higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T350(**E**)(M27)T

NATIONAL CERTIFICATE

CHEMISTRY N4

(15040004)

27 March 2018 (X-Paper)
09:00–12:00

This question paper consists of 6 pages and the 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. Keep the subsections of questions together.
6. Start each question with the formula and the substituted values.
7. Each final answer must be rounded off to THREE decimal numbers.
8. Write neatly and legibly.

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QUESTION 1

1.1 Give a suitable name or term for each of the following descriptions:

1.1.1 An atom that tends to form bonds until it is surrounded by eight valence electrons

1.1.2 The distance between two atomic nuclei where energy is lowest and the bonds develop

1.1.3 When the valence orbitals of atoms overlap and they share an electron pair between the nuclei

1.1.4 The arrangement in space of the covalent bonds in multiple covalents which is related to the number of the electrons in their valency shell

1.1.5 Occurs when the atom with the higher electronegativity exerts a stronger attraction on the shared electrons pair than the other atom

(5 × 2) (10)

1.2 Differentiate between *polar* and *nonpolar molecules*, and give ONE example of each. (6)

1.3 The following substances are provided:

MgO; He; Zn; H_2O; I_2; S

Select, from the given substances, a substance to match each of the descriptions below. Write only the substance next to the question number (1.3.1 – 1.3.5) in the ANSWER BOOK.

1.3.1 An electrovalent compound

1.3.2 A noble gas

1.3.3 Metallic bonds

1.3.4 A covalent compound

1.3.5 Van Der Waal's forces

(5 × 1) (5)

1.4 Name the first FOUR types of energy that occur during the production of sodium chloride. (4)

[25]

QUESTION 2

2.1 Answer the following questions on the chemical compound with the formula CH_4:

2.1.1 Write down the general formula for this compound. (2)

2.1.2 Name this compound. (2)

2.1.3 Draw a Lewis structure for this compound. (3)

2.1.4 What is the shape of a CH_4 molecule? (1)

2.1.5 How many bonding pairs does a CH_4 molecule have? (1)

2.1.6 Does this compound obey the Octet rule? Motivate your answer. (2)

2.1.7 Is this compound a polar or a nonpolar molecule? (1)

2.1.8 How many valence electrons does a CH_4 molecule have? (1)

2.2 Given: $HNO_{3\,(aq)} + H_2O_{\,(l)} \rightarrow H_3O^+_{\,(aq)} + NO_3^-{}_{(aq)}$

2.2.1 Give a suitable chemical name of H_3O^+. (1)

2.2.2 Is H_2O an ionic, a covalent or an interstitional hydride? (1)

2.2.3 Explain why HNO_3 is regarded as an Arrhenius acid in the above reaction? (2)

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

2.2.5 Is K_a big or small? Explain your answer. (2)

2.2.6 Indicate the conjugate acid-base pairs. (2)

2.2.7 Between HNO_2 and HNO_3 which acid is strongest? (1)

[25]

QUESTION 3

3.1 Oxygen can be prepared by the thermal decomposition of lead oxide.

Write down the balanced reaction. (3)

3.2 Briefly explain why ozone is thermodynamically unstable as compared to the oxygen. (2)

3.3 Draw a TWO-line structure of the ozone. (2)

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3.4 Give ONE example of each of the following oxides:

3.4.1 Normal oxide

3.4.2 Mixed oxide

3.4.3 Peroxide

3.4.4 Suboxide

(4 × 1) (4)

3.5 Ammonia (NH_3) is prepared in the laboratory by reacting calcium hydroxide and ammonium chloride.

Write down the balanced chemical reaction. (5)

3.6 Give TWO properties of the ammonia. (2)

3.7 Give THREE ways of producing hydrogen in the laboratory. (3)

3.8 Complete the following reaction:

3.8.1 $4NH_3 + 5O_2 \rightarrow$

3.8.2 $2NO_2 + H_2O \rightarrow$

(2 × 2) (4)
[25]

QUESTION 4

4.1 Name FOUR processes of the carbon cycle in nature. (4)

4.2 Give THREE uses of carbon black. (3)

4.3 Write down the balanced reaction of carbon with calcium. (3)

4.4 Give the correct hydride/carbide of each of the following:

4.4.1 Mn_3C

4.4.2 H_2S

4.4.3 ZrH

4.4.4 SiC

4.4.5 CaC_2

(5 × 1) (5)

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4.5 Name TWO substances that can be used when we prepare carbon tetrachloride (CCl_4). (2)

4.6 Give the suitable chemical name of each of the following:

4.6.1 HNO_2

4.6.2 C_3O_2

4.6.3 N_2O_4

(3 × 1) (3)

4.7 Graphite is manufactured by the Acheson process in industry.

Write down the balanced chemical reaction. (5)

[25]

TOTAL: 100

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THE PERIODIC TABLE OF ELEMENTS
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)
2,1 1 H 1																	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	1,6 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

KEY / *SLEUTEL*

Electronegativity *Elektronegatiwiteit* — Atomic number *Atoomgetal* — Symbol *Simbool* — Approximate relative atomic mass *Benaderde relatiewe atoommassa*

1,9 | 29 | Cu | 63,5

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