Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 10

NOVEMBER 2019

TECHNICAL SCIENCES P2

MARKS: **150**

TIME: **3 hours**

* X T S C E 2 *

This question paper consists of 16 pages, including a graph sheet and 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. You may use a non-programmable calculator.
5. LEAVE a line open between subsections, i.e. QUESTION 2.1 and QUESTION 2.2.
6. You are advised to use the attached DATA SHEETS.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your final numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc. where required.
10. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answers and write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK, for example 1.11 E.

1.1 Which ONE of the following is considered as a non-metal property?

A It conducts heat
B It breaks easily
C It has a dull colour
D It conducts electricity (2)

1.2 Which ONE of the following is an element?

A Ice
B Salt
C Water
D Nitrogen (2)

1.3 A student has a container filled with iron pieces and plastic pieces. In order to collect the iron pieces, which of the following apparatus must be used?

A Spoon
B Paper
C Tweezers
D Bar magnet (2)

1.4 Given the following equation:

$$Mg + O_2 \rightarrow MgO$$

Balance the equation if NOT balanced.
How many Mg moles will react with O_2?

A 1
B 2
C 4
D 3 (2)

1.5 In which group on the periodic table will you find alkali metals?

A Group 1
B Group 2
C Group 3
D Group 4 (2)

1.6 Which ONE of the following defines heat?

A It has mass
B SI unit Joules
C Is a form of energy
D Indication of how hot or cold a body is (2)

1.7 An element that changes from an atom to ANION, when it accepts an electron.

A Boron
B Lithium
C Nitrogen
D Potassium (2)

1.8 The mass number of an element is the number of …

A electrons.
B protons and electrons.
C protons and neutrons.
D electrons and neutrons. (2)

1.9 The correct chemical formula for sodium carbonate is ...

A Na_2CO.
B Na_2CO_3.
C Na_2CO_2.
D $Na_3\,CO_3$. (2)

1.10 A good example of a semiconductor (metalloid) is …

A silicon.
B silver.
C sulphur.
D sodium. (2)

[20]

QUESTION 2 (Start on a NEW page.)

A learner is in possession of four types of rings.

2.1 Which of the rings:

2.1.1 Are metals? (2)

2.1.2 Are semiconductors? (2)

2.2 Silicon is an example of a thermal insulator.

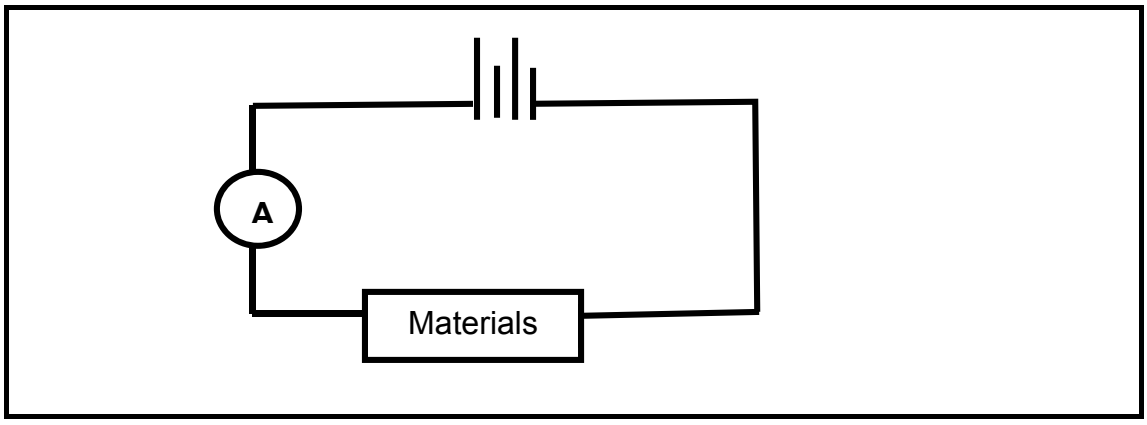
Answer only YES or NO. (1)

2.3 Name TWO properties of non-metals. (2)

2.4 The copper ring is placed outside in open air and reacts with oxygen.

Write down the BALANCED EQUATION for the reaction. (4)

2.5 Furthermore, the learner takes these rings with two other unknown materials (Material **A** and Material **B**) and d. The learner connects all these materials one by one in a circuit as shown below:



After the investigation is completed, the following results were obtained:

MATERIAL	CURRENT
Nickel	0,6
Copper	0,8
Boron	0,2
Silicon	0,1
Material **A**	0,01
Material **B**	0,00

2.5.1 Which material is a WEAK conductor? (1)

2.5.2 Explain, what it means when material **B** has a zero reading. (2)

2.5.3 For this investigation, write down the controlled variable. (1)

2.5.4 What is the aim of this investigation? (2)

2.6 After the investigation has been conducted, the learner clears the desk and accidently puts all the materials together in one bag with iron and a second bar magnet. The learner was advised that all materials should be separated according to magnetic and non-magnetic. The learner uses a bar magnet to separate the materials.

2.6.1 Redraw the table below in your ANSWER BOOK. Write the relevant answer next to the material.

MATERIALS	REPELLED OR ATTRACTED
Copper	
Silicon	
Boron	
Nickel	
Material **A**	
Material **B**	
Iron	
Second bar magnet	

(8 x 1) (8)

2.6.2 All the metals in this bag have magnetic properties.

Write only TRUE or FALSE. (1)

[26]

QUESTION 3 (Start on a NEW page.)

Carbon is an element that is found in abundance in the earth's crust. Carbon is mainly used as coal and in diamond rings.

3.1 Define the following terms:

3.1.1 Element (2)

3.1.2 Valence electrons (2)

3.2 What is the NAME of the product formed when carbon is released in the atmosphere and reacts with oxygen? (2)

3.3 Write down the Aufbau-diagram of an OXYGEN ion. (3)

3.4 Which energy levels are core electrons situated in a structure of an atom? Write down ONLY the word, HIGHEST or LOWEST. (1)

3.5 Write down the number of valence electrons in a CARBON atom. (1)

3.6 Write down the spectroscopic electron configuration (s-p notation) for a CARBON atom. (3)

3.7 Consider the following isotopes of a carbon atom.

$$_{12}^{6}C \qquad _{13}^{6}C \qquad _{14}^{6}C$$

3.7.1 Define the term *isotopes.* (2)

3.7.2 Write down the charge of an electron in the atom. (1)

3.7.3 Write down the name(s) of the particle(s) that are found in the nucleus of an atom. (2)

3.7.4 Study the table below. Redraw the table in your ANSWER BOOK and write the relevant answers represented by **(a)** to **(f).**

Isotope	No. of neutrons	No. of electrons	No. of protons
$_{12}^{6}C$	6	**(a)**	**(e)**
$_{13}^{6}C$	**(b)**	6	**(f)**
$_{14}^{6}C$	**(c)**	**(d)**	6

(6)

[25]

QUESTION 4 (Start on a NEW page.)

Study the given key table for the following elements and use it to answer questions below.

Element	Key	Element	Key
H		**Cℓ**	
N		**Mg**	
O			

4.1 Define the following terms:

4.1.1 Compound (2)

4.1.2 Atomic number (2)

4.2 Draw structures of the molecules from the following compounds by using only the KEYS from the table.

4.2.1 H_2 (2)

4.2.2 NH_3 (2)

4.2.3 $MgC\ell_2$ (2)

4.3 Catalytic converters are used to reduce air pollution. Study the diagram below by using the key table above.

4.3.1 Complete the equation given above by writing the structure of the KEY molecule formed represented by the letter **X**. (2)

4.3.2 Write down the balanced chemical equation by replacing the KEYS with ELEMENTS. (3)

4.3.3 Where does the gas that causes air pollution originate from? (2)

4.4 Write down the names of the following compounds:

4.4.1 $CaCO_3$ (2)

4.4.2 FeO (2)

4.5 Rewrite the following in your ANSWER BOOK and correct the chemical formulae, where necessary:

4.5.1 $LiSO_4$ (1)

4.5.2 AℓOH (1)

4.6 Write the formula of the given compounds:

4.6.1 Magnesium oxide (2)

4.6.2 Copper (II) carbonate (2)

4.7 Complete and balance the following equations by writing chemical formulae:

Ammonium ions + Phosphate ions → (3)

[30]

QUESTION 5 (Start on a NEW page.)

A Grade 10 learner is given five different substances in a laboratory. The substances are labelled from Substance 1 to 5.

Substance 1: Water
Substance 2: Chlorine
Substance 3: Beryllium
Substance 4: Copper nitrate
Substance 5: Sulphur dioxide

5.1 Define the term *pure substance.* (2)

5.2 Rewrite substance 1 to 5 in your ANSWER BOOK and next to it write whether the substance is an ELEMENT or a COMPOUND. (5)

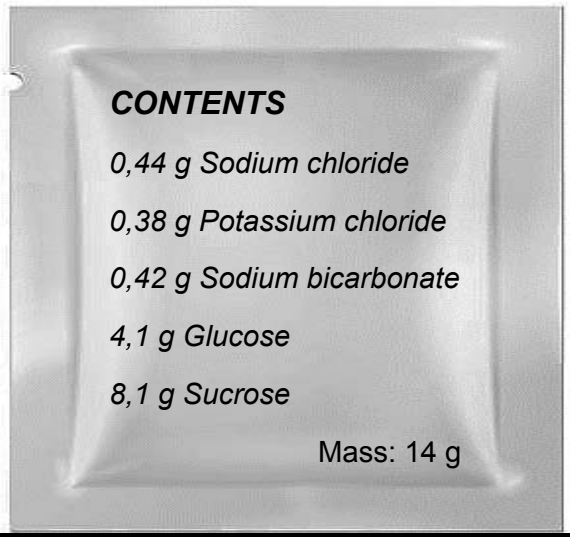
5.3 Write down an equation by writing the chemical formula for the ions that are formed when substance 4 is dissolved in water. (3)

5.4 Redraw and complete the table with the use of the periodic table provided at the back of the question paper. Write the relevant answers next to the letters (**a)** to (**f**) given in the table.

Substances	Group number	Period number	Group name
2	(a)	(c)	(e)
3	(b)	(d)	(f)

(6)

5.5 Here follows information regarding the contents of a 14 g rehydration sachet:



5.5.1 Which names from the listed contents have common names? (2)

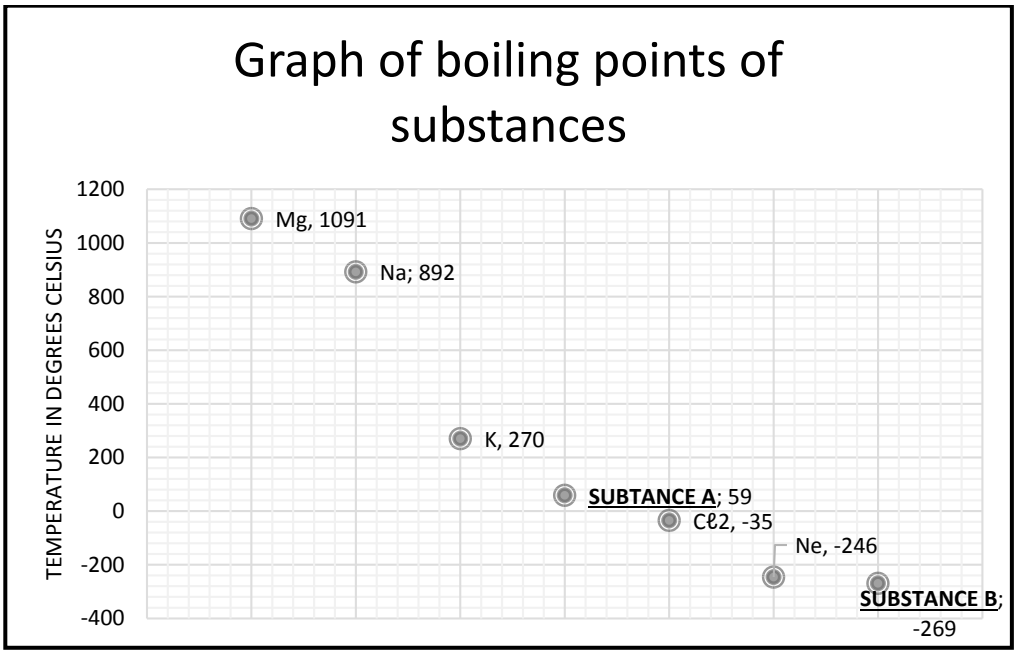
5.5.2 Write down the chemical formulae for potassium chloride. (2)

5.5.3 Identify the anion and cation in sodium chloride. (2)

[22]

QUESTION 6 (Start on a NEW page.)

Here follows a graph of the boiling points of different substances. Two substances are unknown and are marked as Substance **A** and Substance **B.**



6.1 Which substance has the highest boiling point? (1)

6.2 Write down the chemical name of the substance with a boiling point of -246 degrees. (1)

6.3 What does it mean when substances read a negative boiling point? (2)

6.4 With the help of the attached periodic table, substance **A** and substance **B** were identified from the graph. Write down the name of:

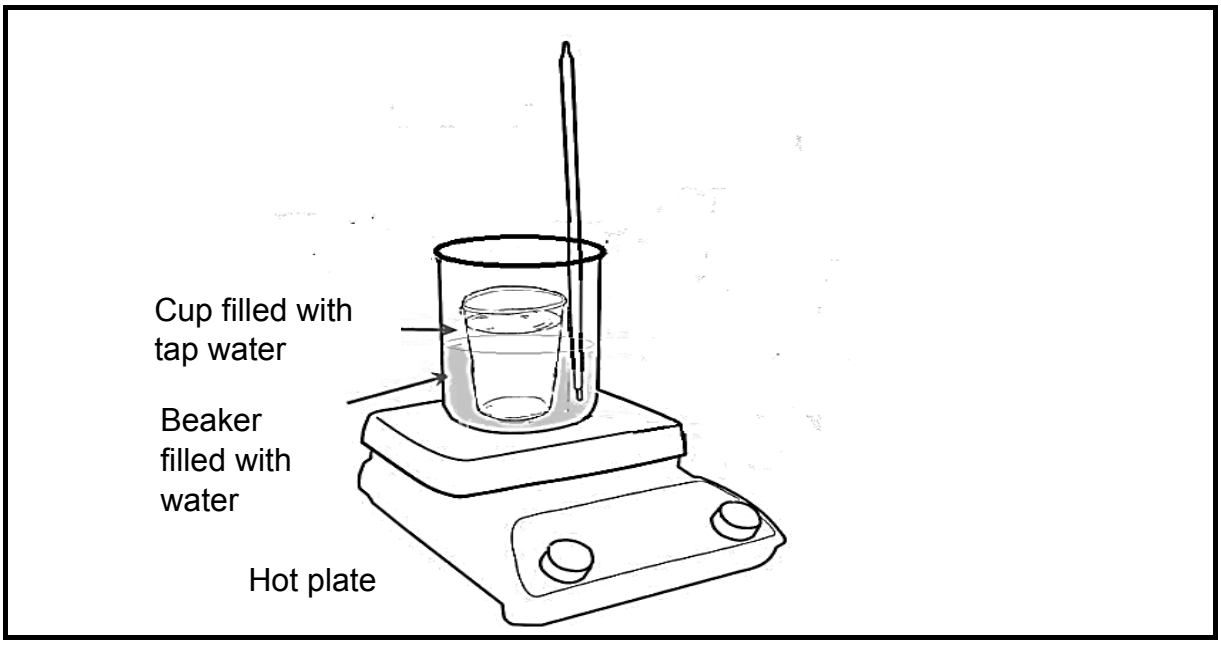
6.4.1 Substance **A**, a non-metal with an atomic number of 35 (1)

6.4.2 Substance **B**, a gas that is lighter than light and used to fill balloons (1)

6.5 What is the GROUP NAME given to the elements Ne and Substance **B** where they are located on the periodic table? (1)
[7]

QUESTION 7 (Start on a NEW page.)

A lab assistant has been given the task to do an investigation to see which cup is the best insulator for boiling water. Two cups have been given to the assistant.



- Water is placed into a large beaker and placed on a hot plate that is switched on at highest setting.
- **Cup A** is filled with normal tap water and the initial temperature is taken.
- The cup is placed inside the beaker.
- A mass piece is placed in the cup.
- Temperature readings are taken every 90 seconds and recorded on a table.
- The same procedure is done for **Cup B.**

The results are tabulated as follows:

Time (in seconds)	**Temperature (in** ℃)	
	Cup A	**Cup B**
0	17	20
1,5	21	55
3	27	75
4,5	30	84
6	33	89
7,5	36	*QUESTION 7.3.2*
9	*QUESTION 7.3.1*	89
10,5	43	88
12	44	87
13,5	46	86

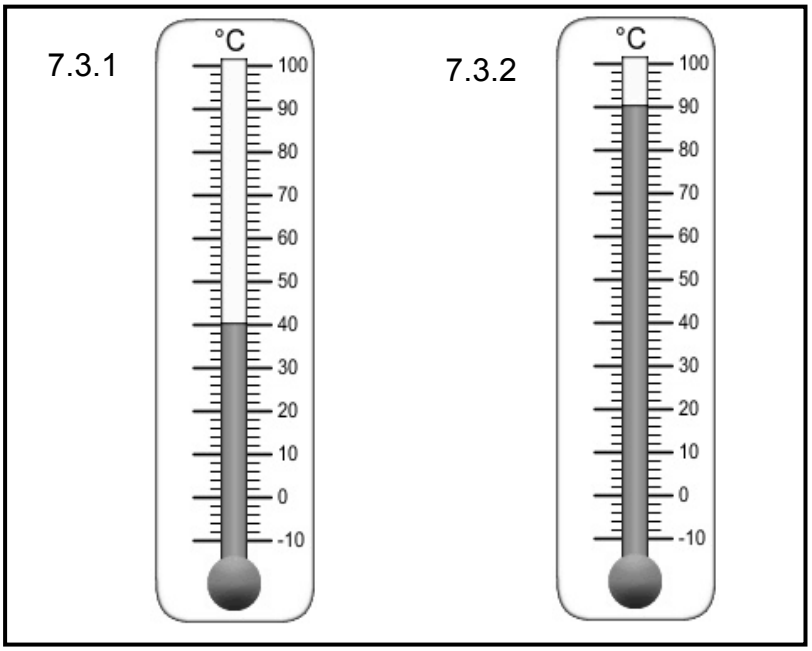
7.1 Name the apparatus used to obtain readings on temperature(heat) and time. (2)

7.2 Calculate the difference in temperature in Cup **A** and Cup **B** using the following formula:

$$\Delta T = T_f - T_i$$

Where T_f is the final temperature
T_i is the initial temperature. (4)

7.3 Studying the apparatus below. Write down the temperature readings in your ANSWER BOOK next to QUESTION 7.3.1 and QUESTION 7.3.2.



(2)

7.4 Convert the above temperature readings from degrees Celsius to Kelvin. (4)

7.5 Give the names of TWO other devices that are used to measure temperature. (2)

7.6 Use the attached graph paper to answer QUESTION 7.6.

Draw a graph of Temperature against Time of cup **A** ONLY up to 7,5 seconds. (5)

7.7 In this investigation, what was the source of heat used to increase the temperature? (1)

[20]

TOTAL: 150

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DATA FOR TECHNICAL SCIENCES GRADE 10
PAPER 2 (CHEMISTRY)

GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 10
VRAESTEL 2 (CHEMIE)

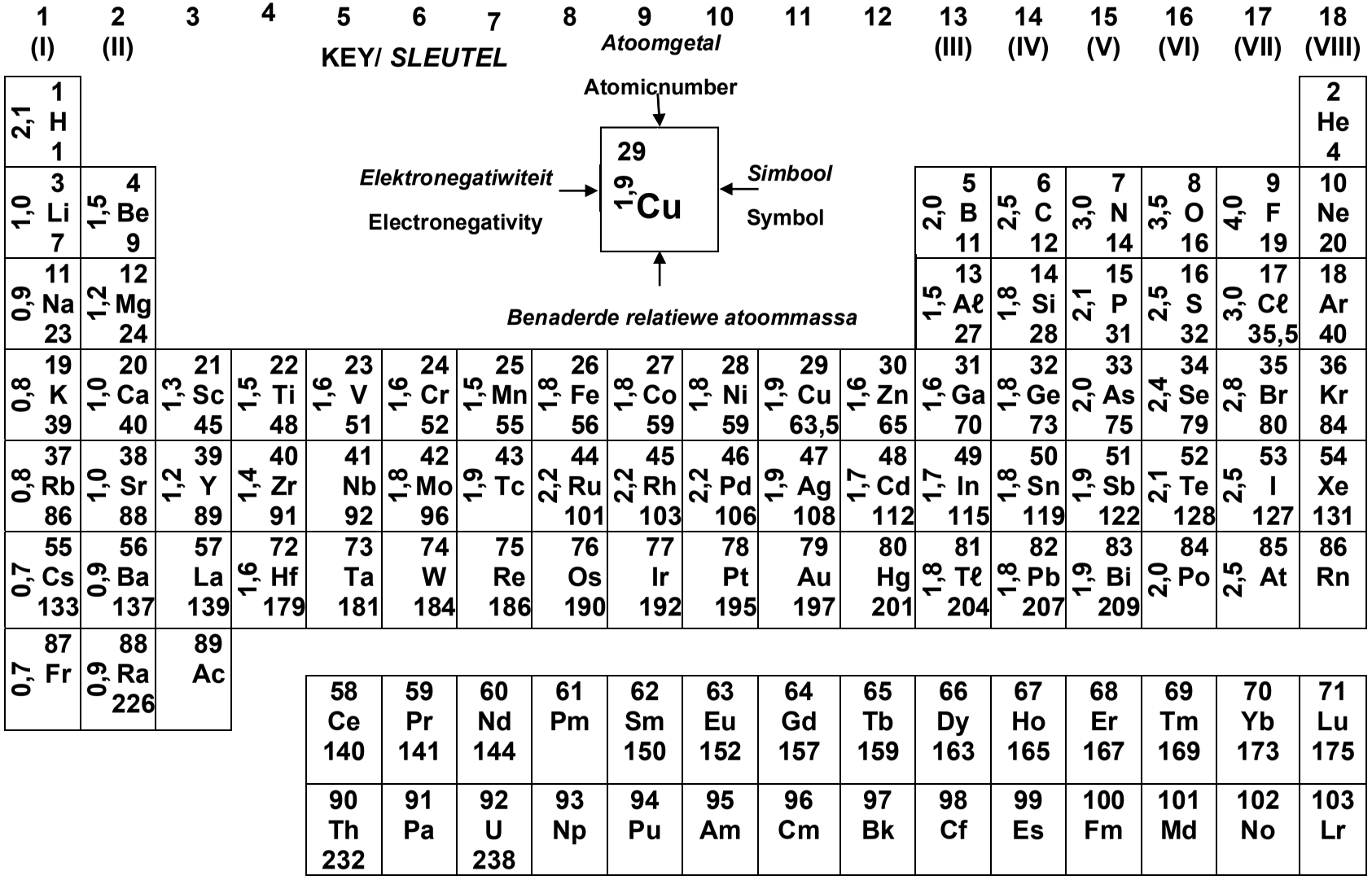
TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAAM/*NAME*	SIMBOOL/*SYMBOL*	WAARDE/*VALUE*
Standard pressure *Standaarddruk*	p^{θ}	$1{,}013 \times 10^5$ Pa
Molar gas volume at STP *Molêre gasvolume teen 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 se konstante*	N_A	$6{,}02 \times 10^{23}$ mol^{-1}

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V} \text{ OR } c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$	$pV = nRT$

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



USE GRAPH PAPER TO ANSWER QUESTION 7.6

NAME AND SURNAME: _____