



education

Department of
Education
FREE STATE PROVINCE

PROVINCIAL EXAMINATION

GRADE 10

TECHNICAL SCIENCES

JUNE 2016

MARKS: 150

TIME: 3 HOURS

This paper consists of 14 pages and two data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of EIGHT 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 pocket 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 applicable.
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–D) next to the question number (1.1–1.10) in the ANSWER BOOK.

- 1.1 Which one of the following materials is the best conductor of electricity?
- A Metal
 - B Plastic
 - C Wood
 - D Porcelain (2)
- 1.2 What is the SI unit of mass?
- A m
 - B N
 - C g
 - D kg (2)
- 1.3 Which one of the following is a scalar quantity?
- A Velocity
 - B Force
 - C Energy
 - D Momentum (2)
- 1.4 Which one of the following pairs represents two vector quantities?
- A Weight and mass
 - B Velocity and speed
 - C Force and velocity
 - D Velocity and energy (2)

- 1.5 In which one of the following are two or more different atoms combined in definite proportions?
- A Compounds
 - B Elements
 - C Mixtures
 - D Solids (2)
- 1.6 Two displacement vectors of magnitudes 20 cm and 80 cm, acting along a straight line, are added. Which one of the following is the only possible choice for the magnitude of the resultant displacement in cm?
- A 0
 - B 28
 - C 60
 - D 114 (2)
- 1.7 Which statement is true of a positively charged object?
- A A positively charged object does not have any electrons.
 - B A positively charged object does not have neutrons or electrons.
 - C There are more protons than electrons on a positively charged object.
 - D Protons and electrons are both positively charged on a positively charged object. (2)
- 1.8 Which one of the following correctly represents a balanced equation for the reaction between sulphur and oxygen to form sulphur dioxide.
- A $\text{S} + \text{O}_2 \rightarrow \text{SO}_2$
 - B $\text{S}_2 + \text{O}_2 \rightarrow \text{S}_2\text{O}_2$
 - C $\text{S} + 2\text{O} \rightarrow \text{SO}_2$
 - D $\text{S}_2 + \text{O} \rightarrow \text{S}_2\text{O}$ (2)

1.9 How does the resistance of a copper wire, at constant temperature and with the same thickness, change when its length is increased?

- A Increases
- B Decreases
- C No change
- D Decreases and then increases. (2)

1.10 A truck moves at a constant speed of $80 \text{ km} \cdot \text{h}^{-1}$. What is the speed of the truck in $\text{m} \cdot \text{s}^{-1}$?

- A $\frac{80}{60 \times 60}$
 - B $\frac{80\,000}{60 \times 60}$
 - C $80 \times 60 \times 60$
 - D $80\,000 \times 60 \times 60$ (2)
- [20]**

QUESTION 2

2.1 A cheap wrist watch loses time at a rate of 8,5 s per day.

2.1.1 How much time, in s, will the watch lose in 30 days? (2)

2.1.2 Convert the answer to question 2.1.1 to minutes. (2)

2.2 Write down the following numbers in scientific notation.

2.2.1 3 560 000 000 m (1)

2.2.2 0,000 000 492 s (1)

2.3 The acceleration due to gravity near the surface of the earth is $9,8 \text{ m}\cdot\text{s}^{-2}$. Convert this number to $\text{cm}\cdot\text{s}^{-2}$. (2)

2.4 A cylindrical container has the following dimensions: radius of the base 7,2 cm and height 5 cm.



Calculate the:

2.4.1 area of the base (take $\pi = 3,14$); and (3)

2.4.2 volume of the container. (3)

2.5 The mass of a box is 2,3 kg. Two gold pieces with masses of 200 g and 170 g are put into the box.

Calculate the:

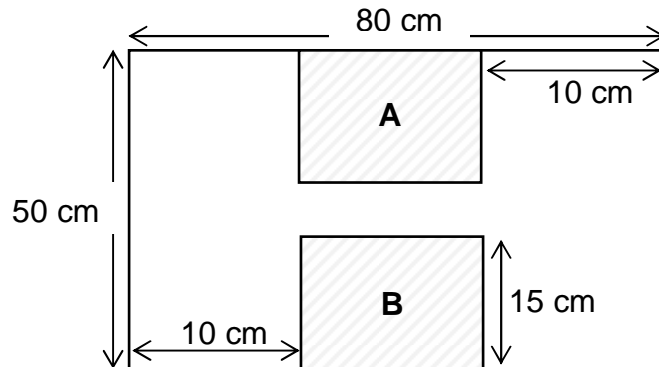
2.5.1 total mass of the box in g; and (3)

2.5.2 difference in the masses of the pieces in g. (2)

[19]

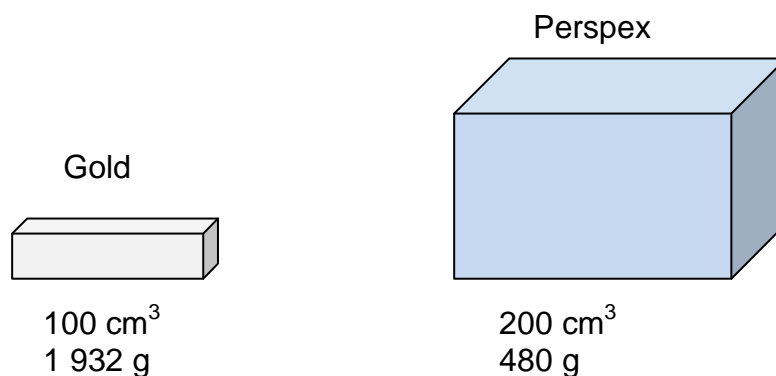
QUESTION 3

- 3.1 Learners have a rectangular metal sheet of dimensions 50 cm by 80 cm. They want to cut out two pieces, **A** and **B**, in order to obtain an H-shaped sheet. The dimensions of **A** and **B** are the same.



Calculate the area of:

- 3.1.1 the metal sheet before **A** and **B** have been removed; (3)
- 3.1.2 piece **A** that must be removed; and (3)
- 3.1.3 the H-shaped sheet after **A** and **B** have been removed. (3)
- 3.2 Two objects, consisting of gold and perspex with the given dimensions and masses, are shown below.



Show by means of a calculation that the density of gold is more than the density of perspex.

(5)
[14]

QUESTION 4

- 4.1 Ben investigates some properties of the materials listed in the table below in order to classify them. QUESTIONS 4.1.1 TO 4.2.3 REFER TO THIS TABLE.

Column 1	Column 2
Plastic ruler	Aluminium
Iron nail	Phosphorus
Sulphur	Neon

From COLUMN 1 write down ONE material which is:

- 4.1.1 magnetic; (1)
- 4.1.2 brittle; and (1)
- 4.1.3 an electrical insulator. (1)

From COLUMN 2 write down ONE material which is a:

- 4.2.1 good conductor of electricity; (1)
- 4.2.2 non-metal; and (1)
- 4.2.3 gas. (1)

- 4.3 When sulphur powder and iron filings are mixed and heated, iron sulphide is formed.

4.3.1 Is this change a physical or chemical change? Write only PHYSICAL or CHEMICAL as an answer. (1)

4.3.2 Explain your answer to question 4.3.1. (2)

4.3.3 Write down the formula for iron sulphide. (2)

- 4.4 Explain the difference between an element and a compound. (4)
- [15]**

QUESTION 5

USE THE ATTACHED PERIODIC TABLE TO ANSWER THIS QUESTION.

5.1 Write down only the SYMBOL or NAME of:

5.1.1 the element in period two with seven valence electrons; (1)

5.1.2 an inert gas in period three; (1)

5.1.3 an element in group one who does not have neutrons; (1)

5.1.4 the element in period two that forms an ion with a 2- charge; (1)

5.1.5 a non-metal in group one; (1)

5.1.6 the element that has the same number of electrons as Ca^{2+} ; (1)

5.1.7 a period three element that forms an X^{2-} ion; (1)

5.1.8 an alkali earth metal in the second period; (1)

5.1.9 the element with five electrons spread over the first two energy levels; (1)

5.1.10 an element with atomic number 19; and (1)

5.1.11 an element with mass number 14. (1)

5.2 Write down the AUFBAU diagram for an oxygen atom. (3)

5.3 Write down the chemical formula of:

5.3.1 calcium nitrate; (2)

5.3.2 potassium sulphate; and (2)

5.3.3 lithium chloride. (2)

5.4 Rewrite the following UNBALANCED or PARTLY BALANCED equations in your answer book and balance each one.

5.4.1 $\text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O}$ (2)

5.4.2 $\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ (2)

5.4.3 $\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$ (2)

[26]

QUESTION 6

The table shows some chemical substances.

A Pb ²⁺	B CuO	C O ²⁻	D I	E Si	F Li
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6.1 Write down the LETTER (A, B, C, etc.) that represents:

6.1.1 a metallic element; (1)

6.1.2 a non-metallic element; (1)

6.1.3 a metalloid; (1)

6.1.4 a compound; (1)

6.1.5 a cation; and (1)

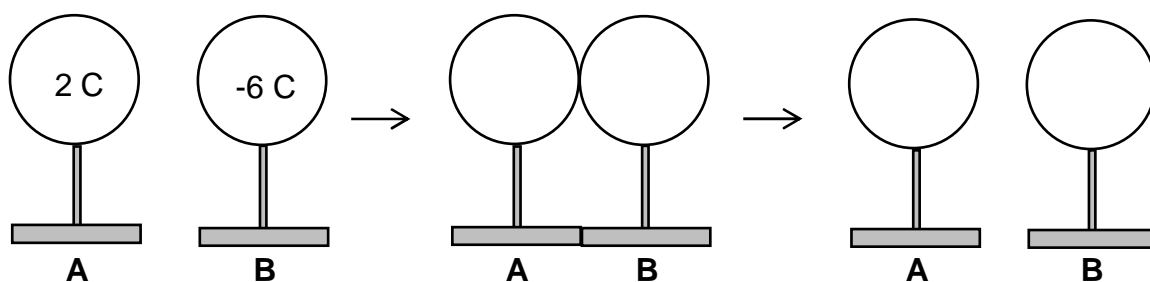
6.1.6 an anion. (1)

6.2 Write down the chemical formula of the compound formed between **F** and **D**. (1)

[7]

QUESTION 7

7.1 Two identical metal spheres, **A** and **B**, on insulated stands carry charges of 2 C and -6 C respectively. The spheres are allowed to touch and then returned to their original positions as shown below.



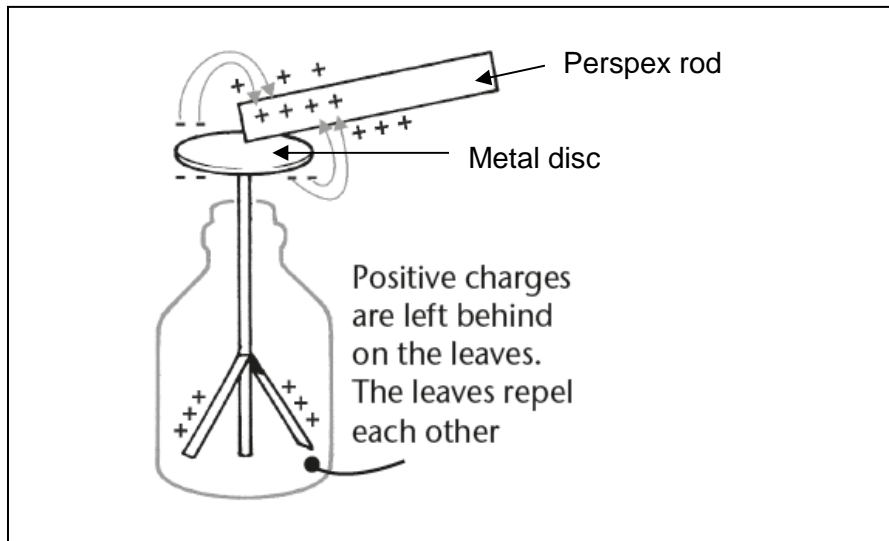
7.1.1 On which sphere, **A** or **B**, are more protons than electrons BEFORE they have touched? (1)

7.1.2 State the *principle of conservation of charge* in words. (2)

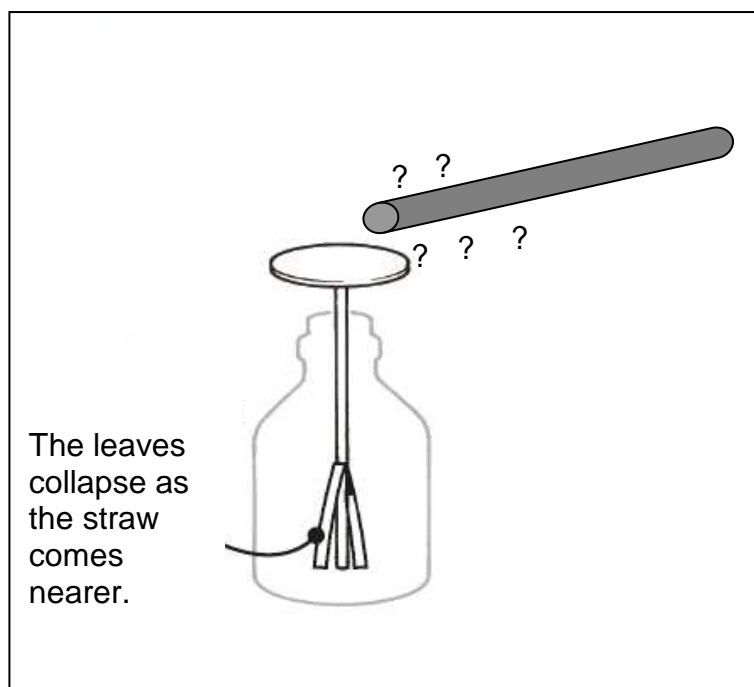
7.1.3 Calculate the charge on sphere **A** AFTER the spheres have been separated. (3)

7.1.4 Were electrons transferred from **A** to **B** or **B** to **A** when the spheres touched? Write down only **A** to **B** or **B** to **A**. (2)

- 7.2 When you touch a metal door handle on a dry, hot day you experience a light, electric shock. Explain this phenomenon. (3)
- 7.3 A perspex rod is charged positively by rubbing it with a woollen cloth. The charged perspex rod is then rubbed on the metal disc of an electroscope to give the latter a positive charge as shown.

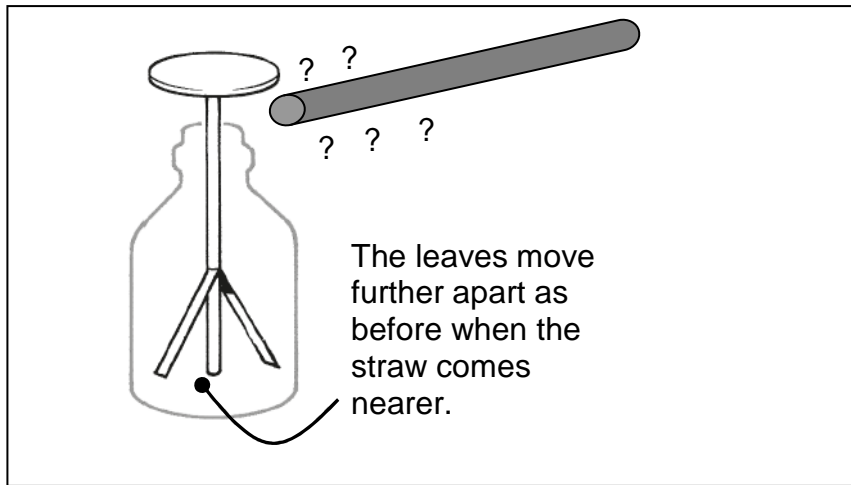


When a straw with an unknown charge is brought near the metal disc of the electroscope, the leaves of the electroscope collapse as shown below.



- 7.3.1 What type of charge does the straw carry? (1)
- 7.3.2 Explain why the leaves of the electroscope collapse. (3)

Another straw with an unknown charge is then brought near the metal plate of the electroscope. The leaves of the electroscope move further apart as before as shown below.

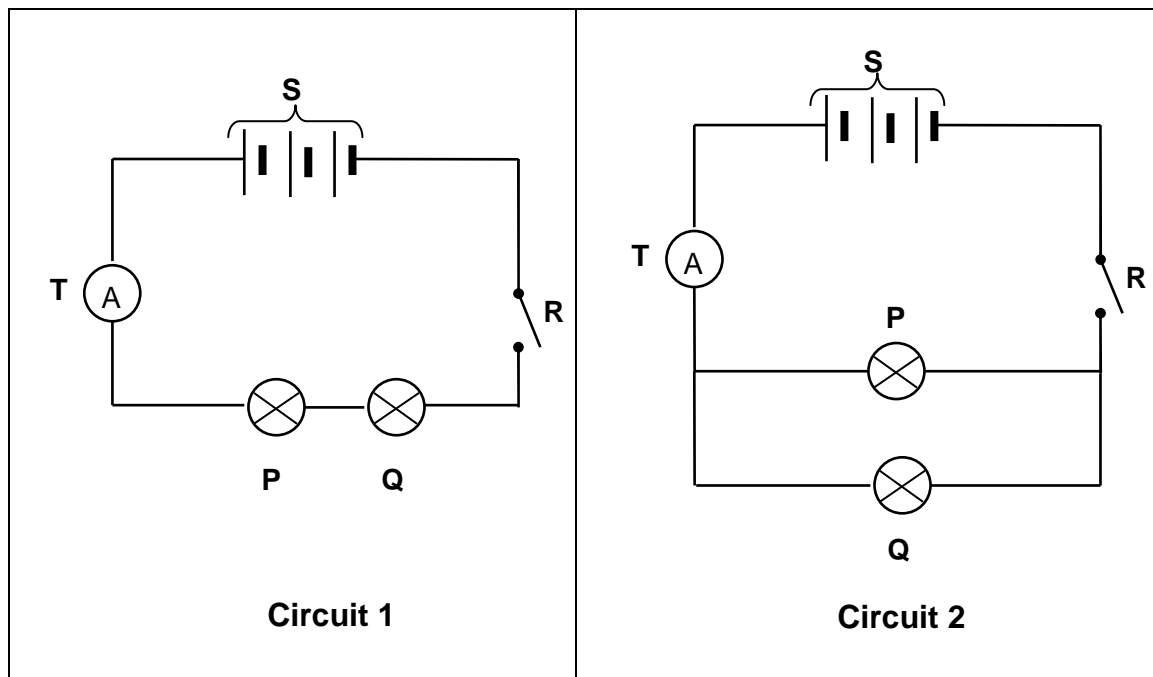


7.3.3 What type of charge does this straw carry? (1)

7.3.4 Explain why the leaves of the electroscope move further apart. (3)
[19]

QUESTION 8

Learners design an electrical system for their science project car. They design two circuits as shown.



- 8.1 In which one of the circuit diagrams are components **P** and **Q** connected in series? Write only CIRCUIT 1 or CIRCUIT 2. (1)
- 8.2 Write down the name of the circuit component represented by:
- 8.2.1 **P** (1)
- 8.2.2 **R** (1)
- 8.2.3 **S** (1)
- 8.2.4 **T** (1)
- 8.3 Component **R** of CIRCUIT 1 is closed. QUESTIONS 8.3.1 TO 8.3.6 REFER TO CIRCUIT 1.
- 8.3.1 Define *electric current* in words. (2)
- 8.3.2 A charge of 6 C is flowing through **P** in 2 s. Calculate the current in **P**. (3)
- 8.3.3 Calculate the charge flowing through **Q** in 5 s. (2)
- 8.3.4 Calculate the emf of component **S** if it transfers a maximum of 90 J of energy to 20 C of charge. (3)

8.3.5 How many cells does component **S** have? (1)

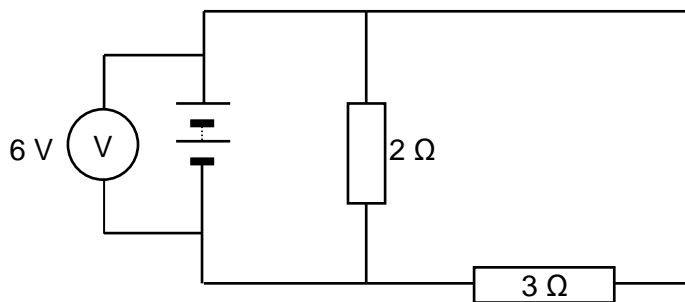
8.3.6 Calculate the emf of one cell if the cells are identical. (1)

8.4 Components **R** of CIRCUIT 2 is also closed.

8.4.1 In which circuit will component **Q** stop working when **P** is removed?
Write only CIRCUIT 1 or CIRCUIT 2. (1)

8.4.2 Give a reason for your answer to question 8.4.1. (1)

8.5 The emf of the battery in the circuit below is 6 V.



Calculate the:

8.5.1 total resistance of the circuit; (4)

8.5.2 main current in the circuit; (3)

8.5.3 current in the $2\ \Omega$ resistor; and (2)

8.5.4 current in the $3\ \Omega$ resistor. (2)

[30]

GRAND TOTAL: 150

**DATA FOR TECHNICALSCIENCES 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 of an object <i>Volume van 'n voorwerp</i>	Volume = area of base x height <i>Volume = oppervlakte van basis x hoogte</i>
Perimeter of a rectangle <i>Omtrek van 'n reghoek</i>	Perimeter = $2l + 2w$ <i>Omtrek = $2l + 2b$</i>
Area of a triangle <i>Oppervlakte van 'n driehoek</i>	Area = $\frac{1}{2}bh$ <i>Oppervlakte = $\frac{1}{2}bh$</i>
Area of a circle <i>Oppervlakte van 'n sirkel</i>	Area = $\pi \times \text{radius} \times \text{radius}$ <i>Oppervlakte = $\pi \times \text{radius} \times \text{radius}$</i>
Volume of a cube <i>Volume van 'n kubus</i>	Volume = side x side x side <i>Volume = sy x sy x sy</i>
Area of a square <i>Oppervlakte van 'n vierkant</i>	Area = side x side <i>Oppervlakte = sy x sy</i>
Area of a trapezium <i>Oppervlakte van 'n trapesium</i>	Area = $\frac{1}{2}(\text{sum of parallel sides}) \times$ perpendicular distance in between <i>Oppervlakte = $\frac{1}{2}(\text{som van ewewydige sye}) \times \text{loodregte afstand tussen-in}$</i>
Density of an object <i>Digtheid van 'n voorwerp</i>	Density = $\frac{\text{Mass}}{\text{Volume}}$ <i>Digtheid = $\frac{\text{Massa}}{\text{Volume}}$</i>

ELECTROSTATICS / ELEKTROSTATIKA

$V = \frac{W}{Q}$

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>KEY/SLEUTEL</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>																	
2,1 1 H 1							29 Cu 63,5										2 He 4
1,0 3 Li 7	1,5 4 Be 9											2,0 5 B 11	2,5 6 C 12	3,0 7 N 14	3,5 8 O 16	4,0 9 F 19	10 Ne 20
0,9 11 Na 23	1,2 12 Mg 24											1,5 13 Al 27	1,8 14 Si 28	2,1 15 P 31	2,5 16 S 32	3,0 17 Cl 35,5	18 Ar 40
0,8 19 K 39	1,0 20 Ca 40	1,3 21 Sc 45	1,5 22 Ti 48	1,6 23 V 51	1,6 24 Cr 52	1,5 25 Mn 55	1,8 26 Fe 56	1,8 27 Co 59	1,8 28 Ni 59	1,9 29 Cu 63,5	1,6 30 Zn 65	1,6 31 Ga 70	1,8 32 Ge 73	2,0 33 As 75	2,4 34 Se 79	2,8 35 Br 80	36 Kr 84
0,8 37 Rb 86	1,0 38 Sr 88	1,2 39 Y 89	1,4 40 Zr 91	41 Nb 92	1,8 42 Mo 96	1,9 43 Tc	2,2 44 Ru 101	2,2 45 Rh 103	2,2 46 Pd 106	1,9 47 Ag 108	1,7 48 Cd 112	1,7 49 In 115	1,8 50 Sn 119	1,9 51 Sb 122	2,1 52 Te 128	2,5 53 I 127	54 Xe 131
0,7 55 Cs 133	0,9 56 Ba 137	57 La 139	1,6 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	1,8 81 Tl 204	1,8 82 Pb 207	1,9 83 Bi 209	2,0 84 Po	2,5 85 At	86 Rn
0,7 87 Fr	0,9 88 Ra 226	89 Ac															
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				