

Safety in the laboratory

Department of Chemistry

University of Fribourg

Version 2016



Safety in the laboratory

Part 1 : Basic aspects

Working hours

Working hours are **Monday through Friday** between **7h00 and 19h00** outside these times :

- it is **forbidden** to do experimental work alone in a lab (a colleague *must* be within earshot!)
- the responsible professor must be informed and he must explicitly authorize high-risk experiments

between **7h00** 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

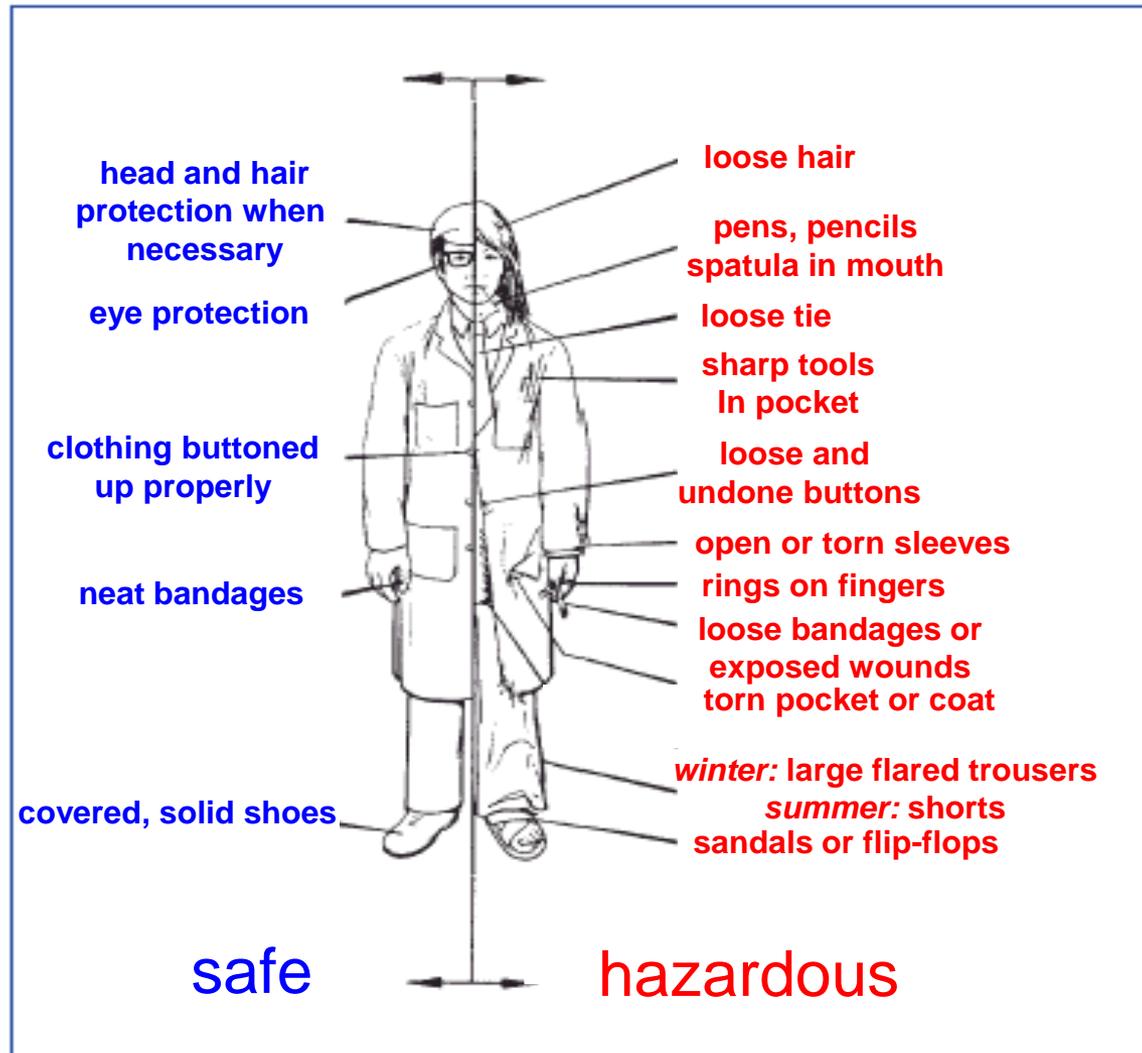
- wear safety goggles
- wear a labcoat that is closed in the front
- tie up long hair
- wear appropriate gloves when manipulating dangerous substances (see later)
- wear closed shoes (no sandals, flipflops etc.)

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
- carefully 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
- do not run in the lab
- use clean and functional lab material
- 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:

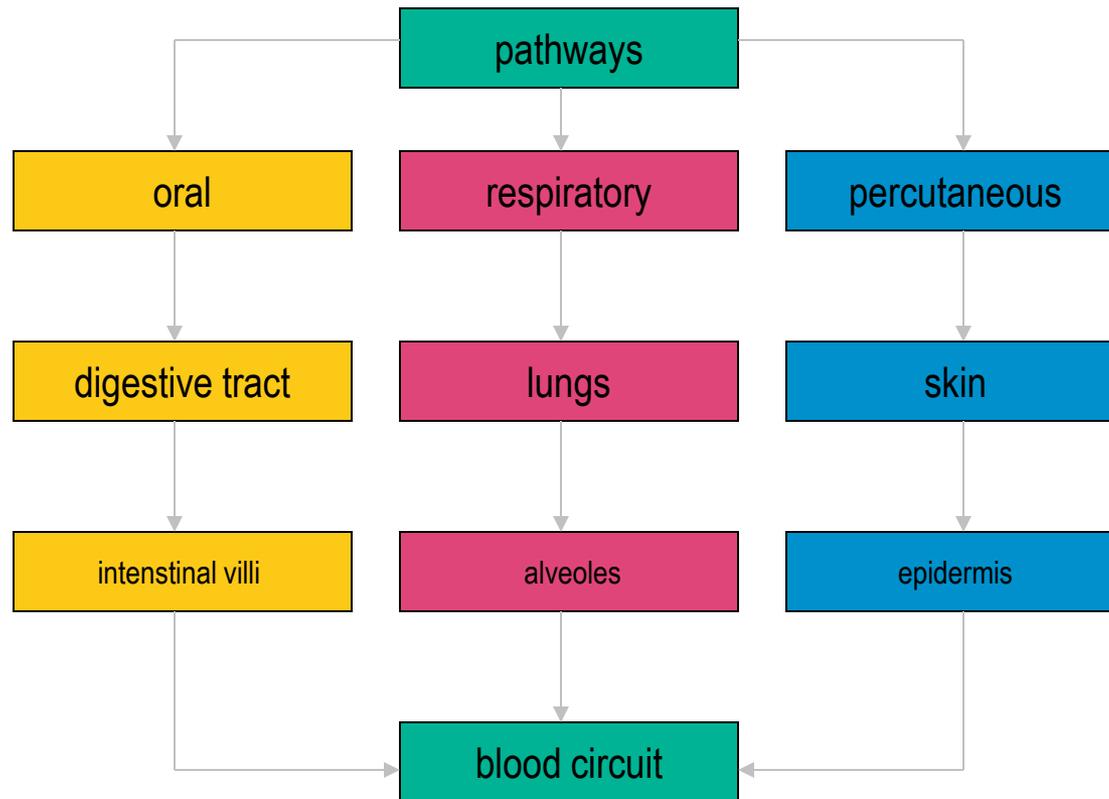
- avoid contaminations
- prevent accidents
- prevent bad smells from spreading
- limit the risk of ignition and fire
- create a pleasant work climate
- work efficiently

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!

How chemicals get into our body



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**

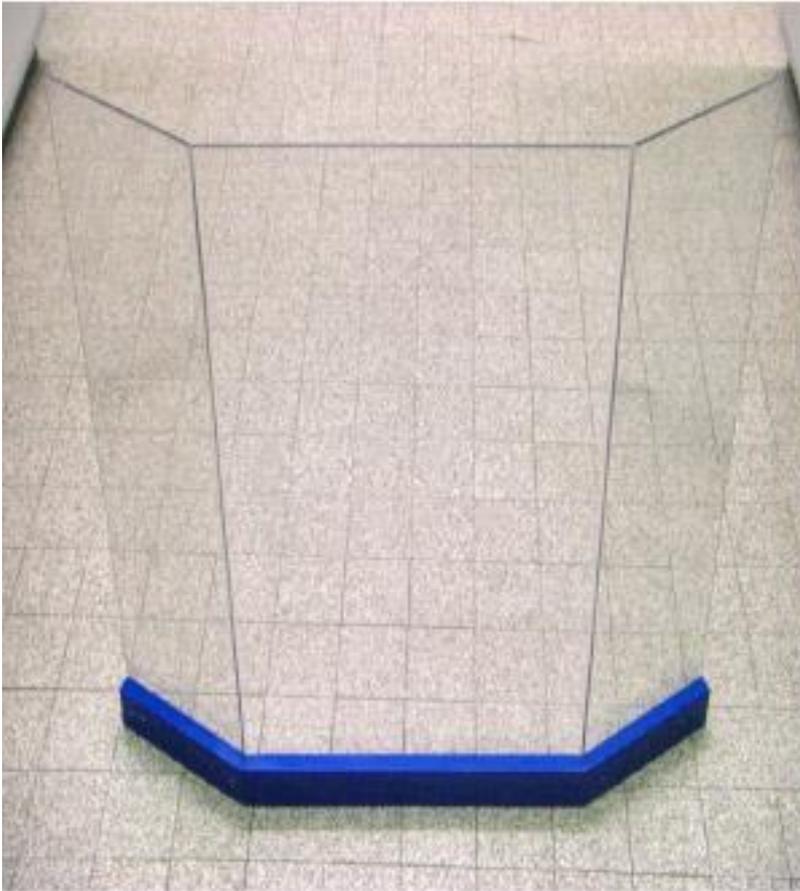


Protective goggles with eyeglass lenses can be obtained on demand from the safety committee.

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 should 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, between the fingers, and on the wrist.

Hoods



(1920)



(1940)



(1970)

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

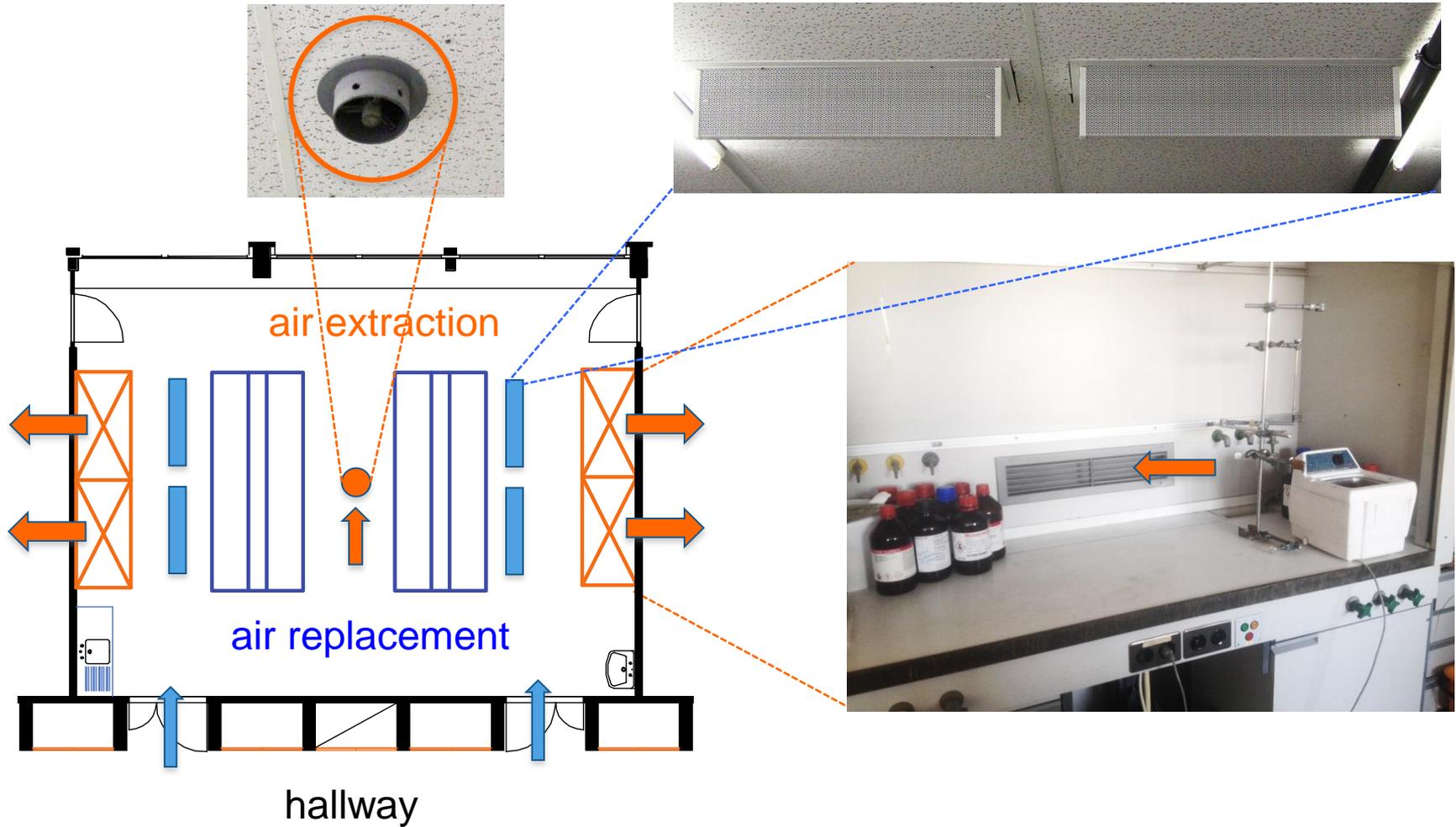
at **high speed**, by pushing the red button **twice**

⇒ 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

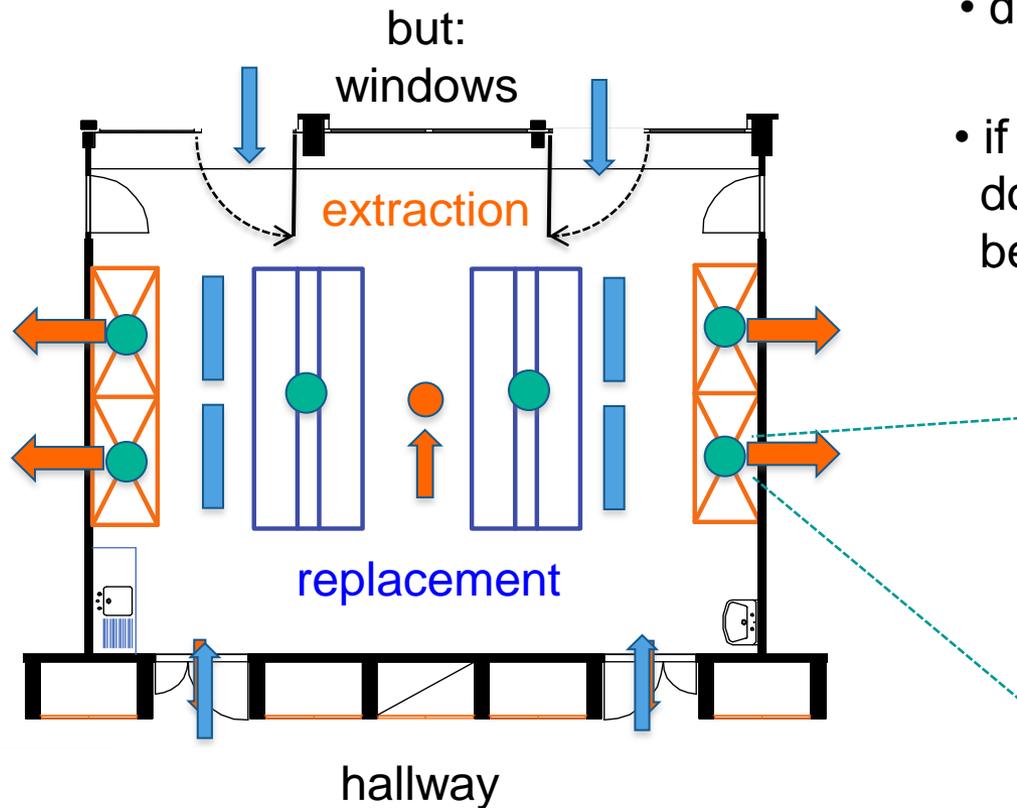
The ventilation system



The ventilation system

In this way the ventilation system is equilibrated (slight underpressure in the labs).

However, if you open the windows, air is pulled in from outside, and makes that air is pushed from the lab into the hallways. Thus:



- do not open the windows of your lab
- if you open a window, *do* close the doors, to avoid air from the lab to be pushed into the hallways



heat and smoke detectors

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
- secure any reactions that should continue

**the assistant shuts the door
when he leaves the lab**

**a checklist is available for under-
graduate lab classes**

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 may arise during nighttime.

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

Waste disposal and recycling

separation of liquid chemical waste (solutions):



if you have mixtures, the green bucket takes precedence 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 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 bottles 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. 35a
Art. 35b

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

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

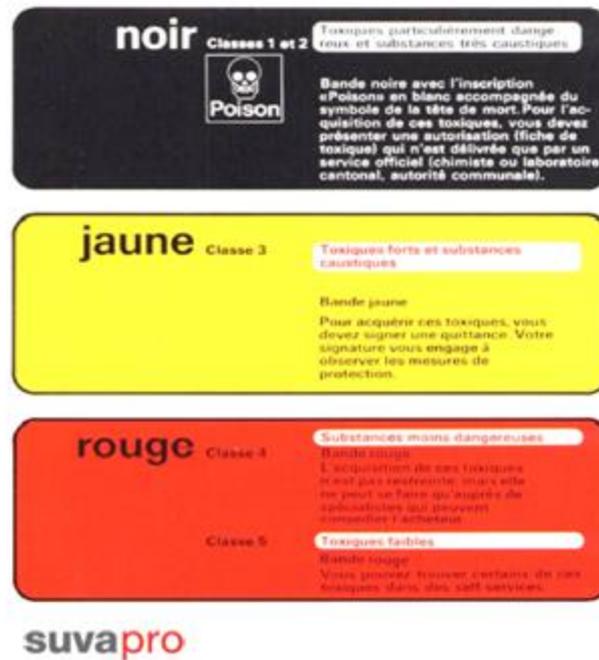
Part 2

SGH system

Chemicals storage

Labels – historic overview

- Law on hazardous substances of 1969
- 5 toxicity classes
- Black, yellow or red labels



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

Evolution of the labelling

chemical products



the labels evolve ...

2015

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

Labelling – GHS

(Globally Harmonized System)

- 2 signal words: DANGER > ATTENTION
- 28 classes of danger (16 physico-chemical, 10 hazardous to health, 1 pollutant, 1 hazardous to the ozone layer)
- 9 new pictograms (black&white + red border)
- H&P phrases
 - H = Hazardous
 - P = Precautionary

Labelling – GHS – H&P phrases

■ H (Hazardous) phrases

- Hxxx

1st number: 2 = physico-chemical
 3 = hazardous to health
 4 = pollutant

■ P (Precautionary) phrases

- Pxxx

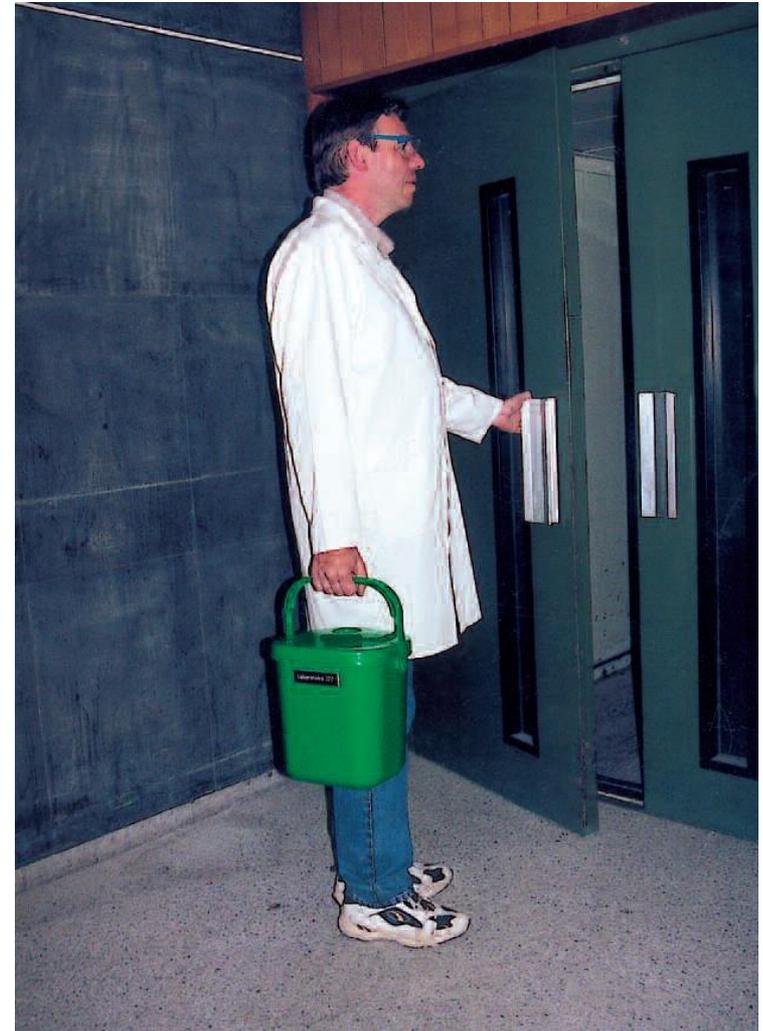
1st number: 1 = general precaution
 2 = prevention precaution
 3 = response precaution
 4 = storage precaution
 5 = disposal precaution

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 1 liter 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

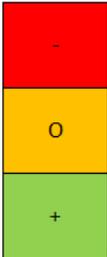


Storage – Prevention objectives

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



= no

= 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.



Indication on the gas bottle

Rückseite

- 1 Prüfzeichen des Sachverständigen
- 2 **Next test date**
- 3 **name of gas**
- 4 Datum der ersten Abnahme
- 5 Höchstzulässiger Fülldruck bei 15 °C
- 6 **owner of the bottle**

Vorderseite

- 1 EWG-Bauartzulassungszeichen
- 2 Wert von R in N/mm²
- 3 Herkunftsland
- 4 Art der Wärmebehandlung
- 5 Herstellerzeichen
- 6 Prüfüberdruck in bar
- 7 Datum der ersten Abnahme (Jahr/Monat)
- 8 Prüfzeichen des Sachverständigen
- 9 EWG-Prüfzeichen
- 10 Fabrikationsnummer
- 11 Garantierter Mindestrauminhalt in Liter
- 12 Leergewicht der Flasche in kg



how to use gas cylinders

- Make sure the cylinder is attached
- Before you begin, make sure that a suitable manometer is correctly 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 N₂, solid CO₂, ...

- 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 N₂ :

- Open the door during transfer

Cryogenic products



- In case of problems, push the red stop button

Safety in the laboratory

Part 3

Conducting experiments safely



general rules

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

general rules



- Never fill flasks more than two thirds.
- Glassware must be safely fastened (preferably at the ground joints) to stands by clamps
- Ground joints must be greased and fixed with clips.

general rules

- Make sure water is running if you use a condenser (the water should enter through the spiral and exit by the straight tube).
- Installations which need no vacuum must have an outlet which opens under excess pressure.
- If you use a septum, make sure that its apron is folded down over the glass tube or joint (see below).



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)

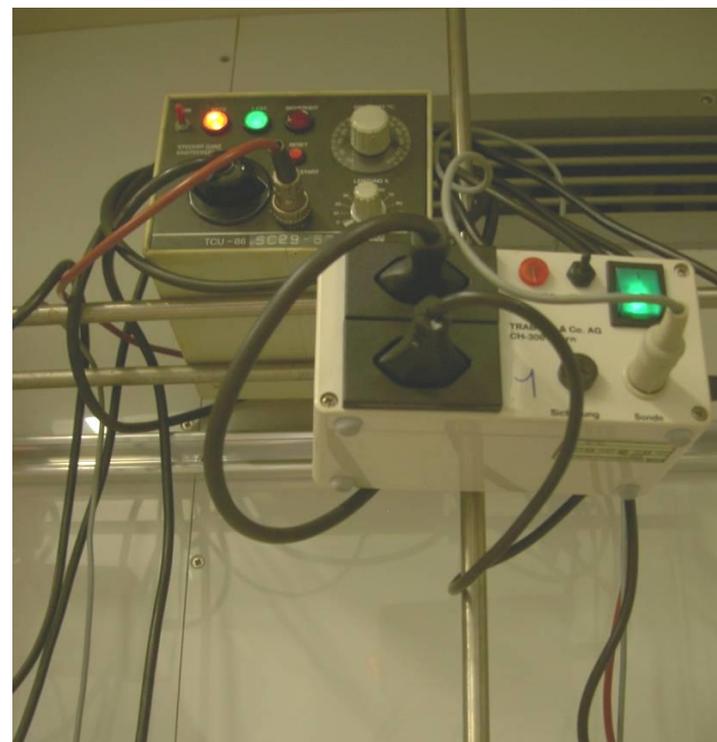
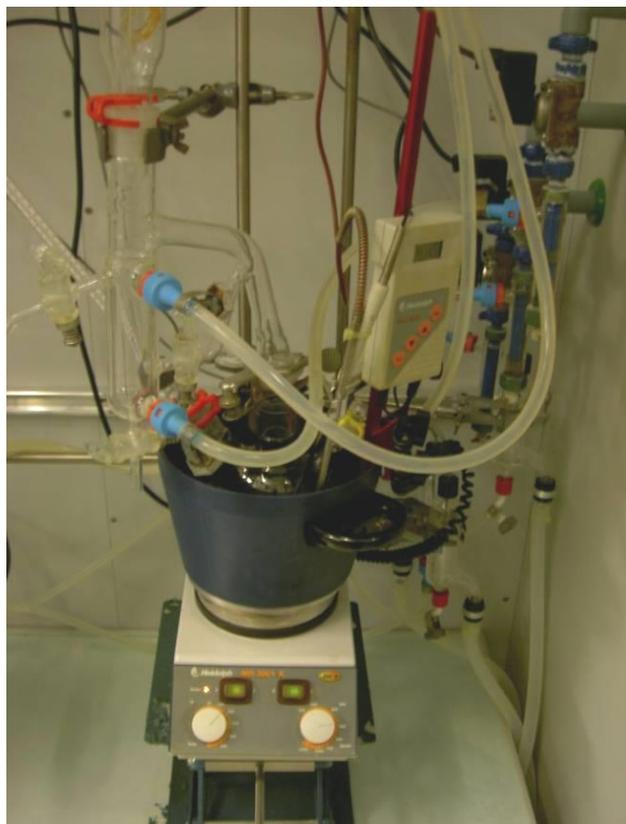
tubes

- Each type of tube has its function
transparent → water
red/orange → vacuum
black or solid white → gas
- Change tubes when they appear to be untight
- All tubes must be secured by buckles (especially water tubes!)



reactions during nights and on weekends

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



risks associated with vacuum installations

- Carefully examine all glassware that is used in a vacuum installation for defects (cracks, holes etc.)
- If a defect is suspected or seen, bring the system back to atmospheric pressure before examining it closely.
- Never carry around an installation under vacuum. This applies also to desiccators.
- Always apply vacuum before you start heating

risks associated with vacuum installations

- Never use flat bottom flasks except if they are explicitly made to be used under vacuum (filtering flasks, desiccators).
- If an installation under vacuum is heated, wait until it has returned to room temperature before venting it to atmospheric pressure
- If you use a water pump, always secure your installation by a Wulff-bottle (see below)



separating funnels

If you use a separating funnel, you must :

- degas frequently: the evaporation of solvents or chemical reactions that happen in the separating funnel may result in the production of gases which may cause overpressure and explosion!
- never orient the opening of a separating funnel towards a colleague because chemicals might be projected during degassing.

Syringes

if you use syringes, prefer the system

Luer-Lock

- the needle is screwed onto the syringe
- smaller risk of aspersion

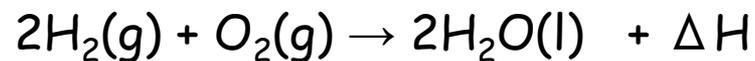


Safety in the laboratory

Part 4

What is to do after an accident has happened

When Bad Things Happen to Good Chemistry



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
<ul style="list-style-type: none">- wood, paper- organic solvents, gases- light metals (Na, K, Mg ...)- electrical equipment	<ul style="list-style-type: none">waterpowder, CO₂dry sandCO₂, 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



First aid

Immediately move injured people away from the dangerous zone **while paying attention to your own safety**. The following measures are given as first aid possibilities until arrival of medical assistance.

- Eye injuries by corrosives substances

Wash the eyes with a large amount of water (eye showers, douche) for approx 10 min. Maintain the eyelid open with the help of the fingers.

- Skin chemical burns

Remove immediately the contaminated clothes. Wash thoroughly the wounded body parts using the emergency showers (located in the lab).

- Burns

Cool the burned area with cold water for approx 10 min. Never use cream or oil!

First aid

- *Toxic gas inhalation*

Close the toxic gas source without endangering yourself. Move the casualties away from the danger zone. **Call 145.**

- *Eye injuries with foreign parts*

Do not administer first aid, wait for a trained professional. **Call 144.**

- *Opened wounds, bites, scrapes*

Cover with sterile bandage. (> first aid kit).

- *Ingestion of chemical substances*

Rinse the mouth thoroughly with water, do not give any antidote emetics.

- *Hemorrhages*

Stop the hemorrhage by placing the wounded limb in an elevated position, press with your finger or first stop the hemorrhage, and cover the wound with sterile bandage. (> first aid kit).

.

First aid

- *Fractures*

Reassure the person; do not move the broken limb

- *Electrocutions*

Turn of electrical power (turn out the fuse, located in the corridors!). In case of respiratory arrest, start artificial ventilation until rescue arrival.

- *Breathing stops*

Call immediately phone number **144**. Immediately perform the artificial respiration with a pocket mask or a protecting sheet in case of mouth-to-mouth operation.

- *Faintness, convulsions, unconsciousness*

Lie the person down with care in the recovery position. Protect the head with clothes or covers.

Safety in the laboratory

Part 5

Laser hazards



Laser Safety

Because you only get two chances



Laser Radiation

Laser:

Light

Amplification by

Stimulated

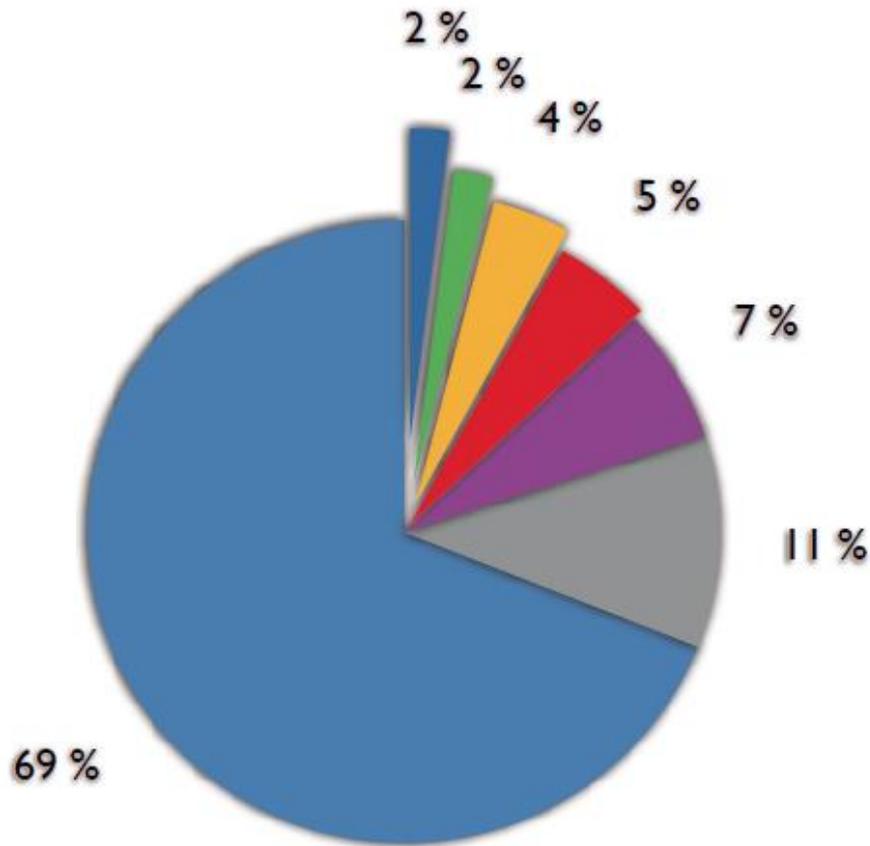
Emission of

Radiation

- **Directional**
- **Monochromatic**
- **Coherent**
- **Visible or invisible**

Laser light can focus more power onto a small area than ordinary light!

Laser Hazards



- Eye or skin damage
- Electrical hazards
- Chemical hazards



from Rockwell Lasers Industries, Inc. [2004]

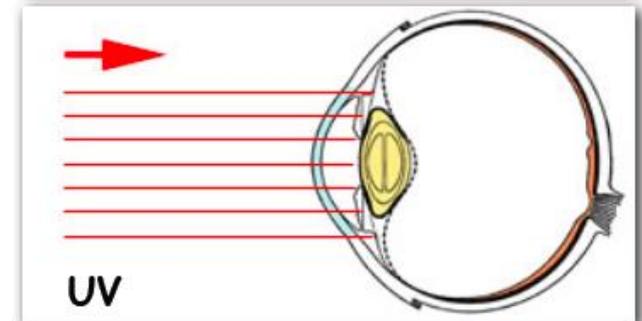
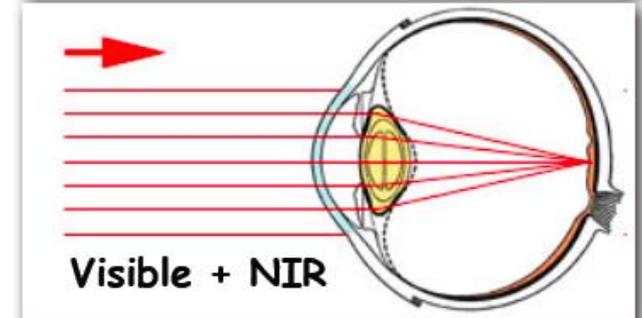
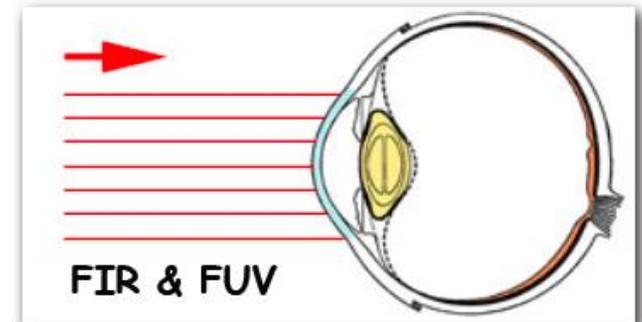
J-D Ganiere IPEQ / EPFL

Eye and Skin Injuries

- Thermal damage
- Acoustic damage ($< 10\mu\text{s}$)
- Photochemical damage

Photobiological Spectral Domain		Eye Effects	Skin Effects
Ultraviolet C	200 - 280 nm	Photokeratitis	Erythema (sunburn) Skin Cancer
Ultraviolet B	280 - 315 nm		Accelerated Skin Aging, Increased Pigmentation
Ultraviolet A	315 - 400 nm	Photochemical UV cataract	Pigment Darkening
Visible	400 - 780 nm	Photochemical & Thermal Retinal Injury	Photosensitive Reactions
Infrared A	0.78 - 1.4 μm	Cataract Retinal Burns	Skin Burns
Infrared B	1.4 - 3.0 μm	Corneal Burn Aqueous Flare IR Cataract	
Infrared C	3.0 - 10.0 μm	Corneal Burn Only	

J-D Ganiere IPEQ / EPFL



J-D Ganiere IPEQ / EPFL

Who Are You Dealing With?

Danger depends on:

- Power
- Wavelength
- Beam divergence
- Exposure duration
- Pulse length
- Pulse repetition rate

LASER CLASSIFICATIONS

Class	Optical power (mW)	Description	Examples
I	IWA	No laser radiation emitted at known hazardous levels.	Laser pointer, laser-based sensor
II	<1	Low power: The normal aversion response to bright light protects a person's eyes	Laser-based sensor
IIa	<1	Special classification for lasers not intended for viewing	Bar-code reader
IIIa	1 to 5	Intermediate power lasers	Penlike laser pointer
IIIb	5 to 500	Moderate-power lasers	Entertainment light-show lasers
IV	>500	High-power lasers are eye and skin hazards and possible fire hazards.	Surgical, cutting, and welding lasers

The table lists general classifications of laser-based devices. Laser photoelectric sensors typically fall under Class I or Class II device ratings.

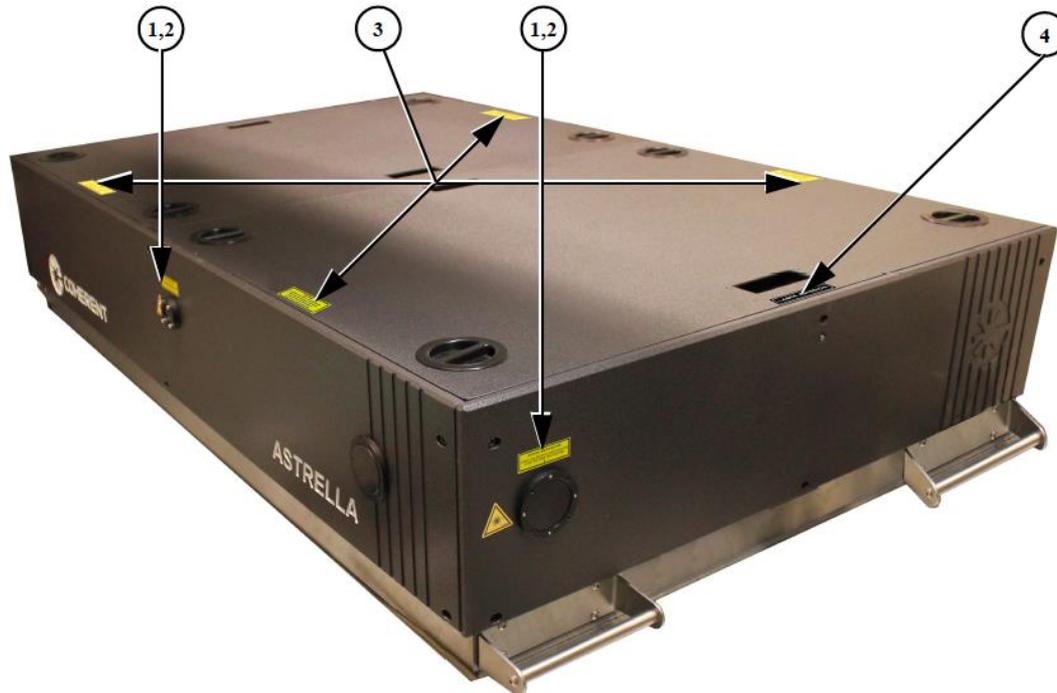
<http://machinedesign.com>

Class	wavelength range				Hazards		
	UV	VIS	NIR	IR	Direct Ocular	Diffuse Ocular	Fire
I	X	X	X	X	No	No	No
IIA	-	X ⁽¹⁾	-	-	only after 1000 sec	No	No
II	-	X	-	-	only after 0.25 sec.	No	No
IIIA	X	X ⁽²⁾	X	X	Yes	No	No
IIIB	X	X	X	X	Yes	only when laser output is near class IIIB limit 0.5 Watt	No
IV	X	X	X	X	Yes	Yes	Yes

X indicates class applies in wavelength range
 (1) Class IIA applicable to lasers "not intended for viewing" only
 (2) CDRH Standard assigns Class IIIA to visible wavelength only
 ANSI 136.1 assigns Class IIIA to all wavelength ranges

Femtosecond Spectroscopy

- **Class IV !**



WARNING!

Direct eye contact with the output beam from the laser will cause serious damage and possible blindness.

Safety Precautions

1) Never rush

Think before doing anything

2) Go into laser lab only with authorization

Warning light should be on if laser is operational

Warn if doing major alignments

3) Contain the beams

Optically isolate setup area

All beams should be horizontal (!optical fibers!)

Know exactly where the beams are

Block all unused beams

4) Keep the setup safe and tidy

Always block beams when inserting optical elements

Properly fix all optical elements

Never use double-sided tape

Remove un-used objects from the table

Safety Precautions

5) Protect your eyes

Wear appropriate laser goggles (with extreme care)

Never look into the beam

Never bend down below beam level

Attenuate the beam when aligning

Beware of invisible beams

Leave room light on if possible

optical density	transmission
0	1
1	0.1
2	0.01
3	0.001
4	0.0001
5	0.00001
6	0.000001



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6) Protect your skin

High power can burn skin and clothing

When working with UV light, wear gloves and long sleeves

Careful with focal points

Safety Precautions



7) Beware of reflections

Remove jewelry and watches

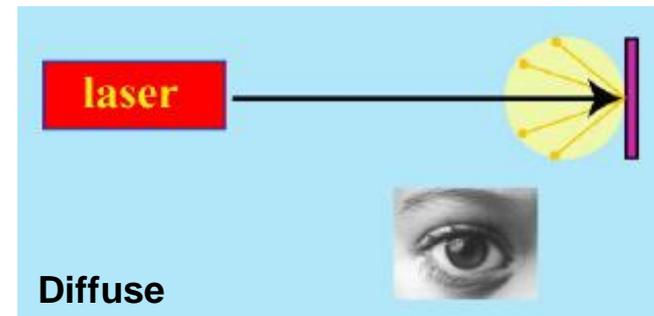
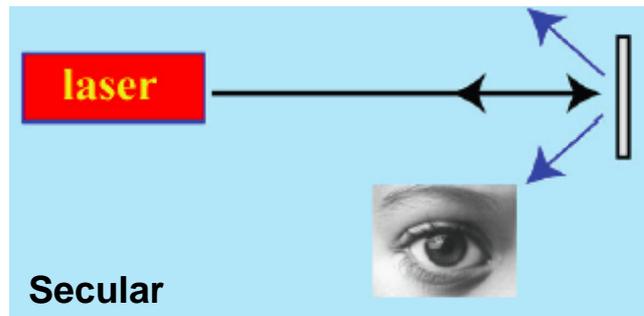
Block beams when using a screw driver

Identify all back-reflections and block them

Avoid reflection on computer screens and oscilloscopes

Avoid overfilling when using bubbling samples

Paper cards reflect (or catch fire) 0.2 W.



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8) Other dangers

Protect cables from laser beams

Careful with electrical circuitry

Careful with spilled solvents, tripping