Enhancing Laboratory Safety

NSS Chemistry

Science Education Section
Education Bureau
2009

http://edblog.hkedcity.net/nsschem/

化學科教師專業發展交流平台

Chemistry Teachers Professional Development and Resources Sharing Platform

Can Accidents be Prevented?

- 女生實驗爆瓶眼不適
  - 十三歲中二女生...二氧化碳...稀硫酸...瓶身漏出液體，滴在女生右手，她連忙清洗後，脫去眼罩擦眼，未幾感到眼睛痕癢不適...送院檢查。
  - 星島日報2009年4月25日

Visions

- Deliver interesting, safe and rewarding chemistry lessons to students
- Encourage students to do more hands-on experiments and then more inquiry-based experiments
- Provide a safe working environment for teachers and laboratory technicians

Grants for Major Repair

Non-Recurrent Grants: Major Repairs/Alterations

- Cost > $8000 (e.g. installation of fume cupboard, fire service installation, exhaust fan maintenance)
- Apply for non-recurrent grants in Apr/May every year
  - EDBCM No.60/2009 (Estimates for 2010-11 Financial Year - Aided Schools Applications for Non-Recurrent Grants: Major Repairs/Alterations)

資助中/小學校舍修葺工程---二零零六年至二零零七年度財政預算［續頁］ 八頁之四

[請交回一式三份]

學校名稱：

甲部（由學校填寫）所需工程的細則				乙部（由建築署/房屋署填寫）預算/備註				
項目編號	位置	工程大綱 (請在非學校部份工程下劃線)	原因	種類	建築工程	屋宇裝備	總數	備註
7	E座	更換四樓化學實驗室煙櫥的抽風扇及煙櫥下部的儲物櫃。	抽風不足；儲物櫃被化學品侵蝕而腐爛，有害氣體外洩，危害師生安全。	~~MB~~	~~80,000~~	~~70,000~~	~~150,000~~	✓
8	E座四樓	更換物理室、科學室及生物室內，部分已損壞的自來水開關掣。	影響教學，這些自來水開關掣專爲實驗室而設，校內未能安排維修。	RA	30,000	—	30,000	✓
9	E座四樓	更換物理室、科學室及生物室洗手盆邊緣的破爛瓷磚。	破爛的地方鋒利，危害師生安全。	RA	10,000	—	10,000	✓
10	E座四樓	更換化學室實驗桌面的破爛膠板。	破爛的地方鋒利，危害師生安全。	RA	30,000	—	30,000	✓
				本頁總數	~~$210,000~~ 60,000			

種類:
- RA = 必要的修葺工程
- RB = 合乎需要但非必要的修葺工程
- RC = 非必要的修葺工程 (註: 工程如屬 RC 種類, 無須列入預算)
- MA = 必要的改善工程
- MB = 合乎需要但非必要的改善工程

資助中學校舍修葺 / 改建工程
二零零七至二零零八年財政年度預算

[請交回一式三份] ［續頁］ 六頁之五

學校名稱：

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項目編號	位置	工程大綱 (請在非學校部份工程下劃線)	原因	種類	建築工程	屋宇裝備	總數	備註
7	E座及G座	更換課室及特別室膠地板爲磚地板。	部份地板破爛，容易拌倒師生，吸收了「沙士」事件的經驗，考慮到清潔及消毒的重要性。磚地板較耐用、不容易磨損，亦易清潔，可保障師生安全。	~~RB~~	~~800,000~~			✗
8	E座	更換四樓化學實驗室煙櫥的抽風扇及煙櫥下部的儲物櫃。	安裝超逾十五年，抽風不足，有害氣體外洩至化學實驗室；儲物櫃被化學品侵蝕而腐爛，桌面防火板多處割破，危害師生安全。	RA	150,000	50,000	200,000	✓
				本頁總數				~~$200,000~~ 1000,000

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More Ideas on Laboratory Design


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Additional Item

Suggested 建議

Furniture & Equipment List
Oct 2008

儀器及傢俱目錄
2008年10月

NSS F/E: New Items

- Bottle Top Dispenser (×3) *
- Gloves (Chemical Resistant, Heat/Cold Resistant, Disposable nitrile) *
- Hand protector *
- Heating Mantle (×2)
- Organic chemistry glassware – microscale, joint size 14/10 (×12) *

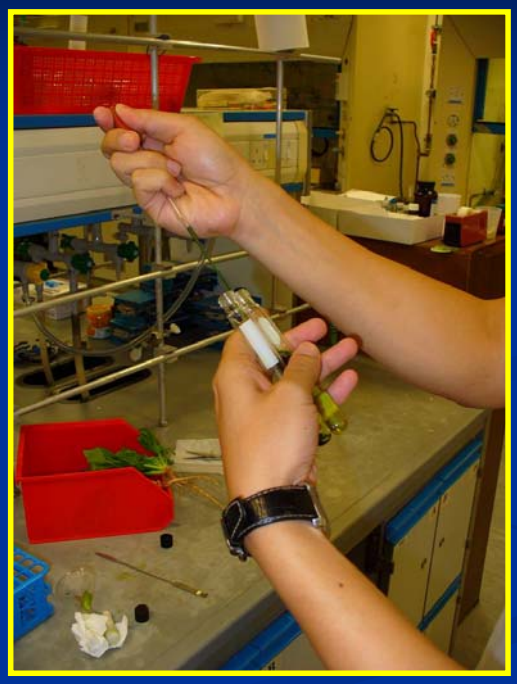
NSS F/E: New Items

- Digital micropipette (×6)
- Screw-cap test tube (×100) *
- Thermometer (15 cm)
- Thin layer chromatography TLC plate (1 pack) *
- Polypropene beaker (250 ml)
- 100 ml volumetric flask & 10 ml pipette

Disposable Nitrile Gloves

Screw-cap Test Tube

Microscale Extraction



Microscale Quickfit Apparatus

Thin Layer Chromatography

Amino acid + Solvent
+ Ninhydrin

or

Chlorophyll + Solvent

NSS F/E: Quantity

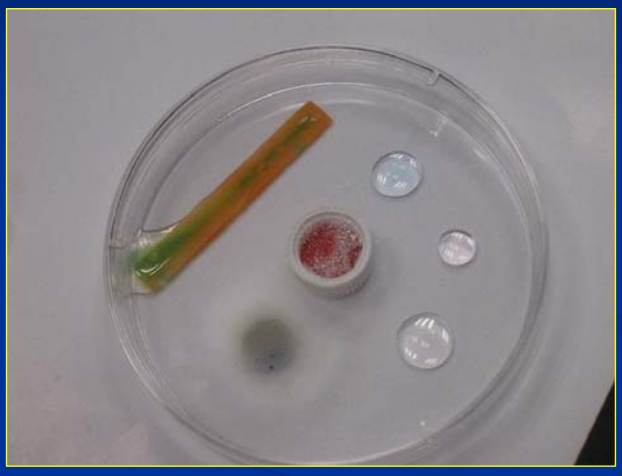
- Titration apparatus e.g. Burette, 25 mL pipette, wash bottle ... (×45)
- Tripod stand, wire gauze, tongs ... (×24)
- Multimeter, stop watch, ... (×12)
- pH meter, colorimeter, low voltage power supply (×6)

Microscale Practices

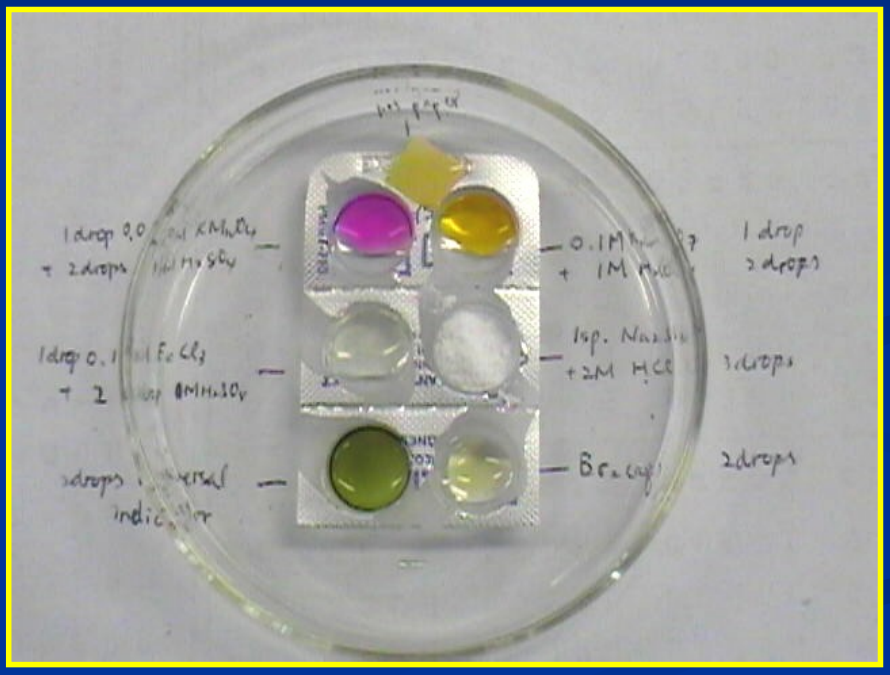
Microscale

Microscale

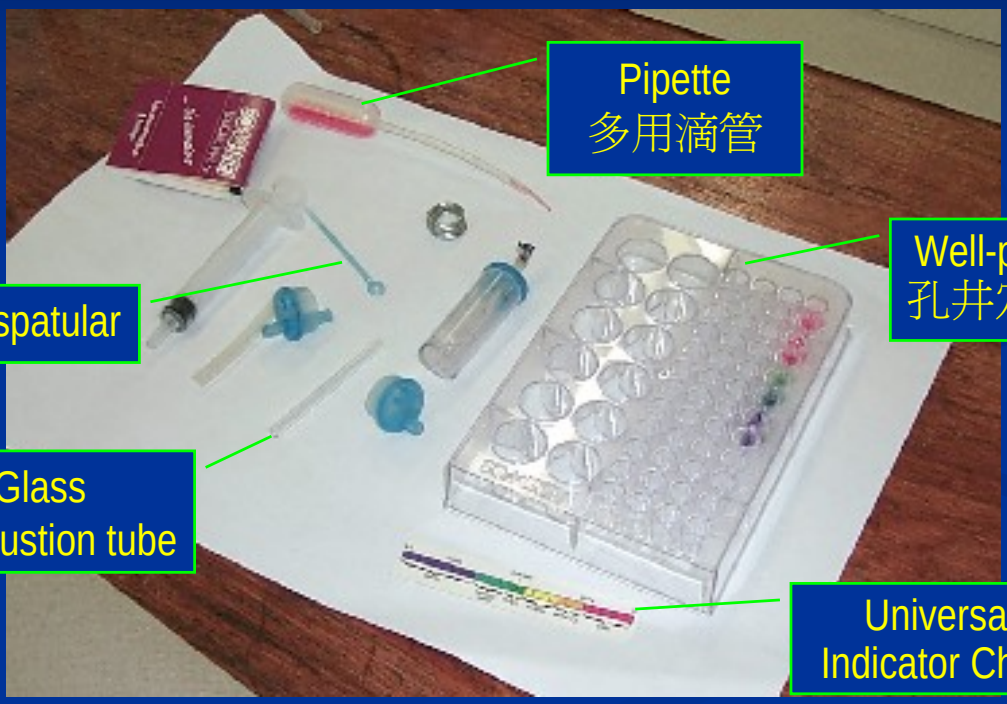
- Reaction of gas with different reagents, e.g. SO_2 + I_2, $KMnO_4$, methylene blue, pH paper
- Reduce the demand on the use of fume cupboard



Microscale

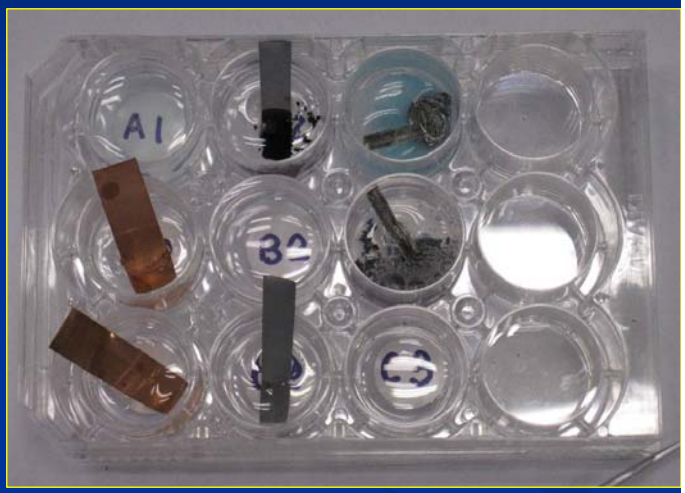


Microscale



Microscale

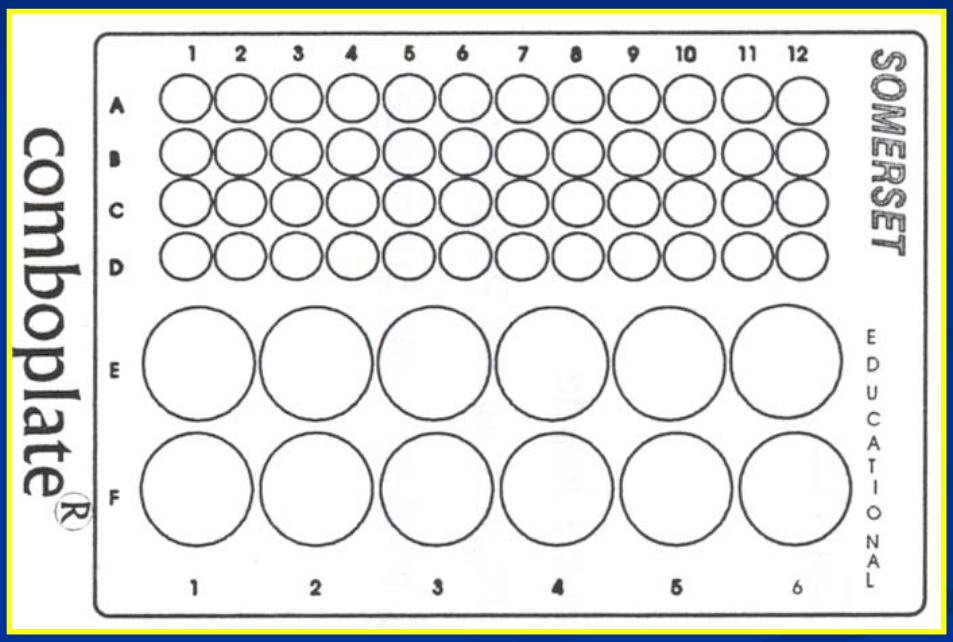
- Comparing reactivity of three different metals
- Equivalent to “6 beakers”
- Easy to compare experimental results



Microscale

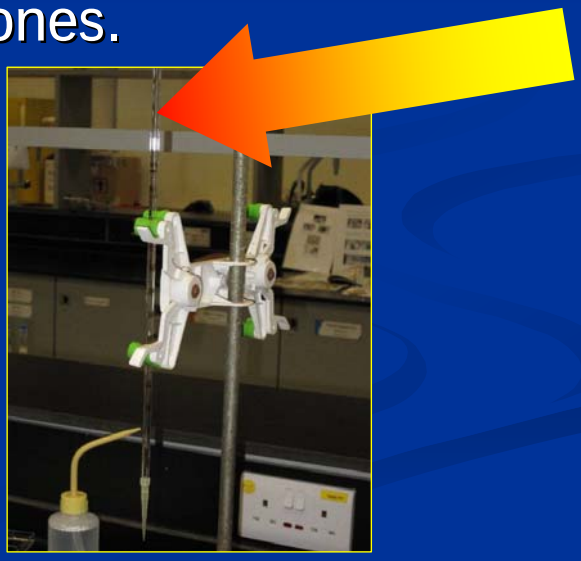
- Generation of hydrogen gas by reaction of acid and zinc metal
- Reduction of copper(II) oxide: heating CuO in a stream of hydrogen gas

Microscale

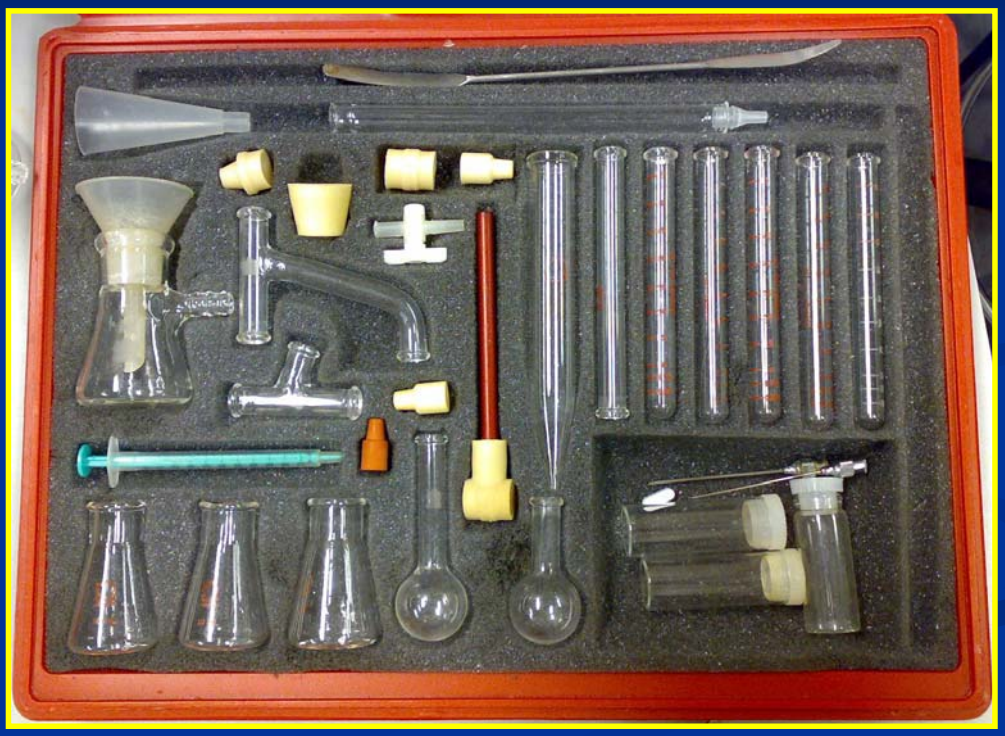


Microscale Titration

- Reduce the amount of chemicals to be used, e.g. 100 mL volumetric flasks instead of 250 mL ones.
- Microscale Titration



Microscale



Safety Practices

安全實務

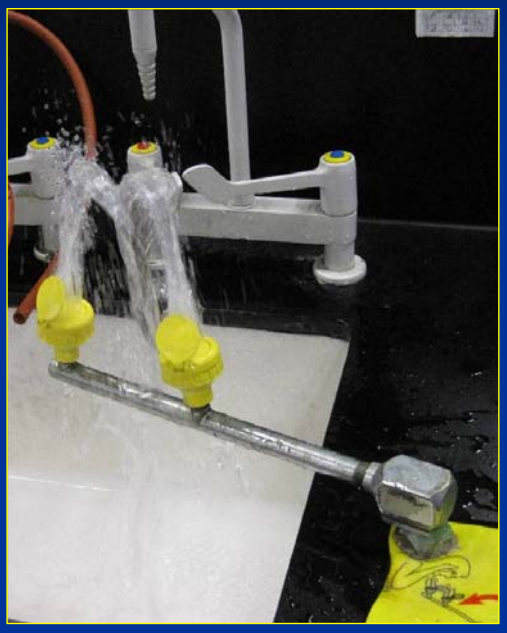
Ducted Fume Cupboard

- Suitable face velocity
  - About 0.5 ms^{-1}
    - UK: not less than 0.3 ms^{-1}, deviation not more than 30%
- Working aperture (movable sash)
  - Around 50-400 mm
- Extraction system

Ductless Fume Cupboard

Eye Wash / Drench Hose

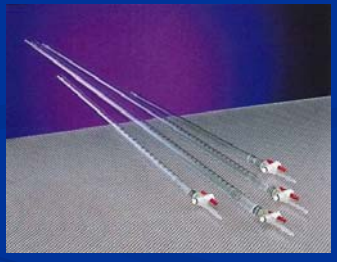
Eye Wash / Drench Hose

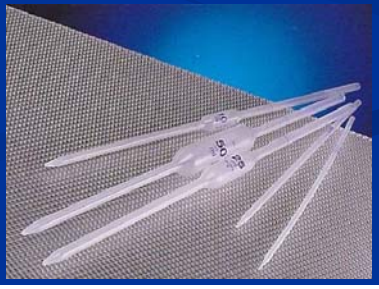


Automatic eye wash

Alternative Laboratory Equipment

- Reduce breakage of glassware
  - Plasticware (e.g. dropper, beaker, funnel)
  - polypropylene (PP), polymethylpentene (PMP, TPX)





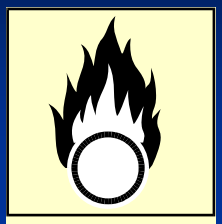
Alternative Laboratory Equipment

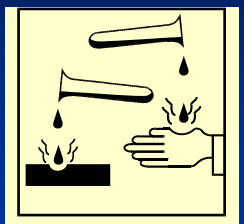
- Thermometers
  - Non-mercury filled
  - Short vs long (150mm / 300mm)
  - Plastic coated / Reinforced bulb
  - Digital (-50 - 150ºC)

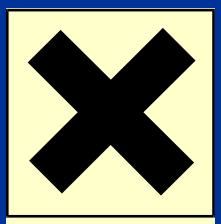
Signs

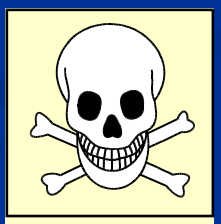
Signs

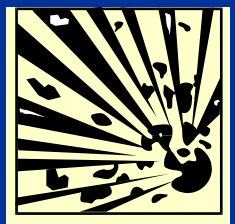

FLAMMABLE 易　燃

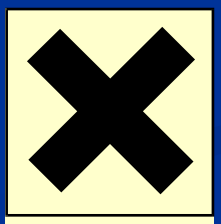

OXIDISING 氧化性


CORROSIVE 腐蝕性


HARMFUL 有　害


TOXIC 有　毒


EXPLOSIVE 爆炸性


IRRITANT 刺激性


CARCINOGEN 致癌物

Signs

Posters

Collection form:
http://resources.edb.gov.hk/cd/science/laboratory/safety/form.pdf

Stay Organised

- Reagent bottle with teat pipette / plastic dropper
- Dispenser
- Use dropping funnel

Stay Organised

Stay Organised

Access to Information

- Safety in Science Laboratories and MSDS

MSDS

- Material Safety Data Sheets developed by the Faculty Laboratory Centre of the City University of Hong Kong. It (Dec 2000 version)
- About 450 MSDSs of the chemicals commonly used in secondary school laboratories.
- URL: http://cd1.edb.hkedcity.net/cd/science/laboratory/content_safety.html

Handbook on Safety in Science Laboratories

- Reference on School Science Laboratory Safety
- English and Chinese version
- URL: http://cd1.edb.hkedcity.net/cd/science/laboratory/safety/SHB_2002e.pdf

Personal Protection Equipment

個人防護裝備

Laboratory Gown

- Encourage students to wear laboratory gown
  - better protected
  - look professional

Safety Spectacles

Hand Protector

- Hand Protector 隔熱護手墊

Disposable Nitrile Gloves

Enhance Safety in Investigative Study

提升探究研習的安全

Risk Assessment

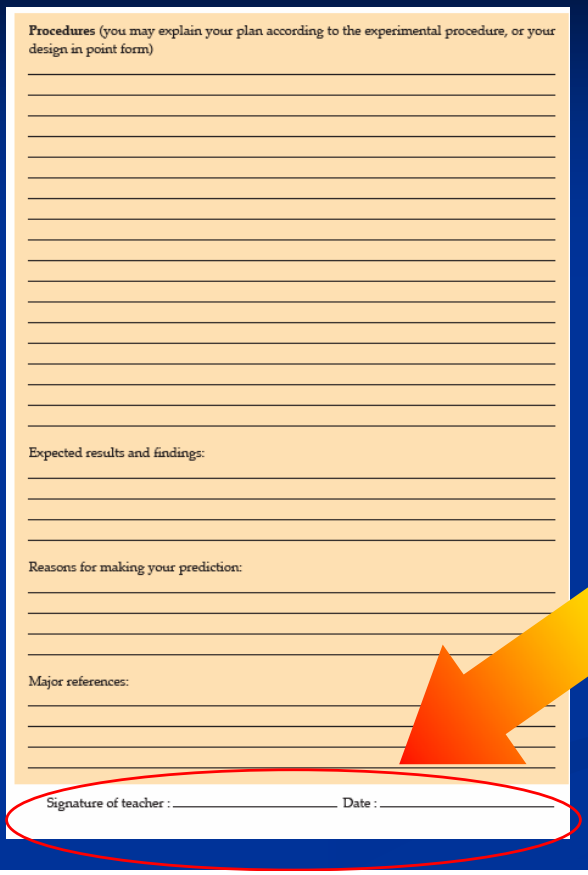
Risk Assessment

Please list the potential hazards of the substances being used or produced, procedures and equipment; and the safety precautions that should be taken. Also think about what emergency procedures could be taken in case of accidents.

Hazardous substances being used or made, hazardous procedures or equipment	Nature of the hazards (e.g. toxic, flammable)	Control measures and precautions (e.g. use chemicals of lower hazard; reduce the scale; use fume cupboard or safety screen, wear protective glove… safety spectacles, etc.)	Emergency	Sources of

MSDS

Monitor students' work



Procedures (you may explain your plan according to the experimental procedure, or your design in point form)

Expected results and findings:

Reasons for making your prediction:

Major references:

Signature of teacher : _____ Date : _____

Teacher's approval for the investigation proposal

Storage of Chemicals

化學品貯存

Concrete Storage Cupboard

Flammable Chemicals Store

Storage of Water Sensitive Chemicals

Handling Chemical Waste

化學廢料處理

Small Container for Waste

Spill Control Kits

Spill Control Kits

Acid Waste and Alkali Waste

Safety Policy and Management
安全政策及管理

Safety Management

- Top management (principal and supervisors)
  - commitment
- Standing Committee on Laboratory Safety (senior science teachers)
  - chair: ranking management
  - members: line management and employee representatives
  - safety policy, emergency measures, auditing, review
- Line management (all science teachers)
  - risk assessment, safe practices and procedure
  - instruction and training
- Employees (laboratory technicians, students)
  - awareness, acceptance, participation

Safety Programme

- Safety policy
- Assignment of responsibility (due diligence)
- Identification and control of hazards
  - risk assessment and control measures
- Safe practices
  - safety procedure, protective and safety equipment
  - equipment inspection and maintenance
  - emergency measures and first-aid
- Recordkeeping, safety audit and review
- Instruction and training

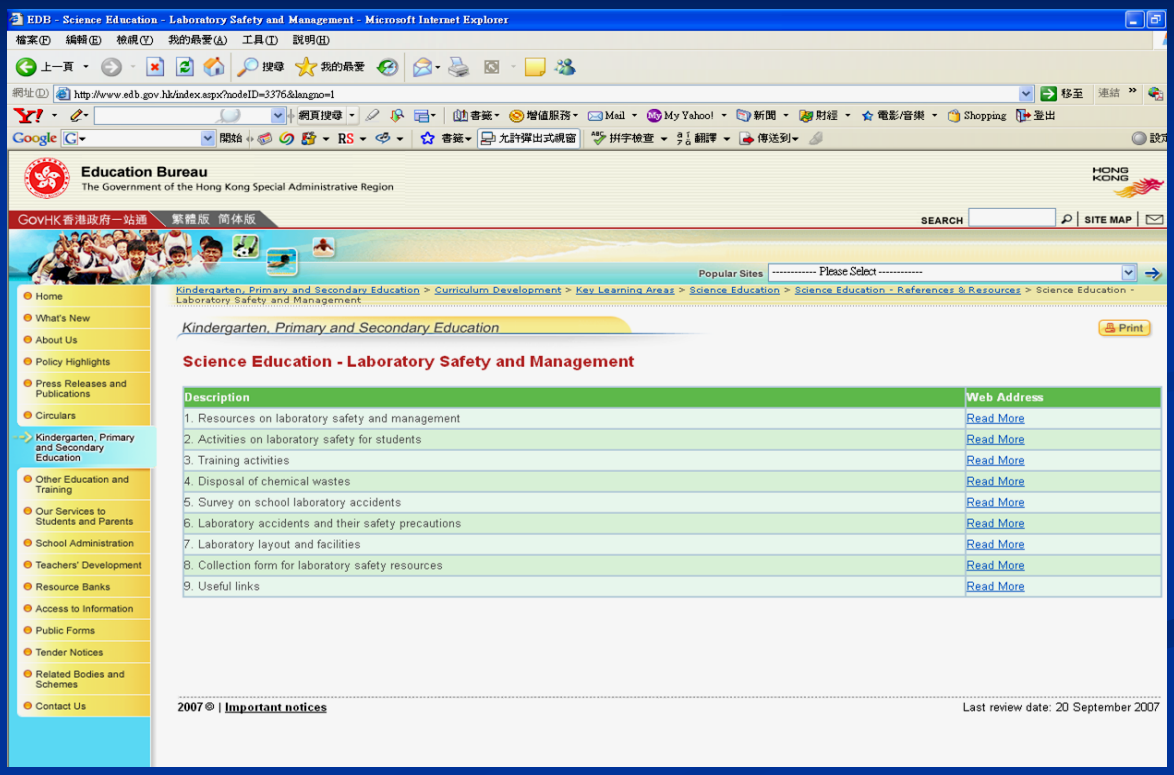
Resources on
Laboratory Safety and Management

- EDB → K P S → CD → Sci Ed → **L S M**
  1. Resources on laboratory safety and management
  2. Activities on laboratory safety for students
  3. Training activities
  4. Disposal of chemical wastes
  5. Survey on school laboratory accidents
  6. Laboratory accidents and their safety precautions
  7. Laboratory layout and facilities
  8. Collection form for laboratory safety resources

URL: http://www.edb.gov.hk/index.aspx?nodeID=3376&langno=1

- Safety in Exploring Science
  URL: http://resources.edb.gov.hk/~ses

Resources on Laboratory Safety and Management (http://edb.gov.hk/cd/sc ➔ References & Resources ➔ Laboratory Safety and Management)

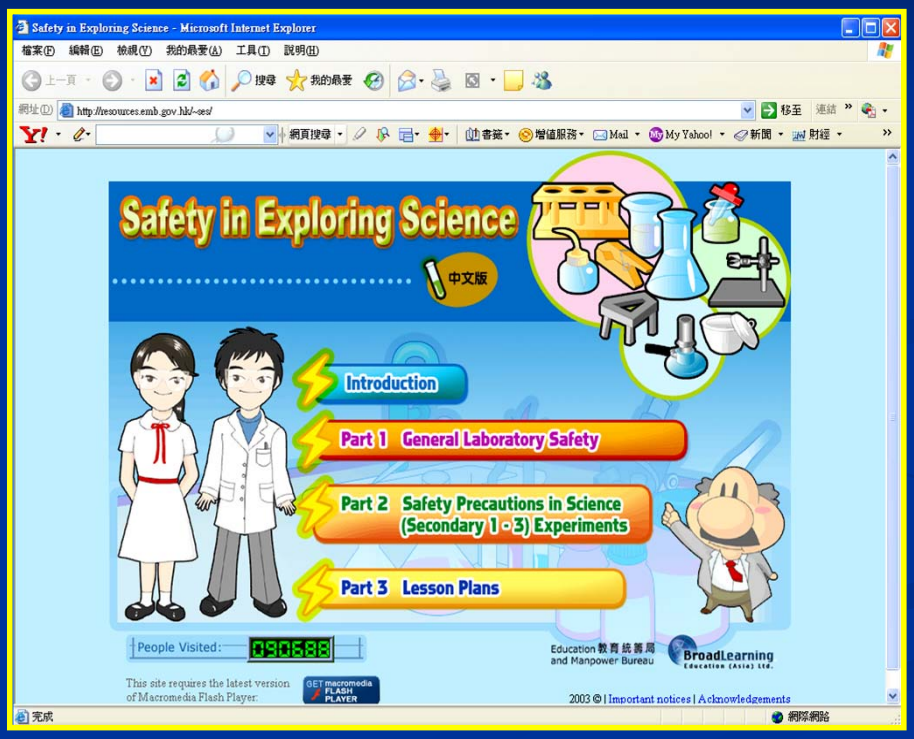


Learning and Teaching Resources on Safety in Science Laboratories

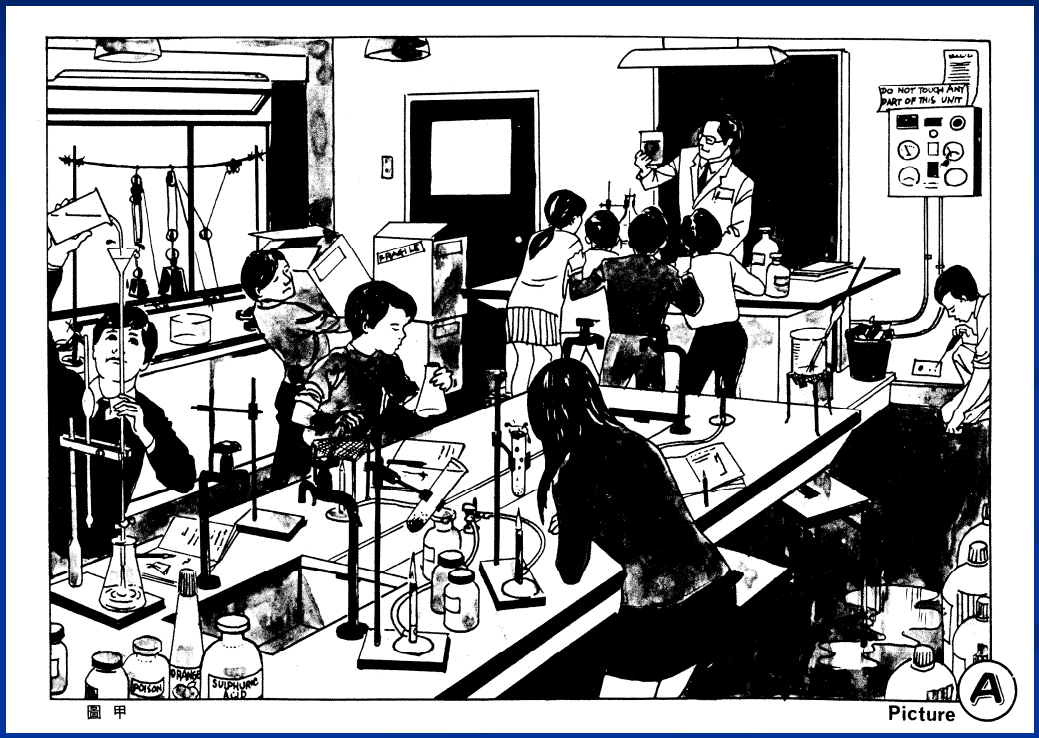
- Suggested teaching strategies for lessons on laboratory safety
- Exemplars of learning activities
  1. Laboratory safety rules
  2. Eye protection
  3. Safety information on chemicals
  4. Risk assessment
  5. What if a laboratory accident happens?

http://cd1.edb.hkedcity.net/cd/science/laboratory/SAFETY/safety_exemplars_e.pdf

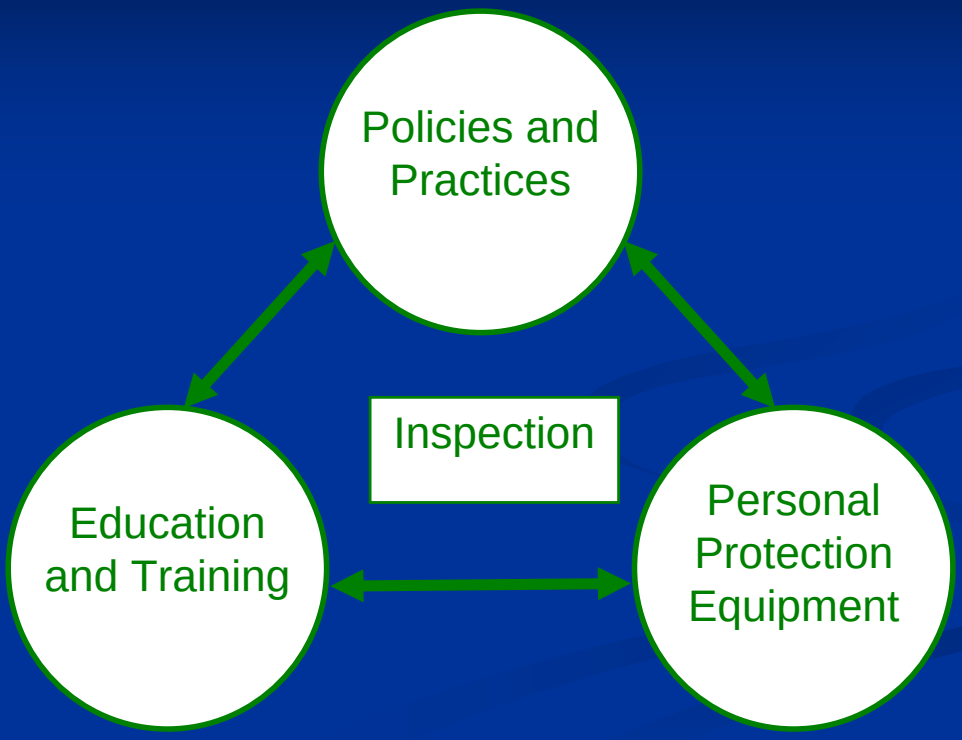
http://resources.edb.gov.hk/~ses/



Safety Education



Summary



Thank You!