Edexcel International Chemistry A Level

CP11 - Finding the Ka Value for a Weak Acid

(A Level only)

Flashcards

What can be used to accurately measure the pH of a solution?

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A pH meter

What is meant by a weak acid?

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An acid that partially dissociates in solution to release some H^+ ions

Phenolphthalein is used during a titration in which alkali is added to a conical flask of acid. What is observed during this reaction?

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Colour change from colourless to pink

What are two possible sources of error during a titration?

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- Measuring apparatus has a small uncertainty which may lead to inaccurate measurement of volumes.
- The end point is subjective and individuals may disagree over the exact point at which the indicator changes colour.

Why might it better to use a pH meter rather than an indicator to measure pH?

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- No ions are added or removed when using a pH meter
- pH meters are more accurate (can record to 2 decimal places)
- pH meters are not subjective

Draw and label a diagram to show the apparatus set-up for a titration

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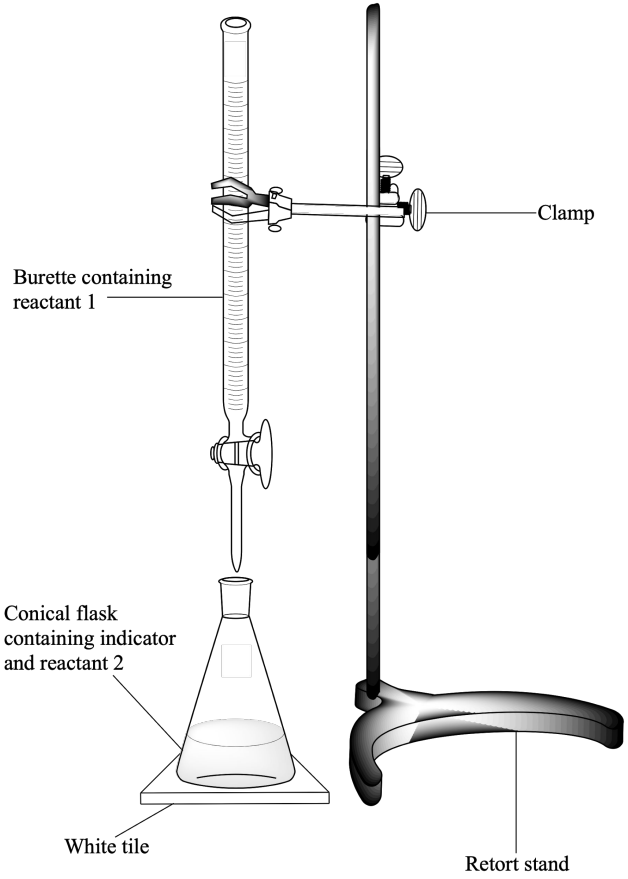

Write the Ka expression for any weak acid (written as HA)

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$$Ka = \frac{[H^+][A^-]}{[HA]}$$

Describe an experiment that can be used to find the Ka value of a weak acid

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1. Calibrate a pH meter
2. Fill a burette with strong alkali. Add 25cm^3 of weak acid to a conical flask with a few drops of phenolphthalein. Place the flask on a white tile.
3. Add the alkali to the acid until the solution first turns permanent pink.
4. Add 25cm^3 of weak acid to the conical flask.
5. Measure the pH using the pH meter. pH = pKa because half the acid has been neutralised (this is the half equivalence point).

After completing the experiment on the previous card, how can Ka be calculated?

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In the experiment, effectively half the acid has been titrated so:

$[H^+] = [HA] = [A^-]$

$$K_a = \frac{[H^+][A^-]}{[HA]}$$

$[A^-]$ and $[HA]$ cancel so:

$K_a = [H^+]$

$pH = -\log_{10}([H^+])$

$K_a = 10^{-pH}$

As pH has been measured, this can be substituted into the equation to calculate Ka.

What does a large Ka value indicate?

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A stronger acid (more dissociation has occurred)

How can pKa be calculated from Ka?

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$$pKa = -\log_{10}(Ka)$$

What is the Henderson-Hasselbalch equation?

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$$pH = pKa + \log_{10}\left(\frac{[A^-]}{[HA]}\right)$$