Metallurgy

Question1

Identify catalyst used in following reaction.

$$CO_{(g)} + H_2O_{(g)} \xrightarrow{623\ K} CO_{2(\ g)} + H_{2(\ g)}$$

MHT CET 2025 5th May Evening Shift

Options:

A.

Iron chromate

B.

Vanadium pentoxide

C.

Ni metal

D.

Traces of acid or alkali

Answer: A

Solution:

We are asked about the catalyst used in the reaction:

$$CO_{(g)} + H_2O_{(g)} \xrightarrow{623K} CO_{2(g)} + H_{2(g)}$$

This is the **water-gas shift reaction**, which is important in industrial hydrogen production.

Catalysts commonly used:

- At high temperature (around 623 K to 850 K), the catalyst used is **iron oxide (Fe_2O_3) promoted by chromium oxide (Cr_2O_3)**, generally referred to as **iron chromate catalyst**.
- At lower temperature (~473 K), catalysts such as Cu-ZnO-Al_2O_3 are used.

Now checking the options:

- **A. Iron chromate → Correct catalyst for high-temperature shift reaction.**
- B. Vanadium pentoxide → Catalyst for contact process ($SO_2 \rightarrow SO_3$).
- C. Ni metal → Catalyst for hydrogenation reactions.
- D. Traces of acid or alkali → Used for ester hydrolysis etc.

✅ **Correct answer: Option A — Iron chromate**

Question2

Which pair of elements from following is used to make alloy for trophies?

MHT CET 2025 25th April Morning Shift

Options:

A. Cr and Zn

B. Ni and Cu

C. Cu and Sn

D. Ni and Zn

Answer: C

Solution:

Bronze, an alloy of copper and tin is tough, strong and corrosion resistant. It is used for making statues, medals and trophies.

Question3

Which of the following alloys is used in construction of outer fuselage of ultra-high speed air craft?

MHT CET 2024 15th May Evening Shift

Options:

A. Nichrome

B. Cupra-nickel

C. Stainless steel

D. Bronze

Answer: C

Solution:

Among the listed options, **stainless steel** is the alloy that has indeed been used in the construction of high-speed aircraft fuselages—famously in aircraft like the Soviet MiG-25 "Foxbat," which was built largely of stainless steel to withstand high-temperature environments at Mach 3 speeds.

Other options:

Nichrome (nickel–chromium) is primarily used as a heating element due to its high electrical resistance and oxidation resistance, not for fuselage construction.

Cupro-nickel (copper–nickel) is widely used in marine applications (e.g., ship hulls, coins) because of its corrosion resistance but not in aircraft fuselages.

Bronze (copper–tin) is traditionally used in bearings, sculptures, etc., not for high-speed aircraft structures.

Hence, among the given choices, the correct answer is:

(C) Stainless steel.

Question4

Identify the alloy used for construction of gas turbine engines.

MHT CET 2024 15th May Morning Shift

Options:

A. Nichrome

B. Bronze

C. Stainless steel

D. Cupra-nickel

Answer: A

Solution:

In the construction of gas turbine engines, **Nichrome** is typically used.

Nichrome is an alloy composed primarily of nickel and chromium. It is known for its high resistance to oxidation and its ability to maintain strength at elevated temperatures, which makes it particularly suitable for high-temperature applications like gas turbine engines. Its excellent heat resistance stems from the formation of an adherent chromium oxide layer on its surface, which protects the underlying metal from further oxidation.

In summary, **Option A**: Nichrome is the alloy most commonly used for the construction of gas turbine engines due to its thermal properties and resistance to oxidation.

Question5

Which from following is a mineral of copper?

MHT CET 2024 15th May Morning Shift

Options:

A. Chalcopyrite

B. Zincite

C. Limonite

D. Siderite

Answer: A

Solution:

Chalcopyrite (Option A) is a mineral of copper. Its chemical formula is $CuFeS_2$, where copper is combined with iron and sulfur. Chalcopyrite is the most important copper ore, making it a significant source for copper

extraction and production. Its brass-yellow color and metallic luster often make it resemble gold, which is why it is sometimes referred to as "fool's gold."

Question6

What is the number of moles of water molecules present in a mole of carnallite?

MHT CET 2024 15th May Morning Shift

Options:

A. 6

B. 4

C. 5

D. 1

Answer: A

Solution:

Carnallite is a hydrated potassium magnesium chloride mineral with the chemical formula $KCl \cdot MgCl_2 \cdot 6H_2O$.

In this formula:

KCl represents one unit of potassium chloride.

$MgCl_2$ represents one unit of magnesium chloride.

$6H_2O$ indicates six units of water of hydration (waters of crystallization).

Therefore, there are 6 moles of water molecules present in one mole of carnallite. Thus, the correct option is:

Option A: 6

Question7

In Haber's process of production of ammonia, K_2O is used as

MHT CET 2024 11th May Morning Shift

Options:

A. catalyst

B. inhibitor

C. promotor

D. adsorbate

Answer: C

Solution:

In the Haber process for the production of ammonia, K_2O is used as a **promotor**.

Explanation:

The Haber Process

The Haber process synthesizes ammonia (NH_3) from nitrogen (N_2) and hydrogen (H_2).

The overall chemical equation for this reaction is:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Role of Catalyst and Promoter

A catalyst is essential to increase the reaction rate, and in this process, iron is commonly used as the catalyst.

The catalyst allows the reaction to occur under less extreme conditions, thereby making the process commercially viable.

Role of K_2O (Potassium Oxide)

Promoters are substances that enhance the effectiveness of a catalyst.

K_2O acts as a promoter by increasing the activity and longevity of the iron catalyst.

It aids in the adsorption of nitrogen and hydrogen gases on the catalyst's surface, improving the overall efficiency of ammonia production.

Conclusion

Thus, K_2O serves to enhance the catalytic performance, classifying it as a promotor within the context of the Haber process.

Question8

What type of solution the alloy is?

MHT CET 2024 10th May Morning Shift

Options:

A. Solid in liquid

B. Gas in liquid

C. Solid in gas

D. Solid in solid

Answer: D

Solution:

An alloy is a type of solution where the components are in the solid state. Alloys are formed by mixing two or more metals, or a metal and a non-metal, while in their molten state, and then allowing them to solidify. Thus, the mixture of elements results in a solid solution.

Option D: Solid in solid

In an alloy, the atoms of the different elements are distributed throughout the structure of the solid. Examples of alloys include brass (copper and zinc), bronze (copper and tin), and steel (iron and carbon, and sometimes other elements).

Question9

Identify a mineral of zinc from following.

MHT CET 2024 4th May Morning Shift

Options:

A. Siderite

B. Calamine

C. Chalcocite

D. Limonite

Answer: B

Solution:

	Mineral	Formula
(A)	Siderite	$FeCO_3$
(B)	Calamine	$ZnCO_3$
(C)	Chalcocite	Cu_2S
(D)	Limonite	$2FeCO_3.3H_2O$

Question10

Identify elements present in copper pyrites.

MHT CET 2024 2nd May Morning Shift

Options:

A. Cu, K, S

B. Mg, Cu, P

C. Ca, S, O

D. Fe, Cu, S

Answer: D

Solution:

The elements present in copper pyrites are:

Option D: Fe, Cu, S

Copper pyrites, also known as chalcopyrite, has the chemical formula $CuFeS_2$. It indicates the presence of copper (Cu), iron (Fe), and sulfur (S).

Question11

Which from following alloys is used to make statues?

MHT CET 2023 13th May Morning Shift

Options:

A. Nichrome

B. Stainless steel

C. Bronze

D. Cupra-nickel

Answer: C

Solution:

Bronze, an alloy of copper and tin, is used for making statues.

Question12

Which from following formulae is of galena?

MHT CET 2023 12th May Evening Shift

Options:

A. $CaSO_4 \cdot 2H_2O$

B. PbS

C. ZnS

D. $BaSO_4$

Answer: B

Solution:

Galena is a natural mineral form of lead sulfide. It is the most important ore of lead and an important source of silver. The chemical formula for galena is lead(II) sulfide, which is represented by the formula:

PbS

Based on the given options, the correct formula for galena is:

Option B: PbS

Here's a brief explanation of the other options provided:

- Option A: $CaSO_4 \cdot 2H_2O$ is the formula for gypsum, a mineral composed of calcium sulfate dihydrate.

- Option C: ZnS is the chemical formula for sphalerite, which is the main ore of zinc.

- Option D: $BaSO_4$ is the formula for barite, a mineral consisting of barium sulfate.

Therefore, Option B is the correct formula for galena.

Question13

Which from following is a non-ferrous alloy?

MHT CET 2023 12th May Morning Shift

Options:

A. Nickel steel

B. Chromium steel

C. Stainless steel

D. Brass

Answer: D

Solution:

A non-ferrous alloy is an alloy that does not contain iron in significant amounts. Among the options provided:

- Nickel steel, Chromium steel, and Stainless steel are ferrous alloys because they are primarily composed of iron along with other elements.
- Brass, on the other hand, is an alloy primarily made up of copper and zinc and does not contain iron in significant amounts.

Therefore, the correct answer is:

Option D: Brass

Brass is a non-ferrous alloy.

Question14

Identify the method used to obtain SO_2 gas in industry.

MHT CET 2023 10th May Morning Shift

Options:

A. By burning sulphur in air

B. By treating sodium sulphite with dil. sulphuric acid

C. By treating sodium sulphite with dil. hydrochloric acid

D. By roasting zinc sulphide and iron pyrites

Answer: D

Solution:

In industry, sulphur dioxide can be prepared by roasting zinc sulphide and iron pyrites.

$$2ZnS_{(s)} + 3O_{2(g)} \xrightarrow{\Delta} 2ZnO_{(s)} + 2SO_{2(g)}$$
$$4FeS_{2(s)} + 11O_{2(g)} \xrightarrow{\Delta} 2Fe_2O_{3(s)} + 8SO_{2(g)}$$

Question15

Which of the following metals is used as catalyst in manufacture of sulphuric acid by contact process?

MHT CET 2023 9th May Morning Shift

Options:

A. Iron

B. Platinum

C. Nickel

D. Cobalt

Answer: B

Solution:

In the contact process of industrial production of sulfuric acid; sulphur dioxide and oxygen from the air react reversibly over a solid catalyst of platinised asbestos.

Question16

Which from the following alloys is used in gas turbine engines?

MHT CET 2021 24th September Morning Shift

Options:

A. Titanium alloy

B. Cupra-nickel

C. Stainless steel

D. Nichrome

Answer: D

Solution:

The correct answer is **Option D, Nichrome**. Here's why:

Gas turbine engines operate at extremely high temperatures, often exceeding 1000°C. This requires materials with exceptional heat resistance, strength, and resistance to oxidation. Let's examine each option:

Option A: Titanium alloy

Titanium alloys are known for their high strength-to-weight ratio, corrosion resistance, and good heat resistance. However, they may not be suitable for the extreme temperatures encountered in gas turbine engines, particularly in the combustion chamber and turbine blades.

Option B: Cupra-nickel

Cupra-nickel is primarily used for its corrosion resistance in marine applications. It doesn't have the necessary heat resistance for gas turbine environments.

Option C: Stainless steel

Stainless steels offer good corrosion resistance and some heat resistance, but their strength at high temperatures can be limited. Certain grades of stainless steel might be used in specific components of a gas turbine, but they are not the primary material choice for high-temperature applications.

Option D: Nichrome

Nichrome, an alloy of nickel and chromium, is specifically designed for high-temperature applications. It possesses excellent resistance to oxidation, high melting point, and good electrical conductivity. This makes it an ideal choice for components like heating elements, turbine blades, and other parts that experience intense heat in gas turbine engines.

Therefore, **Nichrome (Option D)** is the most suitable alloy for use in gas turbine engines due to its superior heat resistance, oxidation resistance, and strength at high temperatures.

Question17

What type of following solution is obtained from amalgam of mercury with sodium?

MHT CET 2021 24th September Morning Shift

Options:

A. liquid in solid

B. solid in gas

C. solid in solid

D. solid in liquid

Answer: A

Solution:

An amalgam is an alloy of mercury with another metal. When mercury combines with sodium, it forms a solid amalgam. Specifically, the amalgam of sodium with mercury results in a solution where solid sodium dissolves in liquid mercury.

In terms of the type of solution, it falls under the category of a "liquid in solid" type of solution, because sodium (the solute) is solid and mercury (the solvent) is liquid at room temperature.

Therefore, the correct answer is:

Option A: liquid in solid

Question18

Which among the following is a nonferrous alloy?

MHT CET 2021 23th September Morning Shift

Options:

A. Brass

B. Nickel steel

C. Stainless steel

D. Chromium steel

Answer: A

Solution:

Nonferrous alloys are metals that do not contain significant amounts of iron. They have distinct properties such as resistance to rust and corrosion, and are typically used in applications where these characteristics are desirable. Let’s analyze the options given:

Option A: Brass

Brass is an alloy of copper and zinc. Since it does not primarily contain iron, it is classified as a nonferrous alloy.

Option B: Nickel steel

Nickel steel is an alloy that includes a significant amount of iron along with nickel. Therefore, it is a ferrous alloy.

Option C: Stainless steel

Stainless steel contains iron along with chromium and usually nickel. Due to its iron content, it is also considered a ferrous alloy.

Option D: Chromium steel

Chromium steel is another steel variant that contains a high percentage of iron and chromium. It is classified as a ferrous alloy due to the iron content.

From the above analysis, we can conclude that **Option A: Brass** is the nonferrous alloy among the given options.

Question19

Identify the correct pair of mineral and its formula from following.

MHT CET 2021 22th September Morning Shift

Options:

A. Baryte - $MgSO_4.7H_2O$

B. Cryolite - Na_3AlF_6

C. Galena - ZnS

D. Epsom salt - $CaSO_4 \cdot 2H_2O$

Answer: B

Solution:

Let's analyze each option and identify the correct pair of mineral and its chemical formula:

Option A: Baryte - $MgSO_4 \cdot 7H_2O$

Baryte is actually barium sulfate, not magnesium sulfate. The correct formula for baryte is $BaSO_4$. Therefore, Option A is incorrect.

Option B: Cryolite - Na_3AlF_6

Cryolite is indeed a mineral with the chemical formula Na_3AlF_6. Therefore, Option B is correct.

Option C: Galena - ZnS

Galena is a mineral consisting of lead sulfide, not zinc sulfide. The correct formula for galena is PbS. Therefore, Option C is incorrect.

Option D: Epsom salt - $CaSO_4 \cdot 2H_2O$

Epsom salt is actually magnesium sulfate heptahydrate, not calcium sulfate dihydrate. The correct formula for Epsom salt is $MgSO_4 \cdot 7H_2O$. Therefore, Option D is incorrect.

Therefore, the correct pair of mineral and its formula from the given options is:

Option B: Cryolite - Na_3AlF_6

Question20

Which mineral among the following contains vanadium in it?

MHT CET 2020 19th October Evening Shift

Options:

A. Crocoisite

B. Azurite

C. Carnotite

D. Malachite

Answer: C

Solution:

Carnotite, mineral contains vanadium in it. It contains, about 53 per cent uranium, 12 per cent vanadium, and trace amount of radium. It is radioactive, bright-yellow, soft and earthy vanadium mineral that is an important source of uranium.

Question21

Which among the following sets of elements is present in chalcopyrite?

MHT CET 2020 19th October Evening Shift

Options:

A. Al, O

B. Cu, Fe, S

C. Al, Fe, O

D. Fe, S

Answer: B

Solution:

In chalcopyrite sets of elements is present as Cu, Fe, S. It is a copper iron sulphide mineral that crystallises in the tetragonal system. It has the chemical formula $CuFeS_2$. It has a brassy to golden yellow colour and a hardness of 3.5 to 4 on the Mohr scale. Its streak is diagnostic as green tinged black.

Question22

How many moles of gaseous oxygen at one atmosphere is considered for the reaction with element for plotting a graph in Ellingham diagram?

MHT CET 2020 19th October Evening Shift

Options:

A. 0.5

B. 2

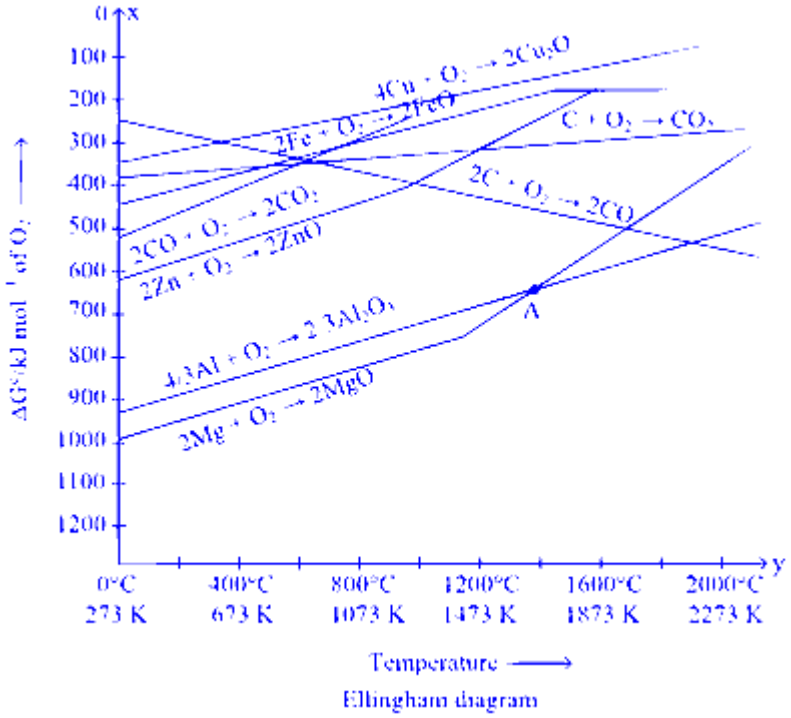
C. 1

D. 0.25

Answer: C

Solution:

In Ellingham diagram graph plotted between standard free energy change (ΔG°) per 1 mole of oxygen at y-axis and temperature (K) at x-axis. So, one moles of gaseous oxygen at one atmosphere is considered for the reaction with element for plotting a graph in Ellingham diagram. It is shown as below:



Question23

Identify the process of refining to obtain pig tin.

MHT CET 2020 16th October Evening Shift

Options:

A. Polling

B. van Arkel

C. Liquation

D. Mond process

Answer: C

Solution:

Pig tin is obtain by liquation process, in this technique for separating constituents of an ore, a metal or an alloy by partial melting. When the material is heated to a temperature, where one of the constituents melts and the other remains solid, the liquid constituent can be drained off. The pure metal (tin) flow down leaving behind the non-fusible material on the health.

Question24

Which of the following metals is refined by vapour phase refining in Mond process?

MHT CET 2020 16th October Evening Shift

Options:

A. Zn

B. Zr

C. Si

D. Ni

Answer: D

Solution:

Nickel (Ni) metal is refined by vapour phase refining process. This process is based on the fact that nickel reacts with carbon monoxide to form highly volatile nickel tetracarbonyl, which decomposes at high temperature to form pure nickel metal.

$$\underset{\text{Impure metal}}{\text{Ni}} + 4\text{CO} \xrightarrow{330-350\ \text{K}} \text{Ni(CO)}_4$$

$$\text{Ni(CO)}_4 \xrightarrow{450-470\ \text{K}} \underset{\text{pure metal}}{\text{Ni}} + 4\text{CO}$$

Question25

Which among the following ore is concentrated by froth floatation process?

MHT CET 2020 16th October Morning Shift

Options:

A. Bauxite

B. Dolomite

C. Galena

D. Diaspore

Answer: C

Solution:

Galena (PbS) ore is concentrated by froth floatation process. This process is used for the concentration of sulphide ores. In the given option, galena (PbS) is only sulphide ore. This method is based on the preferential wetting properties with the frothing agent and water.

Question26

Zirconium is refined by

MHT CET 2020 16th October Morning Shift

Options:

A. liquation process

B. Mond process

C. electrolytic refining process

D. van Arkel method

Answer: D

Solution:

van Arkel method is used for refining zirconium. In this method oxygen and nitrogen, present as impurity are removed by heating metal in an evacuated vessel with iodine. The metal iodide volatilise and it is decomposed on a tungsten filament, heated to about 1800 K. The pure metal is deposited on the filament.

$$\underset{\text{(Impure)}}{\text{Zr}} + 2\text{I}_2 \longrightarrow \text{ZrI}_4$$

$$\text{ZrI}_4 \longrightarrow \underset{\text{(Pure)}}{\text{Zr}} + 2\text{I}_2$$

Question27

In leaching of alumina from bauxite by Bayer's process, then ore is treated with

MHT CET 2019 3rd May Morning Shift

Options:

A. $\text{NaOH}(aq)$

B. $\text{NaCN}(aq)$

C. $\text{KCN}(aq)$

D. $\text{Na}_2\text{CO}_3(\text{aq})$

Answer: A

Solution:

In leaching of alumina from bauxite by Bayer's process, the ore is treated with $\text{NaOH}(aq)$. Concentration is carried out by heating the powdered ore with a concentrated solution of NaOH at $473 - 523$ K and $35 - 36$ bar pressure.This process is called digestion. In this reaction, Al_2O_3 is extracted out as sodium aluminate.

$$\text{Al}_2\text{O}_3(s) + 2\text{NaOH}(aq) + 3\text{H}_2\text{O}(l) \longrightarrow 2\text{Na}\left[\text{Al(OH)}_4\right](aq)$$

The sodium aluminate formed is neutralised by passing CO_2 gas and hydrated Al_2O_3 is precipitated.

$$2\text{Na}\left[\text{Al(OH)}_4\right](aq) + \text{CO}_2(g) \longrightarrow \text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}(s) + 2\text{NaHCO}_3(aq)$$

Question28

Which of the following is not the mineral of iron?

MHT CET 2019 3rd May Morning Shift

Options:

A. Limonite

B. Magnetite

C. Corundum

D. Haematite

Answer: C

Solution:

Corundum is not a mineral of iron. It is a crystalline form of aluminium oxide typically containing traces of Fe, Ti, V and Cr . Limonite, magnetite and haematite are minerals of iron. Name and molecular formula of given minerals is given below:

Name	Mineral
Limonite	$Fe(OH).nH_2O$
Magnetite	Fe_3O_4
Corundum	Al_2O_3
Haematite	Fe_2O_3

Question29

Limestone is used as a flux in the extraction of

MHT CET 2019 2nd May Evening Shift

Options:

A. iron

B. aluminium

C. zinc

D. copper

Answer: A

Solution:

Limestone is used as a flux in the extraction of iron because it decomposes in hot furnace to form calcium oxide and carbon dioxide. The formed calcium oxide actually acts as flux and combined with silica to form fusible calcium silicate slag.

Question30

Which of following metals occurs in native state?

MHT CET 2019 2nd May Evening Shift

Options:

A. Magnesium

B. Platinum

C. Potassium

D. Sodium

Answer: B

Solution:

Among the given metals, platinum has the least reactivity thus, it occurs in native state. While all other metals occurs in their oxides, sulphides and chloride forms.

Question31

Which of following methods is used to separate wolframite and stannic oxide present in cassiterite?

MHT CET 2019 2nd May Morning Shift

Options:

A. Hydraulic washing using Wilfley table

B. Froth flotation

C. Hydraulic classifier

D. Magnetic separation

Answer: D

Solution:

Option D: Magnetic separation

Magnetic separation is the method used to separate wolframite and stannic oxide from cassiterite. Wolframite is a magnetic mineral, while cassiterite and stannic oxide are non-magnetic. By using a magnetic separator, the magnetic wolframite particles can be effectively separated from the non-magnetic cassiterite and stannic oxide particles. This process exploits the difference in magnetic properties to achieve separation.

Question32

Bassemerisation is used in the extraction of

MHT CET 2019 2nd May Morning Shift

Options:

A. iron

B. copper

C. aluminium

D. zinc

Answer: B

Solution:

Bessemerisation is used in the extraction of copper from copper matte.

The following reactions takes place:

$$2FeS + 3O_2 \longrightarrow 2FeO + 2SO_2 \uparrow$$
$$FeO + SiO_2 \longrightarrow \underset{\text{(Slag)}}{FeSiO_3}$$
$$2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2 \uparrow$$
$$2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2 \uparrow$$

The molten copper is allowed to cool. During cooling, dissolved SO_2 comes out in the form of blisters, so it is called blister copper.
