Western Cape Government
Education

# 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 FISIESE 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

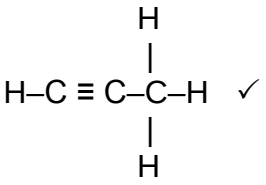
2.1.1 C or F (any one correct) ✓ (1)

2.1.2 B ✓ (1)

2.2.1 2,3-dimethyl✓pent-2-ene✓ *2,3-dimetielpent-2-een* (2)

2.2.2 6-bromo-5-methyl✓heptan-2-one✓ *6-bromo-5-metielheptan-2-oon* (2)

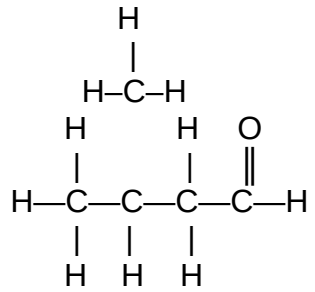
2.2.3



✓ (0/1 if functional group correct, but structure incorrect.) (1)

2.3.1 A (hexanoic acid) ✓ (*heksanoësuur)*

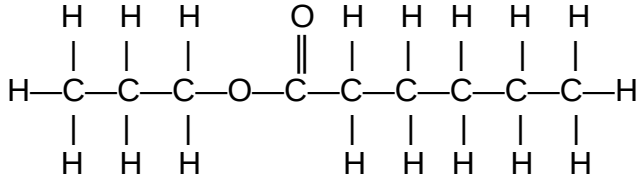
2.3.2



✓ same funct. Grp. / *dieselfde funks gr*

✓ rest of compound / *res van verb* (2)

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

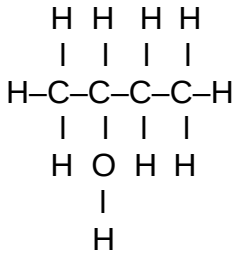


(2)

**[13]**

## QUESTION 3 / VRAAG 3

3.1.1

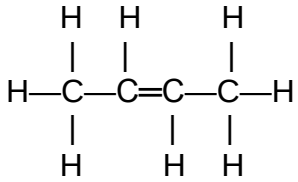


✓ *–O–H (accept –OH)*

✓ *compound* (2)

3.1.2 Substitution / *Substitusie* ✓ (1)

3.2.1



✓ double bond in butane / *dubbelbinding*

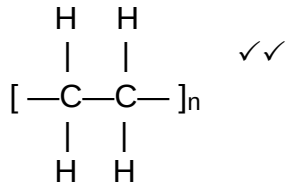
✓ correct position / *korrekte posisie* (2)

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)

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 molekuul (polimere) te vorm deur byvoeging by dubbelbindings* (2)

**[14]**

## QUESTION 4 / VRAAG 4

4.1.1 $2\ C_4H_{10} + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O$ ✓ LHS ✓ RHS ✓ bal (3)

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

methane: $energy = \frac{890}{16} = 55{,}63 kJ \cdot g^{-1}$ ✓ (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 molekuul), 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) (1)
*Reaksie is voltooi / al die Cu (reaktant) is opgebruik (nie: ekwilibrium)*

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 $HNO_3$ decreased / reactants are being used up ✓
*Konsentrasie van $HNO_3$ neem af / reaktanse word opgebruik* (1)

5.5 The number of particles has decreased ✓
thus <u>fewer effective collisions occur per second</u>. ✓
*Die aantal deeltjies neem af dus <u>minder effektiewe botsings per sekonde</u>* (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 nCu = 4 x 0,21 = 0,84 *mol* ✓ use ratio to calc mol Cu

$m_{Cu}$ = n x M = 0,84 x 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

| | **$2\ SO_2$ +** | **$O_2$** | **⇌ $2\ SO_3$** | |
|---|---|---|---|---|
| n start: | 0,8 | 0,5 | 0,6 | |
| n reacts/forms: | 0,5 ✓ | 0,25 | 0,5 | ✓ *ratio* |
| n equilib: | 0,3 | 0,25 | 1,1 | ✓ *calc* |
| conc: c=n/V | 0,15 | 0,125 | 0,55 | ✓ ÷ 2 |

$$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]} = \frac{(0{,}55)^2}{(0{,}15)^2(0{,}125)} = 107{,}56$$ ✓*Kc expression* ✓*subt* ✓*answ* (7)

*6.4.5 350 $^{O}C$.* (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 $H_2O$ ✓ $(COO)_2^{2-}$ ✓ (2)

7.1.3 $H(COO)_2^-$ ✓ (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 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 mol·dm$^{-3}$

✓*formula (if used)* ✓ 0,2x25 ✓36 ✓*ratio* ✓*answer* (5)

7.4.4 Greater than 7 / *groter as 7* (1)

7.4.5 $(COO)_2^{2-}$ (aq) + 2 $H_2O$ ⇄ $(COOH)_2$ (aq) + 2 $OH^-$ (aq) ✓LHS ✓RHS ✓*bal*

*Accept single protonation; accept* $(COONa)_2$ + … → NaOH + … (3)

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

$[H_3O^+][OH^-] = 1 \times 10^{-14}$ ✓ (if used)

$\therefore [H_3O^+] = \frac{1 \times 10^{-14}}{28 \times 10^{-2}} = 3{,}571 \times 10^{-14}\ mol.dm^{-3}$✓ **(✓)**

$pH = -\log[H_3O^+]$✓ (if used…)

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

$\therefore pH = 13{,}45$✓ (4)

**[26]**

## QUESTION 8 / VRAAG 8

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

8.2 T = 25 $^{O}$C✓ conc = 1 mol·dm$^{-3}$ ✓ (2)

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

8.4 Cr + $3Ag^{+}$ → $Cr^{3+}$ + 3 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 $E^{\ominus}_{cell} = E^{\ominus}_{reduction} - E^{\ominus}_{oxidation}$ ✓ (if used)

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

$E^{\ominus}_{X}$ = 0,34 V ✓ **X = Cu**✓ (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**