue by combining it. Thus, slag formation takes place.

It makes the molten mass more conducting.

Q15. How are metals used as semiconductors refined? What is the principle of the method used?

Answer:

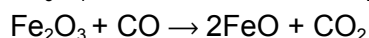
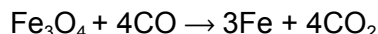
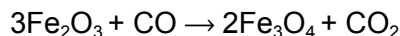
Metals of high grade like germanium, silicon etc., used as semiconductors are refined by zone refining method.

Principle: This method is based upon the principle that impurities are more soluble in the molten state of metal than in the solid state.

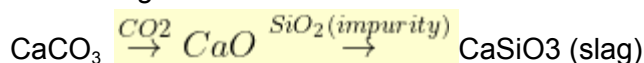
Q16. Write down the reactions taking place in Blast furnaces related to the metallurgy of iron in the temperature range 500-800 K.

Answer:

The reactions taking place in the lower temperature range (500–800K) in the blast furnace are:



Limestone decomposes in the hot furnace, forming calcium oxide (CaO), removing silicate impurity of ore as slag.



Q17. Give two requirements for vapour phase refining.

Answer:

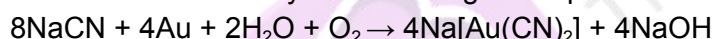
Two requirements for vapour phase refining are

1. The metal should form a volatile compound with an available reagent.
2. The volatile compound should be quickly recovered by decomposition.

Q18. Write the chemical reactions involved in the extraction of gold by the cyanide process. Also, give the role of zinc in the extraction.

Answer:

Gold ores are leached with sodium cyanide solution in the presence of air. Due to oxidation, gold dissolves in sodium cyanide forming a complex.



The metal is recovered by displacement method by adding zinc.



Long Answer Type Questions

Q1. Explain the following:

- (a) CO_2 is a better reducing agent below 710K, whereas CO is a better reducing agent above 710K.
- (b) Generally, sulphide ores are converted into oxides before reduction.
- (c) Silica is added to the sulphide ore of copper in the reverberatory furnace.
- (d) Carbon and hydrogen are not used as reducing agents at high temperatures.
- (e) The Vapour phase refining method is used for the purification of Ti.

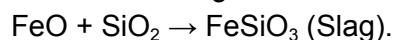
Answer:

(a) As shown in the Ellingham diagram, which related Gibbs Free energy and temperature at below 710K.

$\Delta G(C, CO_2) < \Delta G(C, CO)$ So, CO_2 is a better reducing agent than CO , while above 710 K, it becomes an outstanding reducing agent.

(b) Before reduction, sulphide ores are converted to oxides because sulphide doesn't reduce easily while oxides reduce quickly.

(c) Silica is a flux added to the sulphide ore of copper in the reverberatory furnace leading to the formation of slag



(d) Carbon and hydrogen are not used because carbon and hydrogen react with metals at high temperatures to form carbides and hydrides, respectively.

(e) Vapour phase refining method is used for the purification of Ti as,

