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Safety of toys —

Part 10:
Experimental sets for chemistry and related activities

Sécurité des jouets —

Partie 10: Coffrets d'expériences chimiques et activités connexes

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 181, *Safety of toys*.

This second edition cancels and replaces the first edition (ISO 8124-10:2019). A list of the main technical changes made to the previous edition is given in Annex C.

A list of all parts in the ISO 8124 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is intended to reduce the risks and health hazards to children when experimental sets involving chemical experiments are used as intended or in a foreseeable way, bearing in mind the behaviour of children.

During use of these experimental sets, hazards should be kept to a minimum by the provision of appropriate information to make the experiments safe and controllable. Therefore, this document specifies warning phrases and instructions for use with experimental sets.

As a general rule, experimental sets are designed and manufactured for particular ages of children. Their characteristics are related to the age and stage of development of the children, and their use presupposes certain aptitudes. Age requirements are therefore given.

The requirements of this document do not release parents or carers from their responsibility of watching over a child while he or she is carrying out experiments. On the contrary, the use of these sets requires close supervision by adults.

Products covered by this document may be subject to legal requirements specific to the jurisdiction in which they are sold and conformity with the requirements in this document cannot be relied on to ensure compliance with those requirements.

Safety of toys —

Part 10:
Experimental sets for chemistry and related activities

1 Scope

See A.1

This document specifies requirements for the maximum amount, and, in some cases, the maximum concentration of certain substances and mixtures used in experimental sets for chemistry and related activities.

These substances and mixtures are:

— those classified as dangerous by the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)[1];

— substances and mixtures which in excessive amounts could harm the health of the children using them and which are not classified as dangerous by the GHS; and

— any other chemical substance(s) and mixture(s) delivered with the experimental set.

This document applies to experimental sets for chemistry and related activities, including crystal-growing sets, carbon-dioxide-generating experimental sets and supplementary sets. It also covers sets for chemical experiments within the fields of mineralogy, biology, physics, microscopy and environmental science, whenever they contain one or more chemical substances and/or mixtures which are classified as hazardous according to the GHS[1].

This document also specifies requirements for marking, a contents list, instructions for use, eye protection and the equipment intended for carrying out the experiments.

This document does not apply to combined sets, e.g. a combination of a chemistry set and a crystal growing set.

Requirements for certain other chemical toys are given in ISO 8124-11.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 7619-2, *Rubber, vulcanized or thermoplastic — Determination of indentation hardness — Part 2: IRHD pocket meter method*

ISO 8124-1, *Safety of toys — Part 1: Safety aspects related to mechanical and physical properties*

ISO 8124-11, *Safety of toys — Part 11: Chemical toys (sets) other than experimental sets*

ISO 8317, *Child-resistant packaging — Requirements and testing procedures for reclosable packages*

EN 862, *Packaging — Child-resistant packaging — Requirements and testing procedures for non-reclosable packages for non-pharmaceutical products*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
chemical toy
toy intended for the direct handling of chemical substances and mixtures and which is used in a manner appropriate to a given age-group and under the supervision of an adult

[SOURCE: ISO 8124-2:2014, 3.1]

3.2
experimental set
chemical toy (3.1) in which the experimental and explorative character in playing with single chemical substances and mixtures is guided by strict instructions that dominate over the creative ideas of the user

3.3
chemistry set
experimental set (3.2) consisting of one or more chemical substances and/or mixtures, with or without equipment, intended for carrying out chemical experiments

Note 1 to entry: The definition also covers *experimental sets* for chemical experiments within the fields of mineralogy, biology, physics, microscopy and environmental sciences whenever they contain one or more chemical substances and/or mixtures which are classified as hazardous according to the GHS, excluding *crystal-growing sets* (3.4) and *carbon-dioxide-generating experimental sets* (3.5).

3.4
crystal-growing set
experimental set (3.2) consisting of one or more chemical substances for growing crystals without any reaction between the supplied substances

Note 1 to entry: A crystal-growing set is used to grow crystals of different substances in aqueous solutions. The crystals can be grown on different materials (e.g. stones or gypsum) and can be coloured in different ways (e.g. with food colours). The expanding nature of the growing crystal is not subject to requirements within ISO 8124-1 for expanding materials as the expansion is not related to the absorption of water in the crystal, and the expansion usually takes place over a long period of time (several days or weeks).

3.5
carbon-dioxide-generating experimental set
experimental set (3.2) consisting mainly of a carbon-dioxide-donor substance or mixture and a carbon-dioxide-liberating substance or mixture which after combination generate carbon dioxide in the presence of water in an open system without any gas-tight restriction or confinement

Note 1 to entry: The set is used to carry out and observe chemical reactions where there is no intention to generate carbon dioxide in order to demonstrate speed, velocity or noise.

3.6
supplementary set
incomplete *experimental set* (3.2) which is intended to be used with a complete *experimental set*

4 Chemical substances in experimental sets

See A.2.

4.1 Chemistry sets

4.1.1 Inclusion in the chemistry set

The chemical substances, mixtures and indicators given in Table 1 and Table 2 may be supplied in chemistry sets or in a supplementary set for a chemistry set up to the amounts and concentrations specified in those tables.

The quality of the chemicals used should be appropriate for the experiments described. In particular, the chemicals should not contain impurities or substances that allow undefined or dangerous reactions to occur.

NOTE 1 Information on the quality of chemicals may be obtained from manufacturers.

Furthermore, colourants and colouring materials which are not specified in Table 2 may only be supplied in chemistry sets if they do not react with the substances and mixtures of the set and if they do not fulfil the criteria of any of the following hazard classes:

— “acute toxicity” (hazard class 3.1),

— “skin corrosion/irritation” (hazard class 3.2),

— “serious eye damage/eye irritation” (hazard class 3.3),

— “respiratory or skin sensitisation” (hazard class 3.4),

— “germ cell mutagenicity” (hazard class 3.5),

— “carcinogenicity” (hazard class 3.6),

— “reproductive toxicity” (hazard class 3.7),

— “specific target organ toxicity — single exposure” (hazard class 3.8),

— “specific target organ toxicity — repeated exposure” (hazard class 3.9),

— “aspiration hazard” (hazard class 3.10).

Colourants which are permitted for use in food or cosmetics may be provided.

NOTE 2 The classification is detailed in the GHS (Part 3: Health Hazards).

Besides the chemical substances, mixtures and indicators given in Table 1 and Table 2 and colourants and colouring materials, only additives permitted for use in food and their mixtures may be supplied in chemistry sets, if pure additives permitted for use in food are not classified as hazardous substances [1] or mixtures are not classified as hazardous mixtures [1].

NOTE 3 Samples of rocks, stones, and minerals on which to perform experiments in order to distinguish their composition are sometimes supplied with the set.

4.1.2 Inclusion for experiments (as mentioned in the instructions but not supplied in the chemistry set)

See A.3.

The use of reagents listed in Table 3 may be suggested in the instructions at concentrations not exceeding those specified in this table. The substances specified in Table 3 shall not be supplied in a chemistry set.

Apart from its presence in tincture of iodine, denatured alcohol (ethanol) shall not be supplied in a chemistry set. However, where experiments contained in the instructions of a chemistry set require it, the use of denatured alcohol may be suggested in the instructions.

The instructions for use may suggest the use of other substances that are not classified as hazardous substances [1] or mixtures that are not classified as hazardous mixtures [1] (e.g. sucrose, table sugar, starch, or flour).

4.1.3 Requirements for packaging in containers

The substances and mixtures in Table 1 and 2 in a chemistry set or in a supplementary set of a chemistry set shall be supplied in containers (see 5.2.3) which are provided with closures (see 5.2.4.1).

Table 1 — Maximum amounts of chemical substances and mixtures for chemistry sets and labelling

Chemical substance/mixture	Max. amount per set	GHS pictograms (see Figure 1)	Signal word	CAS number	EINECS number	INDEX number
Aluminium potassium sulfate	10 g	—	—	10043–67–1	233–141–3	—
Ammonium carbonate	5 g	GHS07	Warning	10361–29–2	233–786–0	—
Ammonium chloride	30 g	GHS07	Warning	12125–02–9	235–186–4	017–014–00–8
Ammonium iron (III) sulfate	5 g	GHS05	Danger	10138–04–2	233–382–4	—
Ammonium sodium hydrogen phosphate	5 g	—	—	13011–54–6	235–860–8	—
Calcium carbonate	100 g	—	—	471–34–1	207–439–9	—
Calcium chloride	10 g	GHS07	Warning	10043–52–4	233–140–8	017–013–00–2
Calcium hydroxide[a]	20 g	GHS05, GHS07	Danger	1305–62–0	215–137–3	—
Calcium nitrate	5 g	GHS03, GHS05, GHS07	Danger	10124–37–5	233–332–1	—
Calcium oxide[a]	10 g	GHS05, GHS07	Danger	1305–78–8	215–138–9	—
Calcium sulfate	100 g	—	—	7778–18–9	231–900–3	—
Charcoal[b]	100 g	—	—	7440–44–0	231–153–3	—
Citric acid	20 g	GHS07	Warning	77–92–9	201–069–1	—
Copper sheet	100 g	—	—	7440–50–8	231–159–6	—
Copper (II) oxide	10 g	GHS07, GHS09	Warning	1317–38–0	215–269–1	029–016–00–6
Copper (II) sulfate	15 g	GHS05, GHS07, GHS09	Danger	7758–98–7	231–847–6	029–004–00–0
Disodium disulfite	10 g	GHS05, GHS07	Danger	7681–57–4	231–673–0	016–063–00–2
Glycerol (containing at least 15 % water)	25 g	—	—	56–81–5	200–289–5	—
Hexamethylene-tetramine[b] (solid fuel)	10 g	GHS02, GHS07	Warning	100–97–0	202–905–8	612–101–00–2

[a] Only one of these substances shall be provided in each set.

[b] Generally, IUPAC chemical nomenclature is used with the exception of these substances.

[c] Only to be provided in chemistry sets intended for children over 12 years of age.

[d] Denatured alcohol (ethanol).

Table 1 *(continued)*

Chemical substance/mixture	Max. amount per set	GHS pictograms (see Figure 1)	Signal word	CAS number	EINECS number	INDEX number
Iron fillings[b]	100 g	GHS02	Warning	7439–89–6	231–096–4	—
Iron powder[b]	100 g	GHS02	Danger	7439–89–6	231–096–4	—
Iron (III) chloride	10 g	GHS05, GHS07	Danger	7705–08–0	231–729–4	—
Iron (II) sulfate	10 g	GHS07	Warning	7720–78–7	231–753–5	026–003–00–7
Lactose	100 g	—	—	63–42–3	200–559–2	—
Lead-free solder	100 g	—	—	—	—	—
Magnesium strip	3 g	GHS02	Warning	7439–95–4	231–104–6	012–001–00–3
Magnesium sulfate	25 g	—	—	7487–88–9	231–298–2	—
Manganese (IV) dioxide	5 g	GHS07, GHS08	Danger	1313–13–9	215–202–6	025–001–00–3
Manganese (II) sulfate	15 g	GHS05, GHS08, GHS09	Danger	7785–87–7	232–089–9	025–003–00–4
Ninhydrin	1 g	GHS07	Warning	485–47–2	207–618–1	—
Pepsin A	10 g	GHS07, GHS08	Danger	9001–75–6	232–629–3	647–008–00–6
Potassium bromide	15 g	GHS07	Warning	7758–02–3	231–830–3	—
Potassium hexacyanoferrate (III)[b]	10 g	GHS07	Warning	13746–66–2	237–323–3	—
Potassium hexacyanoferrate (II)[b]	10 g	—	—	13943–58–3	237–722–2	—
Potassium iodide	10 g	GHS08	Danger	7681–11–0	231–659–4	—
Potassium permanganate[c]	15 g	GHS03, GHS07, GHS08, GHS09	Danger	7722–64–7	231–760–3	025–002–00–9
Potassium permanganate: sodium sulfate mixture (1:2) (mass fraction)	10 g	GHS03, GHS07, GHS08, GHS09	Danger	—	—	—
Silver nitrate (0,01 g/ml mass concentration aqueous solution)	10 ml	GHS05, GHS07, GHS09	Warning	7761–88–8	231–853–9	047–001–00–2
Sodium acetate	20 g	—	—	127–09–3	204–823–8	—
Sodium carbonate	50 g	GHS07	Warning	497–19–8	207–838–8	011–005–00–2
Sodium chloride	100 g	—	—	7647–14–5	231–598–3	—
Sodium hydrogen carbonate	50 g	—	—	144–55–8	205–633–8	—
Sodium hydrogen sulfate	30 g	GHS05	Danger	7681–38–1	231–665–7	016–046–00–X
Sodium silicate solution (SiO_2:Na_2O > 2)	100 ml	GHS05	Danger	1344–09–8	215–687–4	—
Sodium sulfate	100 g	—	—	7757–82–6	231–820–9	—
Sodium thiosulfate	50 g	—	—	7772–98–7	231–867–5	—

[a] Only one of these substances shall be provided in each set.

[b] Generally, IUPAC chemical nomenclature is used with the exception of these substances.

[c] Only to be provided in chemistry sets intended for children over 12 years of age.

[d] Denatured alcohol (ethanol).

Table 1 *(continued)*

Chemical substance/mixture	Max. amount per set	GHS pictograms (see Figure 1)	Signal word	CAS number	EINECS number	INDEX number
Sulfur	15 g	GHS07	Warning	7704–34–9	231–722–6	016–094–00–1
Tannin	15 g	—	—	1401–55–4	215–753–2	—
Tartaric acid	20 g	GHS05	Danger	87–69–4	201–766–0	—
Tin (II) chloride	15 g	GHS05, GHS07, GHS08, GHS09	Danger	7772–99–8	231–868–0	—
Tincture of iodine[b] (0,025 g/ml mass concentration ethanolic solution)[d]	10 ml	GHS02, GHS07, GHS08	Danger	7553–56–2	231–442–4	053–001–003
Urea[b]	10 g	—	—	57–13–6	200–315–5	—
Zinc powder (stabilized)/ zinc pellets	20 g	GHS09	Warning	7440–66–6	231–175–3	030–001–01–9
Zinc sulfate (heptahydrate)	20 g	GHS05, GHS07, GHS09	Danger	7446–20–0	231–793–3	030–006–00–9

[a] Only one of these substances shall be provided in each set.

[b] Generally, IUPAC chemical nomenclature is used with the exception of these substances.

[c] Only to be provided in chemistry sets intended for children over 12 years of age.

[d] Denatured alcohol (ethanol).

If indicators are supplied in solution, their solid contents shall not exceed the amounts and concentrations specified in Table 2.

Non-bleeding indicators in books, pads or rolls are not of toxicological concern and are sometimes supplied without any quantity limitations for the relevant indicator(s).

Table 2 — Maximum amounts and concentrations of indicators for chemistry sets and labelling

Chemical substance/mixture	Max. amount per set	GHS pictograms (see Figure 1)	Signal word	CAS number	EINECS number	INDEX number
Eosin	1 g	GHS07	Warning	17372–87–1	241–409–6	—
Iodine [0,025 g/ml mass concentration in an aqueous solution (0,025 g/ml mass concentration) of potassium iodide]	10 ml	GHS08	Warning	7553–56–2	231–442–4	053–001–00–3
Litmus blue	1 g	—	—	1393–92–6	215–739–6	—
Litmus red	1 g	—	—	1393–92–6	215–739–6	—
Luminol [5 % (mass fraction) mixture with sodium sulfate]	3 g	—	—	521–31–3	208–309–4	—
Methyl orange [15 % (mass fraction) mixture with sodium sulfate]	3 g	GHS07	Warning	547–58–0	208–925–3	—
Methylene blue	1 g	GHS07	Warning	61–73–4	200–515–2	—
Phenol red	1 g	GHS07	Warning	143–74–8	205–609–7	—
Thymol blue	1 g	—	—	76–61–9	200–973–3	—
Bleeding universal indicator paper	1 pad	—	—	—	—	—