GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION

JUNE 2024

GRADE 10

PHYSICAL SCIENCES

TIME: **2 hours**

MARKS: **100**

13 pages + 3 data sheets

P.T.O.

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of EIGHT questions. Answer ALL the questions.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Write neatly and legibly.
6. You may use a non- programmable calculator.
7. You may use appropriate mathematical instruments.
8. USE the DATA SHEETS that are attached.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your FINAL numerical answers to a minimum of TWO decimal places.

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 – 1.10) in the ANSWER BOOK, e.g. 1.11 E.

1.1 For which one of the quantities given below is the CORRECT unit of measurement?

	QUANTITY	UNIT
A	Current	$A \cdot s^{-1}$
B	Energy	kW
C	Potential difference	V
D	Resistance	$V \cdot s$

(2)

1.2 A battery is marked 12 V. Which ONE of the following is the correct meaning of 12 V?

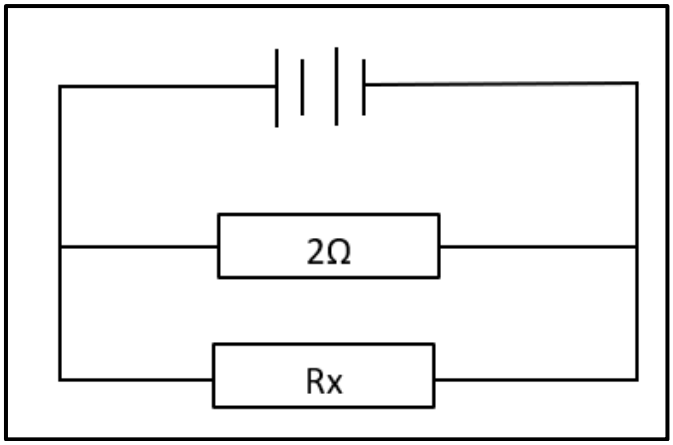
A This means that 12 charges pass the battery.
B This means that 12 J of electrical work is done per coulomb of charge.
C This means that 12 coulomb of charges passes the battery each second.
D This means that 12 J of electrical energy is converted to light and heat. (2)

1.3 In a small electrical appliance, a charge of 3 C flows through a light bulb with a resistance of 6 Ω, in 12 seconds. Which ONE of the following is the correct combination of the current through and potential difference applied across the bulb?

	Current (A)	Potential difference (V)
A	0,25	1,5
B	72	1,5
C	1,5	0,25
D	2	3

(2)

1.4 Consider the circuit diagram given below consisting of two resistors in parallel:



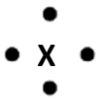
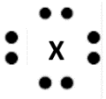
The effective resistance of the circuit is 1,2 Ω. Which ONE of the following correctly represents the resistance of unknown resistor Rx?

A 4 Ω
B 5 Ω
C 1 Ω
D 3 Ω (2)

1.5 Salt crystals (such as NaCℓ) hold together so well because the anions are strongly attracted to …

A protons in the neighbouring nucleus.
B free electrons in the crystals.
C neighbouring anions.
D neighbouring cations. (2)

1.6 Which Lewis dot diagram represents an atom **X** with the highest electronegativity?

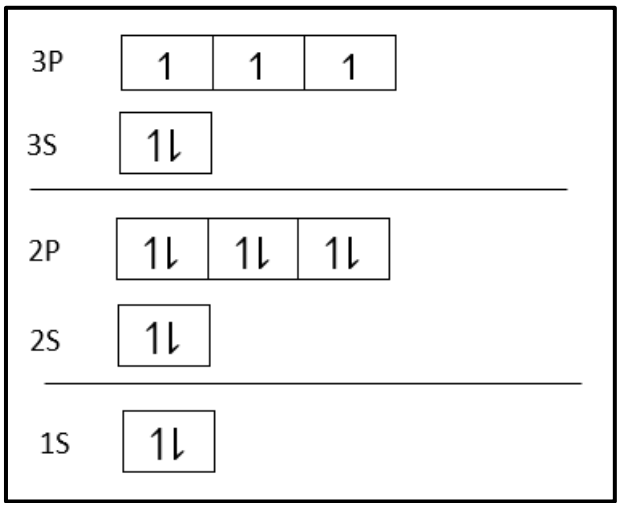
A	B	C	D
			

(2)

1.7 ONE mole of ANY substance contains …

A $6,02 \times 10^{22}$ particles.
B $6,02 \times 10^{23}$ particles.
C $6,02 \times 10^{24}$ particles.
D $6,02 \times 10^{25}$ particles. (2)

1.8 The Aufbau diagram for an element is given below:



The number of valence electrons for the above element is …

A 3.
B 7.
C 2.
D 5. (2)

1.9 The minimum energy required to remove an electron from the outermost orbital of an atom in a gaseous state is …

A kinetic energy.
B ionisation energy.
C electron affinity.
D potential energy. (2)

1.10 The atomic structure of atoms Q, R, S and T are shown in the table below:

Atom	Number of protons	Number of neutrons	Number of electrons
Q	6	7	6
R	7	7	7
S	6	8	6
T	8	8	8

Which TWO atoms are isotopes?

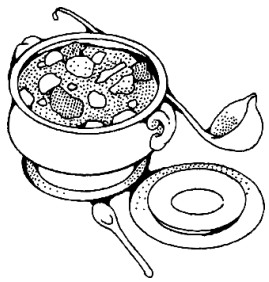
A	Q and S
B	Q and T
C	R and T
D	R and S

(2)
[20]

QUESTION 2

In our everyday lives we see mixtures all the time. A mixture of different foods such as meat and vegetables is called a stew; a mixture of water, salt and other substances can be found in seawater, and a mixture of gases such as carbon dioxide, oxygen and nitrogen is air.

STEW



SEAWATER



AIR



2.1 From the examples given, identify one homogeneous mixture. (1)

2.2 Write the formulae of the following substances:

2.2.1 water (1)

2.2.2 nitrogen (1)

2.3 Classify the following substances as pure or impure:

2.3.1 table salt (1)

2.3.2 oxygen (1)

2.4 Explain your answer to QUESTION 2.3.2. (2)
[7]

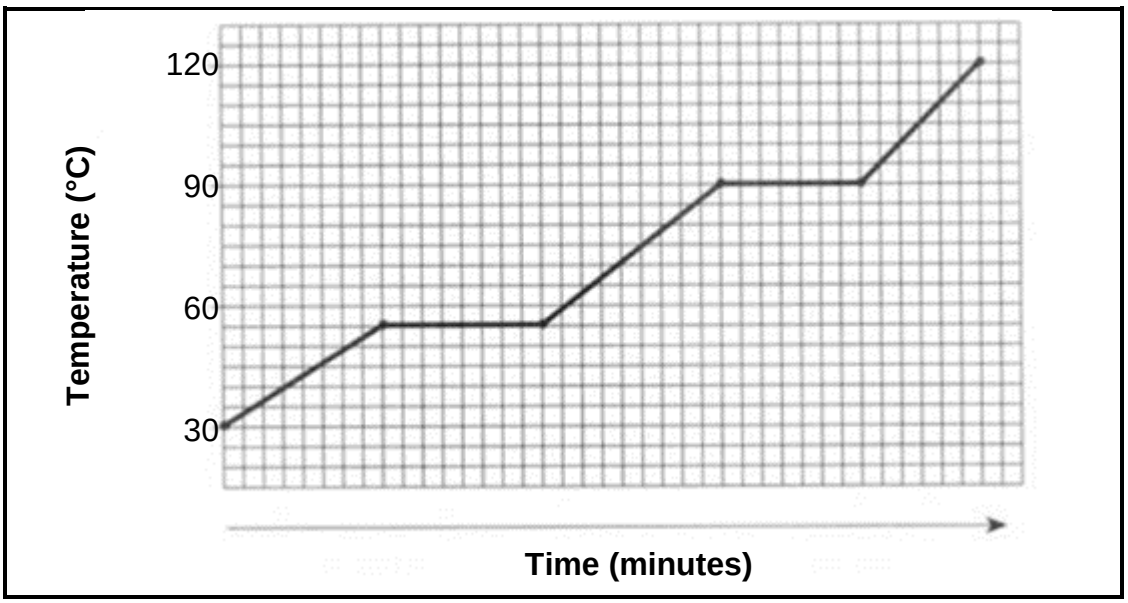
QUESTION 3

Matter exists in one of three states, namely **X**, **Y** and **Z**. Matter in state **X** has a fixed shape and volume. Matter in state **Y** takes on the shape of the container that it is in. Matter in state **Z** completely fills the container that it is in. Matter can change between these states by either adding heat or removing heat. This is known as a **change of state**.

3.1 Identify the state of matter **Y**. (1)

3.2 Define the term *boiling point*. (2)

The graph below represents the heating curve of a substance **A** that starts below its melting point.



3.3 What is the boiling point of this substance? (1)

3.4 In what state is this substance in the graph at the following temperatures?

3.4.1 45 °C (1)

3.4.2 65 °C (1)

3.4.3 100 °C (1)

3.5 Draw the cooling curve of substance **B** using the information from the table below:

Substance	Boiling point (° C)	Melting point (° C)
B	180	(3)

(3)
[10]

QUESTION 4

Consider the following substances given in the table below:

KBr	NH_3	Cu	HF

4.1 Define *covalent bond*. (2)

4.2 From the table given above, write the FORMULAE for the:

4.2.1 Substance(s) that have a covalent bond. (1)

4.2.2 Substance with metallic bonding. (1)

4.2.3 Ionic compound. (1)

4.3 Give a reason for the answer to QUESTION 4.2.3 above. (1)

4.4 Define ionic *bonding*. (2)

4.5 Draw Lewis dot structures for:

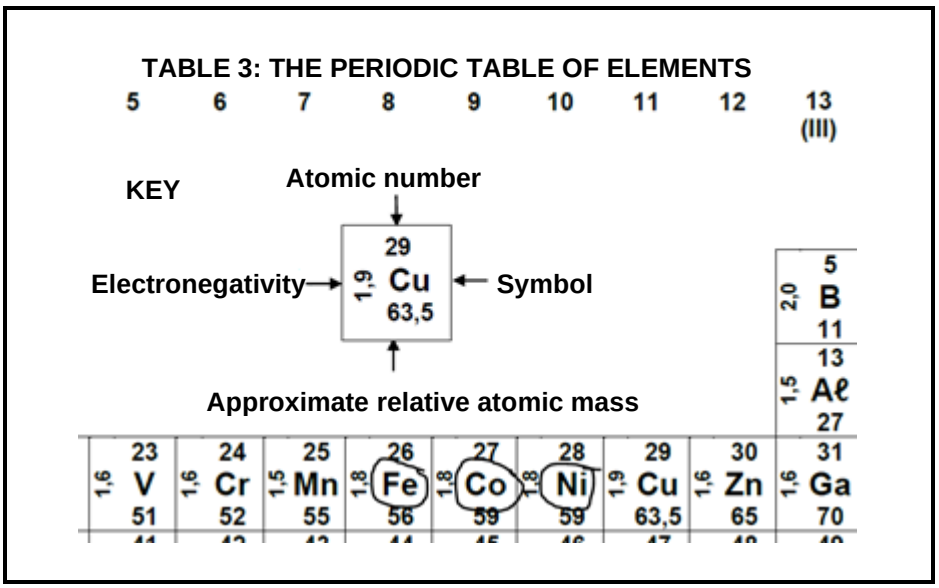
4.5.1 NH_3 (2)

4.5.2 KBr (2)

[12]

QUESTION 5

The image below shows an extract of Table 3 of the Periodic Table of Elements and focuses on the three magnetic elements.



5.1 Describe how to test and classify these elements as magnetic. (2)

5.2 Define the term:

5.2.1 *atomic number*. (1)

5.2.2 *isotopes*. (2)

5.3 Natural nickel consists of five stable isotopes as shown in the table below:

Isotopes	nickel-58	nickel-60	nickel-61	nickel-62	nickel-64
Percentage abundance (%)	68,27	26,10	1,13	3,59	0,91

5.3.1 Give the term that represents the value 58 in nickel-58. (1)

5.3.2 Calculate the relative atomic mass of nickel. (3)

5.4 Write the chemical formula of cobalt (II) chloride. (1)

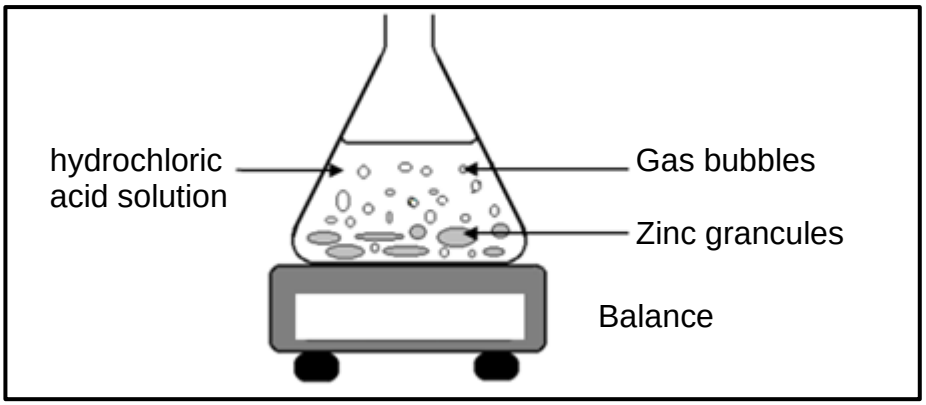
5.5 Draw the Aufbau diagram (orbital box diagrams) of the chlorine atom. (3)

5.6 Determine the charge of iron after removing three electrons from the iron atom. (1)

[14]

QUESTION 6

5 g of zinc granules are added to 400 cm^3 of hydrochloric acid. To investigate the chemical change of the reaction, the change in the mass of the flask containing the zinc and the acid is measured by placing the flask on a reading balance. The reading on the balance shows that there is a decrease in mass during the reaction.



The reaction which takes place is given by the following balanced equation:

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

6.1 Define *one mole*. (2)

6.2 Calculate the:

6.2.1 Concentration of the hydrochloric acid that reacts completely with the 5 g of zinc granules. (4)

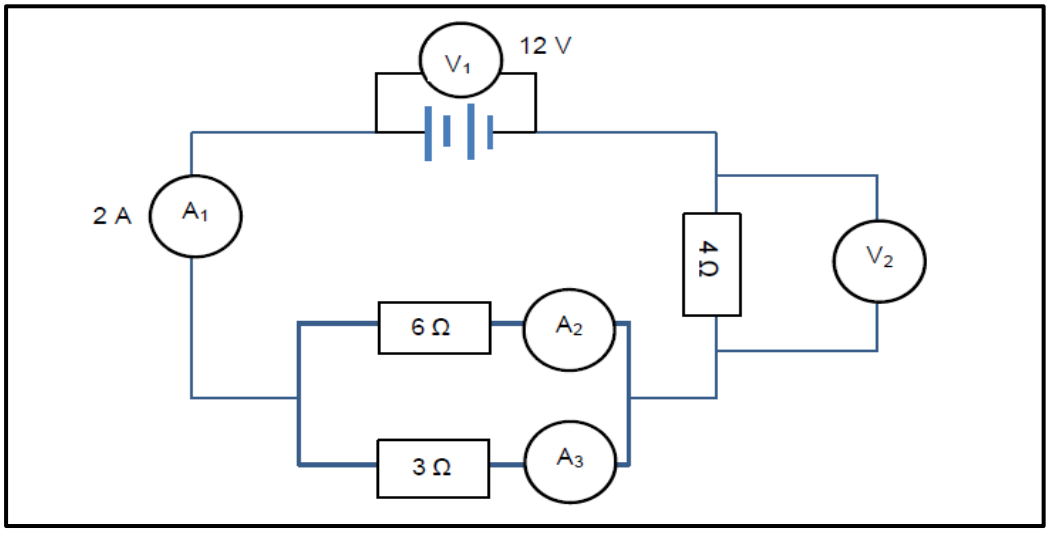
6.2.2 Volume of the gas that is formed if the investigation is performed at STP. (3)

6.2.3 Maximum decrease in the mass of the flask. (2)

[11]

QUESTION 7

In the circuit diagram below the reading on the voltmeter V_1 is 12 V and the reading on the ammeter A_1 is 2 A.



7.1 Define the term *resistance*. (2)

7.2 Calculate the:

7.2.1 Total resistance of the circuit. (3)

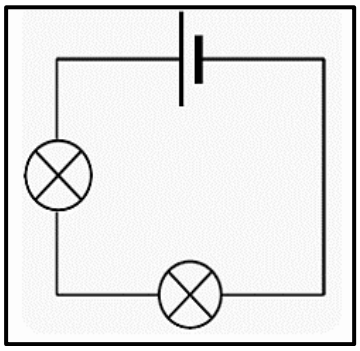
7.2.2 Amount of charge that flows through ammeter A_1 in 60 seconds. (3)

7.3 The 3 Ω is removed from the circuit. How will this change affect the current through A_1? Write down INCREASE, DECREASE or REMAIN THE SAME. Give a reason for the answer. (2)

[10]

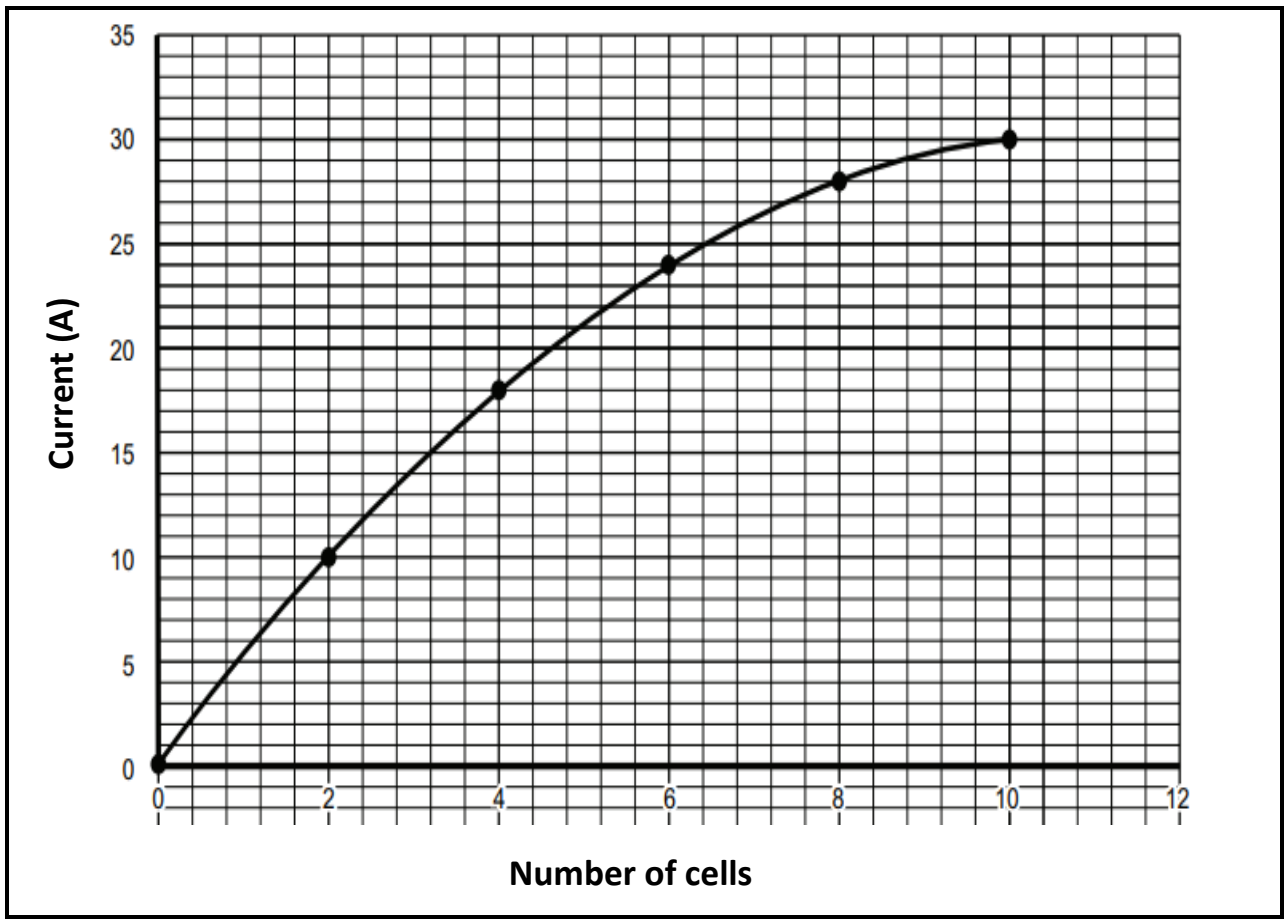
QUESTION 8

A group of learners carried out an investigation to determine the relationship between current and the number of cells added in series. Each cell carries a voltage 1,5 V. The diagram bellow shows the circuit diagram the learners used.



The results are represented in the graph below:

GRAPH OF CURRENT VERSUS NUMBER OF CELLS



8.1 Give a suitable investigation question for this investigation. (2)

8.2 Define the term *emf*. (2)

8.3 Identify the following variables:

8.3.1 Independent variable (1)

8.3.2 Dependent variable (1)

8.4 Predict what will happen to the brightness of the light bulbs as more cells are added into the circuit. (2)

8.5 Use the information on the graph to calculate the total voltage of the circuit that can produce a current of 30 A. (2)

8.6 An ammeter was connected in the circuit and gave a reading of 24 A, in 2 minutes. Calculate the energy dissipated by the circuit. (5)

8.7 Write the conclusion for the investigation. (1)
[16]

TOTAL: 100

END

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)
GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m{\cdot}s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}\ m{\cdot}s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}\ J{\cdot}s$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}\ kg$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

$v = f\lambda$	$T = \frac{1}{f}$
$E = hf$ or/*of* $E = h\frac{c}{\lambda}$	

ELECTROSTATICS/*ELEKTROSTATIKA*

$n = \frac{Q}{e}$ or/*of* $n = \frac{Q}{q_e}$	$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$Q = I\Delta t$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$
$R_s = R_1 + R_2 + \ldots$	$V = \frac{W}{Q}$

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

NAME/*NAAM*	**SYMBOL/*SIMBOOL***	**VALUE/*WAARDE***
Standard pressure *Standaarddruk*	p^{θ}	1,013 x 10^5 Pa
Molar gas volume at STP *Molêre gasvolume by 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 x 10^{-19} C
Avogadro's constant *Avogadro se konstante*	N_A	6,02 x 10^{23} mol^{-1}

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ OR $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$

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

