

Ammonia Chemistry Questions with Solutions

Q1. The chemical formula of ammonia is-

- a.) NH_2
- b.) NH_3
- c.) NH_4
- d.) NH_5

Correct Answer– (b.) NH_3 .

Q2. Which of the following cation does not form an amine complex with an excess of ammonia?

- a.) Al^{3+}
- b.) Cd^{2+}
- c.) Ag^+
- d.) Cu^{2+}

Correct Answer– (a.) Al^{3+}

Q3. The catalyst used in the Haber process for manufacturing ammonia is-

- a.) Pt
- b.) Fe + Mo
- c.) CuO
- d.) Al_2O_3

Correct Answer– (b.) Fe + Mo

Q4. Ammonia gas is collected by-

- a.) Upward displacement of water
- b.) Upward displacement of air
- c.) Downward displacement of water
- d.) Downward displacement of air

Correct Answer– (d.) Downward displacement of air

Q5. ____ fumes confirm the presence of ammonia gas.

- a.) Dense Red
- b.) Dense White

- c.) No fumes
- d.) None of the above

Correct Answer– (b.) Dense White

A glass rod dipped in HCl is brought near the mouth of the gas jar through which white dense fumes can be seen which confirms the presence of ammonia gas.

Q6. Why ammonium nitrate is not used in the preparation of ammonia?

Answer. Ammonium nitrate is not used in the preparation of ammonia because it is explosive and may itself decompose and form a nitrous oxide and water vapour.

Q7. In the preparation of ammonia, why are solid ammonium chloride and slaked lime is taken in the ratio of 2:3 by weight?

Answer. Solid ammonium chloride is a sublimable solid which could be lost due to direct heating. Therefore, to counteract the loss of ammonium chloride by sublimation the higher ratio of slaked lime is taken.

Q8. Fill in the blank.

An aqueous solution of ammonia is used for identifying ____.

Answer. An aqueous solution of ammonia is used for identifying cations. When ammonia is dissolved in water, it produces ammonium hydroxide. In excess NH_4OH , ammonium hydroxide reacts with metallic salt solutions to form insoluble precipitates of their respective metallic hydroxides, which vary in colour and solubility.

Q9. How is ammonia gas dried?

Answer. Ammonia gas can be dried by using a drying agent such as quick lime (CaO). It is basic in nature and does not react with NH_3 which is also basic.

Q10. Why ammonia gas is not collected over water?

Answer. Ammonia is not collected over water because it is highly soluble in water.

Q11. Define liquor ammonia.

Answer. A saturated solution of ammonia in water is liquor ammonia fortis. Liquid ammonia has the chemical formula NH_3 . NH_4OH is the chemical formula for liquor ammonia fortis. Liquor ammonia is used as a cleaning agent and an emulsifier.

Q12. How can ammonia be separated from nitrogen and hydrogen?

Answer. Under pressure, a mixture of ammonia, residual nitrogen, and hydrogen is allowed to expand suddenly through a small nozzle into a low-pressure region. This causes a drop in temperature, which liquefies easily liquefiable NH_3 gas while making nitrogen and hydrogen difficult to liquefy.

Q13. Write your observation when ammonia gas is made to pass through-

- (i) moist red litmus paper
- (ii) Methyl orange solution
- (iii) Phenolphthalein

Answer. When ammonia gas is made to pass through-

- (i) moist red litmus paper - The moist litmus paper will turn blue
- (ii) Methyl orange solution - It turns methyl orange to yellow.
- (iii) Phenolphthalein - It turns phenolphthalein from colourless to pink.

Q14. Give a few large scale applications of ammonia.

Answer. Some of the uses of ammonia are as follows-

- Nearly 80% of the ammonia produced by industry is used as fertiliser in agriculture.
- Ammonia is also used as a refrigerant gas, to purify water.
- It is used to make plastics, explosives, textiles, pesticides, dyes, and other chemicals.
- It is used in the manufacture of other ammonium compounds such as ammonium chloride, ammonium carbonate, ammonium sulphate, etc.

Q15. Give the preparation of ammonia by Haber's process.

Answer. In the Haber process, "the atmospheric nitrogen (N_2) is converted to ammonia (NH_3) by reacting it with hydrogen (H_2)". Here a metal catalyst is used and high temperatures and pressures are maintained.

The raw materials for the process are

- Air, which supplies the nitrogen.
- Natural gas and water supply the hydrogen and the energy needed to heat the reactants.
- Iron is the catalyst and does not get used up.

Preparation-

- In the Haber process, nitrogen gas from the air is taken and combined with hydrogen atoms obtained from natural gas in the ratio of 1:3 by volume.
- The gases are passed through four beds of catalyst, with cooling taking place in each pass. This is done to maintain the equilibrium constant.
- While different levels of conversion occur in each pass where unreacted gases are recycled.
- Normally an iron catalyst is used in the process, and the whole procedure is conducted by maintaining a temperature of around $400 - 450^\circ\text{C}$ and a pressure of $150 - 200 \text{ atm}$.
- The process also involves steps like shift conversion, carbon dioxide removal, steam reforming, and methanation.

- In the final stage of the process, the ammonia gas is cooled down to form a liquid solution which is then collected and stored in storage containers.

Practise Questions on Ammonia

Q1. Ammonia gas can be collected by the displacement of-

- a.) Brine
- b.) Water
- c.) Mercury
- d.) Concentrates Sulphuric acid

Correct Answer– (c.) Mercury

Q2. Which of the following is not used in the preparation of ammonia?

- a.) Reduction of sodium nitrite or sodium nitrate by the reaction of zinc dust and sodium hydroxide.
- b.) Hydrolysis of calcium cyanamide
- c.) Heating ammonium chloride with slaked lime
- d.) Heating $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$

Correct Answer– (d.) Heating $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$.

Q3. How is ammonia gas collected?

Answer. Ammonia gas is lighter than air and therefore, it is collected by the downward displacement of air.

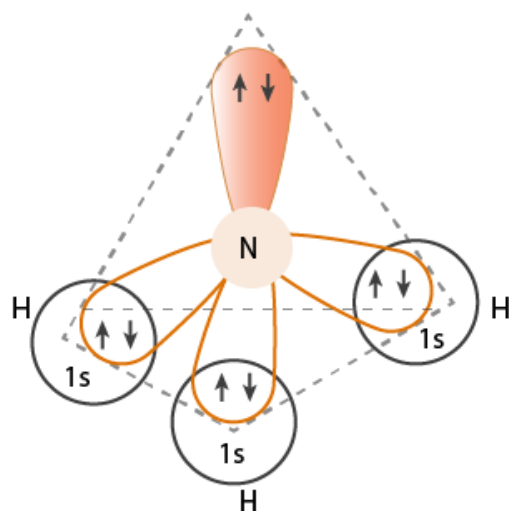
Q4. Is an aqueous solution of ammonia basic in nature?

Answer. Yes, an aqueous solution of ammonia (NH_4OH) is basic in nature. It is a weak base since it undergoes partial dissociation in an aqueous solution to give hydroxyl ions in low concentration.

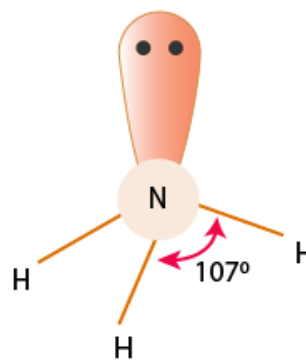
Q5. Give the Geometry of ammonia.

Answer. Ammonia's (NH_3) molecular geometry is trigonal pyramidal or distorted tetrahedral. It is due to a single lone pair of electrons on the nitrogen atom, which is non-bonding and repels the bonding orbitals. The bond angle between hydrogen, nitrogen, and hydrogen atoms (H-N-H) is 107° .

Hybridization of NH_3



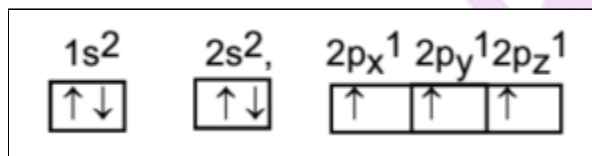
Orbital overlap in NH_3



Pyramidal shape

The hybridization of nitrogen in ammonia (NH_3) is sp^3 .

The ammonia (NH_3) molecule's orbital overlapping is shown below:



The NH_3 (Ammonia) molecule is polar in nature.