The effects of acids on metals (Item No.: P7157500)

Curricular Relevance

Area of Expertise: Chemie
Education Level: Klasse 7-10
Topic: Anorganische Chemie
Subtopic: Säuren und Basen, Protonenübergänge
Experiment: Wirkung von Säuren auf Metalle

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Easy	10 Minutes	10 Minutes	2 Students

Additional Requirements:

Experiment Variations:

Keywords:

metals, acids, reaction behaviour

Task and equipment

Information for teachers

Learning objectives

- Acids react with base metals.
- These reactions lead to the formation of salts and hydrogen.

Notes on set-up and preparation

Preparations
Prepare a 10% hydrochloric acid (30 ml of concentrated HCl and 100 ml of water) and a 10% sulphuric acid (6 ml of concentrated H2SO4 and 100 ml of water). However, it is not necessary to keep the exact concentration levels.

Notes on the students' experiments
If the metals should not enter into reaction (oxide layer), the test tubes must be heated carefully. In this case aluminium reacts vigorously with acids! Be careful!

H- und P-Sätze

Magnesium ribbon:	
H228:	Flammable solid.

Hydrochloric acid:	
H314:	Causes severe skin burns and eye damage.
H335:	May cause respiratory irritation.
H290:	May be corrosive to metals.
P280:	Wear protective gloves and eye/face protection.
P301 + P330 + P331:	IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P309 + P310:	IF exposed or if 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.
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Hazards

- Acids cause severe burns. Wear protective gloves/glasses!

Remarks on the method

This experiment can also be applied in conjunction with the experiments on the proper handing of acids in order to demonstrate the decomposing effect of acids. Furthermore, it can be applied when it comes to demonstrate the different ways of salt formation though, however, it will be taken up again in a modified form in this context anyway. At this point no difference is made between base and noble metals yet. However, if the students already know more about it, this difference as well as the conversion of the word equation into symbolic equations can be explained to them.

Waste disposal

Let smaller residual metal pieces react completely (add some more acid if necessary). Put the excess acids into the collecting tank for acids and alkalis. Larger metal pieces can be rinsed and reused for similar experiments.

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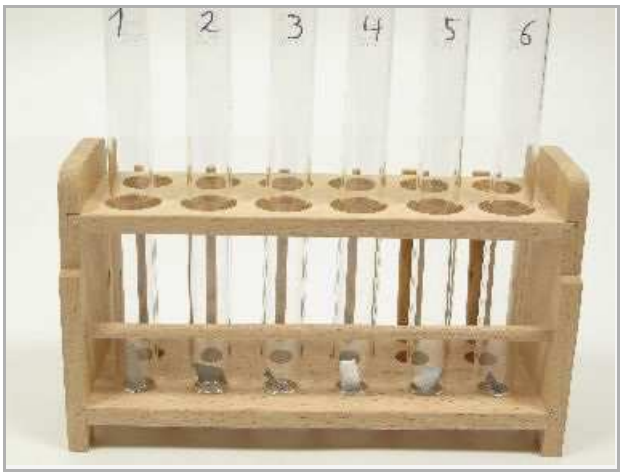
Task and equipment

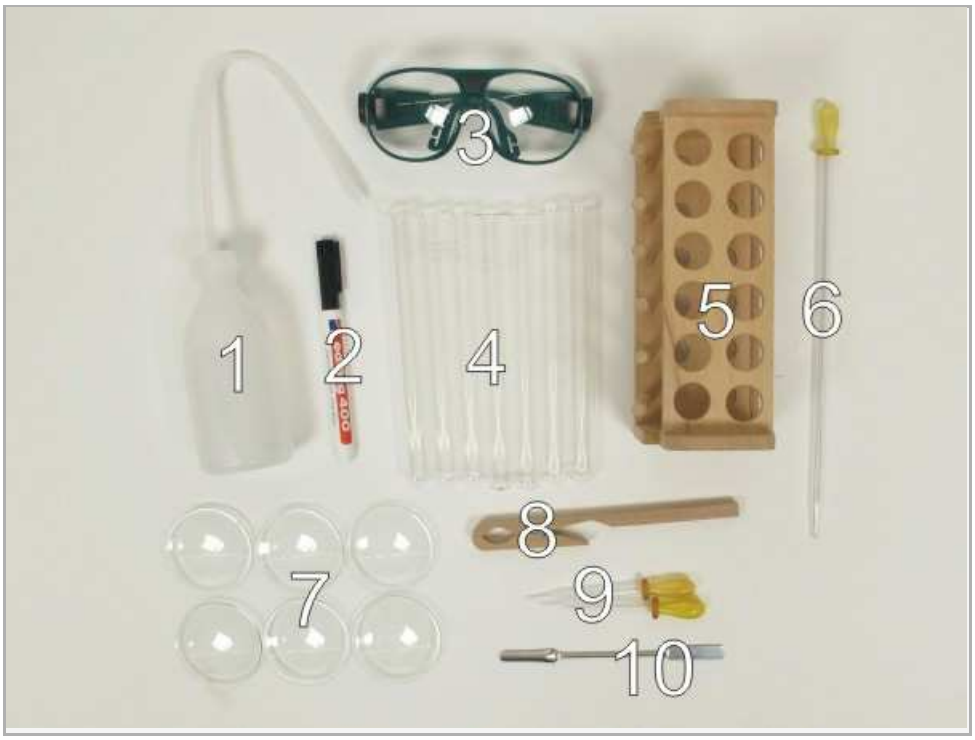
Task

How do acids act on metals?

Study the reaction of several acids with metals.



Equipment



Position No.	Material	Order No.	Quantity
1	Wash bottle, 250 ml, plastic	33930-00	1
2	Labor pencil, waterproof	38711-00	1
3	Protecting glasses, clear glass	39316-00	1
4	Test tube, 18x188 mm, 10 pcs	37658-03	(7)
5	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10	1
6	Pipette with rubber bulb	64701-00	2
7	Watch glass, dia.60 mm	34570-00	6
8	Test tube holder, up to d 22mm	38823-00	1
9	Pipette with rubber bulb, long	64821-00	1
10	Spatula, powder, steel, l=150mm	47560-00	1
	Butane burner f.cartridge 270+470	47536-00	1
	Butane catridge CV 300 Plus, 240 g	47538-01	1
	Aluminium sheet, 0.2mm 50 g	30017-05	1
	Magnesium, ribbon, roll, 25 g	30132-00	1
	Hydrochloric acid 37 %, 1000 ml	30214-70	1
	Sulphuric acid, 95-98% 500 ml	30219-50	1
	Zinc, sheet 250x125x0.5 mm, 200 g	30245-20	1
	Water, distilled 5 l	31246-81	1

Set-up and procedure

Set-up

Hazards

- Acids cause extensive burns. Wear protective glasses!




Set-up

Number 6 test tubes from 1 to 6 and put them into the test tube rack (Fig. 1).

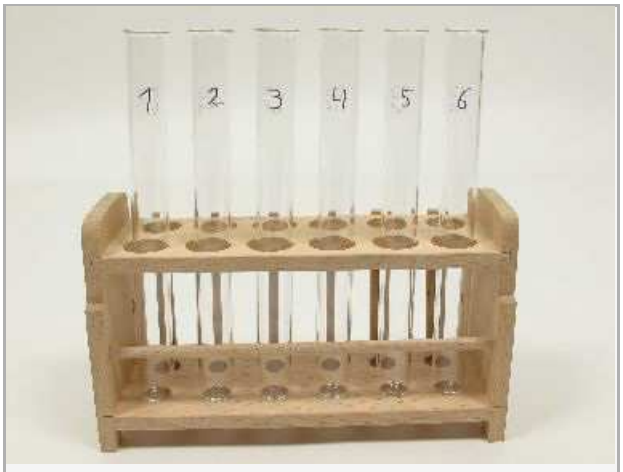


Fig. 1

Put a piece of aluminium, zinc and magnesium into the test tubes 1 to 3 and again into the test tubes 4 to 6 so that each metal can be found in two test tubes (Fig. 2).

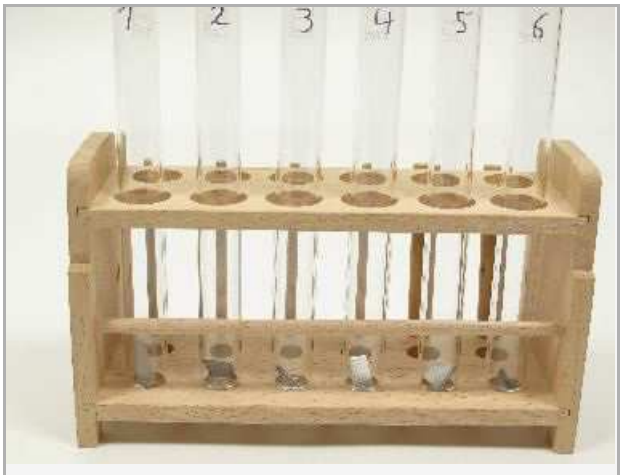


Fig. 2

Procedure

Use a pipette and fill some hydrochloric acid into the test tubes 1 to 3 until they are about one quarter full (Fig. 3).

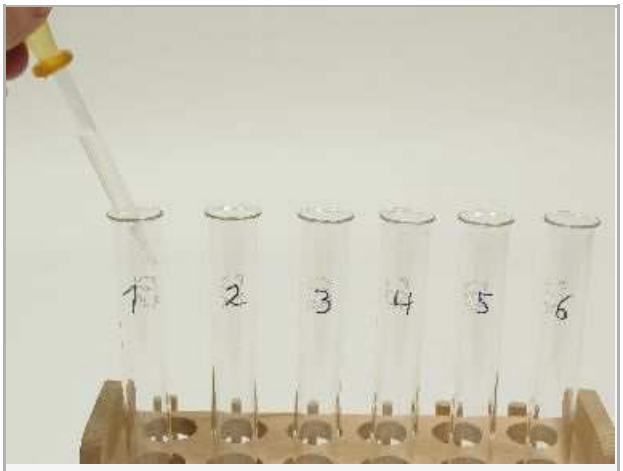


Fig. 3

Put an empty test tube with the orifice down over test tube number 1 (Fig. 4) and carry out a hydrogen-oxygen detonation test after about 1 minute (Fig. 5). Proceed in the same way with test tubes 2 and 3.

Fig. 4

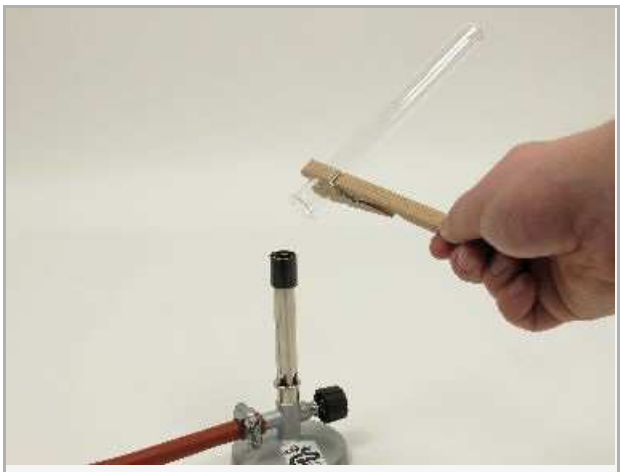


Fig. 5

Use a second pipette and fill some sulphuric acid (filling height approximately 3 cm) into the test tubes 4 to 6. Carry out a hydrogen-oxygen detonation test as described above.
Withdraw a small quantity of the solutions inside the test tube by means of the pipette (Fig. 6) and drop them onto one one glass each (Fig. 7). Let the solutions evaporate.

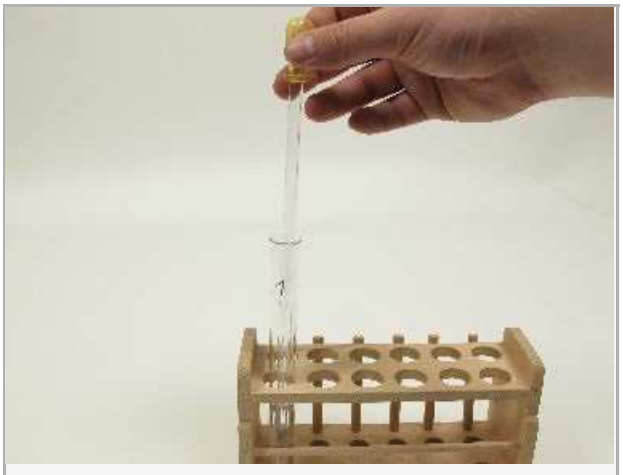


Fig. 6


Fig. 7

Waste disposal

- Put the excess solutions into the collecting tank for acids and alkalis.
- Keep larger residual pieces of metal for similar experiments.

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Report: The effects of acids on metals

Result - Observations

Write down your observations.

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Result - Table 1

Enter the result of the reaction and the hydrogen-oxygen detonation test into Table 1.

Metal	+ hydrochloric acid	Result of the hydrogen-oxygen detonation test	+ sulphuric acid	Result
Aluminium	1	1	1	
Magnesium	1	1	1	
Zinc	1	1	1	

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Evaluation - Question 1

Draw the conclusions from your observations.

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Evaluation - Question 2

What class of substances might the reaction products obtained by evaporation belong to as far as their properties are concerned?

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Evaluation - Question 3

Describe the reactions for all metals and acids in the form of a word equation and develop a general reaction scheme on the basis of this equation.

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