

## Contact process Chemistry Questions with Solutions

**Q-1:** Which of the following catalysts is used in the contact process to produce sulphuric acid?

- a) Iron
- b) Vanadium pentoxide
- c) Vanadium trioxide
- d) Molybdenum

**Answer:** b) Vanadium pentoxide is the catalyst used in the contact process.

**Q-2:** Which of the following is the key step in the manufacture of  $\text{H}_2\text{SO}_4$  by contact process?

- a) Burning of sulphur or sulphide ores in air.
- b) Absorption of  $\text{SO}_3$  in  $\text{H}_2\text{SO}_4$  to give oleum.
- c) Conversion of  $\text{SO}_2$  to  $\text{SO}_3$
- d) All of the above

**Answer:** c) Conversion of  $\text{SO}_2$  to  $\text{SO}_3$

Explanation: The key step in the manufacture of  $\text{H}_2\text{SO}_4$  is the catalytic oxidation of  $\text{SO}_2$  with  $\text{O}_2$  to give  $\text{SO}_3$  in the presence of  $\text{V}_2\text{O}_5$  (catalyst).

**Q-3:** Which of the following impurities are usually found during the production of  $\text{SO}_2$  in the contact process?

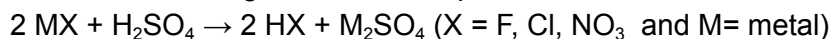
- a) Hydrogen compounds
- b) Arsenic compounds
- c) Nitrogen compounds
- d) All of the above

**Answer:** b) Arsenic compounds

Explanation: Purification of the  $\text{SO}_2$  produced includes the removal of dust and other impurities such as arsenic compounds.

**Q-4:** Which property of sulphuric acid makes it suitable for the production of more volatile acids from their salts?

**Answer:** Sulphuric acid, due to its low volatility, can be used to make more volatile acids from their salts. The following reaction takes place:



**Q-5:** What role does the catalyst play in the production of sulphuric acid during the contact process?

**Answer:** Vanadium pentoxide is the catalyst used in the contact process. The catalyst's action is not to produce more product, but to speed up the reaction by forcing it to reach equilibrium quickly.

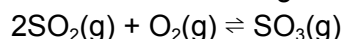
**Q-6:** Conversion of  $\text{SO}_2$  to  $\text{SO}_3$  by the reaction with oxygen in the presence of a catalyst is a \_\_\_\_\_.

- a) Endothermic Reaction
- b) Exothermic Reaction
- c) Precipitation reaction
- d) Reduction Reaction

**Answer: b) Exothermic Reaction**

Explanation: Heat is produced during the conversion of  $\text{SO}_2$  to  $\text{SO}_3$  by the reaction with oxygen in the presence of a catalyst. Exothermic reactions are defined as those in which heat is produced.

**Q-7:** For the following exothermic reaction,



Explain the effect of

- a) Increase in Pressure
- b) Decrease in Volume

**Answer:**

**a)** According to Le Chatelier's principle, increasing pressure causes the reaction to move in the direction with the fewest moles. We can see from the equation that there are three reactant molecules on the reactant side and only two on the product side. Therefore, applying excessive pressure promotes the formation of more sulphur trioxide.

**b)** We know that volume is directly proportional to the number of moles. As a result, a decrease in volume will shift the reaction in the direction where there are fewer moles. As a result, the reaction moves forward.

**Q-8:** What are the byproducts of the contact process?

**Answer:** The contact process produces sulphur trioxide and oleum as byproducts.

**Q-9:** Which of the following is the correct pressure and temperature conditions for plant operation during the contact process?

- a)  $T = 740 \text{ K}$ ,  $P = 2 \text{ bar}$
- b)  $T = 720 \text{ K}$ ,  $P = 2 \text{ bar}$
- c)  $T = 760 \text{ K}$ ,  $P = 1 \text{ bar}$
- d)  $T = 720 \text{ K}$ ,  $P = 1 \text{ bar}$

**Answer: b)  $T = 720 \text{ K}$ ,  $P = 2 \text{ bar}$**

**Explanation:** In practice, the plant is operated at a pressure of 2 bar and a temperature of 720 K.

**Q-10:** Sulphuric acid oxidises a variety of metals and nonmetals. Sulphuric acid is itself reduced to

- a)  $\text{SO}_3$
- b)  $\text{SO}_2$
- c)  $\text{S}^{2-}$
- d) None of the above

**Answer: b)** Both metals and nonmetals are oxidised by concentrated sulphuric acid, which itself is reduced to  $\text{SO}_2$ .

**Q-11:** How does sulphuric acid act as a dehydrating agent?

**Answer:** Concentrated sulphuric acid is a powerful dehydrating agent. Many wet gases get dried by passing them through sulphuric acid, provided the gases do not react with the acid. Sulphuric acid removes water from organic compounds, as evidenced by its charring action on carbohydrates.

**Q-12:** How is pure sulphur extracted for the production of sulphur dioxide in the contact process?

**Answer:** Sulphur dioxide gas cannot be produced without pure sulphur. Sulphur can be extracted from a variety of sources. The recovery of sulphur from natural gas and oil is the most important of these. To obtain sulphur, the organic or mineral components of these are removed.

**Q-13:** Sulphuric acid can be produced by dissolving sulphur trioxide in water. But this method is not used in the contact process. Why?

**Answer:** Sulphuric acid can be produced by diluting sulphur trioxide in water. This is, however, extremely dangerous and is not followed. The reaction of sulphur trioxide with water is highly exothermic, resulting in sulphuric acid fuming. The fumes prevent sulphur trioxide from dissolving further in water.

**Q-14:** Write the three steps involved in the manufacture of sulphuric acid by the contact process.

**Answer:** The contact process, which consists of three steps, is used to produce sulphuric acid.

- (i) Combustion of sulphur or sulphide ores in air to produce  $\text{SO}_2$ .
- (ii)  $\text{SO}_2$  to  $\text{SO}_3$  conversion via oxygen in the presence of a catalyst ( $\text{V}_2\text{O}_5$ ).
- (iii)  $\text{SO}_3$  absorption in  $\text{H}_2\text{SO}_4$  to yield Oleum ( $\text{H}_2\text{S}_2\text{O}_7$ ).

**Q-15:** Where is sulphur trioxide gas present to produce oleum when absorbed in concentrated sulphuric acid?

- a) Blast Furnace
- b) Washing Tower
- c) Catalytic Converter
- d) Beaker

**Answer: c)** Catalytic Converter

Explanation: The  $\text{SO}_3$  gas from the catalytic converter is absorbed in concentrated  $\text{H}_2\text{SO}_4$  to produce oleum.

## Practise Questions on Contact Process

**Q-1:** What is the purity percentage of sulphuric acid obtained by contact process?

- a) 100%
- b) 96-98%
- c) 94-95 %
- d) 90-91%

**Answer: b)** 96-98%

Explanation: The Contact process yields 96-98% pure sulphuric acid.

**Q-2:** Why is it necessary to remove the arsenic oxide impurity before passing the  $\text{SO}_2$  and air mixture through the catalytic chamber?

**Answer:** Arsenic impurity poisons the catalyst [deactivates the catalyst]. As a result, it must be removed prior to passing the  $\text{SO}_2$  air mixture through the catalyst chamber.

**Q-3:** Which of the following steps gives  $\text{H}_2\text{SO}_4$  of desired concentration in the contact process?

- a) Dilution of  $\text{SO}_3$  in water
- b) Dilution of  $\text{H}_2\text{S}_2\text{O}_7$  in water
- c) Dilution of  $\text{SO}_2$  in water
- d) Absorption of  $\text{SO}_3$  in  $\text{H}_2\text{SO}_4$

**Answer: b)** Dilution of  $\text{H}_2\text{S}_2\text{O}_7$  in water

Explanation: In the contact process, dilution of oleum ( $\text{H}_2\text{S}_2\text{O}_7$ ) with water gives  $\text{H}_2\text{SO}_4$  of the desired concentration.

**Q-4:** Give the various uses of sulphuric acid.

**Answer:** It is required in the production of hundreds of other compounds as well as in many industrial processes. The majority of the sulphuric acid produced is used to make fertilisers.

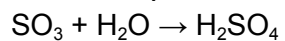
Other applications include:

- (a) Petroleum refining
- (b) The production of pigments, paints, and dyestuff intermediates.
- (c) Detergent industry
- (d) Metallurgical applications.
- (e) Storage batteries

**Q-5:** What happens when:

- a)  $\text{SO}_3$  is passed through water.
- b)  $\text{SO}_3$  is passed through  $\text{H}_2\text{SO}_4$

**Answer:** a) Water dissolves  $\text{SO}_3$  to give  $\text{H}_2\text{SO}_4$



b) When  $\text{SO}_3$  is passed through  $\text{H}_2\text{SO}_4$ , oleum is formed.

