higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T350**(E)**(M28)T

NATIONAL CERTIFICATE

CHEMISTRY N4

(15040004)

28 March 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

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, neat and fully labelled.
5. Write neatly and legibly.

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QUESTION 1: CHEMICAL BONDING

1.1 Give ONE substance for each of the following descriptions by choosing a substance from the list below. Write only the substance next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

He; Na; Cℓ; NH_3; CO_2; NaCℓ

1.1.1 Metal atoms that can attain a stable configuration by the loss of one electron

1.1.2 Noble gas

1.1.3 Atom that can attain a stable configuration by gaining electrons

1.1.4 Electrons shared in pairs so that the atom can attain the stable electron configuration of a noble gas

1.1.5 Sharing occurs but only one atom provides the two electrons that are shared

(5 × 1) (5)

1.2 Name the bonding type in each of the following:

1.2.1 Ca

1.2.2 N_2

1.2.3 HF

1.2.4 NaCℓ

1.2.5 HNO_3

(5 × 1) (5)

1.3 Give ONE substance for each of the following descriptions by choosing a substance from the list below. Write only the substance next to the question number (1.3.1–1.3.5) in the ANSWER BOOK.

KBr; C (diamond); Cu; NH_3; $C\ell_2$

1.3.1 Exists as polar molecules

1.3.2 Low melting and boiling points

1.3.3 Malleable and ductile

1.3.4 Brittle and high melting point

1.3.5 Good conductor of electricity

(5 × 1) (5)

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1.4 Name and discuss in detail the type of bonds that occur between the chlorine atoms in $C\ell_{2\,(g)}$. (5)

1.5 Define the term *dative covalent bond*. (2)

1.6 Draw the Cooper structure for a nitrate ion and clearly indicate the dative covalent bond. (3)

[25]

QUESTION 2: CHEMICAL GEOMETRY

2.1 Is the radius of a chlorine atom bigger, smaller or the same as the radius of a phosphorus atom? Explain the answer. (3)

2.2 Which ion has a smaller radius: Na^{+} or Al^{+3}? Explain the answer. (3)

2.3 Consider the $BeC\ell_2$ compound.

2.3.1 Name this compound. (1)

2.3.2 How many pairs of electrons are in a $BeC\ell_2$ molecule? (1)

2.3.3 Write down the angle in a $BeC\ell_2$ molecule. (1)

2.3.4 What is the shape of a $BeC\ell_2$ molecule? (1)

2.3.5 How many lone pairs of electrons are in a $BeC\ell_2$ molecule? (1)

2.3.6 How many valence electrons are in a $BeC\ell_2$ molecule? (1)

2.3.7 Draw the Cooper structure of a $BeC\ell_2$ molecule. (2)

2.4 Explain the concept of *resonance* by using the structural formulae for a nitrate ion and clearly show the limiting structure. (4)

2.5 Define Sidgwick and Powell's theory. (3)

2.6 Give the appropriate geometric shape of each of the following:

2.6.1 SF_6

2.6.2 SF_4

2.6.3 NH_3

2.6.4 BF_3

(4 × 1) (4)

[25]

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QUESTION 3: ACIDS AND BASES

3.1 Define each of the following:

3.1.1 Brønsted-Lowry acid

3.1.2 Lewis acid

(2 × 1) (2)

3.2 Study the ionisation of hydrochloric acid in water:

$HC\ell_{(aq)} + H_2O_{(l)} \rightarrow$

3.2.1 Complete the reaction. (2)

3.2.2 Write down the K_a value for the expression. (1)

3.2.3 Is the K_a smaller or bigger? Explain the answer. (2)

3.2.4 Write down the conjugate acid-base pair for the equation. (2)

3.3 Which acid is stronger: $HOC\ell$ or HOBr? (1)

[10]

QUESTION 4: CHEMISTRY OF CARBON

4.1 Explain ONE method used to prepare carbon dioxide in the laboratory. (2)

4.2 Give ONE use of each of the following:

4.2.1 Coke

4.2.2 Animal charcoal

(2 × 1) (2)

4.3 Write down the balanced reaction between carbon and boiling sulphur. (2)

4.4 Write down the general formula of alkane. (1)

4.5 Complete the following reaction: $SiO_2 + 3C \rightarrow$. (2)

4.6 Give ONE example of an ionic carbide. (1)

[10]

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QUESTION 5: CHEMISTRY OF HYDROGEN

5.1 Classify each of the following as an ionic, covalent or interstitial hydride:

5.1.1 TiH

5.1.2 CH_4

5.1.3 CaH_2

(3 × 1) (3)

5.2 Write down the balanced reaction between hydrogen and boiling sulphur. (2)

5.3 Give ONE use of hydrogen. (1)

5.4 Name TWO isotopes of hydrogen and clearly indicate its relative masses.

(2 × 2) (4)

[10]

QUESTION 6: CHEMISTRY OF NITROGEN

6.1 Given: $N_2 + 3H_2 \rightarrow 2NH_3$

6.1.1 Name the gas produced. (1)

6.1.2 Name the industrial method represented. (1)

6.1.3 Give TWO uses of ammonia. (2)

6.2 Complete the following reaction: $4NH_3 + 5O_2 \rightarrow$ (2)

6.3 Name each of the following gases:

6.3.1 N_2O_3

6.3.2 NO_2

6.3.3 N_2O

6.3.4 NO

(4 × 1) (4)

[10]

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QUESTION 7: CHEMISTRY OF OXYGEN

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

7.2 Give ONE advantage of the O_3 in the atmosphere. (1)

7.3 Give TWO uses of O_3. (2)

7.4 Name THREE methods used to soften permanent hard water. (3)

7.5 Complete the following reaction: $2Pb_3O_4 \xrightarrow{\Delta}$. (2)

[10]

TOTAL: 100

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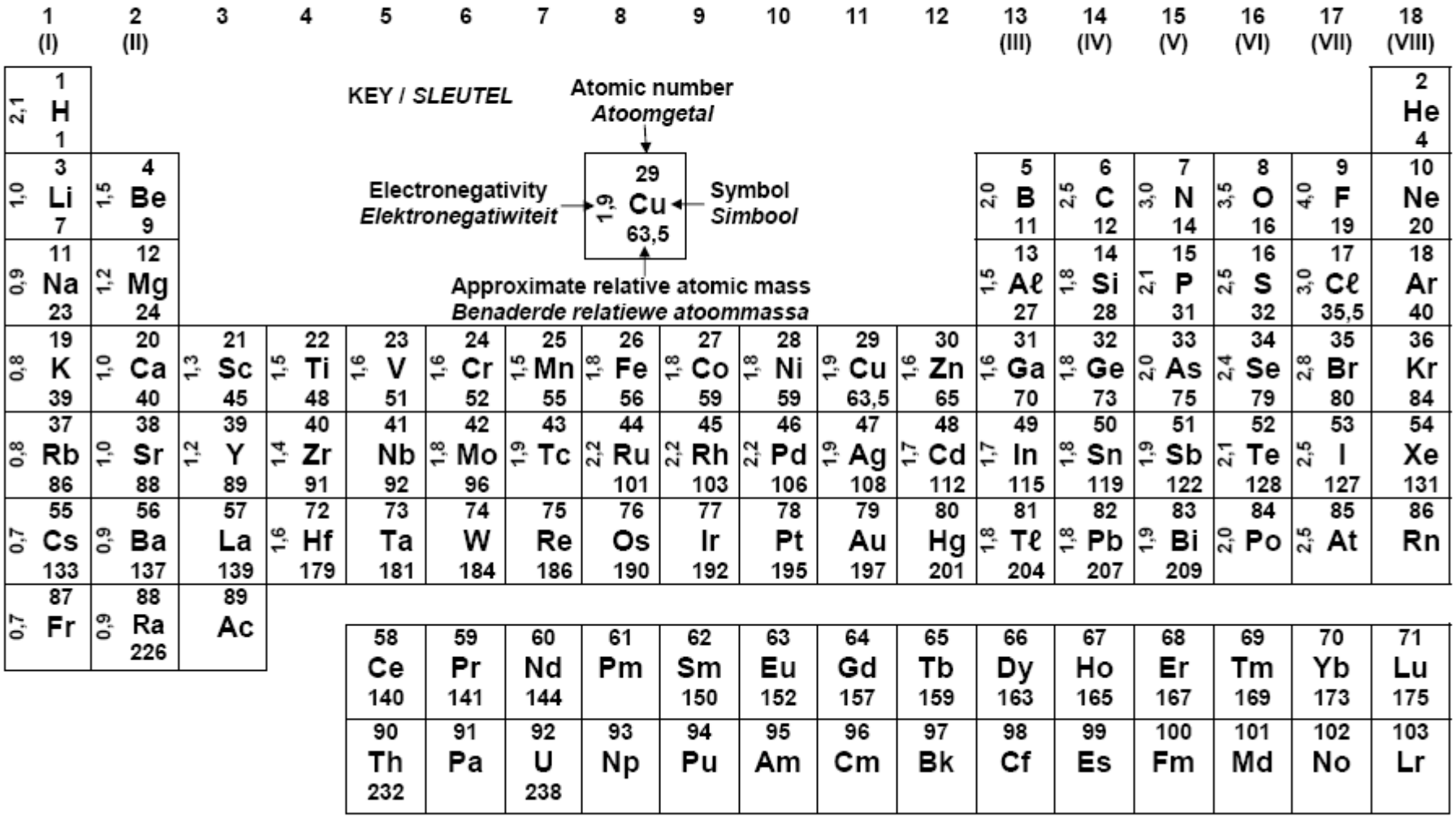
THE PERIODIC TABLE OF ELEMENTS
DIE PERIODIEKE TABEL VAN ELEMENTE



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