higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T350**(E)**(J26)T

# NATIONAL CERTIFICATE

# CHEMISTRY N4

(15040004)

**26 July 2019 (X-Paper)**
**09:00–12:00**

**This question paper consists of 7 pages and 1 periodic table.**

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# DEPARTMENT OF HIGHER EDUCATION AND TRAINING
# REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
CHEMISTRY N4
TIME: 3 HOURS
MARKS: 100

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**INSTRUCTIONS AND INFORMATION**

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Sketches must be large and neat.
5. Write neatly and legibly.

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## QUESTION 1: CHEMICAL BONDING

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

1.1.1 The following substance is NOT a covalent bond:

A $C\ell_2$
B $H_2O$
C $NH_3$
D $HNO_3$

1.1.2 Which ONE of the following best describes an *electrovalent compound*:

A Molecules with little force of attraction among them
B Symmetrical arrangement of oppositely charged ions
C High thermal and electrical conductivities as electrons are free to move in empty spaces
D Malleable and ductile

1.1.3 Which ONE of the following is non-polar:

A $H_2O$
B $H_2S$
C $C_2H_4$
D $SO_2$

1.1.4 … bond is the bond that exists between dipoles of the same substance or between dipoles of different substances.

A A hydrogen
B A covalent
C A dative covalent
D An electrovalent

1.1.5 … bond is the bond that occurs when one or more electrons are transferred from one atom to another so that the ions that are formed have the electron configuration of one of the noble gases.

A An electrovalent
B A covalent
C A dative covalent
D A hydrogen

(5 × 2) (10)

1.2 The following substances are given:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MgO | $H_2O$ | $O_2$ | $I_2$ | $CC\ell_4$ | $SO_2$ | $N_2$ | Ne |

Select from the list of substances given above a substance that is/has:

1.2.1 Polar molecule

1.2.2 Non-polar molecule

1.2.3 Covalent compound

1.2.4 Electrovalent compound

1.2.5 Covalent bonding

1.2.6 Van der Waal's forces

1.2.7 Dative covalent bonding

1.2.8 Hydrogen bonding

1.2.9 Noble gas

1.2.10 Ionic bonding

(10 × 1) (10)

1.3 Name FIVE energies that occur during the formation of sodium chloride. (5)
**[25]**

## QUESTION 2: CHEMICAL GEOMETRY

2.1 Consider the compound $BF_3$ and answer the questions:

2.1.1 Name this compound. (1)

2.1.2 How many pairs of electrons are involved in a $BF_3$ molecule? (1)

2.1.3 Write down the angle that occurs in a $BF_3$ molecule. (1)

2.1.4 What is the shape of the $BF_3$ molecule? (1)

2.1.5 How many lone pairs of electrons occur in a $BF_3$ molecule? (1)

2.1.6 How many valence electrons occur in a $BF_3$ molecule? (1)

2.1.7 Does a $BF_3$ molecule obey the octet rule? (1)

2.1.8 Draw a Cooper structure of a $BF_3$ molecule. (2)

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2.2 Is the radius of the fluorine atom smaller, bigger or the same size as that of the nitrogen atom? Explain your answer. (3)

2.3 Which of the following ions has a smaller radius? Explain your answer.
$Li^+$
$Be^{+2}$ (3)

2.4 Explain the concept of *resonance* by using structural formulae for the carbonate ion. (4)

2.5 Name TWO compounds that each has two lone pairs of electrons. (2)

2.6 Give ONE appropriate example of each of the following geometric shapes:

2.6.1 Linear structure

2.6.2 Tetrahedral structure

2.6.3 Trigonal pyramid

2.6.4 Octahedral

(4 × 1) (4)
**[25]**

## QUESTION 3: ACIDS AND BASES

3.1 Given: $H_2O_{(\ell)} + H_2O_{(\ell)} \rightarrow$

3.1.1 Complete the given reaction. (2)

3.1.2 Explain why this reaction is regarded as amphoteric. (1)

3.2 Carbon dioxide dissolves in water and forms carbonic acid ( $H_2CO_3$ ).

3.2.1 Write down the reaction showing that $H_2CO_3$ dissolves in water. (3)

3.2.2 Write down the $K_a$ value of the equation described in QUESTION 3.2.1 (2)

3.2.3 Explain why the $K_a$ for $H_2CO_3$ is low. (2)
**[10]**

## QUESTION 4: CHEMISTRY OF CARBON

4.1 Name THREE impure forms of carbon. (3)

4.2 Complete the following reaction: $C + 4\,HNO_3 \rightarrow$ (3)

4.3 Give ONE term for each of the following descriptions. Write only the term next to the question number (4.3.1–4.3.4) in the ANSWER BOOK.

4.3.1 The physical form of carbon that is used in pencils

4.3.2 The common name of carbon dioxide in solid form

4.3.3 The oxide of carbon that is a strong reducing agent

4.3.4 The oxide of carbon that has a foul-smelling gas

(4 × 1) (4)

**[10]**

## QUESTION 5: CHEMISTRY OF HYDROGEN

5.1 Give ONE example of each of the following hydrides:

5.1.1 Covalent hydride

5.1.2 Ionic hydride

5.1.3 Interstitial hydride

(3 × 1) (3)

5.2 Name ONE use of each of the following:

5.2.1 Deuterium

5.2.2 Tritium

(2 × 1) (2)

5.3 Name ONE physical property of hydrogen. (1)

5.4 Write down the balanced reaction of magnesium with water. (2)

5.5 Complete the following reaction: $CaH_2 + H_2O \rightarrow$ (2)

**[10]**

## QUESTION 6: CHEMISTRY OF NITROGEN

6.1 Complete the following reaction: $Ca(OH)_2 + 2NH_4C\ell \rightarrow$ (3)

6.2 Ammonia is produced by the Haber process in the industry.

Write down the reaction for the Haber process. (2)

6.3 Name the industrial process used to prepare nitric acid. (1)

6.4 Ammonia reacts readily with oxygen.

Write down the balanced reaction. (4)

**[10]**

## QUESTION 7: CHEMISTRY OF OXYGEN

7.1 Explain how $O_3$ is prepared in the laboratory. (2)

7.2 Name FOUR ways used to prepare oxygen in the laboratory. (4)

7.3 Complete the following reaction: $C + 4HNO_3 \rightarrow$ (3)

7.4 Give the chemical name of $H_2O_2$. (1)

**[10]**

**TOTAL: 100**

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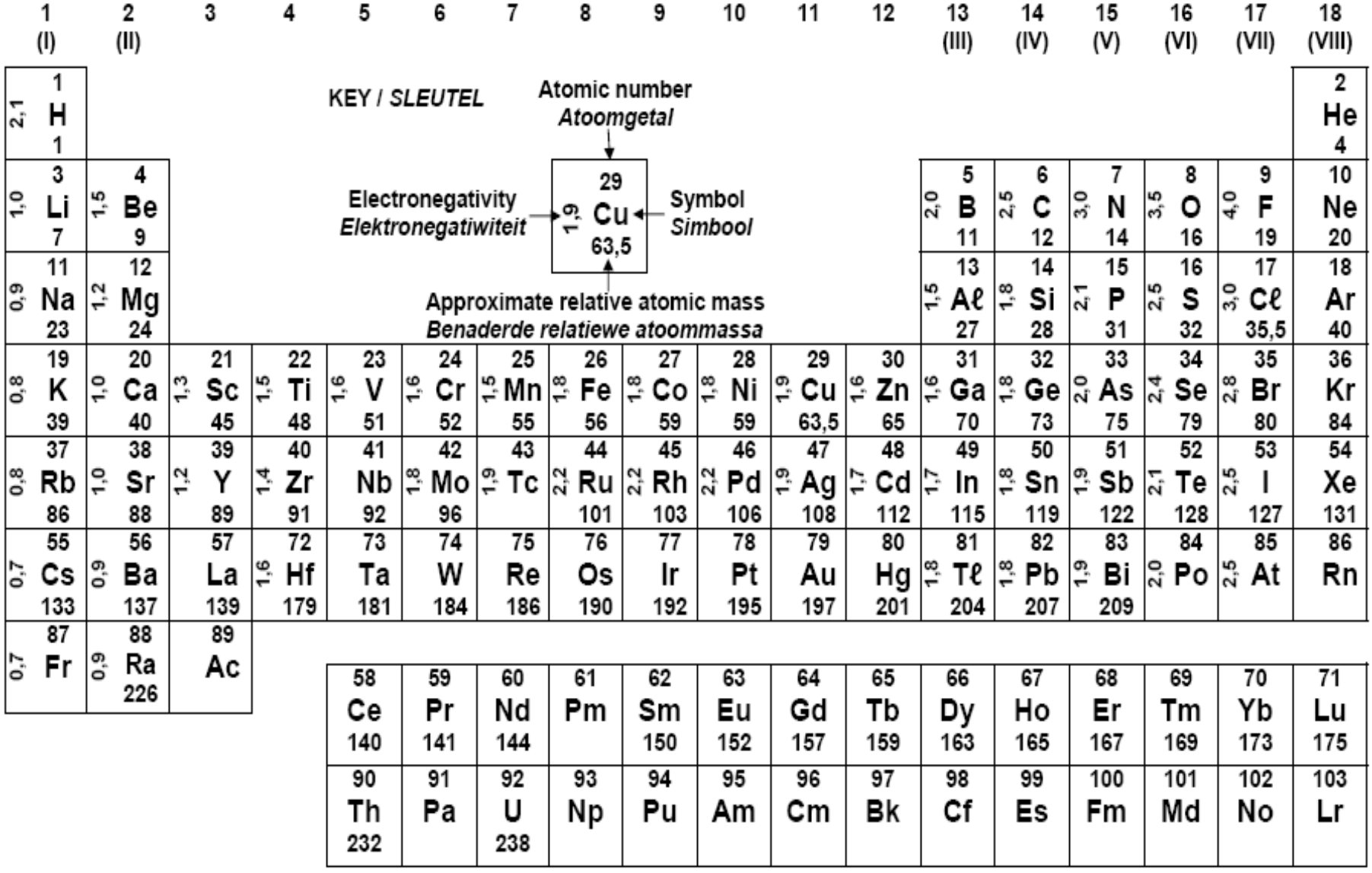
# THE PERIODIC TABLE OF ELEMENTS
## *DIE PERIODIEKE TABEL VAN ELEMENTE*

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