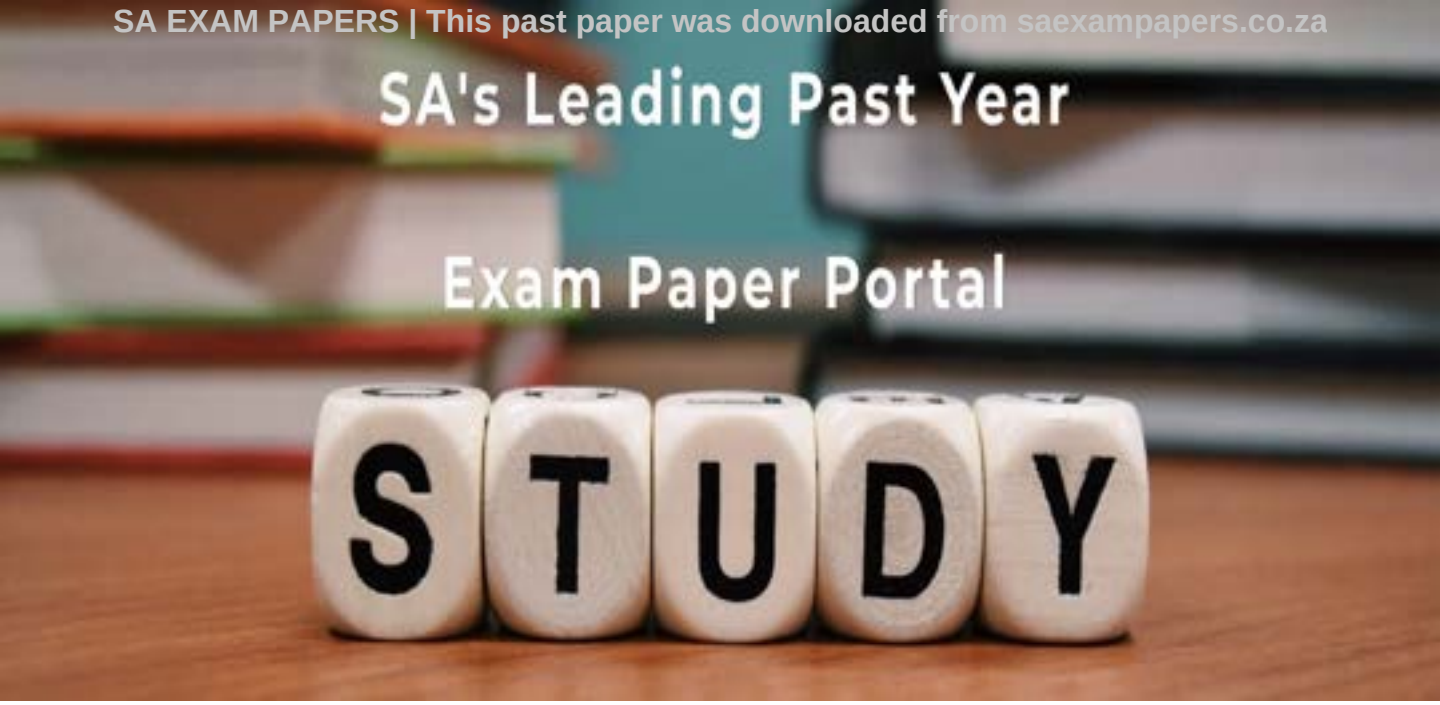
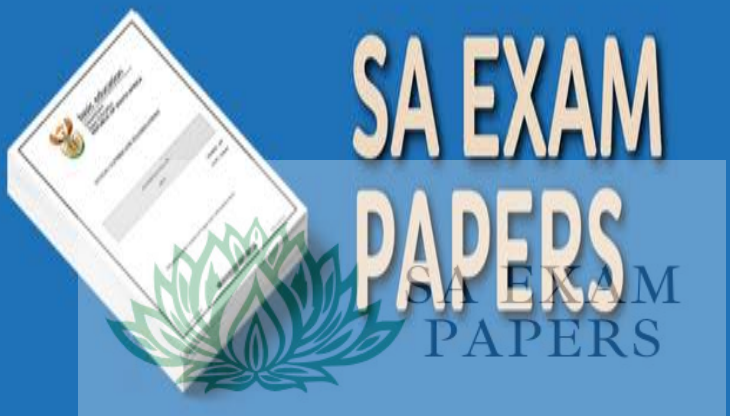


You have Downloaded, yet Another Great Resource to assist you with your Studies ☺

Thank You for Supporting SA Exam Papers

Your Leading Past Year Exam Paper Resource Portal

Visit us @ www.saexampapers.co.za



education
Department: Education
GAUTENG PROVINCE

Gauteng Department of Education

Johannesburg North District (D10)

GRADE 12

PHYSICAL SCIENCES
CONTROLLED TEST 1
15 MARCH 2024

MARKS: 100

TIME: 2 Hours

This paper consists of 13 pages including the cover page and two information sheets

INSTRUCTIONS AND INFORMATION

1. This question paper consists of TWO SECTIONS:

   SECTION A: PHYSICS [50 Marks]
   SECTION B: CHEMISTRY [50 Marks]

2. Answer ALL questions in both sections.

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

4. Leave ONE line between two subquestions, for example between QUESTION 2.1 and QUESTION 2.2.

5. You may use a non-programmable calculator.

6. You may use appropriate mathematical instruments.

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

8. Show ALL formulae and substitutions in ALL calculations.

9. Round off your final numerical answers to TWO decimal places.

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

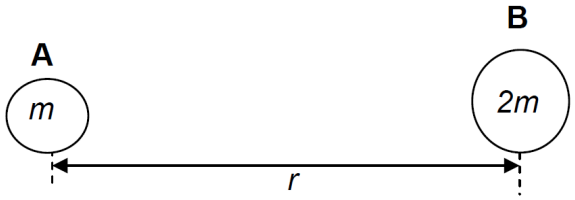
11. Write neatly and legibly.

SECTION A: PHYSICS

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write down only the letter (A – D) next to the question number (1.1 – 1.3) in your answer book. (i.e. 1.4 E)

1.1 Two isolated bodies, **A** and **B**, having masses m and $2m$ respectively, are placed a distance r apart.



Consider the following statements regarding the gravitational force exerted by the bodies on each other.

(i) The force exerted by **B** on body **A** is half that exerted by **A** on body **B**.

(ii) The force exerted on the bodies is independent of the masses of the bodies.

(iii) The force exerted on body **A** by **B** is equal but opposite to that exerted on body **B** by **A**.

(iv) The forces will always be attractive.

Which of the statements above is/are TRUE?

A (i), (ii) and (iv) only.

B (ii), (iii) and (iv) only.

C (iii) and (iv) only.

D (iv) only. (2)

1.2 An object is dropped from rest and after falling a distance x, its momentum is p. Ignore the effects of air friction.
The momentum of the object, after it has fallen a distance $2x$, is …

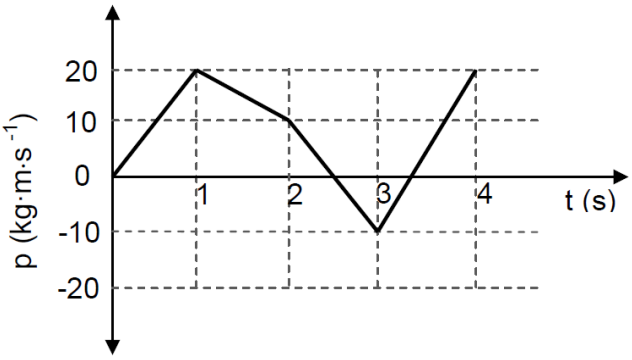
A p

B $\sqrt{2}p$

C $\frac{p}{2}$

D $2p$ (2)

1.3 The graph below shows how the momentum (p) of an object changes with time (t).



During which ONE of the following time intervals, measured in seconds, is the magnitude of the net force acting on the object the greatest?

A 0 – 1 s

B 1 – 2 s

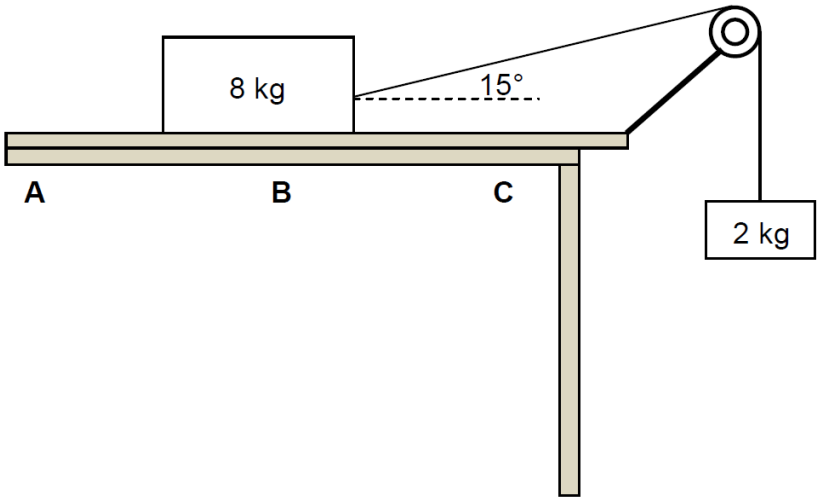
C 2 – 3 s

D 3 – 4 s (2)

[6]

QUESTION 2 (Start on a new page)

A block, of mass 8 kg, is placed on a rough horizontal surface. The 8 kg block, which is connected to a 2 kg block by means of a light inextensible string passing over a light frictionless pulley, starts sliding from point **A**, as shown below.



2.1 State *Newton's Second Law of Motion* in words. (2)

2.2 Draw a labelled free-body diagram for the 8 kg block. (4)

2.3 When the 8 kg block reaches point **B**, the angle between the string and the horizontal is 15° and the acceleration of the system is 1,32 $m \cdot s^{-2}$.

2.3.1 Give a reason why the system is NOT in equilibrium. (1)

2.3.2 Use the 2 kg mass to calculate the tension in the string. (3)

2.3.3 Calculate the kinetic frictional force between the 8 kg block and the horizontal surface. (4)

2.4 As the 8 kg block moves from **B** to **C**, the kinetic frictional force between the 8 kg block and the horizontal surface is not constant.

Give a reason for this statement. (1)

The horizontal surface on which the 8 kg block is moving, is replaced by another horizontal surface made from a different material.

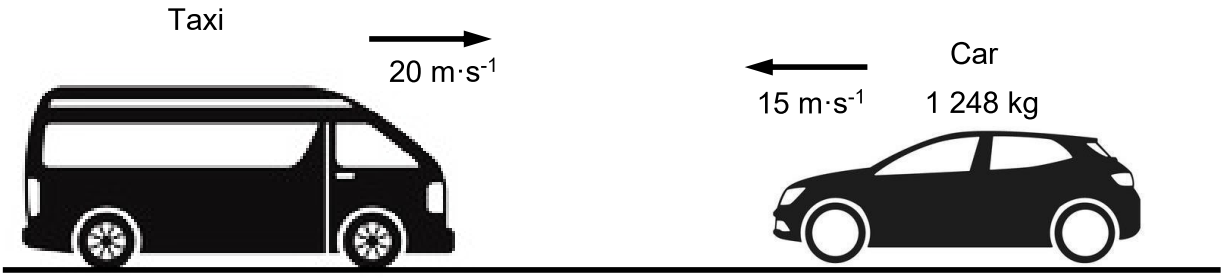
2.5 Will the kinetic frictional force, calculated in QUESTION 2.3.3 above, change? Choose from: YES or NO. Give a reason for the answer. (2)

[17]

QUESTION 3 (Start on a new page)

A minibus taxi, travelling south at a velocity of 20 $m \cdot s^{-1}$, collides head-on with a car, of total mass 1 248 kg (including the driver), heading north with a velocity of 15 $m \cdot s^{-1}$.

After the collision, the vehicles move together at a velocity of 10 $m \cdot s^{-1}$ south.



3.1 State the *principle of conservation of linear momentum* in words. (2)

3.2 The driver of the car claims that the taxi was not only speeding but it was overloaded with passengers.

Consider the information below:

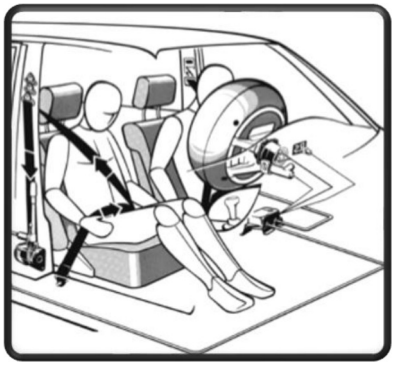
- Mass of the "empty" Taxi: 2 000 kg
- Average mass of a person: 70 kg

Maximum legal occupancy of the taxi is 12 PEOPLE (including the driver)

Use *the principle of conservation of linear momentum* to determine how many passengers exceeded the legal limit for the taxi.
Assume all passengers are of average mass. (5)

3.3 Do the necessary calculations to show that the collision is INELASTIC. (4)

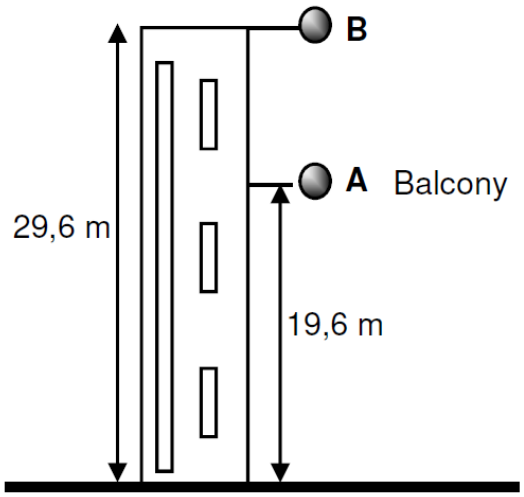
3.4 Modern cars have seat belts, air bags and crumple zones to help minimize injuries during accidents.



Use principles in physics to explain how the air bags and crumple zones, mentioned above, contribute to the safety of passengers. (3)
[14]

QUESTION 4 (Start on a new page)

Ball **A** is dropped from a balcony 19,6 m from the ground. AT THE SAME TIME an identical ball **B**, is projected vertically DOWNWARDS from the top of a building 29,6 m from the ground as shown in the diagram below.



The balls hit the ground simultaneously. Ignore the effects of air resistance.

4.1 Write down the acceleration of ball **A** at the moment it is dropped from the balcony? (1)

4.2 Calculate the:

4.2.1 Velocity with which ball **A** hits the ground. (3)

4.2.2 Velocity with which **B** must be projected to reach the ground at the same time as **A**. (5)

4.3 On the same set of axes, sketch a velocity versus time graph for each ball (**A** and **B**), for the entire motion. Take DOWNWARDS as NEGATIVE.

Show the following on your graph:

- Initial velocity of both balls **A** and **B**.
- Time taken to hit the ground. (4)

[13]

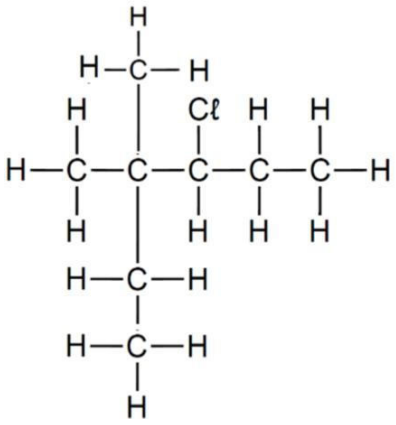
TOTAL SECTION A: [50 MARKS]

SECTION B: CHEMISTRY

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write down only the letter (A – D) next to the question number (1.1 – 1.3) in your answer book. (i.e. 1.4 E)

1.1 Which ONE of the following is the IUPAC name for the compound below?



A 2-ethyl-2-methyl-3-chloropentane

B 3-chloro-2-ethyl-2-methylpentane

C 3-chloro-4,4-dimethylhexane

D 4-chloro-3,3-dimethylhexane (2)

1.2 Which ONE of the following compounds has the highest boiling point?

A CH_3CH_3

B $CH_3CH_2CH_3$

C $CH_3(CH_2)_3CH_3$

D $CH_3CH_2CH_2CH_3$ (2)

1.3 Consider the cracking reaction below:

$$C_{10}H_{22} \rightarrow C_3H_6 + C_3H_X + 2C_YH_Z$$

The correct values of X, Y and Z are respectively…

A 6, 2, 5.

B 6, 4, 10.

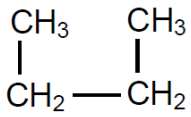
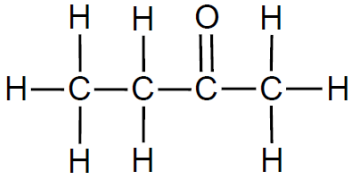
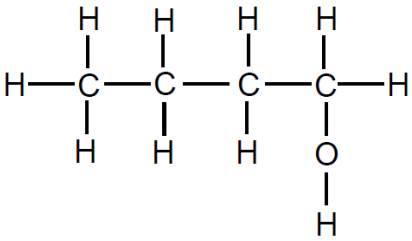
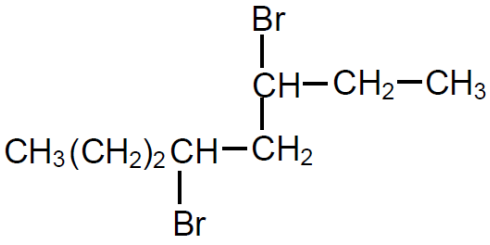
C 8, 2, 4.

D 8, 4, 8. (2)

[6]

QUESTION 2

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

A		**B**	
C	$CH_3CCCH_2CH_3$	**D**	Butyl propanoate
E		**F**	

2.1 Is compound **C** SATURATED or UNSATURATED?
Give a reason for your answer. (2)

2.2 Write down the LETTER that represents each of the following:

2.2.1 An ester. (1)

2.2.2 A functional isomer of butanal. (1)

2.2.3 A compound with the general formula C_nH_{2n+2}. (1)

2.2.4 A compound used as a reactant in the preparation of compound **D.** (1)

2.3 Write down the:

2.3.1 Structural formula of compound **D**. (2)

2.3.2 Name of the functional group of compound **E.** (1)

2.3.3 IUPAC name of the positional isomer of compound **E.** (1)

2.3.4 Structural formula of the chain isomer of compound **A**. (2)

2.4 For compound **F**, write down the:

2.4.1 Homologous series to which it belongs. (1)

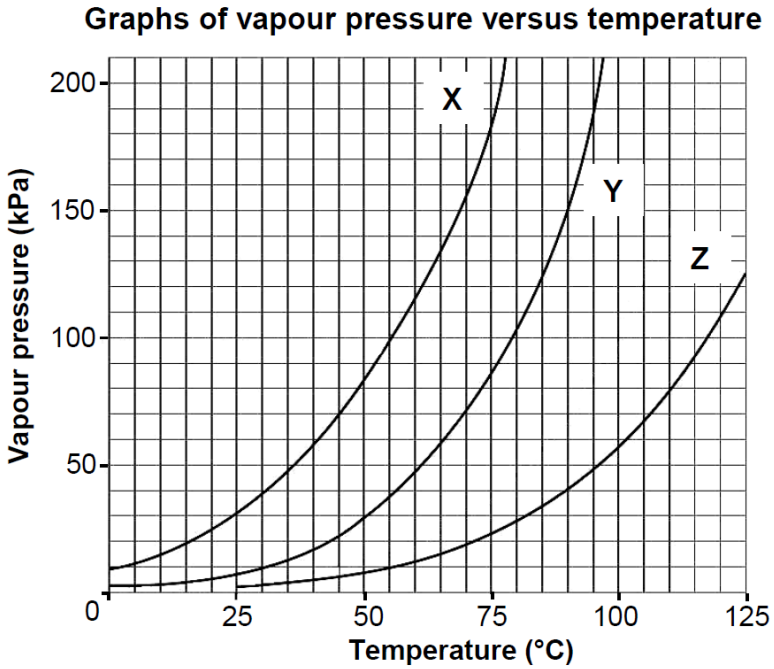
2.4.2 IUPAC name. (3)

2.5 Write a balanced chemical equation, using MOLECULAR FORMULAE for the complete combustion of compound **A**. (3)

[19]

QUESTION 3 (Start on a new page)

Study the vapour pressure versus temperature graphs for three organic compounds, **X**, **Y** and **Z**, below which belong to different homologous series.
Atmospheric pressure is 100 kPa.



3.1 Write down the vapour pressure of compound **Y** at 90 °C. (1)

3.2 The graphs can be used to determine the boiling points of the three compounds.

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

3.2.2 Determine the boiling point of compound **X**. (1)

3.3 The homologous series to which the three compounds of similar molecular masses belong, were identified in random order as:

alcohol; carboxylic acid; ketone

3.3.1 Which compound (**X**, **Y** or **Z**) is the carboxylic acid? (1)

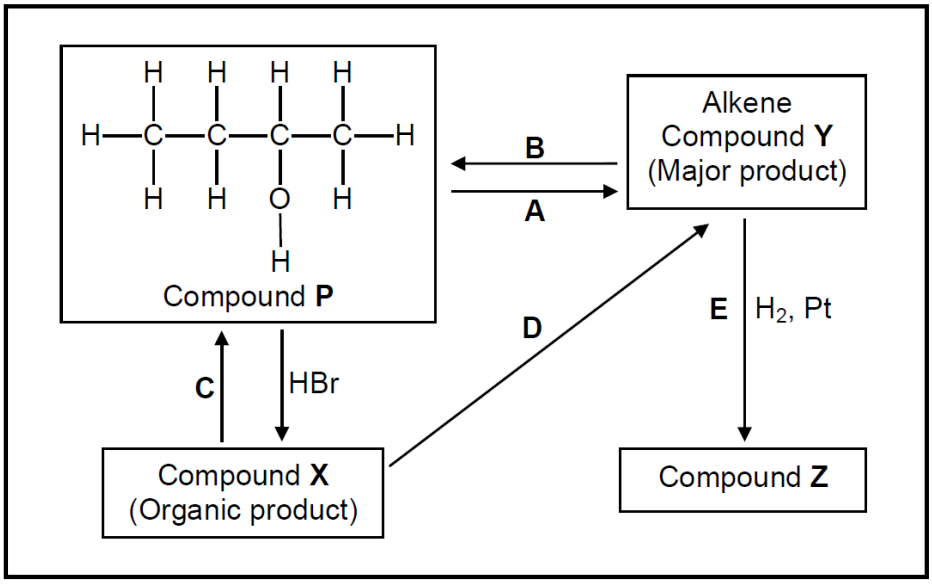
3.3.2 Explain the answer to QUESTION 3.3.1 by referring to the TYPE and STRENGTH of intermolecular forces in compounds of EACH of the homologous series above. (4)

3.3.3 Compound **X** has three carbon atoms per molecule. Write down the IUPAC name of compound **X**. (1)

[10]

QUESTION 4 (Start on a new page)

The flow diagram below shows how an alcohol (compound **P**) can be used to prepare other organic compounds. The letters **A** to **E** represent different organic reactions. **X**, **Y** and **Z** are organic compounds.



4.1 Is compound **P** a PRIMARY, SECONDARY or TERTIARY alcohol? Give a reason for your answer. (2)

4.2 Reaction **A** is an example of a *dehydration* reaction.

4.2.1 Explain what is meant by the term *dehydration*. (1)

4.2.2 Write down the NAME of the catalyst required for reaction **A**. (1)

4.3 Write down the type of:

4.3.1 Addition reaction represented by **E**. (1)

4.3.2 Elimination reaction represented by **D**. (1)

4.4 Sodium hydroxide is used as one of the reactants in reaction **C**.

4.4.1 What type of reaction takes place here? (1)

4.4.2 State the TWO reaction conditions for this reaction. (2)

4.4.3 Write down the IUPAC name of compound **X**. (2)

4.5 Using STRUCTURAL FORMULAE, write down a balanced equation for reaction **E**. (3)

4.6 Write down the IUPAC name of compound **Z**. (1)
[15]

TOTAL SECTION B: [50 MARKS]
[TOTAL = 100 MARKS]

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m{\cdot}s^{-2}$
Universal gravitational constant *Universele gravitasiekonstant*	G	$6,67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
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	$6,63 \times 10^{-34}\ J{\cdot}s$
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	$9,11 \times 10^{-31}\ kg$
Mass of the Earth *Massa van die Aarde*	M	$5,98 \times 10^{24}\ kg$
Radius of the Earth *Radius van die Aarde*	R_E	$6,38 \times 10^{6}\ m$

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* $g = G\frac{M}{r^2}$

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

$W = F\Delta x\cos\theta$	$U = mgh$ or/*of* $E_P = mgh$
$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$	$W_{net} = \Delta K$ or/*of* $W_{net} = \Delta E_k$ $\Delta K = K_f - K_i$ or/*of* $\Delta E_k = E_{kf} - E_{ki}$

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

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 **H** 1 1 **He** 4
0,7 **Fr** 87	0,9 **Ra** 226											1,0 **B** 11	2,5 **C** 12	3,0 **N** 14	3,5 **O** 16	4,0 **F** 19	**Ne** 20
0,7 **Cs** 133	0,9 **Ba** 137	1,2 **La** 139	1,6 **Hf** 179	1,6 **Ta** 181	1,8 **W** 184	1,9 **Re** 186	2,2 **Os** 190	2,2 **Ir** 192	2,2 **Pt** 195	1,9 **Au** 197	1,7 **Hg** 201	1,5 **Aℓ** 27	1,8 **Si** 28	2,1 **P** 31	2,5 **S** 32	3,0 **Cℓ** 35,5	**Ar** 40
0,8 **Rb** 86	1,0 **Sr** 88	1,2 **Y** 89	1,4 **Zr** 91	1,6 **Nb** 92	1,8 **Mo** 96	1,9 **Tc**	2,2 **Ru** 101	2,2 **Rh** 103	2,2 **Pd** 106	1,9 **Ag** 108	1,7 **Cd** 112	1,7 **In** 115	1,8 **Sn** 119	1,9 **Sb** 122	2,1 **Te** 128	2,5 **I** 127	**Xe** 131
0,8 **K** 39	1,0 **Ca** 40	1,3 **Sc** 45	1,5 **Ti** 48	1,6 **V** 51	1,6 **Cr** 52	1,5 **Mn** 55	1,8 **Fe** 56	1,8 **Co** 59	1,8 **Ni** 59	1,9 **Cu** 63,5	1,6 **Zn** 65	1,6 **Ga** 70	1,8 **Ge** 73	2,0 **As** 75	2,4 **Se** 79	2,8 **Br** 80	**Kr** 84
0,9 **Na** 23	1,2 **Mg** 24											1,5 **Aℓ** 27	1,8 **Si** 28	2,1 **P** 31	2,5 **S** 32	3,0 **Cℓ** 35,5	**Ar** 40
1,0 **Li** 7	1,5 **Be** 9											2,0 **B** 11	2,5 **C** 12	3,0 **N** 14	3,5 **O** 16	4,0 **F** 19	**Ne** 20
2,1 **H** 1																	**He** 4

KEY/SLEUTEL

Atomic number *Atoomgetal*

Electronegativity *Elektronegatiwiteit*

29
1,9 **Cu** 63,5

Symbol *Simbool*

Approximate relative atomic mass *Benaderde relatiewe atoommassa*

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**