



ISEBE LEMFUNDU LENTSHONA KOLONI

UKHUSELEKO KWILABHORATRI YESIKOLO

IMIGAQO ELAWULA INKQUBO

MATSHI 2004

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1. INTSHAYELELO

Ukhuseleko kwilabhoratri yesikolo alukhange lufumane ngqwalaselio iyiyo ngokuthe gqolo apha eMzantsi Afrika. Kutyeshelwe ngolona hlobo ukulahlwa komphutha weekhemikhali.

ISebe leMfundu leNtshona Koloni linoxanduva lokuqinisekisa ukuba ukufundiswa nokufundwa kwesayensi ngendlela eyiyo kungensiwa ezikolweni lingayekelangana nje ukuzimisela kwalo kucoceko lokusingqongileyo nakukhuseleko lwabafundi balo, ootitshala balo nezikolo zalo. Eli Sebe liyayiqonda into yokuba iilabhoratri zezikolo ziindawo ezingayingozi enkulu nokuba ukugcinwa nokusetyenziswa kweekhemikhali kufuneka kube phantsi kolawulo olungqongqo. Likwayiqonda into yokuba ukusetyenziswa gwenxa kweekhemikhali ezigcinwe kwizikolo zalo kungalubeka engozini ukhuseleko loluntu.

Eli Sebe liyiqaphale inxaxheba oya kuthi uMthetho oYilwayo weziQhushumbisi omtsha (*new Explosives Bill*) ube nayo ekugcinweni nasekusetyenzisweni kweekhemikhali ezikolweni zalo kune nokuhlolwa ngabantu bangaphandle esele kuthathelwe ingqalelo.

Ngako oko ke eli Sebe linyanzelekile ukuba lithathe amanyathelo ayimfuneko ukuqinisekisa ngokhuseleko nokuthintela ukusetyenziswa gwenxa kweekhemikhali ezikolweni.

2. UMGAQO WEZOKHUSELEKO

Ukwenzela ukufikelela kwiinjongo zalo zokhuseleko kwizikolo zesayensi, eli Sebe:

- lifuna ukuba isikolo sityumbe igosa lezokhuseleko kootitshala baso.
- lifuna ukuba i-EMDC nganye ityumbe umhloli wezokhuseleko wangaphandle (*external safety monitor*) oza kubeka esweni iindlela zokhuseleko kwizikolo zesayensi kuloo-EMDC.
- limisele imisebenzi, uxanduva neemfanelo zenqununu, zegosa lezokhuseleko, zomhloli wezokhuseleko, zootitshala nezabafundi besayensi abasezikolweni.
- selinike imizekelo yeekhemikhali eziyingozi kunye neziphumo zazo (*reactions*).
- libeka imiqathango ekusetyenzisweni kweekhemikhali eziyingozi neziphumo zezi khemikhali zakuba zisetyenzisiwe (*chemical reactions*).
- selinike imiyalelo malunga neendlela emazicinwe ngayo iikhemikhali.
- selibonise iindlela okungathi ngayo wenziwe ungabi nabungozi umphutha weekhemikhali okanye iindlela omawulahlwe ngayo.
- liza kubonelela ngoqequesho lootitshala abatsha abangenamava ngokusetyenziswa kweekhemikhali eziyingozi.
- liza kunika izikolo incwadi esisikhokelo equlethe ulwazi olubanzi ngokhuseleko kwezesayensi yesikolo.

3. UKUTYUNJWA KWEGOSA LOKHUSELEKO LWEZESAYENSI

Inqununu yesikolo minyaka le iya kutyumba ngencwadi ebhaliwego oyena titshala kwabo balapho njengegosa lezokhuseleko elinoxanduva lokujongana nezesayensi. Inqununu iya kubamba iintlanganiso eziliqela kunye nootitshala ize ibhungisane neengcali ukuba kuyimfuneko oko ukuqinisekisa ukuba kutyunjwa oyena mntu utshatsheleyo ngolwazi.

4. UKHUSELEKO KWIILABHORATRI ZESAYENSI EZIKOLWENI

4.1 Imisebenzi yegosa lokhuseleko lwezesayensi

Imisebenzi yegosa lokhuseleko lwezesayensi esikolweni yile

- Kukuqulunqa umgaqo-nkqubo wesikolo wokhuseleko lwezesayensi ngokungqinelana noMgaqo-nkqubo we-WCED weMigaqo yoKhuseleko lwezeSayensi eZikolweni.
- kukulahlia iikhemikhali ezithile ngokungqinelana nenkqubo ye-WCED yoMgaqo woKhuseleko lwezeSayensi eZikolweni.
- kukwenza ithayimthebhile yokusetyenziswa kwelabhoratri ngooitshala nabafundi.
- kukukhupha iikhemikhali eziwiselwe imiqathango nezinye iikhemikhali lizinike ootitshala nokugcina irekhodi yazo.
- kukuqinisekisa ukuba iikhemikhali zisetyenziswa, zigcinwe yaye zicwangciswe ngeendlela eziqinisekisa ukhuseleko.
- kukuqhuba uqequesho nophuhliso lootitshala besayensi ngemiba ephathelele kukhuseleko lwezesayensi.
- kukuqinisekisa ukuba ilabhoratri yesayensi isetyenziswa, ilawulwa kwaye igcinwe ikwimeko eqinisekisa ngokhuseleko kune nokuyihlola qho mihla le.
- kukunika ingxelo ngoko nangoko kwinqununu ngayo nayiphi na imibandela eyingozi okanye enokukhokelela engozini.
- kukugcina uluhlu lwazo zonke iikhemikhali eziwiselwe imiqathango ngokwamagama nobungakanani bazo nokuluhlaziwa qho ngekota olu luhlu.
- kukuqinisekisa ukuba iimpawu zokhuseleko zixhonyiwe elabhoratri nokuba iikhemikhali eziyingozi zifakwe iilebhile.
- kuku-odola iikhemikhali eziyimfuneko ekufundiseni isayensi
- kukuqulunqa umgaqo wokuziphatha ofunekayo wabafundi nootitshala ukuqinisekisa ukhuseleko.

4.2 Imisebenzi noxanduva lootitshala abasebenzisa ilabhoratri neekhemikhali

Ukuze igosa lokhuseleko liphumelele ekwenzeni le misebenzi, ibalulekile intsebenziswano yootitshala abachaphazelekayo. Ukuze kwenzeke oku, kukhankanywe apha ngasezantsi imisebenzi noxanduva lootitshala. Ootitshala abasebenzisa iilabhoratri neekhemikhali mabasebenzisane negosa lokhuseleko ukuqinisekisa ukhuseleko.

Kuya kufuneka ootitshala abalolu hlobo

- bawazi yaye bawusebenzise uMgaqo-nkqubo wokhuseleko IwezeSayensi eSikolweni.
- baqinisekise ukuba abafundi abasebenzisa ilabhoratri balandela umgaqo wokuziphatha ofanelekileyo ukuqiniseka ukhuseleko.
- baqinisekise ukuba abafundi abashiywa bodwa elabhoratri okanye kungekho mntu ubabeke esweni
- bayicime igesi ekupheleni kwesifundo.
- batshixele zonke iikhemikhali yaye baqinisekise ukuba akukho khemikhali zibekwe nje naphi na elabhoratri.
- batshixe ucango Iwaselabhoratri ngamaxesha okuphumla (*breaks*) naxa ingasetyenziswa ilabhoratri.
- bagcine iikhemikhali eziyingozi zitshixelwe xa zingasetyenziswa.
- bafundise abafundi ngeengozi ezibangelwa ziikhemikhali nangamanyathelo okhuseleko ekufuneka athathwe phambi kokuba abafundi baphathe iikhemikhali eziyingozi kwanangezipumo zazo eziyingozi.
- bangavumeli abafundi ukuba benze ezo zinto zifanele, ngokommiselo wesilabhasi, ukuboniswa ngutitshala.
- bangakhuphi zikhemikhali eelabhoratri ngaphandle kwemvume yegosa lokhuseleko.
- bazisebenzise iikhemikhali kuphela ukulungiselela iinjongo ezimiselwe yisilabhasi
- basebenzise kuphela ezo khemikhali zivunywe ligosa lokhuseleko.
- babuyisele iikhemikhali emva kokuzisebenzisa kwiindawo zazo zokuzigcina esitoreni.
- baziphathe ngokukhuselekileyo nangenyameko iikhemikhaki eziyingozi nezinezinto ezizenzayo zakusetyenziswa.

- baxelete igosa lokhuseleko ngazo naziphi na into eyingozi nezo zingabangela ingozi.
- bavumele abafundi bajoje, bangcamle yaye baphathe iikhemikhali kuphela xa bephantsi kweliso lobagadileyo.

4.3 Uxanduva Iwabafundi abasebenzisa ilabhoratri yesayensi

Ukwenzela ukuba igosa lokhuseleko liwenze umsebenzi walo, ibalulekile intsebenziswano yabafundi. Imisebenzi neemfanelo zabafundi abasebenzisa ilabhoratri yesayensi inikwe apha ngasezantsi.

Kuya kufuneka abafundi

- bawazi yaye bawulandele ngqo uMgaqo-nkqubo woKhuseleko IwezeSayensi eSikolweni.
- Basebenzisane notitshala osemsebenzini kunye negosa lokhuseleko ukuqinisekisa ukhuseleko ngalo lonke ixesha.
- balandele indlela yokuziphatha ebekwe ligosa lokhuseleko.

5. UKUTYUNJWA KOMHLOLI WOKHUSELEKO LWEZESAYENSI WANGAPHANDLE

Umlawuli we-EMDC minyaka le uya kutyumba ngencwadi ebhaliweyo oyena titshala onolwazi njengomhloli wezokhuseleko onoxanduva lokujongana nezesayensi. Umlawuli uya kubhungisana neengcali ukuba kuyimfuneko oko ukuqinisekisa ukuba kutyunjwa oyena mntu utshatsheleyo ngolwazi. Ukuba akukho mntu ufumanekayo ufanelekileyo, umcebisi ngezekharityhulam oyintloko okanye umcebisi ngezekharityhulam omkhulu okanye umcebisi ngezekharityhulam uya kubamba njengomhloli wokhuseleko Iwezesayensi wangaphandle.

6. IMISEBENZI YOMHLOLI WOKHUSELEKO LWEZESAYENSI WANGAPHANDLE

Umhloli wokhuseleko lwezesayensi wangaphandle uya

- kuqinisekisa minyala le ukuba isikolo ngasinye esihlohlia isayensi kwi-EMDC sisebenzisa ezokhuseleko ngokoMgaqo-nkqubo nangokweMigaqo yoKhuseleko yeSebe leMfundu leNtshona Koloni phambi kokuba kuthiwe iilabhoratri ziindawo ezikhuselekileyo.
- kunika ingxelo qho ngekota kumlawuli we-EMDC ochaphazelekayo, oko ekwenza egqithe kumcebisi ngezekharityhulam oyintloko, malunga nemeko yezokhuseleko kwizikolo ze-EMDC.
- kuqequesha amagosa okhuseleko esikolo ngemiba yezokhuseleko.

7. IIKHEMIKHALI EZIWISELWE IMIQATHANGO

Uluhlu lweekhemikhali eziyingozi olwanikwa izikolo zeSebe leMfundu leNtshona lushwankathelwe **kwisihlomelo A.** Ukusetyenziswa kwezi khemikhali kuphelele ekusetyenzisweni kwazo ngokwemimiselo yesilabhasi. Xa zisetyenziswa ezi khemikhali, makuthathwe amanye amanyathelo okulumkela ingozi ukuqinisekisa ukhuseleko. Ngaphandle kokuba kucaciswe ngandlela yimbi kwisilabhasi, akuvumelekile ukuba abafundi ngokwabo baphathe ezi khemikhali yaye kuphela ngootitshala amabenze imiboniso kunye nezo zinto zizenzayo ezi khemikhali zakusetyenziswa. Ootitshala abafuna ukusebenzisa naziphi na ezezi khemikhali mabaxelete igosa lokhuseleko kwanethuba ukuze ibe lilo eliya kuzikhupha libanike. Le nkqubo kufuneka ibe yecwangciswe kakuhle ukuze ingaphazamisani nokufunda nokufundisa.

Zonke iikhemikhali eziyingozi mazibe neelebhile ezibonakalayo nemiqondiso efanelekileyo elumkisayo.

Ezi khemikhali mazingasetyenziswa kwizikolo zaseprayimari.

8 IZIPHUMO ZEEKHEMIKHALI EZIWISELWE IMIQATHANGO ZAKUSETYENZISWA

Uluhlu lweekhemikhali ezinikwa izikolo nezithi zikhuphe iziveliso eziyingozi zakutshiswa okanye zakudibana nezinye izinto, lushwankathelwe **kwisihlomelo B.** Ukuboniswa kvezinto ezenzekayo zakusetyenziswa ezi khemikhali kuphelele kwinto emiselwe kwisilabhasi. Xa kusenzeka ezi zinto zisisiphumo (*reactions*), makuthathwe amanye amanyathelo okulumkela ingozi ukuqinisekisa ukhuseleko. Ngaphandle kokuba kucaciswe ngandlela yimbi kwisilabhasi, akuvumelekile ukuba abafundi ngokwabo basebenzise ezi khemikhali ukuze zivelise iziphumo ezibangelwa lusetyenziso lwazo yaye kuphela ngooitshala amabazibonise kubafundi. Ezi zinto zibangelwa lusetyenziso lwekhemikhali mazingaboniswa kubafundi baseprayimari.

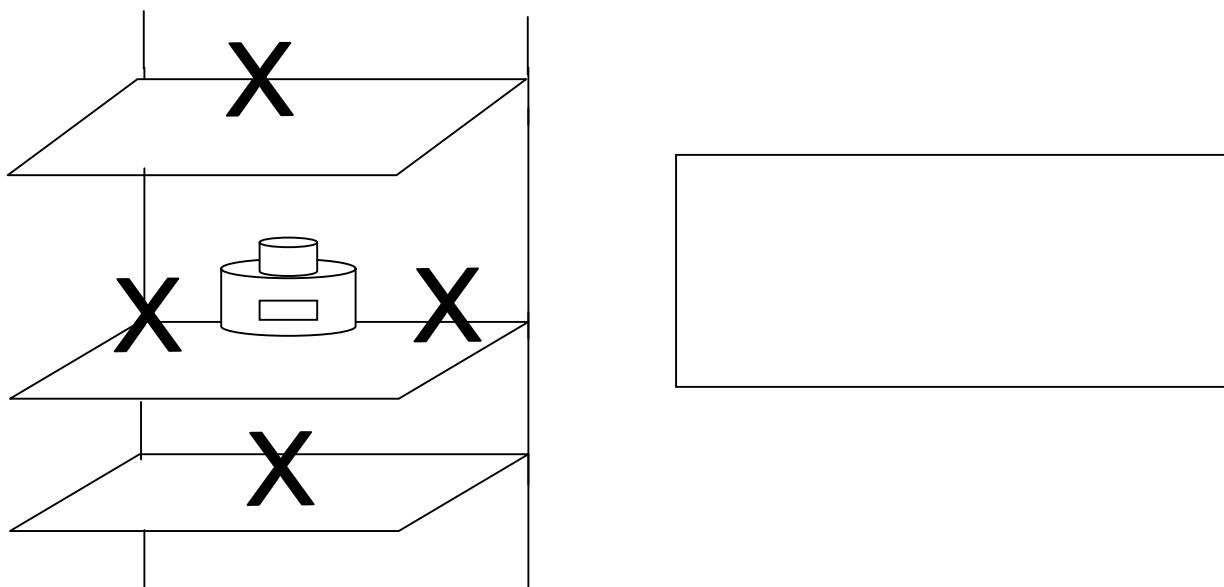
9. UKUGCINWA KWEKHEMIKHALI

9.1 likhemikhali ezingafakwanga kuluhlu kwisilabhasi okanye ezinganikwanga izikolo liSebe leMfundu leNtshona Koloni

Igosa lokhuseleko lwezesayensi yesikolo liya kwenza uluhlu lwazo zonke iikhemikhali, nokuba ngaba zikho kwistokhwe okanye zisandula kuthengwa, nenjongo eziza kusetyenziselwa yona. Olu iuhlu malungeniswe qho ngekota kumhloli wokhuseleko lwezesayensi wangaphandle. Umhloli wokhuseleko lwezesayensi wangaphandle uya kuthintela ukugcinwa kunye(okanye ukusetyenziswa kwazo naziphi na iikhemikhali ezithathwa ngokuba azingqinelani noMgaqo-nkqubo noMgaqo woKhuseleko lwezeSayensi yeZikolo weSebe leMfundu leNtshona Koloni kunye nale Ncwadana yeMigaqo.

9.2 IIKHEMIKHALI EZINGAHAMBELANIYO

'likhemikhali ezingahambelaniyo' ziikhemikhali ezinokuthi xa zidibene nezinye zidale ingozi. likhemikhali mazigcinwe ngeendlela ezenza kube lula ukufumaneka nezenza zingabinakwenza zingozi. Ngako oko ke, iikhemikhali ezingahambelaniyo akufuneki zigcinwe zimiswe nkqo okanye zilaliswe ngecala ezishelifini. Uluhlu Iwezi khemikhali zingahambelaniyo lunikwe **kwiZihlomelo C no-D.**



likhemikhali mazigcinwe kwigumbi elahlukileyo ingabililo elo linezixhobo zeFiziki. Izikhongozeli ezikhulu ezineekhemikhali kufuneka zigcinwe zibekwe phezu komgangatho. Makungabikho mphunga uyingozi kwigumbi elisisitora leFiziki okanye leKhemistri.

10. UKULAHLWA KOMPHUTHA WEEKHEMIKHALI

Umgao-nkqubo wokhuseleko lwezesayensi wesikolo kufuneka wenze amalungiselelo amanyathelo amakalandelwe malunga nokulahlwa komphutha weekhemikhali. Lo mgaqo-nkqubo kufuneka wenze amalungiselelo okulahlwa komphutha weekhemikhali kuphela kwiindawo ezivunywe ngumasipala. Xa zifuna ukulahla umphutha weekhemikhali, izikolo maziqhagamshelane necandelo loLawulo lweNkunkuma likamasipala. Nazi iinkukacha zoqhangamshelwano nabo:

Imibuzo ngefoni ingabhekiswa kwa: (021) 487 2477

Ngefeksi : (021) 487 2476

Idilesi yeziko lewebhu: <http://www.cmc.gov.za> /w&w

Ukulahlwa kweNkunkuma kuphantsi kweCandelo loMLawuli: WeZamanz
neeNkonzo zoLawulo lweNkunkuma. Nazi iinkcukacha zoqhagamshelwano neli
Candelo:

Imibuzo ngokubanzi ebuzwa ngefoni : (021) 487 2669

Kumathuba kaXakeka emva kweeyure zomsebenzi: (021) 424 7715

Idilesi yeziko lewebhu :<http://www.cmc.gov.za>

11. IINKUBO EMAZILANDELWE NGEXESHA LIKAXAKEKA

11.1 Ubusela

Zonke iziganeko zobusela mazixelwe kwigosa lokhuseleko Iwezesayensi lesikolo ngoko nangoko, eliya kuthi lona lixelele inqununu ne-EMDC echaphazelekayo oko likwenza ngomhloli wokhuseleko Iwezesayensi wangaphandle. Igosa lokhuseleko Iwezesayensi lesikolo liya kubhala ingxelo ngesiganeko sobusela eso lize linike iikopi zayo inqununu yesikolo nomhloli wokhuseleko Iwezesayensi wangaphandle. Inqununu yesikolo iya kusisa emapoliseni akufutshane eso siganeko, ize ivule ityala yaye iqalise ngophando. Ukuba kuyimfuneko, umhloli wokhuseleko Iwezesayensi wangaphandle uya kuhlola okwenzekileyo apho kwiziko lemfundu elo aze anike ingxelo yolu hlolo kumcebisi wezekharityhulam oyintloko. Kuzo zonke izenzo zobusela, isikolo kunye ne-EMDC echaphazelekayo kufuneka zifayilishe iingxelo zize zixelete iSebe leMfundu ukuze lihlale likwazi okuqhubekayo.

11.2 Ukwenzakala neengozi ezenzeka elabhoratri

Iziganeko zokwenzakala mazixelwe ngoko nangoko kwinqununu oku kwensiwe ligosa lokhuseleko IwezeSayensi yeSikolo. Wakuba waziwe unobangela wokwenzakala, uitshala osemsebenzini makenze uncedo lokuqala elandela imigaqo ekwiNcwadana

esiSikhokelo seZokhuseleko IwezeSayensi yeSikolo malunga naloo ngozi. Kwiingozi ezimasikizi, umntu (abantu) owenzakeleyo makabalekiselwe esibhedlele.

Kwimeko yeengozi ezimasikizi, ezinjengomlilo ongalawulekiyo makuphunywe elabhoratri kuze kwaziswe umasipala okufutshane ukwenzela ukuyifaka phantsi kolawulo loo meko. Igosa lokhuseleko Iwezesayensi yesikolo malingenise ingxelo ebhaliwego ngesiganeko eso kumhloli wokhuseleko Iwezesayensi yesikolo wangaphandle. Isikolo kunye ne-EMDC echaphazelekayo mazibe neekopi zale ngxelo ziyigcine efayilini.

Ilabhoratri nganye mayixhotyiswe ngezixhobo zoncedo lokuqala, isicima-mlilo, ingubo, umhlakulo ne-emere ngokungqinelana nemimiselo yeNcwadana esiSikhokelo yoKhuseleko IwezeSayensi yeSikolo.

12. UQEQQESHO

Igosa lokhuseleko Iwezesayensi lesikolo liya kukhawuleza liqalise ngokuqequesha ootitshala besayensi ngokhuseleko Iwezesayensi yesikolo xa oku kuyimfuneko. Umhloli wokhuseleko Iwezesayensi yesikolo wangaphandle we-EMDC uya kuqequesha amagosa okhuseleko Iwezesayensi amatsha xa kuye kwakho isicelo soko. Eli gosa liya kuqequesha kwakhona amagosa amatsha okhuseleko Iwezesayensi ezikolweni apho isayensi isandula ukuqaliswa kwikharthyulam.

13. INCWADANA ESISIKHOKELO YOKHUSELEKO KWEZESAYENSI YESIKOLO

ISebe leMfundu liya kuqulunqa esi sikhokelo lize linike isikolo ngasinye ikopi yaso.

14. IZINTO NGOKUBANZI

Lo gama iSebe leMfundu livelana nezikolo ezinozenzele bezixhobo zesayensi, kumelwe kugxininiswe ukuba ukwensiwa nokusetyenziswa kwezixhobo ezelolo hlobo luxanduva izikolo ezo eziya kuluthwala ngokwazo. Ukuba kukho izikolo ezigcina iikhemikhali ngemilinganiselo engeyiyo leyo imiselweyo ukuba isetyenziswe ifunekayo ekuhlohlweni kwesilabhasi, luxanduva olo eziya kuluthwala ngokwazo, yaye ziyakhunjuzwa ukuba ukugcinwa nokusetyenziswa kwezi khemikhali akukhuselwanga ngulo mgaqo-nkqubo.

ISIHLOMELO A: ULUHLU LWEEKHEMIKHALI
EZISETYENZISWA PHANTSİ KWEMIQATHANGO ETHILE

Isalathiso:

E = Eziqhushumbayo (ezithanda ukudubula)
F = Ekulula ukuvutha (zingatshiswa ngumlilo)

T = Ezityhefayo (ezinetyhefu)

M =iMyuthajini (ibangela utshintsho kokuphilayo)

O = loksidenti (ikhuthaza ioksijini okanye ukuvutha

C = Eyuculayo (ibangela ukuyucuka kwenyama)

I = Isirhawuzelisi (yenza kurhawuzele ulusu, amehlo, njl njl)

HC = Ikhlasinojini emntwini (ibangela umhlaza emntwini)

PHC = Engabangela ikhäsinojini emntwini (ingabangela umhlaza emntwini)

IKHEMIKHALI	I s i d u b u i i	I o k s i d e n t i	E k u l a u k u v u t h a	E y u c u a y o	E z i n e t y h e f u	E z i n e t y h e f u	I s i r h a w u z e l i	i M y u t h a j i n i	i K h a s i n o j i n	
lasethikhi asidi (Acetic acid)					C					
Ialuminiyam khlorayidi (Aluminium chloride)					C					
Umgubo wealuminiyam (Aluminium powder)	E									
lamoniya (Ammonia)						T	I			
lamoniyam dayikhromeyithi (Ammonium dichromate)	E				C	T	I	M		
lamoniyam nayitreyithi (Ammonium nitrate)	E									
lamoniyam thayokhyaneyithi (Ammonium thiocyanate)						T				
Ibheriyam khlorayidi (Barium chloride)						T				
Ibheriyam hayidroksayidi (Barium hydroxide)						T				
Ibhenzini (Benzene)				F		T			HC	
Ibromayini (Bromine)					C		I			
Ibyuthanol (Butanol)				F		T				
Ikhabhoni (grafayithi) (Carbon (graphite))							I			
Ikhabhoni dayisalfayidi (Carbon disulfide)	E		F							
Ikhabhoni thetrakhlorayidi (Carbon tetrachloride)						T	I		PHC	
Itshakhowuli (Charcoal)			F							
Ikhlorayini (Chlorine)					C	T	I			
Ikhlorofom (Chloroform)						T			PHC	
Ikopolo vekhabhonevithi (Copper)							I			

carbonate)						
Ikopolo yekhabhoneyithi (Copper carbonate)					I	
Ikopolo yekhlorayidi (Copper chloride)					I	
Ikopolo yenayitreyithi (Copper nitrate)	E				I	
Ikopolo yeoksidayidi (Copper oxide)					I	
Ikopolo yesalfeyithi (Copper sulphate)					I	
Isayiklohekzeyini (Cyclohexane)		F			I	
Isayiklohekzeyini (Cyclohexane)		F				
Idikheyinidayioyili dayikhlorayidi (Decanedioyl dichloride)				T		
Iethanowikhi asidi (Ethanoic acid)		F			I	
Iethanol (Ethanol)						
Ietha (Ether)	E	F				
Ietha (dayethyl etha) (Ether (diethyl ether))		F				
Ihayidrokhlorikhi asidi (Hydrochloric acid)			C	T	I	
Igesi yehayidrojini (Hydrogen gas)	E	F	C			
Ihayidrojini pheroksayidi (Hydrogen peroxide) (30%)		F		T	I	
Ihayidrojini saltayidi (Hydrogen sulphide)					I	
I-indigo khamayini (Indigo carmine)						M
Umphunga we-ayodini (Iodine vapour)			C		I	
Iayodini ezingqakumbana ezimenyezelayo (Iodine crystals)			C		I	
Iayoni khlorayidi (III) (Iron (III) chloride))					I	
Ilothe yeoksayidi (II) (Lead (II) oxide))				T		
Ilothe yeaksitheyithi (Lead acetate)				T		
Ilothe yebromayidi (Lead bromide)				T		
Ilothe yekhabhoneyithi (Lead carbonate)				T	I	
Ilothe yenayitreyithi (Lead nitrate)				T		
Ilothe yesalfayidi (Lead sulphide)				T		
Ulwelo Iwegenesi yepetroliyam (Liquid petroleum gas)	E	F				
Ilithiyam (Lithium)	E		C			
Ikhlorayidi yelithiyam (Lithium chloride)			C			
Ihayidroksayidi yelithiyam (Lithium hydroxide)			C			
Imagneziyam (Magnesium)		F				
Ioksayidi yemetyhuri (Mercuric oxide)				T		
Imetyhuri (Mercury)				T		
Inayitreyithi yemetyhuri (Mercury nitrate)				T		

Imithanol (Methanol)			F		T			
Imethileyithedi spirithi (Methylated spirits)			F					
Imethanowikhi asidi (ifomikhi asidi) (Methanoic acid (formic acid))			F		I			
Imithanali (ifomalini) Methanal (formalin)			F		I			
Inafthalini (Naphthalene)			F		I			
Inikheli (Nickel)								
Inayitrikhi asidi (Nitric acid)		O			I			
Ioksalikhi asidi (Oxalic acid)			C					
Igesi yeoksijini (Oxygen gas)	O							
Ifenolfuthalini (Phenolphthalein)				C	T			
Ifosiforasi (emhlophe) (Phosphorous (white))				C	T			
Ifosiforasi phentoksayidi (Phosphorous pentoxide)				C	T			
Ifosiforasi ebomvu (Phosphorous red)			F					
Ifosiforasi emthubi (Phosphorous yellow)			F					
Ipotaziyam (Potassium)	E			C				
Ipotaziyam khabhoneyithi (Potassium carbonate)								
Ipotaziyam khloreyithi (Potassium chlorate)		O			T	I		
Ipotaziyam dayikhromeyithi (Potassium dichromate)				C				HC
Ipotaziyam hayidroksayidi (Potassium hydroxide)				C		I		
Ipotaziyam phemanganeyithi (Potassium permanganate)	E					I	M	
Ipropanoni (asethoni) (Propanone (acetone))			F		T	I		
Inayitreithi esilivere (Silver nitrate)				C			M	
Ilayim yesoda (Soda lime)				C				
Isodiyam (Sodium)				C				
Isodiyam hayidroksayithi (Sodium hydroxide)				C		I		
Isodiyam hypokhlorayithi (Sodium hypochlorite)				C		I		
Isodiyam yenayitreithi (Sodium nitrate)							M	
Inayitrayithi yesodiyam (Sodium nitrite)	E	O					M	
Isodiyam pheroksayidi (Sodium peroxide)								
Isalfari (Sulphur)			F					
Isalfarikhi asidi (Sulphuric acid)				C				
Ithapenthayini (Turpentine)			F			I		

ISIHLOMELO B: IZIPHUMO ZEEKHEMIKHALI ZAKUDITYANISWA NEZINYE EZITHILE

IKHEMIKHALI	INKCAZO YOKWENZEKAYO KUNYE NENGOZI ENGEHLA
Iiasidi	Zivelisa ubushushu negesi yehayidrojini enokudubula idibene nesinyithi. Zivelisa ubushushu xa zigalelw amanzi. Ziba neziphumo eziyingozi xa iasidi igalelw amanzi kwaye zikhupha iasidi eshushu.
Imethali zealkali (Iqela I) neemethali zomhlaba zealkalini (Iqela II.)	Ziba neziphumo ngamandla zakudityaniswa namanzi zikhuphe ubushushu obuninzi negesi yehayidrojini enokudubula. uninzi lwezi methali luyatsha lwakudibana ne-oksijini okanye nomoya.
Iamoniyan nayitreyithi	Yenza umxube oyingozi isakudityaniswa nee-asidi, neekhloreyithi, nolwelo olukhawuleza luvuthe nezinto ezicukucezw zancinane.
Iamoniyan thiyo sayinethi	Xa itshiswe ngeqondo elingaphezu kuka- 170 °C ingakhupha umphunga onee- siyanadzi.
Umgubo okhuculayo	Ukhupha igesi yeKhlorini enetyhefu xa unyitilikisa emanzini. Uyadubula xa utshiwe ngaphezu kwe-100 °C. Ukhupha umphunga oyityhefu xa kufakwe iasidi kuwo.
Imethali yekhalsiyam	Umphunga ophuma kwikhalsiyam evuthayo yikhalsiyam oksayidi
Ikhalsiyam khabhayithi	Yenza iethim xa idityaniswe namanzi.
Ikhalsiyam oksayidi	Ikhupha ubushushu kakhulu xa idityaniswe namanzi, umphunga, ii-asidi okanye umphunga we-asidi.
Ikhabboni (grafayithi)	Xa itshiswa ingadubula.
Ikhabboni dayisalfayidi	Njengoninzi lweegesi ezikhawuleza zivuthe, yenza umxube onokudubula xa udibene nomoya.
I-ethini (iasithilini)	Iyadubula xa ilunyekwa kukho ioksijini ize ikhuphe ubushushu obuninzi
Ipotaziyan khloreyithi	Ingadubula yenze ingozi enkulu ukuba idityaniswe nekhabboni nee-organikhi khompawundi okanye xa kukho ubumdaka obufana nothuli xa itshiswa.
Ipotaziyan hayidroksayidi	Ikhupha ubushushu xa idityaniswa namanzi.
Isilva nayitreyithi	Yenza umxube onokudubula xa idibene nomgubo wemagniziyam
Isodiyam hayiphoklorayithi	Iba neziphumo yakudibana nee-asidi yenze igesi eyityhefu yekhlorin. Kwakhona ikhupha igesi yekhlorini xa itshiswa.
Isodiyam hayidroksayidi	Ikhupha ubushushu xa idityaniswe namanzi.
Isodiyam nayitrayithi	Iyadubula xa itshiswe ngokusondele kwi-500°C. Ingenza imixube enokuqhushumba xa idibene neetyuwa ze-amoniyamu neethiyosalfeyithi
Isodiyam pheroksayidi	Iba neziphumo eziyingozi xa idibene namanzi
Isalfure	Ikhupha ityhefu eyisalfa dayoksayidi xa itshiswe kwioksijini. Yenza imixube edubulayo xa idibene nezinki nomgubo wemagneziyam nekhloreyiti kune nezinye iioksidenti
Umgubo wezinki	Uyadubula. Wenza imixube edubulayo xa idityaniswe nesalfure.

ISIHLOMELO C: IIKHEMIKHALI EZINGAHAMBELANIYO

[Ngokubanzi]

Ezi zibini zilapha ngasezantsi yimizekelo yezinto ezingahambelaniyo

Isenzi-mhlwa	kunye	nezidala idangatye
Isenzi-mhlwa	kunye	nesinciphisi
Iasidi	kunye	neziseko
Iasidi	kunye	neesalfayidzi
Iasidi	kunye	nezivutha ngokulula
Iasidi	kunye	neekhompaundi zekhlorini
Iasidi	kunye	nezine-alkhoholi
Iasidi	kunye	neemethali zee-elementi
Amanzi	kunye	nee-elementi zamaqela I no-II
Amanzi okanye ezo zidala		
umoya kwakhona	kunye	nantoni na
li-organikhi pheroksayidi	kunye	nantoni na

ISIHLOMELO D: EZINGAHAMBELANIYO [Eziziintlobo ezithile]

Imizekelo ethile yeekhemikhali ezingahambelaniyo ikwesi sicwangciso silapha ngasezantsi

(Ithathwe kwi *Safety in Academic Chemistry Laboratories: Kwi-American Chemical Society*)

IKHEMIKHALI	AZIHAMBELANI
lasithikhi asidi (Acetic acid)	Nenayitrikhi asidi, ihayidroksili khompawundi, iipheroksayidi, iiphemanganeyithi (Nitric acid, hydroxyl compounds, peroxides, permanganates)
lasithilini (Acetylene)	Ikhlorini, ibromayini, ikopolo, iflorini, isilivre, imetyhuri (Chlorine, bromine, copper, fluorine, silver, mercury)
lasithoni (Acetone)	Nemixube yeenayitrikhi asidi (Concentrated nitric acid kunye nesalfurikhi asidi (sulphuric acid)
lalkhali neemethali zomhlaba zealkhalini (Amaqela I no-II eziseko) umz. Ipotaziyam, ilithiyam, isodiyam, ikhalsiyam, imaginziyam nomgubo wealuminiyam (Alkhali and alkaline earth metals [Groups I and II elements] e.g. potassium, lithium, calcium, magnesium and aluminium powder)	Amanzi, ikhabhoni thetrakhlorayidi okanye ezinye iihaydrokhabhoni ezinekhhlorini, ikhabhoni dayoksayidi, iihalojini (Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens)
lamoniya (enihayidrasi) (Ammonia (anhydrous))	Imetyhuri, ikhlorini, ikhalsiyam hayiphokhlorayithi, iayodini, ibromayini, ienihayidrasi, ihayidroflorikhi asidi (Mercury, chlorine, calcium hypochlorite, iodine, bromine, anhydrous hydrofluoric acid)
lamoniyam nayitreyithi (Ammonium nitrate)	Iasidi, izinyithi ezingumgubo, ulwelo olutshisayo, ikhloreyithi, inayitrayithi, isalfure, izinto ezicukucweze zancinane ezenziwe ngezinto ezinokuvutha, (Acids, powdered metals, flammable liquids, chlorates, nitrites, sulphur, finely divided organic combustible materials)
lbromayini (Bromine)	lamoniya, iasithilini, ibyuthadini, ibyutheyini, imitheyini, ipropheyini, (okanye ezinye iigesi zepetroliyam), ihayidrojini, isodiyam khabhayidi, ibhenzini, iimethali, ithapenthayini (Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, metals, turpentine)
Ikhsaliyam oksayidi (Calcium oxide)	Amanzi (Water)
Ikhabhoni ezanya-zanyisiweyo (Carbon (activated))	Ikhsaliyam hayiphokhlorayithi, nazo zonke izinto ezibangela umhlwa (Calcium hypochlorite, all oxidising agents)
Ikhabhoni thetrakhlorayidi (Carbon tetrachloride)	Isodiyam (Sodium)
likhloreyithi (Chlorates)	Iityuwa ze-amoniya, iiasidi, iimethali ezingumgubo, isalfure, izinto ezicukucweze zancinane ezenziwe ngezinto ezinokuvutha (Ammonium salts, acids, powdered metals, sulphur, finely divided organic or combustible metals)
Ikhhlorini (Chlorine)	lamoniya, iasithilini, ibyutheyini, imitheyini, ipropheyini, (okanye ezinye iigesi zepetroliyam), ihayidrojini, isodiyam khabhayidi, ibhenzini, izinto ezicukucweze zancinane ithapenthayini (Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine)
Ikopolo (Copper)	lasithilini, ihayidrojini pheroksayidi (Acetylene, hydrogen)

	peroxide)
Ulwelo oluvutha ngokulula (Flammable liquids)	Iamoniyan nayitreyithi, ihayidrojini pheroksayidi, inayitrikhi asidi, isodiyam pheroksayidi, iihalojini (Ammonium nitrate, hydrogen peroxide, nitric acid, sodium peroxide, halogens)
Iflorini (Fluorine)	Nazo zonke ezinye iikhemikhali (All other chemicals)
Ihayidrokhabboni, umz. Ibyutheyini, ipropheyini, ibhenzini (Hydrocarbons, e.g. butane, propane, benzene)	Iflorini, ikhlorini, ibromayini, isodiyam pheroksayidi (Fluorine, chlorine, bromine, sodium peroxide)
Ihayidroflorikhi asidi (enihayidrasi) (Hydrofluoric acid) (anhydrous))	I-amoniya (aqueous or anhydrous)
Ihayidrojini pheroksayidi (Hydrogen peroxide)	Ikopolo, intsimbi, uninzi lweemethali okanye iityuwa zazo, ii-akhoholi, iasettoni, izinto ezibolayo (Copper, iron, metals or their salts, alcohols, acetone, organic materials)
Ihayidrojini salfayidi (Hydrogen sulphide)	Inayitrikhi asidi eqhumayo, iigesi ezibangela umhlwa (Fuming nitric acid, oxidising gases)
Ihayiphokhlorayithi (Hypochlorites)	Iasidi, ikhabboni ezanya-zanyisiweyo (Acids, activated carbon)
I-ayodini (Iodine)	Iasithilini, iamoniya (iakhwasi ienihayidrasi), ihayidrojjini (Acetylene, ammonia (aqueous okanye ii-anhydrous), hydrogen)
Imetyhuri (Mercury)	Iasethilini, iamoniya (Acetylene, ammonia)
linayitreyithi (Nitrates)	Isalfurikhi asidi (Sulphuric acid)
Inayitrikhi asidi (ejiye kakhulu) Nitric acid (concentrated)	I-asethiki asidi, ihayidrojeni salfayidi, ulwelo oluvutha ngokulula kunye neegesi, ikopolo, ibrasi, naziphi na iimethali ezisindayo (Acetic acid, hydrogen sulphide, flammable liquids and gases, copper, brass and any metals)
I-inayitrayithi (Nitrites)	Ii-asidi (Acids)
I-oksalikhi asidi (Oxalic acid)	Isilivere, imetyhuri (Silver, mercury)
I-oksijini (Oxygen)	Ii-oyili, igrisi, ihayidrojini, ulwelo oluvutha ngokulula, iziqina, okanye iigesi (Oils, grease, hydrogen, flammable liquids, solids or gases)
Ifosiforasi (emhlophe) Phosphorous (white))	Umoya, ioksijini, ii-alkhali, izinto ezinciphisa izinto zibe ncinane (Air, oxygen, alkalis, reducing agents)
Ipothaziyan (Potassium)	Ikhabboni thetrakhlorayidi, ikhabboni dayoksayidi, amanzi (Carbon tetrachloride, carbon dioxide, water)
Ipothaziyan khloreyithi (Potassium chloride)	I-asidi yesalfure nezinye iiasidi (Sulphuric and other acids)
Isilivere (Silver)	I-asithilini, i-oksalikhi asidi, ithatharikhii asidi, iikhompawundi zeamonyiam (Acetylene, oxalic acid, tartaric acid, ammonium compounds)
Isodiyam (Sodium)	Ikhabboni thetrakhlorayidi, ikhabboni dayoksayidi, amanzi (Carbon tetrachloride, carbon dioxide, water)
Isodiyam nayitrayithi (Sodium nitrite)	I-amoniyan nayitreyithi nezinye iityuwa ze-amoniya (Ammonium nitrate and other ammonium salts)
Isodiyam pheroksayidi (Sodium peroxide)	I-ithanol okanye imithanol, iasethikhi asidi ebumkhenke, ikhabboni dayisalfayidi, igliserini, imethili okanye iethili asiteyithi (Ethanol methanol, glacial acetic acid, carbon disulphide, glycerine, methyl or ethyl acetate)
lisalfayidi (Sulphides)	Ii-asidi (Acids)
Ii-asidi yesalfure (Sulphuric acid)	Ipotaziyam khloreyithi, uzifo-zonke, (iikhompawundi ezifana nezeekhompaundi zeemethali ezelula (Potassium chlorate, potassium permanganate (similar compounds of light metals, such as sodium lithium)