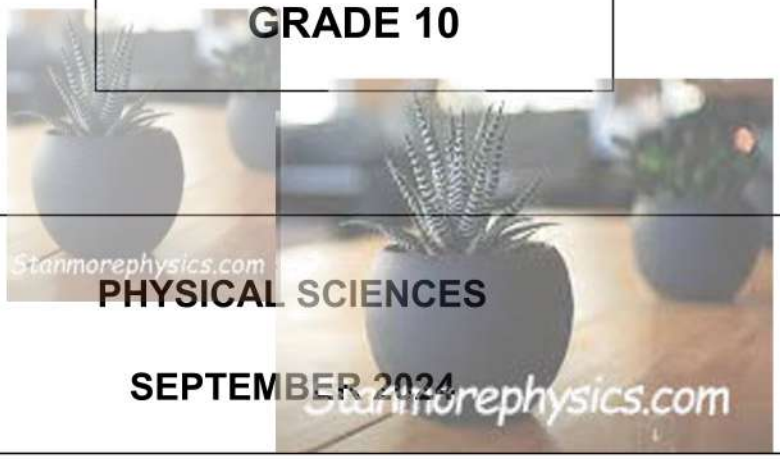
education

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10



PHYSICAL SCIENCES

SEPTEMBER 2024

MARKS: 100

TIME: 2 HOURS

This question paper consists of 15 pages.

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of SIX 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. You are advised to 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

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the best answer and write the correct letter (A – D) next to the question number (1.1 – 1.5) on the ANSWER SHEET

1.1 A car is travelling at a speed of $30 m \cdot s^{-1}$ on a straight road. What would be the speed of the car in $km \cdot h^{-1}$?

A $30 km \cdot h^{-1}$

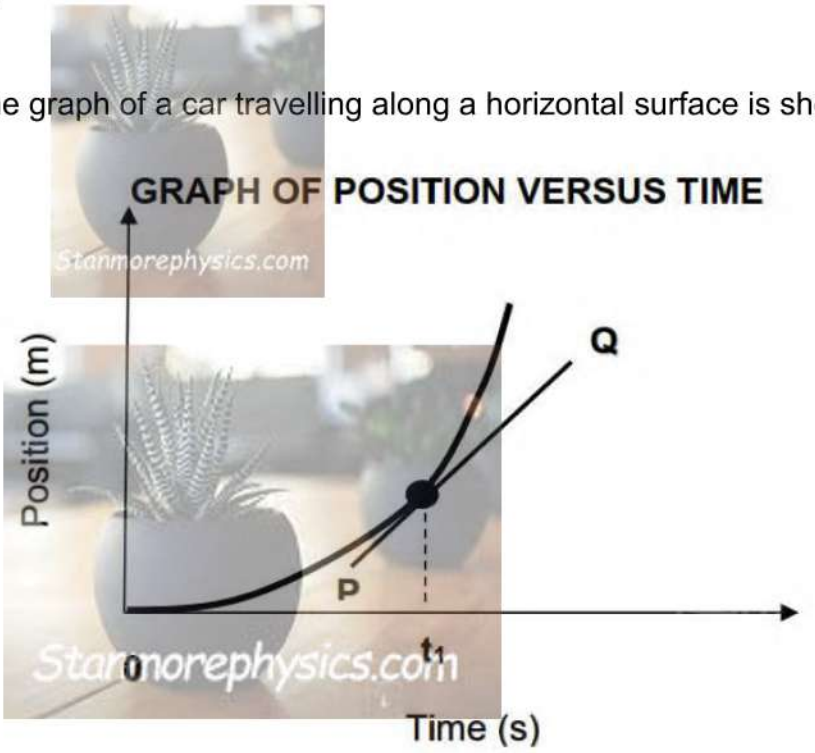
B $130 km \cdot h^{-1}$

C $8.33 km \cdot h^{-1}$

D $108 km \cdot h^{-1}$

(2)

1.2 The position- time graph of a car travelling along a horizontal surface is shown below



Tangent PQ is the tangent to the curve at time t_1.

Which one of the following is equal to the gradient of PQ?

A Average velocity over the period 0 t0 t_1

B Instantaneous velocity at time t_1

C Average acceleration over the period 0 t0 t_1

D Instantaneous acceleration at time t_1

(2)

1.3 The table below shows the changes in the velocity of the car in intervals of 4 seconds.

Time(s)	0	4	8	12	16	20	24	28	32
Velocity(ms^{-1})	0	7	14	21	28	28	28	28	28

Which one of the following is CORRECT for the acceleration of the car?

A Increases initially for 16s then remains constant.

B Is initially constant for 16 seconds then becomes zero

C Is initially constant for 16 seconds and then decreases

D Increases initially for 16s and then becomes zero.

$4A\ell\,(s) + 3O_2\,(g) \rightarrow A\ell_2O_3\,(s)$ (2)

1.4 Consider the balanced chemical equation below:

Which one of the following is the correct number of oxygen atoms required to form 4 moles of aluminium oxide? **($A\ell I_2O_3$)**

A $6 \times 6{,}02 \times^{23}$

B $12 \times 6{,}02 \times^{23}$

C $3 \times 6{,}02 \times^{23}$

D $36 \times 6{,}02 \times^{23}$

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(2)

1.5 Consider the following unbalanced chemical equation below:

$NH_3 + O_2 \rightarrow NO + H_2O$

Which ONE of the sets of coefficients will balance the equation?

A 2,2,2,3

B 2.3.2.3

C 5.4.5.6

D 4.5.4.6

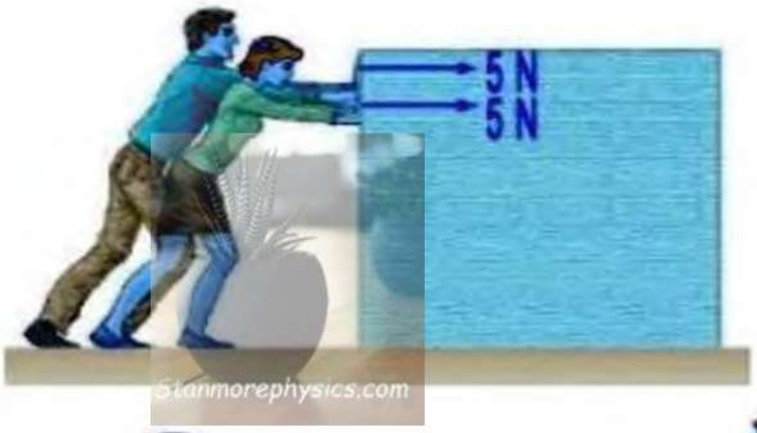
(2)

[10]

QUESTION 2

2.1 The diagram below shows two learners applying forces on the box. In diagram (a), the two learners apply a force of 5N each on the box, in the same direction. And in diagram (b), the two learners apply forces of 5N and 3N in opposite directions respectively.

a)



b)

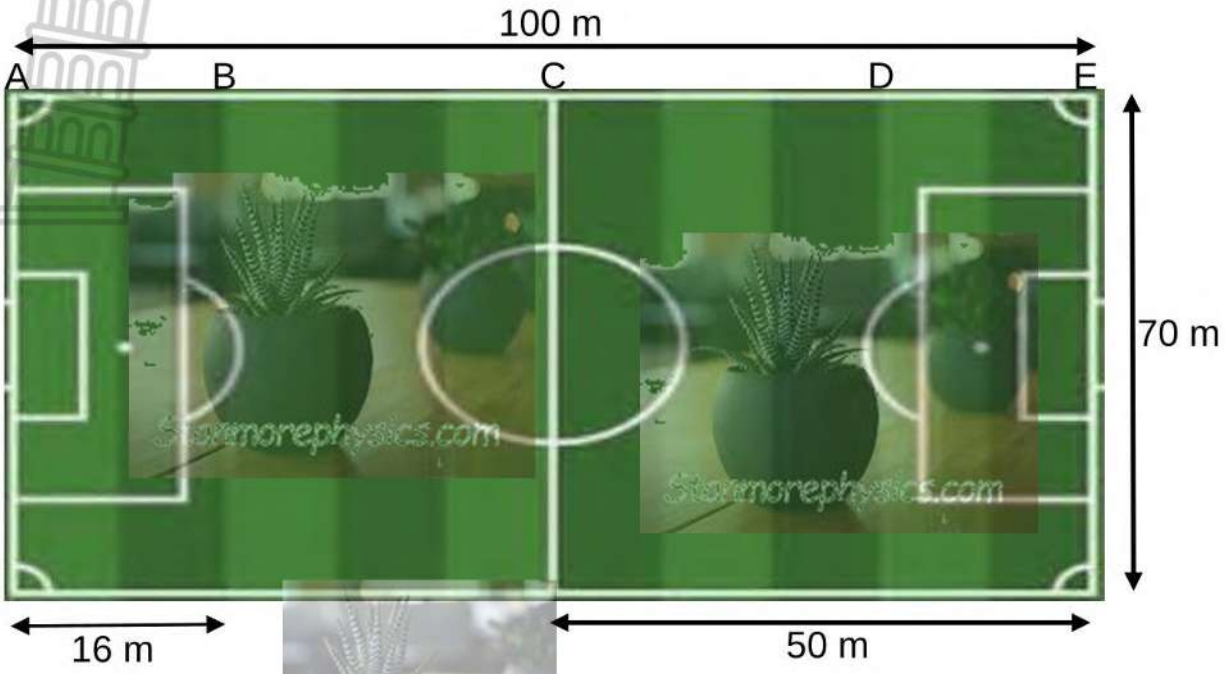


2.1.1 Define the term resultant vector. . (2)

2.1.2 Draw a vector diagram showing all forces for diagram (a) and the resultant vector. (3)

2.1.3 Draw a vector diagram showing all forces for diagram (b) and the resultant vector. (3)

2.2 The diagram below represents a school soccer field.



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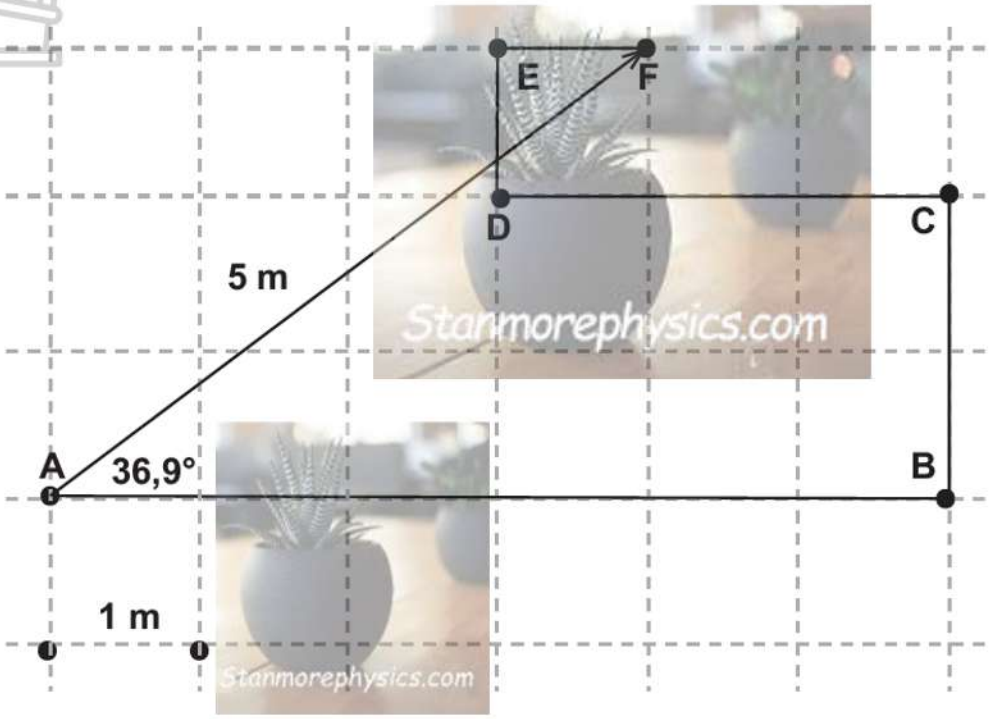
2.2.1 . Define one-dimensional motion (2)

2.2.2 A learner ran from C to D and back to C, and then from C to E in 1,5 minutes. (4)
Calculate the learner's average speed.

[14]

QUESTION 3

3.1 An object moves from A to B to C to D to E to F in 30 seconds, as shown in the diagram below.



3.1 Distinguish clearly the difference between distance and displacement. (4)

3.2 Calculate the distance travelled in 30 s. (2)

3.3 The vector drawn from A to F shows the object's displacement in 30 s. With reference to the definition of displacement, explain why this vector gives the object's displacement, and write down the magnitude and direction of its displacement. (4)

3.4 Calculate the average speed of the object in 30 s. (3)

3.5 Calculate the magnitude of its average velocity in 30 s. (4)

3.6 The forklift starting from Point X needs to pick up a package from Point Y, which is due east of Point X.

The package is thereafter transported to a table, which lies 350 metres due west of Point X. The entire trip takes the driver 2 minutes to complete.



3.6.1 Define the term average velocity in words. (1)

3.6.2 Calculate the average velocity of the forklift for the entire trip. (3)

3.6.3 The average speed of the forklift is $3.75 m \cdot s^{-1}$. (4)
Determine the position of Point Y relative

[25]

QUESTION 4

4.1 The truck mechanic conduct tests after the repair. A truck starts from rest at a traffic light and accelerates for 4 seconds in an easterly direction. A person on the road measures the change in position during equal time intervals. The results obtained are recorded in the table below.

Time (s)	Position (m)
0	0
1	10
2	20
3	30
4	40

For the tests, write down the:

4.1.1 Independent variable (1)

4.1.2 Dependent variable. (1)

4.2 Use the information in the table above and drawn an accurate position-time graph on the graph paper on the attached ANSWER SHEET. (4)

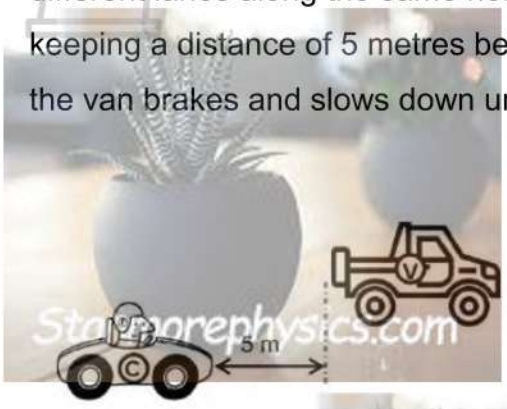
4.3 Calculate the gradient of the graph. (3)

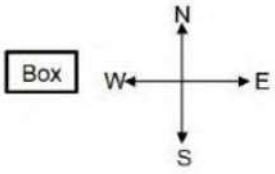
4.4 Which physical quantity is represented by the gradient of the graph? (1)

[10]

QUESTION 5

5.1 A car C and a van V are both travelling at a constant velocity of 25 $m \cdot s^{-1}$ east, on different lanes along the same horizontal road. The driver of the car follows the van, keeping a distance of 5 metres between them. Seeing a box on his lane, the driver of the van brakes and slows down uniformly to stop in 5 seconds.





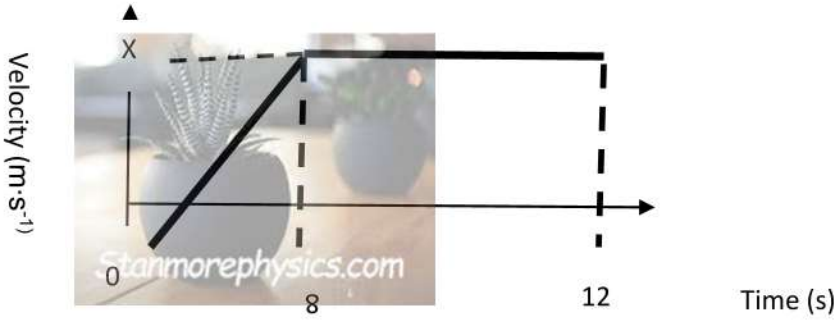


5.1.1 Define acceleration. (1)

5.1.2 Calculate the acceleration of the car while slowing down. (3)

5.1.3 If the car continued at its original motion, how far ahead of the van will the car be when the van stops? (5)

5.2 After passing the box, the van takes off from rest and accelerates uniformly at $4 m \cdot s^{-2}$ for 8 seconds. It thereafter travels at a constant velocity of X $m \cdot s^{-1}$ for a further 4 seconds as shown in the diagram below.



5.2.1 Describe uniform acceleration using words. (2)

5.2.2 Use the GRAPH to determine the value of X. (3)

5.2.3 Sketch the acceleration vs time graph for the 12 seconds represented in the graph above. Indicate the relevant time and acceleration values on the graph. (3)

[17]

QUESTION 6

6.1 Sulphur dioxide (SO_2) reacts with oxygen(O_2) to form sulphur trioxide (SO_3), as shown in the balanced equation below.

$$\mathbf{2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)}$$

In one such reaction, a volume of 2450 cm^3 sulphur trioxide (SO_3), is formed at STP

State ONE MOLE in words. (2)

6.2 Calculate

6.2.1 The number of moles of SO_3 formed. (3)

6.2.2 Mass of SO_2 reacted. (4)

6.2.3 Number of oxygen molecules that reacted. (4)

6.3 The analysis of a compound made up of the elements sodium (Na), sulphur(S) and oxygen(O) provides the following percentage composition by mass.

ELEMENT	PERCENTAGE COMPOSITION
Sodium (Na)	29.11%
sulphur(S)	40.51%
oxygen(O)	30.38%

6.3.1 Define the term empirical formula in words. (2)

6.3.2 Determine the empirical formula of the compound (5)

6.3.3 Determine the percentage composition of water (H_2O) in hydrated copper sulphate ($CuSO_4 \cdot 5\ H_2O$) (4)

[24]

T O T A L: 100



4.2 Information sheets – Paper 1 (Physics)

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*

MOTION/*BEWEGING*

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

WORK, ENERGY AND POWER/*ARBEID, ENERGIE EN DRYWING*

$U = mgh$ or/*of* $E_P = mgh$	$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$

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

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

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

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

4.3 Information sheets – Paper 2 (Chemistry)

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

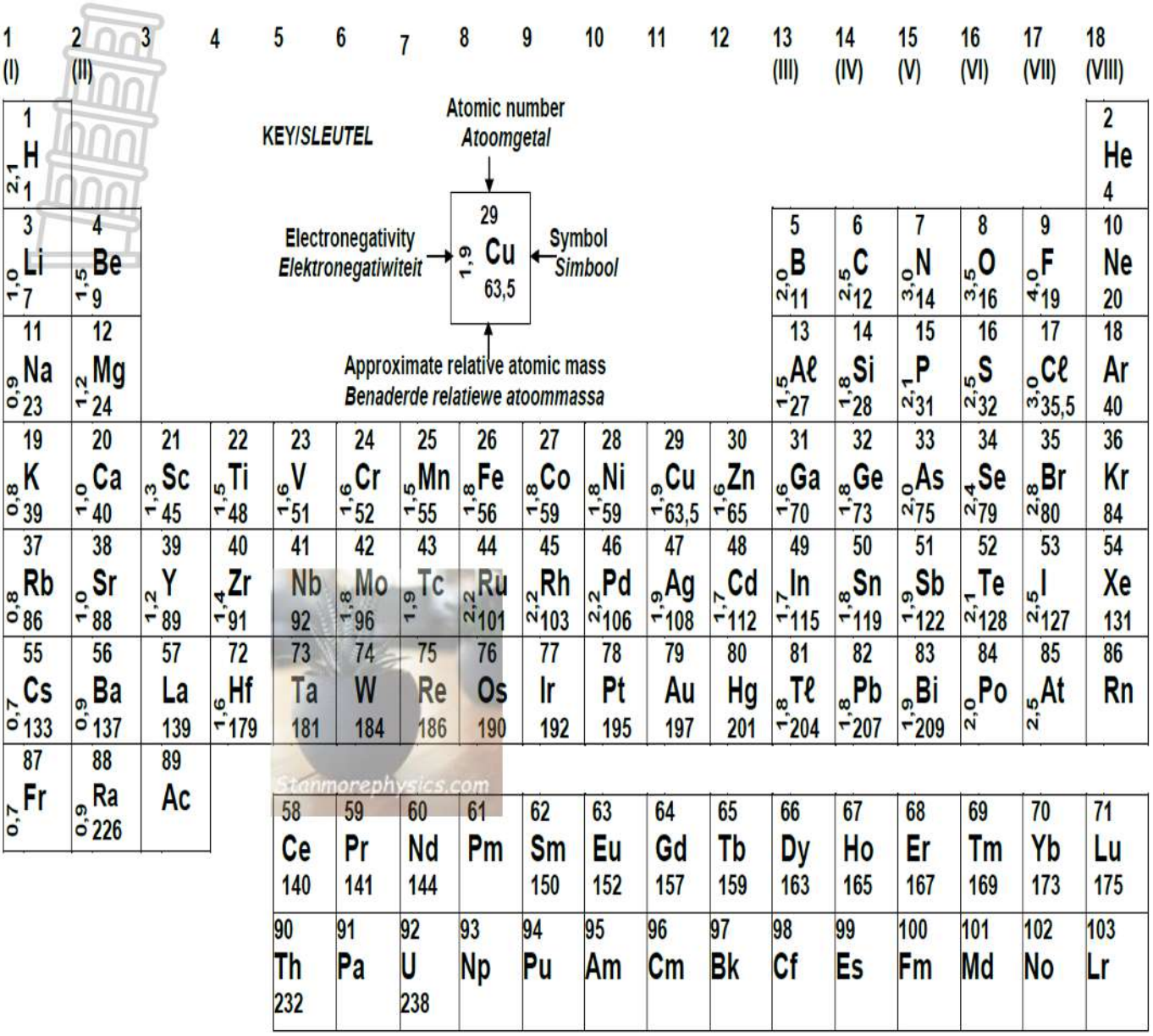
NAME/*NAAM*	**SYMBOL/*SIMBOOL***	**VALUE/*WAARDE***
Standard pressure *Standaarddruk*	p^{θ}	$1{,}013 \times 10^{5}$ Pa
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	22,4 $dm^3 \cdot mol^{-1}$
Standard temperature *Standaardtemperatuur*	T^{θ}	273 K
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}$ 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 $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$



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



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NAME_____

SURNAME_____

4.2

