Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2018

PHYSICAL SCIENCES P2

MARKS: **150**

TIME: **3 hours**

* J P H S C E 2 *

This question paper consists of 20 pages, including 4 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your full NAME and SURNAME in the appropriate spaces on the ANSWER BOOK.

2. This question paper consists of SEVEN questions. Answer ALL the questions in the ANSWERBOOK.

3. Start EACH question on a NEW page in the ANSWER BOOK.

4. Number your answers correctly according to the numbering system used in this question paper.

5. Leave ONE line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.

6. You may use a non-programmable calculator.

7. You may use appropriate mathematical instruments.

8. You are advised to use the attached DATA SHEETS.

9. Show ALL formulae and substitutions in ALL calculations.

10. Round off your FINAL numerical answers to a minimum of TWO decimal places.

11. Give brief motivations, discussions et cetera where required.

12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Write only the correct letter (A–D) next to the question number (1.1–1.10) in the ANSWERBOOK for example 1.11 E.

1.1 Which ONE of the following statements is CORRECT about methane?

Compared to members of its homologous series, methane has the …

A highest boiling point.

B highest melting point.

C lowest vapour pressure.

D highest vapour pressure. (2)

1.2 Which ONE of the following compounds is an alcohol?

A	O ‖ CH_3CH_2C-H	B	O ‖ CH_3CCH_3
C	OH | CH_3CHCH_3	D	CH_3COOCH_3

(2)

1.3 The condensed structural formula of a polymer, **P** is given below.

$$-\!\!\left[CH_2-CH_2\right]_n\!\!-$$

Polymer P

The IUPAC name of the MONOMER of polymer **P** is …

A ethane.

B ethene.

C ethyne.

D polythene. (2)

1.4 Which ONE of the following statements is TRUE about a reaction at equilibrium?

At equilibrium the concentration of products …

A is equal to the concentration of reactants.

B is always greater than that of reactants.

C is always smaller than that of reactants.

D remains constant over a period of time. (2)

1.5 ONE mole of zinc reacts with EXCESS hydrochloric acid of concentration 1 mol.dm^{-3} at 25 °C according to the balanced equation.

$$Zn(s) + 2HC\ell(aq) \rightarrow ZnC\ell_2(aq) + H_2(g)$$

Which ONE of the following changes will increase the average kinetic energy of reacting particles?

A Add more zinc

B Increase temperature

C Add a suitable catalyst

D Increase concentration of HCℓ (2)

1.6 The following reaction reaches equilibrium in a closed container.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g) \qquad \Delta H > 0$$

What effect will a decrease in temperature have on the number of moles of HI at equilibrium and the K_c value?

	Number of moles	**K_c value**
A	Increases	Increases
B	Decreases	Increases
C	Increases	Decreases
D	Decreases	Decreases

(2)

1.7 Which ONE of the following is a product in ALL neutralisation reactions?

A H_2O

B Acid

C Base

D NaCℓ (2)

1.8 An acid solution has a concentration of 0,1 mol.dm^{-3}. The concentration of hydronium ions, [H_3O^+], in the solution is found to be 0,00009 mol.dm^{-3}.

The conclusion that can be drawn from above information is that the acid is …

A weak.

B strong.

C diprotic.

D concentrated. (2)

1.9 Which ONE of the following solutions, each of concentration 0,1 mol.dm^{-3} has the lowest pH?

A KOH

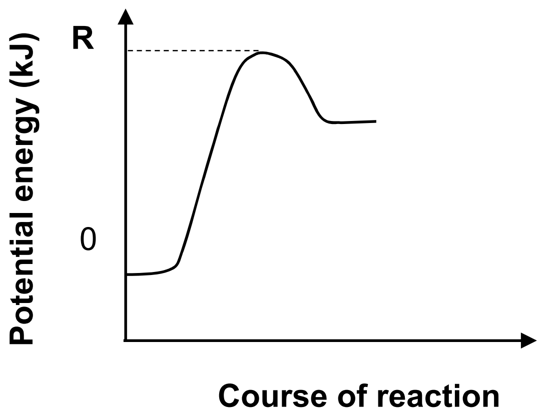
B $NH_4Cℓ$

C Na_2CO_3

D CH_3COONa (2)

1.10 Consider the potential energy diagram for the reaction represented by the balanced equation given below.

$$2CO_2(g) \rightleftharpoons 2CO(g) + O_2(g)$$



What does energy **R** represent?

R represents the …

A heat of reaction for the reverse reaction.

B heat of reaction for the forward reaction.

C activation energy for the reverse reaction.

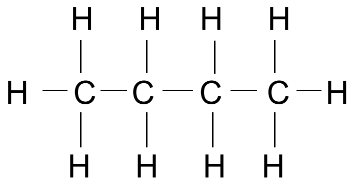
D activation energy for the forward reaction. (2)

[20]

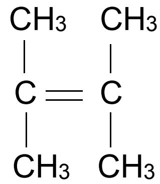
QUESTION 2 (Start on a new page.)

Study the compounds given below and answer the questions that follow.

A.



B.



2.1.1 Both compounds **A** and **B** are hydrocarbons.

Define the term *hydrocarbon*. (2)

For compound **A** write down**:**

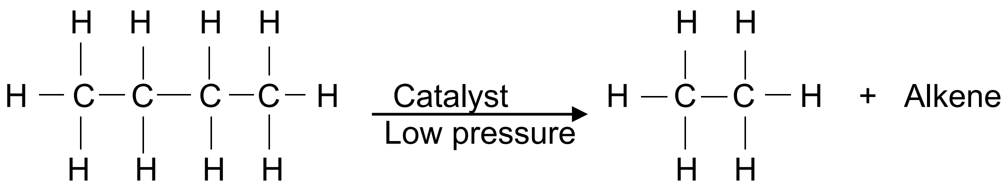
2.1.2 The NAME of the homologous series to which it belongs (1)

2.1.3 The EMPIRICAL formula (1)

2.1.4 A balanced equation for the reaction between compound **A** and excess oxygen using MOLECULAR FORMULAE (3)

2.1.5 Is the reaction mentioned in QUESTION 2.1.4 above EXOTHERMIC or ENDOTHERMIC? (1)

Compound **A** can undergo the cracking process according to the incomplete equation shown below.



2.1.6 Define the term *cracking*. (2)

2.1.7 Write down the STRUCTURAL FORMULA of the alkene. (2)

2.1.8 Give the NAME of the type of cracking used in the reaction above. (1)

For compound **B** answer the following questions.

2.1.9 Classify compound **B** as SATURATED or UNSATURATED.

Give a reason for the answer. (2)

2.1.10 Write down the IUPAC name of compound **B.** (3)

2.2 Consider the compounds, **C** and **D** given below.

C. 5-ethyl-4-methylhept-2-yne

D. $CH_3\overset{\overset{O}{\|}}{C}CH_2CH_2CH_3$

Write down the:

2.2.1 STRUCTURAL FORMULA of compound **C** (3)

2.2.2 IUPAC name of compound **D** (2)

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QUESTION 3 (Start on new page.)

The boiling points of some organic compounds are given in the table below. **X** represents an unknown boiling point. Compounds **A** and **B** have different functional groups.

COMPOUND	FORMULA	BOILING POINTS (˚C)
A	$CH_3CH_2CH_2CH_2\overset{\overset{O}{\|}}{C}-H$	103
B	$CH_3CH_2CH_2CH_2\overset{\overset{O}{\|}}{C}-OH$	**X**
C	$CH_3CH_2CH_2CH_2CH_3$	36,1
D	$CH_3-\underset{\underset{CH_3}{\|}}{\overset{\overset{CH_3}{\|}}{C}}-CH_3$	9,5

3.1 Define the term *functional group.* (2)

3.2 Write down the NAME of the:

3.2.1 HOMOLOGOUS SERIES to which compound **A** belongs (1)

3.2.2 FUNCTIONAL GROUP of compound **B** (1)

3.3 Consider the boiling points given below.

8,1 ˚C	95 ˚C	185,4 ˚C

3.3.1 From these boiling points, choose the boiling point represented by **X** in the table above. (1)

3.3.2 Fully explain how you arrived at the answer to QUESTION 3.3.1. (3)

3.4 Compounds **C** and **D** are structural isomers.

3.4.1 Define the term *structural isomer.* (2)

3.4.2 What TYPE of structural isomers are compounds **C** and **D**?

Choose from FUNCTIONAL, POSITIONAL or CHAIN. (1)

3.4.3 How does the vapour pressure of compound **C** compare to that of **D**? Choose from SMALLER THAN, HIGHER THAN or EQUAL TO.

Explain the answer fully. (4)

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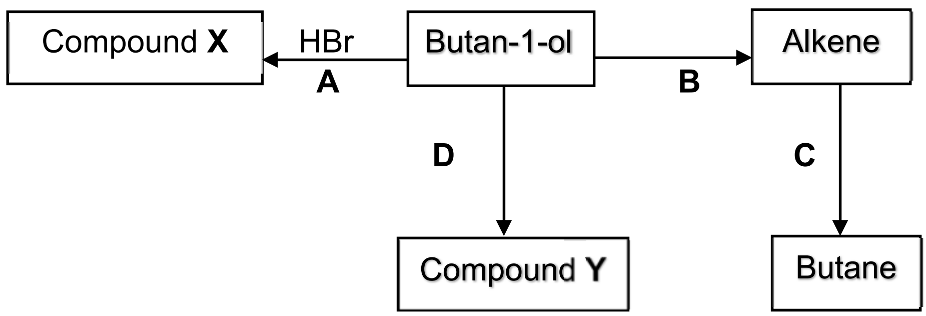
QUESTION 4 (Start on a new page.)

The flow diagram shows how an alcohol can be used to prepare other organic compounds. The letters **A, B, C** and **D** represent different organic reactions. **X** and **Y** are organic compounds.



4.1 Write down the type of reaction represented by:

4.1.1 **A** (1)

4.1.2 **B** (1)

4.2 For reaction **C** write down the:

4.2.1 TYPE OF ADDITION reaction (1)

4.2.2 NAME or FORMULA of the catalyst used (1)

4.3 Using STRUCTURAL FORMULAE, write down a balanced equation for reaction **A.** (4)

4.4 For reaction **B** write down the:

4.4.1 NAME or FORMULA of the inorganic reactant used (1)

4.4.2 STRUCTURAL FORMULA of the alkene produced (2)

4.5 Reaction **D** is an esterification reaction. Compound **Y** is a FUNCTIONAL isomer of pentanoic acid.

For reaction **D** write down the:

4.5.1 TWO reaction conditions needed (2)

4.5.2 STRUCTURAL FORMULA of the carboxylic acid used (2)

4.5.3 IUPAC name of compound **Y** (2)

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QUESTION 5 (Start on a new page.)

5.1 Study the reaction given below in which EXCESS magnesium ribbon (Mg) reacts with 50 cm^3 of a diluted sulphuric acid (H_2SO_4) solution at room temperature.

$$Mg(ribbon) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + H_2(g) \qquad \Delta H < 0$$

What changes can be made to the following substances to increase the rate of reaction?

5.1.1 Magnesium (1)

5.1.2 H_2SO_4 (1)

How will EACH of the following changes affect the reaction rate?

Choose from DECREASES, INCREASES or NO EFFECT

5.1.3 Decrease in temperature (1)

5.1.4 Increase in pressure (1)

5.2 A group of learners uses the reaction between zinc and EXCESS diluted hydrochloric acid (HCℓ) to investigate one of the factors that affects the rate of a chemical reaction. The balanced equation for the reaction is:

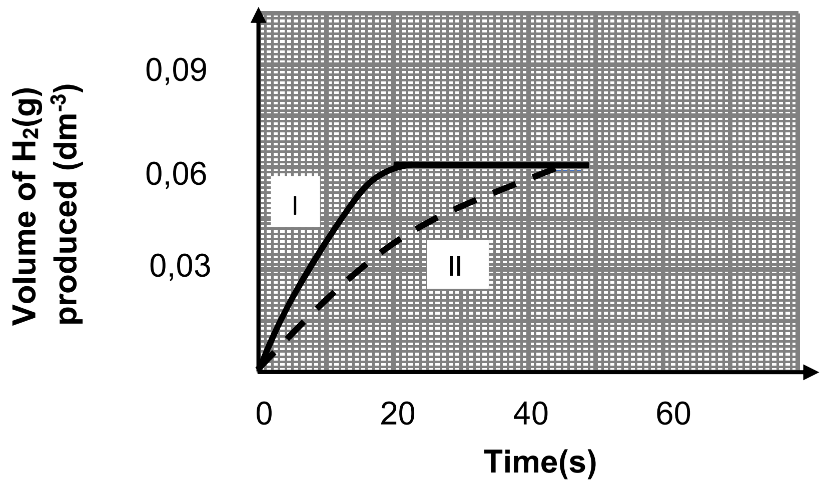
$$Zn(s) + 2HC\ell(aq) \rightarrow ZnC\ell_2(aq) + H_2(g)$$

The same volume of HCℓ and same amount of Zn was used.

Experiment	T (°C)	Volume HCℓ (cm^3)	Concentration of HCℓ ($mol.dm^{-3}$)	State of division of Zn
I	30	100	0,40	Powder
II	30	100	0,40	Granules

5.2.1 Write down the independent variable for the investigation. (1)

The results obtained for **experiment I** and **II** are shown in the graph below.



5.2.2 Explain why the graph for **experiment I** becomes horizontal after 20 seconds. (2)

5.2.3 How does the amount of zinc used in **experiment I** compare to the amount of zinc used in **experiment II**.

Choose from HIGHER THAN, LOWER THAN or EQUAL TO.

Give a reason for the answer. (2)

5.2.4 Calculate the:

(a) Average rate of reaction (in $dm^3.s^{-1}$) from time 0 to 30 seconds for **experiment I** (3)

(b) Initial number of moles of hydrochloric acid in **experiment II** (3)

(c) Mass of hydrochloric acid that remains at the completion of the reaction in **experiment II**

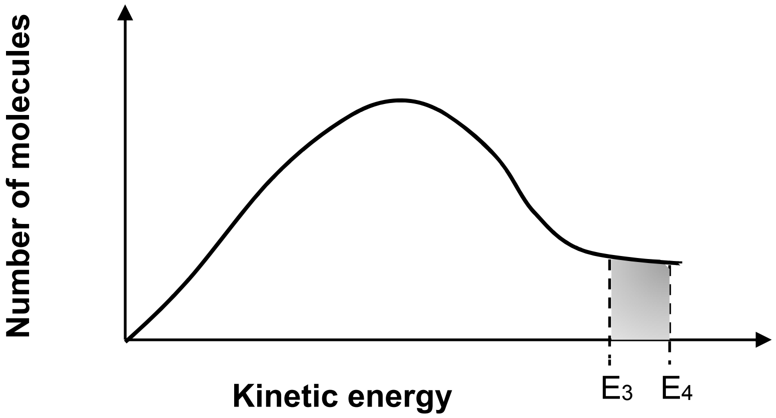
Take the MOLAR VOLUME of gas as 24,3 $dm^3.mol^{-1}$ at 25 ˚C. (5)

The learners conduct TWO more experiments (**experiment III** and **IV**) in order to investigate another factor that affects rate of reaction.

The reaction conditions are summarised in the table below.

Experiment	**T (˚C)**	**Volume of HCℓ (cm^3)**	**Concentration of HCℓ ($mol.dm^{-3}$)**	**State of division of ONE mole of Zn**
III	30	100	0,40	Powder
IV	30	100	0,40	Powder

The diagram below represents the Maxwell-Boltzman distribution curve for the reactions in **experiment III** and **IV**.



E_3 is the activation energy for the reaction in **experiment III** and E_4 is the activation energy for the reaction in **experiment IV.**

5.2.5 Define *activation energy.* (2)

5.2.6 In which experiment (**experiment III** or **experiment IV**) is the reaction rate HIGHER? (1)

5.2.7 Explain how the factor responsible for the difference in the reaction rate of **experiment III** and **experiment IV** affects reaction rate by referring to the collision theory. (4)

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QUESTION 6 (Start on a new page.)

Sulphur (S) is allowed to react with hydrogen gas (H_2) in a closed container according to the balanced equation:

$$H_2(g) + S(s) \rightleftharpoons H_2S(g) \qquad \Delta H < 0$$

The reaction reaches chemical equilibrium after some time.

6.1 Define *chemical equilibrium.* (2)

6.2 Write down TWO conditions that make it possible for the reaction to reach equilibrium. (2)

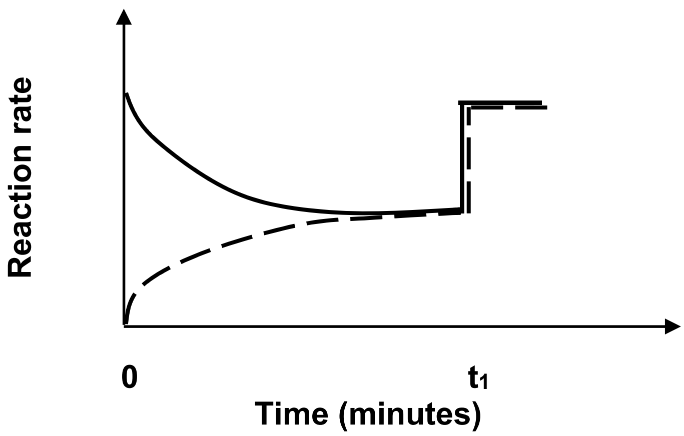
6.3 What effect will the following changes have on the amount of H_2S at equilibrium?

Choose from INCREASES, DECREASES or NO EFFECT.

6.3.1 Adding more sulphur. (1)

6.3.2 Adding more H_2. (1)

6.4 The graph below shows the changes in the rate of reaction from the moment the reactants are introduced in the container.



6.4.1 Which reaction is represented by the dotted line?

Choose from FORWARD or REVERSE. (1)

6.4.2 State TWO possible changes that could be made to the reaction conditions at **t_1**. (2)

6.5 The reaction is started by heating a mixture of hydrogen gas (H_2) and excess sulphur (S) in a closed container of volume **V**. The reaction establishes equilibrium at 210 ˚C.

At equilibrium 17g of H_2S are present.

The value of the equilibrium constant, K_c is 2,56 x 10^{-1} at 210 ˚C.

6.5.1 Is there a HIGH or LOW yield at 210 ˚C? Give a reason for the answer. (2)

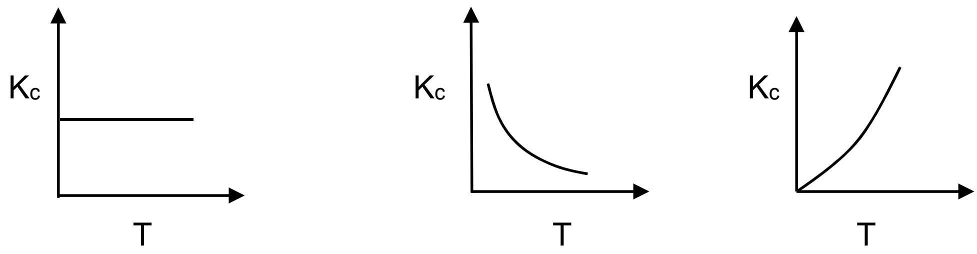
Calculate the:

6.5.2 Initial number of moles of hydrogen (H_2) placed in the container (8)

6.5.3 Initial number of moles of sulphur (S) if only 90% of the original amount of sulphur is present at equilibrium. (3)

Three graphs of K_c versus temperature are shown below.

Graph P **Graph Q** **Graph R**



6.5.4 Which ONE of the graphs can possibly be the K_c versus temperature graph for the reaction?

Explain the answer fully. (4)

[26]

QUESTION 7 (Start on a new page.)

7.1 An ion of a salt reacts with water according to the following balanced equation.

$$CO_3^{2-}(aq) + H_2O(\ell) \rightleftharpoons HCO_3^-(aq) + OH^-(aq)$$

7.1.1 Write down a term for the underlined phrase. (1)

7.1.2 Give a reason why the reaction shown above is said to be an acid-base reaction according to the Lowry-Bronsted model. (1)

7.1.3 Write down the FORMULA of the conjugate base of water. (1)

7.1.4 The carbonate ion CO_3^{2-} is a weak base.

Which ONE of the following values is a possible value for the dissociation constant, K_b at 25 °C for the carbonate ion?

$K_b < 1 \times 10^{-14}$	$K_b > 1 \times 10^{-14}$	$K_b = 1 \times 10^{-14}$

(1)

The hydrogen carbonate ion, HCO_3^- can act as an ampholyte.

7.1.5 Define the term *ampholyte.* (2)

For the hydrogen carbonate ion HCO_3^- ion write down the formula of the:

7.1.6 Conjugate acid (1)

7.1.7 Conjugate base (1)

7.2 A solution of a strong diprotic acid has pH = 1,3.

7.2.1 Define the term *diprotic acid.* (2)

7.2.2 Calculate the concentration of the hydroxide ions in the solution. (4)

7.3 The diprotic acid mentioned in QUESTION 7.2 are diluted by adding 8 cm^3 of the acid to water to make 100 cm^3 of solution.

During a titration the 25 cm^3 dilute acid neutralises exactly 14,2 cm^3 of sodium hydroxide solution.

7.3.1 Calculate the concentration of the sodium hydroxide solution. (6)

In the reaction the ratio of BASE : ACID is 2 : 1.

Three indicators **A**, **B** and **C** available for the titration are shown in the diagram below.

INDICATOR	pH range
A	2,0–4,3
B	6,8–7,4
C	8,6–10,2

7.3.2 Which indicator must be used in the titration?

Give a reason for the answer. (2)
[22]

TOTAL: 150

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DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 2 (CHEMIE)

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAAM/*NAME*	SIMBOOL/*SYMBOL*	WAARDE/*VALUE*
Standard pressure *Standaarddruk*	p^{θ}	$1,013 \times 10^{5}$ Pa
Molar gas volume at STP *Molêre gasvolume teen STD*	V_m	$22,4\ dm^{3}\cdot mol^{-1}$
Standard temperature *Standaardtemperatuur*	T^{θ}	273 K
Charge on electron Lading op elektron	e	$-1,6 \times 10^{-19}$ C
Avogadro's constant Avogadro se konstante	N_A	$6,02 \times 10^{23}\ mol^{-1}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ or/of $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^{+}]$
$K_w = [H_3O^{+}][OH^{-}] = 1\times10^{-14}$ at /by 298 K	

$E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ / $E^{\theta}_{sel} = E^{\theta}_{katode} - E^{\theta}_{anode}$

$E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ / $E^{\theta}_{sel} = E^{\theta}_{reduksie} - E^{\theta}_{oksidasie}$

$E^{\theta}_{cell} = E^{\theta}_{oxidising\ agent} - E^{\theta}_{reducing\ agent}$ / $E^{\theta}_{sel} = E^{\theta}_{oksideermiddel} - E^{\theta}_{reduseermiddel}$

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE*

KEY/ *SLEUTEL*

1,9	29 Cu 63,5

- Atomic Number / *Atoomgetal*: 29
- Symbol / *Simbool*: Cu
- Eletronegativity / *Electronegatiwiteit*: 1,9
- Approximate relative atomic mass / *Benaderde relatiewe atoommassa*: 63,5

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)
2,1 1 H 1																	2 He 4
1,0 3 Li 7	1,5 4 Be 9											2.0 5 B 11	2.5 6 C 12	3.0 7 N 14	3.5 8 O 16	4.0 9 F 19	10 Ne 20
0,9 11 Na 23	1,2 12 Mg 24											1.5 13 Aℓ 27	1.8 14 Si 28	2.1 15 P 31	2.5 16 S 32	3.0 17 Cℓ 35,5	18 Ar 40
0,8 19 K 39	1,0 20 Ca 40	1,3 21 Sc 45	1.5 22 Ti 48	1.6 23 V 51	1,6 24 Cr 52	1.5 25 Mn 55	1.8 26 Fe 56	1.8 27 Co 59	1.8 28 Ni 59	1.9 29 Cu 63,5	1.6 30 Zn 65	1.6 31 Ga 70	1.8 32 Ge 73	2.0 33 As 75	2.4 34 Se 79	2.8 35 Br 80	36 Kr 84
0,8 37 Rb 86	1,0 38 Sr 88	1,2 39 Y 89	1,4 40 Zr 91	41 Nb 92	1,8 42 Mo 96	1.9 43 Tc	2.2 44 Ru 101	2.2 45 Rh 103	2.2 46 Pd 106	1.9 47 Ag 108	1.7 48 Cd 112	1.7 49 In 115	1.8 50 Sn 119	1.9 51 Sb 122	2.1 52 Te 128	2.5 53 I 127	54 Xe 131
0,7 55 Cs 133	0,9 56 Ba 137	57 La 139	1.6 72 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	1.8 81 Tℓ 204	1.8 82 Pb 207	1.9 83 Bi 209	2.0 84 Po	2.5 85 At	86 Rn
0,7 87 Fr	0,9 88 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

TABLE 4A: STANDARD REDUCTION POTENTIALS
TABEL 4A: STANDAARD REDUKSIEPOTENSIALE

Half-reactions/*Halfreaksies*			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/*Toenemende oksiderende vermoë* (↑)

Increasing reducing ability/*Toenemende reduserende vermoë* (↓)

TABLE 4B: STANDARD REDUCTION POTENTIALS
TABEL 4B: STANDAARD REDUKSIEPOTENSIALE

Increasing oxidising ability/*Toenemende oksiderende vermoë* (↓)

Increasing reducing ability/*Toenemende reduserende vermoë* (↑)

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

Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE/
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

JUNE/*JUNIE* 2018

PHYSICAL SCIENCES P2/*FISIESE WETENSKAPPE V2*
MARKING GUIDELINE/*NASIENRIGLYN*

MARKS/*PUNTE*: 150

This marking guideline consists of 10 pages./ *Hierdie nasienriglyn bestaan uit 10 bladsye.*

QUESTION/*VRAAG 1*

1.1 D ✓✓ (2)

1.2 C ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 B ✓✓ (2)

1.6 D ✓✓ (2)

1.7 A ✓✓ (2)

1.8 A ✓✓ (2)

1.9 B ✓✓ (2)

1.10 D ✓✓ (2)

[20]

QUESTION/*VRAAG 2*

2.1.1 Organic compound that consist of carbon and hydrogen atoms only. ✓✓
Organiese verbindings wat slegs uit koolstof- en waterstofatome bestaan.
(2 or/of 0) (2)

2.1.2 Alkanes ✓/*Alkane* (1)

2.1.3 C_2H_5 ✓ (1)

2.1.4 $2C_4H_{10} + 13O_2$ ✓ $\rightarrow$ $8CO_2 + 10H_2O$ ✓ Bal ✓

Notes/*Aantekeninge:*

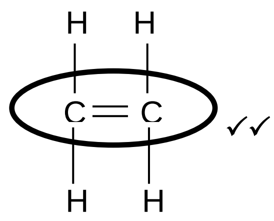
- Reactants✓ Products✓ Balancing✓
  Reaktanse *Produkte* *Balansering*
- Ignore double arrows and phases./ *Ignoreer dubbelpyle en fases.*
- Marking rule 6.3.10/*Nasienreël 6.3.10.*
- If condensed structural formulae used:/*Indien gekondenseerde struktuurformules gebruik:* Max./*Maks. 2/3*

(3)

2.1.5 EXOTHERMIC ✓/*EKSOTERMIES* (1)

2.1.6 The chemical process in which longer chain hydrocarbon molecules are broken✓ into shorter more useful molecules. ✓
Die chemiese proses waarin langer ketting koolwaterstofmolekules afgebreek word in korter meer bruikbare molekules. (2)

2.1.7



Marking criteria/Nasienriglyne:

- Whole structure correct/ *Hele struktuur korrek:* 2/2
- Only functional group correct.
  Slegs funksionele groep korrek. Max./*Maks.*. 1/2

(2)

2.1.8 CATALYTIC✓/*KATALITIES* (1)

2.1.9 UNSATURATED✓/*ONVERSADIG*

<u>Contains double bonds</u> OR <u>multiple bonds</u> between C atoms.✓
<u>Bevat dubbelbindings</u> OF <u>meervoudige bindings</u> tussen C-atome. (2)

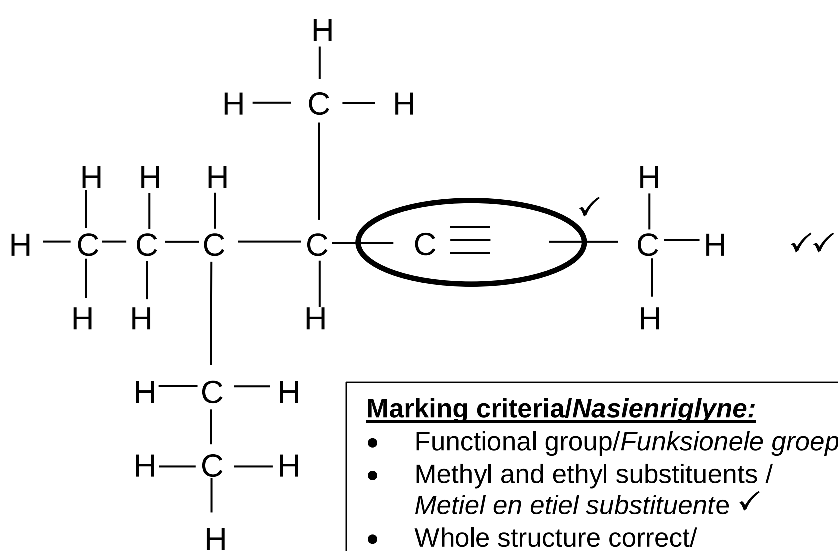
2.1.10 2,3-dimethylbut-2-ene/2,3-dimethyl-2-b*uteen*
2,3-dimetielbut-2-een/2,3-dimetiel-2-buteen

Marking Criteria/*Nasienriglyne:*

- Correct stem i.e <u>but-2-ene/2-butene</u>.
  Korrekte stam bv.but-2-een/2-buteen. ✓
- Substituent dimethyl correctly identified. ✓
  Substituent dimetiel korrek geïdentifiseer.
- Substituents correctly numbered, hyphens and commas correctly used. ✓
  Substituente korrek genommer, koppeltekens en kommas korrek gebruik.

(3)

2.2.1



Marking criteria/*Nasienriglyne:*

- Functional group/*Funksionele groep.* ✓
- Methyl and ethyl substituents /
  Metiel en etiel substituente ✓
- Whole structure correct/
  Hele struktuur korrek ✓ 3/3

(3)

2.2.2 Pentan-2-one✓✓/2-pentanone
Pentan-2-oon/2-pentanoon (2)

[23]

QUESTION/*VRAAG 3*

3.1 A bond or an atom or a group of atoms that determine(s) the physical and chemical properties of a group of organic compounds. ✓✓
'n Binding of 'n atoom of 'n groep atome wat die fisiese en chemiese eienskappe van 'n groep organiese verbindings bepaal. **(2 or/*of 0)*** (2)

3.2.1 Aldehyde ✓/*Aldehied* (1)

3.2.2 Carboxile group ✓/*Karboksiel-groep* (1)

3.3.1 185,4(˚C) ✓ (1)

3.3.2
- Compound **B**/carboxylic acid has hydrogen bonding ✓(in addition to London forces/Dispersion forces/Induced dipole forces/dipole-dipole forces.).
  *Verbinding **B**/karboksielsuur het waterstofbindings behalwe Londonkragte/Dispersiekragte/Geïnduseerde dipoolkragte en dipool-dipoolkragte)*
- *H*ydrogen bonds are stronger ✓ than London forces/Dispersion forces/Induced dipole forces and dipole-dipole forces.
  Waterstofbindings is sterker as Londonkragte/Dispersiekragte/ Geïnduseerde dipoolkragte en dipool-dipoolkragte.
- More energy will be needed to overcome/break(intermolecular) forces. ✓
  Meer energie word benodig om (intermolekulêre) kragte te oorkom/ te breek. (3)

3.4.1 Organic molecules with the same molecular formula ✓ but different structural formulae. ✓
Organiese verbindings met dieselfde molekulêre formule maar verskillende struktuurformules. (2)

3.4.2 CHAIN ✓/*KETTING* (1)

3.4.3 SMALLER THAN ✓/*KLEINER AS*

STRUCTURE/*STRUKTUUR:*
Compound **D** are branched/more compact/more spherical/smaller contact area/smaller surface(over which intermolecular forces act.) ✓
*Verbinding **D** is meer vertak/meer kompak/meer series/kleiner kontak area/kleiner oppervlak(waaroor intermolekulêre kragte werk.)*
INTERMOLECULAR FORCES/*INTERMOLEKULÊRE KRAGTE*
Weaker/Less strength/Decrease in strength of Van der Waals forces/ London forces/Dispersion forces. ✓
Swakker/Afname in sterkte van Van der Waalskragte/Londonkragte/ Dispersiekragte.

ENERGY/*ENERGIE:*
Less energy needed to overcome/break (intermolecular) forces. ✓
Minder energie benodig om (intermolekulêre) kragte te oorkom/breek.

OR/*OF*

STRUCTURE/*STRUKTUUR:*
Compound **C** is a straight chain/less compact/less spherical/larger contact area/larger surface(over which intermolecular forces act.) ✓
*Verbinding **C** is 'n reguitketting/minder kompak/minder sferies/groter kontakarea/groter oppervlak(waaroor intermolekulêre kragte werk.)*
INTERMOLECULAR FORCES/*INTERMOLEKULÊRE KRAGTE*
Stronger/More strength/Increase in strength of Van der Waals forces/ London forces/Dispersion forces. ✓
Sterker/Toename in sterkte van Van der Waalskragte/Londonkragte/ Dispersiekragte.
ENERGY/*ENERGIE*
More energy needed to overcome/break (intermolecular) forces. ✓
Meer energie word benodig om (intermolekulêre) kragte te oorkom/breek. (4)
[15]

QUESTION/*VRAAG* 4

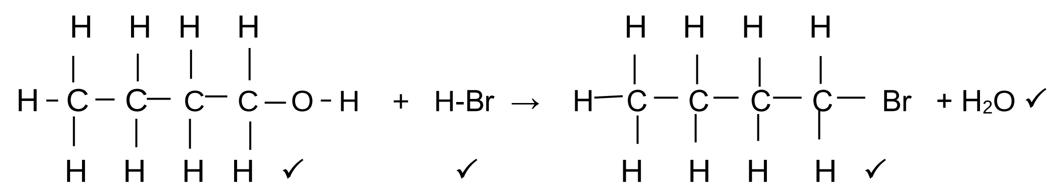
4.1.1 Substitution ✓/*Substitusie* (1)

4.1.2 Eliminasie ✓/Dehydration
Eliminasie/Dehidrasie/Dehidratering (1)

4.2.1 Hydrogenation ✓
Hidrogenasie/Hidrogenering (1)

4.2.2 Pt ✓/Ni/Pd/Platinum/Nickel/*Nikkel*/Palladium (1)

4.3

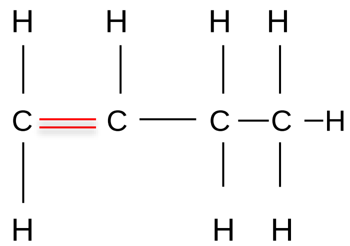


Notes/*Aantekeninge*:

- Ignore double arrows/*Ignoreer dubbelpyle.*
- Accept/*Aanvaar* H_2O
- Any additional reactants and/ or products
  Enige addisionele reaktanse en/of produkte: Max./*Maks.* 3/4
- Accept any coefficients that are multiples:
  Aanvaar koëffisiente wat veelvoude is:
- Incorrect balancing/*Verkeerde balansering:* Max./*Maks. 3/4*
- *Molecular/Condensed formulae*
  Molekulêre/gekondenseerde formule: Max./*Maks. 2/4*
  Accept/*Aanvaar:* -OH as condensed/*-OH as gekondenseerd* (4)

4.4.1 (Concentrated) sulphuric acid ✓/hydrogen sulphate/H_2SO_4
Gekonsentreerde swaelsuur/waterstofsulfaat/ H_2SO_4 (1)

4.4.2



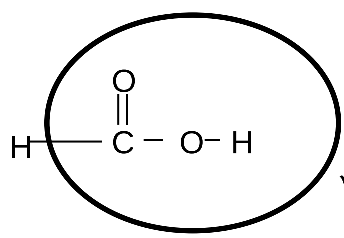
✓✓

Marking criteria/*Nasienriglyne*:
- Whole structure correct/*Hele struktuur korrek: 2/2*
- Only functional group correct
Slegs funksionele groep korrek Max./*Maks. 1/2*

(2)

4.5.1
- Heat ✓/mild temperature over waterbath.
Verhit/matige temperatuur oor 'n waterbad.
- Add concentrated sulphuric acid/H_2SO_4 ✓
Voeg gekonsentreerde swawelsuur/waterstofsulfaat)/H_2SO_4 by. (2)

4.5.2



✓✓

Marking criteria/*Nasienriglyne:*
Only functional group ✓
Slegs funksionele groep
Whole structure correct ✓
Hele struktuur korrek 2/2

(2)

4.5.3 Butyl ✓ methanoate ✓/ *butielmetanoaat* (2)
[17]

QUESTION/*VRAAG* 5

5.1.1 Use magnesium powder. ✓
Gebruik magnesiumpoeier. (1)

5.1.2 Increase concentration (H_2SO_4) ✓/*Toename in konsentrasie (H_2SO_4)* (1)

5.1.3 DECREASES ✓/*VERLAAG* (1)

5.1.4 NO EFFECT ✓/*GEEN EFFEK* (1)

5.2.1 Surface area ✓ (of Zn)/State of division(of Zn)
Oppervlaksarea(van Zn) /Toestand van verdeeldheid(van Zn) (1)

5.2.2 Reaction stops ✓/come to completion/no more hydrogen gas is produced since zinc is used up. ✓
Reaksie stop/kom tot stilstand/geen waterstofgas word geproduseer want sink is opgebruik. (2)

5.2.3 EQUAL TO ✓/*GELYK AAN*

The same Volume of $H_2(g)$ was produced. ✓
Dieselfde volume $H_2(g)$ *is geproduseer.* (2)

5.2.4 (a) Average rate/*Gemiddelde tempo* = $\Delta V/\Delta t$
= (0,06 - 0) ✓/(30 - 0) ✓
= 2×10^{-3}✓($mol.dm^{-3}.s^{-1}$) or/*of 0,002* (3)

(b) n = cV ✓= 0,4 x 100/1000 ✓ = 0,04 mol ✓ (3)

(c) **Marking criteria/*Nasienriglyne:***

- Use 24,3 $dm^3.mol^{-1}$ substituted in the correct formula.✓
  Gebruik 24,3 $dm^3.mol^{-1}$ *vervang in die korrekte formule.*
- Calculate $n(HCl)_{reacted}$ using the mol ratio 1 : 2. ✓
  Bereken $n(HCl)_{gereageer}$ *deur molverhouding 1 : 2 te gebruik*.
- Calculate $n(HCl)_{reacted}$ ✓
  Bereken $n(HCl)_{gereageer}$
- Use 36,5 $g.mol^{-1}$ substitute in correct formule. ✓
  Gebruik 36,5 $g.mol^{-1}$ *vervang in die korrekte formule.*
- Finale antwoord/*Final answer.* (1,28–1,31 g)✓

POSITIVE MARKING from QUESTION 5.2.4 b
POSITIEWE NASIEN vanaf VRAAG 5.2.4 b

$n(H_2)_{produced/berei} = V/V_m$ = 0,06/24,3✓ = $2,47 \times 10^{-3}$ mol (0,002)

$n(HC\ell)_{reacted/gereageer}$ = 2 x $2,47 \times 10^{-3}$✓ Ratio/*Verhouding*
= $4,94 \times 10^{-3}$ mol (0,004)

$n(HC\ell)_{remaining/oorgebly} = n_{initial/begin} - n_{produced/berei}$
= 0,04 – $4,94 \times 10^{-3}$✓
= 0,03506 mol (0,036)

m = nM = 0,03506 x 36,5✓= 1,28 g✓ **Range/*Gebied*** (1,28–1,314 g) (5)

5.2.5 The minimum energy required to start a chemical reaction. ✓✓
Die minimum energie benodig om 'n reaksie te begin. **(2 or/*of* 0)** (2)

5.2.6 Experiment/*Eksperiment* **III** ✓ (1)

5.2.7
- A catalyst ✓ provides an alternative pathway of lower activation energy(E_A). ✓
  'n Katalisator verskaf 'n alternatiewe pad van laer aktiveringsenergie.
- More particles will have sufficient/enough kinetic energy(E_k) to react. ✓ /More particles with $E_k \geq E_A$.
  Meer deeltjies het voldoende(genoegsame) kinetiese energie(E_k) om te reageer./Meer deeltjies het $E_k \geq E_A$.
- More effective collisions per unit time/second. ✓
  Meer effektiewe botsings per eenheidstyd/sekonde.

  OR/*OF*

  Rate/frequency of effective collisions increases.
  Tempo/frekwensie van effektiewe botsings neem toe. (4)

[27]

QUESTION/*VRAAG 6*

6.1 Stage at which the rate of forward reaction equals the rate of reverse. ✓✓
Die toestand/stadium in 'n chemiese reaksie wanneer die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie.

OR/*OF*

The stage where the concentrations/quantities of reactants and products remain constant.
Die toestand wanneer die konsentrasies/hoeveelhede van reaktanse en produkte konstant bly. **(2 or/*of* 0)** (2)

6.2 Closed system ✓/*Geslote sisteem*
Reversible reaction ✓/*Omkeerbare reaksie.* (2)

6.3.1 NO EFFECT ✓/*GEEN EFFEK* (1)

6.3.2 INCREASES ✓/*TOENEEM* (1)

6.4.1 REVERSE ✓/TERUGWAARTSE (1)

6.4.2 Increase in pressure ✓ /Decrease volume; Addition of a catalyst. ✓
Verhoog druk/Afname in volume; Byvoeging van 'n katalisator. (2)

6.5.1 LOW (yield) ✓/*LAE (opbrengs)*
K_c is low. ✓/K_c *is laag.* (2)

6.5.2

Marking Criteria/Nasienriglyne:

- Divide by 34 to calculate $n(H_2S)_{equilibrium}$. ✓
  Verdeel deur 34 om $n(H_2S)_{ewewig}$ te bereken.
- Use mole ratio H_2:H_2S/*Gebruik mol verhouding H_2:H_2S* ✓ *(1 : 1)*
- Divide $n(H_2S)_{equilibrium}$ by V./*Verdeel $n(H_2S)_{ewewig}$ deur V.* ✓
- Correct K_c expression/*Korrekte K_c uitdrukking.* ✓
- Substitution of K_c-value./*Vervanging van K_c waarde.* ✓
- Substitution into Kc expression/*Substitueer in K_c uitdrukking.* ✓
- Calculate /*Bereken* $n(H_2)_{equilibrium/ewewig}$ ✓
- Final answer/*Finale antwoord* $n(H_2)_{initial/begin}$ = 2,45 mol ✓

OPTION/*OPSIE* 1

$n(H_2S)_{equilibrium/ewewig}$ = m/M = 17/34 ✓= 0,5 mol

	H_2	S	H_2S	
$n_{initial/begin}$ (mol)			0	
Δn (mol)	0,5	0,5	0,5	ratio/ *verhouding* ✓
$n_{equilibrium/ewewig}$(mol)			0,5	
$c_{equilibrium/ewewig}$ ($mol.dm^{-3}$)	$n_{equilibrium/ewewig}$/**V**		0,5/**V**	÷**V** ✓

$K_c = [H_2S]/[H_2]$ ✓

$2,56 \times 10^{-1}$ ✓ = (0,5/**V**)/($n(H_2)_{equilibrium/ewewig}$/**V**) ✓

$n(H_2)_{equilibrium/ewewig}$ = 1,95 mol ✓

$n(H_2)_{initial/begin}$ = 0,5 + 1,95 = 2.45 mol ✓ (8)

6.5.3 **POSITIVE MARKING from QUESTION 6.5.2**
POSITIEWE NASIEN vanaf VRAAG 6.5.2

90/100 $n_i(S)$ ✓ = $n_i(S) – 0,5$ ✓

$n_i(S)$ = 5 mol ✓ (3)

6.5.4 Graph/*Grafiek* **Q**✓

- As temperature increases, K_c decreases. ✓
  Indien die temperatuur toeneem, neem K_c af.
- [H_2S] decreases✓/[H_2] increases.
  *[H_2S] neem af**/** [H_2] verhoog.*
- Reverse reaction is favoured by an increase in temperature. ✓
  Terugwaartse reaksie word bevoordeel deur ŉ verhoging in temperatuur. (4)

[26]

QUESTION/*VRAAG* 7

7.1.1 Hydrolysis ✓/*Hidrolise* (1)

7.1.2 Transfer of proton✓(H^{+}) occurs./ CO_3^{2-} gains a proton / H_2O loses a proton.
Oordrag van proton(H^{+}) vind plaas/CO_3^{2-} ontvang 'n proton/H_2O verloor 'n proton(H^{+}). (1)

7.1.3 OH^-✓ (1)

7.1.4 $K_b < 1 \times 10^{-14}$✓ (1)

7.1.5 Substance that can act either as an acid or base./ ✓✓
'n Stof wat as beide suur of basis kan optree. (2)

7.1.6 H_2CO_3 ✓ (1)

7.1.7 CO_3^{-2} ✓ (1)

7.2.1 An acid that donates TWO protons/H^+/H_3O^+-ions. ✓✓
'n Suur wat TWEE protone/H^+/H_3O^+-ione vrystel. (2)

7.2.2 $pH = -\log[H_3O^+]$✓
$1{,}3$✓$= -\log[H_3O^+]$
$[H_3O^+] = 10^{-1{,}3}$

$[OH^-][H_3O^+] = 1 \times 10^{-14}$
$[OH^-] \times 10^{-1{,}3} = 1 \times 10^{-14}$✓
$[OH^-] = 10^{-12{,}7}\ mol.dm^{-3}$✓ $= 1{,}995 \times 10^{-13}\ mol.dm^{-3}$ (4)

7.3.1 **POSITIVE MARKING FROM Q 7.2.2/*POSITIEWE NASIEN VANAF V7.2.2***
OPTION /OPSIE 1

$[H_3O^+] = 10^{-1{,}3}\ mol.dm^{-3}$
$[Acid] = ½ \times 10^{-1{,}3}$ ✓ $= 0{,}0251\ mol.dm^{-3}$

Dilution $c_1V_1 = c_2V_2$
$0{,}0251(8) = c_2 \times 100$✓
$c_2(dilute) = 2{,}008 \times 10^{-3}\ mol.dm^{-3}$

$n(acid\ reacting) = cV = 2{,}008 \times 10^{-3} \times 25/1000$✓ $= 5{,}02 \times 10^{-5}\ mol$

$n(base\ reacting) = 2 \times 5{,}02 \times 10^{-5}$ ✓$= 1{,}004 \times 10^{-4}\ mol$

$c(base) = n/V = 1{,}004 \times 10^{-4}/14{,}2 \times 10^{-3}$ ✓ $= 7{,}07 \times 10^{-3}\ mol.dm^{-3}$✓ (6)

OPTION/OPSIE 2

$[H_3O^+] = 10^{-1,3}$ mol.dm^{-3}
[Acid] = ½ x$10^{-1,3}$ ✓ = 0,0251 mol.dm^{-3}

$c_1V_1 = c_2V_2$
$(0,0251)(8) = c_2 \times 100$ ✓
$c_2 = 2,008 \times 10^{-3}$ mol.dm^{-3}

$$\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$$

$$\frac{2,008 \times 10^{-3}\,(25)}{c_b \times 14,2} = \frac{1}{2}$$ ✓ ✓ ✓

$c_b = 7,07 \times 10^{-3}$ mol.dm^{-3} ✓

Range/*Gebied* ($7,04 \times 10^{-3}$ to/*tot* $7,07 \times 10^{-3}$ mol.dm^{-3})

7.3.2 **B**✓
Titration of a strong base and a strong acid ✓ (solution at end point neutral.)
Titrasie van 'n sterk basis en 'n sterk suur (oplossing is neutraal by eindpunt.) (2)

[22]

TOTAL/*TOTAAL*: 150