Working Safely in Science and Engineering

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Working Safely in Science and Engineering

* The purpose of this presentation is to inform you about the various aspects of safety you will need to know before entering any lab
* In other words, we want to keep you informed rather than letting you have you head in the sand..... like this guy:

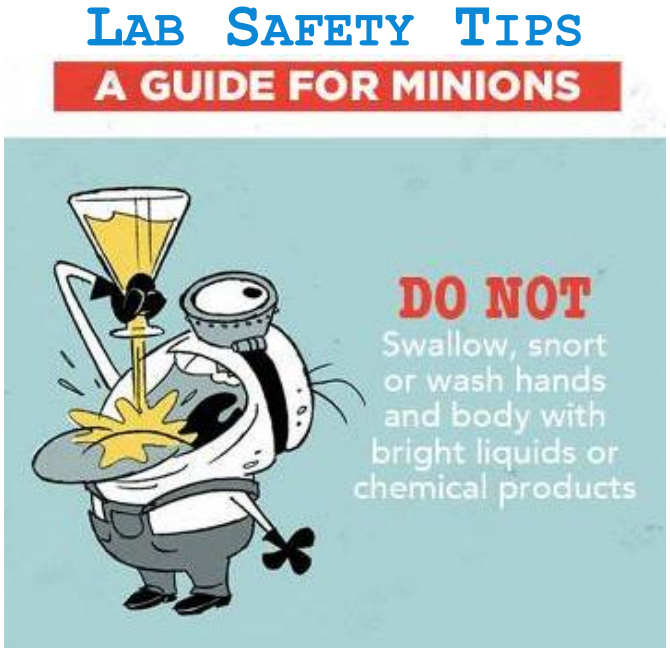
* We also want you to be able to take ownership of your own safety by the time you graduate

Your Safety Officers

* For the labs the following are the relevant safety officers who are responsible for your safety:
* Chemistry:
  * Dr. M. E. Bridge
* Biology:
  * Dr. J. Rochford
* Physics:
  * Mr. J. MacCauley
* Engineering:
  * Dr. S. McCormack

Why Safety?

* We don't want you like these guys!



Why Safety?

* Safety in labs is always a top priority! Labs can be dangerous places if the right precautions are not taken, so therefore safe working is very important.
* We want to present to you some information you need about how to work safely in a lab so that both you and we will be safe in the labs
* Labs are workshops, not playrooms!

Contents of this Presentation

* Section 1: Introduction to Safety
* Section 2: Lab Signage and Labelling
* Section 3: Dress Code in the Lab
* Section 4: Handling Chemicals in the Lab
* Section 5: Lab Safety Equipment
* Section 6: Reporting Accidents/Incidents
* Section 7: Response to Accident and/or Alarm
* Section 8: Blackboard Quiz

Section 1

Introduction to Safety

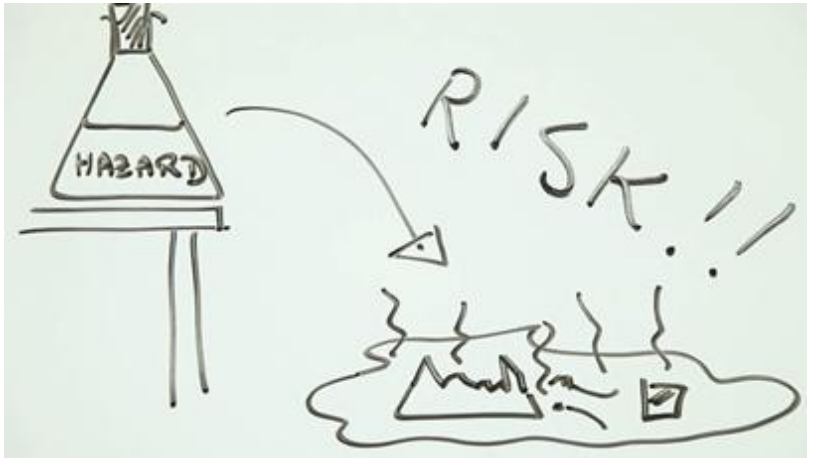
Risks and Hazards

First, there is an important distinction between “risk” and “hazard”:

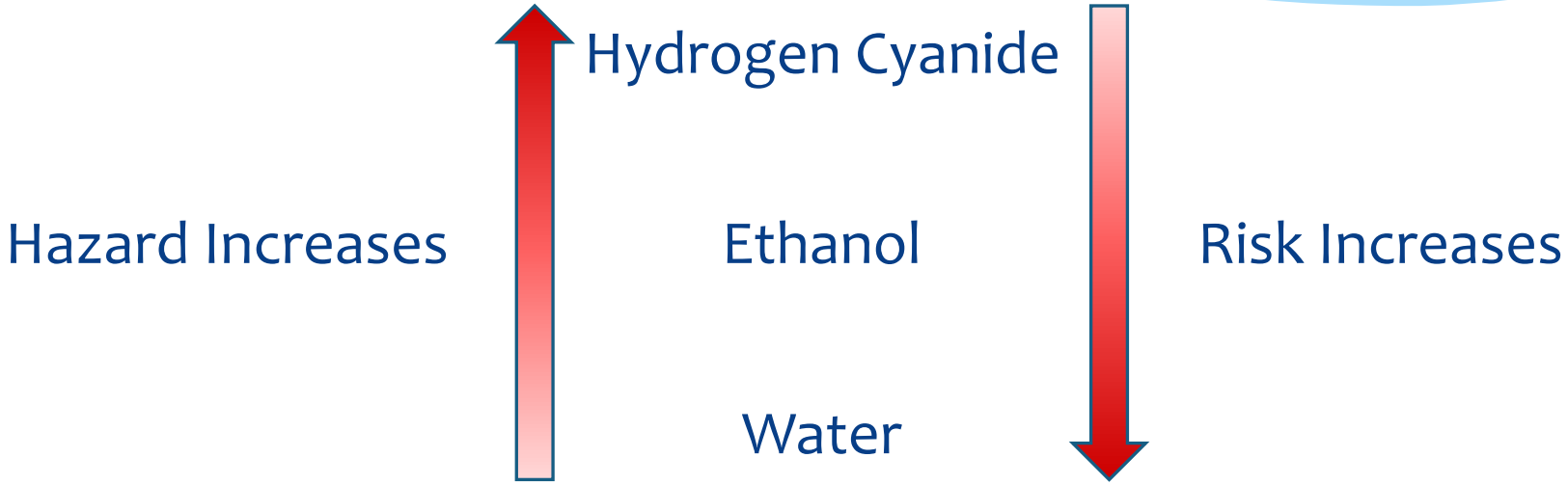
* Hazard
  * The intrinsic property of a chemical agent with the potential to cause harm
* Risk
  * The likelihood, should exposure occur, that the potential for harm will be attained under the condition of use and/or exposure and also the extent of that harm

Put Another Way…..

* Hazard:
  * The nasty things that might happen
* Risk
  * The *probability* that any one of them might happen



Relationship Between Risks and Hazards



* While hydrogen cyanide is far more hazardous than water, far more people die from water than hydrogen cyanide

Section 2

Lab Signage and Labelling

Lab Signs: Colour Code

* Blue signs – Tell you what to do
* Red signs – Tell you what NOT to do and where fire equipment is/instructions in case of fire
* Green signs – Tell you where to go
* Yellow or Orange signs – Gives you a warning

* It is a legal requirement to comply with blue or red signs (e.g. the instruction you are given). It is a criminal offence to not comply with these signs

Lab Signs: Blue Signs

* Blue signs give you an instruction you must follow
* i.e. They tell you what to do
* Common ones you will see in the lab are:
  * Fire door keep closed (keep this door closed)
  * Keep clear (keep this exit/area clear)
  * Eye protection must be worn

Lab Signs: Red Signs

* Red signs tell you what not to do or is for fire equipment/instructions
* Common ones you will see in the lab:
  * No smoking
  * No naked lights (often together with no smoking)
  * Fire extinguisher
  * Switch off mobile phones
* We will look at the different fire equipment signs later

Lab Signs: Green Signs

* Green signs tell you where to go
* Common ones you will see:
  * Fire exit (sometimes with blue keep clear)
  * Assembly point

Lab Signs: Yellow/Orange Signs

* Yellow or orange signs give you a warning
* Often have the words danger, warning or caution also
* Common examples:
  * Acid
  * Highly flammable
  * Bio-hazard
  * Radiation Risk

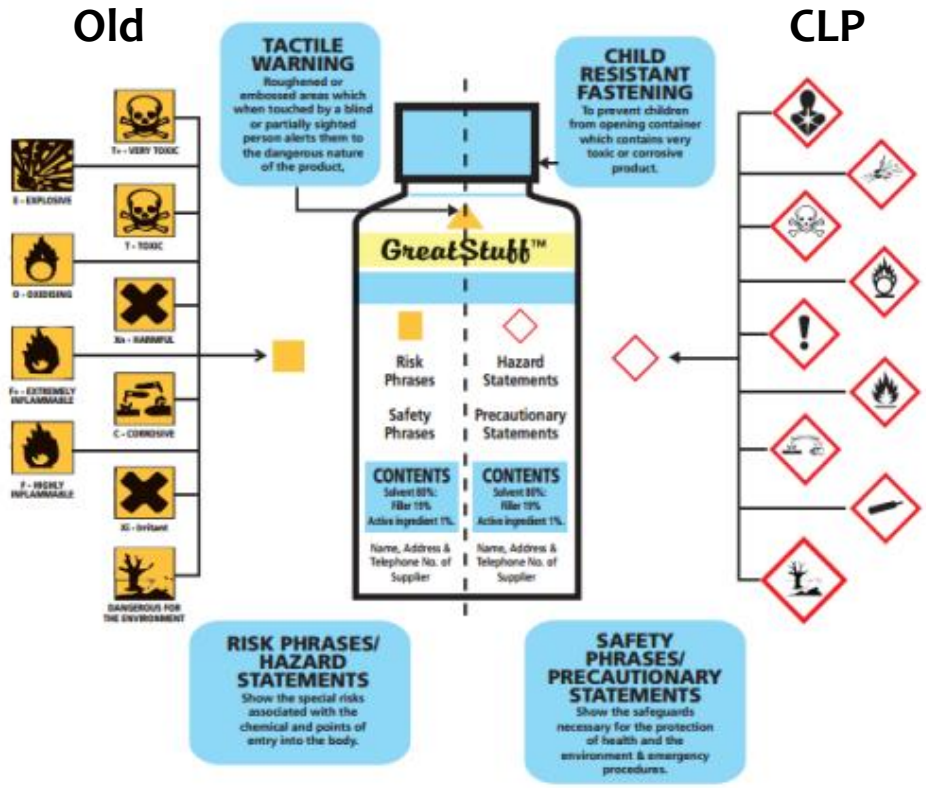
Lab Signs: Colour Code Summary

* Blue signs – Tell you what to do
* Red signs – Tell you what NOT to do/fire equipment
* Green signs – Tell you where to go
* Yellow or Orange signs – Give you warning

Classification, Labelling and Packaging (CLP)

* CLP is the new classification, labelling and packaging system for substances and mixtures
* CLP has new pictograms, signal word, hazard and precautionary statements on the labels
* However you may see the old system on some bottles in the labs

CLP vs. Old system



CLP Pictograms

CLP Pictograms

Explosive

Flammable

Oxidising

Gas under Pressure

Corrosive

Acute Toxicity

Serious Health Hazard

Health Hazard

Hazardous to the Environment

CLP Pictograms: Explosive

What does it mean?

Explosive

What should you do with it?

Handle with great care

Always wear protective equipment

Keep away from sources of ignition

Old pictogram:

CLP Pictograms: Flammable

What does it mean?

Flammable

What should you do with it?

Keep away from sources of ignition

Keep container tightly closed

Keep cool & protect from sunlight

Old pictogram:

CLP Pictograms: Oxidising

What does it mean?

Oxidising agent

What should you do with it?

Keep away from sources of ignition

Wear protective equipment

Rinse contaminated clothing and skin immediately with plenty of water before removing clothes

Old Pictogram:

CLP Pictograms: Gas Under Pressure

What does it mean?

Gas under pressure (gas cylinder present)

What should you do with it?

Protect from sunlight

Keep away from sources of ignition

Old Pictogram:

There is no existing symbol for this hazard pictogram

CLP Pictograms: Corrosive

What does it mean?

Corrosive

Examples of precautionary statements

Wash hands thoroughly after handling

Always wear protective equipment

Store locked up

Keep only in original container

Old Pictograms:

CLP Pictograms: Acute Toxicity

What does it mean?

Toxic

What should you do with it?

- Always wear protective equipment
- Wash hands thoroughly after handling
- Do not get in eyes, on skin, or on clothing
- If swallowed: call a POISON CENTRE or a doctor/physician if you feel unwell
- Remove/take off immediately all contaminated clothing.
- Store locked up in a closed container

Old Pictograms:

CLP Pictograms: Health Hazard

What does it mean?

Harmful to health

What should you do with it?

- Always wear protective equipment
- Wash hands thoroughly after handling
- If inhaled: remove victim to fresh air and keep at rest in a position comfortable for breathing
- If swallowed: call a POISON CENTRE or a doctor/physician if you feel unwell
- If in eyes: rinse cautiously with water for several minutes.

Old Pictogram:

CLP Pictograms: Serious Health Hazard

What does it mean?

Seriously hazardous to health

What should you do with it?

Obtain special instructions before use

Do not handle until all safety precautions have been read and understood

Always use protective equipment

Store locked up

Wash hands thoroughly after handling

If swallowed: call a POISON CENTRE or a doctor/physician

Do NOT induce vomiting

If exposed or concerned: Get medical advice/attention

If inhaled: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing

Old Pictograms:

CLP Pictograms: Hazardous to the environment

What does it mean?

Hazardous to the environment

What should you do with it?

Avoid release to the environment

Collect spillage

Dispose as instructed

Old Pictogram:

CLP Pictograms Summary

Explosive

Flammable

Oxidising

Gas under Pressure

Corrosive

Acute Toxicity

Serious Health Hazard

Health Hazard

Hazardous to the Environment

Section 3

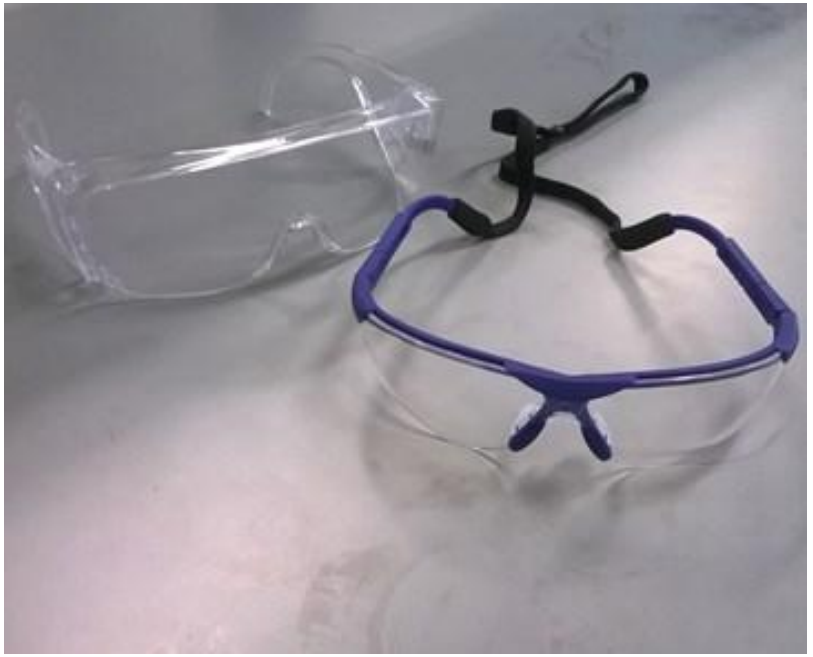
Dress Code in the Lab

What is Required When Where and Why

* In order to work in a lab proper protective clothing must be worn
* In Chemistry/Biology this means some or all of the following:
  * Suitable eye protection
  * Lab coats
  * "Sensible" clothes and footwear under lab coat (examples will be given later)
  * Hair tied back
  * Gloves where appropriate
* Without appropriate PPE (Personal Protective Equipment) you will **not** be permitted to enter the lab!
* No phones are permitted in the labs, please switch them off

Eye Protection

* Safety glasses are a must before entering a lab where they are a requirement
* There are two types of safety glasses:
  * Glasses to protect your eyes directly
  * Goggles to go over prescription glasses if you wear them



Contact Lens Policy

* In labs where safety glasses/goggles are a requirement contact lenses are not permitted under any circumstances. You **MUST** wear your prescription under your goggles
* Should you get something in your eyes and need to rinse them quickly, the contact lenses could impede the rinsing of your eye

Lab Coat

* When entering a lab where lab coats are a requirement, you must put it on before going in
* Lab coats are designed to protect your clothes and to stop you contaminating the outside world
* They are designed to be removed quickly should something nasty be spilled on them
* Note lab coats are not required for physics labs

Lab Coat Policies

* There are some small differences between lab coat requirements for biology and chemistry labs. You will be informed of these requirements by the relevant departments. Make sure, before you purchase a lab coat, that it is "Howie" style
* Please note that you may need to buy a new lab coat when you go into your Junior Sophister year (3rd year)
* If you take off your lab coat correctly, it should come off inside out. Always make sure it is inside out before rolling it up

Appropriate Response to Spills

* Should you spill something on your lab coat, don't panic, that's what it is there for!
* If you spill something nasty on it, remove it quickly and bundle it inside out. Contact a staff member on how to treat the contaminated lab coat
* Do not attempt to wash the lab coat in a normal wash with your clothes – seek advice from the laboratory staff on appropriate laundering techniques.

Gloves

* While gloves may protect you somewhat from a spill, they do however reduce you manual dexterity (therefore making the spill more likely!)
* For most experiments in the freshman years in chemistry and physics, gloves will not be required. However you will be advised, and on occasion instructed, to use gloves for some procedures

Gloves

* There are different types of gloves available (i.e. different materials), and you should choose one appropriate to the chemical handled
* Nitrile gloves are the most common
* They are available as required in the labs

Hair

* Hair should be tied back behind your head such that no hair will be in front of your eyes or in your experiment
* If your ponytail or tied back hair is quite long, it should be tucked in under the neck of the lab coat

What Do We Mean by "Sensible" Clothes and Footwear?

* By "sensible" we mean:
  * Jeans/trousers (no shorts, dresses, skirts, leggings etc.) to cover your legs below your lab coat
  * Splash resistant shoes (no open top shoes or runners that are not waterproof) to stop any spills seeping through onto your feet
  * No jewellery on hands, wrists or fingers

Sensible Clothes

* As described, sensible clothes would mean jeans/trousers that go right down to your shoes, and a t-shirt (or whatever is comfortable) under the lab coat.
* Jumpers can be bulky under lab coats, however the labs are not cold so you should not need one. No hoods should protrude from the lab coat!

Sensible Footwear

* Sensible footwear should be splash resistant shoes that are comfortable and easy to run in (in case of emergency), and jeans/trousers breaking over the shoes so no spilled liquid can run down into the shoes.

Bad Attire Examples (What's Wrong?)

Bad Attire Examples (What's Wrong?)

Why?

* Boots not splash resistant
* Jeans tucked into boots

* Shoes not splash resistant
* Bare skin
* Jeans rolled up (which will catch any spilt liquid)

* Hair not tied back

* Jewellery
* Bare skin (gloves should be right up to lab coat sleeve)
* Shirt sleeve sticking out

Section 4

Handling Chemicals in the Lab

Handling Bottles

* Always pick up bottles with your hand over the label.
* Do not pick up a bottle by its neck or lid
* By picking the bottle up by the label you
  1. Ensure that any liquid runs down the side of the bottle are always down the same side (away from where you will touch it)
  2. Ensure the running liquid does not make the label illegible
  3. Ensure the bottle returns on the shelf label facing out

Storing Chemicals on Shelves

* Always place chemicals back on a shelf with the label facing out so it can be read
* This is not only important so they can be found by the next user without handling them all, but for it to be easier to find something in an emergency

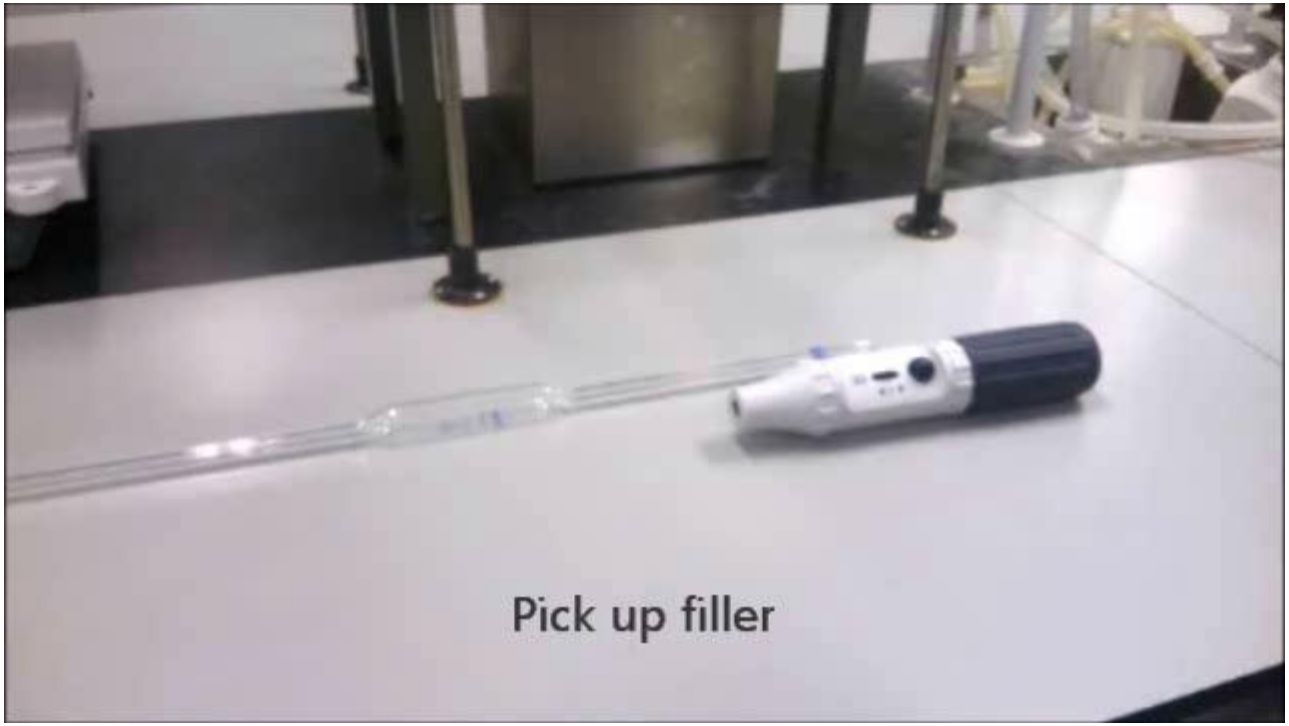
Glassware

* There are plenty of different types of glassware you will use during your time in the lab. The correct types and amounts will be supplied either in a locker or on the bench
* Always dispose of defective or damaged glassware in the sharps bin

Pipettes

* A pipette is an accurate measuring device that you will use in many experiments.
* Pipettes come in a variety of shapes and sizes
* Only ever fill a pipette using a pipette filler

Fitting a Pipette Filler

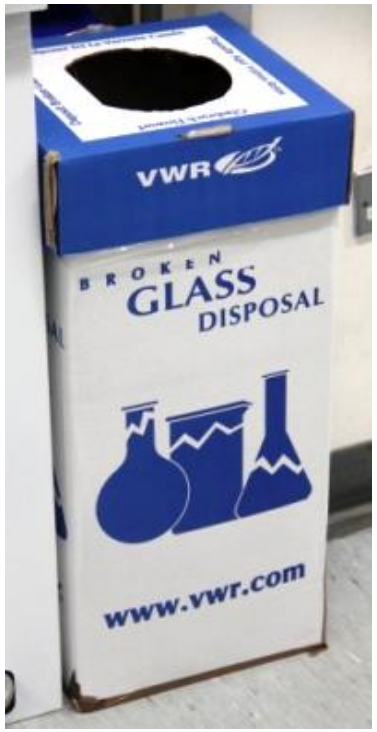


Fitting a Pipette Filler

* Points/Tips:
  * Squeeze the air out of the black top of filler before fitting pipette
  * Always hold the pipette about 1 – 2 cm from the top
  * Hold the filler with your hand over the buttons and above the round cone shaped base where the pipette goes
  * Do **NOT** force the pipette into the filler

Pasteur Pipettes/Droppers

* Pasteur pipettes and droppers are designed to be used to add a small amount of liquid to a reaction
* They can be made of glass or plastic, and may or may not have graduated markings
* After use, wash/dispose of Pasteur pipette as directed (if glass being disposed of, into sharps bin)

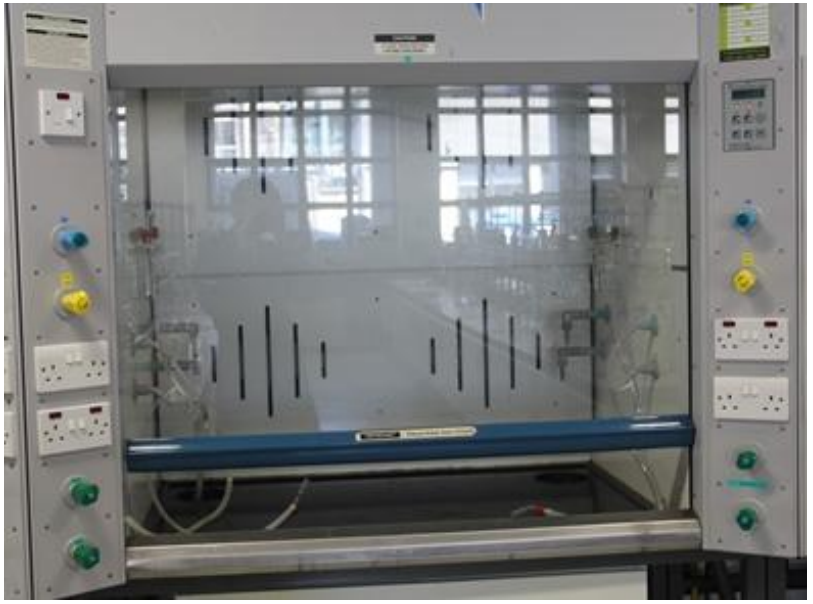


Burettes

* Burettes are used mostly for conducting titrations
* Always use a burette in a retort stand and well in from the edge of the bench

Fume Hood Cupboards

* Fume hood cupboards are used for doing experiments that produce gases; they are designed to suck the fumes away from the lab and up the chimney
* Fume cupboards should be used for one purpose: experiment or storage, **never** both
* Always keep fume cupboards uncluttered and the front 6 – 9 inches clear



Washing Glassware

* Washing glassware is normally the same as you do at home (hot water and detergent). However be very thorough to ensure you've got it perfectly clean. Don't worry the sink doesn't bite, so don't be afraid to scrub!
* Sometimes there are particular cleaning methods that are required. These will be specified in your lab manual
* Only wash empty glassware and always ensure all glassware is clean and dry before use

Section 5

Lab Safety Equipment

Lab Safety Equipment

* All labs you will be using are equipped with safety equipment for any emergency or accident you might have
* This equipment is for **your** safety and **your colleagues'** safety so treat it with respect. It is a criminal offence to tamper with any of the safety equipment inside or outside of the labs
* We will now show you some of the safety equipment present in the labs. Make sure you are aware of the locations of the safety equipment

Lab Safety Equipment

* Rather than using the safety equipment yourself, always contact a member of staff before doing so as they are trained to use it
* Therefore you will need to:
  * Be aware of the location of all the safety equipment **and exits**
  * Make sure all safety equipment/emergency exits are kept clear of bags, coats etc.
  * Know how to identify a staff member or lab technician

Safety Shower

* The safety shower in the lab is only to be used in an emergency (not if you forgot to clean yourself that morning!)
* If you or a colleague spill a dangerous amount of a chemical on yourself, contact the staff member in charge immediately as the shower may be necessary

Eyewash Station

* The eyewash station is designed should anything get in your eye it can be rinsed out rapidly
* If this happens, get a colleague to get a staff member immediately and then bring you to the eyewash station
* Reminder: Contact lenses are prohibited in the labs and you should also be wearing safety glasses/goggles

First Aid Cabinet

* First aid cabinets are posted at various points in the labs for use in case of minor injuries
* Do not open the cabinet yourself, contact a demonstrator or staff member who will deal with your injury

Fire Extinguishers

* Fire extinguishers, as you all must be aware, are designed to fight small fires
* Unless you are trained to use a fire extinguisher, do not attempt to extinguish a fire with them!
* If there is a fire, raise the alarm and leave the building
* Be aware of the location of all the extinguishers and keep them clear!

Waste Disposal

* The disposal of lab waste is a key issue that must be dealt with carefully
* Waste will need to be separated, and different containers will be supplied for each waste type
* It is important to separate chlorinated and non-chlorinated solutions
* More information on waste disposal will be given in the individual lab

Section 6

Reporting Accidents/Incidents

Accidents/Incidents

* It is never anyone's intention to have an accident, **but** they do happen!
* In order to minimise accidents:
  * Always know what you're doing before doing anything
  * If in doubt, stop and ask! That's why demonstrators are there
  * Concentrate on what you're doing, don't get distracted by your phone or anything else
* There is always a good reason for a particular instruction, if you don't know what that is ask!

Some Dos and Don’ts to Prevent Accidents

* Do:
  * ask if you are unsure of something
  * follow staff and demonstrator instructions
  * read your instructions carefully
  * wear appropriate PPE
  * conduct your experiments with all due care and consideration
  * switch your phone off
* Don’t:
  * force a pipette into the filler
  * leave glassware near the edge of the bench where it could fall
  * light a Bunsen burner in a fume cupboard when flammable solvents are present
  * use defective glassware

Reporting an Accident

* If you, or someone near you, has an accident:
  * Report it to a demonstrator and/or the staff member in charge of the lab **immediately**
  * Inform the staff member of the type and severity of the accident
  * Report any injuries to the staff member in charge
* This is very important as an incident report form will need to be filled in
* Report all accidents/incidents no matter how trivial!

Common Incidents

* Common incidents include but are not limited to:
  * Spills
  * Broken glassware
  * Broken thermometers
  * Leaking equipment/bottles
  * Singed electrical cables
  * Minor cuts/burns

College Emergency Number

* In cases of emergency on campus, the number to call is 1999 (or 01 8961999 from a mobile)
* Be ready to state the following to the security centre:
  * Type of assistance required (ambulance, fire brigade, police etc.)
  * Type of emergency (fire, injury etc.)
  * Name, contact number and location
* If possible and safe to do so, keep close to the telephone in order to give further information should it be required for the emergency services

College Emergency Number

* Note that this number (1999) is the only number you should use in an emergency
* It must also **only** be used in an emergency!

Section 7

Response to Accident and/or Alarm

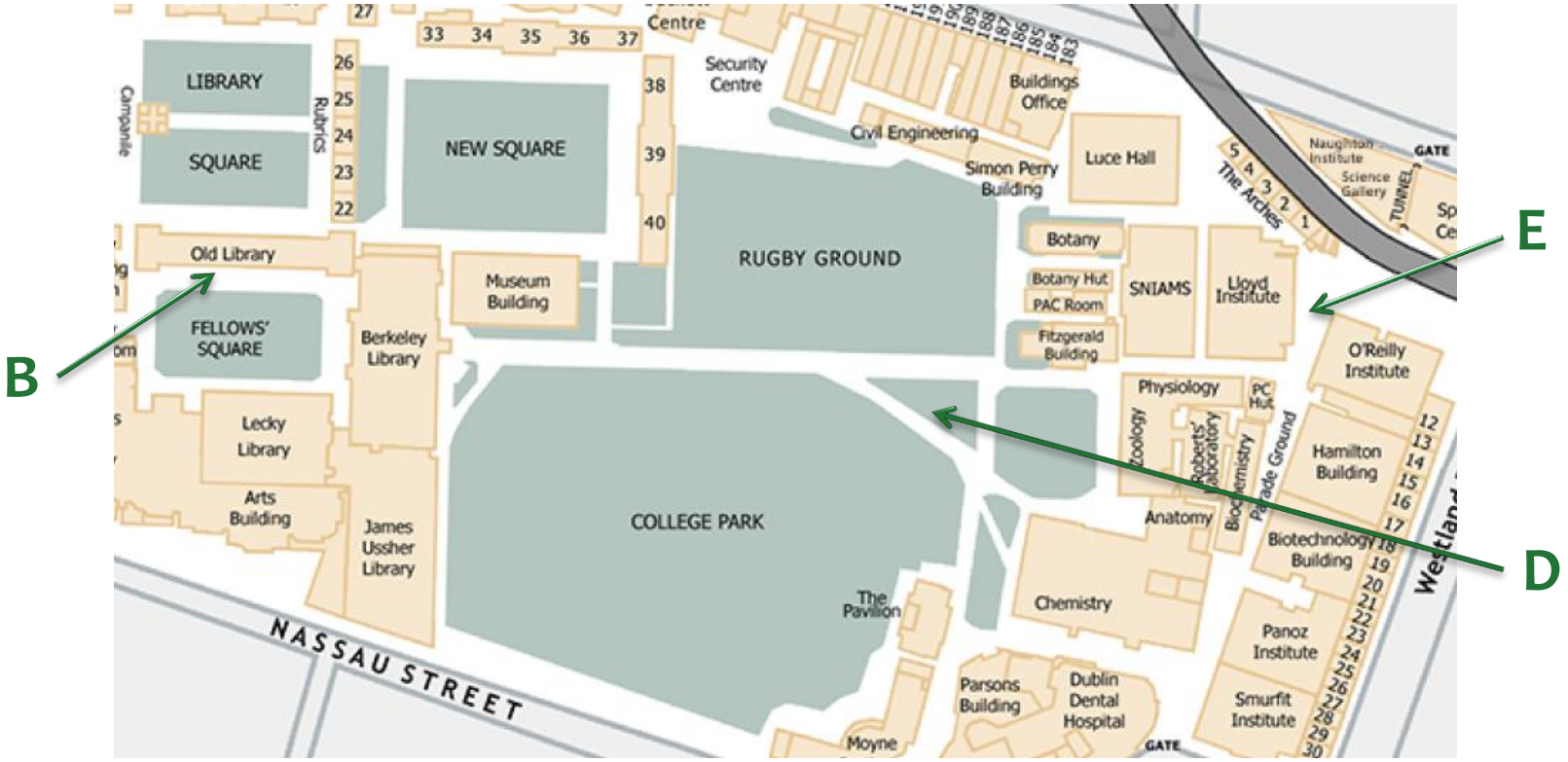
Fire Alarm

* On hearing the fire alarm, stop what you are doing and leave the building for the assembly point.
* Do not stop to collect anything, just leave the building immediately
* Always proceed directly to the assembly point when the alarm goes off as head counts will need to be conducted to ensure everyone is out!

Assembly Points

* Assembly points for each of the labs are as follows:
  * SNIAM Building (Chemistry (Physchem lab), Physics, and Microelectronics labs) **D**
  * East End (Chemistry (Cocker Lab) and Biology Labs) **E**
  * Museum Building (Geology Labs) **B**
* Also be aware of where the assembly points are for other buildings you are in

Assembly Points



Assembly Point B

Assembly Point D

Assembly Point E

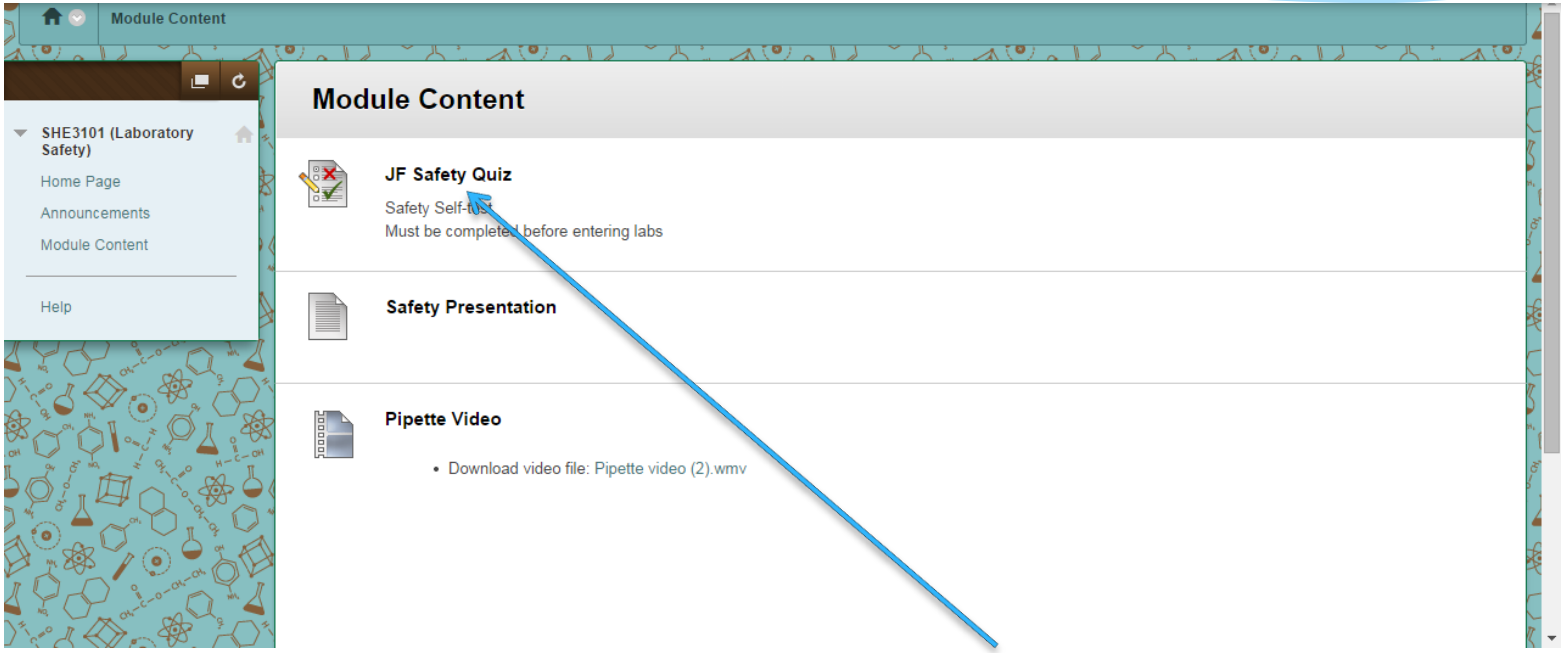
Section 8

Blackboard Quiz

Blackboard

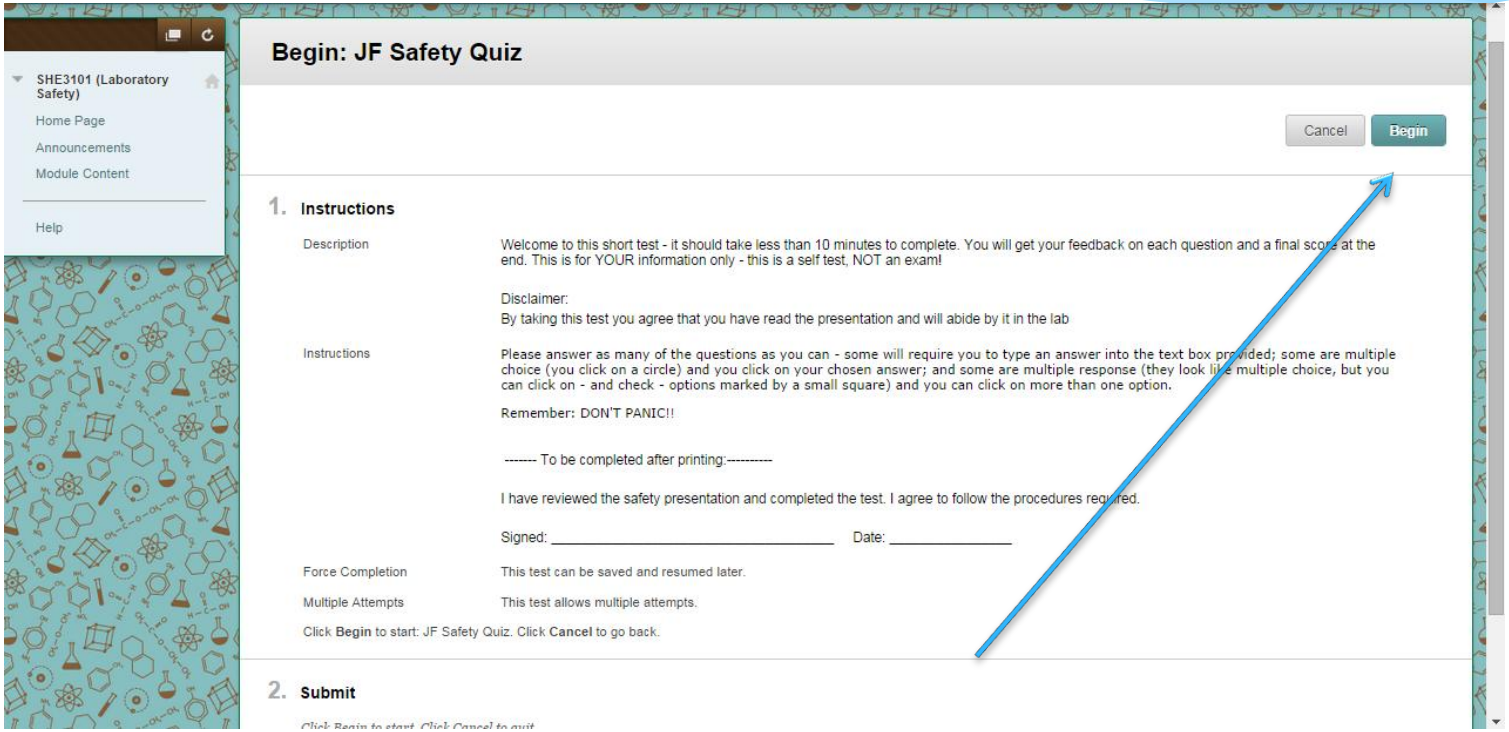
* Both this presentation and a quiz are on Blackboard under module SHE3101
* Access Blackboard through mymodule.tcd.ie
* The quiz must be completed and a “boarding pass” printed and brought to the labs to prove you have taken it
* First we will show you how to access the quiz:

Blackboard Quiz



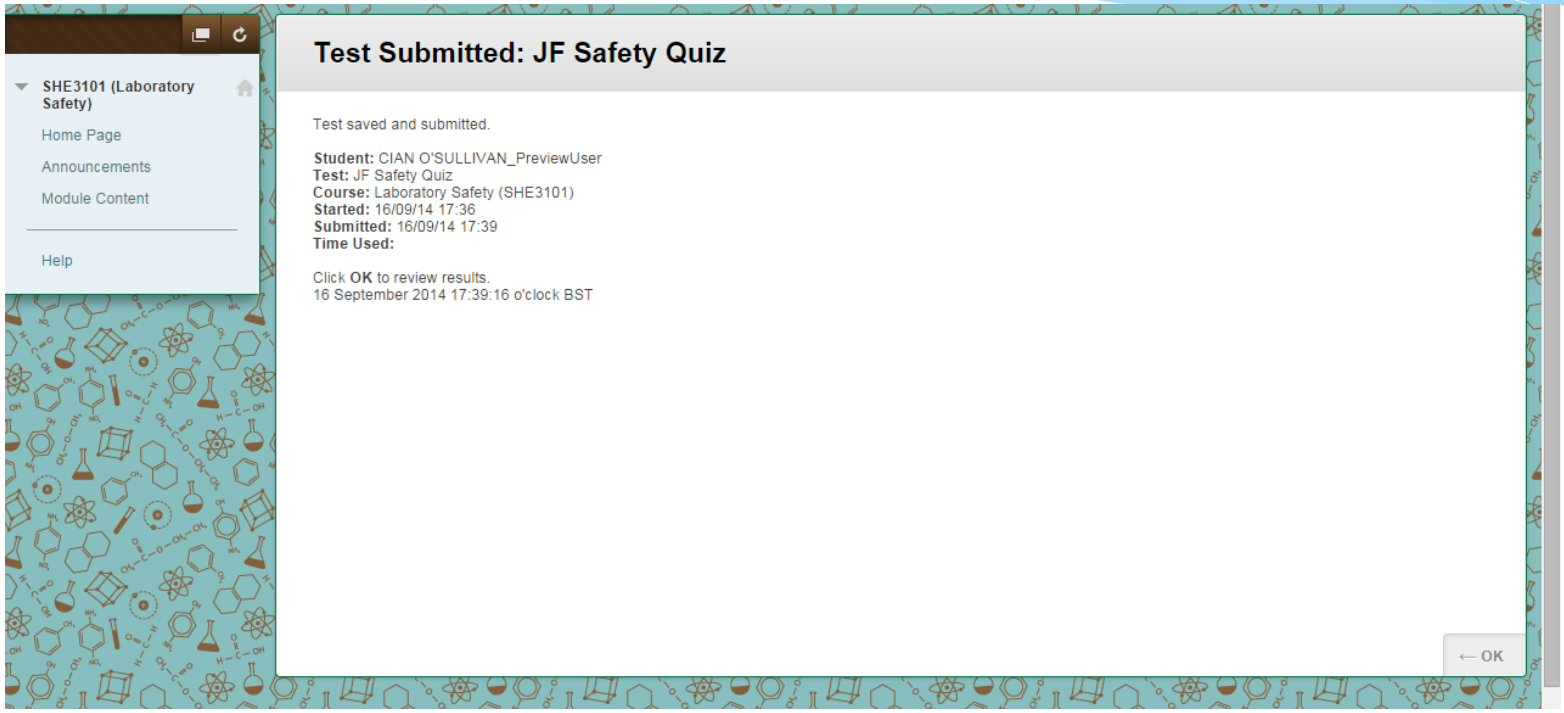
Read the presentation and take the quiz by clicking on it.

Blackboard Quiz



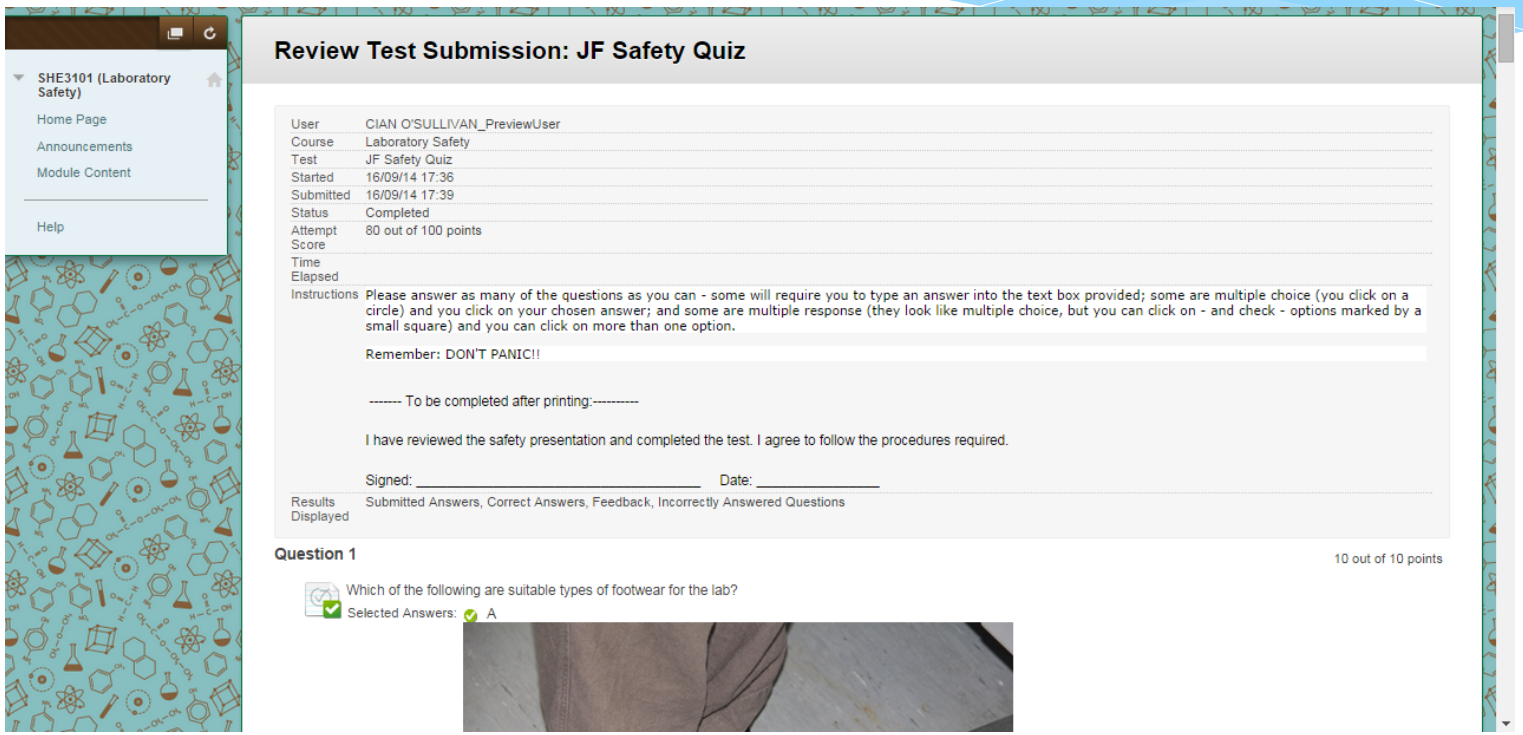
Read the instructions carefully and click *Begin* to take the test

Blackboard Quiz



After submitting the quiz you should see this screen confirming submission. Click *OK* to view your results and feedback

Blackboard Quiz

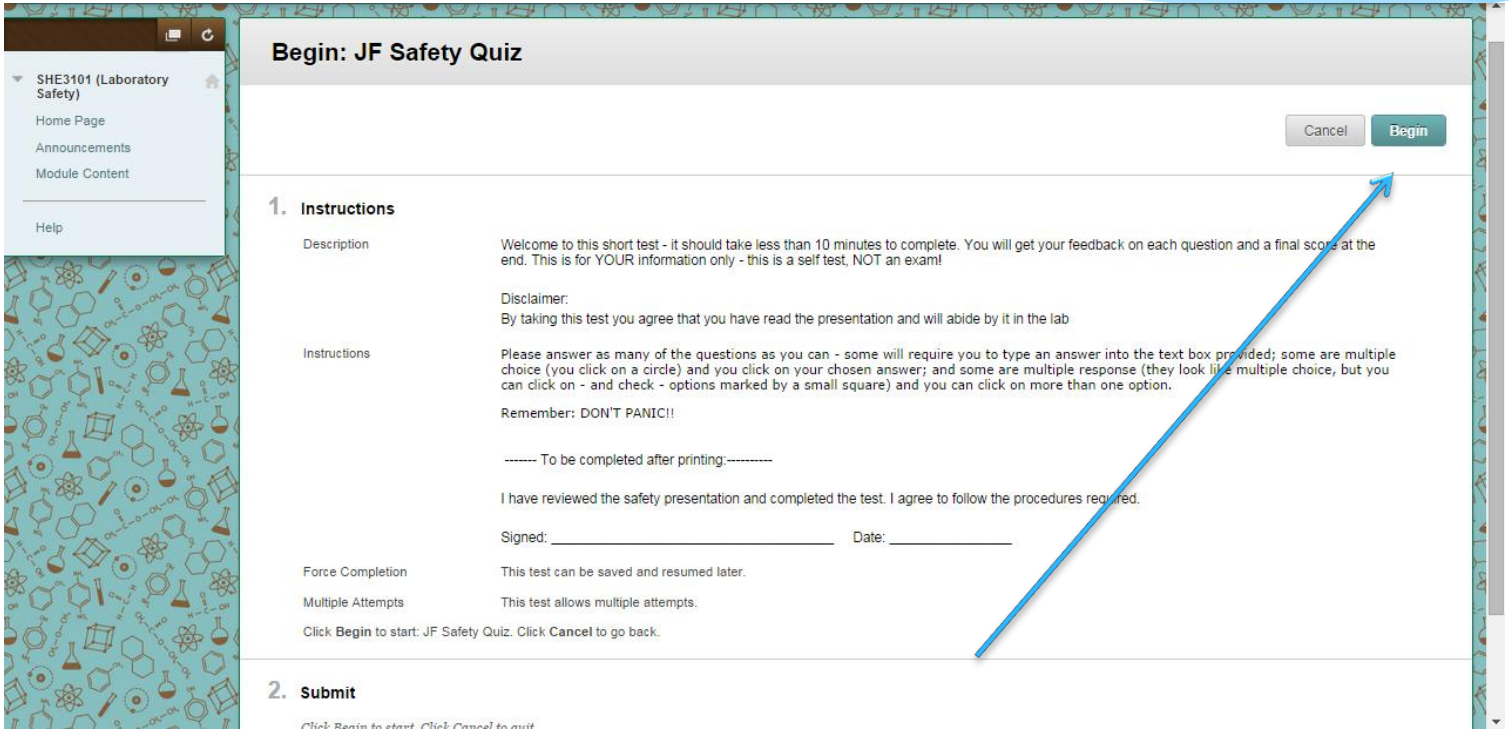


Here you will see your score and feedback on your quiz (answers you submitted, the correct answer, some feedback on your answer, and score)

Blackboard Quiz

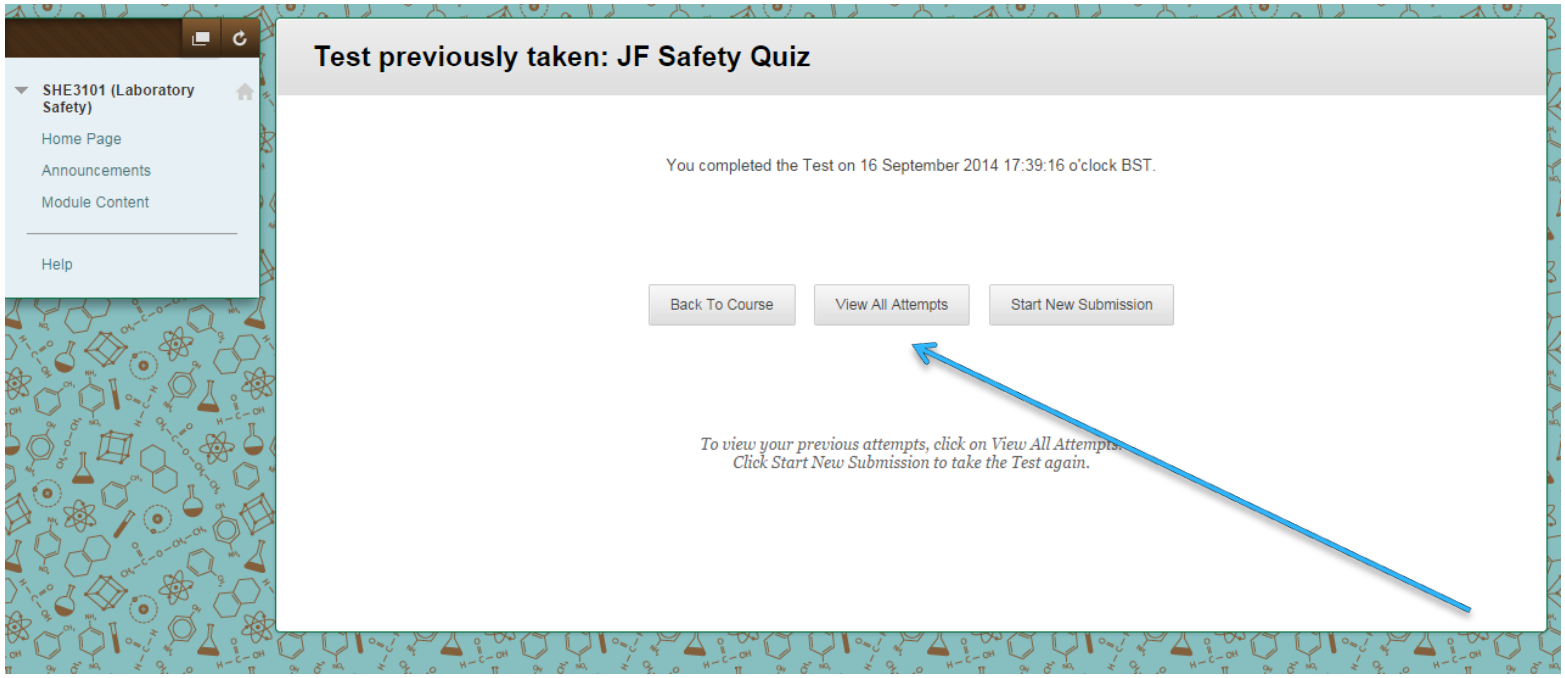
* After reading your feedback you'll find an *OK* button at the bottom of the page which will bring you back out of the test. Once you click this you will not be able to read the feedback for the test!
* Now we will look at how to print the "boarding pass":

Blackboard Quiz



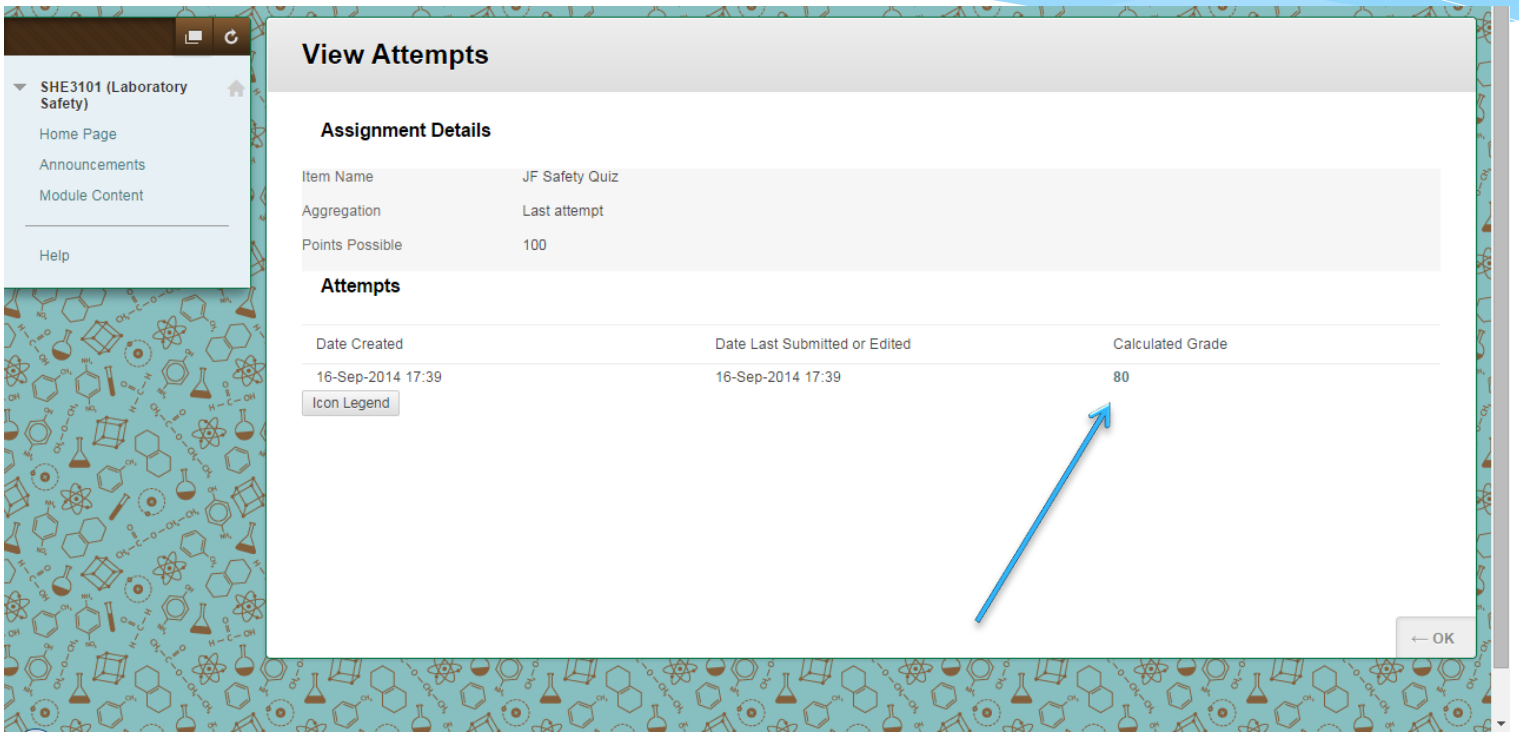
Click on the test and click *Begin* (just like you did to actually take the test)

Blackboard Quiz



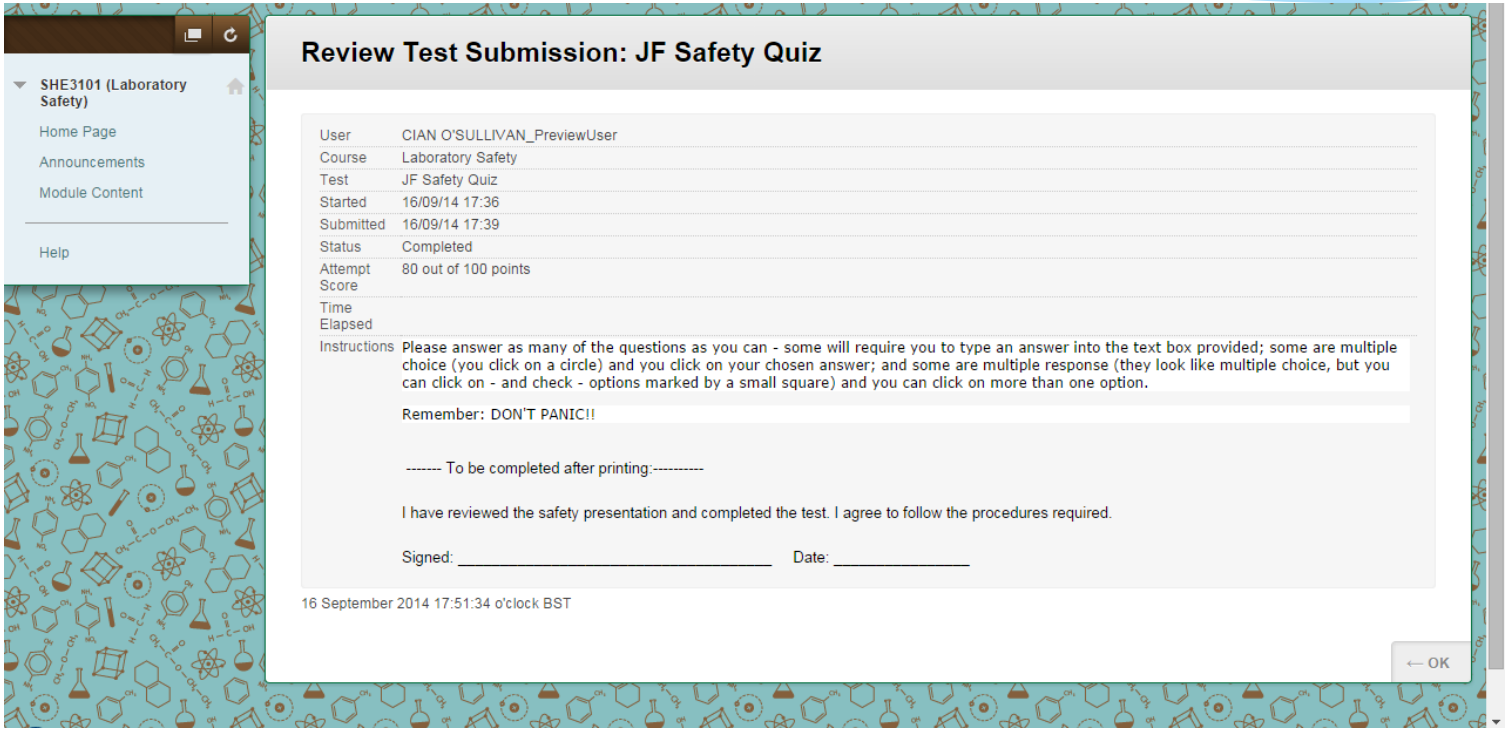
This time you will be presented with this screen. To retake the test click on *Start New Submission*, to print the boarding pass click *View All Attempts*

Blackboard Quiz



This will show you each attempt you have made. Click on the grade number to get the "boarding pass"

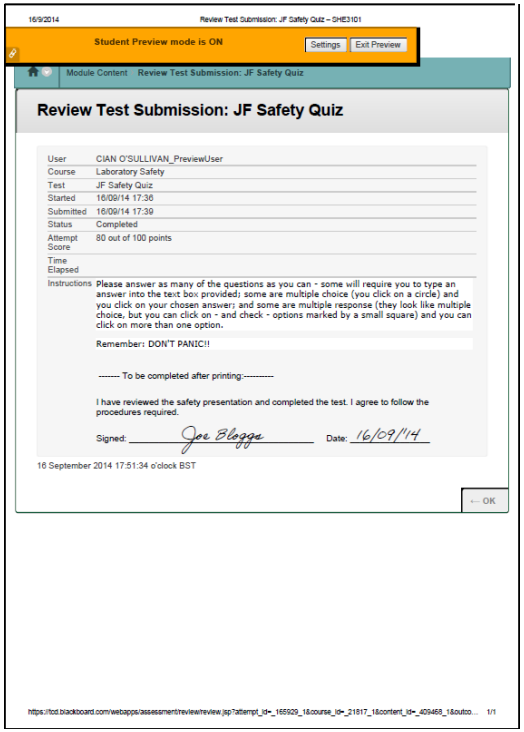
Blackboard Quiz

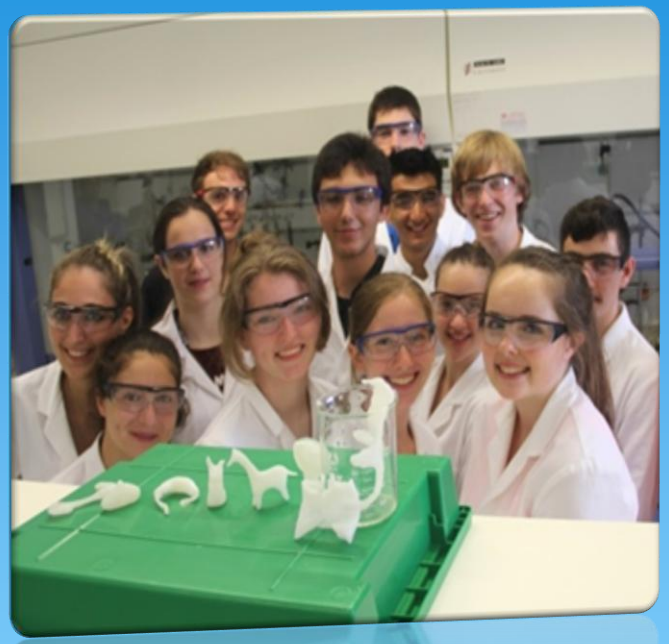


And print this page! Once printed sign and date it to make it valid

Blackboard Quiz

* Once you have got this “boarding pass” printed, signed and dated, bring it with you when requested to the labs.
* If you loose your “boarding pass” don’t worry it can be reprinted using the same steps





Good Luck and Enjoy the Labs!

And remember stay safe!