Calcination Questions with Solutions

Q1: What is Calcination?

Answer: Calcination is a process of heating a metal ore to a high temperature in a restricted amount of oxygen. The temperature at which the metal is heated is lower than the Melting Point of the metal.

Q2. Give an example of the process of Calcination.

Answer: Calcination is a process of purifying a solid substance by heating it to a high temperature in the limited supply of oxygen. This process is usually practised for the hydroxide and carbonate ores. For example, magnesium carbonate is converted into magnesium oxide and carbon dioxide gas.

$$MgCO_3 \xrightarrow{\Delta} MgO + CO_2$$

Q3. What type of reaction occurs in the Calcination process?

Answer: The reaction that takes place during the Calcination process is the Thermal decomposition reaction and Phase Transition reaction.

Q4. Which product is formed on the Calcination of Calcium Carbonate (limestone)?

Answer: The Calcination product of limestone is lime (CaO). Limestone is heated to a high temperature below its boiling point within the limited supply of oxygen. The reaction for the formation of lime from limestone by the process of calcination is given below:

$$CaCO_3 \xrightarrow[1100\ ^0C]{Calcination} CaO + CO_2$$

Q5. The temperature required for Calcination is about:

a. 600-700 ^{0}C
b. 700-800 ^{0}C
c. 800-900$^-$C
d. 1000-1100 ^{0}C

Answer: (d)

Explanation: Calcination is usually carried out at a temperature range of 1000-1100 ^{0}C.

Q6. By Calcination, the substance removed from the solid mass is:

a. Solid Compound itself
b. Moisture

c. Gases
d. Both (b) and (c)

Answer: (d)

Explanation: Calcination is a process of thermal decomposition in which the solid mass is heated to a high temperature to remove any kind of impurity present in the solid. The process removes any trapped gas or volatile compounds and moisture from the solid compound being heated.

Q7. The product of Calcination is called _____.
a. Calcine
b. Lime
c. Limestone
d. None of the above

Answer: (a)

Explanation: The product of Calcination is called a Calcine.

Q8. Comment whether Calcination is an Endothermic or Exothermic process.

Answer: Calcination is a Thermal Decomposition process and takes place at a high temperature. During calcination, the solid mass is broken down to release any volatile impurity present in the compound. As for breaking the bonds, the energy is given to the substance; hence, Calcination is an Endothermic process.

Q9. What is the instrument used in Calcination called?

Answer: The instrument that works in the Calcination process is called the Calciner. The Calciner is a cylindrical structure that is made from steel. Calciner rotates inside a heated furnace, and an indirect high-temperature processing takes place inside it at a temperature range of 500 ^{o}C to 1150 ^{o}C. The process takes place in controlled atmospherical conditions of limited or no oxygen gas supply.

Q10. Write the major difference between Calcination and Roasting.

Answer: The main points of differences between Calcination and Roasting are:

S.No.	Calcination	Roasting
1.	Calcination occurs in the limited or no supply of air or oxygen.	Roasting occurs in the presence of oxygen.
2.	During Calcination, the carbonate ores	Roasting is carried out mostly for

	are thermally decomposed.	sulphide ores.
3.	The moisture is given out of the substance.	Roasting does not involve the dehydration of ores.
4.	As Calcination is usually carried out for the carbonate ores, the process generally gives out the carbon dioxide gas.	Roasting results in the release of toxic, acidic, and metallic components from the solid.

Q11. The compounds that mostly undergo the Calcination process are:

a. Carbonate ores
b. Bicarbonate ores
c. Mineral Acids
d. None of the above

Answer: (a)

Explanation: The Carbonate ores are treated under the Calcination process most often. For example, limestone is calcined to form lime, which is a hygroscopic compound that absorbs moisture from the air. Lime has many laboratory applications, such as storing chemicals and keeping the experiment samples away from atmospheric moisture.

Q12. The changes that occur during Calcination are:

a. Carbonate ores are changed into Oxides
b. Oxides are converted into the Carbonate ores
c. Sulphides are converted into the Carbonate ores
d. Carbonate ores are changed into Sulphides

Answer: (a)

Explanation: During Calcination, the carbonate ores are converted into oxides. The process takes place under a limited supply of air and oxygen at very high temperatures below the compound's melting point.

For example: $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

Q13. Calcination involves:

a. The release of water only
b. The release of carbon dioxide gas only
c. Both (a) and (b) depending on the nature of the compound
d. The release of hydrogen sulfide gas only

Answer: (c)

Explanation: Calcination is a process of purification of compounds. In a number of cases, the carbonate ores are chosen for the calcination process. Hence, the Calcination process mostly involves either the release of carbon dioxide or water. This can be understood by the following examples:

$$CuCO_3 \xrightarrow{\Delta} CuO + CO_2$$

$$2Fe_2O_3.3H_2O \xrightarrow{\Delta} 2Fe_2O_3 + 3H_2O$$

Q14. The sign of complete burning of lime is:

a. The appearance of Red Flame at the top
b. The appearance of Blue Flame at the top
c. The disappearance of the Blue Flame at the top
d. The release of smoke in huge quantity

Answer: (c)

Explanation: During the process of burning, the Blue Flame at the top symbolises complete combustion with no wastage of resources. Hence, the disappearance of the Blue Flame is a sign of the complete burning of lime.

Q15. The origin of the word “Calcination” comes from the:

a. Greek word “Calcinare”
b. Latin word “Calcinare”
c. Greek word “Calcinate”
d. Latin word “Calcinate”

Answer: (b)

Explanation: “Calcinare” is the Latin word which means “to burn lime”. Therefore, Calcination is sometimes referred to as the burning of lime.

Practice Questions on Calcination

Q1. Why does the Calcination process take place in the absence of oxygen?

Answer: This is because, in the absence of oxygen, the carbonate ores undergo decomposition to form a metal oxide and carbon dioxide gas. The carbon dioxide gas evolves from the solid substance, and a pure metal oxide is obtained as a product. However, if the carbonate ore is heated in the presence of oxygen, there will be no chemical change during the process, i.e. the reaction will not take place.

Q2. What is the difference between Calcination and Smelting?

Answer: Calcination is the purification process in which a solid substance (usually carbonate ores) is heated at a high temperature below its boiling point to remove any traces of volatile compounds or moisture from the sample. While during Smelting, the ores are melted in order to extract the metal from the ore. The metals commonly extracted from this process are silver, iron, copper, etc.

Q3. What is a Pre-Calciner? What are the advantages of using a Pre-Calciner?

Answer: The Pre-Calciner is a shaft-heat exchanger that is used to pre-heat the calciner and also to partially calcine the solid substance before it is actually heated in the rotary kiln (furnace). The advantage of using a Pre-Calciner is that if 50-60% of the fuel is used in this chamber, then almost 90% of the calcination process gets completed before treating the substance to a rotary kiln. As a result, the fuel used is less.

Q4. In which of the following feed type kilns does the limestone not come in contact with the fuel?

a. Mixed Feed type
b. Separate Feed type
c. Single Feed type
d. Isolated Feed type

Answer: (b)

Explanation: Only two types of Feed Kilns are there, i.e. the Mixed Feed type Kiln and the Separate Feed type Kiln. In the separate Feed type Kiln, the limestone and the fuel are heated (or burned) separately. In the Mixed Feed type Kiln, the limestone and the fuel are mixed together while burning.

Q5. What is the advantage of Kiln burning over Clamp burning in the burning of limestone?

Answer: The major difference between Kiln burning and Clamp burning is that the Clamp burning method takes as long as two weeks to burn the limestone. At the same time, the Kiln burning takes only a few hours to burn the limestone.