

RULES of SAFETY APPLIANCE in CHEMICAL LABORATORY

General Rules

1. Before the beginning of each lesson in chemical laboratory on analytical chemistry it is necessary to acquire the purpose of work, its theoretical basis and to begin execute the practical task only after drawing up of the thought over plan of work.
2. In an operating time in laboratory it is necessary to adhere to cleanliness and order, and also safety precautions regulations. The disorder and the carelessness at performance of analytical operations frequently results in necessity of recurrence of the executed work.
3. Work in laboratory should be organised so that at performance of analytical operation, which requires a lot of time (sedimentation), washing, the filtration, boiling, tempering etc.), simultaneously was possible to carry out and other operations of laboratory work.
4. It is prohibited to heat up test tubes with solutions of reacting substances directly on an open flame of the torch. Thus the liquid can splash (spray) from test tubes, that results in loss of researched solutions, and sometimes to accidents. In this connection the test tubes should be heated up on water bathe or quartz bath. At heating solutions in test tubes it is prohibited to direct an aperture of a test tube on itself or on the students, working beside, it is prohibited to look from above in a test tube with a liquid, which is heated up, because at a splashing of solutions from test tubes there can be accidents.
5. When there is a necessity to check up smell of substances in test tubes or vessels, in which the liquids are kept, is necessary easy movement of a palm of a hand to direct a flow of air from test tubes or vessel from themselves and cautiously to smell.
6. Reagents, distilled water, gas, electric power it is necessary to spend in laboratory economically.
7. It is necessary to carry out(spend) all kinds of works with substances, at which interaction are created harmful gases or unpleasantly smelling compounds, in the premise (room), specially intended for it, with the strengthened ventilation or at hood. Categorically it is forbidden to work with the named substances on a workplace.
8. To warn defacement of sewer system in laboratory, solutions of acids, alkalis and corrosive substances should be merged in the specially allocated utensils. It is necessary to merge a solutions of iodides, compounds of silver and mercury in separated utensils that further it would be possible to carry out regeneration and to receive from them compounds necessary for work in laboratory.
9. To not suppose pollution reagents, which are intended for sharing in laboratory:
 - a) Unused reagents it is forbidden to pour out back in utensils, in which is kept appropriate reagent;
 - b) The firm substances, which serve reagents, are necessary to take from utensils specially intended for this purpose reagent by palette or spoon. It is not authorised to one spoon or Safety Appliance palette, without their special clearing to take a various reagents;

c) The fuses from utensils with reagents are necessary for putting on a workplace of a table so that they did not concern a surface of a table by the internal party. Categorically it is forbidden to close utensils by fuses from other utensils;

10. It is necessary to carry out all reactions with small amount of researched substances and reagents. For performance of the majority of reactions it is necessary to take solutions from several drops up to 1 ml of a researched solution:

a) It is necessary to remember, that the majority of reactions occurs only at creation of the certain conditions. As a rule, reagent it is necessary to add only then, when for this purpose the researched solution is prepared (appropriate environment, temperature etc.) is created;

b) If the reaction should pass in acid or alkaline environment, it is necessary to add any volume of a solution of alkali or acid in researched substance. After addition of certain volume of solutions of an acid or alkali in a researched solution, the liquid is necessary to shake, and then drop of a mix by glass stick to transfer on a slice of universal indicator paper and to determine of environment.

11. If it is necessary to carry out reaction of precipitation, in test tube bring in small volume of a solution, add reagent and check formation of a precipitate. If the result of this experiment will be negative further to add reagent (precipitator) is inexpedient.

12. To achieve complete sedimentation, after added reagent and formation of a precipitant it is necessary to check up precipitation completeness in small volume of filtrate or supernatant. If the taken part of filtrate or supernatant with reagent gives a precipitant, it is necessary to add precipitator in all researched test. After achievement of precipitation completeness filtrate (supernatant) should not give positive reaction with reagent- precipitator.

13. As a rule, precipitation should be carried out at heating. Due to this the sediment becomes with large grains and easily is separated from a solution by a filtration or centrifugation. In that cases, when the heating negatively influences on precipitation, in the textbooks and practical works it is underlined, that the given reaction should be carried out on a cold.

Work with Acids and Alkalis

1. At work with the concentrated acids and alkalis it is necessary cautiously to handle with them and to keep up, that they have not got on a skin or on clothes because thus there can be burns and to spoil clothes.

2. At dilution the concentrated sulphuric acids are necessary cautiously and slowly for flowing an acid in water, rather the reverse. Because at dilution the sulphuric acid plenty of heat is evolve. Therefore at addition of water to an acid it can splash and get on a body and clothes.

3. At transfusion of plenteous of the concentrated acids and solutions of alkalis it is necessary:

a) Put up rubber mittens, apron and protective glasses;

b) The cylinders, placed in a basket, with the named liquids are necessary for establishing on a support, and then slowly to incline and to pour these solutions through funnels in well washed up and dried up bottles or glasses;

c) Categorically it is forbidden to involve by a mouth through pipettes the concentrated acids and concentrated solutions of alkalis. For this purpose on pipette it is necessary to pull special rubber bulbs and with their aid to collect necessary volumes of acids or solutions of alkalis;

d) The alkalis, which are in a firm condition, are necessary to collect from utensils with the aid palette or tweezers. At crushing alkalis in a firm condition of an eye it is necessary to protect by special glasses.

Work with Harmful and Toxic (poisonous) Substances

At work with harmful and poisoning substances (cyanides, salts of barium, mercury, lead, arsenic, copper, the metal mercury, hydrated sulphur etc.) is necessary to adhere to the following rules:

a) To keep up, that the harmful or poisoning substances have not got in organism through digestive canal. Because it is forbidden to eat in laboratory. After work in laboratory with the named substances it is necessary well to wash up hands;

b) Bottles with mercury or devices, filled with it, it is necessary to establish on special supports, that during damage of devices most amounts of mercury not got on a working table or floor. Spilled from utensils or from the device the mercury should quickly and accurate be collected through copper or silver shovel or vacuum-hose. To work with mercury it is authorised only in special premises (rooms). The persons, which work with mercury, should familiarise with the appropriate instruction.

Work with Combustible and Inflammable Substances

1. At work with diethylic ether, spirits, benzene, acetone and other combustible substances to heat up them it is necessary on water bathe in flasks with reflux condensers.

2. At work with these substances it is prohibited to add them in a mix of reacting substances from bottles of the large sizes. The necessary amount of these substances or their solutions should be poured in clean tube or small flask, and then from them to flow these liquids in a researched solution. It provides safety of work with combustible substances, which are in cylinders of the large sizes.

3. After a closing -up with combustible substances it is necessary to extinguish torches, which are close to devices with these substances, and then to begin work with devices, in which are (or there were) inflammable substances.

4. It is prohibited to keep combustible, inflammable and volatile substance near fire or strongly heated up electrical devices (thermostats, electrical furnaces et.).

5. The alkaline metals should be kept under a layer free from a moisture oil. At work with metal sodium or potassium it is necessary to warn their contact with water. After a closing -up the rest of these metals is necessary for transferring to the vessels, specially allocated for it. It is impossible to place metal sodium or potassium in a bowl or glasses, which are intended for dump of other liquids.

Liquidation of Fire

1. At occurrence of a fire in laboratories it is necessary immediately to switch off gas and all electrical devices. To remove all combustible substances from a place of a fire. The place of a fire is necessary to cover by sand or to cover by a woollen blanket and to extinguish fire through the fire extinguisher.

2. To use water for clearing a fire it is necessary cautiously, because water in some cases promotes not clearing, and strengthening of a fire.
3. At ignition of clothes on loosed it is necessary throw on a felt blanket, which cannot be removed before complete fading of a flame.

First Aid in Case of Accidents

The accidents (burns, impacts, poisoning) in laboratories can take place as a result of insufficient acquaintance working with the existing instructions on protection of work and safety precautions, or as a result of inaccuracy work. The rendering of the first aid loused consists in the following:

1. At hit on a skin of acids this place at first is necessary accurate for washing out by water, and then by solution of sodium hydrocarbonate. At hit on a kin of the concentrated sulphuric acid before washing of the damaged body by an acid it is necessary cautiously wipe this site of a skin) wadded tampon, or dry gauze.
2. At hit on a skin of the concentrated solutions of alkalis the damaged place is necessary to wash out by water, and then rest of a solution to neutralise by the diluted acetic or citric acid.
3. At hit on a skin phenol, bromium or other irritating substances it is necessary the damaged place immediately to wash out by the appropriate organic solvent (spirit, benzene, petrol, ether etc.).
4. At poisonings with chlorine, bromium, oxides of nitrogen losses it is necessary to give to inhale pairs of divorced solution of ammonia, and also to have a drink milk.
5. At burns of a body by a flame it is necessary immediately to wash out a place of a burn by the 10 % solution of potassium permanganate and to put on the damaged place compress of a alcoholic solution of tannin.
6. At cuts it is necessary to process a wound by a alcoholic solution of iodine and to tie up.
7. After rendering the first aid loosed, it is necessary immediately for directing to hospital.

1. Wear eye protection at all times. The potential for serious and perhaps permanent eye injury makes it mandatory that adequate eye protection be worn at all times by students, instructors, and visitors. Eye protection should be donned before entering the laboratory and should be used continuously until it is time to leave. Contact lenses should never be used in the laboratory because laboratory fumes may react with them and have a harmful effect on the eyes.

2. Most of the chemicals in a laboratory are toxic, some are very toxic, and some—such as concentrated solutions of acids and bases—are highly corrosive. Avoid contact between these liquids and the skin. In the event of such contact, *immediately* flood the affected area with large quantities of water. If a corrosive solution is spilled on clothing, remove the garment immediately. Time is of the essence, so do not be concerned about modesty.

3. Never work alone in the laboratory. Always be certain that someone is within earshot.

4. Never bring food or beverages into the laboratory. *NEVER* drink from laboratory

glassware. *NEVER* smoke in the laboratory.

5. Always use a bulb or other device to draw liquids into a pipet. *NEVER* pipet by mouth.
6. Wear adequate foot covering (no sandals). Confine long hair with a net. A laboratory coat or apron will provide some protection and may be required.
7. Be extremely tentative in touching objects that have been heated because hot glass looks exactly like cold glass.
8. Always fire-polish the ends of freshly cut glass tubing. *NEVER* attempt to force glass tubing through the hole of a stopper. Instead, make sure that both tubing and hole are wet with soapy water. Protect your hands with several layers of towel while inserting glass into a stopper.
9. Use fume hoods whenever toxic or noxious gases are likely to be evolved. Be cautious in testing for odors. Use your hand to waft vapors above containers toward your nose.
10. Notify your instructor immediately in the event of an injury.
11. Dispose of solutions and chemicals as instructed. It is illegal to flush solutions containing heavy metal ions or organic liquids down the drain in most localities. Alternative arrangements are required for the disposal of such liquids.

Laboratory Notebook Documentation

A laboratory notebook is needed to record measurements and observations concerning an analysis. The laboratory notebook is a record of your job as an analytical chemist. It documents everything you do. It is the source for reports, publications, and regulatory submissions. The success or failure of a company's product or service may depend on how well you do that documentation. The notebook becomes a legal document for patent issues, government regulation issues (validation, inspections, legal actions), and the like. Remember, "if it isn't written down, it wasn't done." The notebook is where you record your original ideas that may form the basis of a patent, and so it is important to record what went into those ideas and when.

What are the features of a well-maintained notebook? They will vary with individual preferences. But here are some good rules:

- Use a hardcover notebook (no loose leafs).
- Number pages consecutively.
- Record only in ink.
- Never tear out pages. If not used, put a line through the page.
- Date each page, sign it, and have it signed and dated (soon after you complete your report) by someone else, stating "Read and Understood by."
- Record the name of the project, (the title of the experiment) why it is being done.
- A brief statement of the principles on which the analysis is based. Equations for the principal reactions in the analysis.
- An equation showing how the results were calculated.
- Record all data on the day you obtain it.
- A summary of observations