

SA EXAM PAPERS This Paper was downloaded from SAEXAMPAPERS
SA's Leading Past Year

Exam Paper Portal



You have Downloaded, yet Another Great Resource to assist you with your Studies 😊

Thank You for Supporting SA Exam Papers

Your Leading Past Year Exam Paper Resource Portal

Visit us @ www.saexampapers.co.za



**SA EXAM
PAPERS**

SA EXAM PAPERS

Proudly South African



This Paper was downloaded from SAEXAMPAPERS

GAUTENG PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

**JUNE EXAMINATION
GRADE 12**

2026

PHYSICAL SCIENCES: CHEMISTRY

(PAPER 2)

PHYSICAL SCIENCES P2



C2842E

TIME: 3 hours

MARKS: 150

14 pages + 2 data sheets

X05



SA EXAM PAPERS

Proudly South African

**INSTRUCTIONS AND INFORMATION**

1. This question paper consists of SEVEN questions. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in the question paper.
4. Leave ONE line open between subquestions, e.g., between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round-off your FINAL numerical answers to a minimum of TWO decimal places.
9. Provide brief discussions, etc. where required.
10. You are advised to use the attached DATA SHEETS.
11. Write neatly and legibly.

**SA EXAM PAPERS**

Proudly South African

**QUESTION 1: MULTIPLE-CHOICE QUESTIONS**

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A – D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, e.g. 1.11 E.

1.1 Which of the following is an example of an unsaturated hydrocarbon?

- A C_2HCl_3
- B C_4H_8
- C C_3H_8
- D C_3H_7OH

(2)

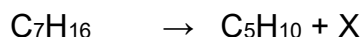
1.2 A compound with the molecular formula $C_6H_{12}O$ could be either of the following:

- i. An ester
- ii. A ketone
- iii. An aldehyde

- A (i) only
- B (i) and (ii) only
- C (ii) and (iii) only
- D (i), (ii) and (iii)

(2)

1.3 The equation below represents the cracking of a long hydrocarbon chain.

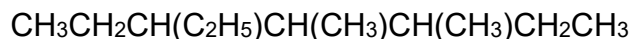


Which of the following represents compound X?

- A Ethanol
- B Ethyne
- C Ethene
- D Ethane

(2)

1.4 Give the IUPAC name of the organic compound below.



- A 4-ethyl-2,3-dimethylheptane
- B 3-ethyl-4,5-dimethylheptane
- C 4-ethyl-5,6-dimethylheptane
- D 2,3-dimethyl-4-ethylheptane

(2)

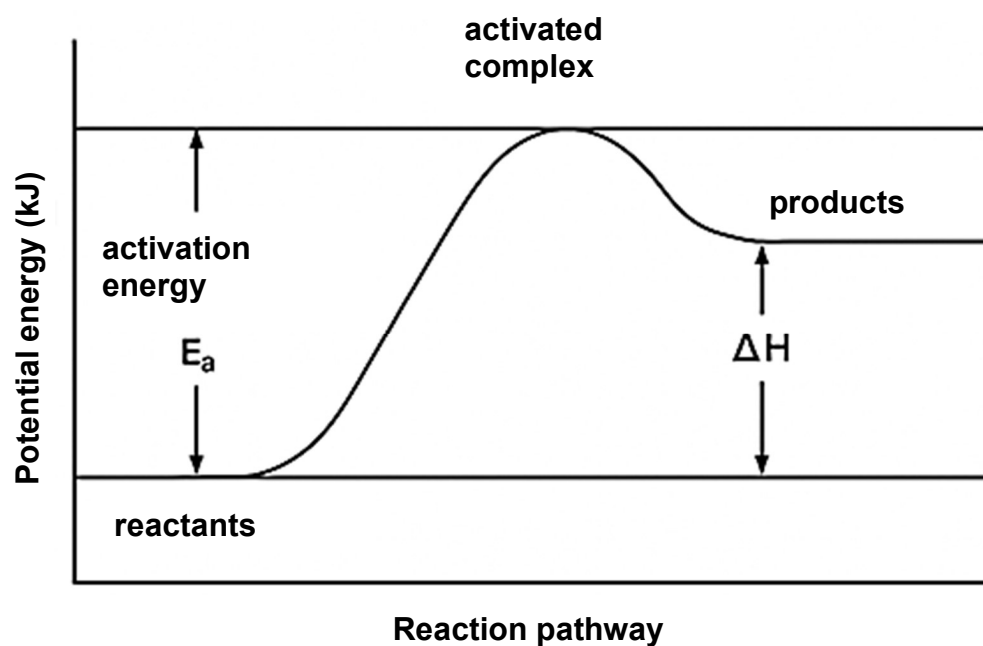
1.5 Which of the following compounds has the strongest Van der Waals forces?

- A $CH_3(CH_2)_2CH_3$
- B $CH_3COCH_2CH_3$
- C $CH_3COOCH_2CH_3$
- D $CH_3CH(OH)CH_2CH_3$

(2)



- 1.6 The diagram below shows the energy profile of an endothermic reaction.



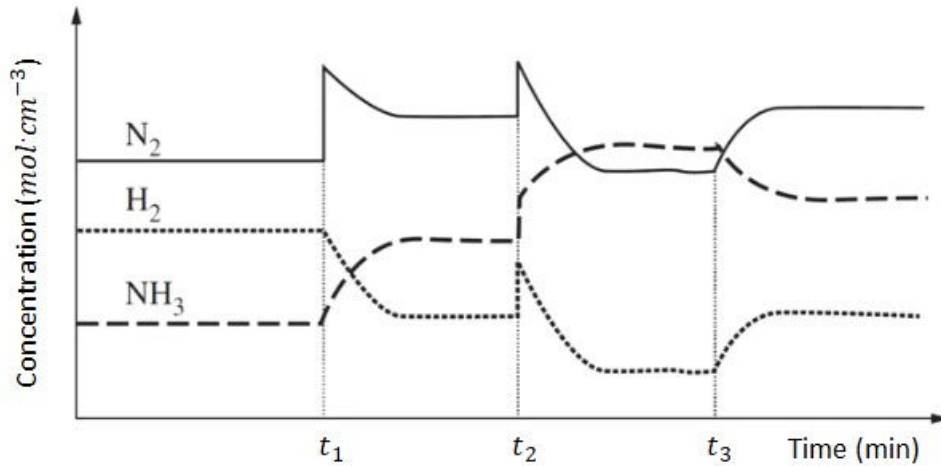
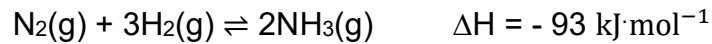
Which of the following correctly describes the effect of a CATALYST on the activation energy, and the enthalpy change for the reverse reaction?

	ACTIVATION ENERGY	ENTHALPY CHANGE
A	Increases	Positive
B	Decreases	Negative
C	Decreases	Remains unchanged
D	Increases	Remains unchanged

(2)



- 1.7 The graph below shows the concentrations of N_2 , H_2 , and NH_3 against time for the reaction:

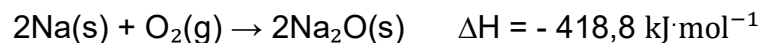


Which is the CORRECT representation for each time in the graph?

	t_1	t_2	t_3
A	$[\text{NH}_3]$ is increased	Pressure is decreased	Temperature is decreased
B	$[\text{N}_2]$ is increased	Pressure is increased	Temperature is increased
C	$[\text{NH}_3]$ is decreased	Temperature is increased	Pressure is increased
D	$[\text{N}_2]$ is increased	Temperature is decreased	Pressure is decreased

(2)

- 1.8 The reaction between sodium and oxygen is:



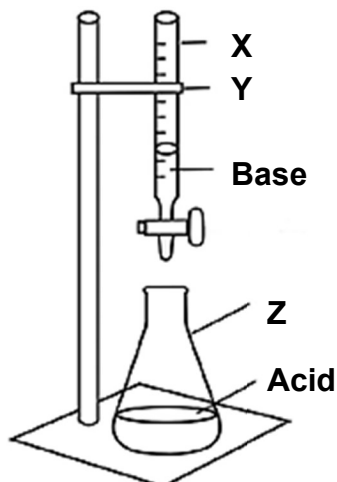
If the equilibrium concentration of $\text{O}_2(\text{g})$ at 25°C is equal to $Y \text{ mol}\cdot\text{dm}^{-3}$, the value of the equilibrium constant at this temperature will be equal to:

A	$\frac{1}{[Y]}$
B	$\frac{1}{[Y]^2}$
C	$[Y]^2$
D	Y

(2)



1.9 Learners conduct a titration experiment using the apparatus below.



The correct labels for **X**, **Y**, and **Z** are ...

	X	Y	Z
A	Burette	Tripod stand	Beaker
B	Pipette	Tripod stand	Conical flask
C	Pipette	Retort stand	Beaker
D	Burette	Retort stand	Conical flask

(2)

1.10 According to the Lowry-Brønsted theory, a base ...

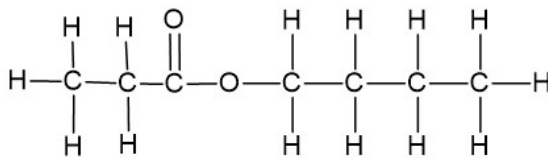
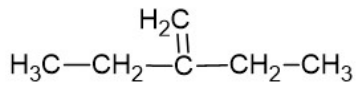
- A is a proton donor.
- B is a proton acceptor.
- C produces hydroxide ions in an aqueous solution.
- D produces hydrogen ions in an aqueous solution.

(2)
[20]



QUESTION 2 (Start on a new page.)

The letters **A** to **H** in the table below represent organic compounds.

A	Propanoic acid	B	$\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{COCH}_3$
C		D	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$
E	$\text{CH}_3\text{CHBrCH}_2\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_3$	F	$\text{C}_7\text{H}_{14}\text{O}$
G	$\text{CH}_3(\text{CH}_2)_4\text{CH}_3$	H	

- 2.1 Define the term *homologous series*. (2)
- 2.2 What is the name of the functional group of the homologous series to which compound **A** belongs? (1)
- 2.3 Using the table above, write down the letter that represents each of the following:
- 2.3.1 An aldehyde (1)
- 2.3.2 An ester (1)
- 2.3.3 An unsaturated hydrocarbon (1)
- 2.3.4 A chain isomer of 2,2-dimethylbutane (1)
- 2.4 Write down the IUPAC name of:
- 2.4.1 Compound **C** (2)
- 2.4.2 Compound **E** (2)
- 2.5 Compound **D** reacts with a primary alcohol containing four carbon atoms in the presence of a catalyst.

Write down the:

- 2.5.1 Name of the catalyst (1)
- 2.5.2 Type of reaction (1)
- 2.5.3 Name AND formula of the inorganic product that is formed (2)



- 2.6 Compounds **B** and **F** are isomers.
- 2.6.1 Define the term *structural isomers*. (2)
- 2.6.2 Identify the type of isomers. Write only CHAIN, POSITIONAL or FUNCTIONAL. (1)
- 2.6.3 Write down the structural formula of compound **F**. (2)
- 2.7 Write down the empirical formula of compound **G**. (2)
- 2.8 Give the general formula of compound **H**. (1)
- 2.9 Compound **G** undergoes complete combustion. Using molecular formulae, write down the balanced equation for this reaction. (3)
- [26]**

QUESTION 3 (Start on a new page.)

The melting points of five organic compounds with known molar masses were determined during a practical investigation. The results are recorded in the table below.

	COMPOUND	MOLAR MASS (g·mol ⁻¹)	MELTING POINT (°C)
P	CH ₃ CH ₂ CH ₃	44	-188
Q	CH ₃ CH ₂ CH ₂ CH ₃	58	-138
R	CH ₃ CH ₂ CH ₂ CH ₂ CH ₃	72	-130
S	CH ₃ CH(CH ₃)CH ₂ CH ₃	72	-160
T	CH ₃ C(CH ₃) ₂ CH ₃	72	-16

- 3.1 Define the term *melting point*. (2)
- 3.2 For compounds **P**, **Q** and **R**, write down:
- 3.2.1 The dependent variable (1)
- 3.2.2 The controlled variable (1)
- 3.2.3 An investigative question (2)
- 3.2.4 An explanation for the trend of the melting points of these compounds. (3)



3.3 Consider compound **R** and compound **S**.

3.3.1 Which compound will have a higher boiling point? (1)

3.3.2 Which compound will have a lower vapour pressure? (1)

3.3.3 Explain the answer to QUESTION 3.3.1. (3)

3.4 Consider compound **T**:

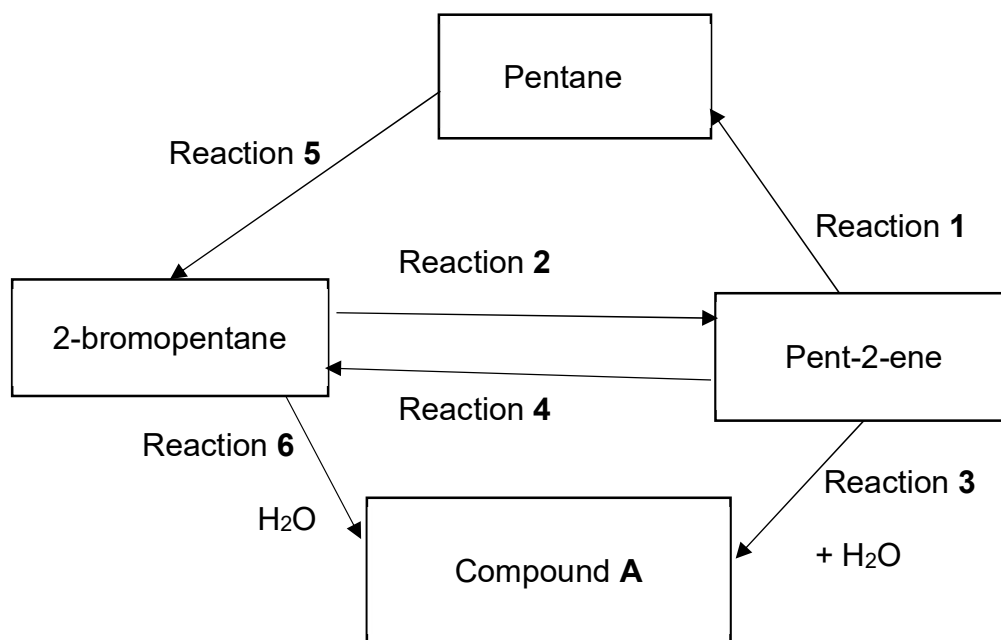
3.4.1 To which homologous series does this compound belong? (1)

3.4.2 Write down the IUPAC name of this compound. (2)

[17]

QUESTION 4 (Start on a new page.)

The flow diagram below represents 6 different organic reactions undergone by various organic compounds.



4.1 Name the TYPE of addition reaction that takes place at:

4.1.1 Reaction 1 (1)

4.1.2 Reaction 3 (1)

4.1.3 Reaction 4 (1)





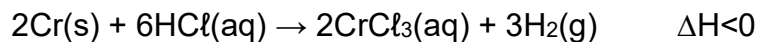
- 4.2 For reaction **2**, write down the:
- 4.2.1 Type of reaction that takes place (1)
 - 4.2.2 Two reaction conditions required (2)
 - 4.2.3 Balanced chemical equation using STRUCTURAL FORMULAE (5)
- 4.3 Consider reaction **3**.
- 4.3.1 To which homologous series does compound **A** belong? (1)
 - 4.3.2 Write down the structural formula of compound **A**. (2)
 - 4.3.3 Write down the IUPAC name of compound **A**. (2)
- 4.4 Write down a balanced chemical equation for reaction **4** using condensed structural formulae. (4)
- 4.5 Name the type of reaction represented by reaction **5**. (1)
- 4.6 Consider reaction **6**.
- 4.6.1 Identify the type of substitution reaction. (1)
 - 4.6.2 Suggest an alternative reactant if water is not available. (1)
- [23]**



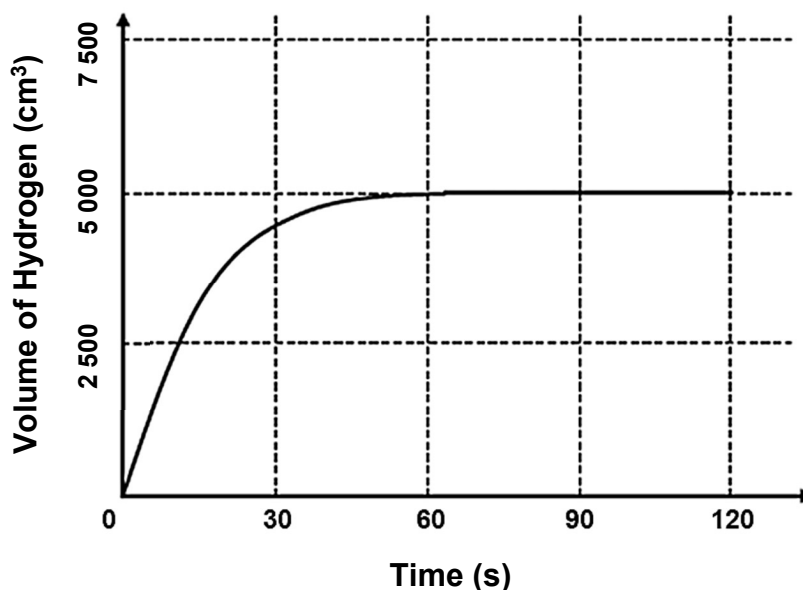
QUESTION 5 (Start on a new page.)

When chromium metal is added to hydrochloric acid, it undergoes a reaction that produces a characteristic green solution of chromium(III)chloride, as well as hydrogen gas.

The balanced equation can be represented as follows:



- 5.1 Define the term *reaction rate*. (2)
- 5.2 Name TWO experimental methods that could be used to measure the rate of this reaction in a school laboratory. (2)
- 5.3 In the experiment, 8,67 g of powdered chromium metal was added to excess hydrochloric acid in a flask. The reaction produced hydrogen gas, which was collected at STP. The volume of hydrogen gas formed was measured at regular time intervals, and the results were used to plot the graph shown below.

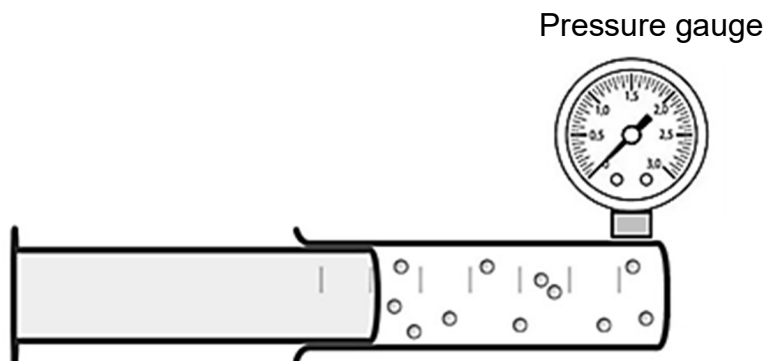


- 5.3.1 Calculate the average rate (in dm^3s^{-1}) of the above reaction for the first 60 s. (4)
- 5.3.2 Calculate the mass of hydrogen gas produced. (4)
- 5.3.3 Calculate the percentage yield of hydrogen gas in this reaction. (5)
- 5.3.4 If a LUMP of chromium is used, how will this affect the rate of the reaction? Choose from INCREASE, DECREASE or REMAIN THE SAME. (1)
- 5.3.5 Use the collision theory to fully explain the answer to QUESTION 5.3.4. (3)

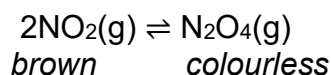


QUESTION 6 (Start on a new page.)

The equilibrium mixture of nitrogen dioxide (NO_2), a brown gas with a sharp, pungent smell, and colourless dinitrogen tetroxide (N_2O_4) is investigated using a sealed industrial gas syringe. This colour change allows the progress of the equilibrium to be observed visually.



The balanced equation is given as follows:



- 6.1 State *Le Chatelier's principle*. (2)
- 6.2 Is the system above OPEN or CLOSED? Give a reason for the answer. (2)
- 6.3 How will EACH of the following changes affect the concentration of $\text{N}_2\text{O}_4(\text{g})$ at equilibrium?
Choose from INCREASES, DECREASES or REMAINS THE SAME.
- 6.3.1 The plunger is pressed to decrease the volume. (1)
- 6.3.2 A catalyst is added. (1)
- 6.4 The syringe is now placed into a water bath filled with ice cubes. The gas in the syringe starts to turn colourless.
- 6.4.1 Is the forward reaction ENDOTHERMIC or EXOTHERMIC? (1)
- 6.4.2 Using *Le Chatelier's principle*, explain the answer to QUESTION 6.4.1. (3)



- 6.5 The sealed industrial gas syringe is removed from the water bath and allowed to reach equilibrium at 298 K. At equilibrium, the mixture contains 0,52 moles of NO_2 and 0,08 moles of N_2O_4 . The volume of the syringe is 1 000 cm^3 .

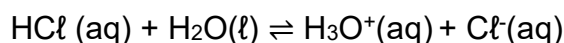
The syringe is then placed in a hot water bath at 373 K. A new equilibrium is established at which point the mixture contains 8,28 g of N_2O_4 .

Calculate the:

- 6.5.1 Number of moles of N_2O_4 at the new equilibrium (3)
- 6.5.2 Value of the equilibrium constant, K_c , at this temperature (7)
- [20]**

QUESTION 7 (Start on a new page.)

Hydrochloric acid (HCl) is a strong acid. It dissolves in water, as shown in the equation below:



- 7.1 Explain what is meant by the term *strong acid*. (2)
- 7.2 Identify ONE conjugate acid-base pair. (2)
- 7.3 Hydrochloric acid is a monoprotic acid. Give a reason for this. (1)



7.4 A 150 cm³ hydrochloric acid, HCl(aq), solution with a concentration of 0,8 mol·dm⁻³ is available for laboratory experiments.

7.4.1 Calculate the number of moles of hydrochloric acid in this solution. (3)

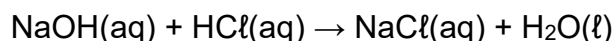
All of the 150 cm³ hydrochloric acid solution, HCl(aq), is allowed to react with **X** g of calcium carbonate, CaCO₃(s), according to the balanced chemical equation:



The hydrochloric acid solution is found to be in excess.

The excess hydrochloric acid, HCl(aq), is neutralised by a 60 cm³ sodium hydroxide, NaOH(aq), solution with a concentration of 0,5 mol·dm⁻³.

The neutralisation reaction is as shown below:



7.4.2 Calculate the value of **X**. (7)

7.4.3 Will the salt that is formed in the neutralisation reaction undergo hydrolysis? Give a reason for the answer. (2)

7.4.4 Bromothymol blue is used as the indicator. Explain why it is the most suitable indicator for this titration by referring to the pH at the equivalence point. (2)

7.5 In aqueous solutions, the concentrations of hydronium ions and hydroxide ions determine the acidity or alkalinity of a solution.

Calculate the pH of potassium hydroxide, KOH(aq), solution with concentration of 2,5 x 10⁻⁷ mol·dm⁻³ at a temperature of 298 K. (4)
[23]

TOTAL: 150



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

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

TABLE 2: FORMULAE/TABEL 2: FORMULES

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ OR/OF $c = \frac{m}{MV}$	$n = \frac{V}{V_M}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$\text{pH} = -\log[\text{H}_3\text{O}^+]$
$K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = 1 \times 10^{-14}$ at/by 298 K	
$E_{\text{cell}}^\theta = E_{\text{cathode}}^\theta - E_{\text{anode}}^\theta / E_{\text{sel}}^\theta = E_{\text{katode}}^\theta - E_{\text{anode}}^\theta$ or/of $E_{\text{cell}}^\theta = E_{\text{reduction}}^\theta - E_{\text{oxidation}}^\theta / E_{\text{sel}}^\theta = E_{\text{reduksie}}^\theta - E_{\text{oksidasie}}^\theta$ or/of $E_{\text{cell}}^\theta = E_{\text{oxidising agent}}^\theta - E_{\text{reducing agent}}^\theta / E_{\text{sel}}^\theta = E_{\text{oksideermiddel}}^\theta - E_{\text{reduseermiddel}}^\theta$	


SA EXAM PAPERS

Proudly South African

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

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
(I)	(II)															(VIII)	
1 H 1,01	2 He 4	3 Li 7	4 Be 9	5 B 11	6 C 12	7 N 14	8 O 16	9 F 19	10 Ne 20	11 Na 23	12 Mg 24	13 Al 27	14 Si 28	15 P 31	16 S 32	17 Cl 35,5	18 Ar 40
19 K 39	20 Ca 40	21 Sc 45	22 Ti 48	23 V 51	24 Cr 52	25 Mn 55	26 Fe 56	27 Co 59	28 Ni 59	29 Cu 63,5	30 Zn 65	31 Ga 70	32 Ge 73	33 As 75	34 Se 79	35 Br 80	36 Kr 84
37 Rb 85	38 Sr 88	39 Y 89	40 Zr 91	41 Nb 92	42 Mo 96	43 Tc 98	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	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	81 Tl 204	82 Pb 207	83 Bi 209	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89 Ac															

KEY/SLEUTEL

Atomic number/
Atoomgetal

Electronegativity/
Elektronegatiwiteit

Symbol/
Simbool

Approximate relative atomic mass/
Benaderde relatiewe atoommassa

29	CU	63,5
----	-----------	------