Mechanical properties of plastics (Item No.: P7180400)

Curricular Relevance

Area of Expertise: Chemie
Education Level: Klasse 10-13
Topic: Organische Chemie
Subtopic: Polymerchemie
Experiment: Mechanische Eigenschaften von Kunststoffen

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

Additional Requirements:

Experiment Variations:

Keywords:

polymers, material property of plastics, mechanical properties

Task and equipment

Information for teachers

Learning objectives

- Plastics have different physical, particularly mechanical, properties.
- Conclusions about the structure of the polymers can be drawn from these properties.
- These properties are important for the further processing and applicability.

Notes on set-up and procedure

Other plastic materials can be also used for this experiment. The suggested polymers are recommendable specially because of the difference of the sound.
In case that the plastic samplings from the sample set (see procurement recommendations) are not used, make sure to use similar formed material.

Hazard and Precautionary statements

No use of hazardous substances in this experiment.

Hazards!

- When plastics break, pieces can split off. Wear protective glasses!

Remarks on the students' experiments

The sound differences become only clear while dropping the polymers on hard surfaces. School tables are absolutely suitable for it, however, damping surfaces are not.

Notes

Sound and mechanical properties are to a large extent dependant on the structure of macromolecules and on the intermolecular forces acting among them, they can therefore be used for the initial classification and identification. Thus, all polymers show a rather dull sound.

Remarks on the method

This experimentally less complex test can be evaluated not only phenomenologically, but also theoretically demandingly, according to the study group. In this respect, the stated problem solutions have to be modified according to the knowledge of the learning group.
Using the entropy concept is possible to have an in-depth discussion on the interactions between the mechanical properties and the degree of order in the A-Lavel classes of secondary school. In this context it is also possible to discuss topics like the "memory effect" of thermoplastics and the temperature components when stretching rubber bands.

Waste disposal

The plastic remains can be treated as normal waste.

Robert-Bosch-Breite 10
D - 37079 Göttingen
Tel: +49 551 604 - 0
Fax: +49 551 604 - 107
info@phywe.de
www.phywe.com

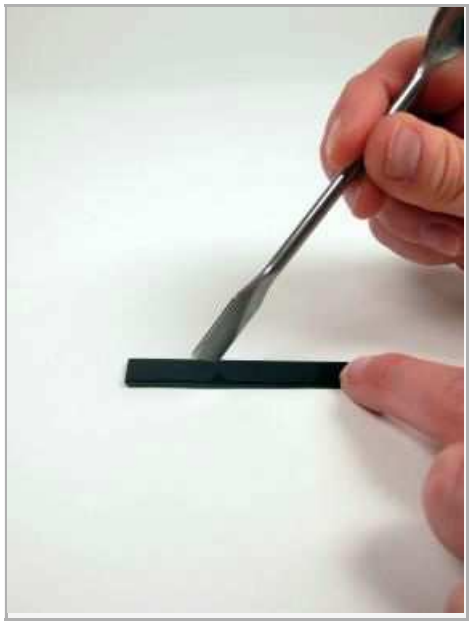
Mechanical properties of plastics (Item No.: P7180400)

Task and equipment

Task

Which properties of plastics can be examined? (1)

Examine the sound and mechanical properties of some plastic materials.



Equipment

Position No.	Material	Order No.	Quantity
1	Spoon, special steel	33398-00	1
2	Protecting glasses, clear glass	39316-00	1
	Sample set for study of plastics, 60 pcs. of each species	31730-00	1

Robert-Bosch-Breite 10
D - 37079 Göttingen

Tel: +49 551 604 - 0
Fax: +49 551 604 - 107

info@phywe.de
www.phywe.com

Set-up and procedure

Set-up

Hazards

- Wear protective glasses!

Procedure

Procedure

Let fall down the different plastic rods onto the work plate from a height of about 30 cm (Fig. 1). Compare the produced sound and write down your results on table 1 in the report.

Fig. 1

Try to scratch the plastic rods with your fingernail (Fig. 2). Write down your results in table 1.

Robert-Bosch-Breite 10
D - 37079 Göttingen
Tel: +49 551 604 - 0
Fax: +49 551 604 - 107
info@phywe.de
www.phywe.com

Fig. 2

Try to scratch the plastic rods with the spatula handle (Fig. 3). Write down your results in table 1.

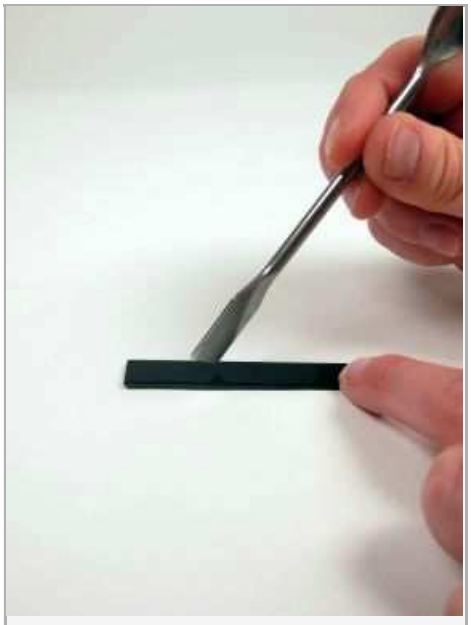


Fig. 3

Bend strongly the rods (Fig. 4) and write down your results in table 1.

Fig. 4

Waste disposal

The plastic remains can be treated as normal waste.

Report: Mechanical properties of plastics

Result - Observations

Write down your observations in general form.

.....

.....

.....

.....

Result - Table 1

Write down your results in Table 1.

Plastics	Sound				Scratchable (yes/no)		Behaviour on handling
	dull	rattling	tinny	woodeny	with fingernail	with spatula handle	
PE (HD)	0 ±0	0 ±0	0 ±0	0 ±0	0	0	
PP	0 ±0	0 ±0	0 ±0	0 ±0	0	0	
PS	0 ±0	0 ±0	0 ±0	0 ±0	0	0	
PMMA	0 ±0	0 ±0	0 ±0	0 ±0	0	0	
PC	0 ±0	0 ±0	0 ±0	0 ±0	0	0	
UP	0 ±0	0 ±0	0 ±0	0 ±0	0	0	

Evaluation - Question 1

Draw the conclusions from your observations.

.....

.....

.....

.....

Evaluation - Question 2

Which conclusions on structure and density can you draw from your observations?

.....

.....

.....

.....

Robert-Bosch-Breite 10
D - 37079 Göttingen

Tel: +49 551 604 - 0
Fax: +49 551 604 - 107

info@phywe.de
www.phywe.com

Evaluation - Question 3

From which other point of view is the examined behaviour of plastics also important?

.....

.....

.....

.....