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The splitting of esters (Item No.: P7173200)



Task and equipment

Information for teachers

Learning objectives

- The ester formation is an equilibrium reaction. Esters can therefore be changed back to the products they were prepared from.
- The reverse reaction, which occurs quicker in the presence of OH⁻ ions, can be detected with an indicator since a carboxylic acid is formed.

Notes on setup and procedure

Preparation:

Prepare 1% sodium hydroxide solution (1 g NaOH to 100 ml water). The quantities and concentrations given should be strictly adhered to, as otherwise no decolouration of the indicator occurs.

Remarks on the students experiments:

Stop the experiment, as soon as the indicator is decolourized.



Hazard and precautionary statements

Ethyl acetate:	
H225:	Highly flammable liquid and vapour.
H319:	Causes serious eye irritation.
H336:	May cause drowsiness or dizziness.
P210:	Keep away from heat/sparks/open flames/hot surfaces – No smoking.
P240:	Ground/bond container and receiving equipment.
P305 + P351 + P338:	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing.



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Teacher's/Lecturer's Sheet

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Sodium hydroxide:

H314:	Causes severe skin burns and eye damage.
H290:	May be corrosive to metals.
P280:	Wear protective gloves/protective clothing/eye protection/face protection.
P301 + P330 + P331:	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P309 + P310:	IF exposed or you feel unwell: Immediately call a POISON CENTER or doctor/physician.
P305 + P351 + P338:	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing.

Hazards

- Sodium hydroxide is corrosive!
- Wear protective glasses!
- Ethyl acetate is highly inflammable. Extinguish all open flames!

Notes

Again here, the reaction belongs to the class of nucleophilic substitutions, in which both the OH⁻ ions and the water molecules act as reactants. The splitting of the ester also takes place without the addition of alkali, but this accelerates the reaction and simultaneously causes the colouration of the indicator.

Remarks on the method

This reaction allows the reversibility of chemical reactions to be taken as a theme. Furthermore a more detailed discussion of the chemical equilibrium can be performed, you can also discuss the influence of the reactants on the equilibrium.

Waste disposal

Pour the contents of the beaker into the container for combustible organic substances.

advanced PHYWE

The splitting of esters (Item No.: P7173200)

Task and equipment

Task

Can esters be changed back to their initial substances?

Examine the reaction of an ester-water mixture.



Equipment



Position No.	Material	Order No.	Quantity
1	Wash bottle, 250 ml, plastic	33930-00	1
2	Glass beaker DURAN®, short, 150 ml	36012-00	1
3	Graduated cylinder, 10 ml, plastic	36636-00	1
4	Pipette with rubber bulb	64701-00	1
5	Protecting glasses, clear glass	39316-00	1
6	Glass rod, boro 3.3, l=200mm, d=6mm	40485-04	1
	Ethyl acetate 250 ml	30075-25	1
	Sodium hydroxide, flakes, 1000 g	30157-70	1
	Water, distilled 5 l	31246-81	1
	Phenolphthalein, 0,5% soution in ethanol, 100 ml	31715-10	1



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Set-up and procedure

Set-up

Hazards

- Sodium hydroxide is corrosive!
- Wear protective glasses!
- Ethyl acetate is highly inflammable. Extinguish all open flames!





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Student's Sheet



Procedure

Pour 20 ml of distilled water into the beaker. Add 5 ml of ethyl acetate and 5 ml of 1% caustic soda (Fig. 1+2).



Add a few drops of phenolphthalein solution to the mixture and stir it vigorously with a glass rod for several minutes (Fig. 3).



Record the changes which occur.

Waste disposal

• Pour the contents of the beaker into the container for combustible organic substances.

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Report: The splitting of esters

Result - Observations

Note your observations.

Evaluation - Question 1

Draw conclusions from your observations.



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Student's Sheet

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Evaluation - Question 2

Formulate the equation for the reaction which has taken place (sodium hydroxide acts only as a catalyst).

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