

Chem C2000

Gigantic!
250
Experiments!



Please observe the safety information, the advice for supervising adults on page 5, the safety rules on page 6, the information about hazardous substances and mixtures (chemicals) on pages 7-9 and their environmentally sound disposal on pages 123-124, the safety for experiments with batteries on page 7, the first aid information on the inside front cover and the instructions on the use of the alcohol burner on pages 12-13.

WARNING. Not suitable for children under 11 years. For use under adult supervision. Contains some chemicals which present a hazard to health. Read the instructions before use, follow them and keep them for reference. Do not allow chemicals to come into contact with any part of the body, particularly the mouth and eyes. Keep small children and animals away from experiments. Keep the experimental set out of reach of children under 11 years old. Eye protection for supervising adults is not included.

WARNING — Chemistry Set. This set contains chemicals that may be harmful if misused. Read cautions on individual containers and in manual carefully. Not to be used by children except under adult supervision.



Chem C2000

Experiment Manual

Kurt Waselowsky

Franckh-Kosmos Verlags-GmbH & Co. KG, Stuttgart, Germany
Thames & Kosmos, LLC, Providence, RI, USA

1st Edition © 2011 Franckh-Kosmos Verlags-GmbH & Co. KG, Stuttgart, Germany

This work and all parts thereof are protected by copyright. Any use beyond the narrow limits of copyright law without the consent of the publisher is prohibited and punishable by law. This applies in particular to reproductions, translations, microfilming and storage and processing in electronic systems. We do not guarantee that all of the information in this work is free of proprietary rights.

Text: Kurt Waselowsky

Project management: Sonja Brinz

Product development: Monika Schall

Design and illustration: Friedrich Werth, Horb

Photos for packaging and materials: pro-studios, Michael Flaig, Stuttgart

Photos for manual: KOSMOS-Archiv, Stuttgart. Werthdesign, Horb. Various image publishers. For all other images, the source is named in the caption.

The publisher has made an effort to locate the holders of image rights for all of the photos used. If in individual cases a holder of image rights has not been taken into account, they are asked to provide evidence to the publisher of their image rights so that an image fee in line with the industry standard can be paid to them.

6th English Edition © 2011, 2013, 2016, 2020, 2021, 2022 Thames & Kosmos, LLC, Providence, RI

© Thames & Kosmos is a registered trademark of Thames & Kosmos, LLC.

Translation: David Gamon and Chris Scogrum; Editing: Ted McGuire; Additional Graphics and Layout: Dan Freitas

Distributed in North America by Thames & Kosmos, LLC. Providence, RI 02903

Phone: 800-587-2872; Web: www.thamesandkosmos.com

We reserve the right to make technical changes.

Printed in Germany / Imprimé en Allemagne

Contents

Safety and Precautions

First Aid Information	Inside front cover
Poison Control Contact Information	Inside front cover
Advice for Supervising Adults	5
What you need to know about chemistry experiment kits and using them	
Safety Rules for Chemical Experiments	6
Safety for Experiments with Batteries	7
Hazardous Substances and Mixtures (Chemicals)	7
How they are labeled and how to properly handle them	
Instructions for Using the Protective Goggles	Inside back cover



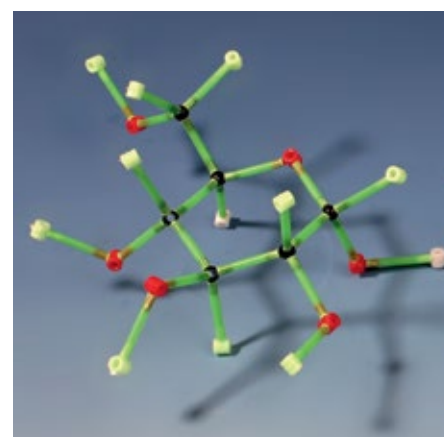
The Experiments

1. Chemistry Is Everywhere	10
2. Workplace and Equipment	11
3. Without Water There Is No Life — And No Chemistry	16
4. Fresh Air for our Lungs	26
5. Acids, Bases, Salts	36
6. The Greenhouse Gas from a Soda Bottle	46
7. Sulfur Dioxide and Acid Rain	54
8. From Table Salt to Chlorine Chemistry	59
9. Baking Soda and Washing Soda: Two CO₂ Stockpiles	65
10. Quicklime and Plaster: Not just for Building	71
11. The Salt of Amun Ra	77
12. Iron: #1 Commercial Metal	83
13. Copper: The Bright Red Semiprecious Metal	88
14. Colorful Chemistry on Paper	94
15. Sugar and Starch: Two Fattening Foods?	100
16. Protein: Not just in Chicken Eggs	106
17. Water, Fats, and Surfactants	111
18. Luminol: The Cold Light	117



Appendix

19. How to Dispose of Waste	123
20. Answers to the Questions	125
21. Index	127





Chem C2000 contains the following parts:

No.	Description	Item No.
1	Protective goggles (Safety glasses)	717019
2	Three conducting wires and copper wire (in bag)	773610
3	Two large graduated beakers	087077
4	Two lids for graduated beakers	087087
5	Funnel	086228
6	Alcohol burner consisting of	
6	Burner base	061117
7	Insulating piece	048067
8	Aluminum disk	021787
9	Wick holder	021777
10	Wick	051056
11	Burner cap	021797
12	Rubber stopper without hole	071078
13	Rubber stopper with hole	071028
14	Cork stopper with hole	071118
15	Safety cap with dropper insert for litmus bottle	704092
16	Clip for 9-volt battery	712310
17	Five test tubes	062118
18	Test tube stand	070187
19	Two dropper pipettes	232134
20	Carbon electrode	026217
21	Pointed glass tube	065308
22	Angled tube	065378
23	Immersion heater	065458
24	Test tube brush	000036
25	Test tube holder	000026
26	Double-headed measuring spoon	035017
27	Lid opener	070177
28	Small bottle for litmus solution	771501

No.	Description	Item No.
29	Sodium hydrogen sulfate, 25g	772503
30	Sodium carbonate, 12g	772504
31	Potassium hexacyanoferrate(II), 4g	772505
32	Calcium hydroxide, 8.5g	772506
33	Ammonium chloride, 10g	772508
34	Potassium permanganate mixture (potassium permanganate-sodium sulfate mixture 1:2 m/m), 10g	775526
35	Sulfur, 4.5g	772524
36	Copper(II) sulfate, 8g	772522
37	Litmus powder, 1g	772502
38	Magnesium strip	772500
39	Luminol mixture (luminol-sodium sulfate mixture 5% m/m), 3g	772513
40	Potassium hexacyanoferrate(III), 6g	772514
41	Filter paper sheets (not pictured)	702842

↑ Divide the polystyrene tray here with a knife (see p. 11)

Keep the packaging and instructions, as they contain important information.

Please check whether all of the parts and chemicals listed in the parts list are contained in the kit.

How can individual parts be reordered?

Contact Thames & Kosmos customer service to inquire about an order.

Additional materials required

On page 14, we have made a list of the additional materials required for a number of experiments.

Safety Information

Information for Supervising Parents and Adults

What you need to know about chemistry experiment kits and using them

Has your child already had the chance to experiment with a beginner's chemistry set? Has he or she marveled over sudden changes in color, or had fun with effervescence or bubbles of gas when you poured water over baking powder mixtures? If so, your child has already started to become familiar with the world of chemical substances. But even if the first encounter with chemistry was in school or with friends, it's never too late for a hands-on introduction into a newly acquired area of interest. Chem C2000 has just the right equipment for any child who likes to experiment and also wants to learn to decipher the secrets hidden in chemical formulas.

Like all Thames & Kosmos experiment kits, Chem C2000 assumes no prior knowledge. All of the work techniques are described in complete detail, and all important concepts are thoroughly explained. Safety alone would require this, but it is also necessary for providing an effective learning experience.

With a chemistry experiment kit, you will of course be wondering about the issue of safety. You know that improper use of chemicals can lead to injuries or other health risks. This kit complies with all applicable US consumer product safety regulations, including those for chemistry sets. Moreover, this kit complies with the more rigorous European safety standard EN 71-4, in which the safety requirements for chemistry experimental kits are established, to reduce risks to a minimum. This standard forms the reliable basis of all Thames & Kosmos chemistry experiment kits. The standard contains requirements for the manufacturer, for example that no particularly hazardous substances can be used. They also require the manufacturer, however, to carefully inform the parents or adult supervisors of the possible hazards and to require them to accompany their children in their new hobby with a helping hand. Therefore, please read all of the safety information prescribed by EN 71-4 listed in the box on the right as well as the advice below. Emphasize to your child the importance of following all of this information, and the importance of carrying out only those experiments that are described in this manual.

The safety rules (pages 6 – 7), the information about hazardous substances and mixtures (pages 7 – 9), and the safety information accompanying the experiments inform you of the risks and help you to estimate the suitability of the experiments for your child. In case anything should happen, please find the first aid information and the poison control center contact information on the inside front cover. To avoid injuries, please inform your child of how to handle glass tubes as described on page 12 (inserting it into the rubber stop and removing it from the stopper), how to use the alcohol burner (pages 12 – 13), and how to heat liquids in the test tubes (Experiments 1 and 2). Please fill the burner with alcohol yourself.

Setting up the working area is described on page 11 and the proper waste disposal on pages 123 – 124. A list of additionally required materials can be found on page 14.

We propose that you carry out the experiments in the prescribed order, because the knowledge of working techniques described in the earlier experiments is a prerequisite for the later ones.

We hope your young chemist, and you as well, have a lot of fun and success with the experiments.

Tips and information for you and the child performing experiments:

- Safely rules (p. 6 – 7)
- Hazardous substances and mixtures/chemicals (p. 7 – 9)
- Setting up the work area (p. 11)
- Handling denatured alcohol and operating the alcohol burner (p. 12 – 13)
- Handling glass tubes (p. 13 – 14)
- Additional materials required (p. 14)
- Preparation of the litmus solution (p. 36)
- Proper waste disposal (p. 123 – 124)
- Information about safety glasses (inside back cover)
- First aid information (inside front cover)
- Poison control centers (inside front cover)

Advice for Supervising Adults

A. Read and follow these instructions, the safety rules and the first aid information, and keep them for reference.

B. The incorrect use of chemicals can cause injury and damage to health. Only carry out those experiments which are listed in the instructions.

C. This experimental set is for use only by children over 11 years.

D. Because children's abilities vary so much, even within age groups, supervising adults should exercise discretion as to which experiments are suitable and safe for them. The instructions should enable supervisors to assess any experiment to establish its suitability for a particular child.

E. The supervising adult should discuss the warnings and safety information with the child or children before commencing the experiments. Particular attention should be paid to the safe handling of acids (e.g. citric acid), alkalis (bases, e.g. sodium carbonate) and flammable liquids (denatured alcohol).

F. The area surrounding the experiment should be kept clear of any obstructions and away from the storage of food. It should be well lit and ventilated and close to a water supply. A solid table with a heat resistant top should be provided (also see page 11).

G. Instructions for the use of the burner (see pages 12 – 13).

Safety Rules

All of the experiments that are described in this manual can be performed without danger if you carefully follow the tips and rules summarized below.

Safety rules for chemical experiments

- 1. Read these instructions before use, follow them and keep them for reference.** Pay special attention to the quantity specifications and the sequence of the individual tasks. Only perform experiments that are described in this instruction manual.
- 2. Keep young children, animals and those not wearing eye protection away from the experimental area.**
- 3. Always wear eye protection.** If you wear corrective eyeglasses, you will need protective goggles for those who wear eyeglasses. When working, wear appropriate protective clothing (old smock and smooth fingered gloves).
- 4. Store this experimental set out of reach of children under 11 years of age.** As well as the additional materials, for example in a lockable cabinet.
- 5. Clean all equipment after use.**
- 6. Make sure that all containers are fully closed and properly stored after use.**
- 7. Ensure that all empty containers are disposed of properly.**
- 8. Wash hands after carrying out experiments.** Chemicals that accidentally get onto your skin must be rinsed off immediately under running water.
- 9. Do not use any equipment which has not been supplied with the set or recommended in the instructions for use.**
- 10. Do not eat or drink in the experimental area.** Do not use any eating, drinking or other kitchen utensils for your experiments unless it is specifically recommended. Any containers or equipment you use in your work should not be used in the kitchen afterwards. Dispose of used drinking straws in the garbage immediately after the experiment. Do not save and reuse them.
- 11. Do not allow chemicals to come into contact with the eyes or mouth.**
- 12. Do not replace foodstuffs in original container. Dispose of immediately (in the household trash or the sink). If you are investigating food products (e.g., sugar, flour, table salt), fill the required amount into one of the graduated beakers (do not use the double-headed measuring spoon for this). Make note on the beaker of what it contains and the date it was filled.**
13. During the experiments with open flame, be sure that there are no flammable objects or liquids nearby. Extinguish the flame at the end of the experiment at the latest as well as when you leave the experiment area even just for a moment. The tealight candle required for some experiments has to be placed on a fire-resistant surface (such as an old plate). Have a bucket or box with sand ready for extinguishing any fires. If the fire can't be extinguished right away, notify the fire department immediately.
14. When heating test tubes, always hold them with their opening pointed away from you and other people.
15. Immediately wipe up any spilled liquids that evaporate quickly and are highly flammable (e.g. denatured alcohol), and thoroughly rinse out the rag.
16. Any filled container or experimental apparatus that are to remain standing for a longer period of time (e.g., for the precipitation of substances) has to be labeled and stored out of reach of young children and animals.
17. Get any additionally required materials ready before starting an experiment.
18. Handle breakable materials (e.g. the glass test tubes or angled tube) carefully.

Also note the information on the chemical vial labels, the information about "Hazardous substances and mixtures" on p. 7 – 9 as well as the safety and waste disposal instructions for the individual experiments (for example, regarding hazardous gases or how to properly handle the glass tube). If additional products are required, also take note of the warnings on their packaging (e.g. for denatured alcohol).

Safety for Experiments with Batteries

WARNING! Only for use by children aged 11 years and older. Instructions for parents or other supervising adults are included and have to be observed. Keep the packaging and instructions as they contain important information.

- For some experiments, you will need a 9-V type 6LR61 square battery, which could not be included in the kit due to its limited shelf life. Press the battery clip equipped with red and black wires onto the battery.
- Have an adult check your experimental setup before performing the experiment.
- Non-rechargeable batteries are not to be charged. They could explode.
- Rechargeable batteries are only to be charged under adult supervision.
- Rechargeable batteries are to be removed from the toy before being charged.
- Exhausted batteries are to be removed from the toy.
- Dispose of used batteries in accordance with environmental provisions, not in the household trash.
- The supply terminals of the battery clip are not to be short-circuited: Neither the battery wire contacts nor the wires connected to them should touch each other. Make sure there is no unintended short circuit due to conductive metal objects, such as coins or a keychain. A short circuit can cause the wires to overheat and the battery to explode.
- Don't throw batteries into the fire and don't store them near heat sources.
- Avoid deforming the batteries.
- Never perform experiments using household current. You know that you should never insert any objects into the wall socket holes. The high voltage can be extremely dangerous or fatal!
- Don't use any voltage source other than the specified battery, including a power supply unit.
- After you are done experimenting, remove the battery clip from the battery.



Hazardous Substances and Mixtures (Chemicals)

How they are labeled and how to properly handle them

On the following pages, we provide you with a list of the chemicals contained in this chemistry set as well as the chemicals you will be obtaining in addition that are classified as hazardous substances or hazardous mixtures. For each substance, the list shows **hazard statements** (in blue) and precautionary statements for avoiding the hazards. In the margin, you will find the corresponding **pictograms** and a **signal word** for the scope of the hazard.

The chart on the inside front cover of the manual explains the pictograms that appear in the list of chemical substances on the following pages. The text under each one cites dangers associated with substances that are designated with the pictogram. A substance designated with a pictogram may be associated with one or more of the hazards listed under that pictogram. For example, copper sulfate (exclamation point) is harmful and irritant. You can find out exactly what hazards are associated with a certain substance by referring to the following list.

The pictograms are a component of Regulation (EC) No. 1272/2008, also called the GHS Regulation. GHS stands for Globally Harmonized System, a system whose aim is to achieve a classification and designation of hazardous substances and mixtures that is uniform throughout the world.

Some of the chemicals listed on the following pages only cause limited risks. Therefore they are not labelled with a pictogram or signal word. Nevertheless the given precautionary statements should be observed.



WARNING

Ammonium carbonate/Ammonium bicarbonate (salt of hartshorn) (Not included)
Harmful if swallowed. – Causes serious eye irritation. – May cause respiratory irritation.
Avoid breathing vapors. – Wear eye protection. – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.



WARNING

Ammonium chloride
Harmful if swallowed. – Causes serious eye irritation.
Wash face, hands and any exposed skin thoroughly after handling. – Do not eat, drink or smoke when using this product. – Wear protective gloves/protective clothing/eye protection/face protection. – Wear eye/face protection. – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. – IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. Rinse mouth.



DANGER

Calcium hydroxide
Causes skin irritation. – Causes serious eye damage. – May cause respiratory irritation.
Do not breathe dust. – Wear eye protection. – IF ON SKIN: Wash with plenty of soap and water. – IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. – Get medical advice/attention.
The warnings also apply to its solution in water, called limewater (for preparations, see Experiments 63/64)

Citric acid (Not included)
Not a hazardous substance
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts.



DANGER

Copper(II) sulfate.
Harmful if swallowed. – Toxic in contact with skin. – Causes skin irritation. – Causes serious eye irritation.
Wash face, hands and any exposed skin thoroughly after handling. – Do not eat, drink or smoke when using this product. – Wear protective gloves/protective clothing/eye protection/face protection. – Specific treatment (See first aid instructions). – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. – IF ON SKIN: Wash with plenty of soap and water. Call a POISON CENTER or doctor/physician if you feel unwell. Remove/Take off immediately all contaminated clothing. Wash contaminated clothing before reuse. If skin irritation occurs: Get medical advice/attention. – IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. Rinse mouth.
Very toxic to aquatic life with long lasting effects.
Avoid release to the environment. Comply with the instructions for disposal in the manual. Follow instructions for disposal (A4, A5, p. 124).



DANGER

Denatured alcohol (or methylated spirits; main ingredient ethanol, ethyl alcohol) (Not included)
Highly flammable liquid or vapors.
Keep away from heat/sparks/open flames/hot surfaces. No smoking. – Keep container tightly closed. Storage: Store in a well-ventilated place. Keep cool.
Request to parents: Keep denatured alcohol locked away. Fill burner yourself and decant the amount that will be required for a few experiments into the test tube.

Hydrogen peroxide (3%) (Not included)
Do not get in eyes or on skin.

Iodine solution (maximum of 2.5% Iodine) (Not included)
Do not get in eyes or on skin.
Avoid release to the environment. Follow instructions for disposal (A9, p. 124).

Litmus powder
Not a hazardous substance

Luminol mixture (5% mixture with sodium sulfate)
Not a hazardous substance
Obtain special instructions before use.



DANGER

Magnesium strip
Flammable solids.
Wash face, hands and any exposed skin thoroughly after handling. – Do not eat, drink or smoke when using this product. – Keep away from heat/sparks/open flames/hot surfaces. – No smoking. Ground/bond container and receiving equipment. – Use explosion-proof electrical/ventilating/lighting/equipment. – Wear protective gloves/protective clothing/eye protection/face protection. – IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. Rinse mouth. – In case of fire: Use CO₂, dry chemical, or foam for extinction.

Potassium hexacyanoferrate(II)

Not a hazardous substance

Obtain special instructions before use. May be harmful if swallowed. – Harmful to aquatic life with long lasting effects. – May cause slight eye irritation.

Avoid release to the environment. Follow recommendation on p. 83.

Potassium hexacyanoferrate(III)

Causes skin irritation. – Causes serious eye irritation. – May cause respiratory irritation.

Wash face, hands and any exposed skin thoroughly after handling. – Wear protective gloves/protective clothing/eye protection/face protection. – Avoid breathing dust/fume/gas/mist/vapors/ spray. – Use only outdoors or in a well-ventilated area. – Wear eye/face protection. – Specific treatment (See first aid instructions). – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. – If eye irritation persists: Get medical advice/attention. – IF ON SKIN: Wash with plenty of soap and water. – If skin irritation occurs: Get medical advice/attention. – Take off contaminated clothing and wash before reuse. – IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing – Call a POISON CENTER or doctor/physician if you feel unwell.



WARNING

Potassium permanganate preparation (Mixture 1:2 with Sodium sulfate)

Harmful if swallowed. – Harmful in contact with skin. – May intensify fire, oxidizer.

Wash face, hands and any exposed skin thoroughly after handling. – Do not eat, drink or smoke when using this product. – Do not breathe dust/fume/gas/mist/vapors/spray. – Wear protective gloves/protective clothing/eye protection/face protection. – Keep away from heat/sparks/open flames/hot surfaces. – No smoking. – Keep/Store away from clothing/combustible materials. – Take any precaution to avoid mixing with combustibles. – Wear fire/flame resistant/retardant clothing. – Immediately call a POISON CENTER or doctor/physician. – Specific treatment (See first aid instructions). – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician. – Wash contaminated clothing before reuse. – IF ON CLOTHING: Rinse immediately contaminated clothing and skin with plenty of water before removing clothes. Rise skin with water/shower. – IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/physician. – IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. Rinse mouth. Do NOT induce vomiting. – In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion. – In case of fire: Use CO₂, dry chemical, or foam for extinction.

Very toxic to aquatic life with long lasting effects.

Avoid release to the environment. Comply with the instructions for disposal in the manual. Follow instructions for disposal (A7, A8, p. 124).



DANGER

Sodium carbonate

Harmful if inhaled. – Causes serious eye irritation.

Avoid breathing dust/fume/gas/mist/vapors/spray. – Use only outdoors or in a well-ventilated area. – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. – IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.



WARNING

Sodium hydrogen sulfate

Causes serious eye irritation.

Wear protective gloves/protective clothing/eye protection/face protection. – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.



DANGER

Sulfur

Causes skin irritation. – Flammable solids.

Wash face, hands and any exposed skin thoroughly after handling. – Wear protective gloves/protective clothing/eye protection/face protection. – Keep away from heat/sparks/open flames/hot surfaces. – No smoking. – Ground/bond container and receiving equipment. – Use explosion-proof electrical/ventilating/lighting/equipment. – Specific treatment (See first aid instructions). – IF ON SKIN: Wash with plenty of soap and water. – If skin irritation occurs: Get medical advice/attention. – Take off contaminated clothing and wash before reuse. – In case of fire: Use CO₂, dry chemical, or foam for extinction.



WARNING

Warning! The following applies to all chemicals:

Store locked up. Keep out of reach of children. This applies to all children except for the experimenting child who is being instructed and supervised by an adult.

Also follow this precautionary statement:

IF SWALLOWED: Get immediate medical advice/attention and have product container or label of chemical substance at hand.

For the sake of environmental protection: **Dispose of contents/ containers (of no-longer-needed chemicals) to a hazardous waste disposal location.**



For information on the protective equipment, see “Workspace and Equipment” on p. 11.

1

Chemistry Is Everywhere



View into a modern chemistry lab (photo: BASF)

For a lot of people, chemistry remains a mysterious science, something they assume is difficult to understand, dangerous, and irrelevant to their daily lives. Maybe they didn't pay attention in school, or their image of chemistry comes from old books or movies where seemingly mysterious things happened. For example, you might have seen a movie that depicts an old, wiry haired professor in his laboratory, surrounded by complicated pieces of equipment in which things are brewing, bubbling, and hissing. The professor stares spellbound at a flask into which a red liquid drips, his latest discovery. But maybe the professor made a mistake with the ingredients, or someone who wishes him harm meddled with them on the sly — resulting in a deafening explosion or some other disaster! The lab is destroyed, and the professor can consider himself lucky if he gets away with the fright of his life and a few scratches.

So it's no wonder that a lot of people still think that chemistry is what explodes and stinks. Now, it doesn't always smell like roses in chemistry labs and factories, but explosions happen only rarely. Outside in the streets, on the other hand, things are exploding millions of times every second — in automobile engines. Those explosions are chemistry! But chemistry is also at work in all sorts of much quieter processes — when candles burn, iron rusts, or green plants produce sugar from a gas that has made its reputation as a climate changer. All biological processes taking place in people, animals, and plants can be studied and explained with chemistry.

You don't need a lab like the old professor's if you want to understand all these chemical processes. This experiment kit will give you an easy entry into chemistry, and the instruction manual will be a reliable guide on your voyage of discovery through the realm of chemicals. When chemists refer to chemicals, they can be talking about any and every known bit of matter — everything is made of chemicals.



Question 1. When you think of chemicals, what comes to mind? Name some of the chemical substances you can think of.*



Nature and chemistry — not opposites at all. Research into natural materials and processes is also part of a chemist's work.

You will learn to see everyday materials from a completely new perspective: ordinary table salt, for example, which contains a poisonous gas, or the already-mentioned climate-altering gas that also happens to be responsible for the fizz in a soda bottle. At the same time, you will become familiar with the chemist's work techniques: filtering, distilling, and heating things in test tubes. And you will learn about important basic concepts of chemistry: elements and compounds, atoms and molecules, ions and pH values. All of this represents knowledge that you can later build on in school or by experimenting with a larger chemistry kit.

In short, chemistry will not be a mysterious science for you, or a foreign topic that you only see depicted in movies and books. You will be able to find your way around better than a lot of other people in an area of knowledge that is very important in today's world. Have we made you curious? So now, it's time to start.

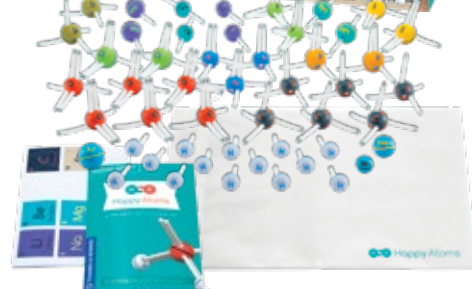
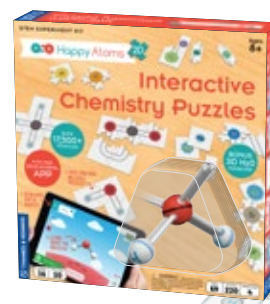
* You will find answers to the questions beginning on p. 125.



Happy Atoms

A revolutionary approach to teaching chemistry

This physical and digital system lets you discover the world of molecules in an intuitive, hands-on way. Assemble molecules using a set of magnetic atoms representing 16 different elements. Then use the included app (for iOS and Android devices) to scan and identify the molecules. The app teaches you about molecules and bonding with guided labs and open-ended discovery.



Available in various set sizes as well as a 2D version

Instructions for use for the safety goggles (Art.-Nr. 717019)

Manufacturer Frame: Georg Schmerler GmbH & Co. KG / Reitweg 7 / 90587 Veitsbrunn / Germany

Manufacturer Lens: IPB NV / Steenovenstraat 30 / 8790 Waregem / Belgium

Certification Office: ECS GmbH – European Certification Service / Hüttfeldstr. 50 / 73430 Aalen, DE / Germany / Notified Body Number: 1883

GSF – Safety goggles comply with the Regulation (EU) 2016/425 on personal protective equipment (PPE), are design tested, and bear the CE symbol. The Model 610 in this kit is suitable for protection against mechanical dangers.

Identification of the frame:

GSF = Code letter of manufacturer

166 = Number of the standard

S = increased robustness

CE = EC Conformity symbol

Identification of the safety lenses:

IPB = Code letter of manufacturer

1 = Optical class

S = increased robustness

If frame and lens have differing certification marks in regards to S, F, B, or A, the lower of the two applies. Wearers with extremely sensitive skin may experience allergic reactions upon contact with some materials. There are no spare parts or additional components available for this model. If damaged please discard the safety

goggles and discontinue use. Eye protectors used for protection against high-speed particles that are worn over standard ophthalmic spectacles may transmit impacts, thus creating a hazard to the wearer. If protection against high-speed particles at extreme temperatures is required then the selected eye protector should be marked with the letter T immediately after the impact letter, i.e. FT, BT, or AT. Otherwise the eye protector should only be worn and used at room temperatures.

Accessories: No accessories are available for this product.

Storage: Store in a dry and dust free place at room temperature.

Cleaning: Clean with clear water and household detergent. (Do not use solvents!) Avoid strong scrubbing as it can cause scratches.

Disinfection: Product can be disinfected with all regular commercial disinfectants.

Disposal: Pay attention to national regulations when disposing.

Length of usage: Do not use longer than 5 years after purchase date.

Warnings: Dispose of the goggles immediately if damaged. Only use eye protection lenses with optical class 1. Do not repair damaged safety goggles.

Limitations of use: These safety goggles in particular are not suitable for high-speed particles (e.g. cartridge tools), laser beam, temperatures above 55 °C, stray light arcs, fusion metals, infectious substances, or organisms.

Declaration of Conformity: A Declaration of Conformity according to Regulation (EU) 2016/425 on PPE and the Directive 2001/95/EC on general product safety is available for this product on the following web address: <http://thamesandkosmos.com/declarations/declaration-717019.pdf>

First Aid Information

When conducting experiments with chemicals and in case any accidents should happen during experimentation:

In case of injury, seek immediate medical help.

- 1. In case of eye contact:** Wash out eye with plenty of water, holding eye open if necessary. Rinse from the nose outward. Seek immediate medical advice.
- 2. If swallowed:** Wash out mouth with water, drink some fresh water. Do not induce vomiting. Seek immediate medical advice.
- 3. In case of inhalation:** Remove person to fresh air. For example, move person into another room with open windows or outside.
- 4. In case of skin contact and burns:** Wash affected area with plenty of water for at least 10 minutes. Cover burns with a bandage. Never apply oil, powder, or flour to the wound. Do not lance blisters. For larger burns, seek immediate medical help.
- 5. In case of doubt, seek medical advice without delay.** Take the chemical and its container with you.
- 6. In case of injury always seek medical advice.**
- 7. In case of cuts:** Do not touch or rinse with water. Do not apply any ointments, powders or the like. Dress the wound with a germ-free, dry first-aid bandage. Foreign objects such as glass splinters should only be removed from the wound by a doctor. Seek medical advice if you feel a sharp or throbbing pain.

Poison Control Centers (United States)

In case of emergency, your nearest poison control center can be reached everywhere in the United States by dialing the number:

1-800-222-1222

Local Hospital or Poison Centre (Europe)

Record the telephone number of your local hospital or poison centre here:

Write the number down now so you do not have to search for it in an emergency.

Warning! Contains functional sharp points or edges that pose a risk of injury. Keep the packaging and instructions as they contain important information.



Substance/mixture

- is flammable
- is self-igniting
- forms flammable gases with water



Substance/mixture

- may intensify fire (is an oxidizer)



Substance/mixture causes

- corrosion (destruction) of metals
- burns on skin
- severe eye damage



Substance/mixture is

- acutely harmful if swallowed, in contact with skin, or inhaled
- an irritant to skin, eyes and respiratory tract
- sensitizing to skin
- narcotic



Substance/mixture

- has life-threatening acute toxicity
- is acutely toxic if swallowed, if on skin, or if inhaled



Substance/mixture is

- acutely very toxic
- very toxic or toxic with long lasting effects to aquatic life

Brief Explanation of the GHS Hazard Pictograms

The chart to the left shows the Globally Harmonized System (GHS) pictograms. The text under each symbol cites dangers associated with substances that are designated with the pictogram.

A substance/mixture designated with a pictogram may be associated with one or more of the hazards listed under that pictogram. For example, copper sulfate (exclamation point) is harmful and irritant. You can find out exactly what hazards are associated with a certain substance in this kit by referring to the list on pages 7 to 9.



Kosmos Quality and Safety

More than one hundred years of expertise in publishing science experiment kits stand behind every product that bears the Kosmos name. Kosmos experiment kits are designed by an experienced team of specialists and tested with the utmost care during development and production. With regard to product safety, these experiment kits follow European and US safety standards, as well as our own refined proprietary safety guidelines. By working closely with our manufacturing partners and safety testing labs, we are able to control all stages of production. While the majority of our products are made in Germany, all of our products, regardless of origin, follow the same rigid quality standards.

