

A Short Guide to Arrows in Chemistry

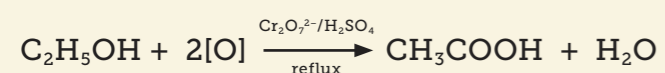
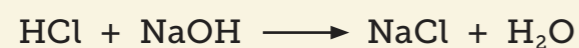
Chemical reaction arrows

Reaction arrow



These arrows point from the reactants to the products of a chemical reaction. Reaction conditions, reagents or catalysts may be written above or below the reaction arrow.

Examples

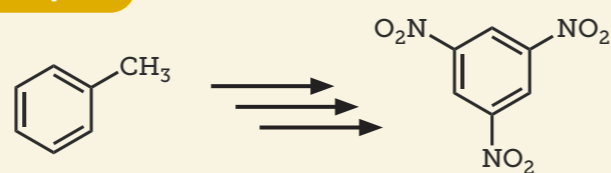


Multiple steps arrow



Chemists use stacked multiple arrows to indicate that there are several reaction steps between the reagents and the products shown on either side of the arrows.

Example

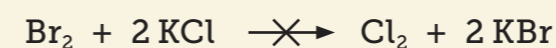
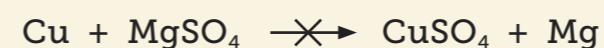


Broken arrow



Chemists use these arrows to indicate chemical reactions that do not take place. The reactants shown cannot be transformed into the products shown.

Examples

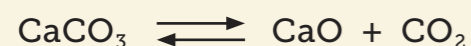
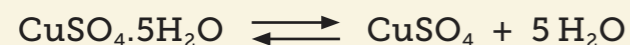


Reversible reaction arrow



Chemists use these arrows to indicate that a reaction is reversible – the reactants react to produce the products, but the products can also react to make the reactants.

Examples

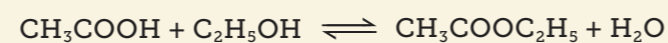
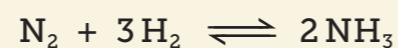


Equilibrium arrow



These arrows show that a reversible reaction is at equilibrium: the forward and reverse reactions occur at the same rate. The length of the arrows can be varied to show if reactants or products are favoured.

Examples

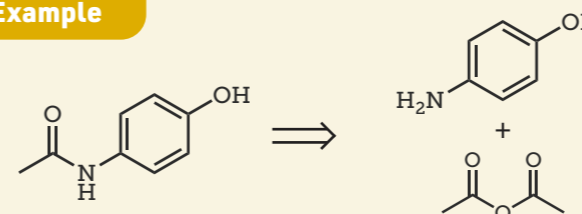


Retrosynthesis arrow



Organic chemists use these arrows to show that the molecule on the left can be made from the starting materials on the right, often through several reaction steps.

Example



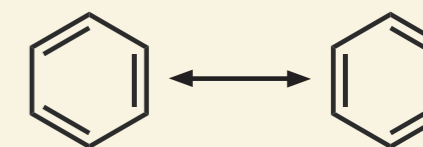
Electron movement arrows

Resonance arrow



Chemists use these arrows to show different resonance forms of the same molecule. The forms differ in electron arrangements; the true structure of the molecule is an average.

Example



Curly arrow



Curly arrows show electron movement in reaction mechanisms in organic chemistry. A double-headed arrow shows movement of an electron pair, while a single-headed arrow shows movement of a single electron.

Example

