Chemical Safety in Schools

20th August 2026

Stockholms universitet

KRC
Kemilärarnas resurscentrum

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Stockholm University

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National Resource centre for Chemistry teachers (KRC)

KRC supports chemistry teachers throughout Swedish primary and secondary school with the aim of promoting stimulating, interesting and up-to-date teaching. Support for chemistry teachers includes providing advice on experiments and other teaching materials, advising on safety and chemical matters, initiating and carrying out continuing education for teachers, and promoting increased contacts between schools and the chemical industry.

https://www.su.se/enheter/kemilararnas-resurscentrum

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In which bottles and cupboards should the chemicals be stored?

How often should emergency showers and eyewashes be checked?

Do chemicals get old? When should they be discarded?

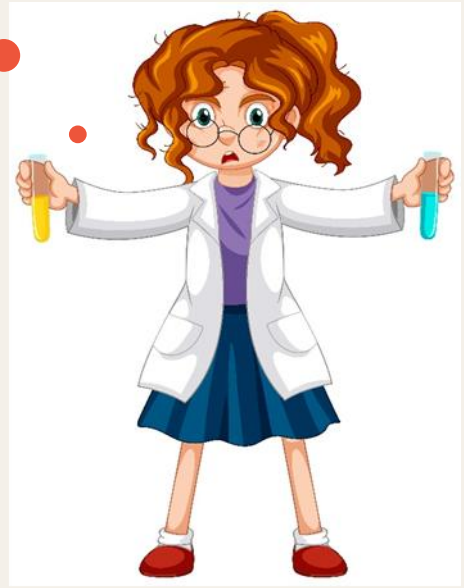

Image by brgfx on Freepik

What can (not) be poured down the sink?

Is it ok to only have safety data sheets online or do they have to be in paper form?

How should tasks be distributed?

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Times	Content
9.00	Chemical Legislation
10.00	**BREAK**
10.15	Chemical Inventory List and Substitution
11.15	Storage – Labelling – Waste
12.00	**Lunch**
13.00	Practical Task
14.30	Risk Assessment
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15.15	Routines, Distribution of tasks, using AI
16.00	Future plans/networking
16.30	End

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BREAK

Introductions:

Name

Subject(s)/levels you teach

Where?

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Swedish curriculum documents

- Years 4–6 Lgr22 (English)
- *Common household chemicals. Their use and impact on the environment and humans, and how they are labelled and should be handled*.
- Years 7–9 Lgr22 (English)
- *Observations and experiments using both analogue and digital tools. Formulate research questions, plan and perform experiments, evaluate results and document data with images, tables, diagrams and reports*.
- Gymnasiet/Upper secondary school Gy25 (swedish)
- *Experiments and practical work: collect data from observations, measurements and simulations. Formulate research questions and plan, risk assess and carry out systematic, scientific investigations*.

(20260326, translated from Swedish, no English version atm)

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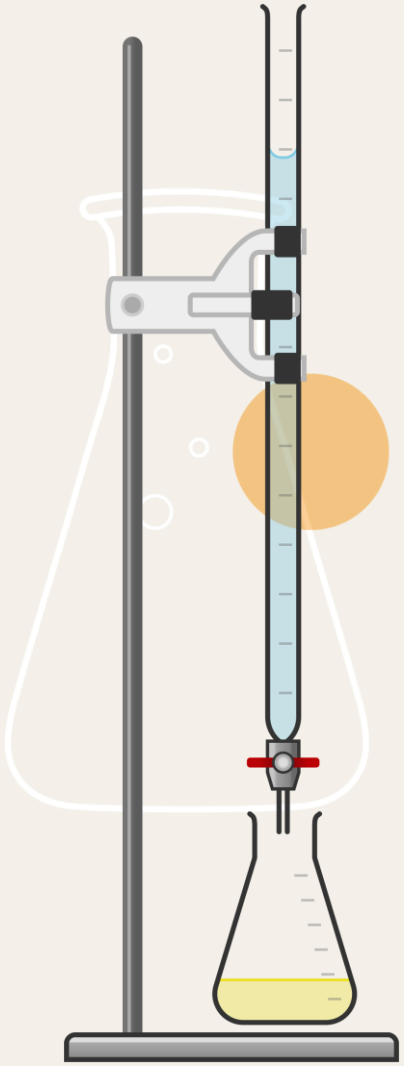
Are chemicals needed in education?

- The upper secondary school Thoren Business School Stockholm - is no longer allowed to offer the Science program, according to the Swedish School's Inspectorate decision (2024-05-20)

  https://www.svt.se/nyheter/inrikes/thorenskola-forlorar-tillstandet.

Some excerpts from the report.

- "the school is not equipped with fume hoods, which are needed when dangerous chemicals are to be handled in laboratories to protect the user from exposure to dangerous substances."
- "Since burettes, which are used for titrations, were missing in the school's science room, the School Inspectorate notes that it has not been possible to carry out experiments with titration."
- "The teaching has only on a few occasions included scientific work methods that include carrying out experiments where the students were given the opportunity to handle chemicals."



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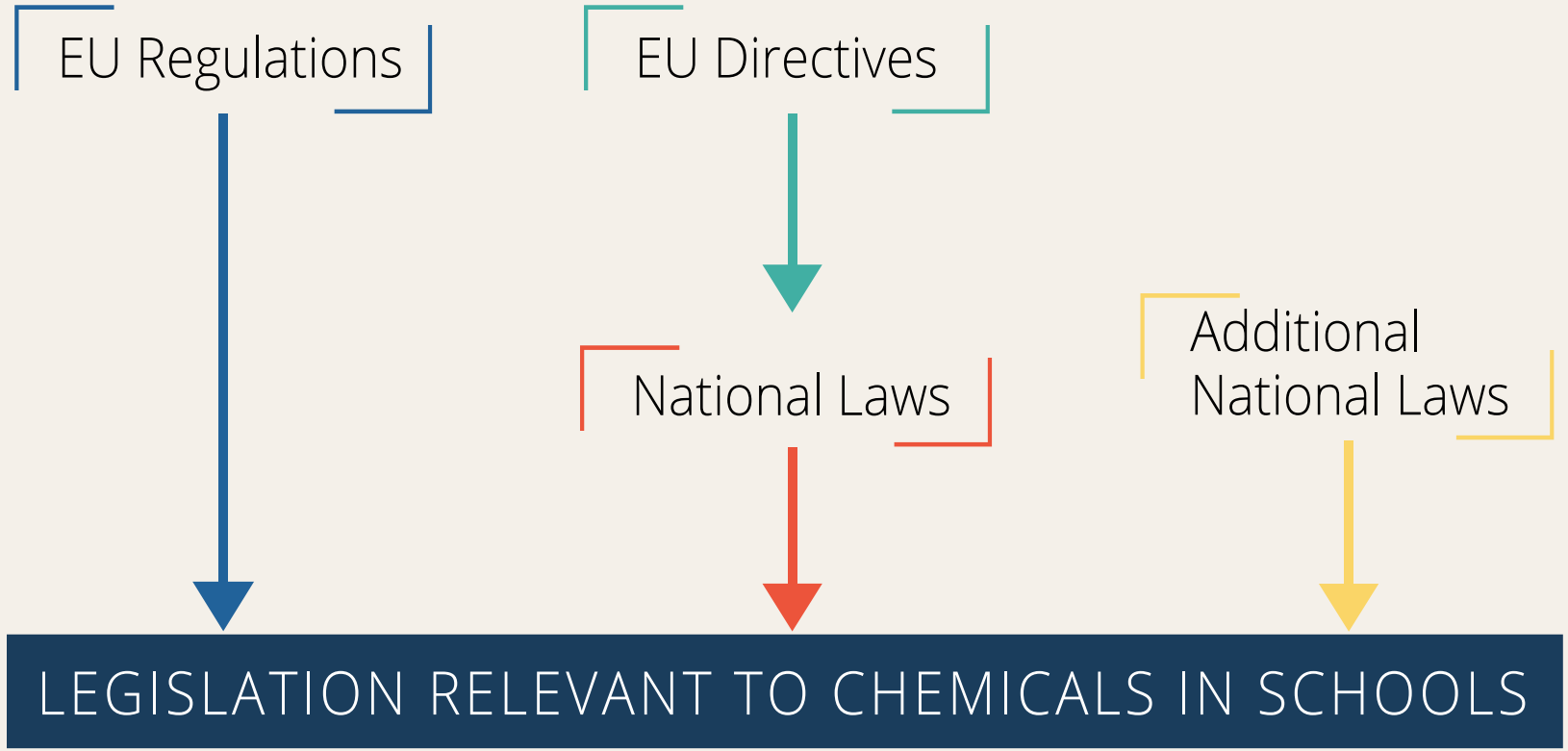
Chemicals legislation – our “safety belt”

Overview of European Chemicals Legislation



- The Classification, Labelling and Packaging Regulation **(CLP)**
- The Registration, Evaluation, Authorization and Restriction of Chemicals Regulation **(REACH)**

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General Principles of EU Chemical Law

Prevention principle

It is better to prevent than to repair.

Precautionary principle

Where there is uncertainty about the risk of environmental harm, the precautionary principle allows or requires protective measures to be taken without having to wait until the harm materialises.

Polluter pays principle

The one who causes pollution to the environment is responsible for paying for the damage.

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Authorities of relevance to school chemistry

Authority
Work environment
Handling of flammable and explosive substances
Nature, the environment and waste
School curricula
Information for chemical industry producers

Swedish Work Environment Authority

Myndigheten för civilt försvar

NATUR VÅRDS VERKET

Skolverket The National Agency for Education

KEMI Swedish Chemicals Agency

Stockholms stad

- Exercise of authority - make the laws - General advice - Inspections
- The authorities have no obligation to actively inform.
- Classroom work as well as teachers' pre- and post-work is covered.

Uppsala kommun

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The Swedish work environment authority (”AFS ar”)

AFS 2023:12 *om utformning av arbetsplatser* -describes, for example, how eye-washing and emergency showers should look and what kind of first aid equipment should be available in a work place.

AFS 2023:10, *Om risker i arbetsmiljön* –includes details on how to handle sources of chemical risk. Includes rules for handling of hazardous chemicals, risk assessment, documentation, information, risk-reducing methods, labelling, storage and rules for PPE.

AFS 2023:2, *om planering och organisering av arbetsmiljön - grundläggande skyldigheter för dig med arbetsgivaransvar*-covers areas such as working alone, working when under-18, pregnant or breast-feeding, threats of violence and organisation of the workplace and its social environment in order to prevent and handle unhealthy workloads.

AFS 2023:11 *om arbetsutrustning och personlig skyddsutrustning* - describes the rules for PPE from an employee’s and employer’s perspective.

NOTE: the actual AFS documents are not available in English, but there is quite a lot of general information on **av.se/en**

AFS 2023:1 *om systematiskt arbetsmiljöarbete – grundläggande skyldigheter för dig med* arbetsgivaransvar-describes how working on the working environment should be a ntaural part of the daily activity of a workplace.

The systematic working environment work includes some of the following:

- Students and teachers should know how to handle hazardous substances and understand their CLP-labelling, and hence be able to prevent damage to health, and accidents. If students or teachers are exposed to serious risks, there must be written instructions.
- Regular risk assessments should be carried out and measures taken, where necessary, to prevent damage. Measures which cannot be taken immediately should be documented in an action plan.

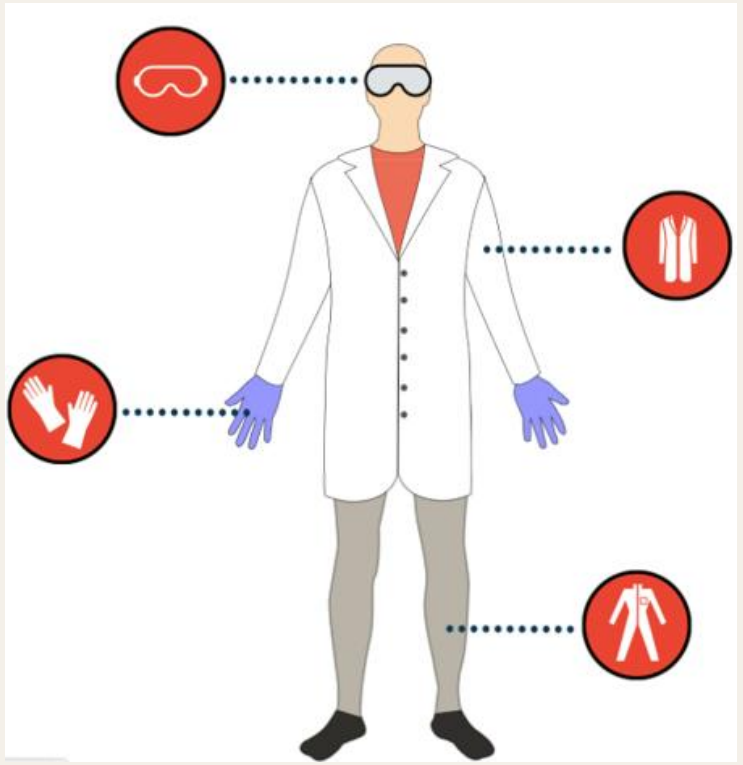
Design of the work place

AFS 2023:12

_https://www.av.se/arbetsmiljoarbete-och-inspektioner/publikationer/foreskrifter/afs-202312/?hl=2023:12

(in Swedish)

- Emergency shower, eye-wash station
- First aid
- Fire extinguisher
- Fire blankets
- Emergency exit



https://chimactiv.agroparistech.fr/en/securite/protection/protections-individuelles

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Eye protection

Acid in the eye:

https://chesse.org/h5p/?id=191

Contact lenses:https://chesse.org/h5p/?id=183

NOTE: these are ‘building blocks’ from CheSSE. We will look at, and evaluate, another one later.

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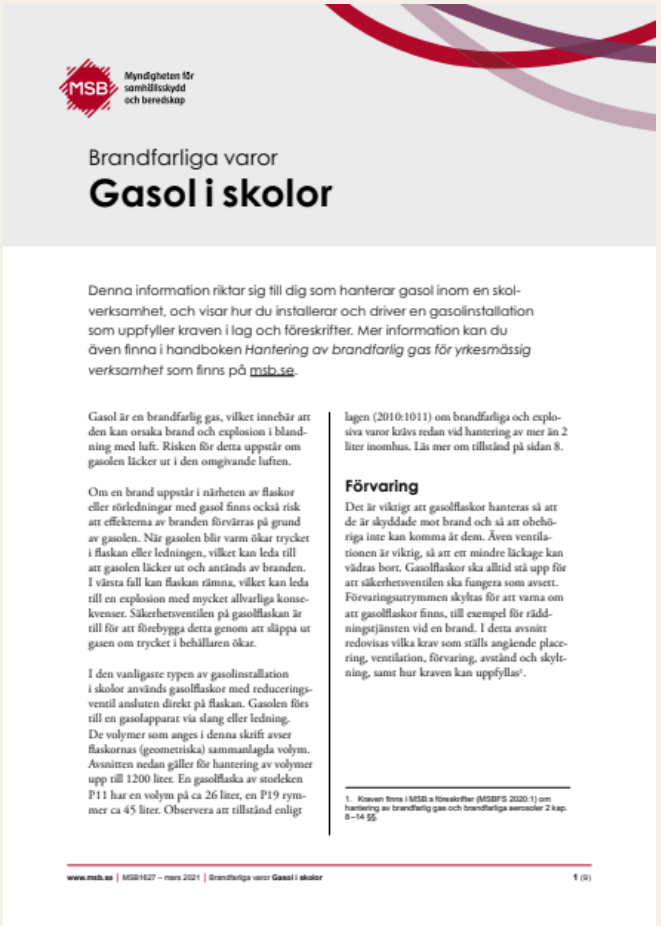
Flammable Substances-MCF (formerly MSB)

Flammable gases, liquids, fire-reactive and explosive substances.

If the school has more than 2 liters of LPG (4 small camping bottles), a permit is needed.

- → MSB: LPG in schools (in Swedish)
- → Manager of flammable goods (in Swedish)
- → CheSSE.org/sv/ about flammable goods (in Swedish)



Myndigheten för samhällsskydd och beredskap

Brandfarliga varor

Gasol i skolor

Denna information riktar sig till dig som hanterar gasol inom en skolverksamhet, och visar hur du installerar och driver en gasolinstallation som uppfyller kraven i lag och föreskrifter. Mer information kan du även finna i handboken *Hantering av brandfarlig gas för yrkesmässig verksamhet* som finns på msb.se.

Gasol är en brandfarlig gas, vilket innebär att den kan orsaka brand och explosion i blandning med luft. Risken för detta uppstår om gasolen läcker ut i den omgivande luften.

Om en brand uppstår i närheten av flaskor eller förledningar med gasol finns också risk att effekterna av branden förvärras på grund av gasolen. När gasolen blir varm ökar trycket i flaskan eller ledningen, vilket kan leda till att gasolen läcker ut och antänds av branden. I värsta fall kan flaskan rämna, vilket kan leda till en explosion med mycket allvarliga konsekvenser. Säkerhetsventilen på gasolflaskan är till för att förebygga detta genom att släppa ut gasen om trycket i behållaren ökar.

I den vanligaste typen av gasolinstallation i skolor används gasolflaskor med reduceringsventil ansluten direkt på flaskan. Gasolen förs till en gasolapparat via slang eller ledning. De volymer som anges i denna skrift avser flaskornas (geometriska) sammanlagda volym. Avsnitten nedan gäller för hantering av volymer upp till 1200 liter. En gasolflaska av storleken P11 har en volym på ca 26 liter, en P19 rymmer ca 45 liter. Observera att tillstånd enligt lagen (2010:1011) om brandfarliga och explosiva varor krävs redan vid hantering av mer än 2 liter inomhus. Läs mer om tillstånd på sidan 8.

Förvaring

Det är viktigt att gasolflaskor hanteras så att de är skyddade mot brand och så att obehöriga inte kan komma åt dem. Även ventilationen är viktig, så att ett mindre läckage kan vädras bort. Gasolflaskor ska alltid stå upp för att säkerhetsventilen ska fungera som avsett. Förvaringsutrymmen skyltas för att varna om att gasolflaskor finns, till exempel för räddningstjänsten vid en brand. I detta avsnitt redovisas vilka krav som ställs angående placering, ventilation, förvaring, avstånd och skyltning, samt hur kraven kan uppfyllas[1].

1. Kraven finns i MSB:s föreskrifter (MSBFS 2020:1) om hantering av brandfarlig gas och brandfarliga aerosoler 2 kap. 8–14 §§.

www.msb.se | MSB1627 – mars 2021 | Brandfarliga varor Gasol i skolor 1 (9)

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Precursors to Explosives

…… substances that can be used as starting materials in the manufacture of explosives.

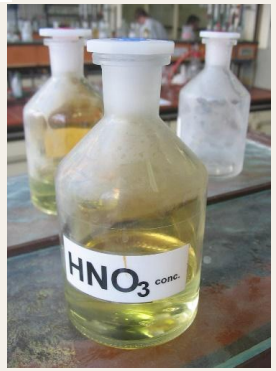
- EU-regulation 2019/1148 applies from 1st February 2021 (Examples in Appendices I and II)
- End user insurance
- Obligation to report thefts, disappearances and "suspicious transactions" within 24 hours. For example someone trying to gain access to precursors (who should not have it): prekursor@polisen.se or 114 14

Appendix I

- Hydrogen peroxide
- Nitromethane
- Nitric acid
- Potassium chlorate
- Sodium chlorate
- Potassium perchlorate
- Sodium perchlorate
- Sulfuric acid
- Ammonium nitrate

Appendix II

- Acetone
- Hexamine
- Potassium nitrate
- Sodium nitrate
- Calcium nitrate
- Calcium ammonium nitrate
- Magnesium nitrate
- Aluminum powder
- Magnesium powder



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Explosive mixtures

- *Solid or liquid substances or mixtures which in themselves, through chemical reaction, can produce gases at such a temperature and such a pressure, and at such a speed, that they can damage the surroundings.*
- The manufacture of explosive goods is subject to a permit according to **MSBFS 2025:2** (in Swedish):
- KRC courses/instructions (LINK to instructions in Swedish at KRC:
- KRC-explosive mixtures_instructions for demonstrations

Production of explosive mixtures for educational purposes (MSF website 7/5/2026)

It is common that schools want to produce explosive mixtures, such as sparklers (tomtebloss), in chemistry lessons. Production of up to 300g of sparkler mixture and production of gunpowder and pyrotechnical mixtures as demonstrations in a chemistry lesson do not need a permit, according to: 2 kap. 10 § **MCFFS 2026:4.**

This is on condition that the production is done in connection with a teacher-led lesson in schools or at university and that the amounts used are in accordance with the guidance in 2 kap. 10 § **MCFFS 2026:4.**

(LINK: Rules about explosive mixtures)

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Using pure ethanol--permission

Folkhälsomyndigheten
PUBLIC HEALTH AGENCY OF SWEDEN

In addition to what is stated in Ch. 6. Section 5 of the Alcohol Act on who has the right to buy technical alcohol the following applies:

Anyone who conducts school activities in accordance with the Schools Act (2010:800) and needs technical alcohol for teaching may purchase a maximum of 15 liters of technical alcohol per calendar year.

According to the Public Health Agency's regulations and general advice on technical spirits and alcoholic preparations (In Swedish: HSLF-FS 2022:63)

To produce ethanol in schools, permission is required from both the Public Health Agency of Sweden and the Tax Agency. Permission is **unlikely** to be granted.

Skatteverket

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BREAK

Legislation: https://chesse.org/legislation/

Questions:

1. would it be useful to have an English version of the instructions of explosive mixtures demonstrations?

2. Do you use pure ethanol for any experiments today?

FIKA

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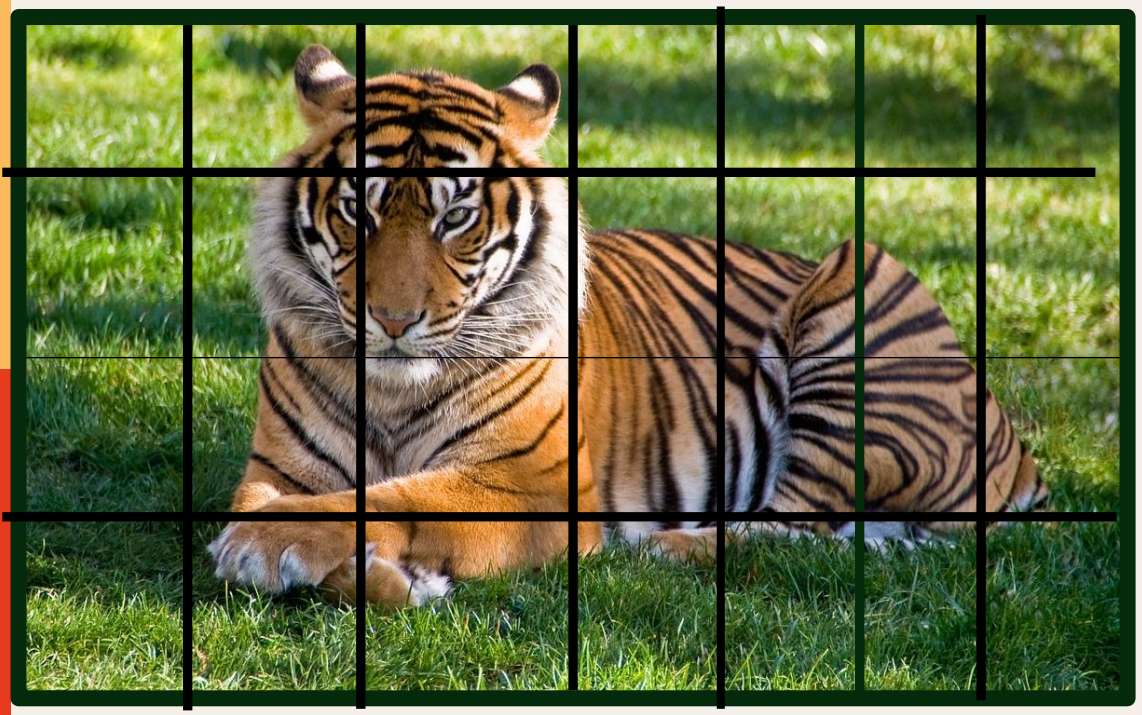
Chemicals with hazardous properties



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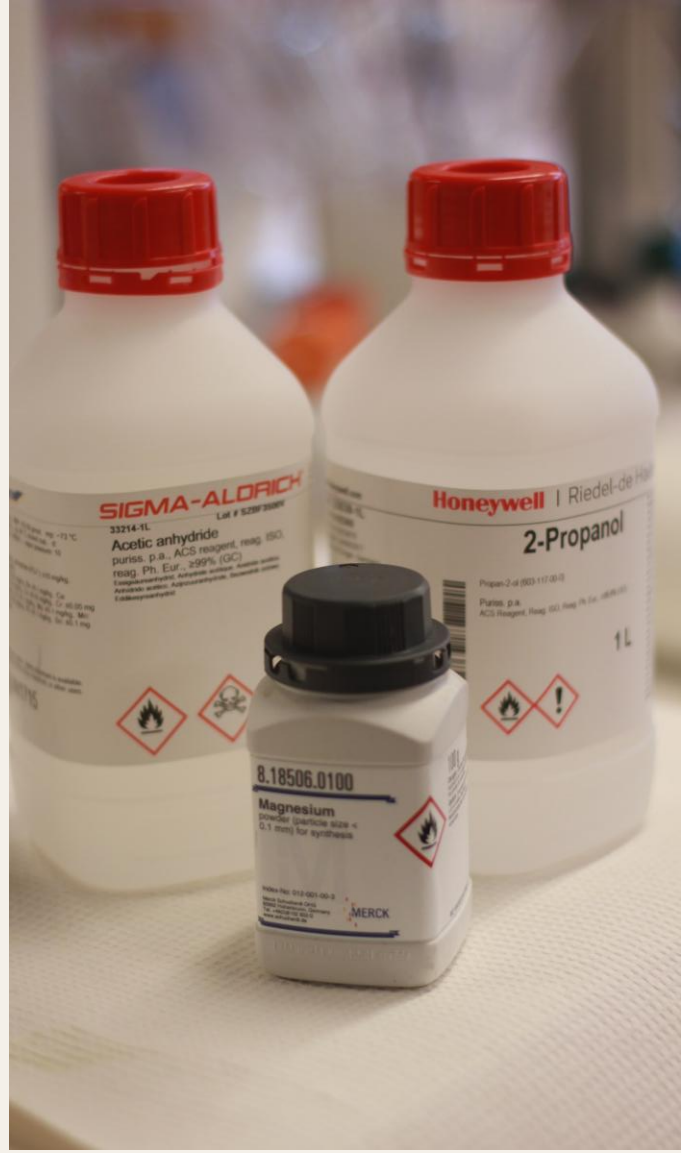
Chemical inventory (list)

7§ AFS 2023:10: *AFS-2023:10*

- the name and date of the listing;
- Hazardous properties - Hazard statements
- where a chemical hazard is stored, used or formed;
- hygienic limit value, if there is one (AFS 2018:1, in Swedish)
- other occupational safety and health regulations specific to the substance.



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Making a chemical inventory

Chesse has a section on this:

https://chesse.org/managing-chemical-safety/chemical-safety-routines/

[Name of school and department]

Chemical substance	Date	Concentration	Amount	Storage	Use	Signal word
Ammonia, NH_3	2022-12-09	c > 25 %, c > 13.4 M	1 L	Cupboard 2	laborations and demonstrations	Danger
Ammonia, NH_3	2022-12-09	1 < c < 3 %, 0.6 < c < 1.7 M	5 L	Cupboard 2	laborations and demonstrations	Warning

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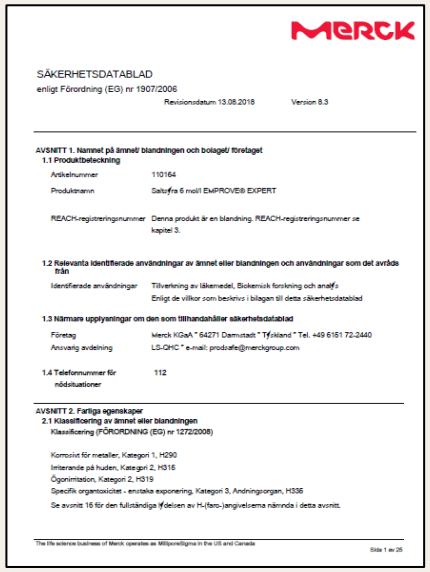
Where to find information about the properties of chemicals



MERCK

SÄKERHETSDATABLAD
enligt Förordning (EG) nr 1907/2006

Revisionsdatum 13.08.2018 Version 8.3

AVSNITT 1. Namnet på ämnet/ blandningen och bolaget/ företaget
1.1 Produktbeteckning
Artikelnummer 110164
Produktnamn Saltsyra 6 mol/l EMPROVE® EXPERT
REACH-registreringsnummer Denna produkt är en blandning. REACH-registreringsnummer se kapitel 3.

1.2 Relevanta identifierade användningar av ämnet eller blandningen och användningar som det avråds från
Identifierade användningar Tillverkning av läkemedel, Biokemisk forskning och analys
Enligt de villkor som beskrivs i bilagan till detta säkerhetsdatablad

1.3 Närmare upplysningar om den som tillhandahåller säkerhetsdatablad
Företag Merck KGaA * 64271 Darmstadt * Tyskland * Tel. +49 6151 72-2440
Ansvarig avdelning LS-QHC * e-mail: prodsafe@merckgroup.com

1.4 Telefonnummer för nödsituationer 112

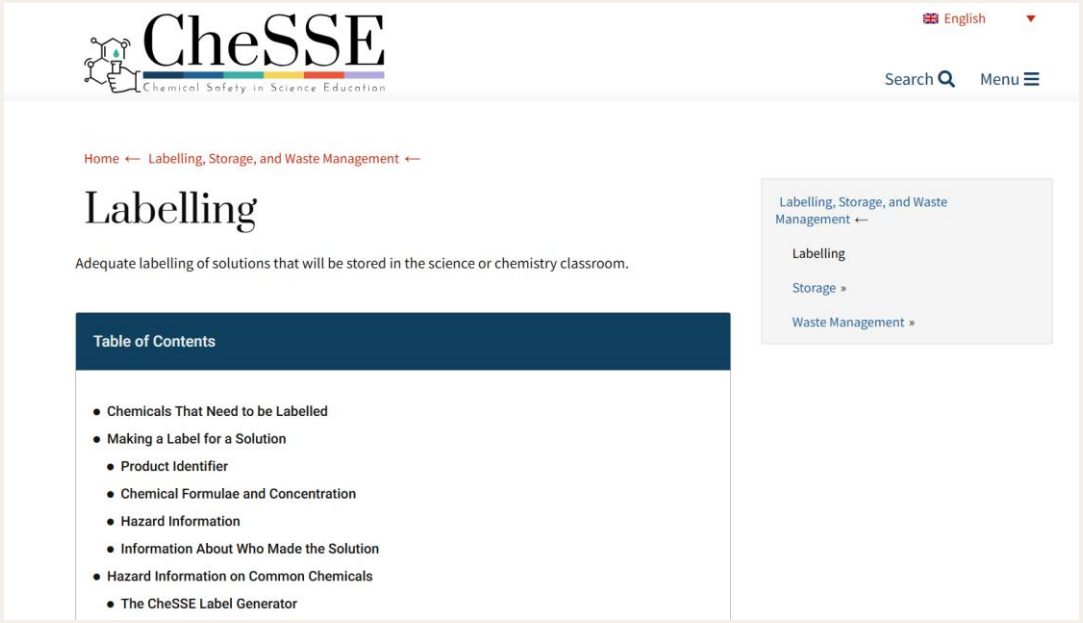
AVSNITT 2. Farliga egenskaper
2.1 Klassificering av ämnet eller blandningen
Klassificering (FÖRORDNING (EG) nr 1272/2008)

Korrosivt för metaller, Kategori 1, H290
Irriterande på huden, Kategori 2, H315
Ögonirritation, Kategori 2, H319
Specifik organtoxicitet - enstaka exponering, Kategori 3, Andningsorgan, H335
Se avsnitt 16 för den fullständiga lydelsen av H-(fara-)angivelserna nämnda i detta avsnitt.

The life science business of Merck operates as MilliporeSigma in the US and Canada

Sida 1 av 25

- SAFETY DATA SHEETS from chemical suppliers
- Chemical management system (KemRisk, Chemgroup, Klara…)
- KRC's chemical list
- CheSSE:s label generator for common chemicals



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Chemical Safety in Science Education

English

Search Menu

Home ← Labelling, Storage, and Waste Management ←

Labelling

Adequate labelling of solutions that will be stored in the science or chemistry classroom.

Table of Contents

- Chemicals That Need to be Labelled
- Making a Label for a Solution
  - Product Identifier
  - Chemical Formulae and Concentration
  - Hazard Information
  - Information About Who Made the Solution
- Hazard Information on Common Chemicals
  - The CheSSE Label Generator

Labelling, Storage, and Waste Management ←
Labelling
Storage »
Waste Management »

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The sections of a safety datasheet (SDS)

1	Identification of the substance	9	Physical and chemical properties
2	**Hazards identification**	10	Stability and reactivity
3	Composition and information on ingredients	11	Toxicological information
4	First aid measures	12	Ecological information
5	Fire fighting measures	13	Disposal considerations
6	Accidental release measures	14	Transport information
7	Handling and storage	15	**Regulatory information**
8	Exposure controls and personal protection	16	Other information

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Hazard and Precautionary statements (CLP)

- https://chesse.org/labelling-storage-waste-management/labelling/

Overview of codes for hazard (H-) statements according to CLP.

CODE	TYPE OF HAZARD
H200–H299	Physical hazard
H300–H399	Health hazard
H400–H499	Environmental hazard

Overview of codes for precautionary (P-) statements according to CLP.

CODE	TYPE OF PRECAUTION
P100–P199	General
P200–P299	Prevention
P300–P399	Response (measures)
P400–P499	Storage
P500–P599	Disposal

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HCl example

Concentration	Hazard pictograms	Signal word	H phrases	P-phrases
C ≥ 6.8 M C ≥ 25%		Danger	Causes serious corrosive damage to skin and eyes. May cause respiratory irritation.	Use eye protection. IF SWALLOWED: Rinse mouth. DO NOT induce vomiting. IF ON SKIN (or hair): Immediately remove all splashed clothing. Rinse skin with water [or shower]. IF IN EYES: Rinse carefully with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a doctor immediately.
6.8 M > C ≥ 2.7 M 25% > C ≥ 10%		Warning	Causes skin irritation. Causes serious eye irritation. May cause respiratory irritation.	Wash hands thoroughly after handling. Use eye protection. IF IN EYES: Rinse carefully with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Seek medical attention.
C < 2.7 M C < 10%	 Not subject to labelling			

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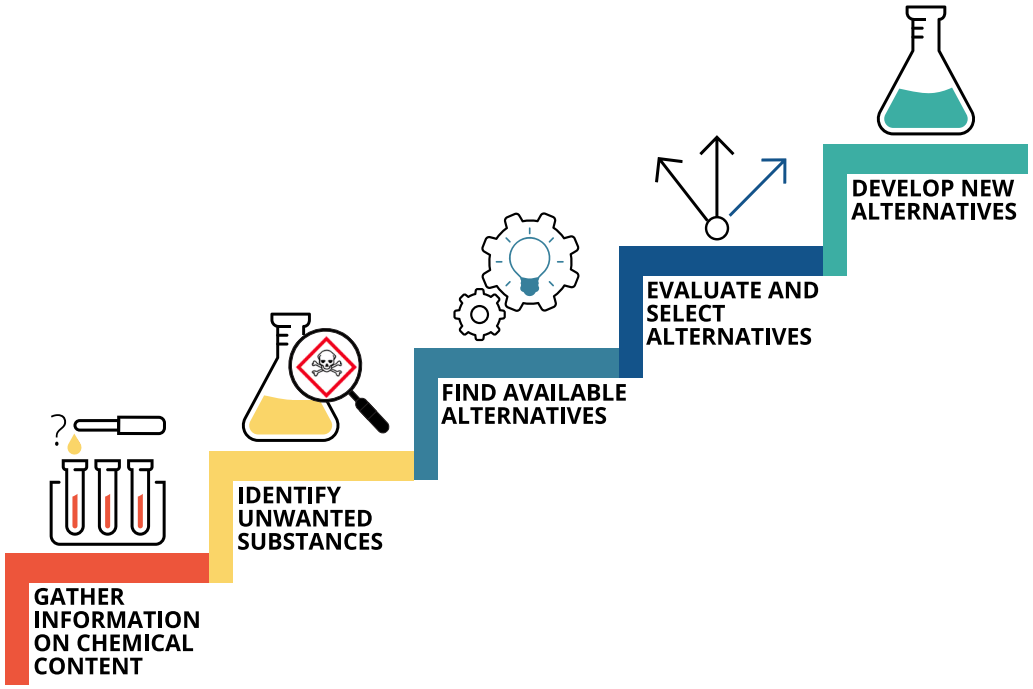
Substitution

https://chesse.org/risk-assessment-and-substitution/substitution/



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Example from CheSSE

Irene Gustafsson, 2021

Copper sulfate, 1 M (<3 Liter)	
Use	Demonstrations and laboratories such as the conductivity of liquids, environmentally hazardous heavy metals and comparisons between molecular compounds and ionic compounds.
Risks	Low risk in use. Solutions are prepared by the responsible teacher. Students only use ready-made solutions. Low risk in waste management. Waste is disposed of as heavy metal solution. Overall, the risk of exposure and spread in the environment was low.
Alternative	A fully adequate alternative does not currently exist.
Phasing out	Will take place when adequate alternatives are available. Continuous control of possible alternatives takes place every academic year.

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STORAGE

https://chesse.org/labelling-storage-waste-management/storage/

CABINET	STORAGE REQUIREMENT(S)	HAZARD PICTOGRAM
Cabinet 1: ▪ OXIDISING AGENTS	Separated from flammable substances. Metal cabinet.	
Cabinet 2: ▪ FLAMMABLES – including organic solvents ▪ WATER REACTIVE SUBSTANCES	Ventilated metal cabinet. Notes: Flammable chemicals can catch fire spontaneously. Water reactive substances can react violently in contact with water.	
Cabinet 3: ▪ ACIDS – both organic and inorganic	Ventilated cabinet. Store containers below eye level. Advice: Concentrated acids should be stored in secondary containers.	
Cabinet 4: ▪ BASES – both organic and inorganic	Ventilated cabinet. Store containers below eye level. Advice: Concentrated bases should be stored in secondary containers.	
Cabinet 5: ▪ TOXIC – acute toxicity, carcinogenic, mutagenic and toxic for reproduction (CMR). Aquatic acute.	Cabinet, ventilated if containing volatile substances.	
Cabinet 6: ▪ GASES – propane/butane burners (flammable) and hydrogen	Ventilated, fire-proof cabinet. Do not store near flammable chemicals. The cabinet has to be marked with a yellow “gas under pressure” sign.	

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Which pictogram is most important?

If a chemical has several hazard pictograms, it should be stored in the highest priority category. The image shows the order of priority

- Oxidizing agents have the highest priority followed by flammable substances.

Examples of oxidizing substances:

- nitrates (NO_3^-)
- chlorates (ClO_3^-)
- perchlorates (ClO_4^-)
- hydrogen peroxide (H_2O_2)
- permanganates (MnO_4^-).

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Storing chemicals together

Table of possibilities of co-storage of chemicals.

	OXIDIZING	FLAMMABLE	CORROSIVE: ACID	CORROSIVE: BASE	HEALTH HAZARD / TOXIC
OXIDIZING	Compatible	Not compatible	Store according to SDS Section 7 and 10	Store according to SDS Section 7 and 10	Store according to SDS Section 7 and 10
FLAMMABLE	Not compatible	Compatible	Not compatible	Not compatible	Store according to SDS Section 7 and 10
CORROSIVE: ACID	Store according to SDS Section 7 and 10	Not compatible	Compatible	Not compatible	Not compatible
CORROSIVE: BASE	Store according to SDS Section 7 and 10	Not compatible	Not compatible	Compatible	Store according to SDS Section 7 and 10
HEALTH HAZARD / TOXIC	Store according to SDS Section 7 and 10	Store according to SDS Section 7 and 10	Not compatible	Store according to SDS Section 7 and 10	Compatible

Examples of 'bad' storage:

- **Acids - bases** e.g. NH_3 and HCl
- **Flammable – oxidizing**

  for example Mg (powder) and $KMnO_4$ or KIO_4
- **Flammable liquids - flammable gas,** e.g. ethanol and hydrogen

In practice, it is not easy to achieve this - you have to do your best.

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Storage of gases (flammable and non-flammable)

•**Flammable gases, LPG and hydrogen gas:** in EI 30 cabinet
(Pragmatic fire engineer thinks that hydrogen gas can be stored together with LPG with a partition or distance.)

- **Non-combustible gases** : oxygen, nitrogen, carbon dioxide, compressed air.
- **NOTE:** Asphyxiating gases such as CO_2 – requires good ventilation

Flammable goods: LPG in schools (msb.se, in Swedish)

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Minimum requirements for labelling

Own solutions must be marked with

- name
- hazard pictogram
- pictogram text
- Special info, e.g. about CMR
- (Date and name of the person who made the solution may be handy)
- The goal is for the user to have the right information.
- (AFS 2011:19 SV)

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Additional concerns

Pregnant and lactating women--- Special caution

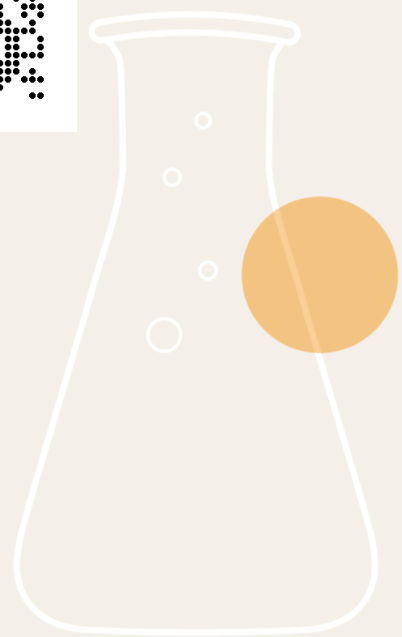
”Phase-out” substances SVHC—substance of very high concern)- should not be used, for example:

- **CMR** - Carcinogenic, Mutagenic and Reproductive inhibitory. E.g., phenolphthalein, gasoline.

- Particularly (environmentally) hazardous metals) hazardous metals. E.g., cobalt chloride and lead.

”Priority risk-reduction” substances

- Acutely toxic, allergenic and environmentally hazardous E.g., substances. Bromine, heptane , copper sulfate, potassium permanganate.



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BREAK

- Make a label for **3M HNO_3** using the CheSSE label generator.

[Label generator CheSSE]

- *Look at the 'educational resources' section of CheSSE where there is a tutorial in how to use the label generator.*

What do you think?

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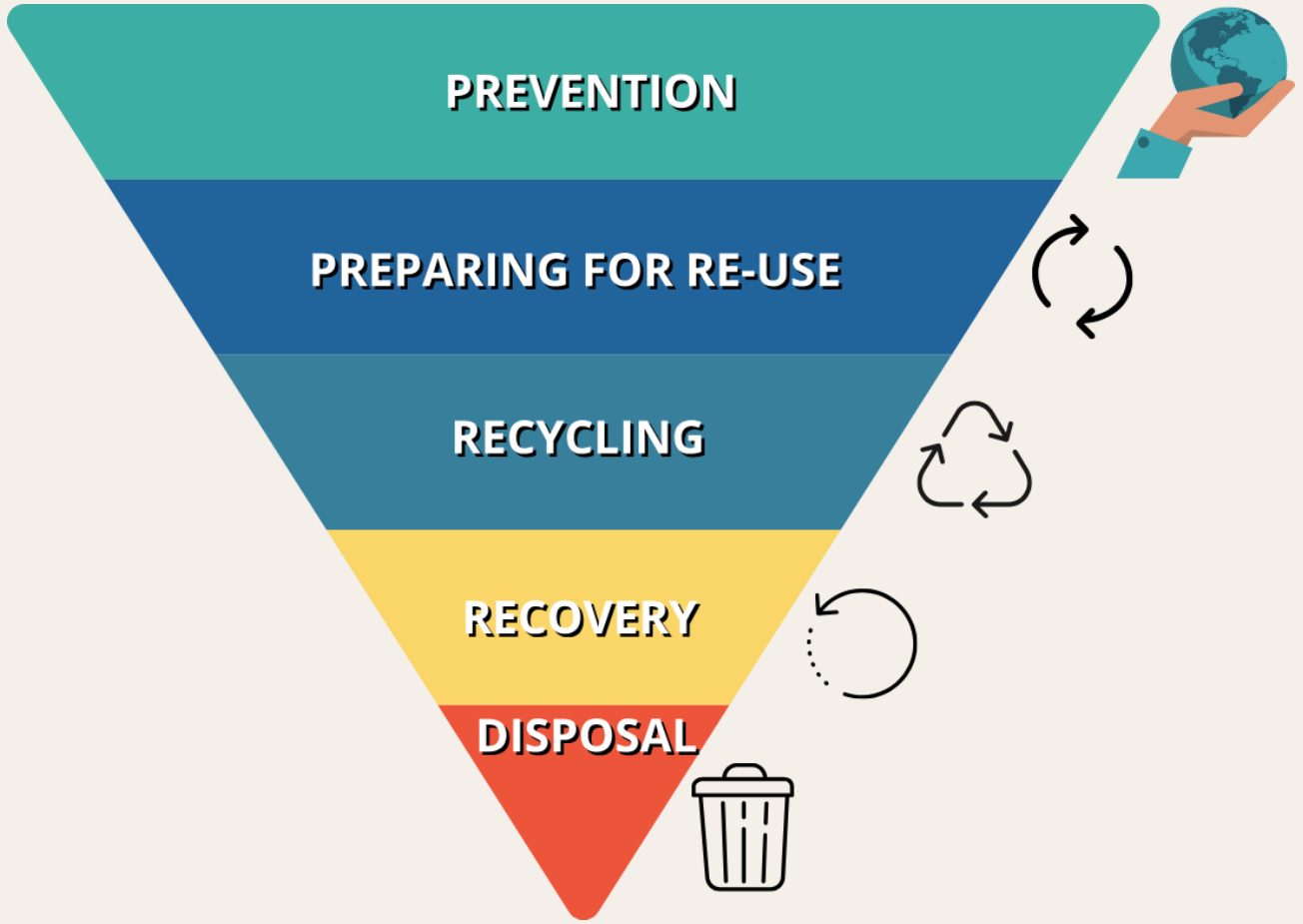
Waste Management

- Waste management CheSSE



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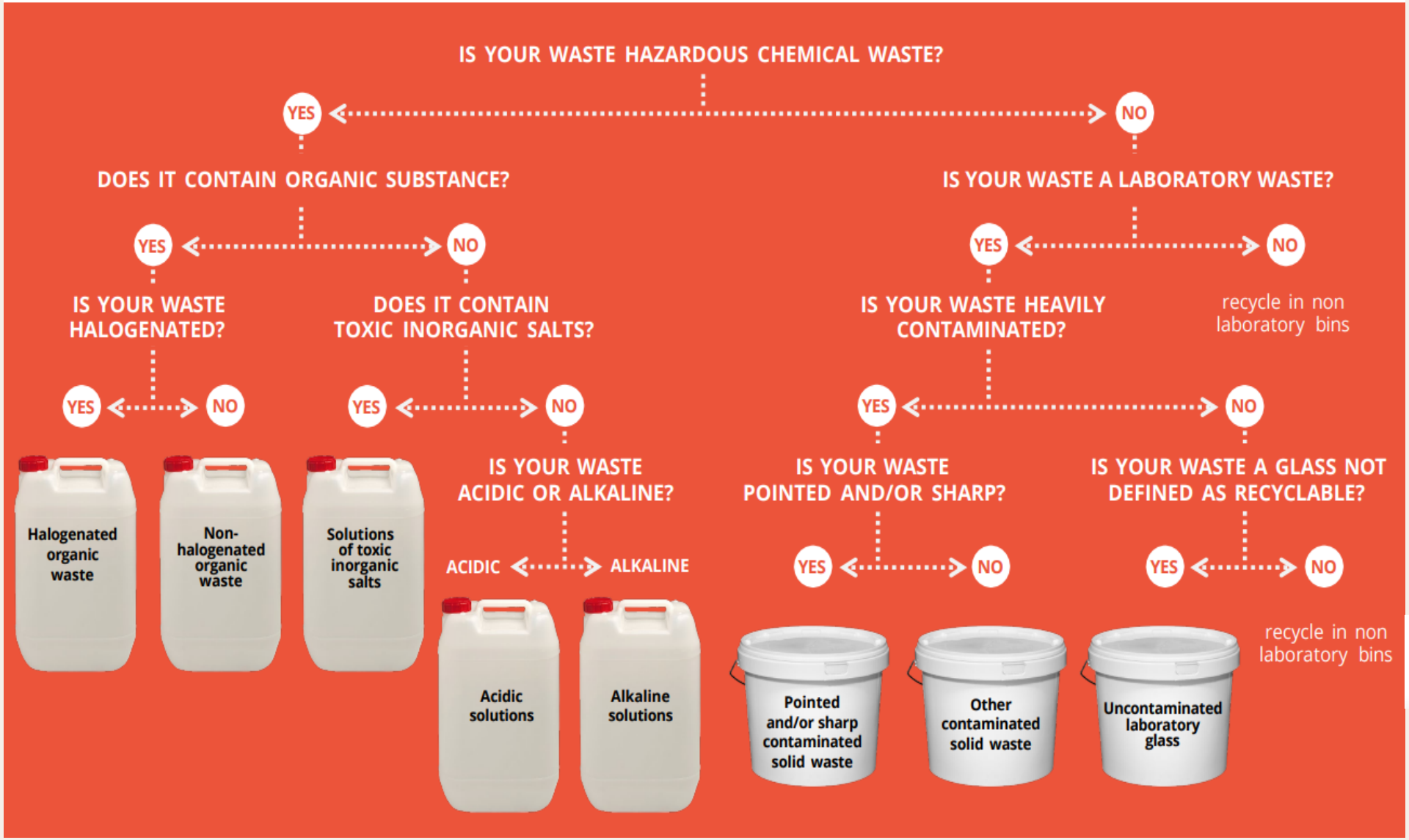
WASTE STORAGE DECISION TREE



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Waste management

CheSSE
Chemical Safety in Science Education

Note: This is a template. Delete this red text in your finished version. Before use, the text below must be adapted to the local conditions at the school.

Routines for Handling Hazardous Waste

This document was last reviewed [date] by [name]

Purpose

This routine describes how the school handles hazardous waste, using a hazardous waste station. To establish a hazardous waste station that suits the needs of your school, follow the advice on chesse.org/waste-management/.

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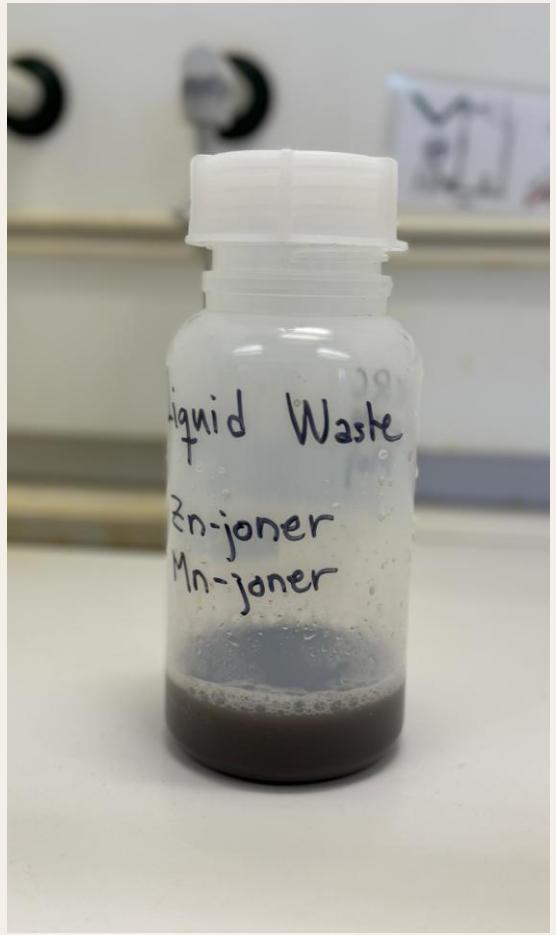
Waste management

- The environmental office in your municipality should be able to answer how the waste should be handled and sorted.
- There may be different regional rules.
- Waste containers must also be clearly marked for appropriate handling and storage
- Have clear procedures in the workplace for waste management.
- How to inform staff and students?
- How often should pick-up take place?



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Waste Containers

	type of hazardous waste	Storage
1	Environmentally hazardous inorganic salts*	Plastic can without lid
2	Organic substances without halogens	Plastic can** with lid in a ventilated area
3	Halogenated organic substances	Plastic can* with a lid in a ventilated area
4	Metal powder (pieces are reused)	Tin container with lid
5a	Regular soda glass (bottles, simple test tubes)	Glass breaker container
5b	Heat-resistant borosilicate glass (e.g Durex)	Crushed glass container (**landfill**)
6	(Mineral acids and bases)	Dilute or neutralize before pouring
7	(Biological hazard waste)	

** The following metal ions can be poured down the drain: Na, K, Li, Ca, Mg*

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Waste containers

- Waste containers must be solvent-resistant vessels.
- Waste containers are usually made of polypropylene (PP) and polyethylene (PE).

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Break/discussion

1. How have you organized the handling and storage of hazardous waste at your workplace?

2. How is the collection of hazardous waste organized at your workplace?

LUNCH 12-13.00

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Times	Content
9.00	Chemical Legislation
10.00	**BREAK**
10.15	Chemical Inventory List and Substitution
11.15	Storage – Labelling – Waste
12.00	**Lunch**
13.00	Practical Tasks
14.30	Risk Assessment
15.00	**Fika**
15.15	Routines, Distribution of tasks, using AI
16.00	Future plans/networking
16.30	End

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Practical Tasks : 13.00-14.30 in M330

1. **Bioplastics**: we will do Experiment 1A and make bioplastics 1 and 2 using tapioca flour.

2. Explosive mixtures 4 ab– potassium nitrate and (a) C, (b) sugar

-- we will try out a demonstration from the explosive mixtures one-day course.

BREAK

Did you find the practical tasks useful?

Would you use them in school?

……..

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Times	Content
9.00	Chemical Legislation
10.00	**BREAK**
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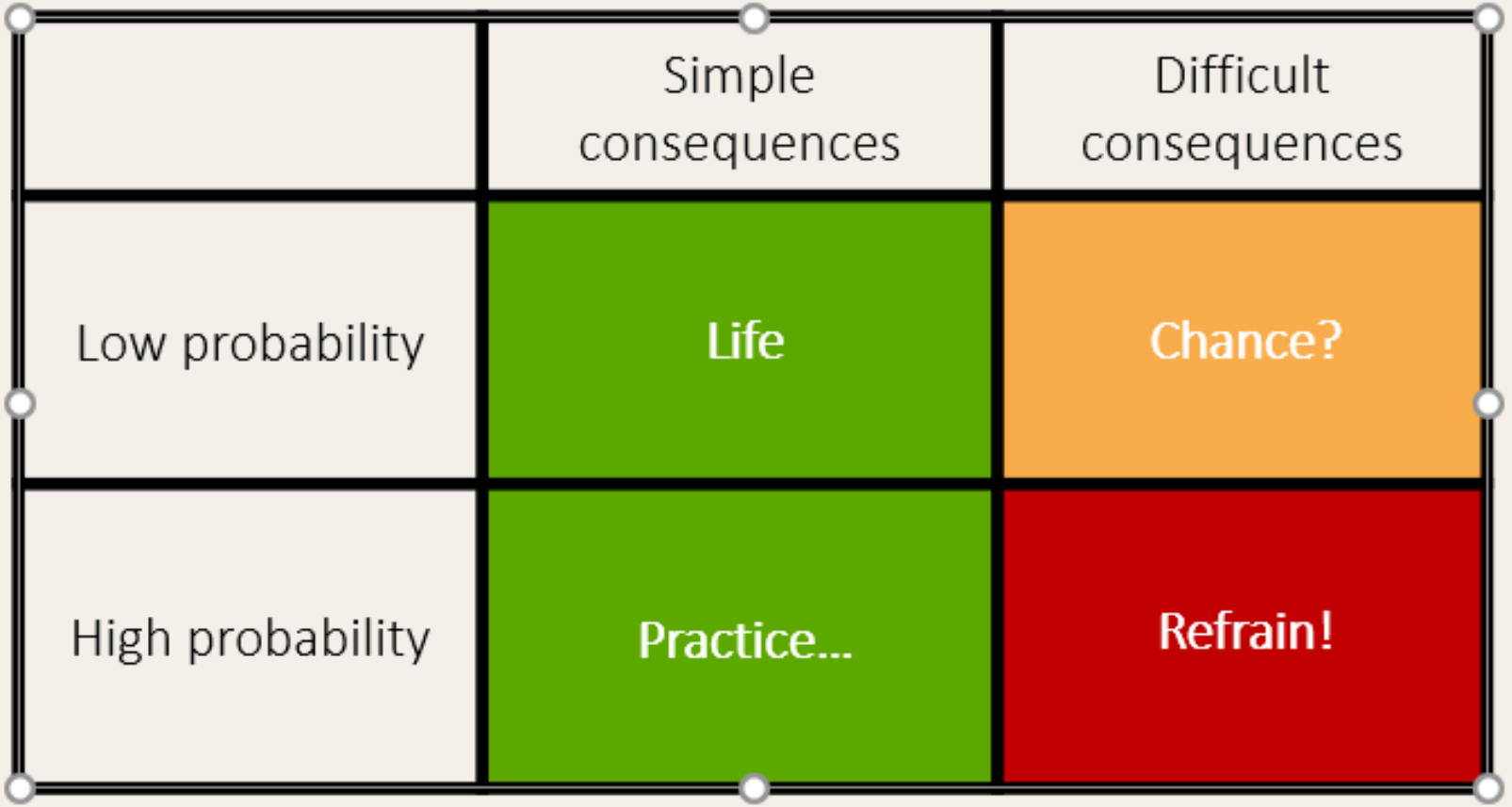
Risk assessment -- general



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Risk assessment rules: AFS 2023:10

AFS-2023:10 Chemical risks

The workplace (school) must

- identify ***sources of risk*** , (chemicals/work elements)
- take protective **measures** and **precautions**,
- provide workers (teachers/students) with **information** about risks
- Have **written documentation** that is dated, signed and available.
- Employers must also keep a register of workers who have been exposed to unhealthy levels of reproductive toxic substances. These records must be kept for at least 5 years.

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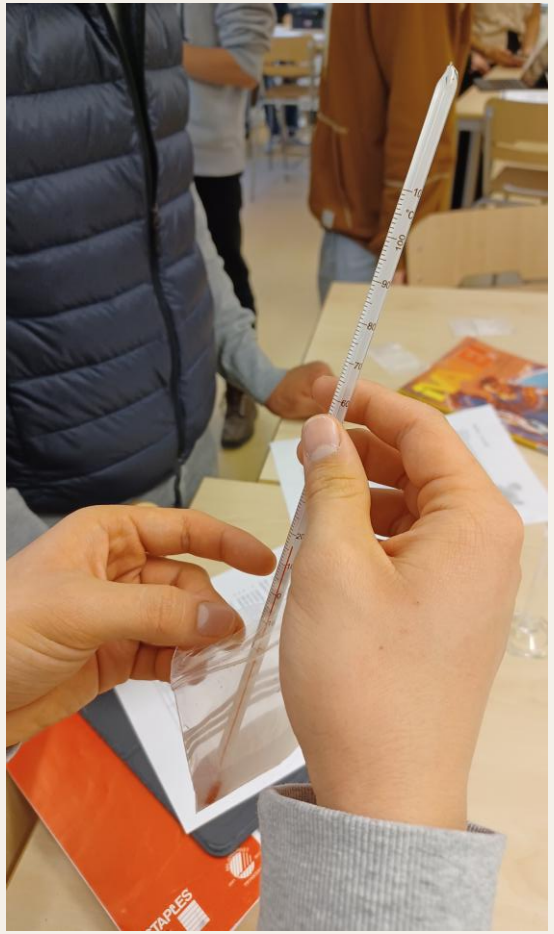
Factors to consider

- Teacher demonstration or student activity
- The students’ previous experience, e.g. to boil in test tubes, to handle burners
- Classroom/group size
- Access to protective equipment
- The teacher's experience
- What happens if you have done something "wrong" in your risk assessment?



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In schools

The risk assessment

- should be useful and accessible.
- could be made starting from other people's/textbook templates.
- Could be made in various forms (digital, or paper)

Group risk assessments

What risk is assessed?	Protective equipment	Other measures?	Who attends?
Teacher's work with concentrated acids	Coat, goggles, gloves, fume hood	The work must not be carried out alone	Employer Chemistry teacher
Ester synthesis	Lab coat, hair up, safety glasses, fume hood	See separate risk assessment	The NV teachers
Work with burners	Lab coat, hair up	Requirements for a burner driver's license according to Appendix X	Teacher in NV, principal
Replacement of LPG bottles	None in particular	Use leak spray, see routine X	Superintendent of flammable goods

Risk assessment of demonstrations/experiments

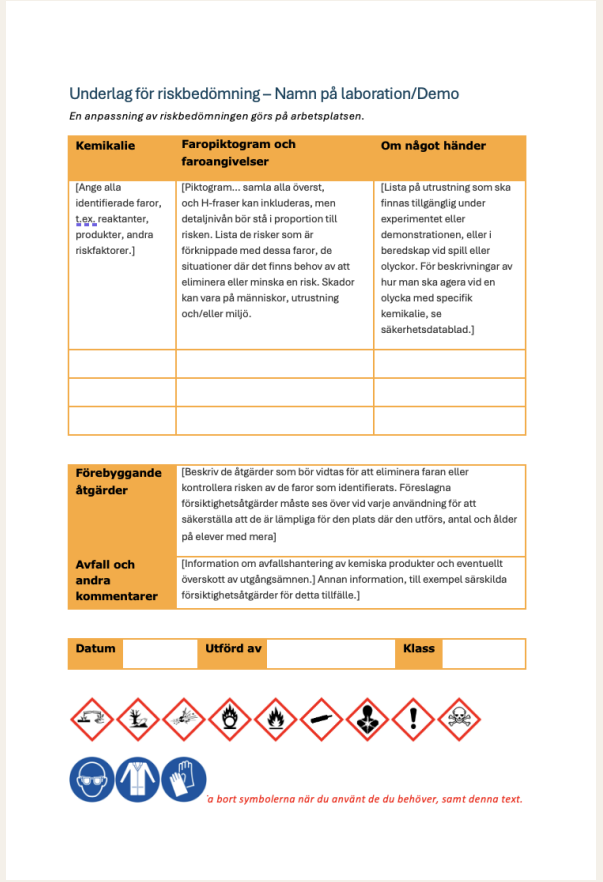
- CheSSE template

[Risk assessment template CheSSE]

- **Tutorials** for using the template:

[Tutorial completing-the-risk-assessment-template CheSSE]

[Example risk-assessment-titration-of-lemon-soda]



Underlag för riskbedömning – Namn på laboration/Demo

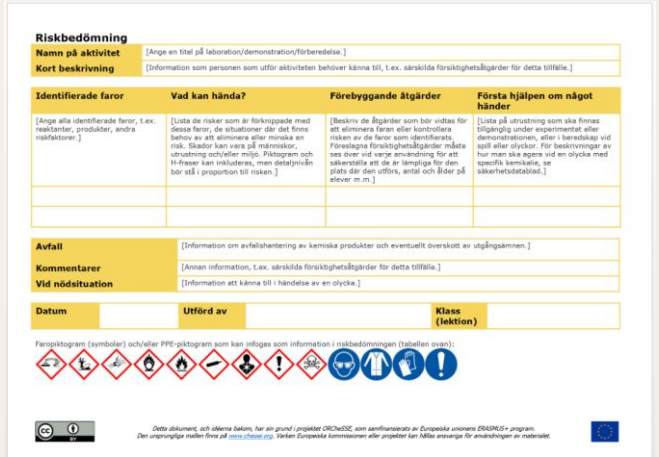
En anpassning av riskbedömningen görs på arbetsplatsen.

Kemikalie	Faropiktogram och faroangivelser	Om något händer
[Ange alla identifierade faror, t.ex. reaktanter, produkter, andra riskfaktorer.]	[Piktogram... samla alla överst, och H-fraser kan inkluderas, men detaljnivån bör stå i proportion till risken. Lista de risker som är förknippade med dessa faror, de situationer där det finns behov av att eliminera eller minska en risk. Skador kan vara på människor, utrustning och/eller miljö.	[Lista på utrustning som ska finnas tillgänglig under experimentet eller demonstrationen, eller i beredskap vid spill eller olyckor. För beskrivningar av hur man ska agera vid en olycka med specifik kemikalie, se säkerhetsdatablad.]

Förebyggande åtgärder	[Beskriv de åtgärder som bör vidtas för att eliminera faran eller kontrollera risken av de faror som identifierats. Föreslagna försiktighetsåtgärder måste ses över vid varje användning för att säkerställa att de är lämpliga för den plats där den utförs, antal och ålder på elever med mera]
Avfall och andra kommentarer	[Information om avfallshantering av kemiska produkter och eventuellt överskott av utgångsämnen.] Annan information, till exempel särskilda försiktighetsåtgärder för detta tillfälle.]

Datum		**Utförd av**		**Klass**	

'a bort symbolerna när du använt de du behöver, samt denna text.



Riskbedömning

Namn på aktivitet	[Ange en titel på laboration/demonstration/förberedelse.]
Kort beskrivning	[Information som personen som utför aktiviteten behöver känna till, t.ex. särskilda försiktighetsåtgärder för detta tillfälle.]

Identifierade faror	Vad kan hända?	Förebyggande åtgärder	Första hjälpen om något händer
[Ange alla identifierade faror, t.ex. reaktanter, produkter, andra riskfaktorer.]	[Lista de risker som är förknippade med dessa faror, de situationer där det finns behov av att eliminera eller minska en risk. Skador kan vara på människor, utrustning och/eller miljö. Piktogram och H-fraser kan inkluderas, men detaljnivån bör stå i proportion till risken.]	[Beskriv de åtgärder som bör vidtas för att eliminera faran eller kontrollera risken av de faror som identifierats. Föreslagna försiktighetsåtgärder måste ses över vid varje användning för att säkerställa att de är lämpliga för den plats där den utförs, antal och ålder på elever m.m.]	[Lista på utrustning som ska finnas tillgänglig under experimentet eller demonstrationen, eller i beredskap vid spill eller olyckor. För beskrivningar av hur man ska agera vid en olycka med specifik kemikalie, se säkerhetsdatablad.]

Avfall	[Information om avfallshantering av kemiska produkter och eventuellt överskott av utgångsämnen.]
Kommentarer	[Annan information, t.ex. särskilda försiktighetsåtgärder för detta tillfälle.]
Vid nödsituation	[Information att känna till i händelse av en olycka.]

Datum		**Utförd av**		**Klass (lektion)**	

Faropiktogram (symboler) och/eller PPE-piktogram som kan infogas som information i riskbedömningen (tabellen ovan):

Detta dokument, och idéerna bakom, har sin grund i projektet ORCheSSE, som samfinansierats av Europeiska unionens ERASMUS+ program. Den ursprungliga mallen finns på www.chesse.org. Varken Europeiska kommissionen eller projektet kan hållas ansvariga för användningen av materialet.

Krc template

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BREAK

Any questions/reflections?

FIKA

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Times	Content
9.00	Chemical Legislation
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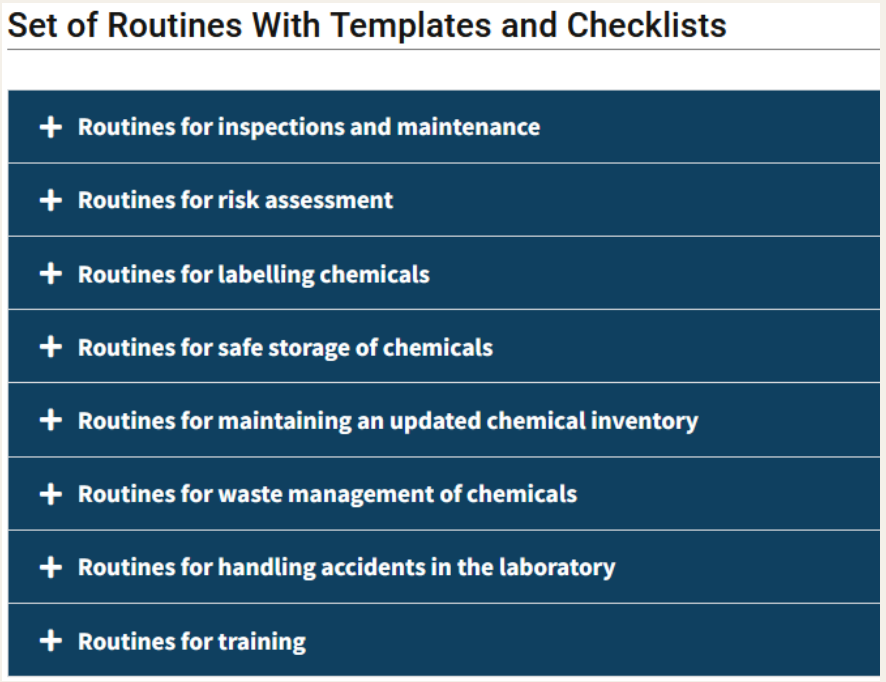
Routines

Templates for written procedures are needed for recurring tasks that can be used as a starting point for.

- Control of protective equipment
- Risk assessment
- Waste disposal
- Purchase
- Cleaning

CheSSE_routines



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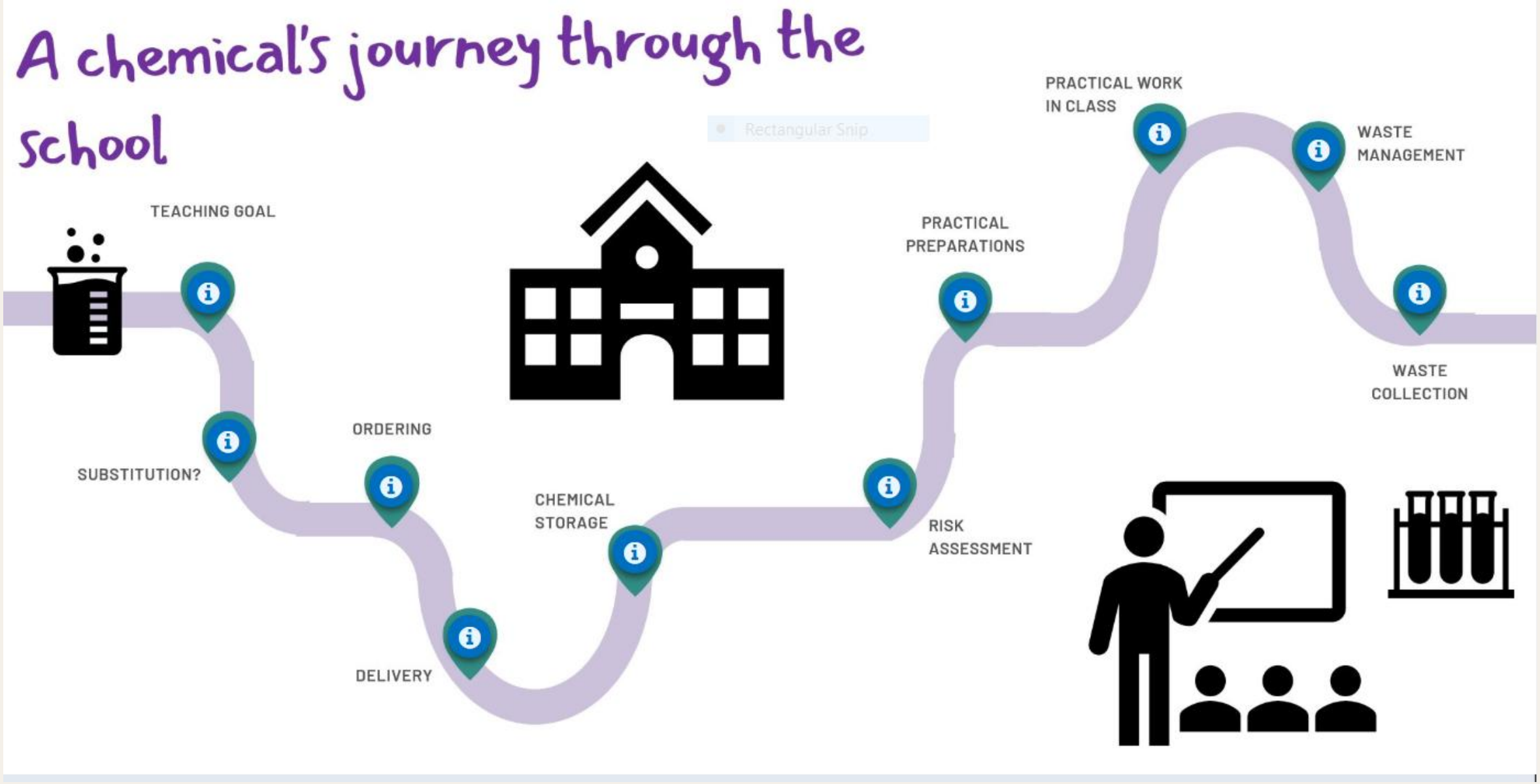

https://chesse.org/the-chemicals-journey-through-school/

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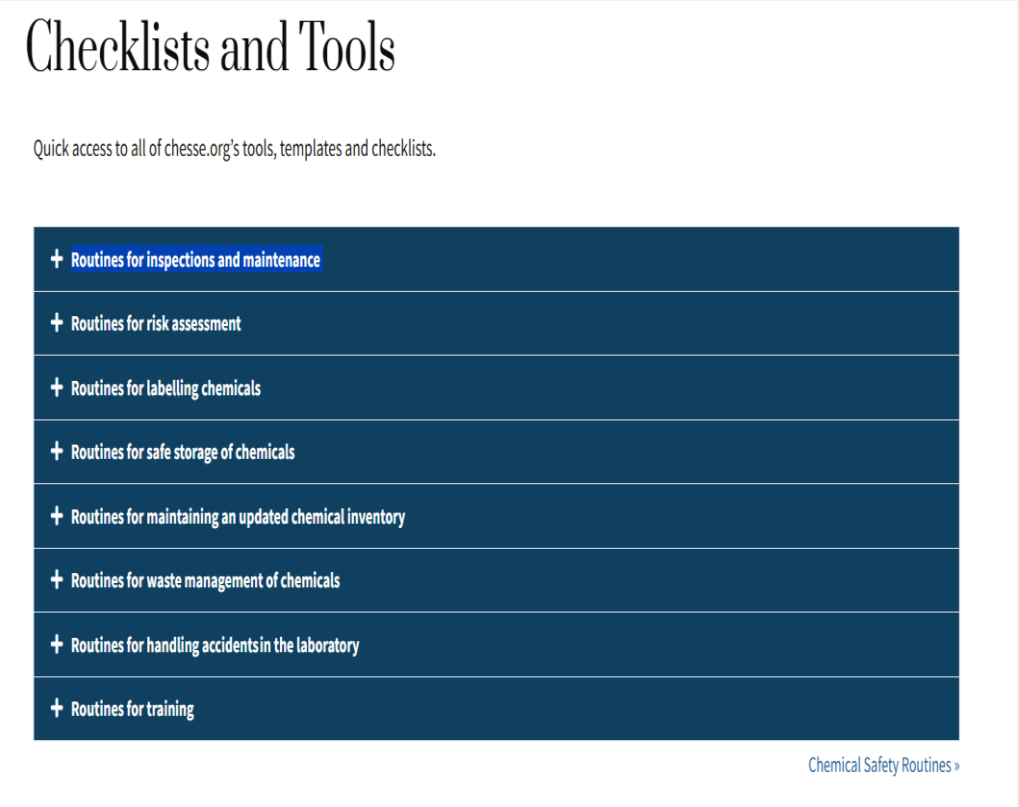
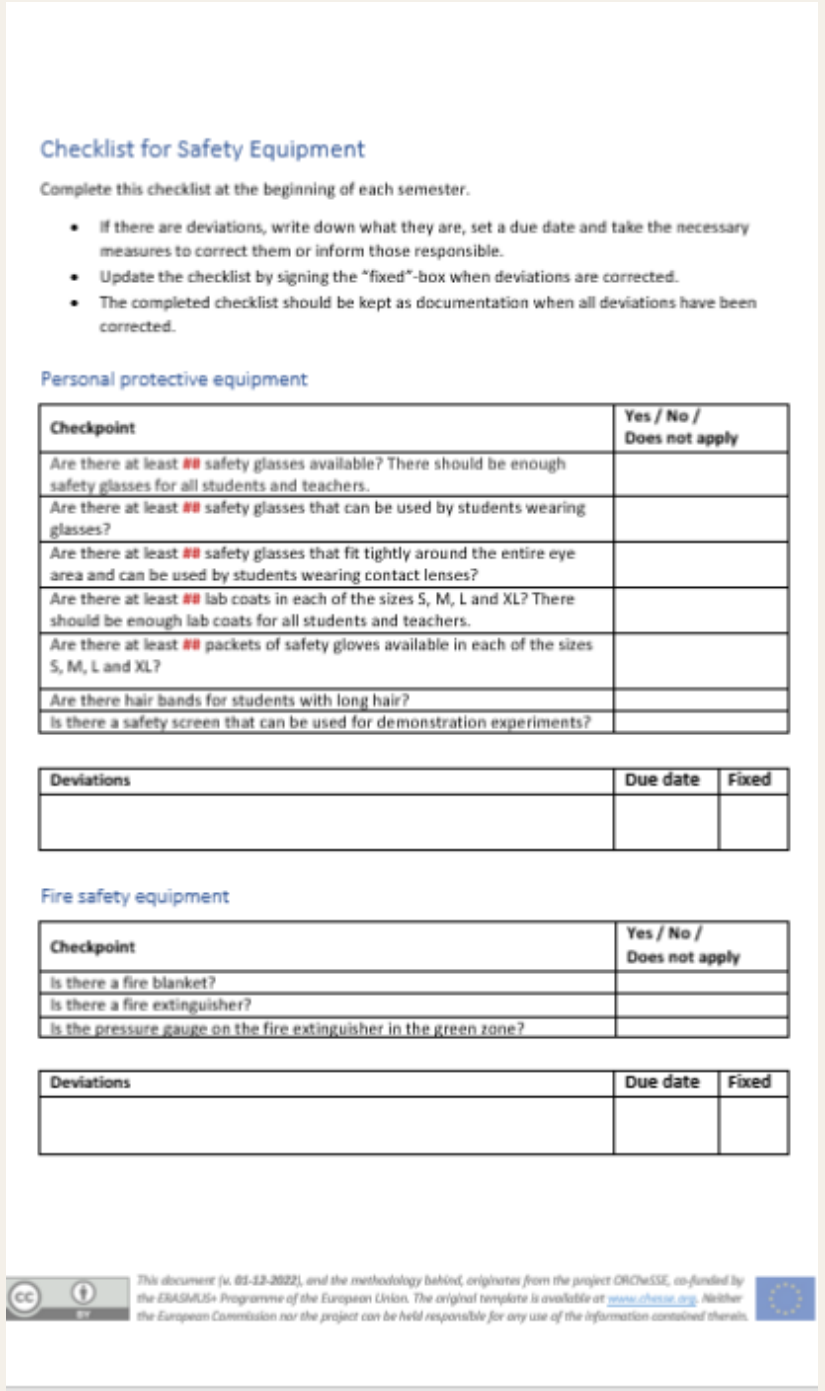
Checklists

https://chesse.org/checklists-and-tools/





Checklist for Safety Equipment

Complete this checklist at the beginning of each semester.

- If there are deviations, write down what they are, set a due date and take the necessary measures to correct them or inform those responsible.
- Update the checklist by signing the "fixed"-box when deviations are corrected.
- The completed checklist should be kept as documentation when all deviations have been corrected.

Personal protective equipment

Checkpoint	Yes / No / Does not apply
Are there at least ## safety glasses available? There should be enough safety glasses for all students and teachers.	
Are there at least ## safety glasses that can be used by students wearing glasses?	
Are there at least ## safety glasses that fit tightly around the entire eye area and can be used by students wearing contact lenses?	
Are there at least ## lab coats in each of the sizes S, M, L and XL? There should be enough lab coats for all students and teachers.	
Are there at least ## packets of safety gloves available in each of the sizes S, M, L and XL?	
Are there hair bands for students with long hair?	
Is there a safety screen that can be used for demonstration experiments?	

Deviations	Due date	Fixed

Fire safety equipment

Checkpoint	Yes / No / Does not apply
Is there a fire blanket?	
Is there a fire extinguisher?	
Is the pressure gauge on the fire extinguisher in the green zone?	

Deviations	Due date	Fixed

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Information to students and colleagues

- Template: Routines for student training in chemical safety (Word)
- Example: Safety rules for the science classroom (Word)
- Example: Detailed safety rules for the chemistry classroom (Word)
- Template: Gas burner instructions (Word)
- Template: Gas burner certificate (PowerPoint)
- Template: Information for students and guardians (Word)

https://chesse.org/managing-chemical-safety/chemical-safety-training/

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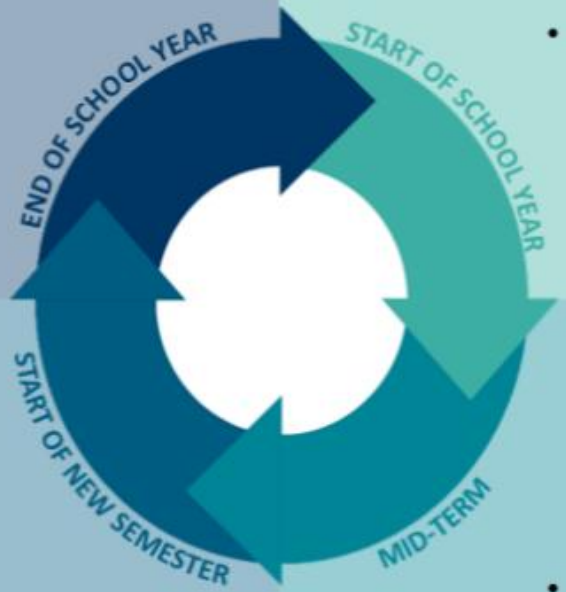
YEAR WHEEL FOR CHEMICAL SAFETY

- Dispose of hazardous waste
- Review risk assessments
- ...



- Inspect the science department
- Inspect safety equipment
- ...

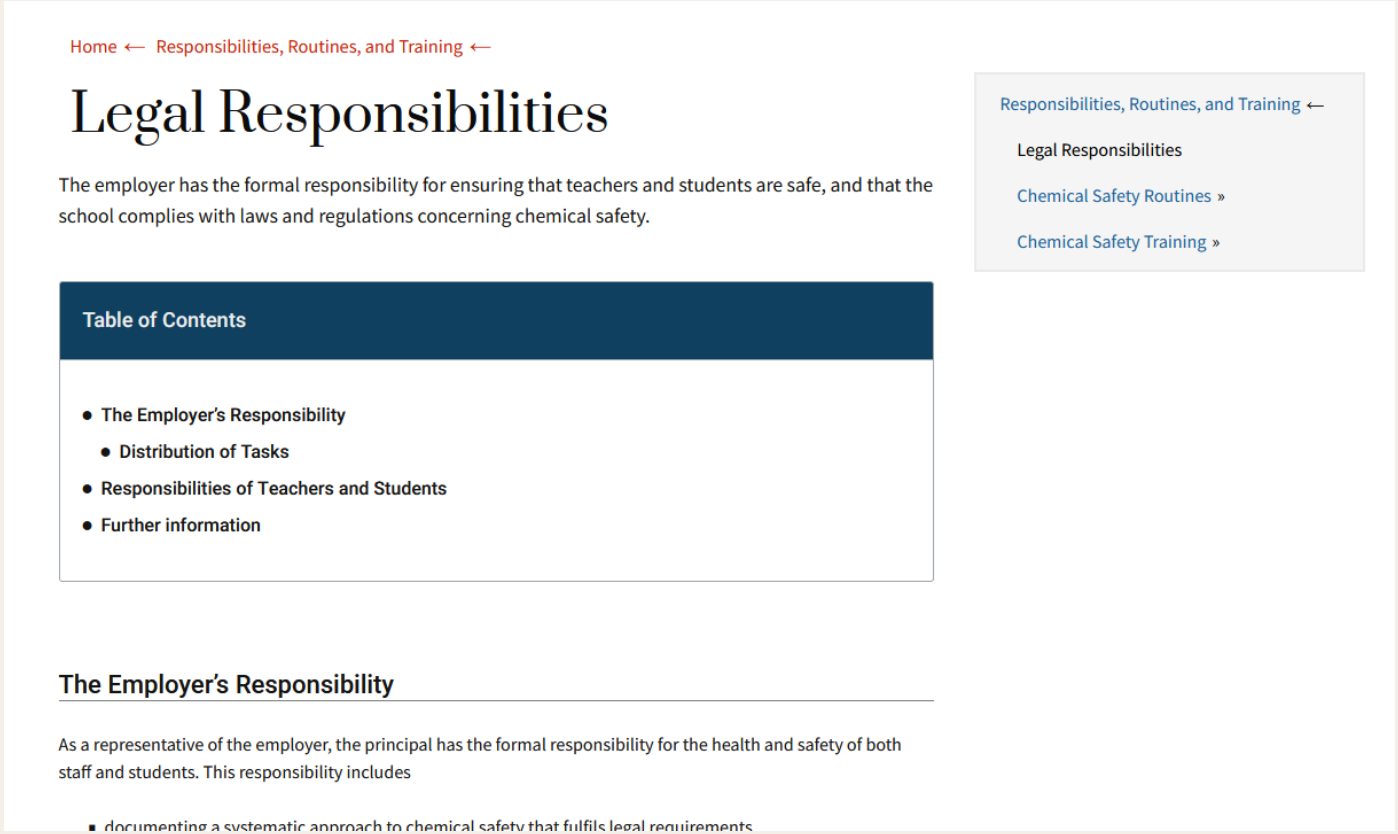
- Inspect safety equipment
- Annual inspection of fume hoods/cupboards
- ...

- Inspect stored chemicals
- ...

Who’s responsibility?

From Flickr.com

Distribution of tasks (in the science/chemistry department)



Home ← Responsibilities, Routines, and Training ←

Legal Responsibilities

The employer has the formal responsibility for ensuring that teachers and students are safe, and that the school complies with laws and regulations concerning chemical safety.

Table of Contents

- The Employer's Responsibility
  - Distribution of Tasks
- Responsibilities of Teachers and Students
- Further information

Responsibilities, Routines, and Training ←

Legal Responsibilities

Chemical Safety Routines »

Chemical Safety Training »

The Employer's Responsibility

As a representative of the employer, the principal has the formal responsibility for the health and safety of both staff and students. This responsibility includes

- documenting a systematic approach to chemical safety that fulfils legal requirements

https://chesse.org/managing-chemical-safety/legal-responsibilities/

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Systematic work environment management (SAM)

The employer must	The worker (teacher) must
take necessary measures to prevent ill-health and accidents.	observe caution to prevent ill health and accidents.
ensure that written routines are in place and that annual follow-ups are carried out in the SAM work.	know and follow given regulations and use protective equipment provided by the employer.
take into account the special conditions of minors.	know that students in education are equated with employees in many respects.

AFS 2023:1

SWEDISH WORK ENVIRONMENT AUTHORITY

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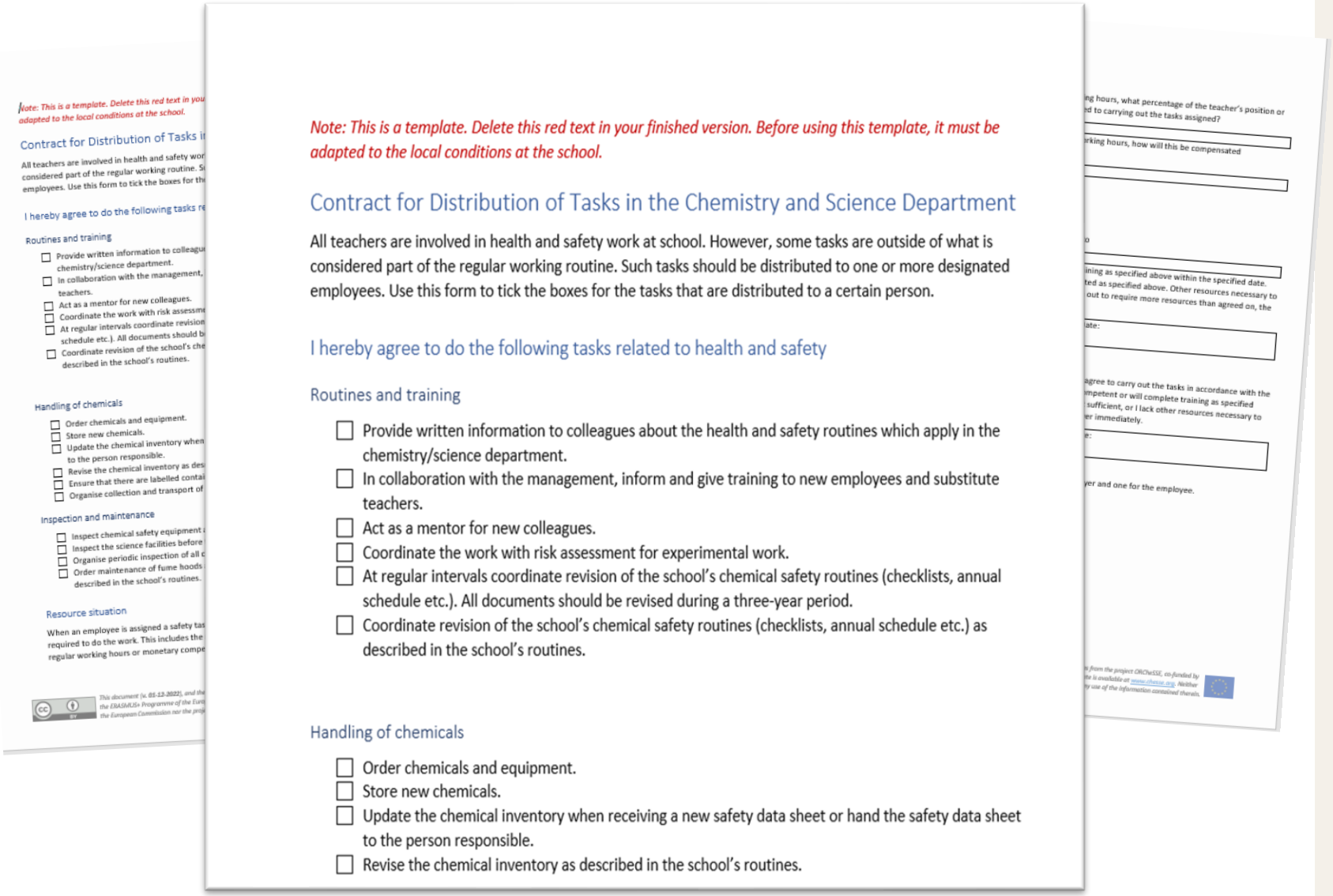
Systematic work environment management (SAM)-continued

- AFS 2023:1

The employer must	The worker (teacher) must
inform the employees about the risks in the work, and about protection and handling instructions.	report to the employer if the work involves immediate danger.
distribute the work environment work in writing and give powers and resources to those concerned.	carry out the assigned tasks or inform the employer (principal) if this is not possible.

If sufficient resources are lacking, the employer must be contacted to prioritize tasks, according to ("Organizational and social work environment)" 2023:1

Contract for distribution of tasks – an example



Note: This is a template. Delete this red text in your finished version. Before using this template, it must be adapted to the local conditions at the school.

Contract for Distribution of Tasks in the Chemistry and Science Department

All teachers are involved in health and safety work at school. However, some tasks are outside of what is considered part of the regular working routine. Such tasks should be distributed to one or more designated employees. Use this form to tick the boxes for the tasks that are distributed to a certain person.

I hereby agree to do the following tasks related to health and safety

Routines and training

- ☐ Provide written information to colleagues about the health and safety routines which apply in the chemistry/science department.
- ☐ In collaboration with the management, inform and give training to new employees and substitute teachers.
- ☐ Act as a mentor for new colleagues.
- ☐ Coordinate the work with risk assessment for experimental work.
- ☐ At regular intervals coordinate revision of the school's chemical safety routines (checklists, annual schedule etc.). All documents should be revised during a three-year period.
- ☐ Coordinate revision of the school's chemical safety routines (checklists, annual schedule etc.) as described in the school's routines.

Handling of chemicals

- ☐ Order chemicals and equipment.
- ☐ Store new chemicals.
- ☐ Update the chemical inventory when receiving a new safety data sheet or hand the safety data sheet to the person responsible.
- ☐ Revise the chemical inventory as described in the school's routines.

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Using AI in Chemistry teaching

For example:

- To create a ’user-friendly’ risk assessment.
- To produce a student-friendly lab instruction
- …….

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A quick example

Risk assessment

I asked Co-pilot (other AI bots are available) to give me a short summary of what to consider when diluting a solution of concentrated HCl to a 2M solution.

I uploaded a generic SDB for HCl (from Merck) and entered the following prompt:

“please write a one paragraph summary to be used by a chemistry teacher of the risks associated with making a 1 litre solution of 2M HCl from concentrated HCl”

Copilot

Preparing 1 L of a 2 M hydrochloric acid solution from concentrated HCl presents several significant hazards that require careful control. Concentrated HCl is a strongly corrosive acid capable of causing severe skin burns and serious eye damage, and it can also release hydrogen chloride vapour that irritates the respiratory system. The dilution process is exothermic, meaning that adding water to the acid can cause rapid heating and splashing, increasing the risk of chemical burns; therefore, acid must always be added slowly to water with stirring. Inhalation risks are important because vapours or aerosols may exceed workplace exposure limits and cause respiratory irritation, particularly in poorly ventilated spaces. The solution is also corrosive to metals and incompatible with bases, posing additional risks of violent reactions if mixed improperly. Appropriate personal protective equipment (chemical-resistant gloves, splash goggles, and lab coat), good ventilation (preferably a fume hood), and strict handling procedures are essential to minimise these hazards during preparation. SDB-CN61-GB-EN-HCl

Sources >

A quick example 2

Student instructions

I asked Co-pilot (other AI bots are available) to give me a short summary of a lab instruction for 15 year old students to carry out the bioplastics lab we did earlier.

My prompt: ” please write a lab instruction for 15 year old students to carry out the lab 1A on bioplastics, include background and a risk assessment.”

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Lab 1A: Making Bioplastics **Aim** To make and compare three different types of bioplastics using simple chemicals.

Background (Student-friendly)

Plastics are useful materials, but most are made from fossil fuels and do not break down easily. Some plastics can stay in the environment for hundreds of years.[Synthesis-...TUDENT (1) | Word] **Bioplastics** are different because they are made from renewable materials (like plants) and can often break down more easily. In this experiment you will make three types of bioplastics: **Starch + citric acid** Forms **strong chemical bonds (esters)** when heated **Starch + glycerol** Forms **weaker hydrogen bonds**, making it more flexible **Citric acid + glycerol** Forms a polymer when heated for a long time These differences affect how strong, flexible, and biodegradable the plastics are. [Synthesis-...TUDENT (1) | Word]

Equipment

Balance 50 mL beakers (×3–4) Measuring cylinder (10 mL) Glass stirring rod Hot plate Aluminium foil dishes (×3) Dropper Paper towels Marker pen

Chemicals

Tapioca starch,Citric acid, Ethanoic acid (10% vinegar), Glycerol, Distilled water, Cooking oil, Food colouring solution

Method **Important** You will make all **three plastics in one session**.

Bioplastic 1: Starch + Citric Acid (Stronger plastic)

Weigh **3.2 g starch** into a beaker

Add **0.5 g citric acid** Add **10 mL water** Add **1 mL ethanoic acid**

Stir well Heat gently (~75 °C), stirring continuously

When the mixture thickens (10–15 min), remove from heat

Add a few drops of food colouring

Pour into a labelled foil dish (Sample 1)

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Heat until it becomes **transparent (~30 min)**

Leave to dry

Bioplastic 2: Starch + Glycerol (Flexible plastic)

Weigh **2.0 g starch**

Add **1.5 g glycerol**

Repeat the same steps as above Label as **Sample 2**

Bioplastic 3: Citric Acid + Glycerol (Polymer plastic)

Mix **2.0 g citric acid + 2 mL water**

Stir until dissolved Add food colouring

Add **2.0 g glycerol** and mix well

Grease foil dish with a little oil

Pour mixture into dish (Sample 3)

Heat in oven at **100 °C for several days** (teacher handles this step)

Observations

After drying, record: Texture (soft, hard, rubbery) Flexibility Transparency Any differences between samples

Risk Assessment (Student Level)

Hazard Risk Safety

Precautions Hot plate / hot mixtures - Burns Use heatproof gloves, don't touch hot equipment

Ethanoic acid (vinegar) Mild irritation - Avoid eyes, wash hands after use

Citric acid - Mild irritant, avoid contact with eyes or skin

Glycerol - Low hazard but sticky, clean spills immediately

Glassware-Breakage Handle carefully

Heating mixtures – Splashes, stir gently, do not overheat

Do not taste any chemicals

Wash hands after the experiment

Follow your teacher's instructions

Key Questions (for students)

Which plastic was strongest? Which was most flexible? How do the types of bonding explain the differences? Which do you think will break down fastest? Why?

Conclusion

You have made three different bioplastics and observed how their **ingredients affect their properties**. This helps scientists design more sustainable materials for the future.

If you want, I can also turn this into a **worksheet, PowerPoint, or assessment rubric** for your class.

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TASK: CheSSE Building blocks-EVALUATE

1. ”A bad day in the lab”–a building block on responsibility.

https://chesse.org/wp-admin/admin.php?page=h5p&task=show&id=200

2. Eye protection in the lab

https://chesse.org/wp-admin/admin.php?page=h5p&task=show&id=188

3.Restrictions on chemicals

https://chesse.org/wp-admin/admin.php?page=h5p&task=show&id=170

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In which bottles and cabinets should the chemicals be stored?

How often should emergency showers and eyewashes be checked?

Do chemicals get old? When should they be discarded?

What can (not) be poured down the sink?

Is it ok to only have safety data sheets online or do they have to be in paper form?

How should tasks be distributed?

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Discussion—what next?

1. Network for English-speaking chemistry teachers? Reference group for evaluating CheSSE building blocks etc?

2. UM4055 Safety course (in Swedish)?

3. Suggestions for future webinars/courses etc?

13th May 2027: workshop on CheSSE competence modules (dissemination).

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Safety in Biology education

- Chemicals in Biology: KRC's Guidelines and Advice (Collaboration)
- Bioresurs works with three areas:

1. Laboratory work with microorganisms and genetically modified microorganisms
   (infection risks, sterile technology, waste management)
2. Animals in education
   (dissection material, animal experiments)
3. Blood Laboratory Exercises in Teaching
   (infection risks, advice and rules)

[National Resource Center for Biology teaching (bioresurs.uu.se)]

Nationellt resurscentrum
för biologiundervisning
WWW.BIORESURS.UU.SE

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Thank you

Thank you for taking part today and please take some time to fill in an **evaluation form** about today's course.

https://survey.su.se/survey/60852

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