

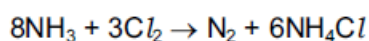
Worksheet: Bronsted-Lowry Acids & Bases

11 Why is ethanoic acid a stronger acid in liquid ammonia than in aqueous solution?

- A Ammonia is a stronger base than water.
- B Ammonium ethanoate is completely ionised in aqueous solution.
- C Ammonium ethanoate is strongly acidic in aqueous solution.
- D Liquid ammonia is a more polar solvent than water.

s/03/qp1

36 Ammonia and chlorine react in the gas phase.

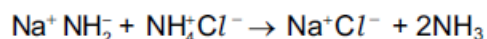


Which statements are correct?

- 1 Ammonia behaves as a reducing agent.
- 2 Ammonia behaves as a base.
- 3 The oxidation number of the hydrogen changes.

s/06/qp1

34 The following reaction takes place using liquid ammonia as a solvent.

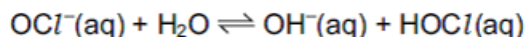


Which statements best explain why this reaction should be classified as a Brønsted-Lowry acid-base reaction?

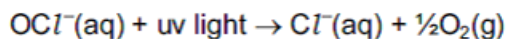
- 1 The ammonium ion acts as a proton donor.
- 2 $\text{Na}^+ \text{Cl}^-$ is a salt.
- 3 Ammonia is always basic.

s/09/qp1

- 11 Swimming pool water can be kept free of harmful bacteria by adding aqueous sodium chlorate(I), NaOCl. This reacts with water to produce HOCl molecules which kill bacteria.



In bright sunshine, the OCl⁻ ion is broken down by ultra-violet light.



Which method would maintain the highest concentration of HOCl(aq)?

- A acidify the pool water
- B add a solution of chloride ions
- C add a solution of hydroxide ions
- D bubble air through the water

s/10/qp11

- 10 The table gives the concentrations and pH values of the aqueous solutions of two compounds, X and Y. Either compound could be an acid or a base.

	X	Y
concentration	2 mol dm ⁻³	2 mol dm ⁻³
pH	6	9

Student P concluded that X is a strong acid.

Student Q concluded that the extent of dissociation is lower in X(aq) than in Y(aq).

Which of the students are correct?

- A both P and Q
- B neither P nor Q
- C P only
- D Q only

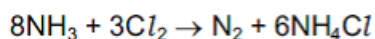
s/10/qp11

- 31 Which statements are correct in terms of the Brønsted-Lowry theory of acids and bases?

- 1 Water can act as either an acid or a base.
- 2 Sulfuric acid, H₂SO₄, does not behave as an acid when dissolved in ethanol, C₂H₅OH.
- 3 The ammonium ion acts as a base when dissolved in liquid ammonia.

s/11/qp11

32 Ammonia and chlorine react in the gas phase.

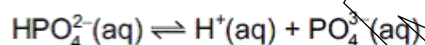
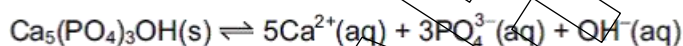


Which statements are correct?

- 1 Each nitrogen atom is oxidised.
- 2 Each chlorine atom is reduced.
- 3 Ammonia behaves as a base.

s/12/qp12

34 Hydroxyapatite, $\text{Ca}_5(\text{PO}_4)_3\text{OH}$, is the main constituent of tooth enamel. In the presence of saliva, the following equilibria exist.

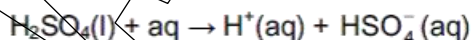


Which of the following statements help to explain why tooth enamel is dissolved more readily when saliva is acidic?

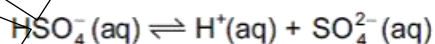
- 1 The hydroxide ions are neutralised by the acid.
- 2 The phosphate ion $\text{PO}_4^{3-}(\text{aq})$ accepts $\text{H}^+(\text{aq})$
- 3 Calcium ions react with acids.

w/05/qp1

32 Concentrated sulphuric acid behaves as a strong acid when it reacts with water.



The HSO_4^- ion formed behaves as a weak acid.



Which statements are true for 1.0 mol dm^{-3} sulphuric acid?

- 1 $[\text{H}^+(\text{aq})]$ is high
- 2 $[\text{SO}_4^{2-}(\text{aq})]$ is high
- 3 $[\text{HSO}_4^-(\text{aq})] = [\text{SO}_4^{2-}(\text{aq})]$

w/06/qp1

32 Which of the following can act as a Bronsted-Lowry acid?

- 1 H_3O^+
- 2 NH_4^+
- 3 H_2O

w/08/qp1

9 The following equilibrium is set up in a mixture of concentrated nitric and sulfuric acids.



Which row correctly describes the behaviour of each substance in the equilibrium mixture?

	HNO_3	H_2SO_4	H_2NO_3^+	HSO_4^-
A	acid	acid	base	base
B	acid	base	base	acid
C	base	acid	acid	base
D	base	acid	base	acid

w/10/qp12

8 Sulfur dioxide is used as a preservative in wine making.

The following equations describe how sulfur dioxide dissolves.



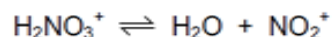
Which statement about these two reactions is correct?

- A HSO_3^- acts as a base.
- B SO_2 acts as an oxidising agent.
- C SO_3^{2-} acts as an acid.
- D SO_3^{2-} acts as a reducing agent.

w/11/qp11

34 The Brønsted-Lowry theory describes acid and base character.

When concentrated sulfuric acid and concentrated nitric acid are mixed, the following reactions occur.



Which species are bases in these reactions?

- 1 HSO_4^-
- 2 HNO_3
- 3 NO_2^+

s/14/qp11

34 Sulfuric acid is a Brønsted-Lowry acid.

In which reactions is sulfuric acid behaving as an acid?

- 1 $\text{H}_2\text{SO}_4 + \text{HNO}_3 \rightarrow \text{H}_2\text{NO}_3^+ + \text{HSO}_4^-$
- 2 $\text{H}_2\text{SO}_4 + \text{CO}_3^{2-} \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{SO}_4^{2-}$
- 3 $\text{H}_2\text{SO}_4 + \text{MgO} \rightarrow \text{MgSO}_4 + \text{H}_2\text{O}$

s/14/qp12

17 Which statement explains the observation that magnesium hydroxide dissolves in aqueous ammonium chloride, but not in aqueous sodium chloride?

- 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.

w/13/qp11

(e) When aqueous hydrazine is reacted with HCl , a solid compound of formula $\text{N}_2\text{H}_5\text{Cl}$ may be isolated. When an excess of HCl is used, a second solid, $\text{N}_2\text{H}_6\text{Cl}_2$, is formed.

(i) Suggest what type of reaction occurs between hydrazine and HCl .

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(ii) What feature of the hydrazine molecule enables this reaction to occur?

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(iii) Suggest why one molecule of hydrazine is able to react with one or two molecules of HCl .

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[3]

s/07/qp2

Hydrogen sulphide is a weak diprotic (dibasic) acid. Its solution in water contains HS^- and a few S^{2-} ions.

(e) (i) What is meant by the term *weak acid*?

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(ii) Write an equation, with state symbols, for the **first** ionisation of H_2S when it dissolves in water.

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[3]

s/05/qp2
