higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

CHEMISTRY N4

(15040004)

26 July 2021 (X-paper)
09:00–12:00

Drawing instruments may be used.

This question paper consists of 6 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. Start each question on a new page.
5. Only use a black or blue pen.
6. Write neatly and legibly.

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QUESTION 1

1.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1.1–1.1.10) in the ANSWER BOOK.

1.1.1 Atoms with the same atomic number but different numbers of neutrons are called isotopes.

1.1.2 An electrovalent compound is composed of a symmetrical arrangement of differently charged ions.

1.1.3 Hydrogen bonds occur between molecules of hydrogen fluoride.

1.1.4 Covalent compounds are good electrolytes in solution form.

1.1.5 A catalyst is a substance that affects the rate of a chemical reaction without itself changing during the reaction.

1.1.6 Electrovalent compounds contain bonds that have directional properties.

1.1.7 Tritium is one of the isotopes of hydrogen used as a tracer for elucidating a wide range of reaction mechanisms.

1.1.8 Non-polar covalent bonds occur when two atoms exert an equal attraction on the shared electron.

1.1.9 Ammonia is a liquefiable gas with no smell.

1.1.10 Nitrogen gas is the only gas that has a covalent bond, obeys the octet rule, and have diatomic and nonpolar molecules.

(10 × 1) (10)

1.2 Name FIVE examples of compounds having trigonal planar. (5)

1.3 Provide a suitable structural formula for each of the following:

1.3.1 Acetic acid

1.3.2 Calcium hydride

1.3.3 Zinc monoxide

1.3.4 Barium sulphate

1.3.5 Iron (III) oxide

(5 × 1) (5)

1.4 The first stage during the formation of sodium chloride is called sublimation.

Define *sublimation energy*, provide the balanced reaction, and indicate whether the energy is exothermic or endothermic. (5)

[25]

QUESTION 2

2.1 Given: PF_5

2.1.1 Name this compound. (2)

2.1.2 Draw a line structure of PF_5. (3)

2.1.3 Indicate the ion pairs of electrons of PF_5. (1)

2.1.4 Does PF_5 obey the octet rule?

Explain your answer. (2)

2.2 Choose a compound from COLUMN B that matches a description in COLUMN A. Write only the letter (A–E) next to the question number (2.2.1–2.2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.2.1	Noble gas	A	N_2
2.2.2	Electrovalent bonding	B	$CH_3C\ell$
2.2.3	Covalent bonding	C	SO_3
2.2.4	Polar molecule	D	He
2.2.5	Polar covalent bonding	E	$C\ell_2$

(5 × 1) (5)

2.3 Given: $CO_{3(aq)}^{2-} + H_2O_{(1)} \leftrightarrow$

2.3.1 Complete the reaction above. (2)

2.3.2 Is CO_3^{2-} a strong or a weak base? (1)

2.3.3 Write down the K_a for this expression. (3)

2.3.4 Indicate the conjugated acid-base pair. (2)

2.4 Write down the balanced reaction of carbon monoxide with water. (4)

[25]

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QUESTION 3

3.1 Given: $A + B \rightarrow CCl_4 + S_2Cl_2$

3.1.1 Name reactants A and B.

3.1.2 Provide a suitable name for CCl_4.

3.1.3 List TWO uses of CCl_4.

(3 × 2) (6)

3.2 Indicate whether the following carbides are IONIC, COVALENT or INTERSTITIAL by writing only 'Ionic', 'Covalent' or 'Interstitial' next to the question number (3.2.1–3.2.3) in the ANSWER BOOK.

3.2.1 Mn_3C

3.2.2 B_4C

3.2.3 Be_2C

(3 × 1) (3)

3.3 Write down the balanced reaction for the manufacturing of graphite by ACHESON process. (5)

3.4 Name THREE isotopes of hydrogen and indicate the molecular mass of each. (3 × 2) (6)

3.5 Name THREE properties of ammonia. (3)

3.6 What type of oxide is each of the following compounds?

3.6.1 BaO

3.6.2 MgO

(2 × 1) (2)

[25]

QUESTION 4

4.1 Name FOUR uses of ozone. (4)

4.2 Draw the resonance of a nitrate ion and clearly indicate the limiting structure. (4)

4.3 Define the term *amphoteric* and give a suitable example. (3)

4.4 List FIVE properties of a covalent bonding. (5)

4.5 Complete the following reactions:

4.5.1 $2Fe_2S_3 + 3O_2 \rightarrow$ (2)

4.5.2 $5CO + I_2O_5 \rightarrow$ (2)

4.5.3 $C + 4HNO_3 \rightarrow$ (3)

4.6 List TWO examples of permanent hardness. (2)

[25]

TOTAL: 100

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PERIODIC TABLE

THE PERIODIC TABLE OF ELEMENTS
DIE PERIODIEKE TABEL VAN ELEMENTE

