LABORATORY SAFETY
SECTION OF CHEMISTRY, UPPSALA UNIVERSITY

All work in chemical laboratories entails a certain amount of risk. Many chemicals that are used can be dangerous unless appropriate safety precautions are taken. Following such precautions drastically reduces the risks and creates a safe and well-functioning laboratory environment. This document summarizes information about risks related to working in chemical laboratories, as well as actions to be taken should an incident nevertheless occur.

Everyone working in the laboratory must inform themselves about possible risks and take necessary precautions before work may begin. Before every laboratory session, a risk assessment is to be completed by the student and approved by the laboratory teacher. The procedure for this is outlined at the end of this document.

Note! Some chemicals must not be handled by pregnant and breast feeding women because they constitute a particular risk for the unborn and/or newborn child. If you are pregnant or breast feeding you should contact the course coordinator at the beginning of the course to ensure that it is safe to participate in the laboratory sessions.

Table of content

NÖDNUMMER*

Poison information	[00] 112 – ask for Poison information [00] 08-33 12 31 (non-urgent)
Ambulance, fire department...	[00] 112
Uppsala University hospital (switch)	[00] 018-611 00 00
Emergency ward (entrance 60)	[00] 018-611 00 00
Eye clinic	[00] 018-611 00 00 (urgent) [00] 018-611 51 28 (non-urgent)
Health information hotline	[00] 1177
Uppsala University's emergency number	[00] 018-471 25 00

*When calling from Uppsala University's stationary phones (red emergency phones) one has to dial 00 before the phone number to reach the external line.

GENERAL RULES

The **lab introduction** before each lab is compulsory. If you miss this introduction you will not be allowed to participate in the lab session.

No bags or jackets are allowed in the lab. At BMC there are lockers in the student changing rooms located in the basement A-corridor where personal belongings should be kept. Students bring their own padlocks and pick a locker themselves. At Ångström first year students will be allocated a locker by the course coordinator for the first chemistry course. Other students may hang their belongings on the hooks in the lab corridor.

Running/rushing around is not permitted in the lab due to the risk of spills, collisions, slipping etc. Sudden movements can also affect the fume hood ventilation.

It is **forbidden to smoke, use "snus", eat, drink, put on make-up or use mobile phones** in the lab. Apart from the obvious risk of getting chemicals in eyes or mouth, these activities also cause distraction.

Safety glasses and lab coats must always be worn in the lab and during all lab work (someone else might splash on you). This applies also when you are washing up! Make sure that your lab coat is done up and that both the lab coat and safety glasses fit comfortably. The lab coat shall have long sleeves, be made of 100 % cotton and preferably have snap buttons. Protective clothing made of synthetic materials must not be used, since such materials may easily catch fire and melt in contact with some chemicals. Lab coats are only to be worn in the lab *and nowhere else*!

Contact lenses are not allowed in the lab. Wearing contact lenses can make it more difficult to rinse the eyes if an accident should occur, which increases the risk for eye injury. Also, lenses can absorb certain chemicals and thereby cause further injury to the eye. Wear normal glasses instead, together with a larger pair of safety glasses.

Long pants and covered shoes shall be worn in the lab to protect legs and feet against chemical splashes. Nylon stockings (= synthetic material) must not be used. **Headwear** should be avoided if possible, but may be worn if they do not contain synthetic material. Long hair shall be worn in pony tail or braids if necessary. **Watches, rings and bracelets** shall be avoided**.** They can delay rinsing of the skin in case of chemical spills on hands, which increases contact time with the skin. They may also get caught in equipment. The lab teacher can deny students to participate in lab sessions due to inappropriate clothing.

Keep it tidy!

- It is all students' joint responsibility to maintain order in the lab.
- Only equipment that is necessary for the actual experiment in progress should be on the workspace. All equipment should be reset and returned to its storage space after use. Used material (chemicals, paper, etc.) should be returned or disposed of appropriately.
- After you have finished your work, the workspace should be in a suitable state for someone else to work there safely. This means that benches should be wiped with wet paper after working with harmless water soluble substances, or 70 % ethanol after working with bacteria. The fume hood surface should be wiped with water or acetone, depending on which chemicals have been handled there. Paper that has been used for wiping your workspace should be disposed in yellow waste bin for contaminated or non-contaminated consumables, depending on what kind of experiments that has been conducted, after organic solvents have been evaporated in a fume hood.
- Used glassware shall be washed. Marking can be removed with 95 % ethanol or acetone. Both the inside and the outside of all vessels shall be clean. Like dissolves like also when washing up – ask your lab teacher what to do if it is difficult to get your glassware clean.
- Dish racks shall be emptied of dry glassware which is put back in the cupboards before wet glassware is put there to dry. If the dish racks gets full it is okay to put wet glassware on paper towels on your lab bench – do not overload the dish racks! Test tubes are dried up side down in test tube racks. NB! The lab technician puts back dry glassware in the cupboards in D5:2 at BMC.
- Broken equipment shall be labelled and returned to the lab teacher or the lab technician.

Hygiene
Before you leave the lab you shall always wash your hands with soap and water to avoid contamination of surfaces outside the lab with chemical residues or bacteria. This applies also when taking shorter breaks.

CHEMICAL HANDLING

Stock bottles
Do not take chemicals directly out of stock bottles. Instead, pour a small amount into a beaker first (unless you have been given other instructions by the lab teacher). Make sure that the spoon/spatula you use to take the chemical from the beaker is clean. *Never ever put chemicals back into a stock bottle!*

Label all containers
Label beakers and other containers with their contents, your name and the date. You (and others) must always be able to find out which substances or solutions you have in your glassware. The consequences of a mistake here can be much more serious than just incorrect experimental results.

Fume hoods
All experiments with volatile chemicals are to be carried out in the fume hood with the safety screen pulled down as far as is practicable. In order to achieve optimal ventilation (and thereby optimal protection), nothing else other than what is required for the experiment is to be placed in the fume hood. The fume hood can also function as splash protection when working with for example corrosive chemicals. Naturally you should not put your head inside the fume hood!

If the fume hood suddenly malfunctions (e.g. power cut, some other technical problem) while work requiring ventilation is ongoing, the experiment must be stopped in a safe manner as soon as possible. Pull down the safety shield and leave the laboratory. Wait for the all-clear signal from the lab teacher/safety officer before beginning work again.

Gloves
When handling certain toxic or corrosive chemicals it may be necessary to use protective gloves. Protective gloves shall only be worn when the dangerous substance is handled. As soon as the work is finished the gloves shall be removed and disposed in appropriate waste container (disposable gloves are normally used in the education laboratories) to avoid contaminating other parts of the laboratory with the dangerous substance. If chemicals are spilled on disposable gloves, the gloves needs to be changed immediately since they only give temporary protection against chemicals.

Different materials protect differently against various chemicals. Therefore it is important to choose gloves that are made of a material that is resistant to the chemical that is going to be handled. Information about suitable gloves can be found in the chemical's safety data sheet. Using the wrong kind of gloves can under certain circumstances do more harm than good as it may impair rinsing off chemicals that have penetrated the glove.

Sometimes disposable gloves are used to protect samples from contamination. The choice of glove material is then less crucial from a safety point of view, but one should still be observant of chemicals penetrating the gloves as prolonged contact also with relatively harmless chemicals may cause irritation on the skin. Gloves should only be used when there is risk for contaminating the samples – if you have worn the same gloves for a whole day the gloves have probably been contaminated with all kind of stuff and do no longer protect the sample from contamination.

Transport of chemicals
Transporting chemicals is always associated with an increased risk of spill. Carefully consider how you can reduce the risk. Shall you bring the stock bottle to your fume hood or shall you bring your E-flask to the stock bottle? Do not bring containers with chemicals to the lab teacher, but bring the teacher to your

fume hood instead. Never walk around with open containers in the laboratory. Chemicals shall be weighed in containers that can be closed before they are transported back to the fume hood.

Clean up all spills
All spills must be taken care of immediately. Even water spills must be wiped up, since it is often not possible to distinguish from more dangerous chemical spills.

Small amounts of liquid chemicals can be wiped up with paper towels. Large amounts of liquid chemicals is covered with absorption material (vermiculite) which is then collected in a separate yellow waste container with broom and shovel. Large spills of strong acids or bases are neutralized before they are absorbed of wiped up. Thera are also other chemicals, e.g. bromine, which need to be deactivated before they can be wiped up in a safe way.

Fridges/freezers
Flammable chemicals must only be stored in fire proof fridges/freezers, not regular fridges/freezers for household use.

Samples that are stored in fridges or freezers shall be labelled with content (substance, solvent, concentration), name, course code, and date. All samples shall be removed from fridges and freezers at the end of the lab session. Only stock solutions and chemicals that should be saved for next lab session can remain the fridges and freezers.

SPECIAL RISK CATEGORIES

Flammable chemicals
Many solvents are very flammable. Organic solvents shall be handled in the fume hood with the ventilation turned on, except when washing up with acetone or ethanol. Bottles with flammable solvents must not be left open, since such solvent vapours in some cases have a high density and may flow across the floor and be ignited by a spark far away from the bottle. Also, some solvents can react with oxygen in the air and cause an explosion. All flammable chemicals that are released into the air lead to deterioration of the environment in the lab as well as more generally. If you wash up with acetone or ethanol, do not flush with warm water since this will lead to the release of large amounts of vapours.

Methanol
Methanol (wood alcohol) is classified as a poison. Ingestion or extended inhalation of methanol can lead to blindness and in the most serious cases even death. Methanol shall be handled in the fume hood.

Ethers
Ethers can form explosive compounds, namely peroxides (R-O-O-R). The reaction takes place with oxygen in the air and is catalysed by normal light. Peroxides can explode with extreme force without warning or ignition. It is therefore necessary to keep ethers in dark, tightly closed bottles that are placed in separate cupboards if possible. Before using a bottle of ether it is necessary to check whether it contains peroxides. This is usually done with special peroxide indicator paper. Petroleum ether is not an ether, but rather an older trivial name of a mixture of liquid hydrocarbons.

Explosive compounds
In addition to peroxides (see above) there are several other functional groups with known explosive properties. Azides ($R\text{-}N_3$), nitro-compounds ($R\text{-}NO_2$, e.g. trinitrotoluene, TNT) and acetylides (compounds that form by abstraction of protons from acetylenes) are examples of explosive functional groups.

Alkylating and acylating agents
Methyl iodide and other alkylating or acylating agents are mutagenic, toxic and volatile. When working with these you should wear protective gloves, and always have a destruction solution (a 1:1 mixture of ethanol and concentrated ammonia) within reach. Work in the fume hood and check that the ventilation

is turned on! In case of skin contact: wash with the destruction solution and then with water. In case of eye contact: wash with water only.

Acids
Concentrated mineral acids (HCl, H_2SO_4, HNO_3, H_3PO_4, H_3BO_4) and organic acids (e.g. carboxylic acids) may cause chemical burns on skin and eyes. They may also cause irritation in the respiratory system upon inhalation of vapours. Concentrated acids shall therefore always be handled in the fume hood.

The acid-in-water rule shall be applied when diluting strong acids, i.e. the acid shall be added to the water and not vice versa. The mixing of acid and water is an exothermic process, meaning that heat is produced. By slowly adding the acid to the water (portionwise if needed) the acid will slowly sink towards the bottom of the container (acids have generally higher density than water) and the heat will be distributed in the container. This way the production of heat can be controlled, and it is possible to stop the addition of acid and cool the mixing container if the solution becomes too hot. If instead the water is added to the acid, the water will form a layer on top of the acid and it can fast become very hot locally at the surface. As a consequence the water may start boiling with risk for splashes of hot water and acid on skin and eyes.

In case of contact with skin or eyes: rinse with plenty of water.

Spills of large amounts of acid (e.g. on the workspace or the floor) are neutralised with Na_2CO_3 and absorbed or wiped up.

Bases
Bases can, just like strong acids, cause chemical burns on skin and eyes. Some bases (e.g. NaOH) are also difficult to rinse off with only water, and therefore the risk of burns becomes even greater. Bases can also cause irritation in the respiratory system upon inhalation of vapours. Concentrated bases shall therefore always be handled in the fume hood.

The base-in water rule shall be applied when diluting strong bases. The base-in-water rule works in the same way as the acid-in-water rule, meaning that the base shall be added to the water and not vice versa.

In case of skin contact: rinse with plenty of water and add soap to the water if the corrosive substance is not water soluble. In case of eye contact: rinse with only water.

Spills of large amounts of base (e.g. on the workspace or the floor) are neutralised with $NaHSO_4$ and absorbed or wiped up.

Sodium hydroxide (NaOH)
Sodium hydroxide is a strong base and can be very dangerous for the human body. Even very small amounts of sodium hydroxide can quickly destroy mucous layers in the mouth, nose and throat, and cause severe burns to the internal organs. Moreover it is one of the most common causes of eye injuries (e.g. due to splashes). If a strong base is swallowed, ensure that it is quickly diluted by drinking large amounts of water or milk.

Ammonia (NH_3)
Aqueous ammonia solutions are strong bases and can therefore cause the same kind of injuries as hydroxide solutions (see above). Ammonia has a strong, sharp odour that is detectable even at low concentrations and can lead to headaches. Vapours from strong aqueous solutions are very irritating for the eyes and the upper respiratory tract. Some individuals are more sensitive than others and even the least sensitive people can suffer from headaches if exposed to ammonia vapours. All work with ammonia (including ammonia/ammonium buffers) must be carried out in the fume hood.

Bromine
Bromine is a volatile liquid that can rapidly cause chemical burns if it comes into contact with skin. When working with bromine protective gloves shall be worn and a destruction solution (sodium thiosulfate, $Na_2S_2O_3$ (10 %, aq)) shall be within reach. In case of bromine spill on the bench or on your skin: wash with sodium thiosulfate and then with water. If case of eye contact: wash with water only.

Oxidizing agents
Strong oxidants always imply a risk for fire and explosions. The danger is greatest when an oxidant could come into contact with a reducing agent, a fuel or something flammable.

Nitric acid (HNO_3)
Apart from being a strong acid, nitric acid is also a strong oxidant. Poisonous by-products (nitrogen oxide gases) and explosive compounds can be formed when nitric acid comes into contact with organic material. It must therefore be handled in the fume hood, and detailed knowledge of the content of reaction mixtures is required when nitric acid is used in experiments. Nitric acid causes immediate burns upon skin or eye contact.

Alkali metals (Li, Na, K, Cs)
Alkali metals are extremely reactive in contact with water and form hydrogen gas that can ignite and explode. They also react with oxygen in the air and are therefore stored in oil or paraffin. They also react strongly with alcohols and chlorinated solvents.

Lithium aluminium hydride ($LiAlH_4$)
Lithium aluminium hydride is a reducing agents that reacts intensively with water and form hydrogen gas that can ignite by the reaction heat and explode. Glassware and solvents that are used in lithium aluminium hydride experiments must be absolutely dry. Sand shall always be available as extinguishing media when handling lithium aluminium hydride. Carbon dioxide extinguisher must not be used. Residual lithium aluminium hydride, including contaminated consumables, must be quenched before it can be disposed in waste containers since it can react with other material or moist in the containers. Ask the lab teacher for advice if you are ever the least bit uncertain how to handle lithium aluminium hydride.

Mercury
Mercury is a liquid metal whose use is now greatly restricted, but still can be found in the lab in older equipment. In case of a mercury spill this should be cleaned up using a mercury tweezer or an HCl-washed zinc plate, mostly to prevent formation of toxic mercury vapours. The collected mercury should be kept in a sturdy container until it is sent for destruction.

Lung damaging gases (Cl_2, Br_2, HCl, SO_2, SO_3, NO_2)
In case of inhalation of lung damaging gases: take the person out into fresh air.

Cooling media (liquid nitrogen, dry ice, mixtures of acetone and ice/dry ice)
Contact with cooling media and very cold objects may cause frostbites that can be just as serious as burns. Liquid cooling media boils vigorously upon contact with warmer (= room tempered) surfaces with risk of splashes. Protective gloves, covering clothing and safety goggles must be used when handling cooling media. When handling large volumes of cooling media a visor shall be used instead of safety goggles. Remember that e.g. metal objects that comes into contact with cooling media rapidly gets very cold – never touch object that recently has been in contact with cooling media without protective gloves.

Many materials becomes brittle when they are exposed to low temperatures. Cooling media shall therefore only be stored in vessels suited to the purpose (Dewars). Cooling media must never be poured into the sink since it may crack the sink or plumbing. Residual cooling medium is instead evaporated in the fume hood.

All cooling media evaporates with time and they shall therefore never be stored in tightly sealed containers. It shall always be possible for formed gas to slowly leak out from the container to avoid pressure to build up inside the container as this impose risk for explosion. All handling of cooling media

shall be done in well ventilated spaces. Spill of liquid nitrogen evaporates rapidly to nitrogen gas, and there is a risk that the formed gas displaces all oxygen in the room leading to asphyxiation. In case of large spills of liquid nitrogen the room shall be evacuated until the nitrogen has evaporated and been removed by the ventilation.

EQUIPMENT

Set-up
All experimental set-ups are to be approved by the lab teacher before the experiment may begin.

Open flame
When using open flames, check that there are no volatile and flammable solvents in the fume hood (and even in the adjacent fume hood). Some solvent fumes can flow from the bottle along the floor and be ignited by a flame somewhere else. Note! Warm hotplates can be an ignition source. Common flammable solvents include ether, methanol, ethanol, benzene, and acetone. When working with open flame on open bench, make sure there is no combustible material near the flame (e.g. solvents, paper, top shelfs/cupboards, etc.). If ethanol is going to be used as disinfectant together with a flame, which is often the case when working with bacteria, it is very important not to spray ethanol towards the flame. The ethanol may catch fire and then spread towards something combustible causing it to catch fire. Do not use disposable gloves when working with at flame, provided that no other superior risk demands it (consult the lab teacher if such a situation should occur). There is a risk that the gloves melt and thereby cause injuries when working close to the flame.

Heating organic solvents
Organic solvents are to be heated in a water or oil bath, and in some cases with a hotplate (though not for diethyl ether!). Always use boiling chips or a magnetic stirrer during warming to prevent the liquid from bumping.

Balances
Keep the balances clean – all spills must be cleaned up immediately! Use a brush to clean the weighing pan from spills of dry material.

Electrical equipment
Check that cables, contacts and switches are intact before plugging in or turning on electrical equipment. Even though checks are regularly made between lab sessions, the previous user may have missed some defect.

Glass
Cuts from broken glass are the most common type of accident in a chemistry laboratory. Always check that glassware is undamaged. If you find broken glassware, put in it the yellow waste bin for broken glass. Exchange glassware with chipped edges with undamaged ones.

Reduced pressure
Before beginning work under vacuum, you must ensure that there are no cracks or unevenness in the glassware. These could lead to implosions where glass splinters and chemicals can spread over a large area! Examples of work at reduced pressure is vacuum filtration and removal of solvent by rotary evaporation.

WASTE

Regular waste bins
Only paper towels that have been used for drying the hands after washing them and material that can be regarded as normal house hold waste (e.g. tape) can be thrown in the regular waste bins.

Consumables
Consumables (gloves, contaminated paper towels, Falcon tubes, Eppendorf tubes, pipette tips, filter paper, TLC-plates, cotton, glass wool, syringes, etc.) is disposed in big yellow plastic bins. Contaminated waste (white label) is separated from non-contaminated waste (blue label). Contaminated waste are material that have been in contact with bacteria or toxic chemicals. Ask your lab teacher if you are unsure about what is to be regarded as contaminated and non-contaminated waste. Consumables that are disposed of in the yellow bin must only contain traces of chemicals or bacteria. Pure chemicals, sample solutions, reaction mixtures and bacteria cultures must not be thrown in the yellow bins. Volatile chemicals are evaporated from the consumables in the fume hood before they are thrown in the yellow bins. This applies e.g. to paper towels that have been used to wipe up spill and gloves with large spills of chemicals on them.

Cutting/puncturing waste
Chipped glassware and broken glass are disposed of in big yellow plastic bins (the same kind that is used for consumables). Contaminated is separated from non-contaminated waste.

Pasteur pipettes made of glass can be put in smaller yellow bins with red lid for cutting/puncturing waste, or in the large yellow bins for broken glass.

Needles are put in small yellow bins with red lid for cutting/puncturing waste.

Chemical waste
Chemical waste is collected in special plastic containers carefully labelled with filling date and content. Different types of waste are taken care of by different methods and shall therefore be collected in separate containers. Halogenated solvents and non-halogenated solvents are collected separately, and solutions containing metal ions are collected separately from other water solutions. Solid material shall not be mixed with liquids, and organic and inorganic solids are usually separated. Ask your lab teacher if you are unsure where to put your waste.

Small amounts of diluted solutions of certain harmless chemicals can be disposed of in the sink (no toxic or environmentally dangerous compounds). Flush with plenty of cold water when chemicals are disposed of in the sink. Examples of solutions that can be disposed of in the sink is diluted salt solutions with pH in the range 6.5-11 (buffers) and ethanol and acetone residuals that arises from washing glassware. Pure chemicals must never be poured into the sink but shall be sent for destruction. Always seek the lab teacher's approval before pouring anything into the sink.

Polymerised acrylamide gels and agarose gels from electrophoresis experiments is disposed of in the yellow bins for contaminated consumables. Liquid agar must never be poured into the sink because it clogs the plumbing when it solidifies. Let it solidify in a suitable container, scrape it out of the container with a spatula or similar and throw it in the yellow bin for consumables.

Bacterial waste
Liquid waste (media) from bacteria cultures is collected in glass bottles with blue caps and autoclaved. Media containing chloramphenicol, kanamycin, or other antibiotics that are not inactivated by autoclavation is collected in plastic containers and sent for destruction as infectious waste. Glassware that has been in contact with bacteria is disinfected with Virkon can then be washed as usual. Culture plates are disposed of in yellow bins for contaminated consumables.

FIRE, ACCIDENTS AND FIRST AID

Fires can occur suddenly and their progress can be very fast. It is therefore very important to familiarize with the facilities in advance in order to quickly find extinguishers and emergency exits in case of fire. An evacuation plan where emergency exits and safety equipment is marked can be found in every corridor. In case of fire you should act according to SAVE-CALL-ALERT-EXTINGUISH-CLOSE-EVACUATE as described below. However, you should never expose yourself to undue danger when

trying to save another person or extinguish a fire. Therefore it may be necessary to skip some of the described steps in case of a serious fire. If there are several persons present that can help you should divide the different task among yourselves.

SAVE people in immediate danger:
- Make sure that people in immediate danger is brought to safety at a safe distance from the fire.
- -If someone's clothes starts burning, help the person to the nearest emergency shower, or push the person onto the floor to extinguish the fire with a fire blanket or possibly a lab coat. Always **start covering the person from the head and work downwards**, so that smoke and flames don't come up into the face of the injured person. Take care to ensure that the fire blanket covers the person tightly and smothers the flames. **Shower the person in the emergency shower** afterwards until the fire is definitely extinguished and that the responsible person at the department or the paramedics have arrived. **Do not remove clothing** since it may cause severe damage to the skin if the clothes have melted into the skin. Note! The fire blanket is air tight. This means that a person laying under the blanket cannot breathe. Therefore it is important to remove the blanket from the person's head as soon as the fire is extinguished. **Check that the person is breathing** when the blanket has been removed. Start CPR if necessary.
- Fire extinguishers must not be used on people. They can cause injuries that are just as serious as fire burns.

CALL the fire department:
- Call SOS Alarm on number [00] 112.
- The address to the building can be found on the evacuation plan in the corridor.
- Designate someone to meet the fire department.

ALERT others that may be affected by the fire:
- The evacuation alarm shall be activated automatically in case of fire. If that does not happen the alarm can be activated manually. Alarm buttons are located by the exits of every corridor. Lift the lid and smash the glass to activate the alarm.

EXTINGUISH the fire if possible:
- Do not try to extinguish chemical fires with water as this often worsens the situation.
- Fires in small containers (beakers, pots, etc.) can be extinguished by covering the container with some kind of lid.
- If a fire occurs in the fume hood, close the sash (switches off the ventilation and reduces the oxygen flow).
- Larger fires are extinguished with appropriate fire extinguisher (carbon dioxide extinguisher for solvent and electrical fires, foam extinguishers for wood and textiles, and lastly powder extinguisher for all types of fires).

CLOSE around the fire if it is not possible to extinguish it:
- Close fume hood sashes, windows and doors to reduce the oxygen supply.
- Remove combustible material if possible.

EVACUATE the building:
- Check that no one is left behind! The last person to leave closes the door.
- Emergency exits are marked with green signs.
- Never use the elevator – you may get stuck in the elevator in case of power failure.
- Go to the assembly point (marked on the evacuation plan in the corridor). Note that the assembly point may vary within the same campus depending on which building you are in. Check that everyone is accounted for. Report missing persons to the emergency services.

Chemical splashes on skin

If your skin comes into contact with dangerous chemicals (corrosives in particular), rinse immediately with large amounts of water. Add soap to the water if the substance is not water soluble. Change lab coat if it has been contaminated with chemicals. If you spill chemicals on your clothes, remove them and rinse the skin with large amounts of water. Always seek medical attention in case of serious injuries/burns, call [00] 112 in urgent cases.

Chemical splashes in the eye
If dangerous chemicals (corrosives in particular) comes into contact with the eye, it must be quickly rinsed away with large amounts of water. Use the eye showers (with tempered water) located in the laboratories. Make sure that the injured eye is open during rinsing. This may require holding the eye open with your fingers. Often assistance from another person is required because the injured person may go into shock. Always seek medical attention for any kind of eye injury!! In urgent cases, call [00] 112.

Some rooms lack permanently installed eye showers. Instead there are portable eye showers that can be used for immediate rinsing in case of splashes in the eye. However, it may happen that the portable eye showers are finished before the eye has been properly rinsed. Then it is important to quickly find a permanent eye shower (or more portable eye showers) where rinsing can be continued. Therefore you should always know the location of the nearest permanent eye shower, even if it is not located in the room you are working in. Portable eye showers may also be used to rinse the eye during transport to the hospital, and therefore it is good to know where they can be found also when working in a room with permanent eye showers.

Cuts
First aid boards or small first aid boxes containing blood stopper bandages and plasters can be found in the corridor or the laboratory (check what is the case in the corridor you are working in). Smaller cuts: rinse them clean and put on a plaster. Larger cuts: Use a blood stopper bandage to put pressure on the wound. Keep the injured body part elevated to reduce the blood flow. Seek medical attention, call [00] 112 in urgent cases.

Incident reports
As part of the systematic work environment management at Uppsala University, all incidents and accidents that occur during work shall be reported to the Head of Department and tillbud@uadm.uu.se. If you are involved in an incident or accident you shall notify your lab teacher who helps you to write an incident report. If you have been injured or if there is risk of a latent injury the incident shall also be reported to Försäkringskassan. The Head of Department is responsible for sending the report to Försäkringskassan, but most likely you will have to provide the Head of Department with your personal details and information about the incident to enable them to write the report.

RISK ASSESSMENT

Regulations
According to the Swedish Work Environment Act and its ordinance, risk assessments shall be made for all work activities taking place at work place. This is of particular importance at chemistry laboratories since many risk sources can be found there, both in the forms of chemicals and equipment. The Swedish Work Environment Authority has issued special provisions regarding work with chemicals, AFS 2011:19Eng Chemical Hazards in the Working Environment. These provisions describe, among other things, how a risk assessment shall be conducted and documented. In addition to the inherent hazards of the chemicals that are going to be used, also choice of method, the knowledge and experience of the person performing the experiment, the design of the laboratory as well as the use of protective equipment, shall be weighed into a risk evaluation.

Doing a risk assessment before starting an experiment is not a waste of time but a natural part of the preparations. Properly conducted risk assessments lead to well-functioning experiments, which reduces the risk that something unexpected happens. If an accident should nevertheless occur, everyone will know what to do to minimise damage.

A general risk assessment is made for each laboratory experiment already when planning the course content, but for educational purposes and to ensure a good working environment all students shall make their own risk assessment before each lab session. After completion of their education, all students are expected to know how to do risk assessments for chemical experiments.

Your task
Before each lab session you shall do a risk assessment of the planned experiment by filling out a risk assessment form. The risk assessment form is often appended to the lab instructions but can also be down loaded electronically from Studium, The completed risk assessment shall be handed in to the lab teacher at the beginning of the lab session, unless you have been instructed to do otherwise. The risk assessment has to be approved by your lab teacher before you can start the experimental work. An insufficient risk assessment may imply that you are not allowed to participate in the lab session. The approved risk assessment shall be kept in a place known to everyone involved. During an ongoing lab session the document can be posted in the vicinity of the experiment, e.g. on the fume hood.

Procedure
Read through the entire instructions for each experiment and check that you understand both the practical aspects as well as the chemicals to be used during the experiment. If you have any questions at all, ask a fellow student, consult appropriate literature (course literature) or ask your lab teacher.

Find the safety data sheets (SDS/MSDS) for the chemicals that will be used. Safety data sheets can be found in Uppsala University's chemical managing system KLARA:

https://secure.port.se/alphaquest/app_uu/pcmain.cfm.

KLARA can only be reached from the university network, but there is no need to login to the system to access the safety data sheets. Simply click the link "Click here" on the start page to reach the search function.

Safety data sheets can also be found at companies selling chemicals. Uppsala university's largest suppliers of chemicals are SigmaAldrich (https://www.sigmaaldrich.com/sweden.html) and VWR https://se.vwr.com/store/. Search for the English name of the chemical or the CAS-number, choose a product and the click on "Safety data sheet", "SDS" or "Safety and Documentation" (it may look a bit different for different products). The safety data sheet is usually provided as a pdf-document.

Fill in the risk assessment form. If there is not enough space, use the back of the form. All green fields must be filled in:
- Fill in all formalities (date, name of the experiment, your name, page number in your lab journal) at the top of the form.
- Summarise potentially riskful steps in field ①. What will happen during the experiment and how are the chemicals handled? Which reactions occur (write reaction equations)? Does the equipment that will be used imply any safety risk?
- List the substances that are used and those that are formed during the experiment in field ②. State also the state of matter, concentration, and amounts to be used.
- State which dangerous property/properties the substances have in field ③. (Section 2.2 in SDS)
- List the H-phrases (Hazard statements) for all substances in field ④. Write in words what the codes mean. (Section 2.2 in SDS)
- Describe all preventative measures and actions if an accident should nevertheless occur in field ⑤. (See P-phrases (Precautionary statements) in section 2.2 and section 4.7 in SDS.) Focus on the scenarios that are relevant for the experiment in question.
- State the type(s) of waste(s) that are produced and how to dispose of it in field.⑥
- Do an overall assessment of the level of risk for the whole experiment in field ⑦.

Remember that "danger" is not synonymous with "risk". If appropriate measures are taken, the risk when handling dangerous chemicals can be minimal. In the same way, the handling of non-dangerous chemicals can be risky due to the method of handling (e.g. moving 100 L of boiling water!). When you perform risk assessments you should therefore consider more than just which chemicals are used – consider also what you are going to do with the chemicals during the experiment, what amounts are handled, what equipment is used and what safety precautions are taken.

Kemiutbildning

Riskbedömning

uppdaterat: 20190402

Datum:	Namn, mob.nr.:	Expt nr/sida i labbjournalen:
Laborationens namn:		

Reaktioner, förhållanden och hanteringar av betydelse för säkerheten:

1

Ämnen, inkl. de som bildas under laborationen samt lösningsmedel. Ange även aggregationstillstånd och ev. koncentrationer.	 Miljöfarlig	Skadlig	Frätande	Hälso-farlig	Giftig	Oxide-rande	Brand-farlig*	Gas under tryck	Explosiv	H-fraser
2					3					4

Fortsättning på baksidan? Ja ☐ Nej ☐

* *Extremt brandfarlig, mycket brandfarlig eller brandfarlig*

Förebyggande skyddsåtgärder och åtgärder vid tillbud (se P-fraser)

5

Avfallshantering

6

Sammanlagd risk med hänsyn till farorna samt vidtagna säkerhets- och skyddsåtgärder: Låg | Medium | Hög | Mycket hög

7

Datum, handledares namnteckning med namnförtydligande

STATEMENT

(Fill in and give to the lab teacher at the first lab session.)

Name:
Course:
Semester:

I have read and understood the information in the document ”Laboratory safety”, established by the Section of Chemistry at Uppsala University. I hereby undertake to follow these instructions when I perform experimental work in the Section of Chemistry laboratories.

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Signature Date