Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

IBANGA 12

SEPTEMBA 2024

IFIZIKHALI SAYENSIZI P2 (IKHEMESTRI)

AMANQAKU: **150**

IXESHA: **3 iiyure**

Eli phepha linamaphepha ayi19, kuquka needatha shithi enamaphepha ayi4.

IINKCUKACHA NOLWAZI

1. Bhala iGAMA neFANI yakho ngokupheleleyo kwizithuba ezilungele oko KWINCWADI YOKUPHENDULELA.

2. Eli phepha lemibuzo liqulethe imibuzo ELITHOBA. Phendula YONKE imibuzo KWINCWADI YOKUPHENDULELA.

3. Qala umbuzo ngamNYE KWIPHEPHA ELITSHA KWINCWADI YOKUPHENDULELA.

4. Nombola iimpendulo zakho ngokuchanekileyo ngendlela esetyenzisiweyo ukunombola eli phepha lemibuzo.

5. Shiya umgca omNYE phakathi kwemibuzwana emibini, umzekelo: UMBUZO 2.1 noMBUZO 2.2.

6. Ungayisebenzisa ikhalityhuleyitha engaprogranywanga.

7. Ungazisebenzisa izixhobo zeMathematika ezifanelekileyo.

8. Bonisa ZONKE iifomyula neesabstityushini kwiikhalityhuleyishini.

9. Sondeza inumerical answer yakho YOKUGQIBELA kwiindawo eziMBINI zedesimali ubuncinane.

10. Nika inxaso emfutshane, ingxoxo njl njl apho kuyimfuneko.

11. Uyacetyiswa usebenzise iiDATHA SHITI ezifakiweyo.

12. Bhala ngokucocekileyo nangokucacileyo

UMBUZO 1: IMIBUZO ENEEMPENDULO EZIKHETHWAYO EZINIKIWEYO

Iindlela ezahlukileyo zinikwe njengeempendulo ezinokuchaneka kwimibuzo elandelayo. Khetha impendulo ze ubhale unobumba (A–D) kuphela ecaleni kweenombolo zemibuzo (1.1 ukuya ku1.10) kwiNCWADI YOKUPHENDULELA, umzekelo: 1.11 E.

1.1 Yeyiphi ENYE kwiihomologous series ezilandelayo ene hydroxyl group ebhondwe kwisatshureyithedi khabhoni athom?

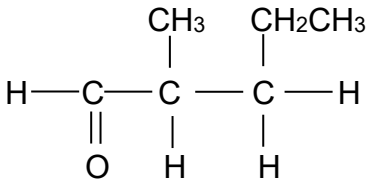
A Ketones

B Aldehydes

C Alcohols

D Esters (2)

1.2 Qwalasela ikhompawundi eboniswe ngezantsi:



Igama ELICHANEKILEYO leIUPAC lekhompawundi engentla yi:

A 3-ethyl-2-methylpropanal

B 2-methyl-3-ethylpropanal

C 2-methylpentanal

D 4-methylpentanal (2)

1.3 Qwalasela ireaction:

$$C_3H_6 + C\ell_2 \rightarrow C_3H_6C\ell_2$$

Igama lereaction yi…

A hydration

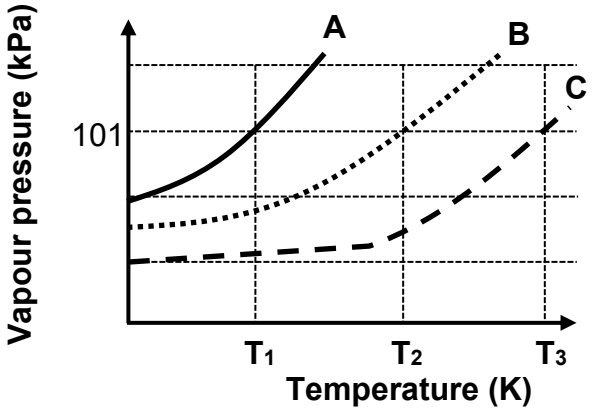
B halogenation

C hydrogenation

D hydrolysis (2)

1.4 Qwalasela ivapour pressure against temperature curves yeeTHREE CHAIN ISOMERS eziphantsi kwestandard atmosopheric pressure.

IVAPOUR PRESSURE VERSUS TEMPERATURE



Qwalasela amabinzana ngokubhekisele kwiikhevu zeeTHREE CHAIN ISOMERS.

I Ikhompawundi **A** unechain length emfutshane kakhulu.

II Iboiling point yekhompawundi **B** ngu T_2.

III Ikhompawundi **C** ikwigaseous phase ku T_2.

Leliphi kumabinzana angentla elichanekileyo/achanekileyo?

A **I** no **II** kuphela

B **III** kuphela

C **II** no **III** kuphela

D **I** no **III** kuphela (2)

1.5 Qwalasela isynthesis reaction yeammonia, NH_3:

$$N_2\,(g) + 3\,H_2\,(g) \rightleftharpoons 2\,NH_3\,(g)$$

Irheyithi ye N_2 (g) esetyenziswe ngexesha lereaction ngu x mol·dm^{-3}·s^{-1}.

Yeyiphi ENYE kwezilandelayo eyireyithi apho iammonia, NH_3 (g) iprodyuswa kwi mol·dm^{-3}·s^{-1} ngokubhekisele kwi N_2 (g)?

A x

B $2x$

C $\frac{x}{2}$

D $3x$ (2)

1.6 Qwalasela ireaction elandelayo kwiekhwilibriyam:

$$CoC\ell_4^{2-}(aq) + 6\ H_2O\ (\ell) \rightleftharpoons Co\ (H_2O)_6^{2+}(aq) + 4\ C\ell^-(aq)$$

Bhlowu Pinki

Isolushini ngalo mzuzu **ipinki**.

Iconcentrated hydrochloric acid (HCℓ) yongeziwe kwiequilibrium mixture.

Yeyiphi ENYE kwiindibabanisela ezilandelayo echaza NGOKUCHANEKILEYO impembelelo yokongezwa kweconcentrated hydrochloric acid (HCℓ) eyakuba nayo kwiequilibrium constant, Kc nokutshintsha kombala wesolushini?

	Kc	UTSHINTSHO LOMBALA
A	Akukho Mpembelelo	Isolushini itshintsha ibe pinki ngakumbi
B	Akukho Mpembelelo	Isolushini itshintsha ibe bhlowu
C	Iyanda	Isolushini itshintsha ibe bhlowu
D	Iyancipha	Isolushini itshintsha ibe pinki ngakumbi

(2)

1.7 Yeyiphi ENYE kwiisubstance ezilandelayo engahlelwa njengeLowry-Brønsted acid?

A Na_2CO_3

B KOH

C NH_4^+

D NaCℓ (2)

1.8 Qwalasela ityuwa, CH_3COONa.

Yeyiphi eNYE kwiindibanisela ezilandelayo echaza NGOKUCHANEKILEYO ihydrolysis reaction ne pH yetyuwa?

	HAYIDROLISISI	i-pH
A	$CH_3COO^- + H_2O \rightleftharpoons CH_3COOH + OH^-$	Inkulu kuno 7
B	$CH_3COO^- + H_2O \rightleftharpoons CH_3COOH + OH^-$	Incinci kuno 7
C	$Na^+ + H_2O \rightleftharpoons NaOH + H_2O$	Inkulu kuno 7
D	$CH_3COO^- + Na^+ \rightleftharpoons CH_3COONa$	Ilingana no 7

(2)

1.9 Qwalasela icell notation yegalvanic cell.

$$A\ell \mid A\ell^{3+} \mid\mid MnO_4^-, Mn^{2+} \mid Pt$$

Yeyiphi ENYE kwiireaction ezilandelayo eyenzeka kwicathode?

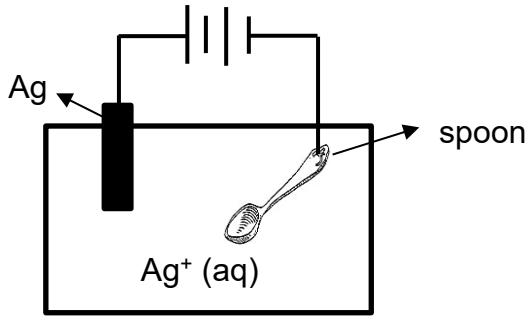
A $Mn^{2+} + 4\ H_2O \rightarrow MnO_4^- + 8\ H^+ + 5\ e^-$

B $MnO_4^- + 8\ H^+ + 5\ e^- \rightarrow Mn^{2+} + 4\ H_2O$

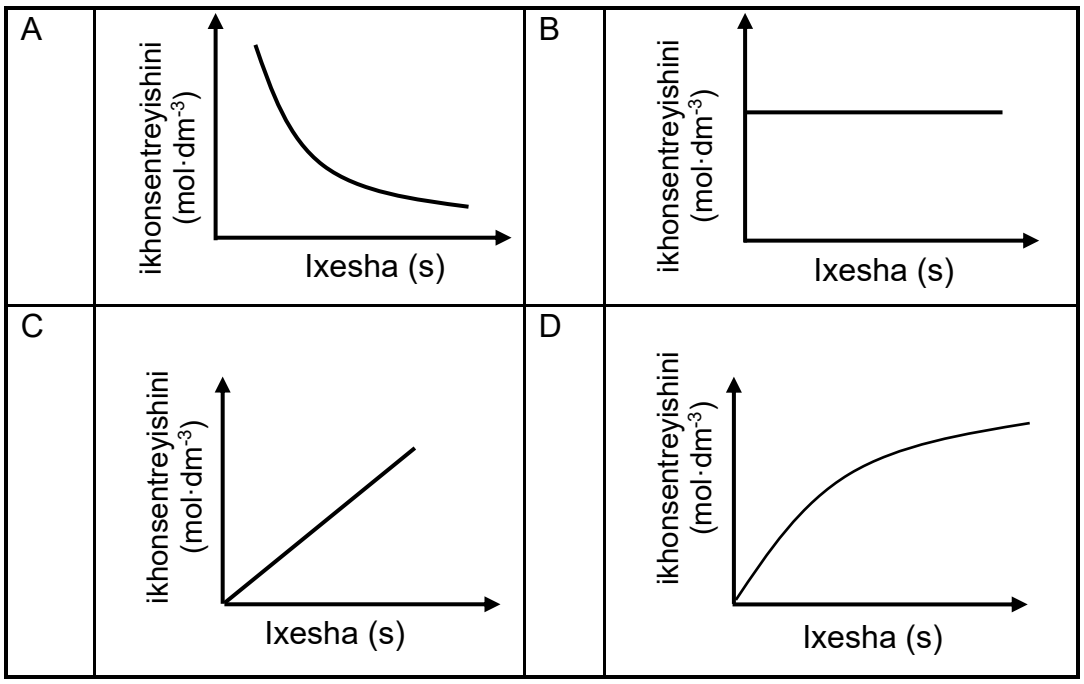
C $A\ell \rightarrow A\ell^{3+} + 3\ e^-$

D $A\ell^{3+} + 3\ e^- \rightarrow A\ell$ (2)

1.10 Icephe lipleyitwe ngesiliva (Ag) ngexesha leprosesi ye-elektrolayisisi.



Yeyiphi ENYE kwiigrafu ezilandelayo ebonisa NGCONO ikhonsentreyishini yeesiliva ayoni (Ag^+) kwielektrolayithi emva kwexesha?

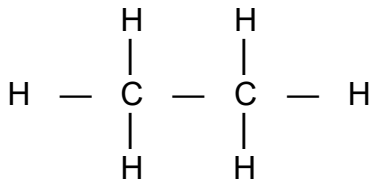
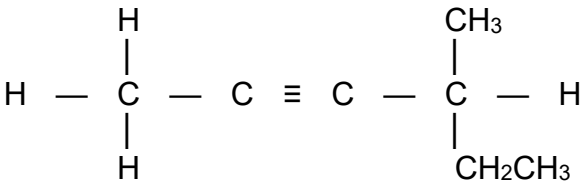
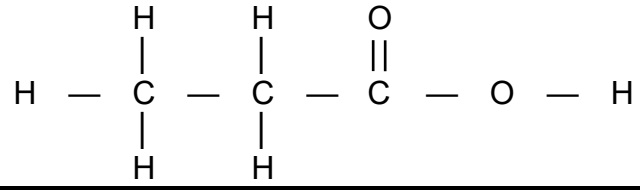


(2)

[20]

UMBUZO 2 (Qala kwiphepha elitsha.)

Qwalasela iioganikhi khompawundi **A–E** ezingezantsi

A 3-methylbutanone	**B** $C_3H_7C\ell$
C 	**D** 
E 	

2.1 Chaza *ifunctional group.* (2)

2.2 Bhala UNOBUMBA wekhompawundi e:

2.2.1 Necarboxyl group (1)

2.2.2 Nejenerali fomyula $C_nH_{2n}O$ (1)

2.2.3 Ne-empirical fomyula engu CH_2 (1)

2.3 Iyakuthelekiswa njani imolecular mass yekhompawundi **E** kwiethyl methanoate?

Khetha kuINKULU KUNE, INCINCI KUNE or ILINGANA NE.

Nika isizathu sempendulo. (3)

2.4 Bhala:

2.4.1 ISITRAKTSHARALI FOMYULA sekhompawundi **A** (2)

2.4.2 Igama leIUPAC yekhompawundi **E** (2)

2.4.3 Igama leIUPAC yekhompawundi **D** (3)

2.5 Ukhompawundi **B** yisecondary haloalkane.

Zoba ISTRAKTSHARALI FOMYULA sekhompawundi **B**. (2)

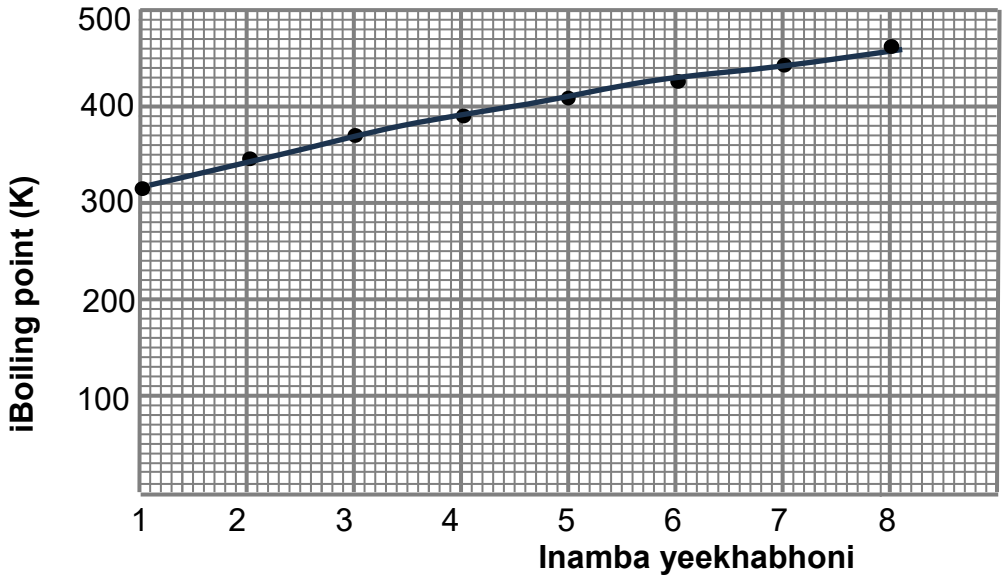
2.6 Usebenzisa liMOLECULAR FOMYULA, bhala ibhalansidi ikhweyizhini yecomplete combustion yekhompawundi **D**. (3)

[20]

UMBUZO 3 (Qala kwiphepha elitsha.)

3.1 Irelationship phakathi kweboiling point nenani leekhabhoni kwiSTRAIGHT CHAIN PRIMARY ALCOHOLS iphandiwe. Ikhevu elandelayo ifunyenwe:

IGRAFU YEBOILING POINT VERSUS INAMBA YEE C ATHOM



3.1.1 Chaza i*boiling point.* (2)

3.1.2 Yintoni ukufana (similarity) kwestraktsha phakathi kwealcohols okwenza olu phando lungabi namkhethe (lubefair)? (1)

3.1.3 Yeyiphi ivan der Waals force enoxanduva lwetrend ebonwe kule khevu? (1)

3.1.4 Bhala igama leIUPAC lealcohol eneboiling point ekumyinge we410 K. (2)

3.2 Olunye uphando lwenziwe ukufumana ieffect of structural differences kwiboiling point. Itheyibhile engezantsi ibonisa iikhompawundi ezahlukileyo neemolar mass zazo ezasetyenziswa kolu phando.

IKHOMPAWUNDI		IMOLAR MASS ($g \cdot mol^{-1}$)
A	Butanone	72
B	Butan-1-ol	74
C	Propanoic acid	74

3.2.1 Yeyiphi ikhompawundi **A**, **B** okanye u**C** eyakuba neboiling point ephezulu? (1)

3.2.2 Cacisa ngokupheleleyo impendulo kuMBUZO 3.2.1. (5)
[12]

UMBUZO 4 (Qala kwiphepha elitsha.)

4.1 Qwalasela iiorganic reaction ezintathu, **I**, **II** no **III** ngezantsi:

I	Pent-1-ene + HCℓ → organic compound **P** (Major product)
II	Organic compound **P** + NaOH → secondary alcohol **Q** + NaCℓ
III	Organic compound **P** + NaOH → organic compound **R** + NaCℓ + H_2O (Major product)

4.1.1 Ingaba ipent-1-ene iSATURATED okanye iUNSATURATED? Nika isizathu sempendulo. (2)

Bhala uhlobo lwereaction eboniswe nge:

4.1.2 Reaction **II** (1)

4.1.3 Reaction **III** (1)

Bhala:

4.1.4 ISTRUCTURAL FORMULA secompound **P**. (2)

4.1.5 Igama le-IUPAC lecompound **Q**. (2)

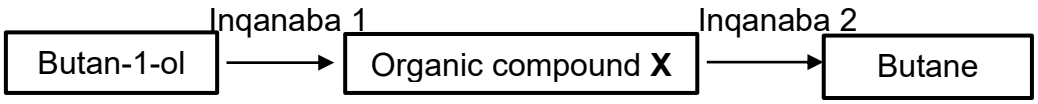
4.1.6 Iireaction **II** no **III** zifuna kusetyenziswe ibheyisi estrongo**.** Bhala iikhondishini eziyakuhambelana nereeaction **II** endaweni yereaction **III.** (2)

4.1.7 Pent-1-ene neorganic compound **R** zii-isomers.

Loluphi uhlobo lweisomer ipent-1-ene neorganic compound **R**?

Khetha iFUNCTIONAL, iPOSITIONAL okanye iCHAIN. (2)

4.2 Iflowu dayagram engezanzi ibonisa ukutshintshwa kwebutan-1-ol ibe yibutane gas.



Iikhemikhali ezilandellayo ziyafuneka:

Concentrated H_2SO_4	Pt	H_2

Usebenzisa iiCONDENSED STRUCTURAL FORMULAE, bhala ibhalansidi ikhweyizhini kwaye ubonise iikhemikhali ezisetyenzisiweyo kwinqanaba ngalinye ekulungisweni/ekwenziweni kwebutane gas ukusuka kwibutan-1-ol. (6)

[18]

UMBUZO 5 (Qala kwiphepha elitsha.)

Ireaction phakathi kweEXCESS hydrochloric acid (HCℓ) nezinc (Zn) esetyenziswe ukuphanda iifektha eziphembelela ireaction rheyithi. Ibhalanisidi ikhweyizhini yale reaction ngu:

$$Zn\,(s) + 2\,HC\ell\,(aq) \rightarrow ZnC\ell_2\,(aq) + H_2\,(g) \qquad \Delta H < 0$$

Ieksperimenti ezintantu zenziwe kwaye ifektha enye itshintshiwe kwieksperimenti nganye. Ivolyum efanayo yehydrochloric acid nobunzima obufanayo beezinc granules zisetyenzisiwe kwieksperimenti nganye. Ihydrochloric acid igquma izinc yonke kwieksperimenti nganye.

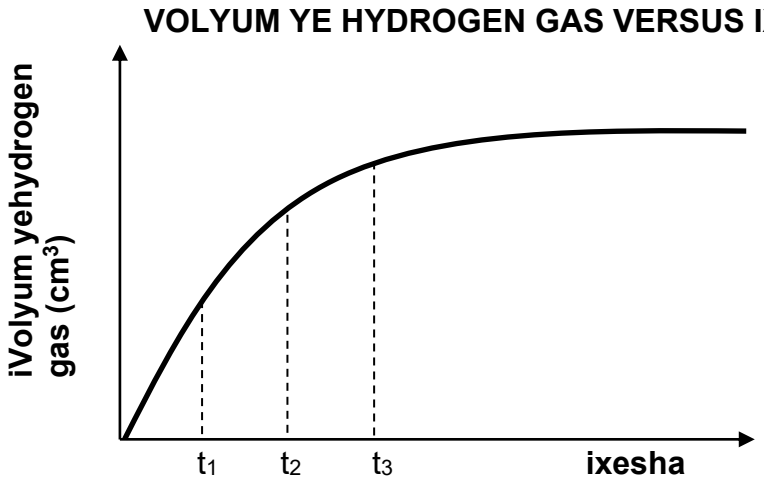
Itheyibhile engezantsi ibonisa iireaction condition.

IEKSPERIMENTI	**ICONCENTRATION KA HCℓ ($mol \cdot dm^{-3}$)**	**Cu (s) EKHOYO**
1	0,5	Hayi
2	0,8	Hayi
3	0,5	Ewe

5.1 Chaza *ireaction rate.* (2)

5.2 Bhala i-investigative question xa uthelekisa ii-eksperimenti **1** no **2.** (2)

5.3 Ikhevu, ayizotywanga ngokwescale, ifunyenwe ngevolyum yehydrogen gas, H_2 (g) eprodyuswe emva kwexesha le-eksperimenti **1**.



5.3.1 Ingathelekiswa njani ireyithi ekuprodyuswa ngayo ihydrogen gas phakathi ko $t_1 - t_2$ kunaleyo ka $t_2 - t_3$?
Bhala NGAPHEZULU KUNO, NGAPHANTSI KUNO okanye ILINGANA NO kuphela. (1)

5.3.2 Zoba kwakhona igrafu kwiNCWADI YOKUPHENDULELA. Leyibhelisha ngokucacileyo ikhevu ngo**A**.

Kwakule seti inye yee-ekzizi, sketsha ikhevu eyakufunyanwa nge-eksperimenti **3**. Leyibhelisha le khevu ngo**B**. (2)

5.4 Ireaction ye-eksperimenti **1** ithatha i58 s ukuba igqibe ze iavareyiji reaction rheyithi ekuprodyuwsa ngayo ihydrogen gas, H_2 ibengu 8,39 $cm^3 \cdot s^{-1}$.

Khalityhuleyitha i-initial mass yezinc esetyenziswe kwieksperimenti nganye.

Imolar volyum yehydrogen gas (H_2) ku25 $^{\circ}C$ ngu24 000 $cm^3 \cdot mol^{-1}$.

Ieksperimenti **4** ngoku ikhondakhthwa ngokonyusa ithempritsha yereaction mixture kueksperimenti **1**. (5)

5.5 Olu tshintsho luzakuyichaphazela njani ireaction rheyithi?

Khetha ku IYENYUKA, IYEHLA okanye IHLALA INJALO. (1)

5.6 Cacisa impendulo kuMBUZO 5.5 ngokubhekisele kwicollision theory. (3)
[16]

UMBUZO 6 (Qala kwiphepha elitsha.)

6.1 Qwalasela ihypothetical reaction elandelayo ekwi ekhwilibriyam:

$$A\ (g) \rightleftharpoons 2\ B\ (g)$$

Idatha ekwitheyibhile engezantsi ibonisa ii-ekhwilibriyam concentration zika A (g) and B (g) kwiithempritsha ezahlukileyo:

Ithempritsha (˚C)	A (mol·dm^{-3})	B (mol·dm^{-3})
200	0,0125	0,843
300	0,171	0,764

6.1.1 Chaza iLe Chaterlier's principle. (2)

6.1.2 Ingaba IFORWARD okanye iREVERSEI reaction fovoured ku200 ˚C?

Nika isizathu sempendulo. (2)

Iyakuchaphazeleka njani i-ekhwelibriyam concentration ka**A** ku200 ˚C zezi zilandelayo:

Khetha IYANDA, IYANCIPHA okanye AKUKHO MPEMBELELO

6.1.3 Ipresha inyusiwe. (1)

6.1.4 Kongezwe isuitable catalyst. (1)

6.1.5 Ingaba iforward reaction iExothermic okanye ENDOTHERMIC? (1)

6.1.6 Sebenzisa iLe Chatelier's principle ze ujonge kwidatha ekwitheyibhile ukucacisa impendulo kuMBUZO 6.1.5. (3)

6.2 Ekuqaleni, i-1,05 iimole zeBromine (Br_2) zitywinelwe kwikhonteyina engenanto. Ireaction elandelayo yenzeka ku1 600 ˚C.

$$Br_2\ (g) \rightleftharpoons 2\ Br\ (g)$$

Kwiekhwilibriyam iconcentration yeBromine (Br_2) ngu2,074 mol·dm^{-3}. Iekhwilibriyam constant, Kc ngu6,34 x 10^{-4} ku1 600 ˚C

Khalityhuleyitha ivolyum yekhonteyina. (7)
[17]

UMBUZO 7 (Qala kwiphepha elitsha.)

7.1 Isulphuric acid, H_2SO_4 yi-asidi esitrongo eionises ngamanqanaba amabini njegoko iboniswe ngeekhweyizhini ngezantsi:

Inqanaba 1: $H_2SO_4\ (aq) + H_2O\ (\ell) \rightleftharpoons HSO_4^-\ (aq) + H_3O^+\ (aq)$

Inqanaba 2: $HSO_4^-\ (aq) + H_2O\ (\ell) \rightleftharpoons SO_4^{2-}\ (aq) + H_3O^+\ (aq)$

7.1.1 Cacisa ithetha ntoni i*strong acid.* (2)

7.1.2 Nika isizathu kutheni isulphuric acid kusithiwa yidiprotic acid. (1)

7.1.3 Bhala iconjugate base yeH_3O^+. (1)

7.1.4 Bhala IFOMYULA yesubstance esebenza njenge ampholyte ngexesha le ionisation yesulphuric acid. (2)

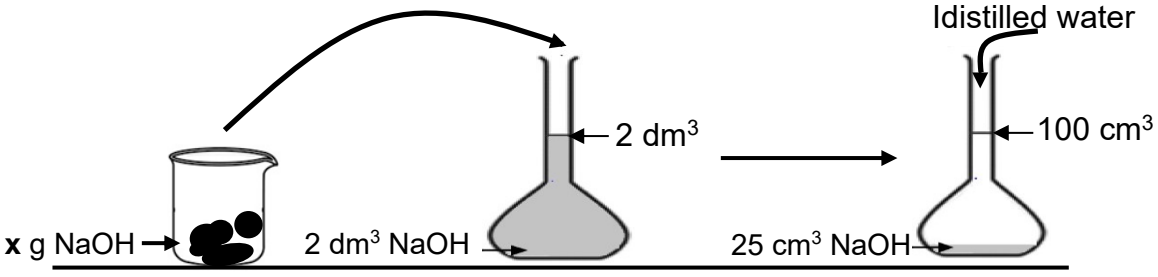
Isulphuric acid inekhonsentreyishini engu0,1 mol·dm^{-3}.

7.1.5 Khalityhuleyitha ipH velyu emva kwecomplete ionisation. (4)

7.2 1,2 g yeanhydrous oxalic acid ($H_2C_2O_4$) inyityikiliswa emanzini ukwenza i50 cm^3 yesolushini.

7.2.1 Khalityhuleyitha ikhonsentreyishini yeoxalic acid, $H_2C_2O_4$. (3)

Abafundi banyibilikisa i**x** g yesodium hyidroxide, iNaOH ukwenza isolushini eyi2 dm^3 yesodium hydroxide, NaOH (aq). Batransferela isolushini eyi25 cm^3 yesodium hydroxide, NaOH solushini kwivolumetric flasikhi baze bongeza idistilled water ukwenza **idayiluthedi** 100 cm^3 solushini**.**



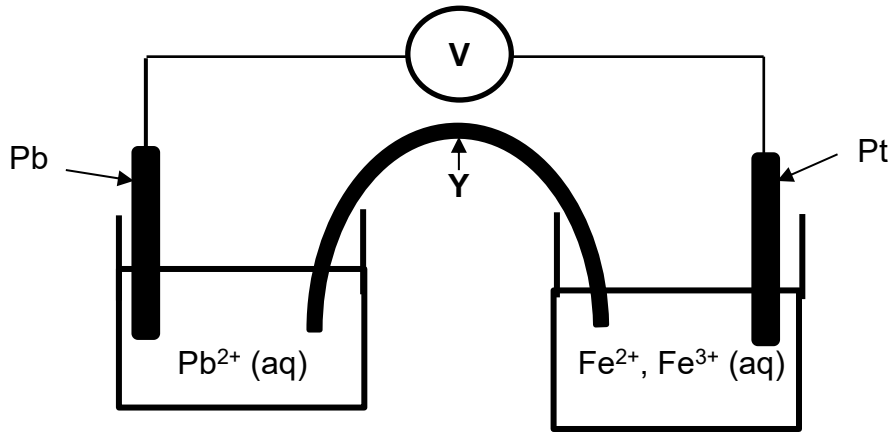
Batrita (they titrate) i43,8 cm^3 ye**dayiluthedi** sodium hyidroxide, NaOH solushini ngokuchasene ne25 cm^3 oxalic acid, $H_2C_2O_4$ ebiyenziwe kuMBUZO 7.2. ukufikelela kwiendpoint.
Ibhalansidi ikhweyizhini yi:

$$H_2C_2O_4\ (aq) + 2\ NaOH\ (aq) \rightarrow Na_2C_2O_4\ (aq) + 2\ H_2O\ (\ell)$$

7.2.2 Khalityhuleyitha imass, **x** g yesodium hyidroxide ebisetyenzisiwe ukwenza i2 dm^3 solushini. (7)
[20]

UMBUZO 8 (Qala kwiphepha elitsha.)

Istandard electrochemical cell isetiwe njengoko ibonisiwe ngezantsi.



8.1 Chaza ienergy conversion eyenzekayo kule seli. (2)

8.2 Ikhomponenti **Y** iqinisekisa ukuba iseli iphelele**.**

Chaza umsebenzi OMNYE wekhomponenti **Y**. (1)

8.3 Bhala ireduction half reaction. (2)

8.4 Khalityhuleyitha i-initial emf yale seli. (4)

8.5 Iyakuchaphazeleka njani ireading yevoltmeter, ukuba:

Khetha IYANDA, IYANCIPHA okanye IHLALA INJALO

8.5.1 I-initiali khonsentreyishini yePb^{2+} iyanyuswa. (1)

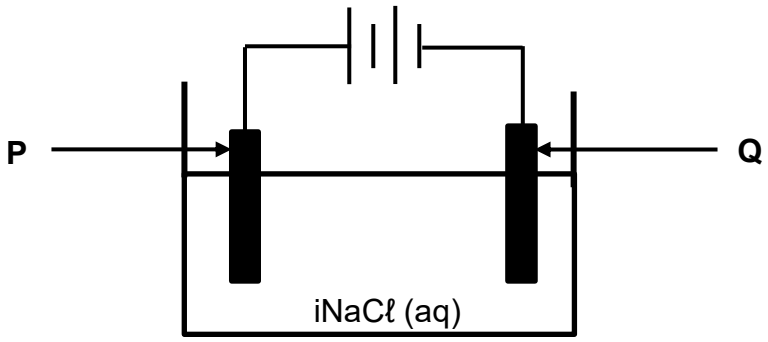
8.5.2 Isafeyisi eriya yePt electrode iyanyuswa. (1)

8.5.3 Pb│Pb^{2+} half-cell itshintswe ngeZn│Zn^{2+}. (1)

8.6 Cacisa impendulo kuMBUZO 8.5.3 ngokubhekisele kwirelative strength seereducing agent. (2)
[14]

UMBUZO 9 (Qala kwiphepha elitsha.)

Amaqabaza ambalwa ephenolphthalein ongeziwe kwiconcentrated sodium chloride (NaCℓ) solushini. Isolushini ihlala ingenambala (colourless). Icarbon eletrodes **P** no **Q** ezikonekthwe kwibhetri ziditshwe kwisolushini njengoko kubonakalisiwe ngezantsi.



9.1 Chaza ie*lectrolysis.* (2)

9.2 Bhala igama lekhomponenti ebonisa ukuba iseli engentla yielectrolytic cell (1)

9.3 Bhala IGAMA okanye IFOMYULA yegesi eprodyuswa kwielectrode **Q**. (1)

9.4 Bhala ihalf reaction eyenzeka kwielectrode **P**. (2)

9.5 IPhenolphthalein AYINAMBALA (is COLOURLESS) kwiacidic solution ze ibePINKI kwialkaline solution.

Bhala umbala wesolushini around electrode **Q** nefomyula yesubstance responsible for the colour. (2)

9.6 Ielectrolytic cell isetelwe ukuphurifaya icopper (Cu) ore enezinc (Zn) neplatinum (Pt) impurities. Emva kokugqitywa kwepurification yeimpure copper, i1,38 x 10^{-2} mol ze-electrons zatransferwa. I-initial mass yecathode ngu2 g.

9.6.1 Yeyiphi imethali, ngaphandle kwecopper, eza kuoksidayizwa (oxidised)?

Khetha kwiZinc okanye kwiPlatinum (1)

9.6.2 Khalityhuleyitha imass yecathode emva kwepurification. (4)

[13]

EWONKE: 150

NATIONAL SENIOR CERTIFICATE
IDATHA YEFIZIKHALI SAYENSI IBANGA 12
IPHEPHA 2 (IKHEMESTRI)

TABLE 1: PHYSICAL CONSTANTS/I*THEYIBHILE 1: IIFIZIKHALI KONSTENTI*

IGAMA/*NAME*	ISIMBOLI/*SYMBOL*	IVELYU/*VALUE*
Standard pressure *Istandard presha*	p^{θ}	$1{,}013 \times 10^{5}$ Pa
Molar gas volume at STP *Imollar gas volume kwiSTD*	V_m	$22{,}4\ dm^3 \cdot mol^{-1}$
Standard temperature *Istandard thempritsha*	T^{θ}	273 K
Charge on electron *Itshaji kwielektroni*	e	$-1{,}6 \times 10^{-19}$ C
Avogadro's constant *IAvogadro konstenti*	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$

TABLE 2: FORMULAE/*ITHEYIBHILE 2: IIFOMYULA*

$n = \frac{m}{M}$ okanye $n = \frac{N}{N_A}$ okanye $n = \frac{V}{V_m}$	$c = \frac{n}{V}$ okanye $c = \frac{m}{MV}$ $\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	pH= -log[H_3O^+] K_w = [H_3O^+][OH^-] = $1x10^{-14}$ ku 298K
$E^{\theta}_{seli} = E^{\theta}_{kathowudi} - E^{\theta}_{anowudi}$ $E^{\theta}_{seli} = E^{\theta}_{rhidakshini} - E^{\theta}_{okshdeyishini}$ $E^{\theta}_{seli} = E^{\theta}_{oksidayizingi\ eyijenti} - E^{\theta}_{rhidyusingi\ eyijenti}$		
$q = I\Delta t$ $n = \frac{Q}{e}$ okanye $n = \frac{Q}{q_e}$		

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/I*THEYIBHILE 3: IPHIRIYODIKHI THEYIBHILE YEE ELEMENTI*

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
1 2,1 H 1																	2 He 4
3 1,0 Li 7	4 1,5 Be 9											5 2,0 B 11	6 2,5 C 12	7 3,0 N 14	8 3,5 O 16	9 4,0 F 19	10 Ne 20
11 0,9 Na 23	12 1,2 Mg 24											13 1,5 Aℓ 27	14 1,8 Si 28	15 2,1 P 31	16 2,5 S 32	17 3,0 Cℓ 35,5	18 Ar 40
19 0,8 K 39	20 1,0 Ca 40	21 1,3 Sc 45	22 1,5 Ti 48	23 1,6 V 51	24 1,6 Cr 52	25 1,5 Mn 55	26 1,8 Fe 56	27 1,8 Co 59	28 1,8 Ni 59	29 1,9 Cu 63,5	30 1,6 Zn 65	31 1,6 Ga 70	32 1,8 Ge 73	33 2,0 As 75	34 2,4 Se 79	35 2,8 Br 80	36 Kr 84
37 0,8 Rb 86	38 1,0 Sr 88	39 1,2 Y 89	40 1,4 Zr 91	41 Nb 92	42 1,8 Mo 96	43 1,9 Tc	44 2,2 Ru 101	45 2,2 Rh 103	46 2,2 Pd 106	47 1,9 Ag 108	48 1,7 Cd 112	49 1,7 In 115	50 1,8 Sn 119	51 1,9 Sb 122	52 2,1 Te 128	53 2,5 I 127	54 Xe 131
55 0,7 Cs 133	56 0,9 Ba 137	57 La 139	72 1,6 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 1,8 Tℓ 204	82 1,8 Pb 207	83 1,9 Bi 209	84 2,0 Po	85 2,5 At	86 Rn
87 0,7 Fr	88 0,9 Ra 226	89 Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

KEY/*IKHI*

IAtHOMIKHI NAMBA Atomic number

i-Elektronegethivithi Electronegativity

iSimboli Symbol

Umyinge weerelative atomic mass
Approximate relative atomic mass

TABLE 4A: STANDARD REDUCTION POTENTIALS
ITHEYIBILE 4A: ISTANDADI RHIDAKSHINI POTENISHIYALI

Half-reactions/*Hafu rhiekshini*			E^{θ} (V)
$F_2(g) + 2e^-$	⇌	$2F^-$	+ 2,87
$Co^{3+} + e^-$	⇌	Co^{2+}	+ 1,81
$H_2O_2 + 2H^+ + 2e^-$	⇌	$2H_2O$	+1,77
$MnO_4^- + 8H^+ + 5e^-$	⇌	$Mn^{2+} + 4H_2O$	+ 1,51
$C\ell_2(g) + 2e^-$	⇌	$2C\ell^-$	+ 1,36
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	⇌	$2Cr^{3+} + 7H_2O$	+ 1,33
$O_2(g) + 4H^+ + 4e^-$	⇌	$2H_2O$	+ 1,23
$MnO_2 + 4H^+ + 2e^-$	⇌	$Mn^{2+} + 2H_2O$	+ 1,23
$Pt^{2+} + 2e^-$	⇌	Pt	+ 1,20
$Br_2(\ell) + 2e^-$	⇌	$2Br^-$	+ 1,07
$NO_3^- + 4H^+ + 3e^-$	⇌	$NO(g) + 2H_2O$	+ 0,96
$Hg^{2+} + 2e^-$	⇌	$Hg(\ell)$	+ 0,85
$Ag^+ + e^-$	⇌	Ag	+ 0,80
$NO_3^- + 2H^+ + e^-$	⇌	$NO_2(g) + H_2O$	+ 0,80
$Fe^{3+} + e^-$	⇌	Fe^{2+}	+ 0,77
$O_2(g) + 2H^+ + 2e^-$	⇌	H_2O_2	+ 0,68
$I_2 + 2e^-$	⇌	$2I^-$	+ 0,54
$Cu^+ + e^-$	⇌	Cu	+ 0,52
$SO_2 + 4H^+ + 4e^-$	⇌	$S + 2H_2O$	+ 0,45
$2H_2O + O_2 + 4e^-$	⇌	$4OH^-$	+ 0,40
$Cu^{2+} + 2e^-$	⇌	Cu	+ 0,34
$SO_4^{2-} + 4H^+ + 2e^-$	⇌	$SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + e^-$	⇌	Cu^+	+ 0,16
$Sn^{4+} + 2e^-$	⇌	Sn^{2+}	+ 0,15
$S + 2H^+ + 2e^-$	⇌	$H_2S(g)$	+ 0,14
$2H^+ + 2e^-$	**⇌**	**$H_2(g)$**	**0,00**
$Fe^{3+} + 3e^-$	⇌	Fe	– 0,06
$Pb^{2+} + 2e^-$	⇌	Pb	– 0,13
$Sn^{2+} + 2e^-$	⇌	Sn	– 0,14
$Ni^{2+} + 2e^-$	⇌	Ni	– 0,27
$Co^{2+} + 2e^-$	⇌	Co	– 0,28
$Cd^{2+} + 2e^-$	⇌	Cd	– 0,40
$Cr^{3+} + e^-$	⇌	Cr^{2+}	– 0,41
$Fe^{2+} + 2e^-$	⇌	Fe	– 0,44
$Cr^{3+} + 3e^-$	⇌	Cr	– 0,74
$Zn^{2+} + 2e^-$	⇌	Zn	– 0,76
$2H_2O + 2e^-$	⇌	$H_2(g) + 2OH^-$	– 0,83
$Cr^{2+} + 2e^-$	⇌	Cr	– 0,91
$Mn^{2+} + 2e^-$	⇌	Mn	– 1,18
$A\ell^{3+} + 3e^-$	⇌	$A\ell$	– 1,66
$Mg^{2+} + 2e^-$	⇌	Mg	– 2,36
$Na^+ + e^-$	⇌	Na	– 2,71
$Ca^{2+} + 2e^-$	⇌	Ca	– 2,87
$Sr^{2+} + 2e^-$	⇌	Sr	– 2,89
$Ba^{2+} + 2e^-$	⇌	Ba	– 2,90
$Cs^+ + e^-$	⇌	Cs	- 2,92
$K^+ + e^-$	⇌	K	– 2,93
$Li^+ + e^-$	⇌	Li	– 3,05

Increasing oxidising ability/Ukwenyuka kwe oxidising ability ↑

Increasing reducing ability/Ukwenyuka kwe reducing ability ↓

TABLE 4B: STANDARD REDUCTION POTENTIALS
ITHEYIBILE 4B: ISTANDADI RHIDAKSHINI POTENISHIYALI

Half-reactions/*Halfreaksies*			E^{θ} (V)
$Li^+ + e^-$	⇌	Li	– 3,05
$K^+ + e^-$	⇌	K	– 2,93
$Cs^+ + e^-$	⇌	Cs	– 2,92
$Ba^{2+} + 2e^-$	⇌	Ba	– 2,90
$Sr^{2+} + 2e^-$	⇌	Sr	– 2,89
$Ca^{2+} + 2e^-$	⇌	Ca	– 2,87
$Na^+ + e^-$	⇌	Na	– 2,71
$Mg^{2+} + 2e^-$	⇌	Mg	– 2,36
$A\ell^{3+} + 3e^-$	⇌	$A\ell$	– 1,66
$Mn^{2+} + 2e^-$	⇌	Mn	– 1,18
$Cr^{2+} + 2e^-$	⇌	Cr	– 0,91
$2H_2O + 2e^-$	⇌	$H_2(g) + 2OH^-$	– 0,83
$Zn^{2+} + 2e^-$	⇌	Zn	– 0,76
$Cr^{3+} + 3e^-$	⇌	Cr	– 0,74
$Fe^{2+} + 2e^-$	⇌	Fe	– 0,44
$Cr^{3+} + e^-$	⇌	Cr^{2+}	– 0,41
$Cd^{2+} + 2e^-$	⇌	Cd	– 0,40
$Co^{2+} + 2e^-$	⇌	Co	– 0,28
$Ni^{2+} + 2e^-$	⇌	Ni	– 0,27
$Sn^{2+} + 2e^-$	⇌	Sn	– 0,14
$Pb^{2+} + 2e^-$	⇌	Pb	– 0,13
$Fe^{3+} + 3e^-$	⇌	Fe	– 0,06
$2H^+ + 2e^-$	**⇌**	**$H_2(g)$**	**0,00**
$S + 2H^+ + 2e^-$	⇌	$H_2S(g)$	+ 0,14
$Sn^{4+} + 2e^-$	⇌	Sn^{2+}	+ 0,15
$Cu^{2+} + e^-$	⇌	Cu^+	+ 0,16
$SO_4^{2-} + 4H^+ + 2e^-$	⇌	$SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + 2e^-$	⇌	Cu	+ 0,34
$2H_2O + O_2 + 4e^-$	⇌	$4OH^-$	+ 0,40
$SO_2 + 4H^+ + 4e^-$	⇌	$S + 2H_2O$	+ 0,45
$Cu^+ + e^-$	⇌	Cu	+ 0,52
$I_2 + 2e^-$	⇌	$2I^-$	+ 0,54
$O_2(g) + 2H^+ + 2e^-$	⇌	H_2O_2	+ 0,68
$Fe^{3+} + e^-$	⇌	Fe^{2+}	+ 0,77
$NO_3^- + 2H^+ + e^-$	⇌	$NO_2(g) + H_2O$	+ 0,80
$Ag^+ + e^-$	⇌	Ag	+ 0,80
$Hg^{2+} + 2e^-$	⇌	$Hg(\ell)$	+ 0,85
$NO_3^- + 4H^+ + 3e^-$	⇌	$NO(g) + 2H_2O$	+ 0,96
$Br_2(\ell) + 2e^-$	⇌	$2Br^-$	+ 1,07
$Pt^{2+} + 2e^-$	⇌	Pt	+ 1,20
$MnO_2 + 4H^+ + 2e^-$	⇌	$Mn^{2+} + 2H_2O$	+ 1,23
$O_2(g) + 4H^+ + 4e^-$	⇌	$2H_2O$	+ 1,23
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	⇌	$2Cr^{3+} + 7H_2O$	+ 1,33
$C\ell_2(g) + 2e^-$	⇌	$2C\ell^-$	+ 1,36
$MnO_4^- + 8H^+ + 5e^-$	⇌	$Mn^{2+} + 4H_2O$	+ 1,51
$H_2O_2 + 2H^+ + 2e^-$	⇌	$2H_2O$	+1,77
$Co^{3+} + e^-$	⇌	Co^{2+}	+ 1,81
$F_2(g) + 2e^-$	⇌	$2F^-$	+ 2,87

Increasing oxidising ability/ *Ukwenyuka kwe oxidising ability*

Increasing reducing ability/ *Ukwenyuka kwe reducing ability*