# The characterization of acetone (Item No.: P7172500)



## Task and equipment

### Information for teachers

### Learning objectives

- Acetone can be won technically by heating calcium acetate.
- It can be separated from the aqueous solution by salting-out.

### Notes on setup and procedure

#### Preparation:

Supply a sufficient quantity of crushed ice. The cooling mixture must reach a relatively low temperature (-10 °C).

#### Remarks on the students experiments:

Ensure that the Duran test tube is heated over its whole length before the calcium acetate is heated. The burner must not be brought near the mouths of the test tubes after decomposition has begun.



### Hazard and precautionary statements

Acetone (propanone):	
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.
P233:	Keep container tightly closed.
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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Potassium carbonate:	
H315:	Causes skin irritation.
H319:	Causes serious eye irritation.
H335:	May cause respiratory irritation.
P302 + P352:	IF ON SKIN: Wash with soap and water.
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

- Highly inflammable mixtures of gases are evolved during this experiment. Do not bring the Bunsen burner near the mouths of the test tubes!
- Wear protective glasses!
- To make glass/rubber connections, wet the glass with glycerol so that it can be easily inserted!

#### Notes

The method used here to prepare acetone from calcium acetate has now been replaced most widely by the preparation from cumene hydroperoxide (Hock's splitting), as this allows phenol to be won simultaneously.

### **Remarks on the method**

The extremely good solvent properties of acetone (e.g. for lacquers) should be demonstrated on the basis of some examples.

### Waste disposal

- Pick up solid residues with a little water and put them in the container for acidic and alkali waste.
- Put liquids in the container for combustible organic substances.

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### Task and equipment

#### Task

### How is acetone produced industrially?

Produce acetone (propanone) from calcium acetate.





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## Equipment



Position No.	Material	Order No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, stainless steel, I=370 mm, d=10 mm	02059-00	1
3	Test tube brush w. wool tip,d25mm	38762-00	1
4	Universal clamp	37715-00	2
5	Test tube, 180x18 mm,100pcs	37658-10	(1)
6	Test tube,180x20 mm,side arm,PN19	36330-00	1
7	Boss head	02043-00	2
8	Rubber tubing, i.d. 6 mm	39282-00	1
9	Spoon, special steel	33398-00	1
10	Rubber stopper, d=22/17 mm, without hole	39255-00	1
11	Protecting glasses, clear glass	39316-00	1
12	Wash bottle, 250 ml, plastic	33930-00	1
13	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	2
14	Glass beaker DURAN®, short, 250 ml	36013-00	1
15	Test tube,180x20 mm,DURAN, PN19	36293-00	1
16	Glass tubes,right-angled, 10	36701-59	(1)
	Butane burner f.cartridge 270+470	47536-00	1
	Butane catridge CV 300 Plus, 240 g	47538-01	1
	Calcium acetate 100 g	30050-10	1
	Glycerol, 250 ml	30084-25	1
	Potassium carbonate,98-100% 250 g	30096-25	1
	Sodium chloride 1000 g	30155-70	1
	Water, distilled 5 I	31246-81	1
Additional material			
	lce		



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### Set-up and procedure

### Set-up

### Hazards

- Highly inflammable mixtures of gases are evolved during this experiment. Do not bring the Bunsen burner near the mouths of the test tubes!
- Wear protective glasses!
- To make glass/rubber connections, wet the glass with glycerol so that it can be easily inserted!



### Setup

Set up the stand as shown in Fig. 1 with two boss heads and two universal clamps. Put 3 spoonfuls of calcium acetate in the Duran test tube (Fig. 2), knock the test tube slightly on the bench to pack the calcium acetate down on the bottom. Fix the test tube horizontally on the stand.



Ease the short arm of the right-angled tube through the stopper for the Duran test tube and put it on the Duran test tube (Fig. 3). Put the appropriate bored stopper on the side-arm test tube.





Ease the long arm of the right-angled tube through the bored stopper of the side-arm test tube until the tip is about 3 cm above the bottom of the test tube thereby connecting both test tubes (Fig. 4). Fix the side-arm test tube vertically with the second clamp. Ensure that the two test tubes are well closed but that there is no tension in the connection.



Half-fill the beaker with ice and add 10 spoonfuls of sodium chloride. Position the beaker under the side-arm test tube which acts as a condenser and adjust the high of the apparatus so that the bottom half of the test tube is immersed in the ice. Connect a piece of rubber tubing to the side arm of the test tube. The end of this should hang over the edge of the laboratory bench, down to the floor if possible.

### Procedure

First heat the Duran test tube over its whole length, then heat the calcium acetate strongly (Fig. 5). Extinguish the Bunsen burner as soon as about 5 ml of condensate have been collected in the condenser.



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Disassemble the apparatus and pour (take care, turn the side-arm upwards before pouring!) the condensate into the plain test tube (Fig. 6). Add the same amount of distilled water to the test tube.



Add potassium carbonate to the mixture until the solution is saturated. Close the test tube with a rubber stopper and shake it vigorously (Fig. 7).



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### Waste disposal

- Pick up solid residues with a little water and put them in the container for acidic and alkali waste.
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### **Report: The characterization of acetone**

#### **Result - Observations 1**

Carefully test the smell of the condensate.

### **Result - Observations 2**

Note the observations you make.

a) On heating the calcium acetate.

b) On examining the condensate.



### **Student's Sheet**

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### **Evaluation - Question 1**

Draw conclusions from your observations.

### **Evaluation - Question 2**

Formulate an appropriate equation for the reaction which took place.



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#### **Student's Sheet**

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#### **Evaluation - Question 3**

Enter the characteristic properties of acetone which have been determined until now in the table. Fill in missing entries by looking them up in your textbook.

Name of substance:	Acetone (propanone) 1
	CH <sub>3</sub> -CO-CH <sub>3</sub> 1
	colourless 1
	liquid 1
	-94 °C
	56.1 °C
	highly flammable; water soluble; can be separated from water by salting-out 1
	is formed by the oxidation of secondary alcohols; technically produced from 1 calcium acetate or cumene hydroperoxide (Hock's splitting)
	solvent (nail varnish remover); production of plastics



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