OCR (A) Chemistry A-level

Topic 5.1.3 - Acids, Bases and Buffers

Flashcards

Define a Bronsted-Lowry acid

Define a Bronsted-Lowry acid

Proton donor

Define a Bronsted-Lowry base

Define a Bronsted-Lowry base

Proton acceptor

Define Lewis acid

Define Lewis acid

Electron pair acceptor

Define Lewis base

Define Lewis base

Electron pair donor

What ion causes a solution to become acidic? (2 answers) Name and formula

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H+ (hydrogen ion) or, more accurately, H_3O+ (oxonium ion), as protons react with H_2O to form it

What ion causes a solution to be alkaline?

What ion causes a solution to become alkaline?

-OH (hydroxide ion)

Write an equation for the ionisation of water (2)

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$2H_2O\ (l) \rightleftharpoons H_3O^+\ (aq) + {}^-OH\ (aq)$

OR $H_2O\ (l) \rightleftharpoons H^+\ (aq) + {}^-OH\ (aq)$

Give example of a monobasic acid

Give example of a monobasic acid

HCl

Give example of a dibasic acid

Give example of a dibasic acid

H_2SO_4

Give example of a tribasic acid

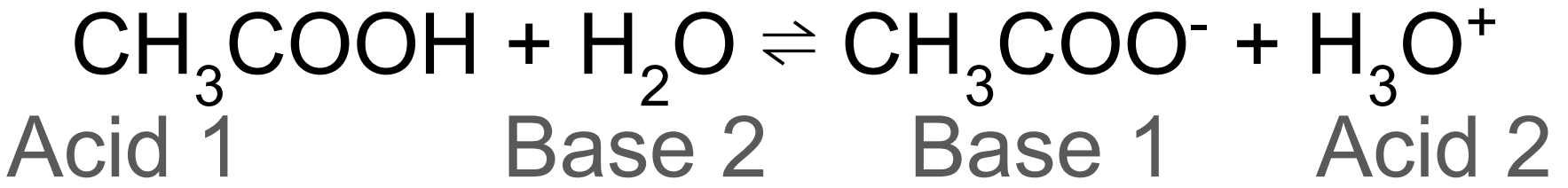
Give example of a tribasic acid

H_3PO_4

Identify the acid base pairs for the reaction below

$$CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$$

Identify the acid base pairs for the reaction below



Define strong acid

Define strong acid

Acids dissociate completely

Give some examples of strong acids

Give some examples of strong acids

- Hydrochloric acid
- Sulfuric acid
- Nitric acid

What is the difference between concentrated and strong?

What is the difference between concentrated and strong?

Concentrated means many mol per dm3, strong refers to amount of dissociation

Define weak acids

Define weak acids

Acids that only partially dissociate

Give some examples of weak acid

Give some examples of weak acid

Methanoic acid, any organic acid

What is constant that is used to measure the extent of acid dissociation called?

What is constant that is used to measure the extent of acid dissociation called?

Acid dissociation constant

What is the symbol of acid dissociation constant?

What is the symbol of acid dissociation constant?

K_a

Write the acid dissociation constant expression

Write the acid dissociation constant expression

For acid HA, $HA \rightleftharpoons H^+ + A^-$

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

What does a larger K_a value mean?

What does a larger K_a value mean?

Larger the K_a - greater the extent of dissociation

Write the equation used to convert K_a into pK_a

Write the equation used to convert K_a into pK_a

$$pK_a = -\log_{10} K_a$$

Write the equation used to convert pK_a into K_a

Write the equation used to convert pK_a into K_a

$$K_a = 10^{-pKa}$$

What is the relationship between pK_a and strength of the acid?

What is the relationship between pK_a and strength of the acid?

Smaller the pK_a stronger the acid

Write the equation used to convert concentration of H^+ into pH

Write the equation used to convert concentration of H+ into pH

$$pH = -\log[H^+]$$

Write the equation used to convert pH into concentration of H+

Write the equation used to convert pH into concentration of H+

$$[H^+] = 10^{-pH}$$

Why is a pH scale useful compared to concentration of H^+?

Why is a pH scale useful compared to concentration of H+?

pH scale allows a wide range of H^+ concentration to be expressed as simple positive values

What is the relationship between pH and $[H^+]$?

What is the relationship between pH and [H+]?

High pH value means a small [H^+]

If two solutions have a pH difference of 1, what is the difference in [H+]?

If two solutions have a pH difference of 1, what is the difference in [H+]?

A factor of 10

$[H^+]$ of a strong acid is equal to what?

[H+] of a strong acid is equal to what?

$[H^+] = [HA]$

Write the equation used to calculate $[H^+]$ of weak acids

Write the equation used to calculate [H+] of weak acids

$$[H^+] = \sqrt{K_a \times [HA]}$$

What is the assumption made when calculating pH of weak acids?

What is the assumption made when calculating pH of weak acids?

It is assumed that the concentration of acid at equilibrium is equal to the concentration of acid after dissociation. This is because only very little of the acid dissociates

Write the expression for ionic product of water, K_w

Write the expression for ionic product of water, Kw

$$K_w = [H^+][OH^-]$$

What is the units for K_w?

What is the units for Kw?

mol^2dm^{-6}

What is the value of K_w at 298 K?

What is the value of K_w at 298 K?

1.0×10^{-14}

What physical factors affect the value of K_w? How do they affect it?

What physical factors affect the value of K_w? How do they affect it?

Temperature only - if temperature is increased, the equilibrium moves to the right so K_w increases and the pH of pure water decreases

Indices of of $[H^+]$ and $[OH^-]$ always adds up to what value?

Indices of of [H+] and [OH-] always adds up to what value?

-14

Define the term strong base

Define the term strong base

Base that dissociates 100% in water

Give examples of some strong bases

Give examples of some strong bases

$NaOH$

KOH

$Ca(OH)_2$

Give example of a weak base

Give example of a weak base

Ammonia

Write the equation used to calculate $[H^+]$ of strong bases

Write the equation used to calculate [H+] of strong bases

$$[H^+] = K_w / [OH^-]$$

Define a buffer solution

Define a buffer solution

A mixture that minimises pH change on addition of small amounts of an acid or a base

What are the 2 ways in which buffers can be made?

What are the 2 ways in which buffers can be made?

- Weak acid and its conjugate base
- Weak acid and a strong alkali

In which direction does the equilibrium shift when an acid is added to a buffer solution? Why?

In which direction does the equilibrium shift when an acid is added to a buffer solution? Why?

Equilibrium shifts to the left because [H+] increases and the conjugate base reacts with the H^+ to remove most of the H^+

In which direction does the equilibrium shift when an alkali is added to a buffer solution? Why?

In which direction does the equilibrium shift when an alkali is added to a buffer solution? Why?

Equilibrium shifts to the right, because $[OH^-]$ increases and the small concentration of H^+ reacts with OH^-. To restore the H^+ ions HA dissociates shifting the equilibrium

Write the equation used to calculate $[H^+]$ of buffer solution

Write the equation used to calculate [H+] of buffer solution

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

Which buffer system maintains blood pH at 7.4? What happens when acid/alkali is added?

Which buffer system maintains blood pH at 7.4? What happens when acid/alkali is added?

$H^+ + HCO_3^{--} \rightleftharpoons CO_2 + H_2O$

Add OH^- → reacts with H^+ to form H_2O, then shifts equilibrium left to restore H^+ lost

Add H^+ → equilibrium shifts to the right, removing excess H^+

What is a titration?

What is a titration?

The addition of an acid/base of known concentration to a base/acid to determine the concentration. An indicator is used to show that neutralization has occurred, as is a pH meter.

Draw a diagram of the equipment that could be used for a titration

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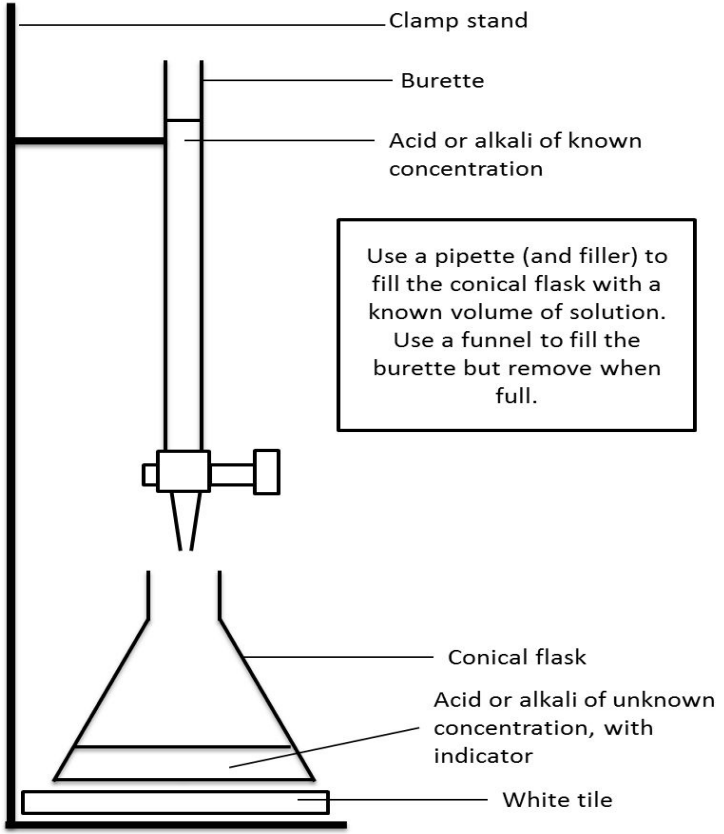

Draw the titration curve for a strong acid with a strong base added

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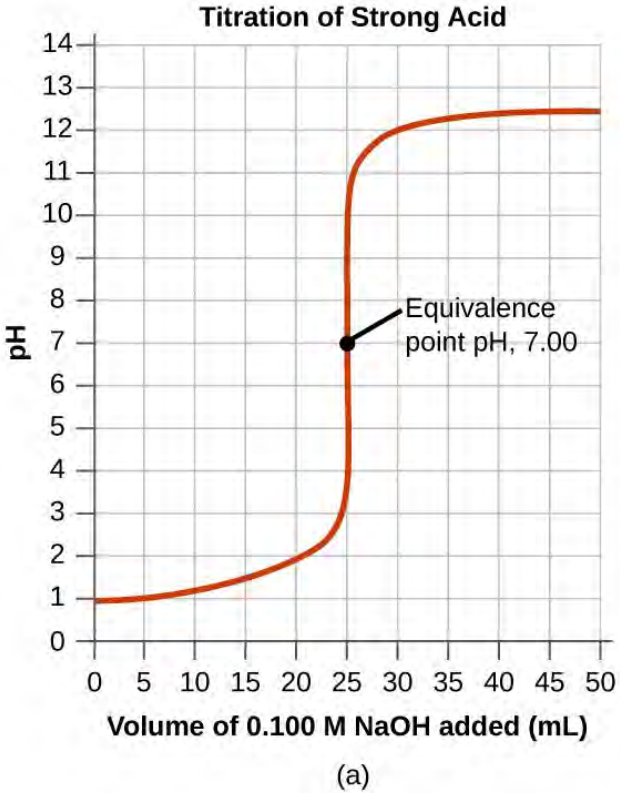
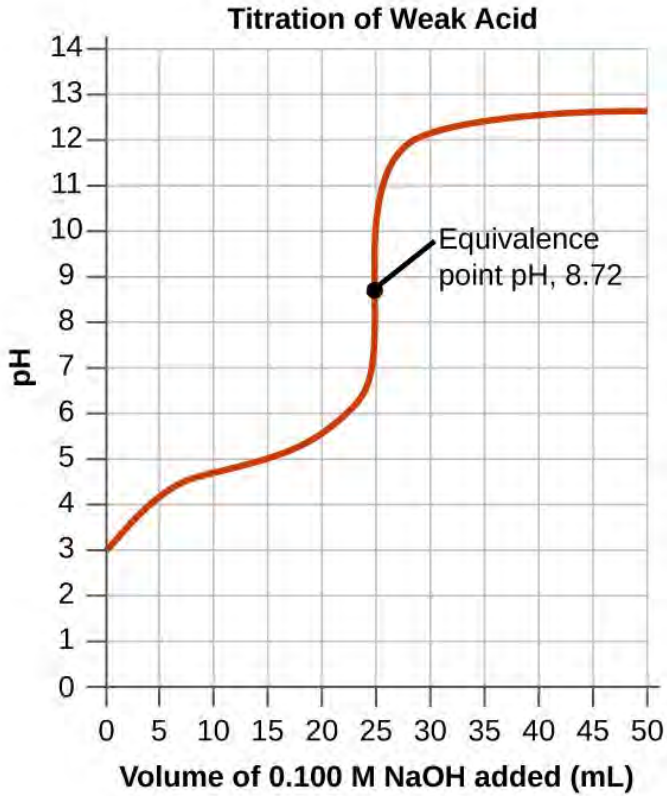


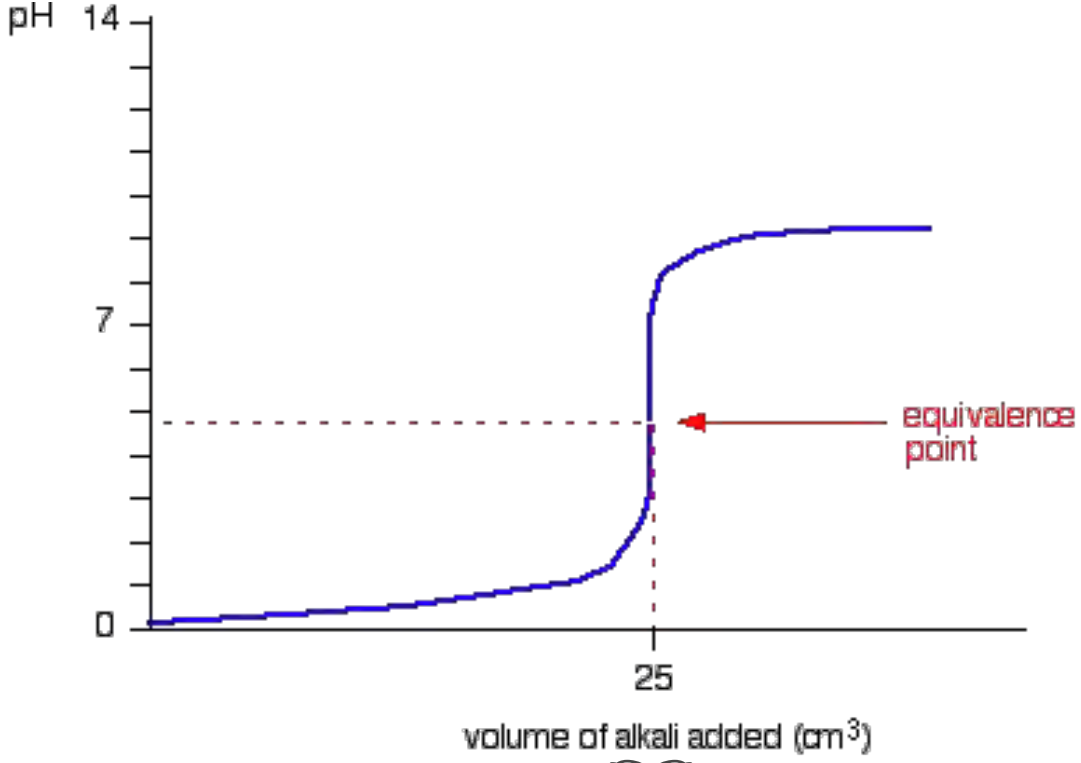
Draw the titration curve for a weak acid with a strong base added

Draw the titration curve for a weak acid with a strong base added



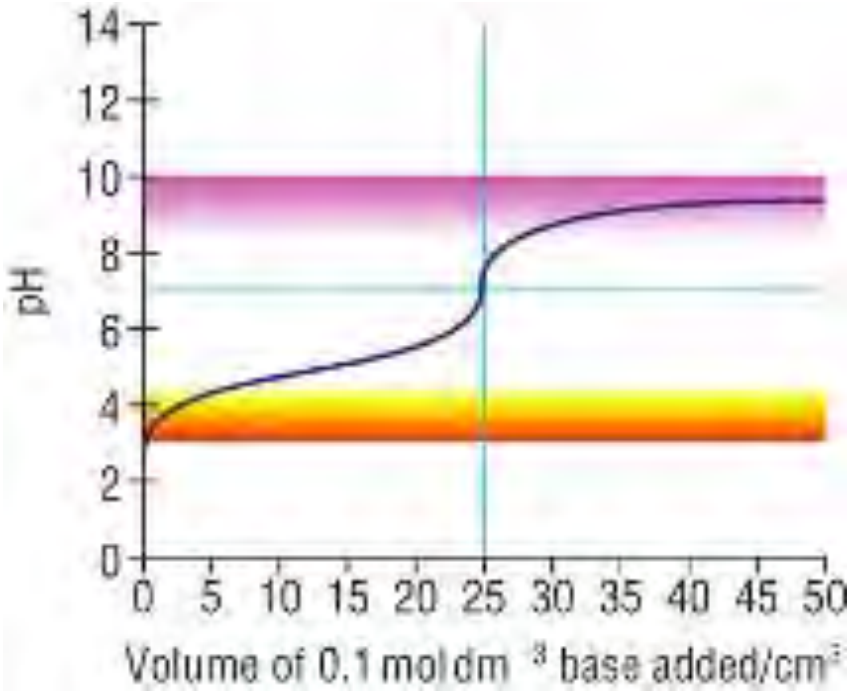
Draw the titration curve for a strong acid with a weak base added

Draw the titration curve for a strong acid with a weak base added



Draw the titration curve for a weak acid with a weak base added

Draw the titration curve for a weak acid with a weak base added



Define the term equivalence point

Define the term equivalence point

The point at which the exact volume of base has been added to just neutralise the acid, or vice-versa

What is the end point?

What is the end point?

The point at which pH changes rapidly

What are the properties of a good indicator for a reaction? (3)

What are the properties of a good indicator for a reaction? (3)

Sharp colour change (not gradual) - no more than one drop of acid/alkali needed for colour change

End point must be the same as the equivalence point otherwise titration gives wrong answer.

Distinct colour change so it is obvious when the end point has been reached.

What indicator would you use for a strong acid-strong base titration?

What indicator would you use for a strong acid-strong base titration?

Phenolphthalein or methyl orange, but phenolphthalein is usually used as clearer colour change.

What indicator would you use for a strong acid-weak base titration?

What indicator would you use for a strong acid-weak base titration?

Methyl orange

What indicator would you use for a strong base-weak acid titration?

What indicator would you use for a strong base-weak acid titration?

Phenolphthalein

What indicator would you use from a weak acid-weak base titration?

What indicator would you use from a weak acid-weak base titration?

Neither methyl orange or phenolphthalein is suitable, as neither give a sharp change at the end point.

What colour is methyl orange in acid?In alkali?

What colour is methyl orange in acid?In alkali?

Red in acid; yellow in alkali.

What colour is phenolphthalein in acid? In alkali?

What colour is phenolphthalein in acid? In alkali?

Colourless in acid; red in alkali

What colour is bromothymol blue in acid? In alkali?

What colour is bromothymol blue in acid? In alkali?

Yellow in acid and blue in alkali

Describe how to use a pH metre

Describe how to use a pH metre

- Remove the pH probe from storage solution and rinse with distilled water
- Dry the probe and place it into the solution with unknown pH
- Let the probe stay in the solution until it gives a settled reading