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METRO SOUTH EDUCATION DISTRICT

CURRICULUM AND ASSESSMENT POLICY STATEMENT

GRADE 12

PHYSICAL SCIENCES: PHYSICS (P2)

SEPTEMBER 2015

MARKS: 150

TIME: 3 hours

MEMORANDUM

This memorandum consists of 11 pages.

METROSOUTH PHYSICAL SCIENCE PAPER 2 - SEP 2015 MEMORANDUM**METROSUID FISIIESE WETENSKAPPE VRAESTEL 2 - SEP 2015 MEMORANDUM****QUESTION 1 / VRAAG 1**

- 1.1 B ✓✓ (2)
- 1.2 D ✓✓ (2)
- 1.3 D ✓✓ (2)
- 1.4 C ✓✓ (2)
- 1.5 A ✓✓ (2)
- 1.6 A ✓✓ (2)
- 1.7 C ✓✓ (2)
- 1.8 A ✓✓ (2)
- 1.9 C ✓✓ (2)
- 1.10 D ✓✓ (2)

TOTAL [20]

QUESTION 2 / VRAAG 2

2.1.1 C or F (any one correct) ✓ (1)

2.1.2 B ✓ (1)

2.2.1 2,3-dimethylpent-2-ene ✓ 2,3-dimetielpent-2-een (2)

2.2.2 6-bromo-5-methylheptan-2-one ✓ 6-bromo-5-metielheptan-2-oon (2)

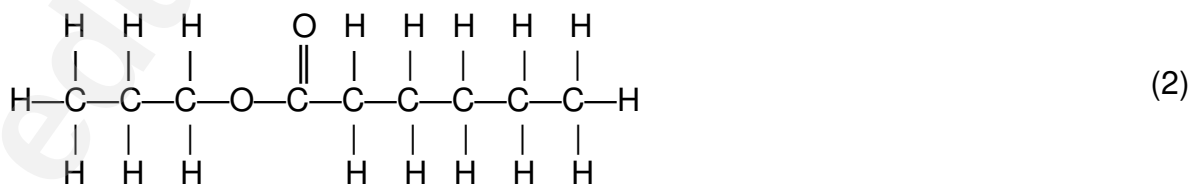
2.2.3
$$\begin{array}{c} \text{H} \\ | \\ \text{H}-\text{C} \equiv \text{C}-\text{C}-\text{H} \\ | \\ \text{H} \end{array} \quad \checkmark \quad (0/1 \text{ if functional group correct, but structure incorrect.})$$
 (1)

2.3.1 A (hexanoic acid) ✓ (heksanoësuur)

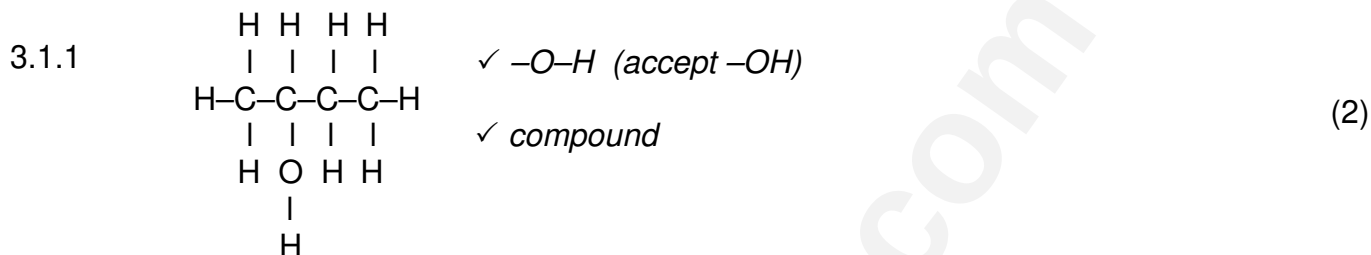
2.3.2
$$\begin{array}{c} \text{H} \\ | \\ \text{H}-\text{C}-\text{H} \\ | \quad | \\ \text{H} \quad \text{H} \\ | \quad | \quad | \quad | \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ | \quad | \quad | \quad || \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{O} \end{array} \quad \checkmark \text{ same funct. Grp. / } \textit{dieselfde funks gr} \quad (2)$$

✓ rest of compound / *res van verb*

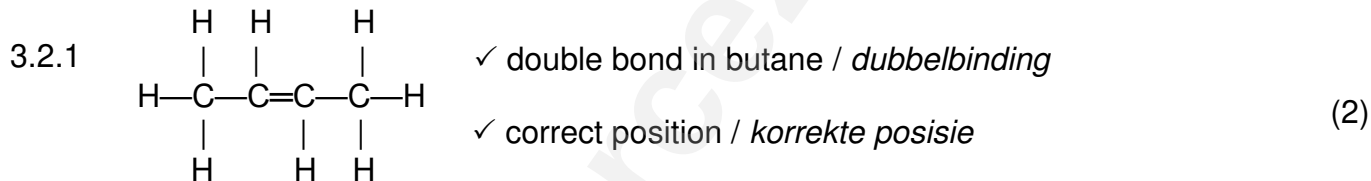
2.4 methyl ✓ funct grp ✓ hexanoate ✓
metiel funks grp heksanoaat



[13]

QUESTION 3 / VRAAG 3

3.1.2 Substitution / *Substitusie* ✓ (1)



3.2.2 Elimination ✓ / Dehydrohalogenation *Eliminasie / Dehidrohalogenering* (1)

3.3.1 Cracking ✓ / *Kraking* (1)

3.3.2 CH_2CH_2 ✓✓ (max 1 if structural formula given) (2)

3.4.1 Polyethene ✓ (accept polythene) / *politeen* (1)



3.4.2 (Addition) A reaction in which small molecules (monomers) join to form very large molecules (polymers) ✓ by adding on double bonds. ✓
(Addisie) 'n Reaksie waarin klein molekule (monomere) verbind om baie groot molekule (polimere) te vorm deur byvoeging by dubbelbindings (2)

[14]

QUESTION 4 / VRAAG 4

4.1.2 For 1 mol of each: butane: $\text{energy} = \frac{2636}{58} = 45,45 \text{kJ} \cdot \text{g}^{-1}$ ✓ (ignore units)

methane: $\text{energy} = \frac{890}{16} = 55,63 \text{kJ} \cdot \text{g}^{-1}$ ✓ (ignore units if same as)

Methane releases more energy ✓ / *Metaan stel meer energie vry* (3)

- 4.1.3 • SA has an abundant supply / *SA het oormaat voorraad*
 • It is a solid and thus easier to handle / *Is 'n vaste stof en dus makliker om te hanteer*
 • It doesn't react too quickly – its energy release can be controlled / *Dit reageer nie so vining nie – vrystelling van energie kan beheer word* ✓ (any ONE / *Enige EEN*) (1)

- 4.2.1 Pentane has a longer chain (larger molecule) ✓ , thus will have stronger IMF's ✓
 that require more energy to overcome. ✓

Pentaan het 'n langer ketting (groter molekule), daarom sterker IMK, wat meer energie benodig om bindings te breek (3)

- 4.2.2 Methylpropane has a branched structure ✓ thus a smaller surface area (or ✓)
 thus weaker IMFs that need to be overcome ✓

Metielpropaan het 'n vertakte ketting, dus kleiner oppervlakarea, dus swakker IMK om te oorkom (2)

- 4.2.3 So that only 1 independent variable is considered ✓/
Slegs 1 onafhanklike veranderlike (1)

- 4.2.4 Propane / *Propaan* ✓ (1)

[14]

QUESTION 5 / VRAAG 5

5.1 NO (a product) is a gas ✓ (and escapes) **OR** not a closed system ✓
*NO (produk) is 'n gas (en ontsnap) **OF** nie 'n geslote sisteem nie* (1)

5.2 ave rate = $\frac{\Delta m}{\Delta t} = \frac{6,3}{105} = 0,06 g \cdot s^{-1}$ ✓✓substitution ✓ answer (& unit required) (3)

5.3 Reaction is completed / all Cu (reactant) used up ✓ (not: equilibrium)
Reaksie is voltooi / al die Cu (reaktant) is opgebruik (nie: ewilibrum) (1)

5.4.1 Temp increased / heat given off / in exothermic reaction ✓
Temperatuur neem toe / hitte word vrygestel / eksotermiese reaksie (1)

5.5.2 Conc of HNO₃ decreased / reactants are being used up ✓
Konsentrasie van HNO₃ neem af / reaktanse word opgebruik (1)

5.5 The number of particles has decreased ✓
thus fewer effective collisions occur per second. ✓
Die aantal deeltjies neem af dus minder effektiewe botsings per sekonde (2)

5.6 NO : $n = \frac{m}{M} = \frac{6,3}{30} = 0,21 mol$ ✓ formula – if used ✓ molar mass

$n_{Cu} : n_{NO} = 1:4$ $n_{Cu} = 4 \times 0,21 = 0,84 mol$ ✓ use ratio to calc mol Cu

$m_{Cu} = n \times M = 0,84 \times 63,5 = 53,34g$ ✓ answer (& unit required) (4)

[17]

QUESTION 6 / VRAAG 6

- 6.1 Fertilisers must replenish nutrients ✓ used by growing of crops
Kunsmis moet voedingstowwe vervang / gebruik om gewasse te lewer (1)
- 6.2 • Excessive fertiliser seeps/washes into groundwater ✓ and contaminates drinking water ✓
Oormatige kunsmisstowwe beland in grondwater / en besmet drinkwater
- Excessive fertiliser run-off can lead to eutrophication ✓ which depletes aquatic life which serves as a food source ✓
Oormatige kunsmisstowwe kan lei tot eutrifikasie / visse as voedselbron uitgeput
- Excessive fertilisation can damage crops ✓ which leads to a smaller harvest ✓
Oormatige toediening van kunsmis kan oeste beskadig / lei tot kleiner oeste
- Any ONE of the above / *Slegs EEN van bostaande* (2)
- 6.3.1 Contact Process / *Kontakproses* (1)
- 6.3.2 Vanadium pentoxide / vanadium (IV)oxide / V_2O_5 ✓ (1)
- 6.3.3 $H_2S_2O_7$. (1)
- 6.3.4 $(NH_4)_2SO_4$ (2)
- 6.3.5 (a) To make phosphates soluble / *Fosfate oplosbaar* (1)
- (b) Guano / bone meal / fish meal / *Ghwano / beenmeel / vismeel* (1)

6.4.1 A dynamic equilibrium ✓ when the rate of the forward reaction equals the rate of the reverse reaction. ✓

'n Dinamiese ewewig wanneer die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie (2)

6.4.2 Increased / Toeneem (1)

6.4.3 When the pressure is increased, the reaction that decreases pressure by decreasing the number of moles (particles) is favoured ✓ –

thus the forward reaction. ✓

Wanneer die druk toeneem, sal die reaksie die druk verlaag deur die verlaging in aantal molekules te bevoordeel – dus die voorwaartse reaksie (2)

6.4.4

	2 SO₂	+	O₂	⇌	2 SO₃	
n start:	0,8		0,5		0,6	
n reacts/forms:	0,5 ✓		0,25		0,5	✓ <i>ratio</i>
n equilib:	0,3		0,25		1,1	✓ <i>calc</i>
conc: c=n/V	0,15		0,125		0,55	✓ ÷ 2

$$K_c = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 [\text{O}_2]} = \frac{(0,55)^2}{(0,15)^2 (0,125)} = 107,56 \quad \checkmark Kc \text{ expression} \quad \checkmark \text{subt} \quad \checkmark \text{answ} \quad (7)$$

6.4.5 350 °C. (1)

[23]

QUESTION 7 / VRAAG 7

7.1.1 An acid that can donate two protons / 'n Suur wat twee proton kan skenk (1)

7.1.2 H_2O ✓ $(\text{COO})_2^{2-}$ ✓ (2)

7.1.3 $\text{H}(\text{COO})_2^-$ ✓ (1)

7.2.1 No. ✓ (1)

7.2.2 A weak acid does not ionise completely ✓ (or and forms a low concentration of H_3O^+ ions) while a dilute solution contains a small amount of moles acid per volume water ✓ and does not depend on whether the acid is strong or weak.

'n Swak suur ioniseer nie volledig nie (vorm lae konsentrasie van H_3O^+ -ione) terwyl 'n verdunde oplossing 'n klein hoeveelheid (getal mol) suur in verhouding met die volume water bevat ongeag of die suur sterk of swak is. (2)

7.3 $c = \frac{m}{M \times V}$ ✓ if used $0,2 = \frac{m}{126 \times 0,25}$ ✓ 126 ✓ 0,25 $m = 6,3 \text{ g}$ ✓ (4)

7.4.1 Endpoint: the point when the indicator changes colour
Eindpunt: die punt wanneer die indikator van kleur verander (1)

7.4.2 Phenolphthalein / Fenolftaleïen (1)

7.4.3 $\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$ $\frac{0,2 \times 25}{c_b \times 36} = \frac{1}{2}$ $c_b = 0,28 \text{ mol} \cdot \text{dm}^{-3}$
✓ formula (if used) ✓ 0,2x25 ✓ 36 ✓ ratio ✓ answer (5)

7.4.4 Greater than 7 / groter as 7 (1)

7.4.5 $(\text{COO})_2^{2-} (\text{aq}) + 2 \text{H}_2\text{O} \rightleftharpoons (\text{COOH})_2 (\text{aq}) + 2 \text{OH}^- (\text{aq})$ ✓ LHS ✓ RHS ✓ bal
Accept single protonation; accept $(\text{COONa})_2 + \dots \rightarrow \text{NaOH} + \dots$ (3)

7.4.6 From 7.4.3: $[\text{OH}^-] = 0,28 \text{ mol} \cdot \text{dm}^{-3} = 28 \times 10^{-2} \text{ mol} \cdot \text{dm}^{-3}$ (+ marking)

$[\text{H}_3\text{O}^+][\text{OH}^-] = 1 \times 10^{-14}$ ✓ (if used)

$$\therefore [\text{H}_3\text{O}^+] = \frac{1 \times 10^{-14}}{28 \times 10^{-2}} = 3,571 \times 10^{-14} \text{ mol} \cdot \text{dm}^{-3} \checkmark (\checkmark)$$

$$\text{pH} = -\log[\text{H}_3\text{O}^+] \checkmark (\text{if used...})$$

$$\text{pH} = -\log[3,571 \times 10^{-14}] (\checkmark)$$

$$\therefore \text{pH} = 13,45 \checkmark (4)$$

[26]

QUESTION 8 / VRAAG 8

8.1 Galvanic or voltaic ✓ / *Galvaniese of voltaïese sel* (1)

8.2 $T = 25^{\circ}\text{C}$ ✓ $\text{conc} = 1 \text{ mol}\cdot\text{dm}^{-3}$ ✓ (2)

8.3 $\text{Cr} \rightarrow \text{Cr}^{3+} + 3\text{e}^{-}$ ✓LHS ✓RHS (2)

8.4 $\text{Cr} + 3\text{Ag}^{+} \rightarrow \text{Cr}^{3+} + 3\text{Ag}$ ✓LHS ✓RHS (2)

8.5.1 no change / *geen verandering* ✓ (1)

8.5.2 increase / *toeneem* ✓ (1)

8.5.3 increase / *toeneem* ✓ (1)

8.2.1 Cr ✓✓ (2)

8.2.2 $E^{\ominus}_{\text{cell}} = E^{\ominus}_{\text{reduction}} - E^{\ominus}_{\text{oxidation}}$ ✓ (if used)

$$1,08 \text{ ✓} = E^{\ominus}_{\text{X}} - (-0,74) \text{ ✓}$$

$$E^{\ominus}_{\text{X}} = 0,34 \text{ V ✓} \qquad \mathbf{X = Cu} \text{ ✓} \quad (5)$$

[17]

QUESTION 9 / VRAAG 9

- 9.1 Concentrated solution of sodium chloride✓ / Gekonsentreerde oplossing van natriumchloried (1)
- 9.2 Cl_2 ✓✓ **OR** chlorine / *chloor* (2)
- 9.3.1 H_2O is a stronger oxidising agent than Na^+ / H_2O is 'n sterker oksideermiddel as Na^+ (2)
- 9.3.2 NaOH (2)
- 9.4 To prevent the solutions mixing but to allow only positive sodium ions through
Om te verhoed dat die oplossings meng, maar om slegs positiewe natriumione deur te laat (1)
- 9.5 DC / GS ✓ (1)
- 9.6 AC would cause the reaction to reverse ✓ (and thus desired products not produced)
WS sal reaksie omkeer (dus gewenste produkte nie geproduseer nie) (1)

[10]**TOTAL: 150**