

WJEC (Wales) Chemistry

A-level

Topic 1.7 - Simple Equilibria and Acid-Base Reactions

Flashcards

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What is meant by a 'reversible reaction'?



What is meant by a 'reversible reaction'?

A reversible reaction is a reaction in which the products can react together to form the original reactants.



What is meant by 'dynamic equilibrium'?



What is meant by 'dynamic equilibrium'?

Dynamic equilibrium occurs in a reversible reaction when the rate of the forward reaction equals the rate of the backwards reaction. The concentration of the reactants and products are constant.



What is Le Chatelier's principle?



What is Le Chatelier's principle?

If a change is made to the conditions of a reversible reaction, the position of equilibrium will move to counteract the change.



How does increasing the temperature affect the equilibrium position?



How does increasing the temperature affect the equilibrium position?

Increasing the temperature will favour the endothermic reaction, so the equilibrium will shift towards the products of the endothermic reaction.



How does decreasing the temperature affect the equilibrium position?



How does decreasing the temperature affect the equilibrium position?

Decreasing the temperature will favour the exothermic reaction, so the equilibrium will shift towards the products of the exothermic reaction.



How does increasing the pressure affect the equilibrium position?



How does increasing the pressure affect the equilibrium position?

Increasing the pressure favours the side of the reaction with fewer moles of gas, so the position of the equilibrium will move to that side.



How does increasing the concentration of the reactants affect the position of equilibrium?



How does increasing the concentration of the reactants affect the position of equilibrium?

Equilibrium will shift to the right to increase the concentration of the products.



What is K_c ?



What is K_c ?

The equilibrium constant.

The magnitude indicates whether there are more reactants or products in an equilibrium system.



How do you calculate K_c ?



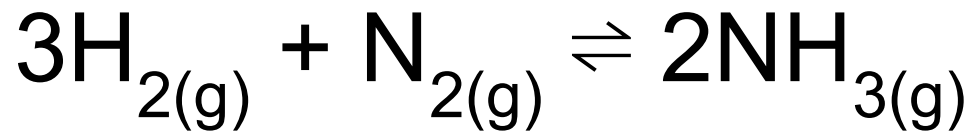
How do you calculate K_c ?



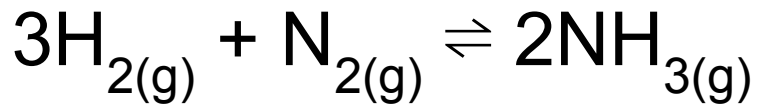
$$K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$



Deduce an expression for K_c for the equation below



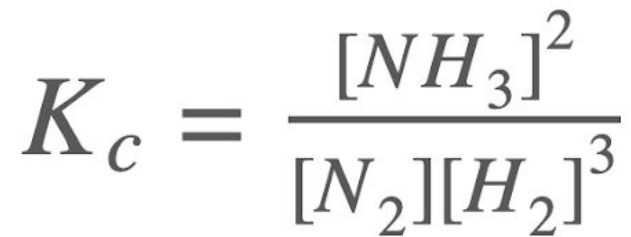
Deduce an expression for K_c for the equation below:



$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$$



How do you work out the units for K_c
from the expression?



How do you work out the units for K_c from the expression?

Substitute in the concentration units and cancel down:

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

$$K_c = \frac{(\text{mol dm}^{-3})^2}{\text{mol dm}^{-3} \times (\text{mol dm}^{-3})^3} = \frac{\text{mol}^2 \text{dm}^{-6}}{\text{mol}^4 \text{dm}^{-12}} = \text{dm}^6 \text{mol}^{-2}$$



What is the effect on K_c if the concentration of the reactants are increased?



What is the effect on K_c if the concentration of the reactants are increased?

Concentration has no effect on K_c .



What is the effect on K_c if the pressure of the system is increased?



What is the effect on K_c if the pressure of the system is increased?

Pressure has no effect on K_c .



Why does the addition of a catalyst not affect the value of K_c ?



Why does the addition of a catalyst not affect the value of K_c ?

A catalyst does not move the position of equilibrium, it only increases the rate at which equilibrium is reached.



If the forward reaction of a reversible reaction is endothermic, what effect will increasing the temperature have on the position of equilibrium?

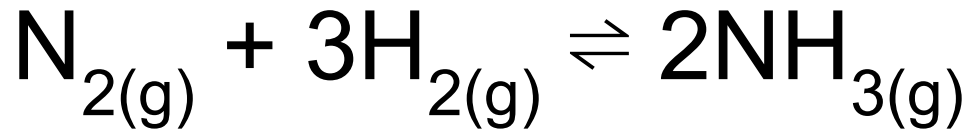


If the forward reaction of a reversible reaction is endothermic, what effect will increasing the temperature have on the position of equilibrium?

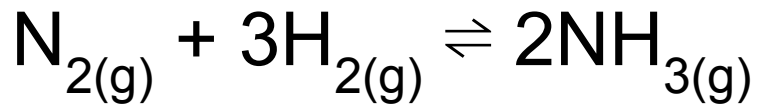
Increasing the temperature will favour the forward reaction so the position of equilibrium will shift to the right in order to oppose the change.



How does increasing the pressure affect the position of equilibrium of the following reaction?



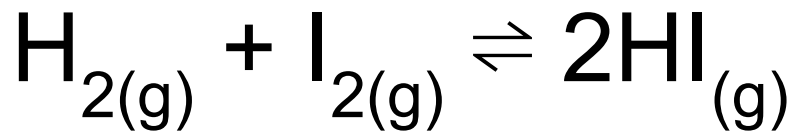
How does increasing the pressure affect the position of equilibrium of the following reaction?



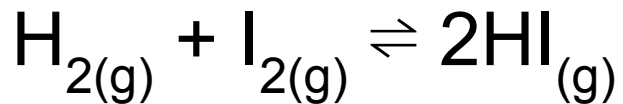
When there is an increase in pressure, the position of equilibrium shifts to the side with fewer moles of gas. Therefore the position of equilibrium will shift to the right.



How does decreasing the pressure affect the position of equilibrium of the following reaction?



How does decreasing the pressure affect the position of equilibrium of the following reaction?



There is an equal number of molecules of gas on either side of the equation so the position of equilibrium is not affected by a change in pressure.



If the forward reaction is exothermic,
what effect will increasing the
temperature have on the value of K_c ?



If the forward reaction is exothermic, what effect will increasing the temperature have on the value of K_c ?

If the temperature is increased then the backwards endothermic reaction will be favoured. This means the position of equilibrium will move to the left and the concentration of reactants compared to products will increase. Therefore the value of K_c will decrease as the denominator of the K_c expression is increasing.



What is a Brønsted-Lowry acid?



What is a Brønsted-Lowry acid?

A proton donor.



What is a Brønsted-Lowry base?



What is a Brønsted-Lowry base?

A proton acceptor.



What do acid-base reactions involve the transfer of?



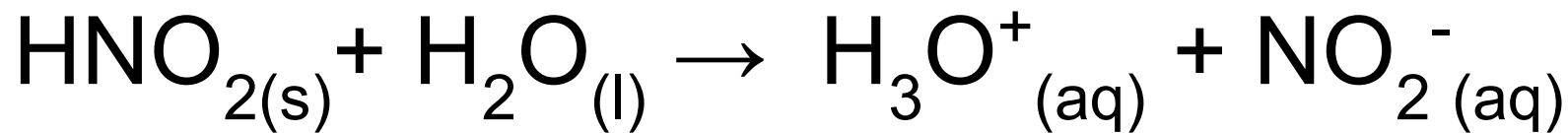
What do acid-base reactions involve the transfer of?

Protons (H^+ ions).

Acids donate $\text{H}^+(\text{aq})$ ions to the bases,
which accept the $\text{H}^+(\text{aq})$ ions.



What is the proton donor and proton acceptor in this reaction:



What is the proton donor and proton acceptor in this reaction: $\text{HNO}_{2(s)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{H}_3\text{O}^+_{(aq)} + \text{NO}_2^-_{(aq)}$

Proton donor: $\text{HNO}_{2(aq)}$

Proton acceptor: $\text{H}_2\text{O}_{(l)}$



What is pH?



What is pH?

A value which expresses the acidity or alkalinity of a substance, on a scale where 7 is neutral.

It is a simple way of measuring hydrogen ion concentration.



How do you calculate the pH of a strong acid?



How do you calculate the pH of a strong acid?



For a strong acid the concentration of acid = concentration of H^+ ions.

$$\text{pH} = -\log[\text{H}^+]$$



What expression can be used to calculate the hydrogen ion concentration of a strong acid, given its pH?



What expression can be used to calculate the hydrogen ion concentration of a strong acid, given its pH?

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



List the apparatus required to carry out a titration



List the apparatus required to carry out a titration

- Burette
- Conical flask
- Pipette and pipette filler
- Funnel
- Clamp and stand
- White tile



Describe how to carry out a standard acid/alkali titration to find the concentration of the alkali



Describe how to carry out a standard acid/alkali titration to find the concentration of the alkali

- Add acid to a burette. Use the pipette to add 25 cm^3 of alkali to a conical flask.
- Add a few drops of indicator to the conical flask.
- Record initial burette reading. Slowly add the acid to the conical flask, swirling constantly.
- When the solution in the conical flask changes colour, stop adding the acid and record the final volume in the burette.
- Calculate the total volume of acid added from the burette.



Why must the conical flask be swirled during a titration?



Why must the conical flask be swirled during a titration?

To ensure all the particles react.



Why is a white tile used when carrying out a titration?



Why is a white tile used when carrying out a titration?

The white tile is placed under the conical flask so that the colour change of the indicator is easier to see.



What does a pH curve look like for a strong acid-strong base reaction?



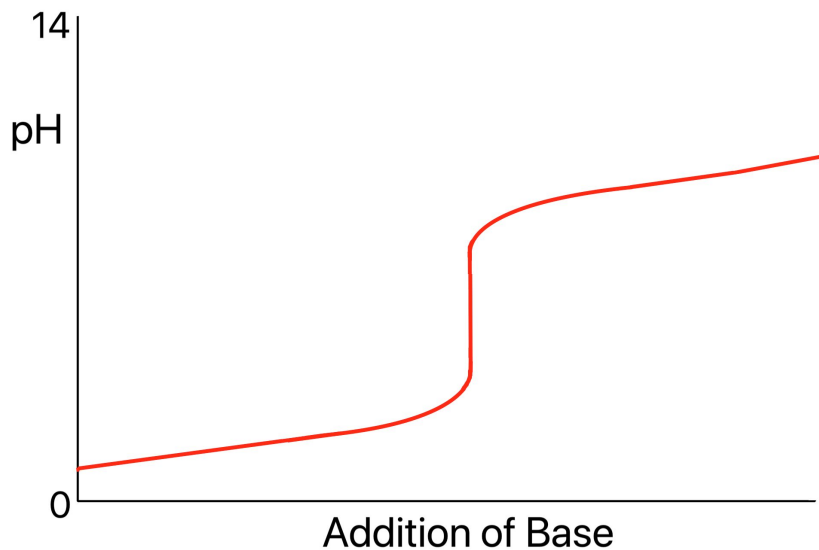
What does a pH curve look like for a strong acid-strong base reaction?



What does a pH curve look like for a strong acid-weak base reaction?



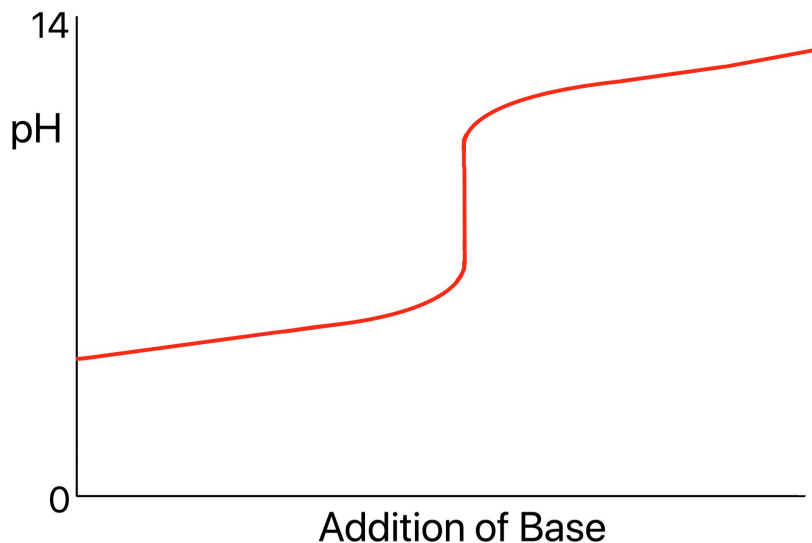
What does a pH curve look like for a strong acid-weak base reaction?



What does a pH curve look like for a weak acid-strong base reaction?



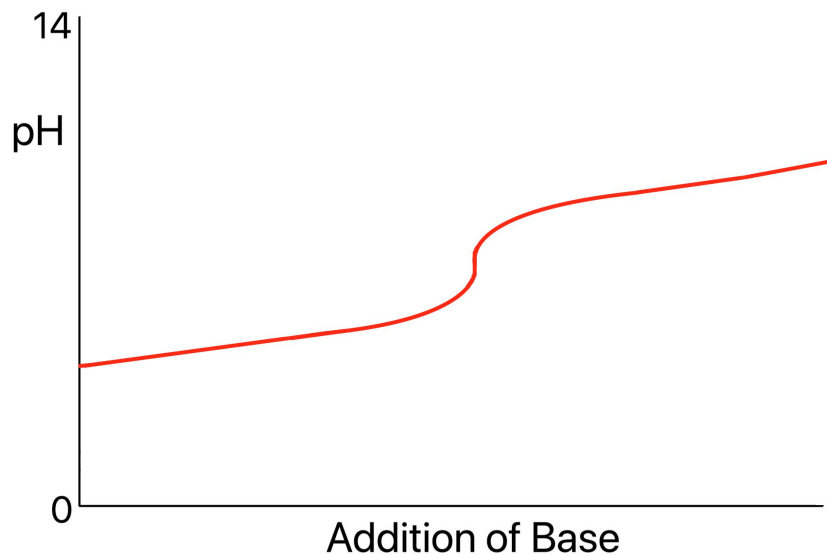
What does a pH curve look like for a weak acid-strong base reaction?



What does a pH curve look like for a weak acid-weak base reaction?



What does a pH curve look like for a weak acid-weak base reaction?

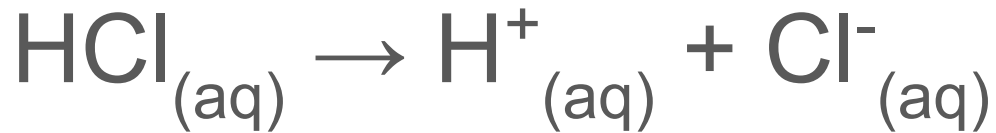


What is a strong acid?



What is a strong acid?

A strong acid is an acid that completely dissociates in solution to form hydrogen ions:



What is a strong base?



What is a strong base?

A strong base is a base that completely dissociates in solution to form hydroxide ions:



What is a weak acid?



What is a weak acid?

A weak acid is an acid that only partially dissociates in solution:



What is a weak base?



What is a weak base?

A weak base is a base that only partially dissociates in solution:

