



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL / NASIONALE
SENIOR CERTIFICATE / SERTIFIKAAT**

GRADE / GRAAD 11

**PHYSICAL SCIENCES: CHEMISTRY (P2)
FISIESE WETENSKAPPE: CHEMIE (V2)**

**EXEMPLAR 2007
MODEL 2007**

MEMORANDUM

**This memorandum consists of 16 pages.
Hierdie memorandum bestaan uit 16 bladsye.**

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MEMORANDUM

Learning Outcomes and Assessment Standards Leeruitkomst en Assesseringstandaarde		
LO 1 / LU 1	LO 2 / LU 2	LO 3 / LU 3
<p>AS 11.1.1: Plan and conduct a scientific investigation to collect data systematically with regard to accuracy, reliability and the need to control variables.</p> <p><i>Bepan en voer 'n wetenskaplike ondersoek uit met betrekking tot akkuraatheid, betroubaarheid en die kontroleer van veranderlikes.</i></p> <p>AS 11.1.2: Seek patterns and trends, represent them in different forms to draw conclusions, and formulate simple generalisations.</p> <p><i>Soek patrone en tendense, stel dit in verskillende vorms voor, maak gevolgtrekkings en formuleer eenvoudige veralgemenings.</i></p> <p>AS 11.1.3: Apply known problem-solving strategies to solve multi-step problems.</p> <p><i>Pas bekende probleemoplossingsstrategieë toe om probleme met meervoudige stappe op te los.</i></p>	<p>AS 11.2.1: Define and discuss basic prescribed scientific knowledge.</p> <p><i>Definieer en bespreek voorgeskrewe wetenskaplike kennis.</i></p> <p>AS 11.2.2 Express and explain prescribed scientific theories, models and laws by indicating the relationship between different facts and concepts in own words.</p> <p><i>Verduidelik en druk voorgeskrewe wetenskaplike teorieë, modelle en wette uit deur die verwantskap tussen verskillende konsepte in eie woorde aan te dui.</i></p> <p>AS 11.2.3: Apply scientific knowledge in everyday life contexts.</p> <p><i>Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.</i></p>	<p>AS 11.3.2: Identify ethical and moral issues related to the development of science and technology and evaluate the impact (pros and cons) of the relationship from a personal viewpoint.</p> <p><i>Identifiseer etiese en morele aspekte verwant aan die ontwikkeling van wetenskap en tegnologie, en evalueer die impak (voordele en nadele) van die verwantskap uit 'n persoonlike oogpunt.</i></p> <p>AS 11.3.3: Evaluate the impact of scientific and technological knowledge on sustainable development of resources and suggest long-term and short-term strategies to improve the management of resources in the environment.</p> <p><i>Evalueer die impak van wetenskaplike en tegnologiese kennis op volhoubare ontwikkeling van bronne, en stel langtermyn en korttermyn strategieë voor om bestuur van bronne in die omgewing te verbeter.</i></p>

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SECTION A / AFDELING A

QUESTION 1 / VRAAG 1

- | | | | |
|-----|---|-----------|-----|
| 1.1 | Bond length / <i>Bindingslengte</i> ✓ | [11. 2.1] | (1) |
| 1.2 | Hydrocarbons / <i>Koolwaterstowwe</i> ✓ | [11.2.1] | (1) |
| 1.3 | Redox reaction / <i>Redoksreaksie</i> ✓ | [11.2.1] | (1) |
| 1.4 | Concentration / <i>Konsentrasie</i> ✓ | [11.2.1] | (1) |
| 1.5 | Lithosphere / <i>Litosfeer</i> ✓ | [11.2.1] | (1) |
- [5]**

QUESTION 2 / VRAAG 2

- | | | | |
|-----|-----|----------|-----|
| 2.1 | C ✓ | [11.2.3] | (1) |
| 2.2 | A ✓ | [11.2.1] | (1) |
| 2.3 | F ✓ | [11.2.3] | (1) |
| 2.4 | H ✓ | [11.2.1] | (1) |
| 2.5 | G ✓ | [11.2.1] | (1) |
- [5]**

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QUESTION 3 / VRAAG 3

- 3.1 False / Onwaar ✓
The C – H bond is stronger than the C – C bond because a H-atom is smaller than a C-atom. ✓
Die C – H-binding is sterker as die C – C-binding omdat die H-atoom kleiner is as die C – atoom. [11.2.2] (2)
- 3.2 False / Onwaar ✓
Carbon dioxide gas behaves less like an ideal gas than hydrogen gas.
Koolstofdioksiedgas toon minder ideale gedrag as waterstofgas. [11.2.2] (2)
- 3.3 False / Onwaar ✓
Energy can be absorbed or released.
Energie kan opgeneem of vrygestel word. [11.2.1] (2)
- 3.4 False / Onwaar ✓
According to the kinetic theory of gases, all gas molecules have different kinetic energies, but the same average kinetic energy.
Volgens die kinetiese teorie vir gasse het alle molekule van alle gasse verskillende kinetiese energieë, maar dieselfde gemiddelde kinetiese energie by dieselfde temperatuur. [11.2.1] (2)
- 3.5 False / Onwaar ✓
Polythene is a polymer of ethene.
Polieteen is 'n polimeer van eteen. [11.2.1] (2)
- [10]**

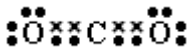
QUESTION 4 / VRAAG 4

- 4.1 D ✓✓✓ [11.2.3] (3)
- 4.2 C ✓✓✓ [11.2.1] (3)
- 4.3 B ✓✓✓ [11.2.3] (3)
- 4.4 C ✓✓✓ [11.2.1] (3)
- 4.5 C ✓✓✓ [11.2.2] (3)
- [15]**

TOTAL SECTION A: 35

SECTION B / AFDELING B

QUESTION 5 / VRAAG 5

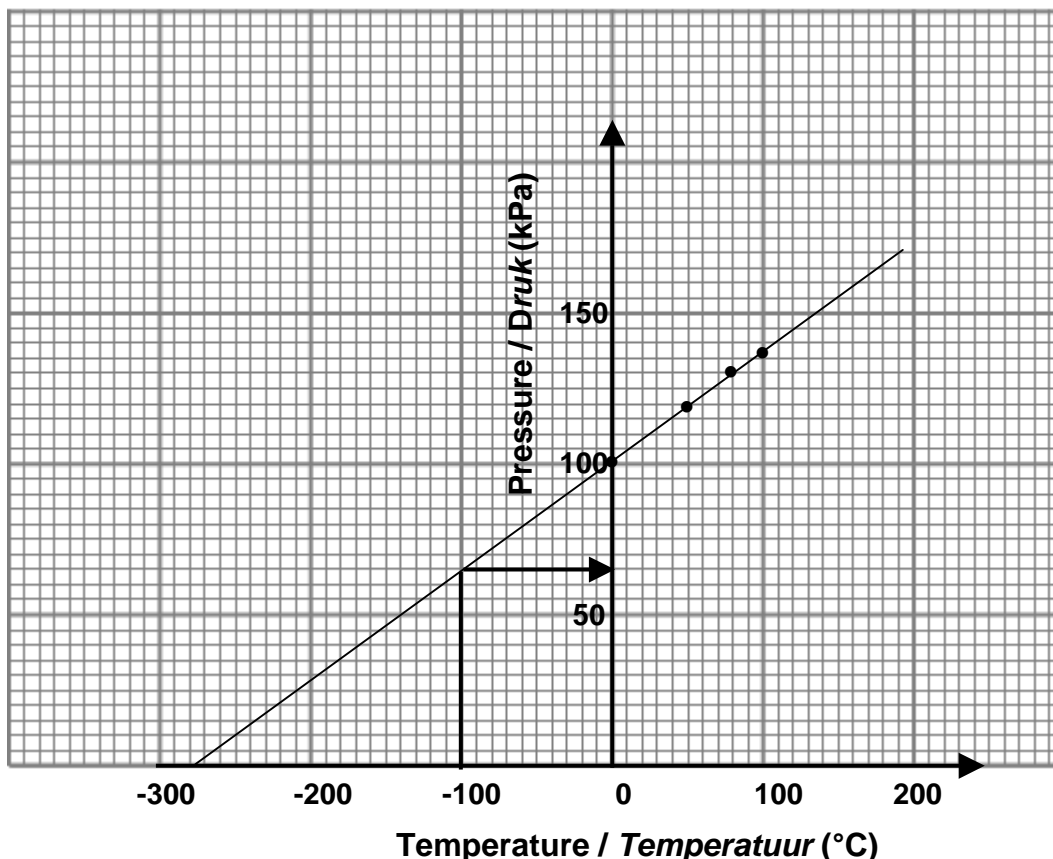
- 5.1 Gases absorb and re-emit infrared radiation. ✓✓
Gasse absorbeer en straal infrarooistraling uit. [11.2.1] (2)
- 5.2  ✓✓ [11.2.3] (2)
- 5.3 $\Delta\chi = \chi(\text{O}) - \chi(\text{C}) = 3,5 - 2,5 \checkmark = 1,0 \checkmark$ [11.2.3] (2)
- 5.4 Carbon dioxide molecule: non-polar ✓ due to linear shape. ✓
Koolstofdioksied: niepolêr weens lineêre vorm. [11.2.3] (2)
- 5.5 A carbon dioxide molecule contains unequal distribution of charge during vibrations, resulting in a dipole moment. ✓
The nitrogen molecule contains equal distribution of charge during vibrations and thus has no dipole moment. ✓
'n Koolstofdioksiedmolekuul bevat bindings met 'n oneweredige ladingsverspreiding tydens vibrasies wat 'n dipoolmoment tot gevolg het..
Die stikstofmolekuul bevat 'n binding met 'n eweredige ladingsverspreiding tydens vibrasies en het geen dipoolmoment nie. [11.2.2] (2)
- 5.6 Any one of / *Enigee van:*
Save electricity – less coal needs to be burnt ✓✓
Bespaar elektrisiteit – minder steenkool hoef dan verbrand te word.
Don't make unnecessary fires. / Moenie onnodige vure maak nie.
Don't smoke. / Moenie rook nie.
Travel to school in groups / bicycle / walk.
Ry in groepe saam skool toe / ry fiets / loop. [11.3.3] (2)

[12]

QUESTION 6 / VRAAG 6

6.1

Graph of pressure vs temperature / Grafiek van druk vs temperatuur



Criteria for the graph: Kriteria vir die grafiek:	1	0
Suitable heading. <i>Geskikte opskrif.</i>		
Axes correctly labelled with units. <i>Asse korrek benoem met eenhede.</i>		
Correct scale on both axes <i>Korrekte skaal op beide asse</i>		
Points correctly plotted. <i>Punte korrek geplot.</i>		
Straight line graph drawn through points. <i>Reguitlyngrafiek getrek deur punte.</i>		
Total out of 5 / <i>Totaal uit 5</i>		

[11.1.2] (5)

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- 6.2 Approximately / *ongeveer* – 273 °C ✓✓ [11.1.2] (2)
- 6.3 The pressure for a fixed mass of gas is directly proportional to temperature in Kelvin. ✓✓
Die druk van 'n vaste massa gas is direk eweredig aan die temperatuur in Kelvin. [11.1.2] (2)
- 6.4 64 kPa (+/- 5 kPa) ✓✓ [11.1.2] (2)
- 6.5 Increases / *Toeneem* ✓✓ [11.1.2] (2)
- [13]**

QUESTION 7 / VRAAG 7

- 7.1 $pV = nRT$ ✓
 $99,3 \times 10^3 \checkmark \times 65 \times 10^{-3} \checkmark = n \times 8,31 \checkmark \times (273 + 25) \checkmark$
 $n = 2,61 \text{ mol}$

 $m = n \times M$
 $m = 2,61 \times 28 \checkmark$
 $m = 73,0 \text{ g} \checkmark$ [11.1.3] (7)
- 7.2 $E_k \propto T(K)$ ✓
When the temperature decreases the intensity of collisions with the walls of the airbag and between particles decreases. ✓
Therefore pressure decreases. ✓

 *$E_k \propto T(K)$
Wanneer die temperatuur afneem neem die intensiteit van botsings met die wande van die lugkussing en tussen die deeltjies af.
Dus neem die druk af.* [11.2.2] (3)
- [10]**

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QUESTION 8 / VRAAG 8

- 8.1 In 100 g of acetic acid is: 39,9 g C, 6,7 g H and 53,4 g O /
In 100 g asynsuur is: 39,9 g C, 6,7 g H en 53,4 g O

$$n = \frac{m}{M} \checkmark$$

$$n_C = \frac{39,9}{12} = 3,33 \text{ mol } \checkmark$$

$$n_H = \frac{6,7}{1} = 6,7 \text{ mol } \checkmark$$

$$n_O = \frac{53,4}{16} = 3,34 \text{ mol } \checkmark$$

mol ratios / *verhouding*: C : H : O = (3,33 / 3,33) : (6,7 / 3,33) : (3,34 / 3,33) = 1 : 2 : 1

Empirical formula / *empiriese formule*: CH₂O ✓

[11.1.3] (5)

- 8.2 Molecular formula is / *Molekulêre formule is* (CH₂O)_n

$$n = \frac{\text{molecular mass}}{\text{empirical mass}} \checkmark$$

Molecular formula = (CH₂O)₂ = C₂H₄O₂ OR CH₃COOH ✓

$$n = \frac{\text{molekulêre massa}}{\text{empiriese massa}}$$

Molekulêre formule = (CH₂O)₂ = C₂H₄O₂ OR CH₃COOH

[11.1.3] (2)
[7]

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QUESTION 9 / VRAAG 9

9.1 $n = \frac{m}{M} \checkmark$
 $n(\text{O}_3) = \frac{0,74}{48} \checkmark = 0,0154 \text{ mol.} \checkmark$
 $n(\text{NO}) = \frac{0,67}{30} \checkmark = 0,0223 \text{ mol} \checkmark$ [11.2.3] (5)

9.2 From the equation 1 mol O₃ combines with 1 mol NO
hence 0,0154 mol O₃ combines with 0,0154 mol NO ✓
the O₃ yields the smaller product hence it is the limiting reagent ✓

*Vanaf die vergelyking kombineer 1 mol O₃ met 1 mol NO
Dus 0,0154 mol O₃ kombineer met 0,0154 mol NO
Die O₃ gee die kleiner produk dus is dit die beperkende reagens*

OR/ OF

Needed ratio / *benodigde verhouding* = $\frac{1}{1}$
Actual ratio / *werklike verhouding* $\frac{\text{O}_3}{\text{NO}} = \frac{0,0154}{0,0223} = 0,69 < 1 \checkmark$
Thus O₃ is the limiting reagent. ✓
Dus is O₃ die beperkende reagens. [11.2.3] (2)

9.3 O₃ is the limiting reagent / *is die beperkende reagens.*

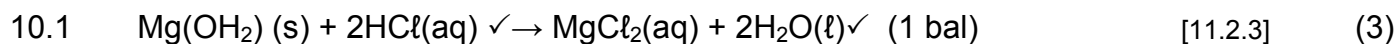
From equation / *Uit vergelyking*: 1 mol O₃ yields / *lewer* 1 mol NO₂ ✓

Hence / *Dus*: 0,0154 mol O₃ yields / *lewer* 0,0154 mol NO₂ ✓

$m(\text{NO}_2) \text{ produced} / \text{berei} = nM = (0,0154 \times 46 \checkmark) = 0,708 \text{ g} \checkmark$ [11.1.3] (4)
[11]

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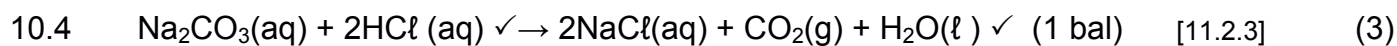
QUESTION 10 / VRAAG 10



10.2 Adults have a bigger mass and generally produce more acid than children. \checkmark Adults will therefore need more antacid to neutralise the excess acid. \checkmark

Volwasse nes het 'n groter massa as kinders en produseer gewoonlik meer suur as kinders. Volwasse nes sal dus meer teensuur benodig om die suur te neutraliseer. [11.3.2] (2)

10.3 A low acid concentration \checkmark in the stomach may slow down food digestion or may cause further stomach upset. \checkmark /
'n Lae suur konsentrasie in die maag mag spysvertering vertraag of die maag verder omkrap. [11.3.2] (2)



10.5 $c = \frac{n}{V} \checkmark \therefore n(\text{Na}_2\text{CO}_3) = cV = (0,1 \times 0,025) \checkmark = 0,0025 \text{ mol}$

From the equation : 1 mol Na_2CO_3 neutralises 2 mol acid
Van die vergelyking : 1 mol Na_2CO_3 neutraliseer 2 mol suur
 $\therefore \text{mol acid / suur} = 2 \checkmark \times 0,0025 = 0,005 \text{ mol}$

$$C(\text{HCl}) = \frac{n}{V} = \frac{0,005}{0,035} \checkmark = 0,143 \text{ mol.dm}^{-3} \checkmark$$

OR use / OF gebruik $\frac{n_a}{n_b} = \frac{c_a V_a}{c_b V_b}$ [11.1.3] (5)
[15]

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QUESTION 11 / VRAAG 11

- 11.1 Exothermic ✓
Energy of products lower than energy of reactants ✓
or ΔH smaller than zero.

Eksotermies
Energie van produkte laer as energie van reaktante.
 ΔH kleiner as nul. [11.1.2] (2)
- 11.2 Enzymes increase the rate of reaction ✓ by lowering the activation energy. ✓
Ensieme verhoog die reaksietempo deur die aktiveringsenergie te verlaag. [11.1.2] (2)
- 11.3 Oxygen concentration in the system is increased ✓ therefore more glucose molecules will break down ✓ and will not accumulate as fat in the body. ✓
Suurstof konsentrasie in die sisteem word verhoog en gevolglik word meer glukosemolekule afgebreek en versamel nie as vet in die liggaam nie. [11.3.2] (3)
[7]

QUESTION 12 / VRAAG 12

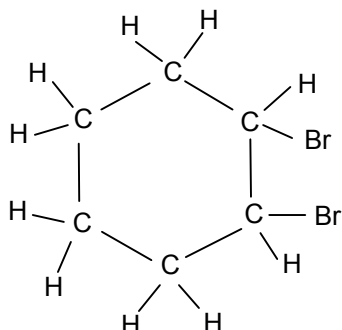
- 12.1 Any two of the following / *Enige twee van die volgende:*
Wear gloves ✓ / Wear goggles ✓ / Wear a gas mask / Perform experiment in fume cupboard or outside the lab or in a well ventilated room.
Dra handskoene / Dra 'n bril / Dra 'n gasmasker / Voer die eksperiment in 'n dampkas of buite die laboratorium of in 'n goed geventileerde vertrek uit. [11.1.1] (2)
- 12.2 Examples / *Voorbeelde:*
Alkenes are more reactive than alkanes under identical conditions.
Alkene is meer reaktief as alkane onder identiese toestande.
OR / OF
Alkanes are more reactive than alkenes under identical conditions.
Alkane is meer reaktief as alkene onder identiese toestande.

Mark allocation / Puntetoekenning
Reference to alkenes/alkanes ✓ Reference to reactivity ✓
Verwysing na alkene/alkane ✓ Verwysing na reaktiwiteit ✓ [11.1.1] (2)
- 12.3.1 Under the same conditions ✓ alkenes are more reactive, than alkanes. ✓
Onder dieselfde omstandighede is alkene meer reaktief as alkane. [11.1.2] (2)

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12.3.2 Alkenes react more readily in bromine than alkanes. ✓✓
Alkene reageer meer gereedelik in broom as alkane. [11.1.2] (2)

12.4



[11.2.3] (2)
[10]

QUESTION 13 / VRAAG 13

13.1 A: troposphere / *troposfeer* ✓
B: stratosphere / *stratosfeer* ✓
D: thermosphere / *termosfeer* ✓ [11.2.1] (3)

13.2 stratosphere (B) / *stratosfeer (B)* ✓ [11.2.1] (1)

13.3 Pressure is proportional to temperature. Pressure decreases with altitude and therefore temperature decreases with altitude. ✓✓
Druk is eweredig aan temperatuur. Druk neem af met hoogte en dus neem die temperatuur ook af met hoogte. [11.2.2] (2)

13.4 The high energy radiation from the sun dissociates oxygen molecules into oxygen atoms: $O_2(g) \rightarrow 2O(g)$ ✓

The oxygen atoms combine with other oxygen molecules to produce ozone molecules: $O_2(g) + O(g) \rightarrow O_3(g)$ ✓

This reaction is exothermic which accounts for the increasing temperature in this layer. ✓

Die hoë energie straling vanaf die son dissosieer suurstofmolekule in suurstofatome: $O_2(g) \rightarrow 2O(g)$

Die suurstofatome kombineer met suurstofmolekule om osoonmolekule te produseer: $O_2(g) + O(g) \rightarrow O_3(g)$

Hierdie reaksie is eksotermies wat die stygende temperatuur in hierdie laag verklaar. [11.2.3] (3)
[9]

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QUESTION 14 / VRAAG 14

14.1 Yes / Ja ✓

Coal was formed millions of years ago when plant material became fossilised. ✓ / *Steenkool was miljoene jare terug gevorm toe plante versteen is.*

[11.2.3] (2)

14.2 Best before 2300. ✓ / *Beste voor 2300*

Coal might run out by then. ✓ / *Steenkool mag voor dan opgebruik wees.*

[11.1.2] (2)

14.3 No. Burning of coal is not healthy to people and the environment. ✓

Greenhouse gases are released that cause global warming. ✓
Oxides of sulphur and nitrogen are released that cause acid rain ✓ that causes respiratory problems and damages plants and buildings.
Coal mines takes up a lot of space and changes ecosystems. ✓
Safety of miners, as in all mining activities, is not fully guaranteed.

Nee. Verbranding van steenkool is nie gesond vir die mens en omgewing nie.

*Kweekhuysgasse wat vrygestel veroorsaak aardverwarming.
Oksiede van swawel en stikstof word vrygestel wat suurreën veroorsaak wat asemhalingsprobleme veroorsaak en plant en geboue beskadig.*

*Steenkoolmyne neem baie plek in beslag en verander ekosisteme.
Veiligheid van mynwerkers, soos in alle mynaktiwiteite, is nie ten volle gewaarborg nie.*

[11.3.3] (4)

14.4 Any one / Enigeen:

South Africa has large coal reserves. ✓✓
Coal is relatively cheap.

*Suid-Afrika het groot steenkoolreserwes.
Steenkool is relatief goedkoop.*

[11.3.3] (2)
[10]

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QUESTION 15 / VRAAG 15

- 15.1 Cyanidation / *sianidering* ✓✓ [11.2.1] (2)
- 15.2 Oxidised / *geöksideer* ✓ [11.2.3] (1)
- 15.3 Au(0) in gold ore changes to Au(I) in NaAu(CN)₂ ✓✓
Au(0) in gouderts verander na Au(I) in NaAu(CN)₂.
- OR / OF
The oxidation number increases from 0 to 1.
Die oksidasiegetal neem vanaf 0 na 1 toe. [11.2.3] (2)
- 15.4 Zinc / *Sink* ✓✓ [11.2.1] (2)
- 15.5 Gold is smelted at high temperatures to remove impurities. ✓✓
Goud word gesmelt by hoë temperature om onsuiverhede te verwyder. [11.2.1] (2)
- 15.6 Cyanide can pollute water ✓ and becomes a threat to aquatic life. ✓
Waste water can dissolve sulphur compounds causing water in rivers
and aquifers to become acidic. /
Sianied kan water besoedel en 'n bedreiging inhou vir waterlewe.
Afvalwater kan swaelverbindings oplos wat veroorsaak dat water in
riviere veroorsaak. [11.3.3] (2)
- [11]**

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QUESTION 16 / VRAAG 16

- 16.1 X: Carbon dioxide / *Koolstofdiksied* ✓
Y: Carbon monoxide / *Koolstofmonoksied* ✓ [11.2.1] (2)
- 16.2 $\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow 2 \text{Fe} + \text{CO}_2$ ✓ balance/balansering ✓ [11.2.3] (3)
- 16.3 Reducing agent / *Reduseermiddel* ✓ [11.2.3] (2)
- 16.4 Purification / *Suiwering* ✓ [11.2.1] (2)
- 16.5 Any one / *Enigeen* ✓
Exporting of iron has a positive financial impact on our country.
Iron is relatively a cheap metal that we can use to make different articles.
- Uitvoer van yster het 'n positiewe finansiële uitwerking op ons land.
Yster is relatief goedkoop metaal wat in verskeie artikels geskep kan word.*
- Any one / *Enigeen*: ✓
Open cast mines destroy habitats.
Waste materials (sulphur and other heavy metals) can pollute rivers.
Extraction process releases greenhouse gases.
- Oopgroefmyne vernietig habitate.
Afvalmateriale (swawel en swaarmetale) kan riviere besoedel.
Ontgunningsproses gee kweekhuisgasse af.* [11.3.3] (2)

[11]

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QUESTION 17 / VRAAG 17

- 17.1 X: H_2SO_4 ✓
Y: H_3PO_4 ✓ [11.2.1] (4)
- 17.2 Reaction A: super phosphate ✓
Reaksie A: superfosfaat
- Reaction B: triple super phosphate ✓
Reaksie B: trippelsuperfosfaat [11.2.1] (2)
- 17.3 No precipitate of CaSO_4 is formed. ✓
Geen CaSO_4 presipitaat vorm nie.
- More concentrated form of phosphate. ✓
Meer gekonsentreerde vorm van fosfaat. [11.2.1] (2)
- 17.4 Insoluble / *onoplosbaar* ✓ [11.2.1] (1)
- 17.5 Advantages: ✓✓
A raw material in production of fertilisers to provide enough food to all people.
Use for production of phosphoric acid used in different products e.g. fizzy cold drinks.
- Disadvantages: ✓✓
Radioactive CaSO_4 forms as waste material and is stored in the environment.
Phosphates still present can dissolve in aquifers and rivers leading to eutrophication.
- Voordele:*
'n Grondstof vir die produksie van kunsmis om voldoende kos vir mense te voorsien.
Gebruik vir produksie van fosforsuur wat in verskeie produkte bv gaskoeldranke gebruik word.
- Nadele:*
Radioaktief CaSO_4 vorm as afvalmateriaal en is in die omgewing gestoor.
Fosfate nog verteenwoordig kan in grondwater en riviere oplos wat na eutrofikasie lei. [11.3.3] (2)

[11]