Chemical Industries

Important Q/As

QUESTION .1

What are the basic steps of metallurgical operations?

ANSWER

Metallurgy

A procedure used to extract metals in their pure state is referred to as metallurgy. Minerals are made up of soil, rocks, limestone, sand, and metal complexes. Commercial metals are easily and cheaply mined from minerals. Ores are the name for these minerals. Flux is a material that is added to the furnace charge to eliminate the gangue (impurities). The purification of metals and the creation of alloys are the subjects of metallurgy.

Basic Metallurgical Operations

Metallurgy is the collective term for the different procedures used to extract metals from their ores and refine them for use.

The several steps in the metal extraction or metallurgical process are as follows:

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1. The ore is crushed and grinded

2. Ore enrichment, ore concentration, is another name for this process.

3. Extraction of metal from concentrated ore.

4. Metals that are impure are refined or purified.

QUESTION .2

What are the methods to find the concentration of metal ore?

ANSWER

Concentration Of Ore

The process of eliminating gangue particles from ore to increase the amount of metal in the ore is known as ore concentration, sometimes known as ore enrichment. The methods used to remove impurities from ores are determined by the differences in the physical or chemical properties of the ore and the impurities.

The following methods are used to find the concentration of ore:

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1. Magnetic Separation

Magnetic properties of either the ore or the gangue are utilized to separate the ore and gangue. Before being transported on a conveyor belt that travels through a magnetic roller, the ore is first carefully processed. While the gangue flows off the belt, the magnetic ore remains there. This procedure is used to concentrate magnetic iron ores such as magnetite, chromite, and manganese by removing non-magnetic impurities (pyrolusite). In this process, a magnetic separator is utilized.

2. Cyclone Separation

A cyclone is a centrifugal separator where particles are forced to the outer edges by the force of the centrifugal force due to their mass. Arriving air is naturally compelled to adopt a quickly rotating spiral motion, or "double vortex."

3. Flotation Process

In mineral processing, flotation is a technique for separating and concentrating ores by modifying their surfaces to a hydrophobic or hydrophilic state, meaning that the surfaces are either attracted to or repellent to water.

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QUESTION .3

What are the general methods for the extraction of metals from their ores?

ANSWER

Extraction Of Metals

Mining is the process of removing metal ores from subterranean deposits. The earth's crust contains variable amounts of metal ores. We can utilise the minerals in the earth because metals can be extracted from ores. The finished metals that we see in buildings and bridges are substantially different from the ores. Ores are made up of the desired metal combination as well as gangue, which are earthy impurities

Following are the general methods used to extract metal from ores

1. Roasting

Roasting is the name for the metallurgical procedure in which an ore is heated below its melting point in the presence of extra air to produce its oxide. Sulfur is typically emitted as sulfur dioxide, a gas, while sulfide is transformed into an oxide.

$2ZnS+3O_2 \rightarrow 2ZnO+2SO_2$

$CaCO_3 \rightarrow CaO + CO_2$

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2. Smelting

Smelting is the process of removing a metal from its ore, either as an element or as a simple compound, by heating it over the melting point, typically with the help of reducing chemicals like coke or air. This kind of metallurgy is extractive. Silver, iron, copper, and other base metals are among the many metals that can be extracted from their ores using this method.

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

$WO_3 + 3H_2 \rightarrow W + 3H_20$

3. Bessimerization

In the metallurgical process known as bessemerization , the air is blasted onto copper matte that is maintained in a Bessemer converter. And a portion of the copper sulfide is changed into copper (I) oxide by this airburst. The molten copper that is produced is known as Bessemer copper and is 99% pure copper.

$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$

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

4. Refining Of Metals

Refining is a process used to get high-purity metals by removing impurities. Depending on the characteristics of the metal and

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the impurities, numerous procedures are used to remove the impurities from an unrefined metal.

A. Electro Refining

By using the electrolytic process, a metal (most commonly copper) is purified through electrolytic refining. When it comes to the mechanism of the process, electrolysis involves using a large slab or chunk of impure metal as the anode and a thin strip of pure metal as the cathode.

The anode, or positive electrode, is a block of impure copper. Along with pure copper tubes serving as the cathode or negative electrode, copper sulfate that has been acidified with sulfuric acid is utilized as a graphite-coated electrolyte. Copper sulfate splits into a positive copper ion (Cu^{++}) and a negative sulfate ion ($SO4^{-}$) during this electrolysis phase. The positive copper ion (Cu^{++}) or cations go in the direction of the pure copper negative electrode, where they take electrons from the cathode. On the graphite layer of the cathode, a Cu atom is deposited.

Anodic Reaction; $Cu \rightarrow Cu^{+2} + 2e^-$

Cathodic Reaction; $Cu^{+2} + 2e^- \rightarrow Cu$

B. Distillation

Mercury and zinc are two examples of metals whose boiling points are low and can be purified using this technique. The

impure metal is heated above its boiling point during this procedure so that it can produce vapours. The impurities are segregated because they do not vaporize.

QUESTION .4

Write is Solvay process explain?

ANSWER

Solvay process

The main industrial procedure for producing sodium carbonate is known as the Solvay process or ammonia-soda process (soda ash, Na2CO3). The Belgian chemist Ernest Solvay transformed the ammonia-soda process into what it is today in the 1860s. Salt brine (from inland sources or the sea) and limestone are the ingredients for this, and they are both easily accessible and affordable. An estimated 42 million tonnes of soda ash were produced worldwide in 2005, or more than six kilos (13 lb) for every person on the planet. Currently, about three-quarters of this supply is produced by chemical factories centered in Solvay, with the remainder coming from mining natural sources. The Leblanc process was replaced by this procedure.

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Raw Materials

1. Ammonia

2. Brine

3. Limestone

Steps In Solvay Process

1. First ammonical brine is prepared by dissolving ammonia gas in brine then it is fed into the carbonating tower.

2. In carbonating tower ammonical brine is passed through carbon dioxide

$NaCl+CO_2+NH_3+H_2O \rightarrow NaHCO_3+NH_4Cl$

3. Precipitates of $NaHCO_3$ are separated from a milky solution by filtration. it is used as baking soda.

4. $NaHCO_3$ is heated to get sodium carbonate

$2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$

Recovery Of Ammonia

5 . Carbon dioxide is produced by heating limestone in a kiln

$CaCO3 \rightarrow CaO + CO2$

Carbon dioxide is fed into the carbonating tower. An equal volume of lime and water are used to form $Ca[OH]_2$

$CaO + H_20 \rightarrow Ca[OH]_2$

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6. Ammonical chloride is then treated with calcium hydroxide to recover almost all of the ammonia

$2NH_4Cl + Ca[OH]_2 \rightarrow 2NH_3 + CaCl_2 + 2H_2O$

QUESTION .5

Write a note on the advantages of the Solvay process

ANSWER

Advantages Of the Solvay Process

[I] It is a low-cost technique because the raw materials are inexpensive.

(ii) Ammonia and carbon dioxide are recovered and put to use again.

(iii) Process is pollution-free because calcium chloride solution is the only waste product.

(iv) Extremely pure sodium carbonate is produced.

QUESTION .6

What is urea explain with example?

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ANSWER

Urea

A soluble organic molecule with 46% nitrogen is urea [$CO(NH_2)_2$]. It naturally occurs in various molds and fungus as well as in urine. Synthetic urea is made by combining natural gas, ambient nitrogen, and water and reacting them under intense pressure and heat to create ammonia and carbon dioxide.

Fertilizer, a natural or synthetic substance, is put into the soil or plants to encourage growth and productivity. They provide nutrients to the plants. Consider urea.

Chemicals like ammonia, natural gas, atmospheric nitrogen, phosphate minerals, and sulfur are used to make synthetic fertilizers. Various fertilizer blends are created in a fertilizer manufacturing facility.

Organic fertilizers are all-natural fertilizers made from plants and animals. It improves the soil by adding carbonic molecules required for plant growth.

Advantages Of Fertilizers

1. Simple to apply, store, and transport

2. Due to its nutrient-specific nature, we can choose a specific fertilizer to supply a certain nutrient.

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3. Easily disintegrates in soil and is soluble in water. As a result, plants may easily absorb them.

4. They quickly affect the crops.

5. Boost crop production to produce more food and feed the big population.

6. Dependable and predictable

QUESTION .7

How is urea formed?

ANSWER

Raw Materials

1. Ammonia

2. Carbon Dioxide [CO_2]

Steps In Formation Of Urea

1. NH_3 reacts with CO_2 to form ammonium carbamate.

$2NH_3 + CO_2 \rightarrow NH_2COONH_4$

2. Ammonium carbamate undergoes distillation.

$NH_2COONH_4 + Heat \rightarrow NH_2CONH_2 + H_2O$

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3. Liquid ammonia is evaporated and granulated ammonia is obtained

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QUESTION .8

What is petroleum in simple words?

ANSWER

Petroleum

"Black Gold" is a term used to describe petroleum. Its significance to humanity is indicated by the name alone. Because it is used to make so many other items, including plastics, synthetic fabrics, fuel, and medications, crude oil is known as the "mother of all commodities." Since the 1950s, petroleum, often known as oil, has been the primary energy source on the globe.

A liquid called petroleum can be found naturally in rock formations. This is made up of an intricate blend of organic molecules and hydrocarbons with various molecular weights. Some of the chemical compounds made by petroleum can also be found in other fossil fuels

Origin Of Petroleum

Petroleum takes millions of years to create. It develops as a result of dead animal remnants that are buried beneath the

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earth's surface. These deceased remains get degraded and liquefied as a result of being heated and compressed. Petroleum, often known as crude oil, is a liquid form of organic matter. Oil wells can be dug to extract it, and the oil can then be refined to produce different products or fractions. The dead aquatic animals sink to the sea floor where they rot. Under identical circumstances, petroleum is also created.

QUESTION .9

What is meant by fractional distillation of petroleum?

ANSWER

Fractional Distillation

Miscible liquids are separated via a type of distillation called fractional distillation. The mixture is typically divided into parts after a series of distillations and condensations. When the combination is heated to a specific temperature where some of the mixtures begin to evaporate, the separation takes place.

Fractional Distillation of Petroleum (Crude Oil)

The process of separating the various components of crude oil is a typical example of fractional distillation in the industrial world. Typical components of crude oil include kerosene,

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paraffin wax, gasoline, diesel, naphtha, and lubricating oil. Effective separation of these components is made possible by the distillation process.

The chamber is filled with crude oil and heated using high-pressure steam. As the mixture begins to boil, vapour is produced. Various compounds now transition into the vapour phase. In the fractional distillation column, which is made up of multiple plates, the vapour climbs to the top. Because of the gaps in the plates, the vapour can travel through them. In most cases, the top of the fractionating column is kept cool. The lower portion of the column will condense the substances with the highest boiling points, while the top of the column will condense the substances with the lowest boiling points. The condensed liquid or gas portions are then cleared from the column's sides. The collected liquid fractions can be further cooled by passing through condensers.

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