



Students' life / fragment of the picture by Ivan Koulakov

Module 4 Part 4

Safety in the Physics Laboratory

“Prepare and prevent, don’t repair and repent.” – unknown author

Grammar Focus: Modals + Passive Voice

WARM-UP

Ex.1 In pairs, discuss some potential health hazards in your lab classes. Have you been instructed how to deal with them?

READING

Ex.2 Read the text. Do you have the same safety responsibilities as described in the text?

Intro

Lab work is the key to progress in science. Therefore, systematic, careful lab work is an essential part of any science program. In this class, you will practice some of the same fundamental laboratory procedures and techniques that experimental physicists use to pursue new knowledge.

The equipment and apparatuses you will use involve various safety hazards, just as they do for working physicists. You must be aware of these hazards. Your teacher or instructor will guide you in properly using the equipment and carrying out the experiments, but you must also take responsibility for your part in this process. With the active involvement of you and your teacher, these risks can be minimized so that working in the physics laboratory can be a safe, enjoyable process of discovery.

Instructor’s Responsibilities

The laboratory instructor will inform the students of possible hazards in working in the laboratory environment as these hazards present themselves. Some of the experiments need extra concern as they include multiple safety hazards. The instructor will also maintain a watch on the different laboratory groups and point out safety issues and corrective action as the need arises. If you have a question about safety, you should direct it immediately to the lab instructor.

Student's Responsibilities

The students in the physics lab are expected to exercise common sense judgment when working with laboratory equipment. When personal experience does not help in the identifying and avoiding possible safety hazards, the student should exercise extra caution and ask the instructor for assistance. Safety is more important than pride, and questions about safety will be answered promptly by the instructor. Note that it is better to NOT proceed if you suspect a safety issue than to learn the hard way! Students are expected to listen to and follow all instructions given by the laboratory instructor. This includes all safety precautions and guidelines.

Primary Physics Laboratory Safety Concerns

Although the physics laboratory doesn't usually use chemicals like biology and chemistry labs, there are still safety concerns that not everyone is commonly aware about. In the physics lab, the main concerns are mechanical, extreme heat and cold, electrical, radiation.

Many of the devices in the physics lab require mechanical motion and use significant amounts of mass. Students should be careful to place themselves and sensitive electronics out of the path of these masses in case a string or other holding device was to fail. This does happen from time-to-time in introductory laboratories.

In the heat and thermodynamics experiment, two different heat mechanisms are used: electric furnace and hot plate. Care should be taken while heating the objects by either method. Use insulating gloves and large tongs to transfer the object in and out of the furnace or hotplate. Check the electric furnace with tester for any leakage current before touching it.

A HeNe laser (633nm, 3mW) is being used in optics experiment. Direct staring into the beam will damage the retina of the eye. Safety goggles should always be worn while working at the level of the laser beam.

Extra precautions are needed while working with cryogenics in the lab. In the Liquid Nitrogen L-N₂ experiment, cryogenics gloves and safety goggle should be worn. There's always a chance of accidental spillage of L-N₂ which can be avoided by caution and common sense. Always avoid direct contact with L-N₂ as it will cause frostbite and in some cases, irreversible damage to skin.

The variac (variable transformer) is rated at 5KVA, 20A. High voltage /current can be lethal so rubber gloves should be used while working with it. Always check for leakage current in the magnetic phase transition apparatus prior to operation and operate the variac with one hand.

Remember, safety is the first priority. Let us work toward a safe and productive process in physics lab.

VOCABULARY

Ex. 3 Study the definitions of the words. Find them in the texts above and translate in context.

essential /ɪ'senʃəl/	(adj.) very important and necessary
to involve	(v.) to include someone in something
hazard /'hæz.əd/	(n.) something that is dangerous and likely to cause damage
caution /'kəʊ.ʃən/	(n.) advice or a warning
promptly	(adv.) quickly, without delay

precaution /pri'kəʊ.ʃən/	(n.) an action that is done to prevent something unpleasant or dangerous happening
concern /kən'sɜ:n/	(n.) something that is important to you, or the fact of being important
furnace /'fɜ:.nis/	(n.) a container that is heated to a very high temperature, so that substances that are put inside it, such as metal, will melt or burn
hotplate	(n.) a small cooker that can be moved
tongs /tɒŋz/	(n.) a device used for picking up objects
leakage current	the current that flows from either AC or DC circuit in an equipment to the chassis, or to the ground
retina /'ret.i.nə/	(n.) the area at the back of the eye that receives light and sends pictures of what the eye sees to the brain
accidental /,æk.sɪ'den.təl/	(adj.) happening or existing by chance
spillage /'spɪl.ɪdʒ/	(n.) an amount of something that has come out of a container
frostbite	(n.) injury to someone caused by severe cold, that causes permanent loss of tissue
irreversible	(adj) not possible to change; impossible to return to a previous condition

Ex. 4 Use the words from the text above to complete the sentences.

1. Heatshield safety barrier prevents.....contact with the heating plate.
2. No one was hurt but the accident caused a diesel
3. Use extremewhen working with hot plates or other heating devices.
4. Looking directly at a light source may damage theof the eye.
5. Learn the safety symbols so you can take the appropriate
6. So if you want toa job in this lab, make sure you know the procedures to follow in case of a fire or an emergency.
7. There is no clear definition of where refrigeration ends andstarts.
8. The equipment and apparatuses you will use involve various safety
9. Reporting all the accidents to the teacher immediately is
10. The experimentusing chemicals. Do not touch them or allow them to contact areas of bare skin.

Ex. 5 Translate the following useful phrases. Use the text when in doubt. Make your own example sentences with these phrases.

Добиваться новых знаний, быть осведомлённым, проводить эксперимент, нести ответственность, активное вовлеченность, держать под наблюдением, указать на некоторые моменты, действовать из соображений здравого смысла, учиться на горьком опыте

Ex. 6 Comprehension questions

1. What is a laboratory instructor responsible for?
2. What is a student responsible for when working with lab equipment?
3. What are the main concerns in the physics lab?
4. What should students care about when using various devices?
5. What is a main danger when working with a laser?
6. What precautions are needed while working with cryogenics and the variac?
7. Talk about your own experience of working in the lab. Have you ever faced with the safety hazards?

GRAMMAR: Modal + Passive Voice

Risks can be minimized. / You can minimize risks.

Ex. 7 Analyze the following sentences taken from the text. Change them into the Active Voice. Is there any difference in meaning?

1. Questions about safety will be answered promptly by the instructor.
2. Care should be taken while heating the objects.
3. Safety goggles should always be worn.
4. There's always a chance of accidental spillage of L-N₂ which can be avoided by caution and common sense.
5. High voltage /current can be lethal so rubber gloves should be used while working with it.

Ex. 8 Change Active into Passive in underlined sentences or underlined parts of the sentences, using modals of obligation:

1. Students must wear appropriate clothing to laboratory. Any food or drink brought to the lab must remain in the students carrying bag until they leave.
2. Place all sensitive electronic equipment safely on your table or within your bag under your table so that expensive damage can be avoided.
3. Do not modify or damage the laboratory equipment in any way unless the modification is directed by the instructor.
4. Use care when loosening and tighten screws and bolts. Treat the equipment as if it were your own.
5. Do not force any of the equipment. If an excessive amount of force is necessary then tell your instructor.
6. In case the fire alarm sounds, please exit the building by the nearest safe exit. Do Not Use The Elevators. If the fire is in the room leave everything behind. Your safety is not worth even an Rs.100, 000 computers. If the fire is not in the room and immediate danger is not apparent, then quickly and quietly pack your bag and exit the room or just leave the stuff behind. The instructor will lock the doors on the way out to ensure security.
7. In the case of any other emergency, follow the instructions of the laboratory instructor and all safety personal.

MODULE 4

GRAMMAR PRACTICE

Expressing ability: **can / could / be able to**

can (могу, умею)

- much more common than *be able to*
- for ability in the present

*He can swim five kilometers non-stop.
He can speak four languages.*

could (мог)

- for general ability in the past

He could swim when he was four.

be able to (быть в состоянии, мочь)

- very formal
- for specific achievement in the past

Please inform us if you are able to attend the meeting.

The house was on fire but he was able to escape.

There were great waves, but he was able to swim to the shore.

(=There were great waves, but he managed to swim to the shore.)

Ex. 1 Complete the sentences with *could* or *was/were able to*. In some sentences you can use both expressions.

1. Despite yesterday's snowfalls, we...drive home in less than an hour. 2. I only lived a mile from the office and...drive to work in less than an hour. 3. When she was the manager of the company she...take holidays when she wanted to. 4. I was very busy at work, but I... take a short holiday over Christmas. 5. In the 16th century, fishermen...smuggle wine into the country without fear of being caught by the authorities. 6. Robert...smuggle knife on board the plane without being detected by the security.

Expressing permission and requests

Permission: can / may / be allowed to can / can't (можно / нельзя)

*You can use my computer.
You can't use my computer.*

may (можно) - more formal

*May I have a word with you?
May I come in?*

be allowed to (разрешается) - for rules

*We aren't allowed to smoke in the office.
Are we allowed to use a dictionary for this test?*

Requests: can / could / will / would

can (можешь)

- a little more informal

*Can you help me?
Can I have your pen for a moment?*

could (могли бы вы) - more polite

*Could you help me?
Could I speak to Mary, please?*

Ex.2 Ask permission in these situations. Use Can I...? Could I...? May I...?

You want...

- 1...to change the conditions of the experiment.
- 2...to discuss the theme of your diploma work with your supervisor.
- 3...to ask exactly what your job is.
- 4...to talk to the employer about your application.
- 5...to call your brother from your friend's phone.

Ex.3 Use *aren't*, *weren't allowed to* or *couldn't*.

1. When I was a student, students...(not) do research in this institute. 2. Although he didn't have necessary papers, he... take part in the conference. 3. To our surprise, we... to work extra hours in the lab at weekends. 4. Although I had been waiting for two hours to talk to the Dean, I... speak to him. 4. She... leave the room until she had completed her work. 5. Students... to work with references in the reading room, but they ...take them home. 6. Students... use laptops in classes. 7. Before the meeting finished, I...give my point of view.