education

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES (P1 & P2)

CONTROL TEST

MARCH 2026

MARKS: 100

TIME: 2 hours

This question paper consists of 14 pages including data sheets

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INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on the FOLIO PAPER.
2. This question paper consists of EIGHT questions. Answer ALL the questions in the FOLIO PAPER.
3. Start EACH question on a NEW page in the FOLIO PAPER.
4. Number the 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.

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QUESTION 1 : MULTIPLE-CHOICE QUESTIONS

Four 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 number (1.1 – 1.5) in the ANSWER BOOK, for example, 1.6 E.

1.1 Which ONE of the following is NOT TRUE about the frictional force?

A Is proportional to the applied force.

B Is proportional to the normal force.

C Is independent of the area of contact.

D Is independent of the velocity of motion. (2)

1.2 A ball is thrown vertically upwards. Which ONE of the following combination of physical quantities of the ball have NON-ZERO values at its highest point? Ignore the effects of air friction.

A Kinetic energy and time

B Acceleration and weight

C Displacement and momentum

D Potential energy and velocity (2)

1.3 Which ONE of the following is equal to the rate of change of momentum?

A $F_{net} \cdot \Delta t$

B Δp

C $m \cdot a$

D p (2)

1.4 Which ONE of the following organic compounds will RAPIDLY decolourise bromine water?

A CH_2CH_2

B CH_3CH_3

C CH_3CHO

D CH_3COOH (2)

1.5 Which ONE of the following organic compounds has STRUCTURAL ISOMERS?

A Ethanal

B 1,1-dibromoethane

C Propane

D Methanoic acid. (2)

[10]

QUESTION 2 (Start on a new page.)

A satellite of mass 2 $x10^4$ kg orbits around the surface of planet **X** at a distance of 4 000 km. Planet **X** has a mass FOUR TIMES the mass of planet EARTH and a radius which is a THIRD $(\frac{1}{3})$ of the radius of the EARTH.

2.1 State Newton's law of Universal gravitation in words. (2)

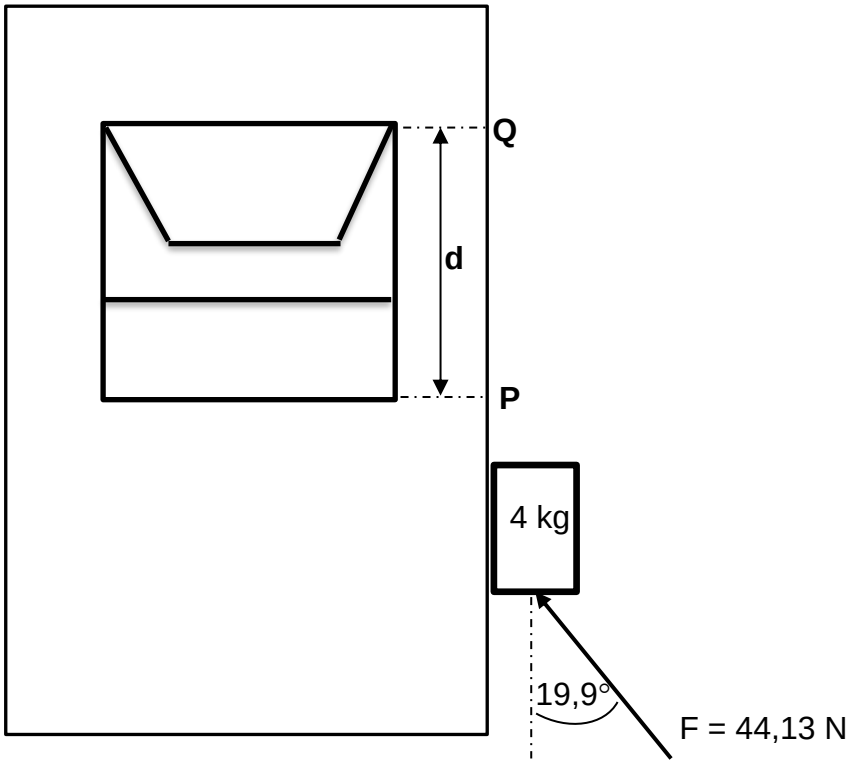
2.2 Calculate the Gravitational force that planet **X** exerts on the satellite when the satellite is at a distance of 4 000 km from the surface of the planet. (4)

2.3 How does the mass of the satellite on the surface of planet **X** compares to the mass of the satellite on the surface of planet EARTH? Write down GREATER THAN, LESS THAN OR EQUAL TO. (1)

[07]

QUESTION 3 (Start on a new page.)

In an experiment to determine the length of a window, a learner pushes a 4 kg block against the wall with a force of 44,13 N at an angle of 19,9° as shown in the diagram below. The block reaches point **P** at a speed of 1,45 $m \cdot s^{-1}$ and travels the distance, **d**, in 0,5 s.



The coefficient of kinetic friction between the wall and the block is 0,1. Ignore the effects of air friction.

3.1 Define kinetic frictional force. (2)

3.2 Draw a labelled free-body diagram indicating all the forces acting on the block whilst moving between point **P** and **Q**. (4)

3.3 Calculate the:

3.3.1 Magnitude of kinetic frictional force acting on the block. (3)

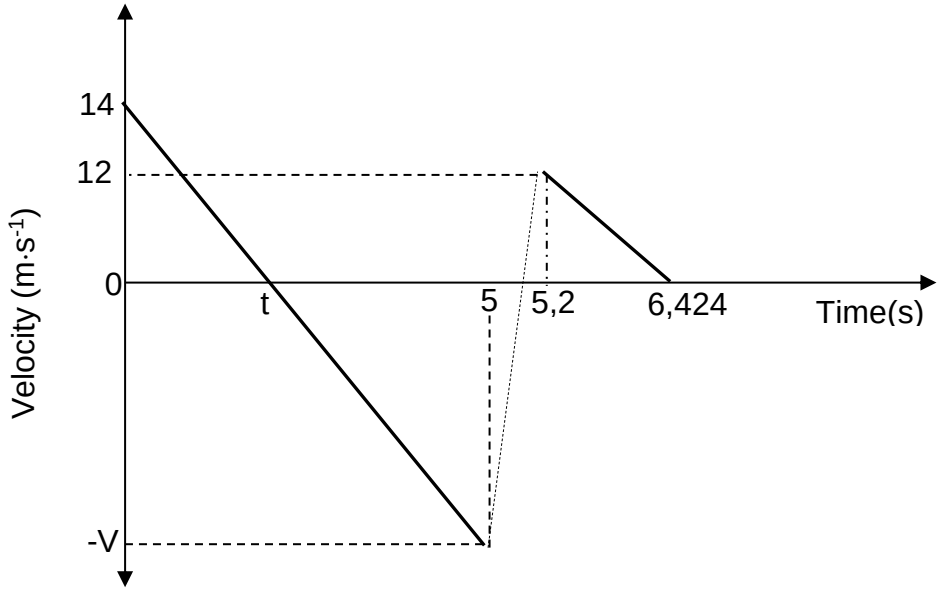
3.3.2 Length of the window (distance, **d**). (5)

3.4 The same magnitude of the force is now applied at a smaller angle. What effect will this change have on the value calculated in QUESTION 3.3.1? Write down INCREASES, DECREASES or REMAINS THE SAME. Give a reason for the answer. (2)

[16]

QUESTION 4 (Start on a new page.)

The velocity-time graph below represents the entire motion of a ball of mass 250 g is thrown vertically upwards from a height of 52,5 m above the ground. The ball rises to a maximum height of 10 m above the point of launch, falls to the ground and bounces to an unknown maximum height. Ignore the effects of air friction.



4.1 Define *free fall.* (2)

4.2 Calculate the:

4.2.1 Numerical value of, **t**, on the graph WITHOUT USING THE EQUATIONS OF MOTION. (2)

4.2.2 Velocity at which the ball reaches the ground. (3)

4.3 State *Newton's second law in terms of momentum*. (2)

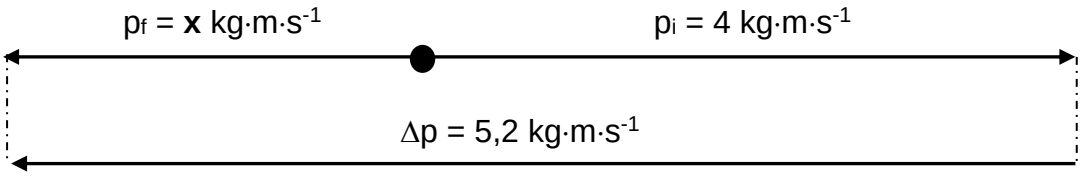
4.4 Calculate the magnitude of the force exerted by the surface on the ball during contact. (4)

4.5 Draw the acceleration time-graph for the entire motion of the ball. (2)

[15]

QUESTION 5 (Start on a new page.)

A ball with an unknown mass, m, is thrown horizontally due EAST towards a wall, and it strikes the wall at a velocity of 36 $km \cdot h^{-1}$ and rebounce back off from the wall at an unknown velocity. The diagrams below illustrates the relationship between the initial momentum, the final momentum and the change in momentum for the ball.



5.1 Describe *linear momentum.* (2)

5.2 Calculate the:

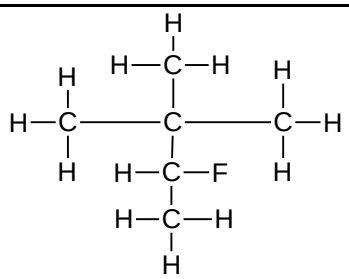
5.2.1 Mass of the ball. (3)

5.2.2 Velocity at which the ball leaves the wall after contact. (3)

[08]

QUESTION 6 (Start on a new page.)

The letters **A** to **D** in the table below represent four organic compounds from different homologous series. Use the table to answer the questions that follow.

A		**B**	Methyl ethanoate
C	Propane	**D**	CH_3COCH_3

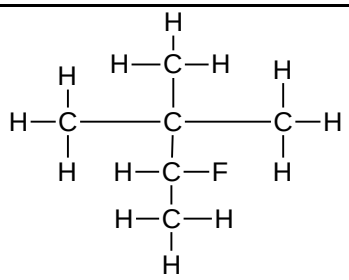
6.1 Define *homologous series*. (2)

6.2 Write down the letter(s) that represent(s) each of the following:

6.2.1 Compound produced during CONDENSATION reaction. (1)

6.2.2 FUNCTIONAL ISOMER of Propanal. (1)

The table on page 7 is redrawn below for easy reference.

A		**B**	Methyl ethanoate
C	Propane	**D**	CH_3COCH_3

6.3 For organic compound, **A**, write down the:

6.3.1 IUPAC NAME (3)

6.3.2 Type of Halo-alkane (PRIMARY, SECONDARY or TERTIARY). Give a reason for the answer. (2)

6.4 Draw the STRUCTURAL FORMULA of the ORGANIC ACID used to form compound, **B**. (2)

6.5 Write down a balanced chemical equation USING MOLECULAR FORMULA for the complete combustion of compound, **C**. (3)

6.6 Consider the organic compound, **D**, to answer the questions below.

6.6.1 Write down the name given to its functional group. (1)

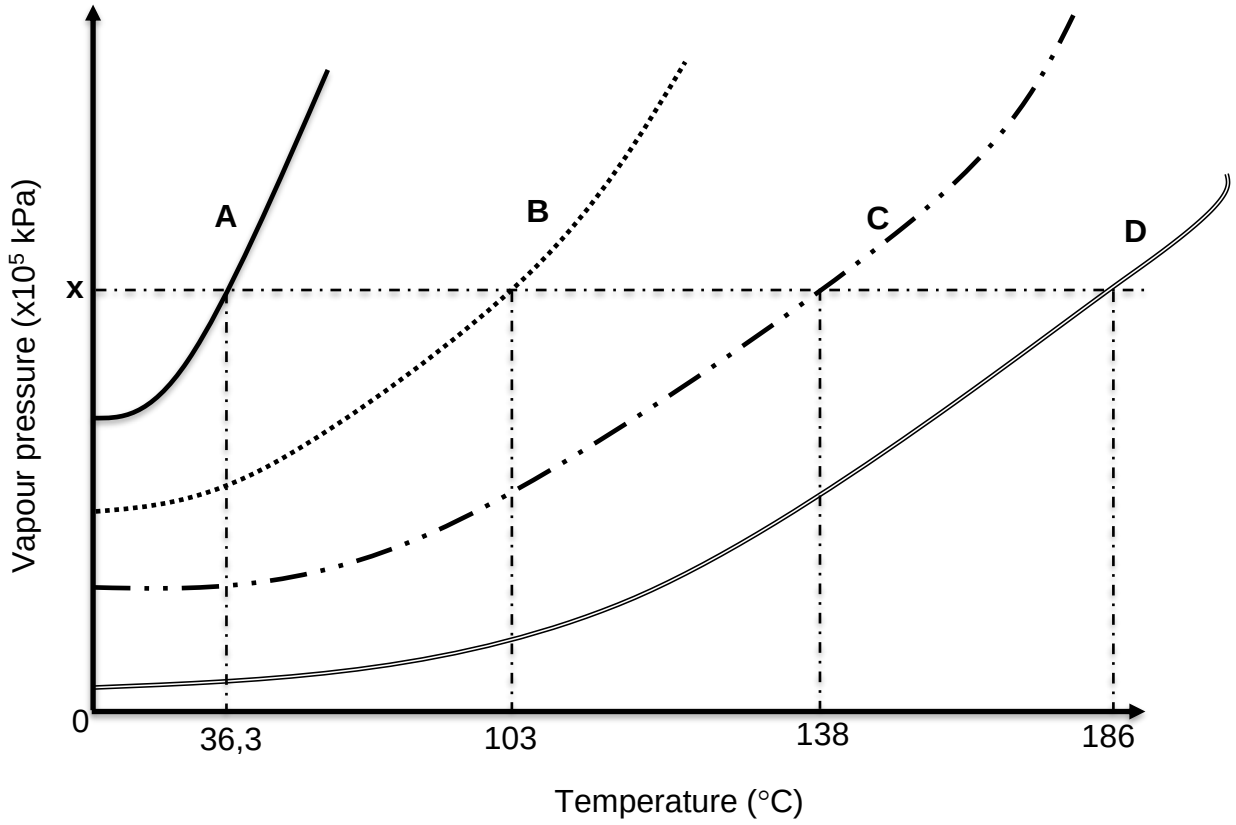
6.6.2 Draw the structural formula of the FUNCTIONAL ISOMER of compound **D**. (2)

6.6.3 Calculate the percentage composition of OXYGEN atoms in the compound. (2)

[19]

QUESTION 7 (Start on a new page.)

The vapour pressure versus temperature graph below was obtained for FOUR straight chain (unbranched) compounds with FIVE carbon atoms in their structures, **A**, **B**, **C** and **D**, which belong to different homologous series. The homologous series are randomly identified as Carboxylic acids, aldehydes, alkanes and alcohols. The boiling point of the saturated hydrocarbon is 36,3 °C



7.1 Define the term *vapour pressure*. (2)

7.2 Write down the:

7.2.1 Value represented by **x** on the graph. (1)

7.2.2 CONDENSED STRUCTURAL FORMULA of the SATURATED HYDROCARBON. (2)

7.2.3 NAME of the FUNCTIONAL GROUP of compound **B**. (2)

7.3 Which compound (**A** or **B**) has STRONGER INTERMOLECULAR FORCES? Give a reason for the answer. (2)

7.4 Explain the difference in boiling points of compound **C** and **D**. (4)

[13]

QUESTION 8 (Start on a new page.)

Consider the INCOMPLETE equations for reactions I to III below. **P**, **R** and **S** are organic compounds. Study the equations and answer the questions that follow.

I	2-bromopropane + NaOH $\rightarrow$ **P** + **Q** + H_2O
II	**P** + H_2O $\rightarrow$ **R** (minor product)
III	**R** + **S** $\rightarrow$ Propyl propanoate + **T**

8.1 Write down the:

8.1.1 NAME of the ELIMINATION reaction represented by reaction I. (1)

8.1.2 ONE reaction conditions for reaction I. (1)

8.1.3 MOLECULAR FORMULA of compound **P**. (1)

8.1.4 CHEMICAL FORMULA or CHEMICAL NAME of compound **Q**. (1)

8.2 For reaction II, write down the:

8.2.1 Type of reaction. (1)

8.2.2 Chemical formula of the INORGANIC ACID required during this reaction. (1)

8.2.3 Balanced chemical equation using STRUCTURAL FORMULAE. (3)

8.3 For reaction III, write down the:

8.3.1 Type of reaction. (1)

8.3.2 IUPAC NAME of compound **S**. (1)

8.3.3 CHEMICAL FORMULA or CHEMICAL NAME of compound **T**. (1)

[12]

GRAND TOTAL: 100

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DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m{\cdot}s^{-2}$
Universal gravitational constant *Universele gravitasiekonstant*	G	$6,67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
Radius of the Earth *Radius van die Aarde*	R_E	$6,38 \times 10^6\ m$
Mass of the Earth *Massa van die Aarde*	M_E	$5,98 \times 10^{24}\ kg$
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	$6,63 \times 10^{-34}\ J{\cdot}s$
Coulomb's constant *Coulomb se konstante*	k	$9,0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2}$
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*

MOTION/*BEWEGING*

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ or/*of* $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ or/*of* $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ or/*of* $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = G\frac{m_1 m_2}{d^2}$ or/*of* $F = G\frac{m_1 m_2}{r^2}$	$g = G\frac{M}{d^2}$ or/*of* $g = G\frac{M}{r^2}$

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 2 (CHEMIE)

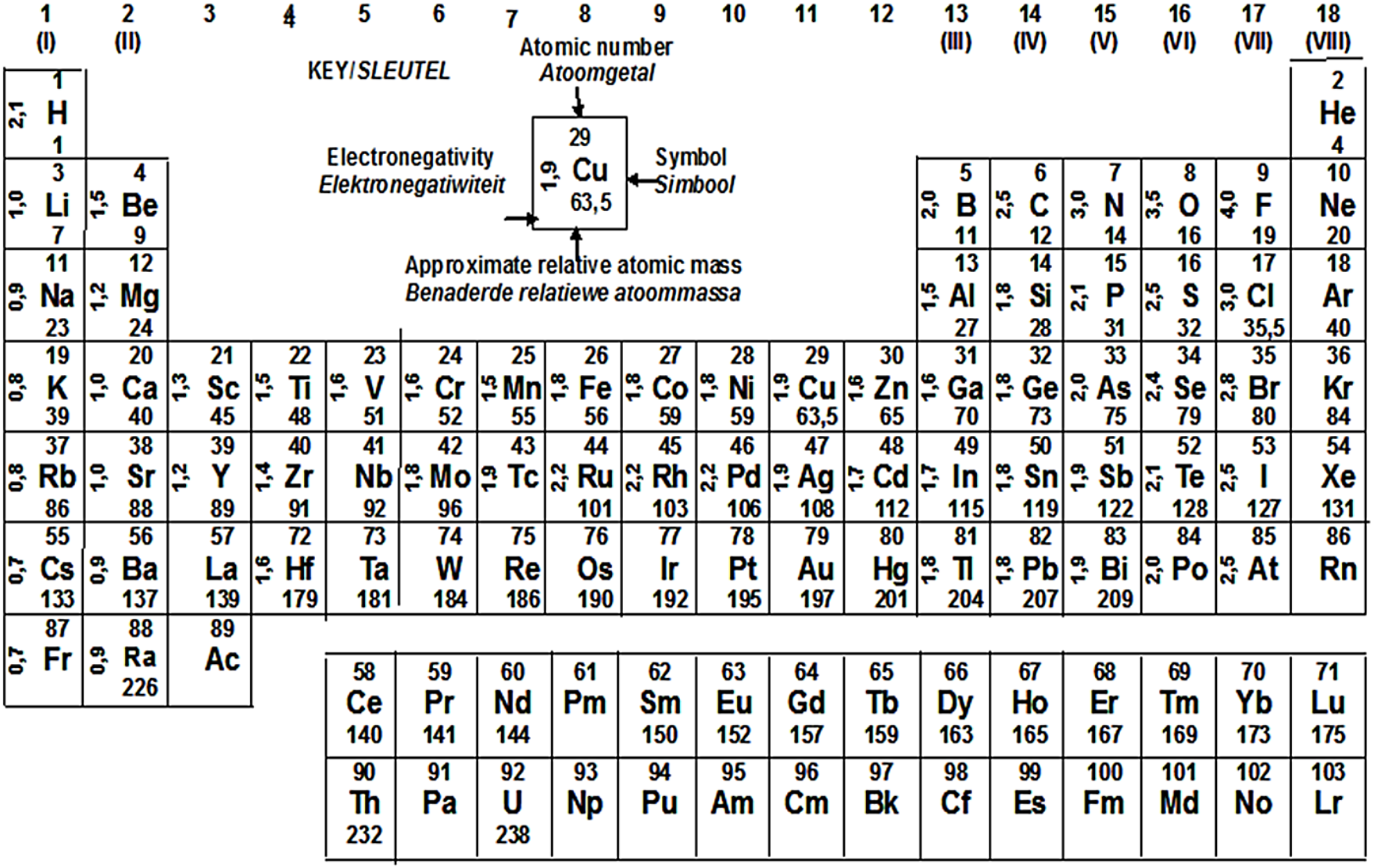
TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Standard pressure *Standaarddruk*	p^θ	$1{,}013 \times 10^5$ 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	$-1{,}6 \times 10^{-19}$ C
Avogadro's constant *Avogadro-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* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ at/*by* 298 K	
$E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode} / E^\theta_{sel} = E^\theta_{katode} - E^\theta_{anode}$ or/*of* $E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation} / E^\theta_{sel} = E^\theta_{reduksie} - E^\theta_{oksidasie}$ or/*of* $E^\theta_{cell} = E^\theta_{oxidisingagent} - E^\theta_{reducingagent} / E^\theta_{sel} = E^\theta_{oksideermiddel} - E^\theta_{reduseermiddel}$	
$q = I\Delta t$ $n = \frac{Q}{e}$ or/*of* $n = \frac{Q}{q_e}$	

TABLE 3: THE PERIODIC TABLE OF ELEMENTS
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