Laboratory safety

實驗室安全須知

1. Introduction of the Safety System of UM
2. What is Safety
3. Chemical Safety
4. Biological Safety
5. Safety Facility
6. Personal Protective Equipment (PPE)
7. Personal Hygiene

Part I:
Introduction of UM Safety System

Laboratory Safety Objective

- For a leading university in education and research,

Committed to take every measure to ensure its operations & activities (high-risk research laboratories and workshops)

⇨ to protect the safety of its staff, students, contractors and visitors.

Part 2:
What is Lab Safety?

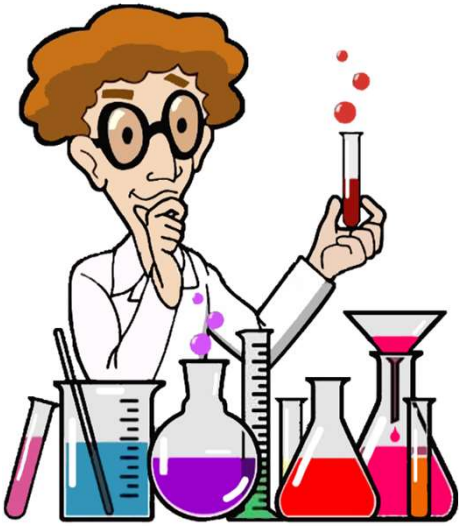
What is Lab Safety?

- L -- *L*abel everything clearly
- A -- *A*ppropriate containers in good condition
- B -- *B*e neat and orderly

- S -- *S*tore only what you will use
- A -- *A*lways wear protective clothing
- F -- *F*ood allowed in eating areas only
- E -- *E*verything in its place on a shelf
- T -- *T*ime to inventory & organize
- Y -- *Y*our safety is important

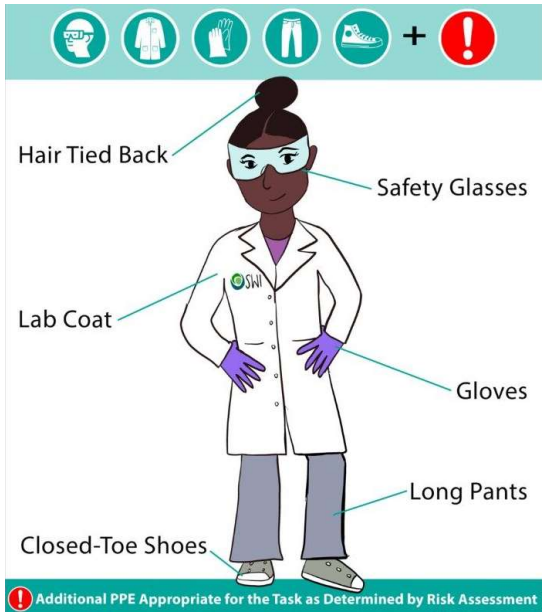
What is Lab Safety?

- Safe working protects:
  - ✓You
  - ✓Other lab workers
  - ✓Cleaners
  - ✓Visitors
  - ✓Your work



General Laboratory Safety Rules

- ✓ Wear a face mask (if needed)
- ✓ Wear safety glasses in handling chemicals or operating machinery
- ✓ Laboratory coats or work suit must be kept fastened
- ✓ Don’t wear sandals or open-toe shoes
- ✓ Long hair must be tied back
- ✓ Contact lens and make-up are not allowed in laboratory especially in wet lab
- ✓ Working alone in laboratory is not recommended
- ✓ Keep your work area well ordered



Laboratory Hygiene

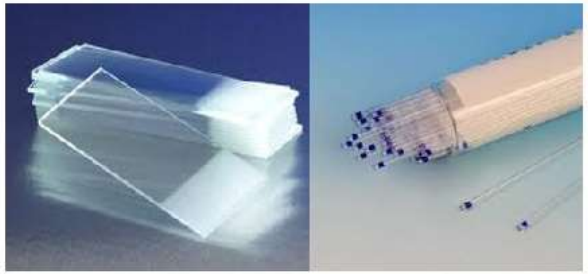
- Never eat, drink or smoke in a laboratory
- Never touch your face, mouth or eyes with gloves
- Never suck pens or chew pencils
- Always wash your hands before you leave laboratory and especially before eating
- Do not apply cosmetics

What are the general hazards in a lab

Sharps

Common sharps:

- needles and syringes
- scalpel blades
- razor blades
- microscope slides and coverslips
- Pasteur pipets



Sharps

Sharps containers have to be:

- Puncture-resistant
- Clearly marked
- Closeable

Sharps

To avoid injuries from sharps:

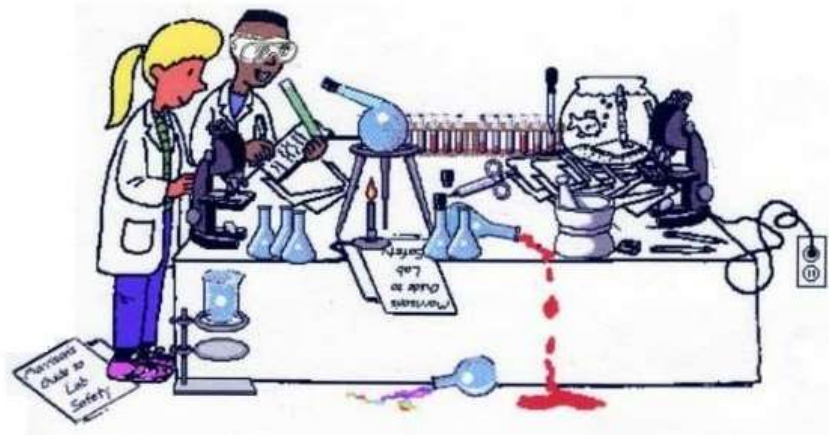
- Needles must not be bent, recapped, removed from disposable syringes
- Never reach into sharp container or broken glass box
- Never remove lid from the container
- Never force materials into the container
- Never fill containers more than 3/4 full

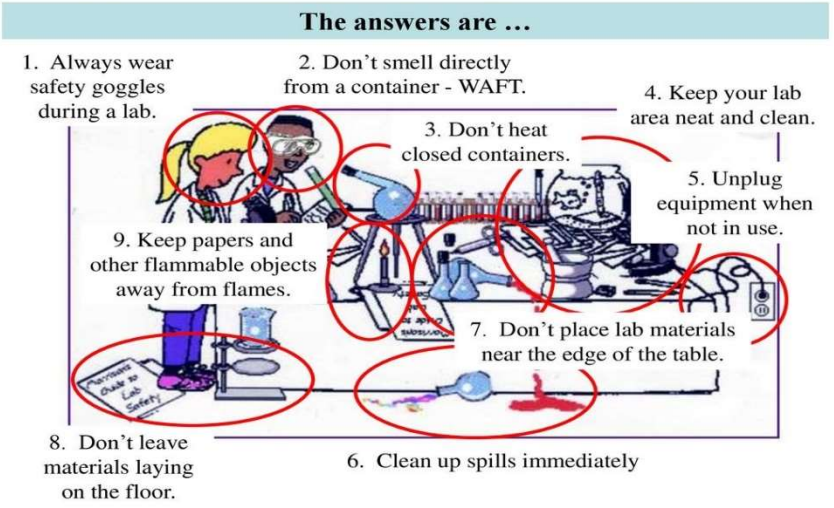
Spillage

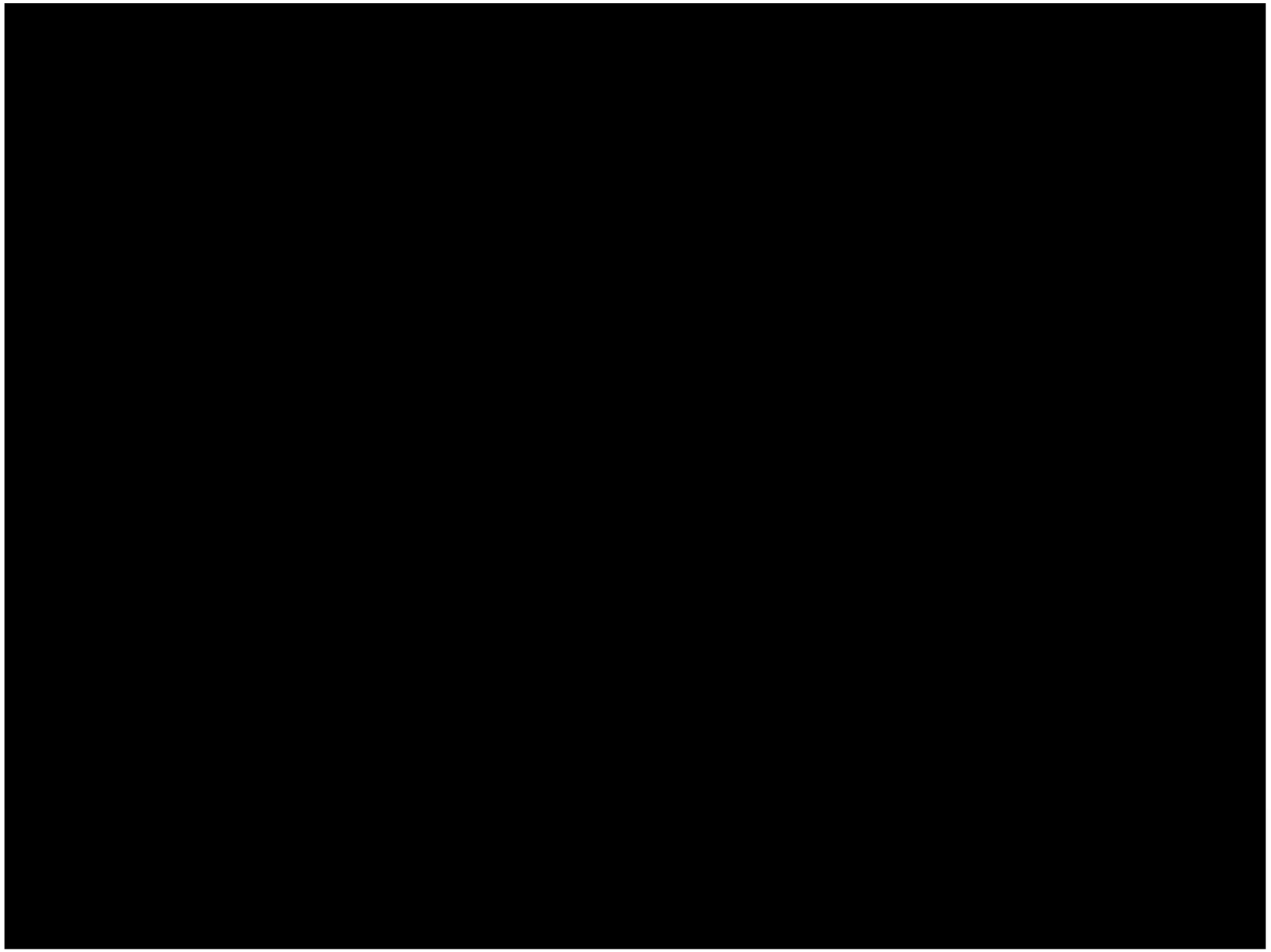
Cause: Poor housekeeping

- Clear up spillage promptly (wear proper PPE)
- Only clean up small spills

Messy workers are usually poor workers!!

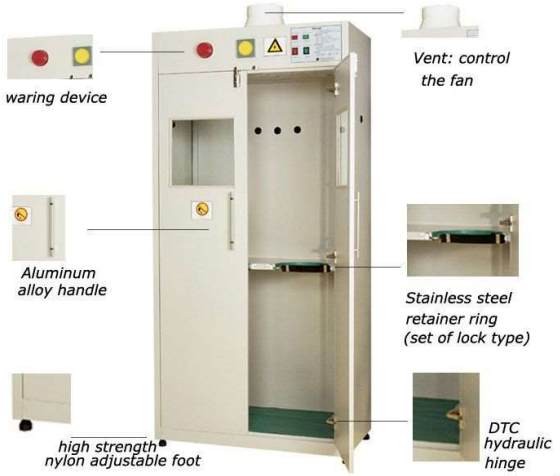






Gas cylinders

- Never use without formal training
- Minimise the number in a laboratory
- Ensure that they are chained
- Away from heat source or high power
  - electrical appliances
- Toxic gas/flammable gas **MUST** be
  - installed in gas cabinet with exhaust
- Move only with a cylinder trolley
- Use regulators & control equipment suitable for the gas concerned



Electrical Equipment

- Always do a visual check on electrical equipment before use, looking for obvious wear or defects
- NEVER use defective equipment

General Tidiness

Laboratory Equipment

- Never use any laboratory equipment unless you are trained & have been authorised to do so
- Aside from injury, damage is also costly

Part 3:
Chemical Safety

Chemical Risk labels

- Common labels found on chemicals

Chemical Risk labels

Fire related

Health related

- Ammonia

- Acid and alkaline

- Organic solvents

- Cyanide, chlorine

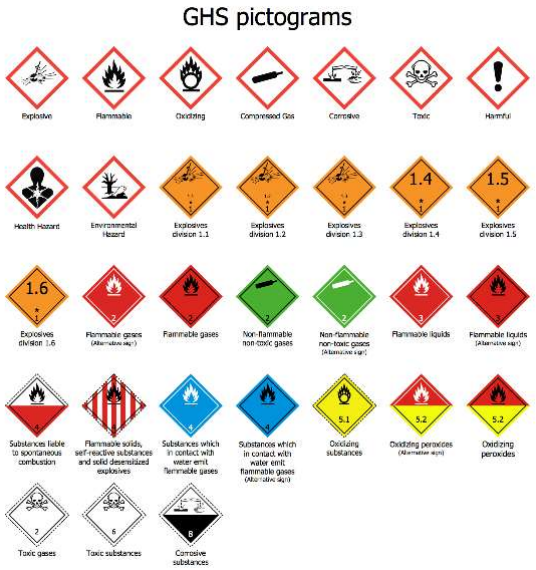
Global Harmonized System (GHS)

Global Harmonized System (GHS)

- Two sets of pictograms:-

(1) labeling of containers
workplace hazard

(2) transport of dangerous goods



Global Harmonized System (GHS)

Physical Hazard pictograms


Explosive


Flammable


Oxidizing


Compressed gas


Corrosive

Health Hazard pictograms

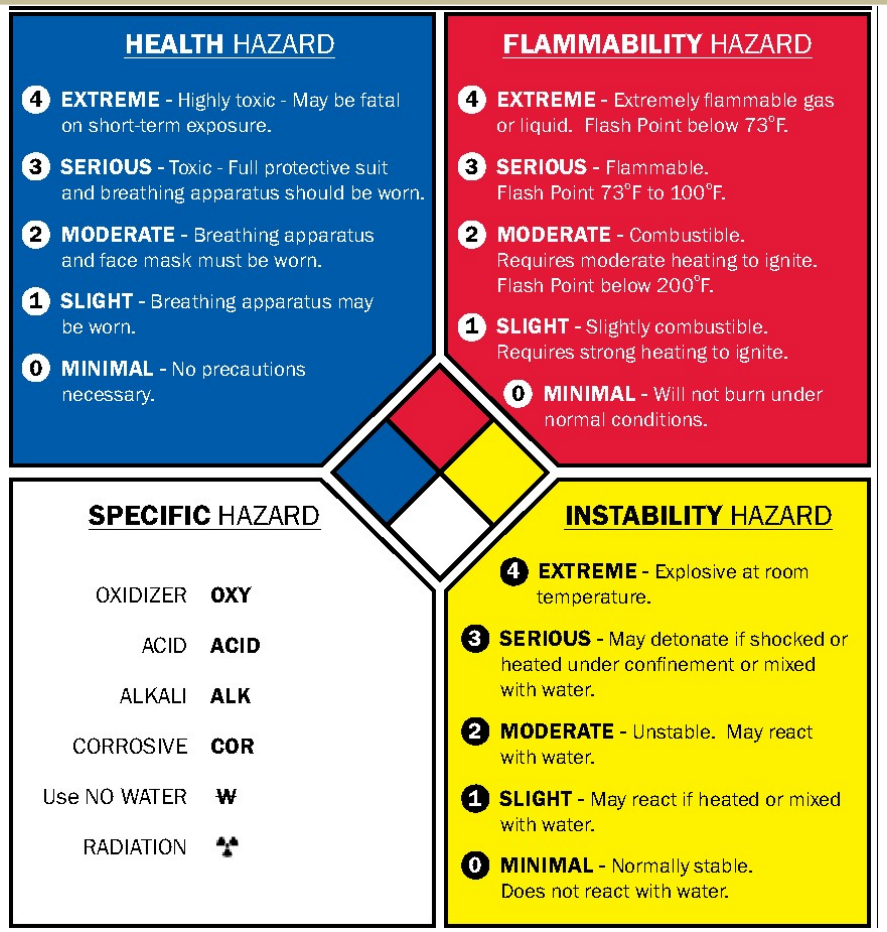

toxic


Corrosive


Health Hazard

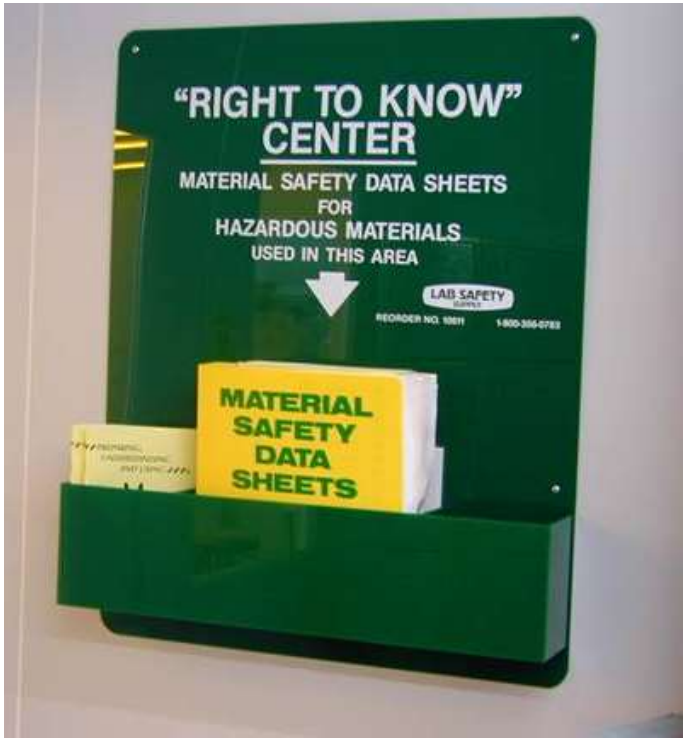
Environmental Hazard pictograms

National Fire Protection Association (NFPA)



Material Safety Data Sheet (MSDS)

- Material Safety Data Sheet (材料安全數據表)
  - a document that list information of various substances
  - information may include instruction for the safe use and potential hazards, spill-handling procedure



Material Safety Data Sheet (MSDS)

16 Sections of Safety Data Sheets:

SDS Sections 1-8: General Information

Section 1: Identification
Section 2: Hazard(s) Identification.
Section 3: Composition/Information on Ingredients.
Section 4: First Aid Measures
Section 5: Firefighting Measures
Section 6: Accidental Release Measures
Section 7: Handling and Storage
Section 8: Exposure Controls/Personal Protection

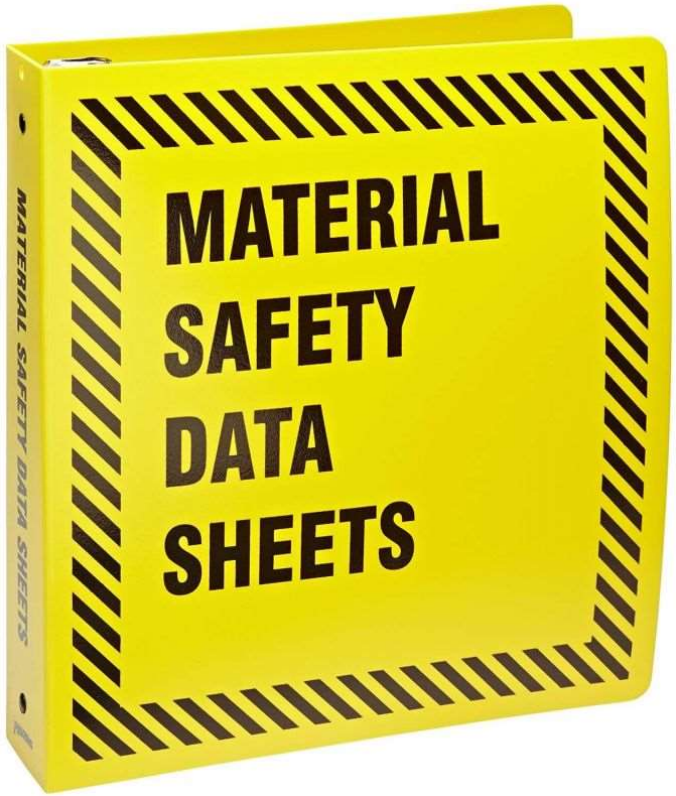
Sections 9-11: Technical & Scientific Information

Section 9: Physical and Chemical Properties
Section 10: Stability and Reactivity.
Section 11: Toxicological Information

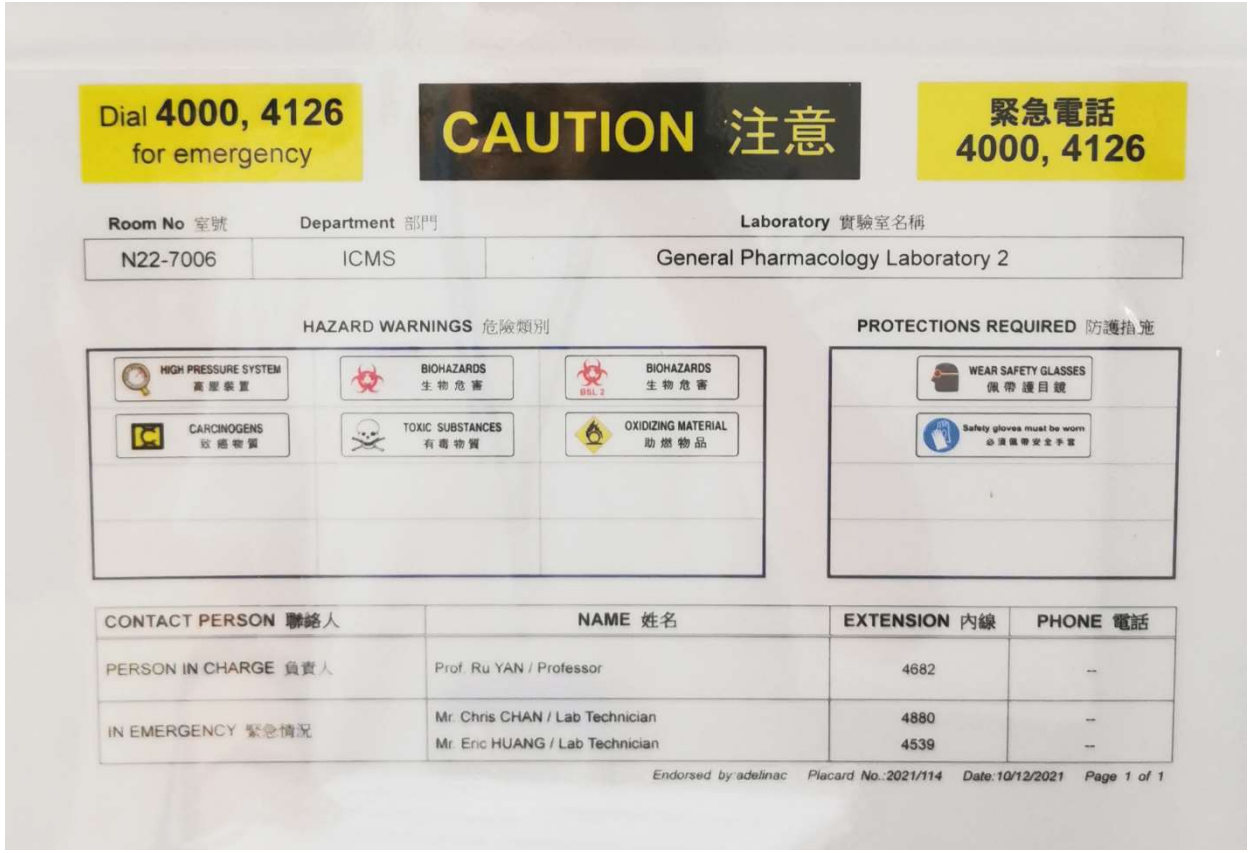
Sections 12-15: Information Governed by Other Agencies

Section 12: Ecological Information (non-mandatory)
Section 13: Disposal Considerations (non-mandatory).
Section 14: Transport Information (non-mandatory)
Section 15: Regulatory Information (non-mandatory)

Section 16: Other Information



Placard



Dial **4000, 4126** for emergency

CAUTION 注意

緊急電話 4000, 4126

Room No 室號	Department 部門	Laboratory 實驗室名稱
N22-7006	ICMS	General Pharmacology Laboratory 2

HAZARD WARNINGS 危險類別

- HIGH PRESSURE SYSTEM 高壓裝置
- BIOHAZARDS 生物危害
- BIOHAZARDS 生物危害 BSL 2
- CARCINOGENS 致癌物質
- TOXIC SUBSTANCES 有毒物質
- OXIDIZING MATERIAL 助燃物品

PROTECTIONS REQUIRED 防護措施

- WEAR SAFETY GLASSES 佩帶護目鏡
- Safety gloves must be worn 必須佩帶安全手套

CONTACT PERSON 聯絡人	NAME 姓名	EXTENSION 內線	PHONE 電話
PERSON IN CHARGE 負責人	Prof. Ru YAN / Professor	4682	--
IN EMERGENCY 緊急情況	Mr. Chris CHAN / Lab Technician	4880	--
	Mr. Eric HUANG / Lab Technician	4539	--

Endorsed by:adelinac Placard No.:2021/114 Date:10/12/2021 Page 1 of 1

The placard is posted on the door of every laboratory

Law on the Control of Dangerous Substances

Law on the Control of Dangerous Substances

Dangerous Goods Applications

- Share(\\pcshare)(N:)\ICMS and HSEO (DG endorsement)\Share\DG Record\HSEO DG Form 2024

HSEO DG Form_2024 - Excel

Item	Item Decsription	Brand	Model / Cat. #	CAS #	Qty.	Packing Volume	Packing Unit	Date	Requestor	PI	Lab Room No.	HSEO Endorsement	Item Code	Dangerous Goods (Y / N)	Remarks (If any)
1	Petroleum ether (60-90 AR)	西陇	N/A	8032-32-4	100	500	mL	28/3/2024	Fong Leong	Lab Tech	N22-6026	No adverse comment	31L000003c	Y	Despite the above i
2	1,2 dichloromethane (AR)	西陇	N/A	75-09-2	100	500	mL	28/3/2024	Fong Leong	Lab Tech	N22-6026	No adverse comment	61L000006i	Y	Despite the above i
3	Ethanol 95% (AR)	西陇	N/A	64-17-5	6	20	L	28/3/2024	Fong Leong	Lab Tech	N22-6026	No adverse comment	32L000001l	Y	Despite the above i
4	Ethanol 99% (AR)	西陇	N/A	64-17-5	5	20	L	28/3/2024	Fong Leong	Lab Tech	N22-6026	No adverse comment	32L000001l	Y	Despite the above i

All dangerous goods purchase need to fill out this online form to get HSEO endorsement through Qualtrics

Dangerous Goods Applications

澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU

Office of Health, Safety and Environmental Affairs
安健及環境事務辦公室辦公室

申請購買化學品/危險物品 APPLICATION FOR PURCHASING OF CHEMICALS/DANGEROUS GOODS

部門/學院 Department/Faculty	日期（日/月/年） Date (dd/mm/yy)	申請人 Requester	實驗室房號 Laboratory room no.

項目編號 Item code	危險物品名稱 Name of dangerous goods	商品名稱 Brand name	化學文摘社登記號碼 CAS No.	數量 Qty	包裝規 Packing size	單位 Unit	*HSEO 審核 HSEO endorsement*

由 HSEO 填寫理由 Justification by HSEO:

申請人簽名 Requester signature

安健及環境事務辦公室簽名/蓋章 HSEO signature/stamp

請參閱背頁指引；Please refer to the guidelines on the back page

hseof/009/2015-r2

AT/ac/mc
02/04/2020

This is the offline dangerous good application form

Dangerous Goods Stores

- N26 and E12

Chemical Fumehood

- Know the warning signals
- Know how to use the controls
- Keep sash close unless loading or unloading
- **NOT** for storage

Safe use of Chemicals

- Minimum amounts needed for your work
- All containers clearly labelled
- Toxic materials must be locked away
- Corrosive substances must be stored securely at a low level in bunded trays
- Flammable materials in specially designed cupboards
- Store acids, bases & solvents separately

Safe use of Liquid Nitrogen

- Extremely cold (cold burns)
- Cause asphyxiation
- If you need to take cryogens in a lift, there are special procedures to follow (speak to your supervisor or a senior member of technical staff)

Chemical Waste Disposal

Chemical Wastes

(1) Organic

(2) Inorganic

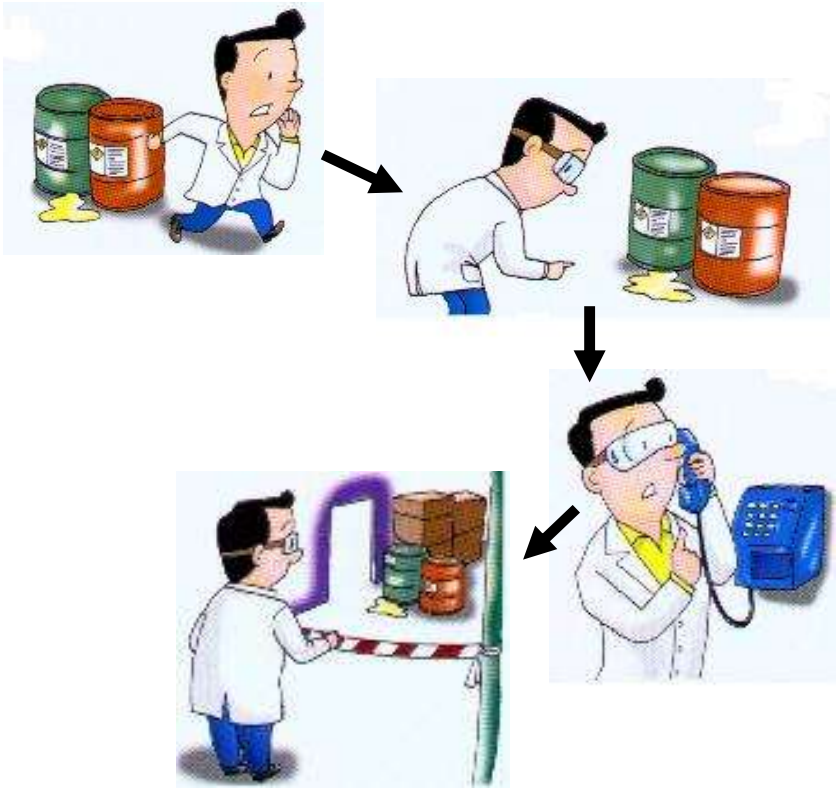
- Mixture

(dispose in organic waste)

- Waste containers must have secondary containment and max. 80% full

Emergency Procedures for Chemical Spills

- Alert nearby persons
- Understand the situation
- Notify person-in-charge
  - lab. Safety supervisor
  - HSEO (ext. 4235, 4237)
- Isolate the scene



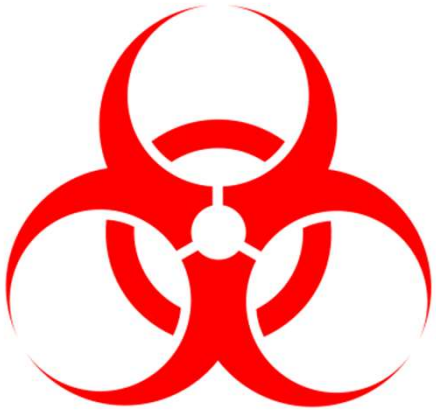
Part 4:
Biological Safety

Biological Safety

Biological safety is the prevention of infectious material or biological agents affect human health.

Objective:

- Containment of potentially harmful biological agents
- Reduce or eliminate exposure to biohazard agents



Biosafety Level (BSL)

- Biosafety Levels (BSL) prescribe

  - procedures

  - levels of containment for particular microorganism

  - research materials

- BSL are graded from 1 – 4

Biosafety Level (BSL)

Biosafety Levels 1-4 (BSL)

- Increasing levels of employee and environmental protection
- Guidelines for working safely in research & medical laboratory facilities

Animal Biosafety Levels 1- 4 (ABSL)

- Laboratory animal facilities
- Animal models that support research
- Guidelines for working safely in animal research facilities

Agents that cause Biological Hazards

- Bacteria
- Fungi
- Virus
- Human cells

Biosafety Level (BSL)

Biosafety Level 1

Biosafety Level 2

Biosafety Level 3

Biosafety Level 4

Biosafety Level 1

Biosafety Level-1 (BSL-1 or ABSL-1)

- Well characterized agents
- Agents not known to cause disease (in healthy human adults)
- Prophylactic treatment available
- Open bench procedures
- Animals in open cage system or open environment (outdoors)
- Good laboratory practices

Biosafety Level 1

Good Practices

- Bench-top work allowed
- Daily Decontamination
- Manual pipetting
- Required Hand washing
- Red bag waste
- Bio cabinet not required

  (unless creating aerosols)

Biosafety Level 2

Biosafety Level-2 (BSL-2 or ABSL-2)

- Agents associated w/ human disease
- Treatment for disease available
- Agent poses moderate hazard to personnel and environment

Good Practices

- Limited access to lab when work in progress
- Minimize bench work
- Daily decontamination
- Mechanical pipetting
- Labcoat, safety glasses and gloves required
- Red bag & sharps containers required

Biosafety Level 3

Biosafety Level-3 (BSL-3 or ABSL-3)

- Indigenous or exotic agents
- Aerosol transmission
- Serious health effects
- Treatment may or may not exist

No BSL-3 labs exist at UM

Biosafety Level 3

Good Practices

- Public access NOT permitted
- Daily decontamination after spill and upon completion of experiment
- Autoclave required
- Foot activated hand washing sink and controls
- No sharps unless absolutely necessary
- Bench top work not permitted

Biosafety Level 4

Biosafety Level-4 (BSL-4 or ABSL-4)

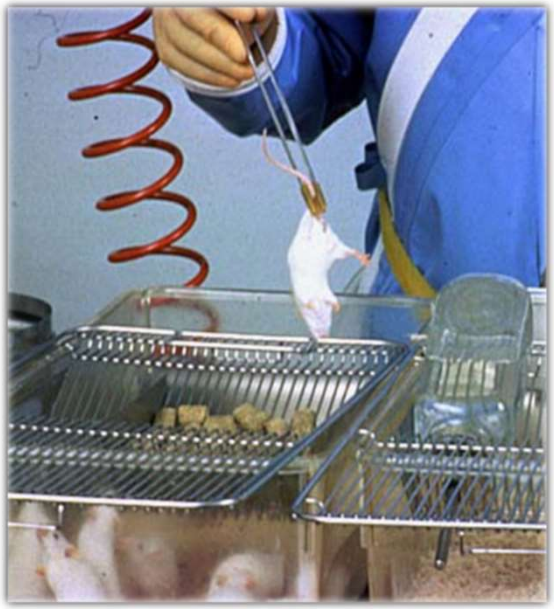
- Dangerous/exotic agents
- Life threatening disease
- Aerosol transmission
- Agents of unknown risk of transmission or health affects
- No known treatment

No BSL-4 labs exist at UM

Biosafety Level 4

Good Practices

- Builds on BSL-3/ ABSL-3 practices
- Maximum containment facilities
- Pressurized Containment Suite
  - BSL-3 + Class III Biosafety cabinet
- Chemical decontamination showers
- Liquid effluent collection / decontamination



Biological Waste Disposal

Metal sharps and broken glass

- Cause laceration or puncture, go to “Sharps”
- Metal sharps and broken glass may commingled
- NEVER mixed biological waste with chemical waste

Biological Waste Disposal

Solid biohazard waste

- Autoclave bags or container for solid biohazard waste
- **NO** sharps

Liquid

- Leak proof container
- **NO** plastic bag

Emergency Procedures for Biological Spills

- Alert nearby persons
- Understand the situation
- Notify person-in-charge
  - lab. Safety supervisor
  - HSEO (ext. 4235, 4237)
- Isolate the scene
- Shut down the room ventilation, especially BSL 2 or above

Overall for Chemical and Biological Safety

- Read everything thoroughly before doing anything
- Do not performed unauthorized experiment
- Never work alone in the lab
- Report all accidents immediately

Part 5:
Safety Facilities

Safety Facilities

- Operating ~ 0.5 m/s
- Standby ~ 0.3m/s
- Emergency exhaust
- Muted button

Safety Facilities

- Oxygen Detector (less than **19.5%** - alarm will be on)

- Evacuation button

- Emergency exit

Safety Facilities

Emergency door release

Break Glass

Safety Facilities

- Fire blanket

- Fire extinguisher

- Sand bucket

Safety Facilities

Types of fire extinguisher and their uses

WATER

Used on paper, wood, coal, cardboard and other solid fuel fires.

Solid Red

Can be used on:
Class A

FOAM

Used on solid fuel fires as well as flammable liquids.

Cream

Can be used on:
Class A
Class B

POWDER

Used on any kind of fire except for Class F cooking oils.

Blue

Can be used on:
Class A
Class B
Class C
Class D
Electrical

CO2

Used on flammable liquids and electrical fires.

Black

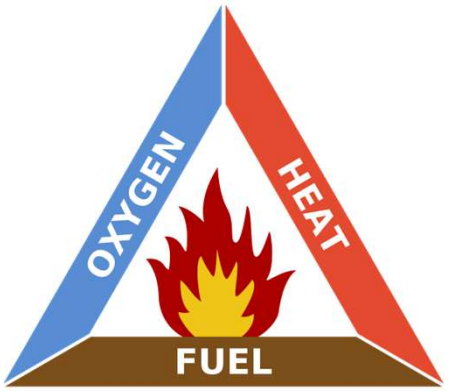
Can be used on:
Class B
Electrical

WET CHEMICAL

Used on cooking oil fires as well as combustible solid materials.

Yellow

Can be used on:
Class A
Class F



Class A
Combustible materials. These include paper, textiles, wood and similar materials.

Class B
Flammable liquids. These include petrol, oil and paint.

Class C
Flammable gases. These include butane and methane.

Class D
Flammable metals. These include potassium and uranium.

Electrical
Electrical goods. These include appliances in kitchens as well as computers, phones etc.

Class F
Cooking oils. These include chip pan fires and deep fat fryers.

Safety Facilities

- When UV light is on, DO NOT ENTER the room
- Eye wash shower

Safety Facilities

- First aid box

- Spill kit

Safety Facilities

Safety Facilities

Steps in Fire Safety in Laboratories:

- Recognize hazards
- Evaluate the space before lab tests or chemical reactions have begun. This includes housekeeping and storage practices.
- Protect yourself through the proper PPE and emergency equipment.

Fire Safety

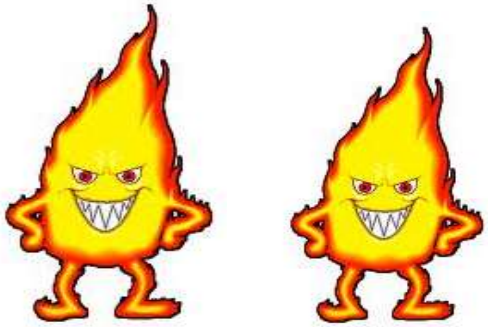
- **Flammable substances**
  - Use minimum quantity
  - Store in special storage cabinet
  - Store in HSEO DG stores
- **No open flames**
  - Use temperature-controlled heating sources

Fire Safety

- Ensure your own safety
- Keep calm
- Call for emergency (ext. 4000)
- Evacuate the site → assembly point

EVACUATION ASSEMBLY PLACE

緊急疏散集合地點

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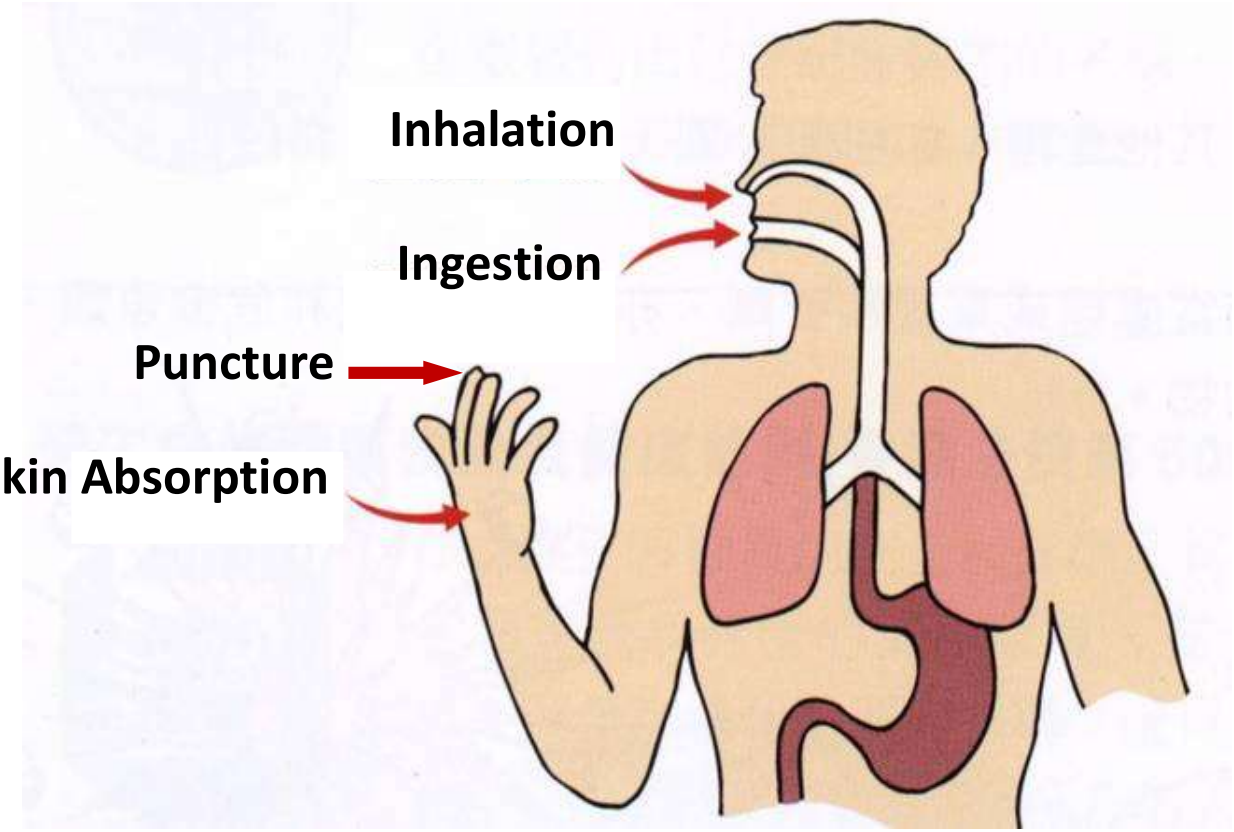
Alcohol lamp

- Before using, always inspect the alcohol lamp for damage or disrepair.
- If an alcohol lamp fails the pre-use inspection, notify your LSO.
- Prior to starting, examine the alcohol lamp work area.
- Know where the laboratory fire extinguisher and wash station are located and how to use them.
- Never leave a lit alcohol lamp unattended.
- Keep your hair away and hands away from the open flame.
- Always wear eye protection when using an alcohol lamp.
- Use tongs or heat-resistant gloves to pick up heated object or equipment.
- Place hot objects on hot pads.
- Never heat a closed container over an alcohol lamp.
- Carefully monitor liquids as they are heated.
- Always use a laboratory burner in a fume hood if noxious chemical fumes will be produced during the heating process.

Part 6:
Personal Protective Equipment (PPE)

Four ways to enter the Human Body



What is PPE

Equipment worn by an student/staff that is designed to prevent injury or illness from a specific hazard

PPE (Gloves)

Natural Rubber

Polyvinyl Alcohol (PVA)

Nitrile

Neoprene

Polyvinyl Chloride (PVC)

Cotton

Wire mesh

Kevlar

Welding

Leather

Anti-vibration

PPE (Gloves)

Glove Material	General Uses
Butyl	Offers the highest resistance to permeation by most gases and water vapor. Especially suitable for use with esters and ketones.
Neoprene	Provides moderate abrasion resistance but good tensile strength and heat resistance. Compatible with many acids, caustics and oils.
Nitrile	Excellent general duty glove. Provides protection from a wide variety of solvents, oils, petroleum products and some corrosives. Excellent resistance to cuts, snags, punctures and abrasions.
PVC	Provides excellent abrasion resistance and protection from most fats, acids, and petroleum hydrocarbons.
PVA	Highly impermeable to gases. Excellent protection from aromatic and chlorinated solvents. Cannot be used in water or water-based solutions.
Viton	Exceptional resistance to chlorinated and aromatic solvents. Good resistance to cuts and abrasions.
Silver Shield	Resists a wide variety of toxic and hazardous chemicals. Provides the highest level of overall chemical resistance.
Natural rubber	Provides flexibility and resistance to a wide variety of acids, caustics, salts, detergents and alcohols.

Glove Selection:

- Degradation rate
- Breakthrough time
- Permeation rate

PPE (Gloves)

How to remove gloves safety

PPE (Eye Protection)

Safety glasses

Chemical splash goggles

Face shields

PPE (Eye Protection)

Laser protective glasses are chosen to match the type of laser used

PPE (Eye Protection)

Quick tips on how to select the proper protective eyewear

- LPE should never be the first line of protection.
- LPE must protect against the laser wavelength being used.
- LPE must have an appropriate Optical Density (OD) value for the application.
- LPE must have an appropriate Visual Light Transmission (VLT) value.

PPE (Face)

Half face mask

N95

Full face mask

Disposable mask

PPE (Face)

Filter types				
Colour code	**Type**	**For use against**	**Class**	**Other information**
White	P	Particles	1 2 3	European standard: EN 143
Brown	A	Organic gases and vapours, boiling point above 65 °C	1 2 3	European standard: EN 14387
Grey	B	Inorganic gases and vapours	1 2 3	European standard: EN 14387 Do not use against carbon monoxide
Yellow	E	SO_2 and other acid gases	1 2 3	European standard: EN 14387
Green	K	Ammonia and its organic derivatives	1 2 3	European standard: EN 14387
Red & white	Hg P3	Mercury	–	European standard: EN 14387 Includes P3 particle filter Maximum use time 50 hours No class number
Blue & white	NO P3	Oxides of nitrogen	–	European standard: EN 14387 Includes P3 particle filter Single use only No class number
Brown	AX	Organic gases and vapours, boiling point at or below 65 °C	–	European standard: EN 14387 Single use only No class number
Violet	SX	Substance as specified by the manufacturer	–	European standard: EN 14387

PPE

PPE


non-woven shoecover
Non skid bottom shoecover
CPE shoe cover
PE shoe cover
shoe cover
sleeve cover
apron
N0.1 PE
No.2 PVC powdered
No.3 PVC black
No.4 PVC powder-free
No.5 Synthetic vinyl
No.6 PE long sleeve
CE

PPE (Ear Protection)

Ear muffs

Ear plugs

Ear caps

Ear muffs and earplugs provide about equal protection, ear caps somewhat less

PPE (Foot protection)

Part 7:
Personal Hygiene

Vaccination

澳門特區防疫接種計劃 -- 推薦的兒童接種表（2018年起）
Programa de Vacinação da RAEM - Calendário de Vacinação Recomendado para Crianças (a partir de 2018)
Macao SAR Immunization Programme - Recommended Children's Schedule (from 2018)

預防的疾病 Vacinas contra Vaccines for	年齡 / 年級 Idade/Ano Age/Grade									
	出生時 Nascimento At birth	1 月 mês mth.	2 月 meses mths.	4 月 meses mths.	6 月 meses mths.	12 月 meses mths.	15 月 meses mths.	18 月 meses mths.	小學一年級 1.º ano do ensino primário Primary 1	小學六年級 6.º ano do ensino primário Primary 6
結核病 Tuberculose Tuberculosis	BCG 1									
乙型肝炎 Hepatite B Hepatitis B	HepB 1	HepB 2			HepB 3					
脊髓灰質炎 Poliomielite Poliomyelitis			IPV 1	IPV 2	IPV 3			IPV 4	IPV 5	
b型流感嗜血桿菌 *Haemophilus influenzae b* *Haemophilus influenzae b*			Hib 1	Hib 2	Hib 3		Hib 4			
白喉，破傷風，百日咳 Difteria, Tétano, Tosse Convulsa Diphtheria, Tetanus, Pertussis			DTPa 1	DTPa 2	DTPa 3			DTPa 4	DTPa 5 /Tdap	Tdap
麻疹，德國麻疹，腮腺炎 Sarampo, Rubéola, Parotidite Measles, Mumps, Rubella						MMR		MMRV		
水痘 Varicela Varicella						VZV				
肺炎鏈球菌 Pneumococo Pneumococcus			PCV 1	PCV 2	PCV 3		PCV 4			
人類乳頭狀瘤病毒 Papilomavirus humano Human papillomavirus										HPV 1 HPV 2

Full Course of Tetanus Vaccine

	childhood	childhood	childhood	Every 10 years
Case 1 vaccinated in childhood	DTPa/DTaP (百白破三联)	DTPa/DTaP (百白破三联)	DTPa/DTaP (百白破三联)	Tetanus booster 破伤风加强剂
	Adult	Adult	Adult	Every 10 years
Case 2 never vaccinated in childhood	Tetanus(Td) (破伤风)	Tetanus(Td) (破伤风) 1 month after the first shot	Tetanus(Td) (破伤风) 6 months after the second shot	Tetanus booster 破伤风加强剂

Result of affected by Bacterium Clostridium

References

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- https://ehs.princeton.edu/laboratory-research/chemical-safety
- https://www.google.com/lab+coat
- https://www.youtube.com/watch?time_continue=2&v=4e7evinsfm0
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Thank You!

Office of Health, Safety & Environmental Affairs

Central Administration Building,
Room 4011
Tel: (853) 8822-4235, 8822-4237
Web site: http://www.umac.mo/hseo