



# education

Department of  
Education  
FREE STATE PROVINCE

**EXAMINATION**

**GRADE 10**

**TECHNICAL SCIENCES**

**JUNE 2017**

**MARKS: 200**

**TIME: 3 HOURS**

**This question paper consists of 14 pages and two data sheets.**

## **INSTRUCTIONS AND INFORMATION**

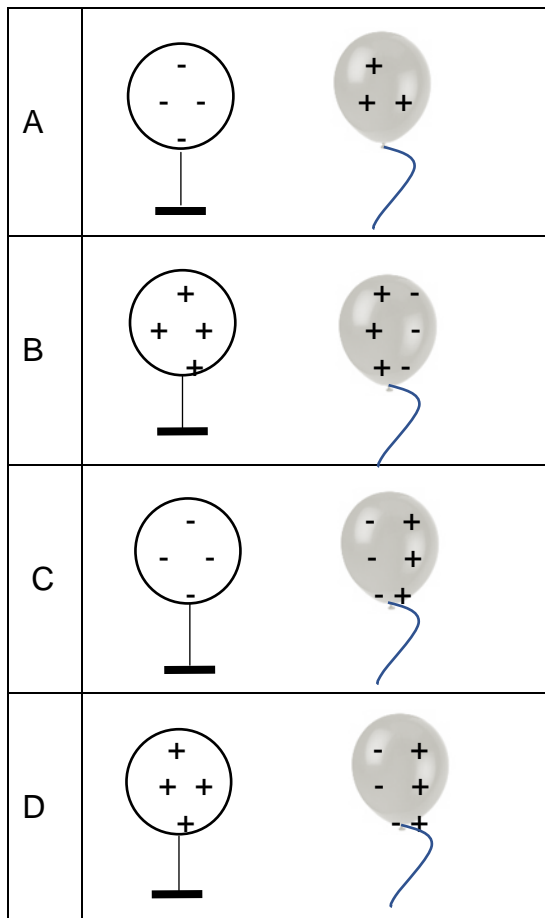
1. Write your name and other applicable information in the appropriate spaces on the ANSWER BOOK.
2. This paper consists of 11 questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. 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 where necessary.
11. Give brief motivations, discussions, et cetera where required.
12. Write neatly and legibly.

### 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, B, C or D next to the question number (1.1 – 1.10) in the ANSWER BOOK.

- 1.1 Which one of the following represents a physical quantity per unit time?
- A Distance
  - B Rate
  - C Force
  - D Time (2)
- 1.2 What is the SI unit for velocity?
- A  $\text{m.h}^{-1}$
  - B  $\text{kn.h}^{-1}$
  - C  $\text{m.s}^{-1}$
  - D  $\text{cm.s}^{-1}$  (2)
- 1.3 Which one of the following is a vector quantity?
- A Time
  - B Distance
  - C Energy
  - D Acceleration (2)
- 1.4 Which one of the following concerning mass and weight is correct?
- A Weight is a force of attraction.
  - B Mass is a force of attraction.
  - C Mass is measured in newton.
  - D Weight is measured in kilogram. (2)

- 1.5 A neutral balloon is brought closer to a charged sphere without touching it. Which one of the following is the correct representation of the distribution of charges on the balloon?



(2)

- 1.6 Which one of the following does NOT influence the resistance of a copper wire?

- A Shape of the wire
- B Thickness of the wire
- C Length of the wire
- D Temperature of the wire

(2)

1.7 A negatively charged ion has ...

- A more electrons than protons, because it lost protons.
- B more protons than electrons, because it lost electrons.
- C more electrons than protons, because it gained electrons.
- D more protons than electrons, because it gained protons. (2)

1.8 What is the general name for NaCl?

- A Plaster of Paris
- B Table salt
- C Ammonia
- D Nitric acid (2)

1.9 Which one of the following is correct?

- A  $F^-$  is a cation.
- B  $Cu^{2+}$  is a cation.
- C  $CO_2$  is an element.
- D  $F_2$  is a compound. (2)

1.10 Which one of the following is an isotope of  ${}^{27}_{13}X$  ?

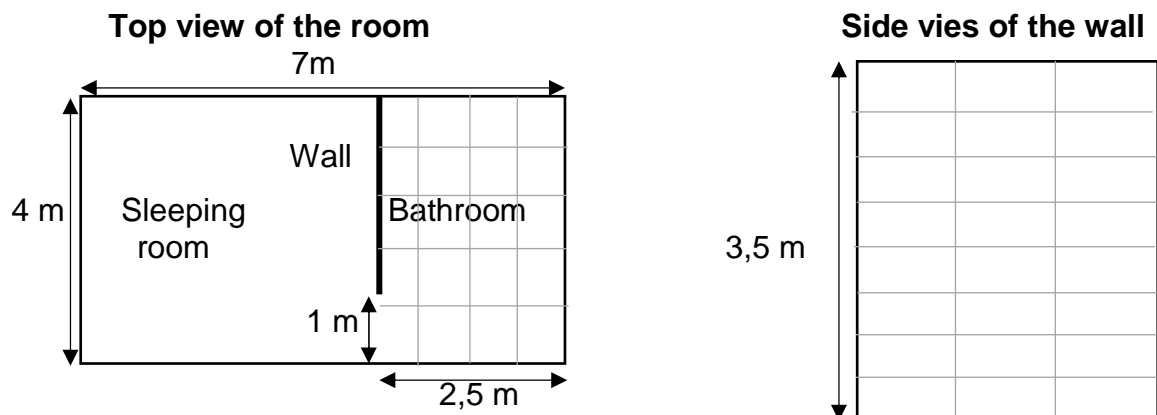
- A  ${}^{27}_{14}X$
  - B  ${}^{28}_{13}X$
  - C  ${}^{27}_{12}X$
  - D  ${}^{27}_{15}X$  (2)
- [20]**

## QUESTION 2

- 2.1 A car moves at  $85 \text{ km} \cdot \text{h}^{-1}$ .
- 2.2.1 Convert the speed of the car to  $\text{m} \cdot \text{s}^{-1}$ . (3)
- 2.2.2 Calculate how far, in km, the car travels in six hours. (3)
- 2.2 Write down the following numbers in scientific notation.
- 2.2.1 4 567 340 km (1)
- 2.2.2 0,000 325 min (1)
- 2.3 The approximate density of the earth is  $5\,515,3 \text{ kg} \cdot \text{m}^{-3}$ . Convert this number to  $\text{g} \cdot \text{cm}^{-3}$ . (3)
- 2.4 A block of salt, with dimensions of  $10 \text{ cm} \times 10 \text{ cm} \times 2 \text{ cm}$ , weighs 433 g. It is thrown into a container with oil that has a density of  $0,93 \text{ g} \cdot \text{cm}^{-3}$ . Determine whether the salt will float or sink. Show all your calculations and express your final answer in  $\text{g} \cdot \text{cm}^{-3}$ . (6)
- [17]**

## QUESTION 3

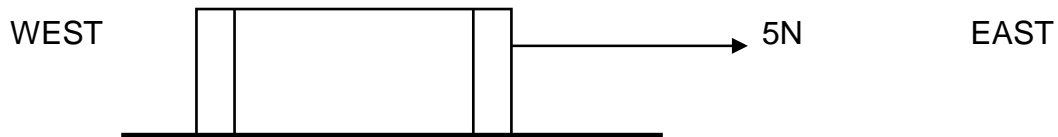
A home owner asks the grade 10 technical sciences class to build a wall that will divide his sleeping room into two parts; one part will be used as sleeping room and the other part as bathroom. The bathroom must be tiled with tiles that are 30 cm by 30 cm and the wall must be painted on BOTH sides. The diagrams below represent a top view of the room and a side view of the wall. Study it thoroughly and answer the questions that follow.



- 3.1 Calculate the area, in  $\text{m}^2$ , that must be tiled. (3)
- 3.2 Calculate how many tiles are needed to tile the bathroom. (6)
- 3.3 Calculate how many litres of paint is necessary to paint the wall on both sides if 1 l of paint covers  $11 \text{ m}^2$ . (5)
- 3.4 Calculate how long it will take to build the wall if the learners build at a rate of  $0,0125 \text{ m}^2$  per minute. Express your answer in hours. (5)
- [19]**

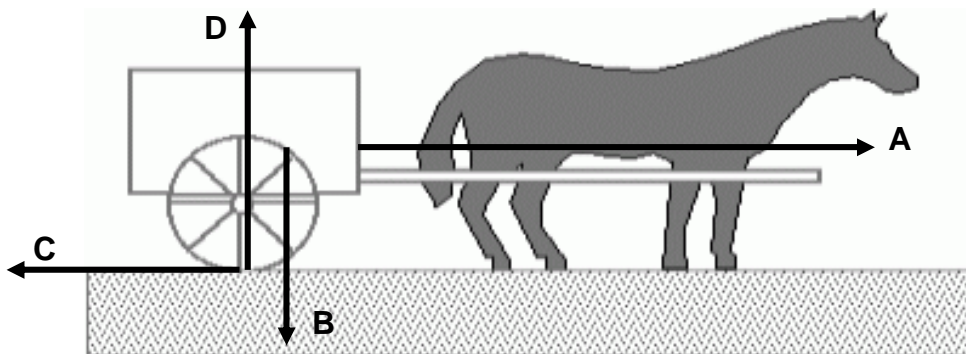
## QUESTION 4

- 4.1 Two horizontal forces, one with a magnitude of 5 N and an unknown force  $F$ , are acting on an object that is at rest on a smooth, horizontal surface. The sketch shows only the direction of the 5 N force. It is not a scale drawing.



The **RESULTANT** of the two forces is 13 N west. Determine the magnitude of the force  $F$ :

- 4.1.1 Graphically, by using a scale where 1 cm represents 2 N (4)
- 4.1.2 With the help of a calculation (4)
- 4.2 The diagram below shows forces **A**, **B**, **C** and **D** acting on a wagon when a donkey pulls the wagon with the help of rope that is attached to the wagon.



- 4.2.1 Give the name of each force and indicate each time whether it is a contact or non-contact force. (8)

- 4.2.2 Give the definition of force **C** in words. (2)

**[18]**

## QUESTION 5

- 5.1 Experiments were done on SULPHUR, GOLD, IRON and MERCURY to investigate their macroscopic properties and the following results were obtained. Use these results to answer the questions that follow.

Material	Properties
1	<ul style="list-style-type: none"> <li>• Yellow with a dull surface</li> <li>• Brittle</li> <li>• Insulator of heat and electricity</li> <li>• Melting point 119°C</li> </ul>
2	<ul style="list-style-type: none"> <li>• Heavy</li> <li>• Grey with a shiny surface</li> <li>• Non-magnetic</li> <li>• Good conductor of heat and electricity</li> <li>• Melting point -39°C</li> </ul>
3	<ul style="list-style-type: none"> <li>• Ductile</li> <li>• Heavy</li> <li>• Yellow with a shiny surface</li> <li>• Non-magnetic</li> <li>• Good conductor of heat and electricity</li> <li>• Melting point 1 065°C</li> </ul>
4	<ul style="list-style-type: none"> <li>• Ductile</li> <li>• Heavy</li> <li>• Grey with shiny surface</li> <li>• Magnetic</li> <li>• Good conductor of heat and electricity</li> <li>• Melting point 1 540°C</li> </ul>

- 5.1.1 Which one of the substances that was tested has the strongest forces between the particles? Write down only 1, 2, 3 or 4 and explain your answer. (2)
- 5.1.2 Explain what is meant by BRITTLE. (2)
- 5.1.3 Explain what is meant by DUCTILITY and give an example where it is used in daily life. (3)
- 5.1.4 Give another word for materials that are magnetic. (1)
- 5.1.5 Give the phase change that takes place at the melting point of a substance. (2)
- 5.1.6 Identify materials 1 to 4. (4)



- 5.2 Complete the following table. Write down only the question number and correct answer.

Name	Symbol	Protons	Neutrons	Electrons	Nucleons
Magnesium	Mg	12	12	5.2.1	24
5.2.2	5.2.3	8	8	10	16
Iron ion	Fe <sup>3+</sup>	5.2.4	30	23	5.2.5
Potassium	5.2.6	19	5.2.7	19	39

(7)  
[21]

## QUESTION 6

The letters **A** to **M** in the simplified periodic table below represent some of the elements. The letters **A** to **M** are NOT the chemical symbols of the elements.

	1 (I)	2 (II)	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
1	<b>A</b>							<b>M</b>
2	<b>B</b>	<b>E</b>	<b>G</b>	<b>H</b>	<b>I</b>	<b>K</b>	<b>L</b>	
3	<b>C</b>	<b>F</b>			<b>J</b>			
4	<b>D</b>							

- 6.1 Write down the NAME of the GROUP to which elements **A**, **B**, **C** and **D** belong to. (1)
- 6.2 How many protons does one atom of element **K** have? (1)
- 6.3 Write down the NAME of the GROUP to which element **M** belongs to. (1)
- 6.4 Write down the letter (choose from **A** to **M**) that represents an element which:
- 6.4.1 Has four valency electrons (1)
  - 6.4.2 Has an atomic number of eight (1)
  - 6.4.3 Is a non-metal, but is grouped with the metals on the period table (1)
  - 6.4.4 Appears in period four of the periodic table (1)
  - 6.4.5 Has a completely filled highest energy level (1)

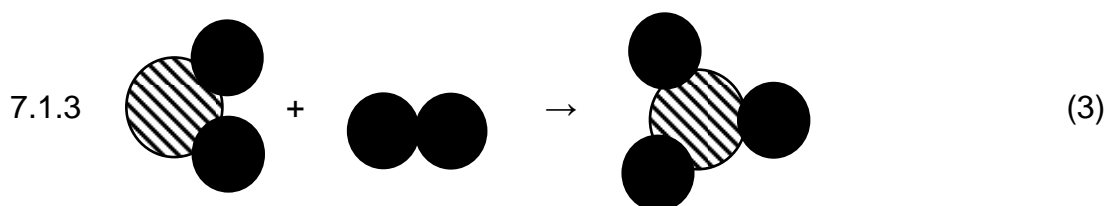
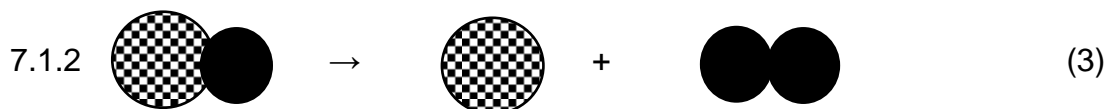
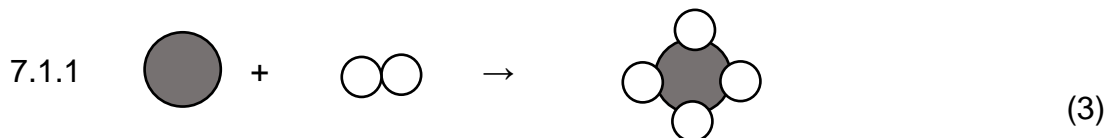
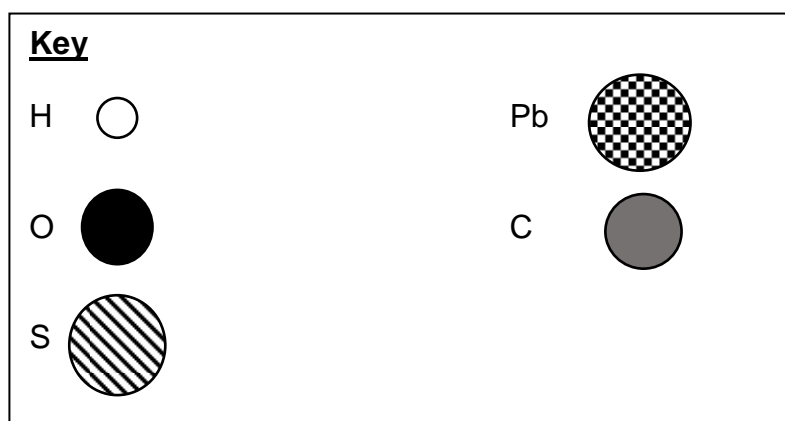
6.4.6 Has an electron configuration of  $1s^2 2s^2 2p^6 3s^2 3p^3$  (1)

6.4.7 Is a metalloid (1)

6.5 Draw the Aufbau diagram of element **C**. (4)  
**[14]**

### QUESTION 7

7.1 Use the following key to RE-WRITE THE REACTIONS BELOW IN SYMBOLS.  
BALANCE each reaction afterwards.



7.2 Give the CHEMICAL NAME of each of the following compounds:

7.2.1  $Al_2O_3$  (2)

7.2.2  $MgSO_4$  (2)

7.2.3  $FeN$  (2)

7.3 Write down the CHEMICAL FORMULA of each of the following compounds:

7.3.1 Lead(IV) oxide (2)

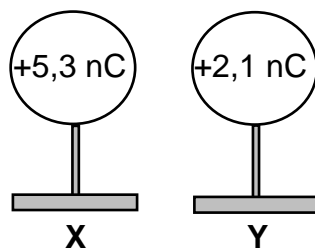
7.3.2 Calcium hydroxide (2)

7.3.3 Sodium chloride (2)

**[21]**

### QUESTION 8

Two identical metal spheres, **X** and **Y**, on isolated stands, carry charges of +5,3 nC and +2,1 nC respectively. The spheres are allowed to touch where after they are taken back to their original positions.



8.1 Give the *principle of conservation of charge* in words. (2)

8.2 Calculate the charge, in coulomb, on sphere **X** AFTER they have been separated. (3)

8.3 Were electrons transferred from **X** to **Y** or from **Y** to **X** when the spheres touched each other? Write down only **X** to **Y** or **Y** to **X** and give a reason for your answer. (3)

8.4 Calculate how many electrons were transferred during contact if the charge on one electron is  $-1,6 \times 10^{-19}$  C. Use the following formula:

$$n_e = \frac{Q_f - Q_i}{Q_e}$$

$n_e$  is the number of electrons  
 $Q_f$  is the charge after contact  
 $Q_i$  is the charge before contact  
 $Q_e$  is the charge on one electron

(4)  
**[12]**

## QUESTION 9

Electric circuits are used in a variety of everyday appliances to make life easier. Answer the following questions about circuits.

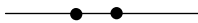
9.1 Name THREE requirements for charges to flow; i.e. to have a current. (3)

9.2 Re-draw the following table in your answer book and use it to briefly describe THREE DIFFERENCES between series and parallel circuits.

Series circuit	Parallel circuit

(6)

9.3 Complete the following table by writing down ONLY the QUESTION NUMBER and CORRECT ANSWER in your answer book.

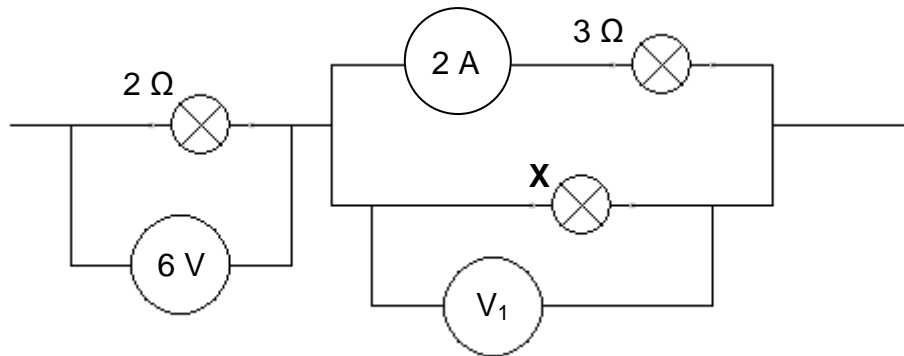
Component(s)	Symbol
2 cells in parallel	9.3.1
9.3.2	
Rheostat	9.3.3

(4)

**[13]**

### QUESTION 10

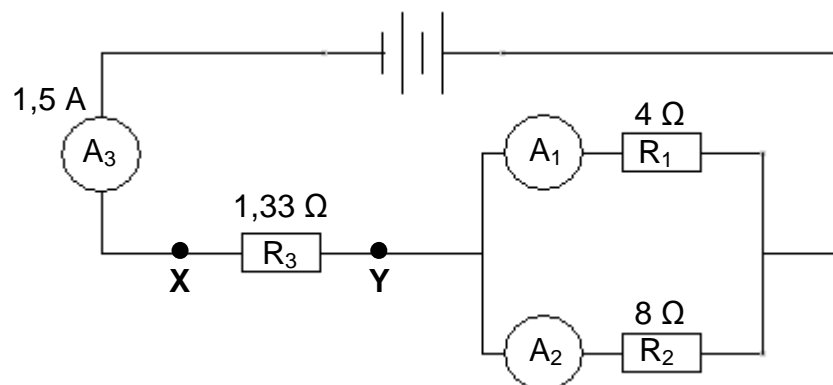
Consider the section of an electric circuit below. The voltmeter across the  $2\ \Omega$  bulb registers a reading of  $6\text{ V}$  and the current in the  $3\ \Omega$  bulb is  $2\text{ A}$ . The  $3\ \Omega$  bulb is connected in parallel with bulb **X** with an unknown resistance. Voltmeter 1 ( $V_1$ ) is connected across bulb **X**.



- 10.1 Show that voltmeter  $V_1$  registers a reading of  $6\text{ V}$ . (3)
  - 10.2 Calculate the total potential difference across all three bulbs. (4)
  - 10.3 Explain the difference between the total potential difference and emf. (4)
  - 10.4 Calculate the amount of work done when  $540\text{ C}$  of charge moves through the  $2\ \Omega$  bulb. (4)
- [15]**

### QUESTION 11

Study the circuit diagram below and answer the questions that follow.



- 11.1 Explain in words what an *electric current* is. (2)
- 11.2 What is the direction of current in this circuit? Choose your answer from **X** to **Y** or **Y** to **X**. Explain your answer. (3)
- 11.3 Calculate the amount of charge that flows through the  $1,33\ \Omega$  resistor in 1 hour. (4)

11.4 How does the amount of charge which flows through  $R_1$  compare with the amount of charge that flows through  $R_2$  in the same time? Choose your answer from MORE, THE SAME or LESS. (2)

11.5 Calculate the total resistance in the circuit. (6)

11.6 A resistor  $R_4$  is connected in SERIES with resistor  $R_3$ . What influence does this have on the following?

11.6.1 Total resistance in circuit. Choose your answer from DECREASES, REMAINS THE SAME or INCREASES. (2)

11.6.2 Reading on ammeter  $A_3$ . Choose your answer from DECREASES, REMAINS THE SAME or INCREASES. (2)

11.7 Resistor  $R_4$  is disconnected so that the circuit is in its original state.  $R_4$  is then connected in PARALLEL with resistor  $R_2$ . What influence does this have on the following?

11.7.1 Total resistance in circuit. Choose your answer from DECREASES, REMAINS THE SAME or INCREASES. (2)

11.7.2 Reading on ammeter  $A_3$ . Choose your answer from DECREASES, REMAINS THE SAME or INCREASES. (2)

11.8 Resistor  $R_4$  and resistor  $R_2$  are both disconnected. What influence does this have on the following?

11.8.1 Total resistance in circuit. Choose your answer from DECREASES, REMAINS THE SAME or INCREASES. (2)

11.8.2 Reading on ammeter  $A_3$ . Choose your answer from DECREASES, REMAINS THE SAME or INCREASES. (2)

11.9 Which single resistor must be removed from the circuit in its original state if you want to interrupt the current? (1)

**[30]**

**GRAND TOTAL: 200**

**DATA FOR TECHNICAL SCIENCES GRADE 10  
JUNE EXAMINATION**

**GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 10  
JUNIE-EKSAMEN**

**TABLE 1: FORMULAE / TABEL 1: FORMULES**

**PERIMETER, AREA, VOLUME & DENSITY  
OMTREK, OPPERVLAKTE, VOLUME & DIGTHEID**

Volume <i>Volume</i>	Volume = area of base x height <i>Volume = oppervlak van basis x hoogte</i>
Perimeter of a rectangle <i>Omtrek van 'n reghoek</i>	Perimeter = $2l + 2w$ <i>Omtrek = <math>2l + 2b</math></i>
Area of a rectangle <i>Oppervlak van 'n reghoek</i>	Area = $l \times w$ <i>Oppervlak = <math>l \times b</math></i>
Area of a square <i>Oppervlakte van 'n vierkant</i>	Area = side x side <i>Oppervlakte = <math>sy \times sy</math></i>
Density of an object <i>Digtheid van 'n voorwerp</i>	Density = $\frac{\text{Mass}}{\text{Volume}}$ <i>Digtheid = <math>\frac{\text{Massa}}{\text{Volume}}</math></i>

**MOTION / BEWEGING**

Speed = $\frac{\text{Distance}}{\text{Time}}$	Spoed = $\frac{\text{Afstand}}{\text{Tyd}}$
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**ELECTROSTATICS / ELEKTROSTATIKA**

$V = \frac{W}{Q}$
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**ELECTRIC CIRCUITS / ELEKTRIESE STROOMBANE**

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

**TABLE 2: THE PERIODIC TABLE OF ELEMENTS**  
**TABEL 2: 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)
<p><b>KEY/SLEUTEL</b></p> <p>Atomic number <i>Atoomgetal</i></p> <p>Electronegativity <i>Elektronegatiwiteit</i></p> <p>Symbol <i>Simbool</i></p> <p>Approximate relative atomic mass <i>Benaderde relatiewe atoommassa</i></p>																	
1 H 1																	2 He 4
3 Li 7	4 Be 9																
11 Na 23	12 Mg 24																
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 86	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 227															
58 Ce 140	59 Pr 141	60 Nd 144	61 Pm 147	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 231	92 U 238	93 Np 237	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259	103 Lr 262				