304-1|2

DEPARTMENT OF EDUCATION

POSSIBLE ANSWERS FOR / MOONTLIKE ANTWOORDE VIR :

FINAL MARKING GUIDELINE

PHYSICAL SCIENCE P2 HG
NOV 2003

QUESTION 1 / *VRAAG 1*

1.1	B	1.2	A	1.3	A
1.4	B	1.5	B	1.6	C
1.7	C	1.8	C	1.9	D
1.10	D	1.11	A	1.12	C
1.13	A	1.14	D	1.15	D

[15x4=60]

QUESTION 2 / *VRAAG 2*

2.1 X $n(NO_3^-) = cV$ ✓
$= 0,5 \times 250 \times 10^{-3}$ ✓
$= 0,125$ mol (+)

Y $n(NO_3^-) = cV$
$= 2$ ✓$\times 0,25 \times 200 \times 10^{-3}$
$= 0,1$ mol (+)

$[NO_3^-] = \frac{n}{V} = \frac{0,125+0,1}{0,45} = \frac{0,225}{0,45}$ ✓✓

$= 0,5$ mol.dm^{-3} ✓

(6)

NB	1 mark for formula in any one of the three steps/*1 punt vir die formule in enige van die drie stappe* If n(Y) is given as 0,05 mol then max. 5 marks **unless** it was multiplied by 2 in the next step/*As n(Y) gegee word as 0,05 mol, dan maks. 5 punte **tensy** dit met 2 vermenigvuldig word in die volgende stap.*

2.2.1 Since HI has a larger molecular mass (than HCℓ) (OR HI has more electrons than HCℓ) ✓
the intermolecular forces (Van der Waals/Dipole-dipole forces) in HI will be greater ✓
∴ a higher boiling point /
Omdat HI 'n groter molekulêre massa (as HCℓ) het (OF omdat HI meer elektrone het as HCℓ) sal die intermolekulêre kragte (Van der Waalskragte/Dipool-dipoolkragte) groter wees. ∴ 'n hoër kookpunt (2)

OR / OF Boiling point increases with increase of molecular mass ✓✓/ *Kookpunt neem toe soos wat molekulêre massa toeneem*

OR / OF Because HI has larger intermolecular forces (than HCℓ) ✓✓/ *Omdat HI groter intermolekulêre kragte het (as HCℓ)*

2.2.2 There is hydrogen bonding in HF✓✓ (which is stronger than the intermolecular force in HCℓ) */Daar is waterstofbinding in HF (wat sterker is as die intermolekulêre kragte in HCℓ).* (2)

OR / OF Because HF has larger intermolecular forces (than HCℓ) ✓/ *Omdat HF groter intermolekulêre kragte het (as HCℓ)*

3

2.3.1 Increase in temp. increases **kinetic** energy ✓ and the force (or number) of collisions ✓with container increases. ∴ Volume increases ✓for pressure to remain constant (P=F/A) /
*Toename in temperatuur verhoog **kinetiese** energie en die botsingskrag (of aantal botsings)met houer neem toe. ∴ Volume neem toe vir druk om konstant te bly* (P=F/A) (3)

OR/OF Decrease in temp. decreases kinetic energy ✓and the force (or number) of collisions ✓with container decreases. ∴ Volume decreases ✓for pressure to remain constant (P=F/A) /
Afname in temp. verlaag kinetiese en die botsingskrag (of aantal botsings)met houer neem af. ∴ Volume neem af vir druk om konstant te bly (P=F/A)

V α T OR if T changes then V changes proportionally (1/3)/
V α T OF as T verander moet V ooreenkomstig verander (1/3)

2.3.2 Graph B ✓/*Grafiek B* (1)

2.3.3 $\frac{V}{T} \alpha \frac{1}{p}$ ✓✓

∴ Graph with smaller slope was established at higher pressure ✓/
∴ *Grafiek met kleiner helling was by hoër druk verkry* (3)

OR/OF Slope is inversely proportional to pressure. ✓
$V_A > V_B$ ✓ at constant temperature and therefore $p_A < p_B$ ✓/
Helling is omgekeerd eweredig aan druk.
$V_A > V_B$ by konstante temperatuur en daarom is $p_A < p_B$

OR/OF $p \alpha \frac{1}{V}$ ✓ $V_A > V_B$ ✓ at constant temp. and therefore $p_A < p_B$ ✓/
$p \alpha \frac{1}{V}$ $V_A > V_B$ *by konstante temp.* en daarom is $p_A < p_B$

OR/OF pV = nRT and p = nRT/V ✓ at constant temperature
$V_A > V_B$ ✓ and therefore $p_A < p_B$ ✓/
pV = nRT en p = nRT/V by konstante temperatuur
$V_A > V_B$ *en daarom is* $p_A < p_B$

p α T ✓ $T_B > T_A$ ✓at constant volume therefore $p_B > p_A$ ✓ /

p α T ✓ $T_B > T_A$ ✓ *by konstante volume en daarom* $p_B > p_A$ ✓

2.3.4 pV = nRT ✓

$p = \frac{0,01 \times 8,31 \times (-151 + 273)}{100 \times 10^{-6}}$ ✓ ✓ ✓ ✓

$= \frac{0,01 \times 8,31 \times 122}{10^{-4}}$

= 101 382 Pa ✓
= 101, 38 kPa

OR/OF $p = \frac{0,01 \times 8,31 \times 366}{300 \times 10^{-6}}$ → (93 + 273)

OR/OF $p = \frac{0,01 \times 8,31 \times 244}{200 \times 10^{-6}}$ → (-29 + 273)

IF V is not in m^3, then max. 4/6
AS V nie in m^3 is nie, dan maks. 4/6

(6)
[23]

QUESTION 3 / *VRAAG 3*

3.1.1 SO_2 + H_2O ✓→ H_2SO_3✓ | OR/OF SO_2 + H_2O ✓→ HSO_3^- + H^+ ✓ (2)

3.1.2 Hydrogen sulphide ✓✓/ *Waterstofsulfied (swawelwaterstof)* | H_2S (1/2) (2)

3.1.3 Ammonia ✓✓/ *Ammoniak* | NH_3 (1/2) (2)

3.2.1 Na_2SO_3 ✓✓ | OR/OF $NaHSO_3$ ✓✓ | Sodium sulphite/*Natriumsulfiet* (1/2) Sodium bisulphite/Natriumbisulfiet (1/2) (2)

3.2.2 H_2SO_4 + $NaC\ell$ ✓→ $NaHSO_4$ ✓ + $HC\ell$ ✓ | Deduct one mark per additional compound / *Trek een punt per addisionele verbinding af* (3)

OR/OF H_2SO_4 + 2$NaC\ell$ ✓ → Na_2SO_4 + 2$HC\ell$ ✓ (✓ bal.)

3.2.3 Acid ✓✓/ *Suur* | OR/OF Donates protons✓✓/*Skenk protone* (2)

3.2.4 SO_2 + 2Mg ✓→ 2MgO + S ✓ (✓bal.) (3)

3.2.5 Oxidising agent ✓✓/ *Oksideermiddel* | OR/OF It oxidises the Mg ✓✓/ *Dit oksideer die Mg* (2)

[18]

QUESTION 4 / *VRAAG 4*

4.1 $2C\ell^- \rightarrow C\ell_2 + 2e^-$ ✓✓ (2)

$2C\ell^- \rightleftharpoons C\ell_2 + 2e^-$ (1/2)
$2C\ell^- \leftarrow C\ell_2 + 2e^-$ (0/2)
$C\ell_2 + 2e^- \leftarrow 2C\ell^-$ (2/2)
$C\ell_2 + 2e^- \rightleftharpoons 2C\ell^-$ (0/2)

IF ionic charges are omitted, 1 mark is forfeited (not applicable to electrons)/
As ioonlading weggelaat is, word 1 punt verbeur (nie van toepassing op elektrone)

IF equation is unbalanced, 1 mark is forfeited/
AS vergl. ongebalanseerd is, 1punt verbeur

IF equation is incomplete/*INDIEN vergl. onvolledig* – (0/2)

4.2 $2NaC\ell(\ell) \rightarrow 2Na(\ell) + C\ell_2(g)$ ✓ ✓ (✓bal.) (3)

OR/OF $2NaC\ell(\ell) + 2H_2O$ ✓ $\rightarrow 2NaOH(aq) + H_2(g) + C\ell_2(g)$ ✓ (✓bal.)

4.3 Chloride OR name of any soluble chloride ✓✓/ *Chloried OF naam van enige oplosbare chloried* (2)

$C\ell^-$ (1/2)

Chlorine/*Chloor*/$C\ell$/$C\ell_2$ (0/2)

4.4 Add xylene/chloroform/$CC\ell_4$/CS_2✓✓ (to A and C)/
Voeg xileen/chloroform/$CC\ell_4$/CS_2 (by A en C)

If iodide/iodine ✓is present the xylene/chloroform/$CC\ell_4$/CS_2-layer will turn red/pink/purple)✓/ *Indien jodied/jodium teenwoordig is, sal die xileen/chloroform/$CC\ell_4$/CS_2-laag) rooi/pienk/pers kleur*

OR/OF If bromide/bromine✓ is present the layer will turn yellow/brown/yellowish-brown✓/ *Indien bromide/broom teenwoordig is, sal die laag geel/bruin/geelbruin verkleur*

OR/OF Add an $AgNO_3$ solution✓ to each of the **original** solutions✓/
Voeg 'n $AgNO_3$ oplossing by elk van die **oorspronklike** oplossings

If bromide is present✓, a cream precipitate forms✓/
As bromied teenwoordig is sal 'n room presipitaat vorm
OR/OF
If iodide is present✓, a yellow precipitate forms✓/
As jodied teenwoordig is sal 'n geel presipitaat vorm

(4)

4.5 $C\ell_2 + H_2O \rightarrow HOC\ell + HC\ell$ ✓ ✓ ✓ (3)

Deduct one mark per additional compound / *Trek een punt per addisionele verbinding af*

$C\ell_2 + 2e^- \rightarrow 2C\ell^-$ (2/3)

[14]

QUESTION 5 / *VRAAG 5*

5.1 To activate the catalyst ✓✓/*Om die katalisator te aktiveer*

OR/OF (Provides energy) to initiate the reaction✓✓/
Voorsien energie om die reaksie aan die gang te sit

(2)

5.2 Heat from this exothermic reaction ✓✓ keeps the gauze hot /
Hitte van hierdie eksotermiese reaksie hou die gaas warm (2)

5.3 Decrease the temperature ✓✓/ *Verlaag die temperatuur* (2)

5.4 Decrease in temperature favours the exothermic✓ reaction and the forward reaction is exothermic ✓ / *Verlaging in temperatuur bevoordeel die eksotermiese reaksie en die voorwaartse reaksie is eksotermies* (2)

5.5 According to Le Chatelier an increase in pressure will favour the forward reaction (shifts equilibrium to the right)✓ because there are 3 moles on the left and 2 moles on the right✓(fewer moles on the right). Therefore yield of NO_2 will increase ✓ / *Volgens le Chatelier se beginsel sal 'n toename in druk die voorwaartse reaksie bevoordeel (verskuif ewewig na regs) omdat 3 mol aan die linkerkant en 2 mol aan die regterkant (minder molle regs) voorkom. Die NO_2-opbrengs sal dus verhoog.* (3)

5.6 $2NO_2$ ✓ ⇌ N_2O_4✓ (bal. ✓)

$2NO_2$	→	N_2O_4	(3/3)
N_2O_4	⇌	$2NO_2$	(3/3)
N_2O_4	→	$2NO_2$	(0/3)

(3)
[14]

QUESTION 6 / *VRAAG 6*

6.1

	NO_2	+	NO	⇌	N_2O	+	O_2
initial/*aanvanklike* :	0,06		0,29		0,18		0,38
used/formed/*gebruik/gevorm:*	+ 0,06		+ 0,06		- 0,06		- 0,06 ✓
equilibrium/ewewig(mole/[ ]):	0,12		0,35✓		0,12✓		0,32✓

$$K_c = \frac{[N_2O][O_2]}{[NO_2][NO]} \checkmark$$

$$= \frac{(0,12)(0,32)}{(0,12)(0,35)} \checkmark$$

$$= 0,91\checkmark$$

If original eq. concentrations used in calculation **or** if no calculation of incorrect eq. concentrations are shown – max. 1/8 (for the expression)/
As oorspronklike gegewe ewewigkonsentrasies in berekening gebruik is of as geen berekening van foutiewe konsentrasies getoon is – maks. 1/8 (vir die uitdrukking)

(8)

If no table or equilibrium concentration calculations were done but correct values substituted (6/8)
As geen tabel of ewewigs konsentrasie berekeninge gegee is, maar korrekte waardes vervang (6/8)

$$K_c = \frac{[N_2O][O_2]}{[NO_2][NO]} \checkmark$$

$$= \checkmark \frac{(0,12)(0,32)}{(0,12)(0,35)} \checkmark$$

$$= 0,91\checkmark$$

If K_c = [Products]/[Reagents] and values were correctly substituted then 4/4 for the latter part/
As K_c = [Produkte]/[Reagense] en waardes korrek vervang dan 4/4 vir die laaste deel.

If no expression was given, but values were correctly substituted 1 mark is forfeited/
As geen uitdrukking gegee word, maar waardes is korrek vervang, word 1 punt verbeur

If both the original and new K_c calculations are **shown** and are **equal** then max. 4/8 for 6.1 and the following positive marking will be accepted for 6.2 and 6.3/

*Indien beide die oorspronklike en nuwe K_c berekeninge **getoon** word en **dieselfde** is, dan maks. 4/8 vir 6.1 en die volgende positiewe nasien vir 6.2 en 6.3 kan aanvaar word.*

6.2 Concentration/*Konsentrasie* ✓

6.3 K_c did not change ✓✓ and only temp. can change K_c ✓✓/ K_c het nie verander en slegs temp. kan Kc verander.

6.2 Temperature✓/ T*emperatuur*

Calculation could have been done in 6.1/ Berekening kon in 6.1 gedoen word

(1)

6.3 $K_c = \frac{[N_2O][O_2]}{[NO_2][NO]} = \frac{(0,18)(0,38)}{(0,06)(0,29)} = 3,9\checkmark\checkmark$ OR/OF

Temperature caused the change in K_c ✓✓/
T*emperatuur het die verandering in Kc veroorsaak*

The reverse reaction was favoured ✓(increase in $[NO_2]$). The reverse reaction is exothermic✓, which means temp. had to be changed. ✓✓/
Die terugwaartse reaksie is bevoordeel (verhoog $[NO_2]$). Die terugwaartse reaksie is eksotermies, wat beteken dat temp. moes verander.

(4)
[13]

NB If no calculation was given OR if it was assumed that K_c has changed (2/4)
Indien geen berekening gemaak is OF indien aanvaar is dat K_c verander het (2/4)

QUESTION 7 / *VRAAG 7* **NB!**

Marking rule 16.3.1 to be applied to question 7. Penalise once for mol and once for $mol.dm^{-3}$. Therefore max. penalty of 2 marks for units in the **entire** question 7/ *Nasienreël 16.3.1 word toegepas in vraag 7. Penaliseer 1 keer vir mol en 1 keer vir* $mol.dm^{-3}$. *Dus 'n maksimum penalisasie van 2 punte vir eenhede in vraag 7* ***in geheel***

7.1.1 $n = cV$
$= 0,05 \times 36 \times 10^{-3}$ ✓
$= 1,8 \times 10^{-3}$ mol ✓ (2)

7.1.2

$n_{(Na2CO3)} = n_{(H2SO4)}$ ✓
$= 1,8 \times 10^{-3}$ mol in 25 cm^3 ✓

∴ no of moles/*aantal mol* in 250 cm^3
$= 1,8 \times 10^{-3} \times 10$ ✓
$= 1,8 \times 10^{-2}$ mol ✓

OR/OF

$n_{(Na2CO3)} = n_{(H2SO4)}$ ✓

$1,8 \times 10^{-3}$ mol Na_2CO_3 in 25cm^3 ✓

$\therefore c = \frac{n}{V} = \frac{0,0018}{0,025} = 0,072$ $mol.dm^{-3}$ ✓

In 250 cm^3: $n = 0,072 \times 0,250$
$= 1,8 \times 10^{-2}$ mol ✓Na_2CO_3

OR/OF

$\frac{c_a V_a}{c_b V_b} = \frac{1}{1}$ ✓ $c_b = \frac{0,05 \times 36}{25} = 0,072 mol.dm^{-3}$ ✓

$\therefore n_b = cV = 0,072 \times 0,250$
$= 1,8 \times 10^{-2}$ mol ✓

OR/OF

$n_{(Na2CO3)} = n_{(H2SO4)}$ ✓
$= 1,8 \times 10^{-3}$ mol in 25cm^3 ✓
$m = nM$ ✓ $= 1,8 \times 10^{-3} \times 106$ ✓
$= 0,1908$ g ✓ in 25 cm^3
m in 250 $cm^3 = 0,1908 \times 10$ ✓
$= 1,9$ g ✓

$n = \frac{m}{M}$ ✓
$m = nM = 1,8 \times 10^{-2} \times 106$ ✓
$= 1,9$ g ✓

NB If n = answer in 7.1.1 then max. 2/3 for this part/
As n = antw. In 7.1.1 dan maks. 2/3 vir hierdie deel

(7)

7.1.3 % $Na_2CO_3 = \frac{1,9}{5,13} \times 100$ ✓

$= 37,1\%$ ✓ (2)

7.2 $HBr + KOH \rightarrow KBr + H_2O$

0,005 mol KOH reacts with / *reageer met* 0,005 mol HBr ✓

n(HBr) in excess/ *in oormaat* = 0,05 - 0,005 = 0,045 mol ✓

$n(H^+) = 0,045$ mol

$[H^+] = \frac{n}{V} = \frac{0,045}{75 \times 10^{-3}}$ ✓

$= 0,6$ $mol.dm^{-3}$ ✓

pH = -log $[H^+]$
= -log 0,6 ✓✓
= 0,22 ✓

NB If n = 0,05 or 0,005 then max. 4/7
As n = 0,05 of 0,005 dan maks. 4/7

(7)
[18]

QUESTION 8 / *VRAAG 8*

8.1.1 Concentration/*Konsentrasie*: 1 mol.dm^{-3} ✓
Pressure/*druk*: 1 atm./101,3 kPa ✓ (Not/Nie 100 kPa)
Temp.: 25 °C/298 K ✓ (3)

NB If only the conditions are mentioned/*As die toestande slegs genoem word (0/3)*
If only the values(included units) are given/*As slegs die waardes(met eenhede) gegee word (3/3)*

8.1.2 (Fe/Fe^{2+}) or/of (Fe-half-cell) or/of Fe(s) ✓✓ (2)

8.1.3 $Fe \rightarrow Fe^{2+} + 2e^-$ ✓✓ (2)

No positive marking from 8.1.2 through 8.1.3 up to 8.1.6 **but** if 8.1.3 and 8.1.4 were swapped around then positive marking at 8.1.5/ *Geen pos. nasien van 8.1.2 deur 8.1.3 tot by 8.1.6 **maar** as 8.1.3 en 8.1.4 omgeruil word, dan positiewe nasien by 8.1.5.*

$Fe \rightleftharpoons Fe^{2+} + 2e^-$ (1/2)
$Fe \leftarrow Fe^{2+} + 2e^-$ (0/2)
$Fe^{2+} + 2e^- \leftarrow Fe$ (2/2)
$Fe^{2+} + 2e^- \rightleftharpoons Fe$ (0/2)

8.1.4 $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$ ✓✓ (2)

$O_2 + 4H^+ + 4e^- \rightleftharpoons 2H_2O$ (1/2)
$O_2 + 4H^+ + 4e^- \leftarrow 2H_2O$ (0/2)
$2H_2O \leftarrow O_2 + 4H^+ + 4e^-$ (2/2)
$2H_2O \rightleftharpoons O_2 + 4H^+ + 4e^-$ (0/2)

8.1.5 $2Fe + O_2 + 4H^+$ ✓$\rightarrow 2Fe^{2+} + 2H_2O$ ✓ (✓bal.) (3)

OR/OF $2Fe + O_2 + 2H_2SO_4$ ✓$\rightarrow 2FeSO_4 + 2H_2O$ ✓ (✓bal.)

OR/OF $2Fe + O_2 + 4HC\ell$ ✓$\rightarrow 2FeC\ell_2 + 2H_2O$ ✓ (✓bal.)

IF ionic charges are omitted, 1 mark is forfeited per equation. (not applicable to electrons)/ *INDIEN ioonlading weggelaat is, word 1 punt per vergelyking verbeur. (n.v.t. op elektrone)*

IF equation is unbalanced, 1 mark is forfeited per equation./ *INDIEN vergelyking ongebalanseerd is, word 1 punt per vergelyking verbeur.*

IF equation is incomplete/*INDIEN vergelyking onvolledig is – (0/2)*

8.1.6 $E^\theta_{cell/sel} = E^\theta_{cathode/katode} - E^\theta_{anode}$ ✓
$= 1{,}23 - (-0{,}44)$ ✓✓
$= 1{,}67$ V ✓ (4)

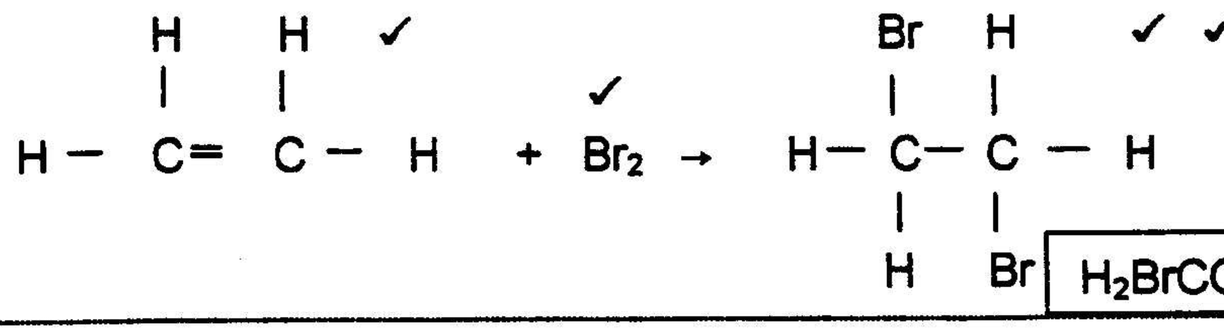
8.2 Mg is a stronger reducing agent than iron (Fe) ✓✓ Therefore Mg is more easily oxidized than iron.✓ Hence Mg will protect the iron. ✓ /
Mg is 'n sterker reduseermiddel as yster (Fe). Mg is daarom makliker geoksideer. Mg sal derhalwe die yster beskerm.

Mg cannot protect Fe/*Mg nie Fe kan beskerm* (0/4) (4)

[20]

QUESTION 9 / *VRAAG 9*

9.1.1



If Br-atoms are on the same carbon-atom then 0/2.
As Br-atome op dieselfde koolstof-atoom is, dan 0/2

H_2BrCCH_2Br 1/2 (4)

The following applies to 9.1.1 **as well as** to 9.2.2/*Die volgende geld vir 9.1.1* ***sowel as*** *9.2.2:*
Hydrogen atoms omitted – Deduct one mark/*Waterstof-atome weggelaat – Trek een punt af*
No marks for incorrect formulae(e.g. 1 extra H)/*Geen punte vir verkeerde formule(bv. 1 ekstra H)*

9.1.2 Compound B has single C-C bonds✓(OR it is saturated) (OR it is an alkane) and therefore more energy is required to break the bonds. ✓ *I*
Verbinding B het enkel C-C bindings (OF dit is versadig) (OF dit is 'n alkaan) en daarom word meer energie benodig om die bindings te breek (2)

OR/OF Compound B has sigma bondings and A has sigma and pi-bondings✓ and pi-bondings are weaker than sigma-bondings✓ *I*
Verbinding B het sigma-bindings en A het sigma en pi-bindings en die pi-bindings is swakker as die sigma-bindings

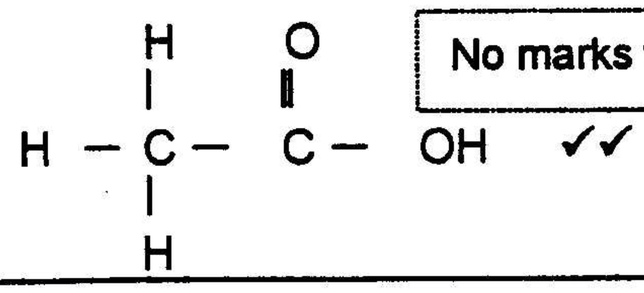
OR/OF Because of the double bonding✓in compound A a pair of electrons is available for bonding✓
A.g.v. die dubbelbinding in verbinding A is 'n elektronpaar beskikbaar vir binding

9.1.3 Haloalkane/*Halo-alkane* ✓✓ OR/OF (alkyl halide✓✓/*Alkielhalied*) (2)

9.1.4 Trichloromethane ✓✓ / *Trichloormetaan* Chloroform (0/2) (2)

9.2.1 Fermentation✓✓ / *Fermentasie of gisting* OR/OF Brewing✓✓/*Brou* (2)

9.2.2



No marks for name given/*Geen punte vir die naam nie*

Also see 9.1.1/*Sien ook 9.1.1*

(2)

One mark is awarded for correct) condensed structural formulae/
Een punt word toegeken vir (korrekte) gekondenseerde struktuurformule

9.2.3 Carboxyl group ✓✓ / *Karboksielgroep* (2)

Carboxylic group or carboxylic acid (0/2)
Karboksielsuur (0/2)

9.2.4 Ethyl ethanoate ✓✓/ *Etieletanoaat* (2)

9.2.5 H_2SO_4 ✓✓ Sulphuric acid/*Swaelsuur* (1/2) (2)

[20]

TOTAL/TOTAAL: 200