Safety in the laboratory

Department of Chemistry

University of Fribourg

Version 2019

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Safety in the laboratory

Part 1 : Basic aspects

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Working hours

Working hours are **Monday through Friday** between **6h30 and 20h00**

outside these times :

- it is **forbidden** to do experimental work alone in a lab
  (a **forewarned** colleague must be nearby and within earshot!)
- the responsible professor must be informed and he must explicitly and **written** authorize high-risk experiments (contamination of person, fire or explosion,etc.)

between **6h30** and **20h00**, the technical staff can intercept alarms

during nights, weekends and holidays,
all alarms are directly transmitted to the fire brigade

Behavior in the laboratory

It is mandatory to

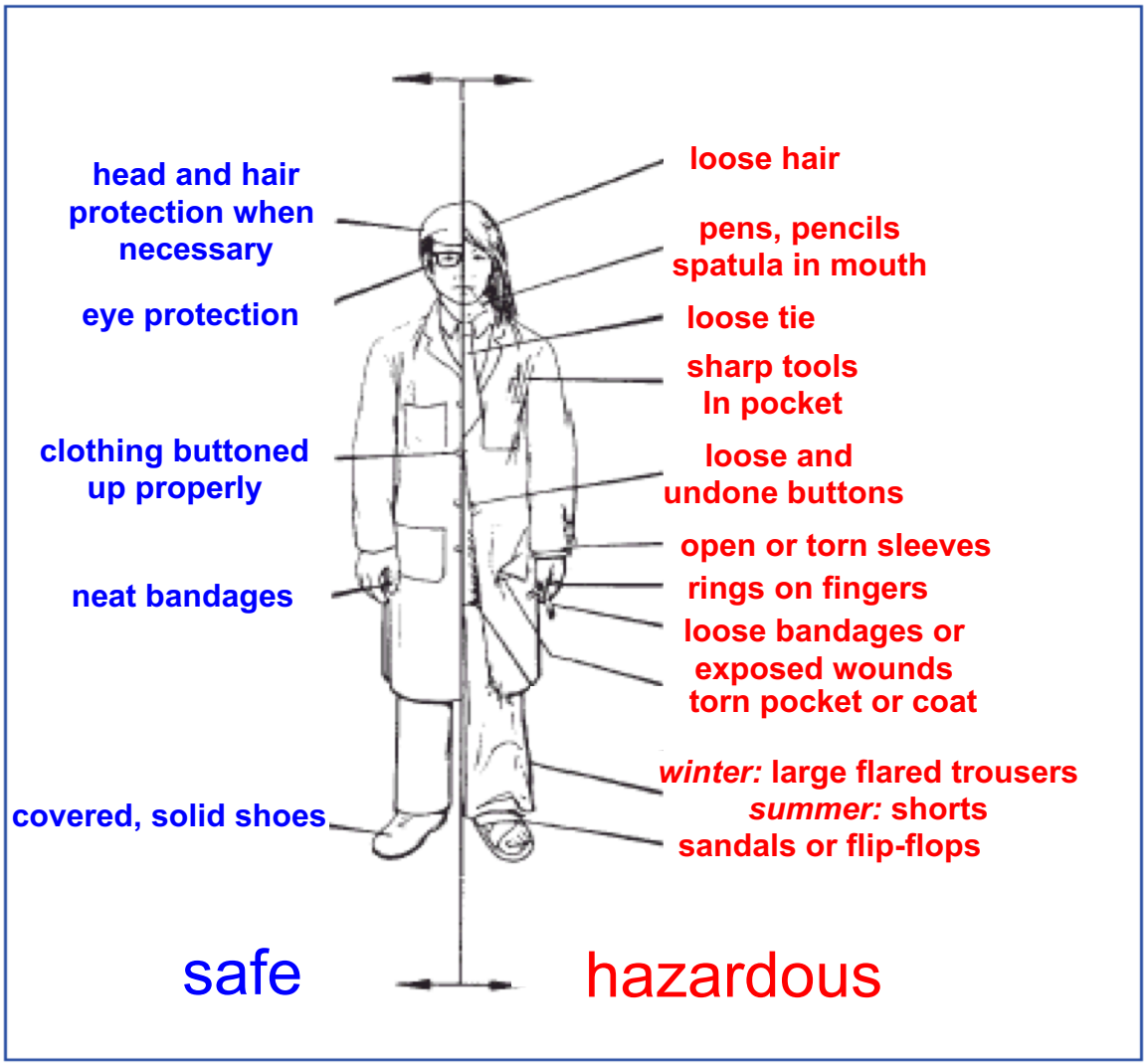
- wear safety goggles
- wear a labcoat that is closed in the front
- tie up long hair
- wear appropriate gloves when manipulating dangerous substances (see later)
- wear closed shoes (no sandals, flipflops etc.)
- wear long pants

Behavior in the laboratory

In the laboratory it is forbidden to

- eat or drink (let alone smoke!)
- wear inappropriate clothes (shawls, blouses or shirts with loose sleeves or from easily flammable fabrics)
- wear a headphone to listen to music (alarms!)
- work without a colleague being in hearing distance
- wear contact lenses (safety goggles with optical lenses are made available at no cost to permanent staff)
- bring to or take out chemical products from the building

Safety / danger



Safety

Precautions:

- be familiar with the task at hand.
  (if not: seek assistance!)
- carefully read the directions
- understand the chemistry
- carfully and calmly plan delicate manipulations
- think before acting

THINK → ASK → DO

Make sure you know

- where is the next:
  - telephone (and what are the emergency numbers!)
  - safety door
  - fire extinguisher and fire blanket
  - sandbox (to extinguish burning metals)
  - first aid box

  } and how to use it !

  - person to ask/alert in case of problems
  - safety shower
  - eye washing station
  - gaz mask

  } and how to use it !

  - safety instruction poster

Recommendations

- do not obstruct walkways and safety exits
- work in a stable position
- use clean and functional lab material
- do not run in the lab
- wash your hands before and after manipulations
- label all recipients clearly and readably
- run and clean the eye showers every month.
- do not keep food in lab fridges containing chemicals

Order- and cleanliness

- keep your lab equipment clean and in good shape
- clean used glassware
- keep order in your lab
- dispose regularly of your chemical waste

This will allow to:

- avoid contaminations
- prevent accidents
- prevent bad smells from spreading
- limit the risk of ignition and fire
- create a pleasant work climate
- work efficiently

Protective measures

- read and respect the safety labels and instructions on chemical bottles.
- wear your personal safety equipment (goggles, lab coats, gloves etc.) correctly and keep it in shape.
- respect the safety directives.

announce all anomalies, incidents or accidents to your supervisor and/or to a member of the safety committee!

Safety goggles

Our two eyes cannot be replaced !!

they can be hurt by:

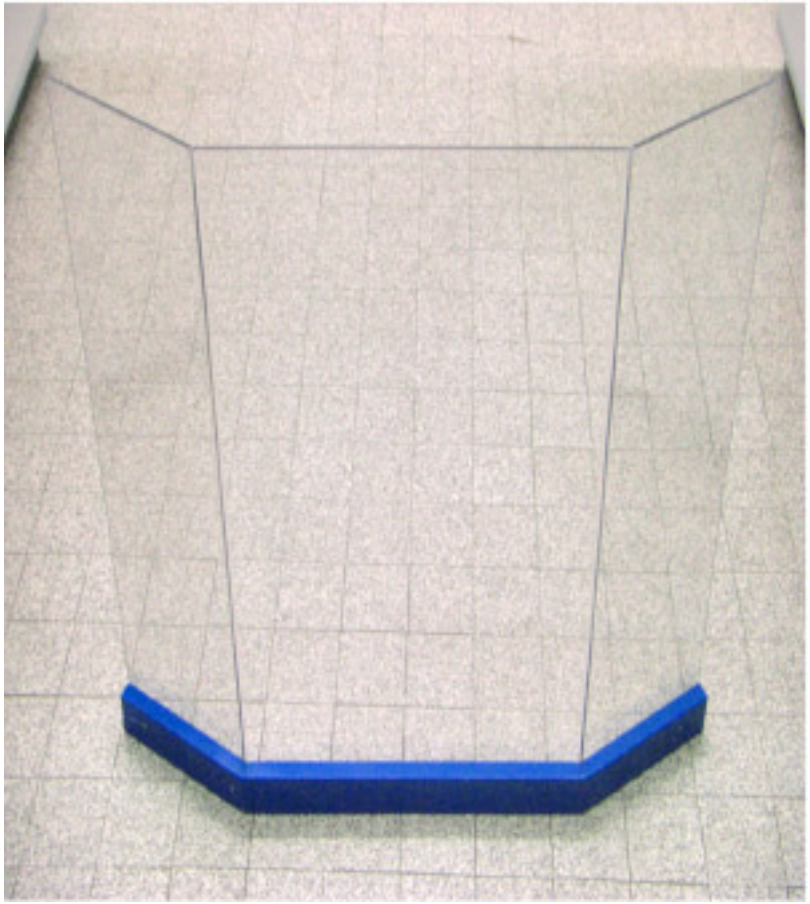
- splashes of chemicals
- vapours and dust particles
- glass splinters
- laser beams
- work done by your colleagues

Protective goggles with eyeglass lenses can be obtained on demand from the safety committee.

Reminder: it is forbidden to wear contact lenses in the lab!

Protective shields

can be obtained from Anne Schuwey



Lab coat

must be made from fabrics (cotton) that are equipped to:

- reject liquids
- reject odors
- protect underlying clothes
- are not flammable

take off your lab coat if you go to seminar rooms, cafeterias etc!

Types of safety gloves

Shieldskin Chem
Neo Nitrile

Different kinds of safety gloves

water-soluble products
⇒ **latex or nitrile gloves**

acids, bases, alcohols
⇒ **vinyl or nitrile gloves**

toxic or corrosive products, solvents
⇒ **nitrile gloves**

manipulation of glassware
⇒ **kevlar gloves**

Remarks on gloves

all gloves are available plain or powdered.

nitrile gloves are about twice as expensive as latex gloves.

lab gloves are for protection and shold be used accordingly:

remove gloves before using keyboards, telephones, door handles, banisters etc. because else you may spread contaminations!

How to remove gloves

- peel off the first glove by grabbing it by the cuff.

- wrap it up into a ball and put that into the other, still protected hand.

- peel off the second glove, touching only its interior surface.

- then, enclose the second glove in the first

immediately proceed to wash your hands

When to change gloves

- as soon as a glove is soiled or it leaks
- at the end of a manipulation
- at least every work hour

} except for the new red gloves

(because after some time gloves become porous)

Protective creams

- protective creams help the skin to heal little lesions and seal the skin from chemicals (close pores)

- apply the cream **before** you begin to work and **after** breaks.

- apply it also on the back of all fingers, around the fingernails, beetwen the fingers, and on the wrist.

Hoods

(1920)

(1940)

(1970)

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Hoods

the primary purpose of the hoods is to protect your health and safety and that of your colleagues

- for better ventilation of the hood,
    - lower the glass pane
    - close unused hoods

Please turn off the ventilation in unused hoods (this saves a lot of energy, particularly in winter).

However, leave at least always one hood per lab on low speed (also at night).

Hood ventilation control

Make sure that the ventilation of your hood is running.

at **small speed**, by pushing the red button **once**

⇒ the green light comes on

or

at **high speed**, by pushing the red button **twice**

⇒ the orange light comes on.

If the red light remains on, then the ventilation is **mal-functioning**. Switch the ventilation off and back on,
If the problem persists, contact the technical service

Before you leave the lab

- switch off
  - the ventilation in hoods that are not used
  - all apparatus (rotavaps, heaters, stirrers)
  - all lights

- close
  - the solvent cabinets
  - all windows
  - all water faucets and spigots for vacuum, gas, nitrogen
  - the covers of the used solvent containers

- put away and store
  - chemicals
  - solvent cans

the assistant shuts the door when he leaves the lab

a checklist is available for under-graduate lab classes

- secure any reactions that should continue

Night laboratories

120 / 214 / 326

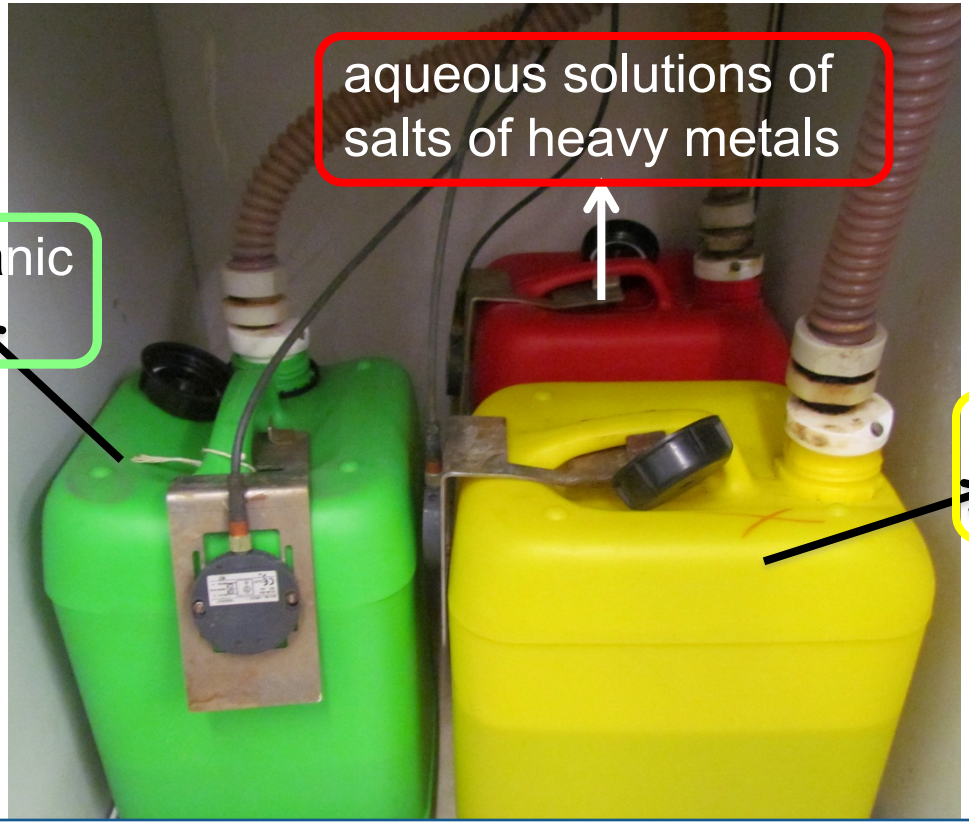
All experiments that require overnight heating (or potentially evolve heat) must be installed in one of the above night labs.

These labs are equipped with a sprinkler installation for emergency situations that my arise during nighttime.

Fill in the form and add a telephone number where you (or the assistent for lab classes) can be reached.

Waste disposal and recycling

separation of liquid chemical waste (solutions):



if you have mixtures, the green bucket takes precendece over the red and over the yellow

Waste disposal and recycling

White buckets : solid waste (contaminated paper and gloves, pasteur pipettes, chromatography support materials, filter papers…)

Non-contaminated glass, aluminium, metal, wood and paper are eliminated in buckets designated for such waste

Toxic heavy metals (Hg, As, Cd, Os, Sb, Se, Tl, Cr ...) should be collected and eliminated separately.

Waste collection: Tuesday 10:00-11:00 and Friday 13:30-14:30 behind the chemistry building

Waste must be eliminated from the lab at least once a week

Waste disposal and recycling

chemical products in their original package may be collected in large 30 litre white buckets that may be borrowed at the shop in the basement, and should be separated in four categories:

- organic substances
- inorganic substances
- reactive products (residues of alkali metals, BuLi solutions, etc…)
- unknown substances

Waste disposal and recycling

syringe needles should be disposed in the special yellow plastic cans (or be capped, then the whole syringe can be disposed of in the white buckets.

Heating bath oil is collected separately in labelled bottels or buckets.

to dispose of *any other chemical waste* inquire with the shop in the basement or with the safety committee.

cyanides and *metal hydrides* must be inactivated before being disposed.

Washing glassware

Always rinse glassware, first with acetone, then with water.

Special washing machines for laboratory glassware are available in the basement

Pregnancy

LTr
Art. 35
Art. 35*a*
Art. 35*b*

Entrée en vigueur le 27 juin 2000

OLT 1
Art. 60-66

Entrée en vigueur le 27 juin 2000

OProMa
Ordonnance du DFE

Entrée en vigueur le 1er octobre 2008

Directive of the Faculty of Science and Medicine

Pregnancy

during pregnancy absolutely avoid the contact with following products :

- R 40 – 45 – 46 - 49
- R 60 to 64
- H 340 – 341
- H 350 – 351
- H 360 to 362

- Mercury and by-products
- Inhibitors of mitose
- Carbon monoxide

Safety in the laboratory

Part 2

SGH system

Chemicals storage

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Labels – the R&S system

- Law on chemicals since 2005.
- Indications on the dangers and risks, similar to EU standards.
- Dangers for the environment and inflammability.
- Risks and security advice (R & S)
- 7 symbols on orange background.

Labelling – R&S symbols

C - corrosive

N - environmentally harmful

T - toxic

T+ - very toxic

Xn - harmful

Xi – irritating

O - supports combustion

F - easily flammable

F+ - very easily flammable

E - explosive

Labelling - GHS

4 pictograms of physicochemical dangers

explosive | inflammable | oxydant | compressed gas

Labelling – GHS

5 pictograms indicating danger for the human health and the environment

corrosive | toxic | irritant | CMR, STOT*) | dangeous to the environment

*) CMR: cancerogenic, mutagenic, toxic to reproduction
STOT: Specific Target Organ Toxicity

Security data sheets

1. identification of the substance and the manufacturer
2. composition / information on the components
3. identification of dangers
4. first aid in case of exposure
5. how to fight a fire involving this product
6. what to do if the products is accidentally spilled
7. how to manipulate and store the product
8. how to control and how to protect oneself against exposure
9. physicochemical properties
10. stability / reactivity
11. toxicological informations
12. ecological informations
13. how to eliminate / dispose of the product
14. how to transport the product
15. legal bases
16. other informations

transporting chemicals in the building

- Never transport chemicals without using a basket (available in the shop).
- Never transport chemicals in the small elevator, use the freight elevator.
- If you are transporting > 5 l tanks of liquid nitrogen you should *not accompany them* in the freight elevator (take the small elevator up and call the freight elevator from there)

Storage - Risks

- Fire
- Explosion
- Fall
- Packing embrittlement
- Chemical degradation

Storage - General

- Chemicals must be stored in ventilated cabinets (wher such cabinets exist)
- Storage in the laboratory should be a « buffer storage » for the daily use, specially for solvents
- Pay attention to the packing of the chemicals (form and material)

Storage – Maximum

- **15** liters of organic solvent per workplace ***including the waste solvents*** in the laboratory
- Organic solvent stored in **maximum 1liter bottles can stay on the lab-benches, shelves, etc.**
- For larger amounts, use the fireproof cabinet (yellow or orange) with a **maximum of 100 liters**
- **Attention**: Those cabinets are reserved for the storage solvents, **not chemicals**!
- For even larger amounts, use the solvent room on the 2nd floor

Storage – Prevention objectives

- Keep the smallest practical amounts in the laboratory.
- Arrange chemicals in a logical way.
- Do not obstruct escape routes.
- Do not obstruct security devices (fire extinguisher, emergency exit, safety showers, safety doors, …).
- Separate chemicals from the other things to store.
- Separate chemicals according to their compatibility (do not keep strong oxidants next to easily oxidized compounds, etc.).

Storage - Compatibility

	o	-	-	-	-	-	+	-	-
	-	+	-	-	-	-	+	-	-
	-	-	+	o	-	-	-	-	-
	-	-	o	+	o	-	-	-	-
	-	-	-	o	o	o	o	o	o
	-	-	-	-	o	+	+	+	+
	+	+	-	-	o	+	+	+	+
	-	-	-	-	o	+	+	+	+
	-	-	-	-	o	+	+	+	+

- = no
o = yes if… (see other conditions)
+ = yes

Gas cylinders

- **Hydrogen** cylinders are forbidden in the laboratories! There is a hydrogenation lab (ask Anne Schuwey).
- You need to get a permission to use **acetylene** cylinders.
- Transport:
  - Always with a cart (for big cylinders)
  - Without the manometer and with the valve cap and cover
- Make sure your cylinder is stable and fixed.
- Bring it back when it is empty or not used anymore.

how to use gas cylinders

- Make sure the cylinder is attached
- Before you begin, make sure that a suitable manometer is corectly and tightly attached and shut.
- Select the desired pressure on the manometer.
- Close the main valve on the gas bottle and let spare gas escape from the manometer as soon as you don't need the gas anymore.

Cryogenic products

e.g. liquid N_2, solid CO_2, …

- Always use them in a well ventilated room.
- Touch only with isolated gloves to prevent burning.
- Wear your protection glasses and gloves!

when drawing liquid N_2 :

- Open the door during transfer

Safety in the laboratory

Part 3

Conducting experiments safely

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general rules

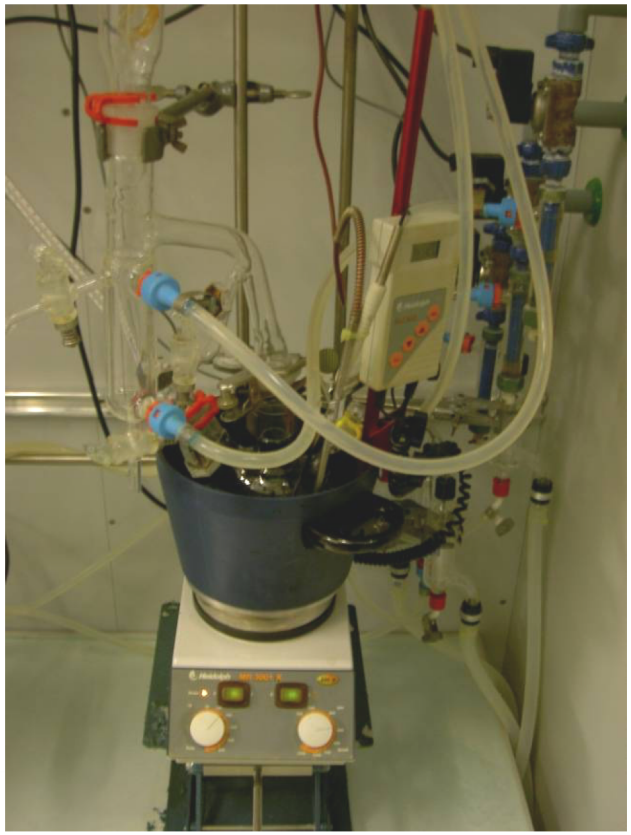
- Control electrical connectors and cables at regular intervals. If necessary, have them changed by Bertrand Dubois or Olivier Graber
- Shut faucets (water, gaz, vacuum) as soon as you don't need the resource anymore.

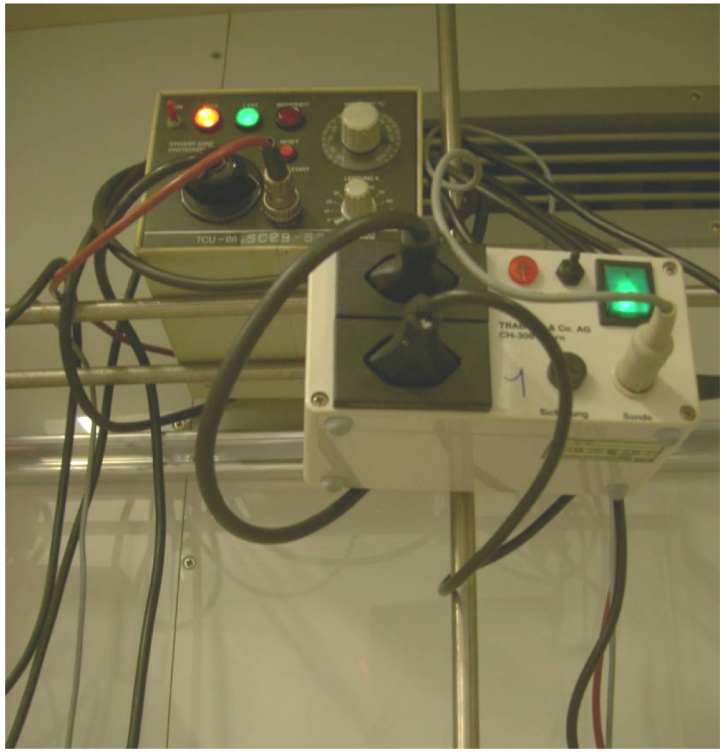
heating installations

- The level of the heating fluid should never be above that of the reaction mixture inside the flask.
- Regularly clean heating baths and change the heating fluid (to lower its flash point).
- Do not overfill heating baths (heating fluids expand with temperature).
- For reactions that require temperatures above 150° C (max 250° C), DrySin heaters are available from the safety committee (contact Anne Schuwey)

reactions during nights and on weekends

- If a reaction must run overnight or on a weekend, additio-nal safety systems (water and heating) must be installed.





Safety in the laboratory

Part 4

What is to do after an accident has happened

When Bad Things Happen to Good Chemistry

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(l) \quad + \Delta H$$

Call help

the emergency numbers are

144 and 145 (Tox center)

posted in each lab:

IN CASE OF FIRE

stay calm, act thoughtfully

ALARM find one of the red alarm buttons at the end of each corridor and press it (automatic call to the fire brigade!)

SAVE evacuate persons who are in danger

SECURE avoid drafts by closing all windows and doors Including those at the ends of the corridors

EXTINGUISH

FLAMMABLE MATERIALS	EXTINGUISH WITH
- wood, paper - organic solvents, gases - light metals (Na, K, Mg ...) - electrical equipment	water powder, CO_2 dry sand CO_2, powder

posted in each lab:

INTERDICTION

evacuation of the building: alternating siren signal or oral order

gathering place in case of evacuation:
in front of the physiology/MED3 building, next to the automatic teller machine

international urgency call	112
police	117
fire brigade	118
emergency services / ambulance	**144**
toxicology center Zürich	145
minor accidents / injuries	8680, 8779, 8790, 8708, 8755, 7300

Address of the department Chemin du Musée 9

Building evacuation
(alternating siren)

The evacuation is always decided by the intervention services

Leave the building. Take your personal effects.

Close the door, but don’t lock it

Take the visitors with you and the people with reduced mobility

Follow the instructions by the firemen

Do not use the elevators !

Proceed to the gathering place

Do not leave the gathering place without authorization.

Fire fighting course

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