We've reimagined our chemistry, so our students can understand what's happening in Breaking Bad.

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ACIDIC AND BASIC SALTS: The concept

- When a salt dissolves in water, it forms the anion and cation
- The cation can either
  - react with the water (if it is a weak acid/base with a weak conjugate)
  - not react with the water (if it a very weak acid/base with a strong conjugate, or is a metal ion)
- The anion can also either
  - react with water (if it is a weak acid/base with a weak conjugate)
  - not react with the water (if it is a very weak acid/base with a strong conjugate)

ACIDIC AND BASIC SALTS:
The calculation/ formula and example

Explain the acidic nature of the salt NH_4Cl. Include a balanced equation in your answer.

Step 1 – write the equation of NH_4Cl dissolving in water and describe what is happening:

$$NH_4Cl(aq) \rightarrow NH_4^+(aq) + Cl^-(aq)$$

'ammonium chloride dissociates in water to form ammonium and chloride ions'

Step 2 – Explain whether or not the cation reacts with water and describe what happens:

$$NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)$$

~~$NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_5^+(aq) + OH^-(aq)$~~

'ammonium reacts with water as a ***weak Bronsted-lowry acid*** *and forms its* ***weak conjugate base*** *ammonia, whilst water acts as the* ***weak Bronsted-lowry base*** *and accepts a proton to form the hydronium ion'*

ACIDIC AND BASIC SALTS:
The calculation/ formula and example

Step 3 – Explain whether or not the anion reacts with water and describe what happens:

$$Cl^-(aq) + H_2O(l) \rightleftharpoons HCl(aq) + OH^-(aq)$$

'*chloride ions will not react with water as it is the extremely weak conjugate base of the strong acid HCl*'

Step 4 – Put it all together:

'As there is an excess formation of the hydronium ion from the ionisation of ammonium in water, there will be a net increase in hydronium, making the salt acidic. According to the equation $pH = -\log_{10}[H_3O^+]$ *this will result in a decrease in pH'.*

ACIDIC AND BASIC SALTS:
The past paper question

Question:

Explain why the salt, sodium acetate, forms a basic solution when dissolved in water. Include an equation in your answer.

(HSC 2015 Q24(a))

Remember:

1. Dissolution
2. Ionisation of acid/base (+ Bronsted-Lowry Conjugate acid/base)
3. Put it together

TITRATION: The concept

- An acid-base reaction where at the end of the reaction, the number of moles of the acid and base are in stoichiometric ratio
- E.g. at the **end-point** of an acid-base titration:
  - $CH_3COOH(aq) + NaOH(aq) \rightarrow CH_3COONa(aq) + H_2O(l)$
    - $n_{CH_3COOH} = n_{NaOH}$
  - $2HCl(aq) + Ba(OH)_2(aq) \rightarrow BaCl_2(aq) + 2H_2O(l)$
    - $n_{HCl} = 2 \times n_{Ba(OH)_2}$
  - $H_3PO_4(aq) + 3KOH(aq) \rightarrow 3H_2O(l) + K_3PO_4(aq)$
    - $n_{H_3PO_4} = \frac{1}{3} \times n_{KOH}$

TITRATION: The example

A 25mL aliquot of HCl of unknown concentration was titrated again a 0.1005M solution of $NaOH$. The average titre volume was 16.73mL. Determine the concentration of HCl.

TITRATION: The example (stepping it up)

A 25mL of H_2SO_4 of an unknown concentration was diluted to 500mL in a volumetric flask. 25mL of the diluted solution was then titrated again a 0.670M solution of KOH. The titre volumes were as follows:

Titration volume #1	23.6 mL
Titration volume #2	21.62 mL
Titration volume #2	21.65mL
Titration volume #2	22.60mL
Titration volume #2	21.58mL

Determine the original concentration of H_2SO_4.

TITRATION: The even harder example (hit me up with the back titration fam)

Seashells contain a mixture of carbonate compounds. The standardised hydrochloric acid (c = 0.200M) was used to determine the percentage by mass of carbonate in a seashell using the following procedure.

- A 0.145 g sample of the seashell was placed in a conical flask.
- 50.0 mL of the standardised hydrochloric acid was added to the conical flask.
- At the completion of the reaction, the mixture in the conical flask was titrated with 0.250M sodium hydroxide.

The volume of sodium hydroxide used in the titration was 29.5 mL. Calculate the percentage by mass of carbonate in the sample of the seashell. (HSC 2016 Q29(b))

TITRATION: The calculation

A manufacturer makes lemon cordial by mixing flavouring, sugar syrup and citric acid. The concentration of the citric acid is determined by titration with NaOH.

The sodium hydroxide solution is prepared by dissolving 4.000 g of NaOH pellets in water to give 1.000 L of solution. This solution is standardised by titrating 25.00 mL with a 0.1011 mol L^{-1} standardised solution of HCl. The average titration volume is found to be 24.10 mL.

To analyse the lemon cordial 50.00 mL of the cordial is diluted to 500.0 mL. Then 25.00 mL of the diluted solution is titrated with the NaOH solution to the phenolphthalein endpoint.

The following data were collected during one of the analysis runs of the lemon cordial.

Titration #1 volume	26.55 mL
Titration #2 volume	27.25 mL
Titration #3 volume	27.30 mL
Titration #4 volume	27.20 mL

(a) Why is the calculated concentration of the standardised NaOH solution different from the concentration calculated using the mass given, assuming no human error occurred?

Determine the concentration of citric acid in the lemon cordial.

Remember:

1. Figure out the story
2. Write out the formula
3. Write out the mathematical equation
4. Substitute values into the equation
5. Calculate and write the final answer with correct S.F. and units