



Organic Chemistry Experiment

Synthesis of ethyl benzoate

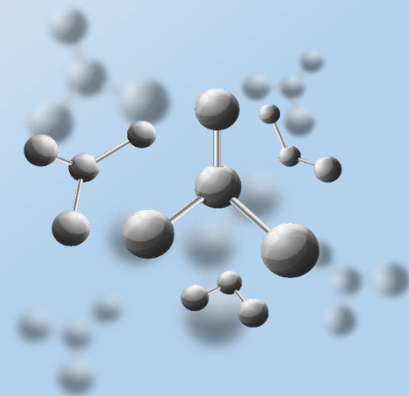
Experimental Center for Chemical Education of Fudan University





Experimental Purpose

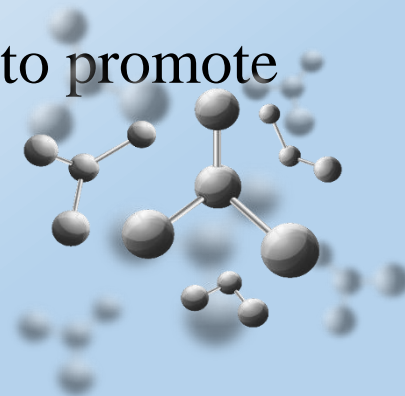
1. Understand the mechanism of esterification
2. Learn to use the oil-water separator
3. Master basic operations such as extraction, drying, and distillation





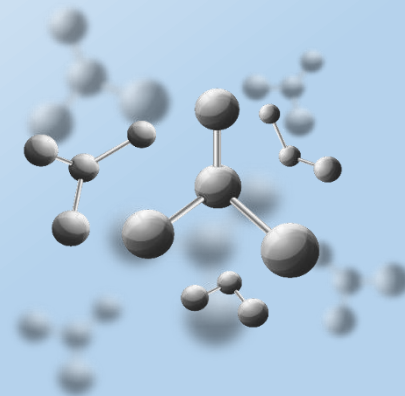
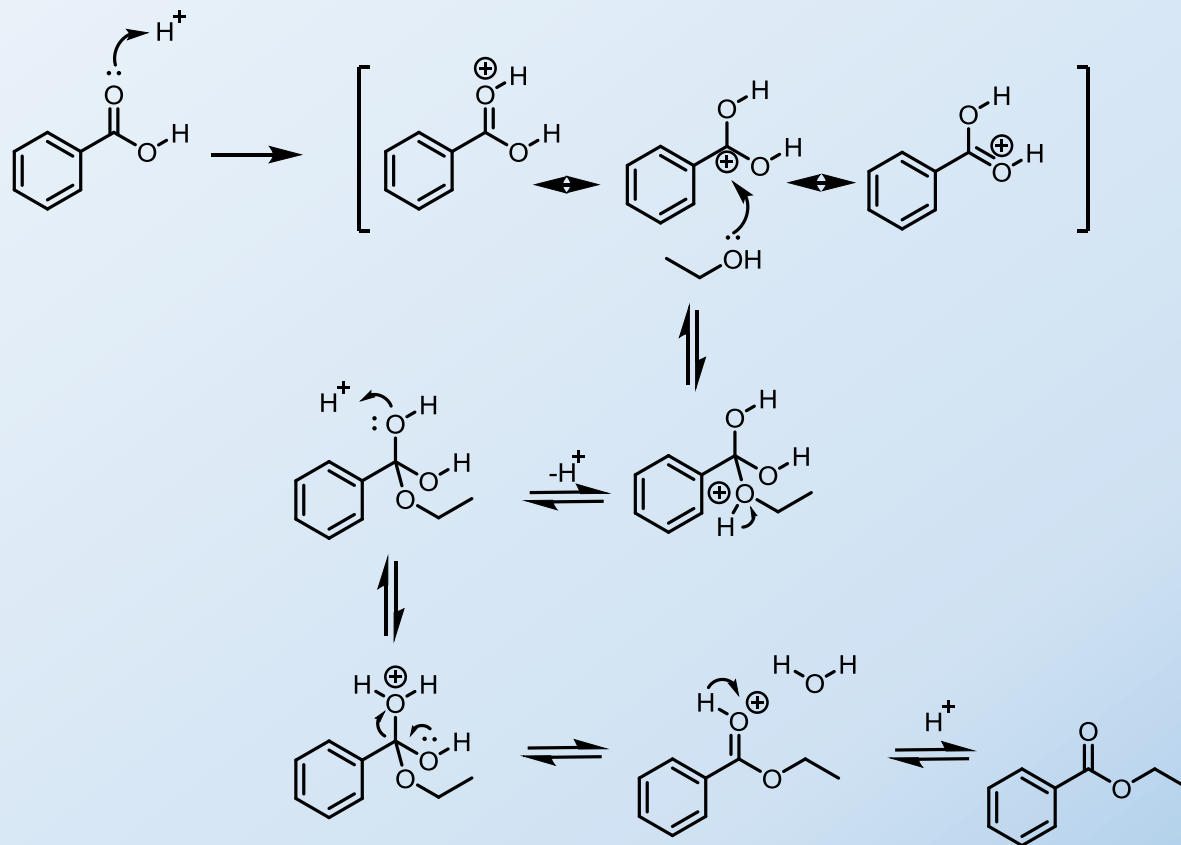
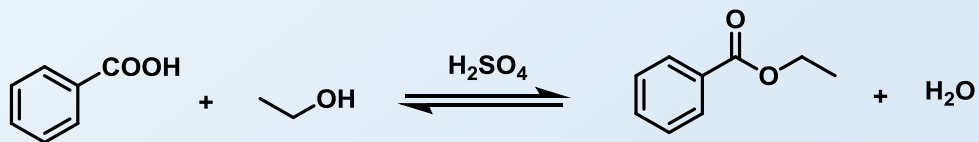
Experimental Background

Esterification is a common type of organic chemical reaction. It is the reaction between alcohol and carboxylic acid or oxygen-containing inorganic acid to form ester and water. The esterification reaction between carboxylic acid and alcohol is reversible, and the reaction is generally very slow. Therefore, concentrated sulfuric acid is often used as a catalyst, and the operation with water can be used to promote the reaction process.





Experimental Mechanism



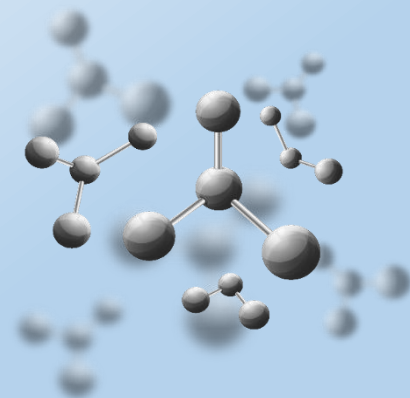


Physical Constant

Benzoic acid FW 122.12 *mp* 122-123 °C

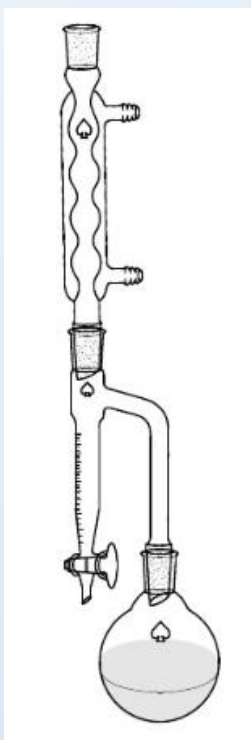
Ethanol FW 46.07 *bp* 78 °C *d* 0.789 n_D^{20} 1.3600

Ethyl Benzoate FW 150.18 *bp* 212 °C *d* 1.051 n_D^{20} 1.5068

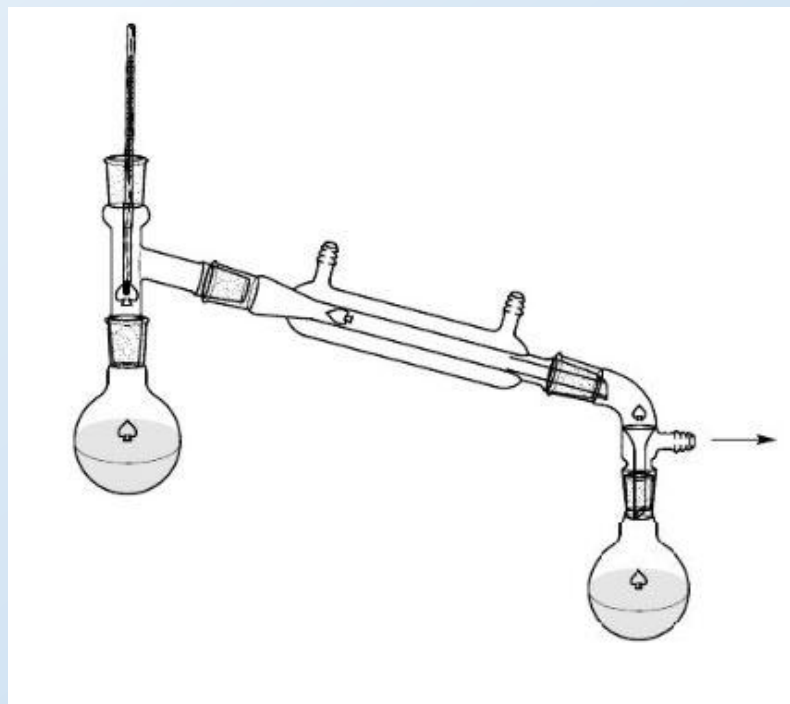




Experimental Device



Synthesis Device



Purification Device



Synthetic Procedures

1. The device was set up as drawn and cyclohexane (5 mL) was added from the upper end of the oil-water separator. Benzoic acid (8.0 g), 95% ethanol (18mL), cyclohexane (15mL) and concentrated sulfuric acid (3 mL) was refluxed until that there were almost no drops of water. The water was discharged and continue heating until most of the ethanol and cyclohexane are distilled into the oil-water separator.
2. The resulting mixture was put into cold water. Sodium carbonate was added to adjust the pH to 7.
3. The aqueous layer was extracted with ether (20mL) and combined with the product layer. The organic phase was dried over anhydrous magnesium sulfate for 0.5 h.
4. Evaporate the ether. Then use an air bath to heat the temperature to 140 °C. Replace the straight condenser with an air condenser, and collect the 210-213 °C fraction.



Attention

1. When heating to reflux, start the reflux slowly!
2. When adding sodium carbonate powder to neutralize the acid, slowly add and stir!
3. When distilling diethyl ether, avoid open flames, and connect a rubber tube to the drain pipe at the end of the pipe!

