



Answer all the questions below as fully as you can then check your answers

1. Which of these ions is found in many fertilisers?

- a) OH^- b) H^+ c) NH_4^+ d) Cl^-

2. What is the starting material for making many fertilisers containing ammonium ions?

True or False:

3. A base neutralises an acid.

Fill in the Blank to complete the sentence below:

b. When ammonia dissolves in water, it forms the alkaline solution _____

4. What ions are present in all acids?

5. Match the acid with its correct classification:

Acid
H_2SO_4
H_3PO_4
HCl

Type of acid
monoprotic
diprotic
triprotic

6. Put the following steps in the correct order to describe how ammonium chloride is formed:

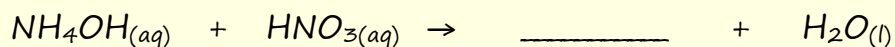
b) Ammonium hydroxide reacts with hydrochloric acid.

a) Ammonia dissolves in water to form ammonium hydroxide.

c) Ammonium chloride and water are produced.

7. Explain why sulfuric acid requires two moles of ammonium hydroxide for complete neutralisation, while hydrochloric acid only requires one.

8. Complete the following neutralisation reaction:



b. Write a word equation to represent the symbolic equation in part a.

9. Write symbolic equations to show what happens when, and also describe how these two reactions differ from each other:

a) 1 mole of ammonium hydroxide reacts with 1 mole of phosphoric acid.

b) 3 moles of ammonium hydroxide reacts with 1 mole of phosphoric acid.

10. Explain what is meant by the term "spectator ion" in the context of neutralisation reactions. Use the reaction of ammonium nitrate solution with hydrochloric acid as an example.

Stretch and Challenge questions

11. If you only had 2 moles of ammonium hydroxide available, what fertiliser could you partially produce from phosphoric acid and what would the formula of the fertiliser be? Write the balanced equation.

12. Compare the number of moles of ammonium hydroxide needed to fully neutralise 1 mole of nitric acid and 1 mole of phosphoric acid. Explain your answer in terms of the number of hydrogen ions present in each acid.

Answers

1. Which of these ions is found in many fertilisers?

- a) OH^- b) H^+ c) NH_4^+ d) Cl^-

Answer: c) NH_4^+

2. What is the starting material for making many fertilisers containing ammonium ions?

Answer: Ammonia (NH_3)

True or False:

3. A base neutralises an acid.

Answer: True

Fill in the Blank to complete the sentence below:

3. When ammonia dissolves in water, it forms the alkaline solution _____
_____.

Answer: ammonium hydroxide

4. What ions are present in all acids?

Answer: Hydrogen ions (H^+)

5. Match the acid with its correct classification:

Acid	Type of acid
H_2SO_4	monoprotic
H_3PO_4	diprotic
HCl	triprotic

6. Put the following steps in the correct order to describe how ammonium chloride is formed:

b) Ammonium hydroxide reacts with hydrochloric acid.

a) Ammonia dissolves in water to form ammonium hydroxide.

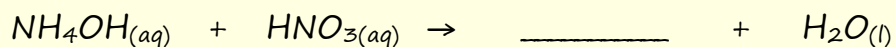
c) Ammonium chloride and water are produced.

Answer: a, b, c

7. Explain why sulfuric acid requires two moles of ammonium hydroxide for complete neutralisation, while hydrochloric acid only requires one.

Answer: Sulfuric acid (H_2SO_4) is diprotic, meaning it has two hydrogen ions (H^+). Each hydrogen ion requires one hydroxide ion (OH^-) from the ammonium hydroxide to neutralise it. Hydrochloric acid (HCl) is monoprotic, having only one H^+ .

8. Complete the following neutralisation reaction:



Answer: $NH_4NO_{3(aq)}$

b. Write a word equation to represent the symbolic equation in part a.

Answer:

Ammonium nitrate + nitric acid → ammonium nitrate + water

9. Write symbolic equations to show what happens when, and also describe how these two reactions differ from each other:

a) 1 mole of ammonium hydroxide reacts with 1 mole of phosphoric acid.

b) 3 moles of ammonium hydroxide reacts with 1 mole of phosphoric acid.

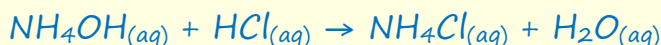
Answer:

a) $\text{NH}_4\text{OH}_{(aq)} + \text{H}_3\text{PO}_4_{(aq)} \rightarrow (\text{NH}_4)\text{H}_2\text{PO}_4_{(aq)} + \text{H}_2\text{O}_{(aq)}$ (Partial neutralisation)

b) $3\text{NH}_4\text{OH}_{(aq)} + \text{H}_3\text{PO}_4_{(aq)} \rightarrow (\text{NH}_4)_3\text{PO}_4_{(aq)} + 3\text{H}_2\text{O}_{(aq)}$ (Complete neutralisation)

10. Explain what is meant by the term "spectator ion" in the context of neutralisation reactions. Use the reaction of ammonium nitrate solution with hydrochloric acid as an example.

Answer: Spectator ions are ions that are present in the reaction mixture but do not take part in the actual reaction. They remain unchanged. For example, in the reaction between ammonium hydroxide and hydrochloric acid:

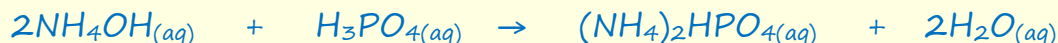


the Cl^- ion is a spectator ion. The actual reaction is between H^+ and OH^- to form water.

Stretch and Challenge questions

11. If you only had 2 moles of ammonium hydroxide available, what fertiliser could you partially produce from phosphoric acid and what would the formula of the fertiliser be? Write the balanced equation.

Answer: You could partially produce ammonium hydrogen phosphate. The formula would be $(\text{NH}_4)_2\text{HPO}_4$. The balanced equation would be:



12. Compare the number of moles of ammonium hydroxide needed to fully neutralise 1 mole of nitric acid and 1 mole of phosphoric acid. Explain your answer in terms of the number of hydrogen ions present in each acid.

Answer: Nitric acid (HNO_3) is monoprotic and has one H^+ ion, so it requires 1 mole of ammonium hydroxide for complete neutralisation. Phosphoric acid (H_3PO_4) is triprotic and has three H^+ ions, so it requires 3 moles of ammonium hydroxide for complete neutralisation. This is because each OH^- ion from the ammonium hydroxide neutralises one H^+ ion from the acid.