

7. Equilibria

7.2 Brønsted–Lowry theory of acids and bases

Paper 1

Question Paper

- 1** NaOH(aq) is added to NH_4Cl (aq). The mixture is warmed.

The gas that is produced turns damp red litmus paper blue.

Which row is correct?

	behaviour of the ammonium ion in NH_4Cl	behaviour of the water present on the litmus paper
A	Brønsted–Lowry acid	Brønsted–Lowry base
B	Brønsted–Lowry acid	Brønsted–Lowry acid
C	Brønsted–Lowry base	Brønsted–Lowry acid
D	Brønsted–Lowry base	Brønsted–Lowry base

- 2** Which reaction mixture produces an acidic gas?

- A** aqueous ammonium nitrate and solid calcium oxide
- B** calcium and aqueous hydrochloric acid
- C** potassium chloride and concentrated sulfuric acid
- D** sodium oxide and water

- 3** Solid R is added to a solution of ammonium nitrate and the mixture is heated. A gas is given off which turns red litmus to blue.

What could be R?

- A** aluminium chloride
- B** magnesium chloride
- C** sodium oxide
- D** phosphorus oxide

- 4 Magnesium hydroxide dissolves in aqueous ammonium chloride, but not in aqueous sodium chloride.

Which statement explains this observation?

- A The ionic radius of the NH_4^+ ion is similar to that of Mg^{2+} but not that of Na^+ .
 - B NH_4Cl dissociates less fully than NaCl .
 - C The Na^+ and Mg^{2+} ions have the same number of electrons.
 - D The NH_4^+ ion can donate a proton.
- 5 Ammonium carbonate is a crystalline solid. On gentle warming a reaction occurs, forming ammonia as one product.

How are the carbonate ions behaving during this reaction?

- A Brønsted–Lowry acid
 - B Brønsted–Lowry base
 - C oxidising agent
 - D reducing agent
- 6 Which type of reaction occurs when solid ammonium sulfate is heated with an excess of sodium hydroxide solution?
- A acid–base
 - B precipitation
 - C redox
 - D thermal decomposition

- 7 Ammonia, carbon dioxide and water react together to form ammonium carbonate.

Which statement about this reaction is correct?

- A It is a redox reaction.
- B It is an acid–base reaction.
- C The H–N–H bond angle decreases as a consequence of this reaction.
- D The three substances react in a 1 : 1 : 1 ratio in this reaction.

8 In which reaction does ammonia behave as a Brønsted-Lowry base?

