FINAL	%	

UNISA

CHE1501

OCTOBER/NOVEMBER 2017

GENERAL CHEMISTRY 1A

STUDENT NUMBER												

IDENTITY NUMBER												

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Question No	Marks Examiners					
	1		2		3	
1						
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8						
Total						

Subject

Number of paper

Date of examination

Examination centre

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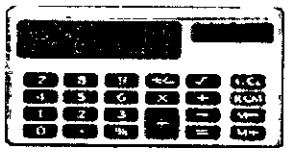
UNIVERSITY EXAMINATIONS



UNIVERSITEITSEKSAMENS

UNISA university of south africa

CHE1501

October/November 2017

GENERAL CHEMISTRY IA

Duration 2 Hours

100 Marks

EXAMINERS

FIRST MR MG SMITH
SECOND DR B VAN DER WESTHUIZEN

Use of a non-programmable pocket calculator is permissible

Closed book examination.

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The above-mentioned calculator may be a SCIENTIFIC calculator.

This paper consists of 22 pages (including this page).

Five pages are attached for rough work (pg 16-20)
A table of physical constants and conversion factors is included (pg 21)
A periodic table is attached (pg 22)

Answer all the Questions

Fill in the answers on the question paper

Show all your calculations

Write the correct units at each step in your calculations and answers

NB Marks may be lost for incorrect or missing units

Section A: Multiple choice questions

Section Total: 38 Marks

WRITE THE LETTER OF THE CORRECT OPTION *NEATLY* IN THE SQUARE BOX PROVIDED IN EACH QUESTION.

You are provided with empty rough work pages on page 16 – 20 in this exam book.

Only one answer per question is allowed.

Answers are not marked negatively.

Section A has a total of 38 marks. You should pace yourself so as not to spend more than approximately 40 – 45 minutes on this section.

QUESTION 1 [20]

Questions 1.1 – 1.10 are worth 2 marks each.

Question 1.1 (2)

Which of the following is a compound?

A. Air.
B. Gold.
C. Coffee.
D. Glucose
E. Milk.

Question 1.2 (2)

The oxyanions ClO^- and ClO_4^- are respectively called:

A. Chlorite and chlorate ions.
B. Hypochlorite and perchlorate ions
C. Chlorite and hypochlorite ions.
D. Hypochlorite and chlorate ions.
E. None of the above.

Question 1.3 (2)

From your knowledge of solubility guidelines, which of the following compounds is soluble in water?

A Sodium phosphate
B Calcium sulfide
C Magnesium hydroxide
D Silver chloride
E Barium sulfate

Question 1.4 (2)

Which of the following is isoelectronic to a magnesium cation?

A K^+
B O^{2-}
C Ar
D K
E None of the above

Question 1.5 (2)

Which quantum number is the same for all d-electrons in any atom?

A Principal quantum number, n
B Magnetic quantum number, m_ℓ
C Spin quantum number, m_s
D Angular momentum (azimuthal) quantum number, ℓ
E None of the above

Question 1.6 (2)

The term that is related to the closeness of measured readings to each other (repeatability) is

A Accuracy
B Precision
C Qualitative
D Quantitative
E Property

Question 1.7 (2)

Which one of the following elements has the lowest electron affinity?

A K
B Ca
C Ga
D As
E Se

Question 1.8 (2)

Which of the following is considered a weak acid?

A Hydrochloric acid.
B Hydroiodic acid
C. Hydrofluoric acid
D Nitric acid.
E None of the above

Question 1.9 (2)

The value of the *rate constant* of a chemical reaction is **NOT** dependent on which of the following?

A. Temperature
B Concentration
C. Pressure
D Catalyst
E All of the above

Question 1.10 (2)

Consider the following redox reaction:

$$2NaOH + Cl_2 \rightarrow NaCl + NaClO + H_2O$$

Which of the following statement is **false?**

A. A Cl atom has been oxidised.
B A Cl atom has been reduced.
C Oxygen has an oxidation state of -1 in NaClO
D Cl_2 has an oxidation number of 0.
E None of the above

QUESTION 2

[18]

Questions 2.1 – 2.6 are worth 3 marks each.

Question 2.1 (3)

Which of the following atoms is diamagnetic?

A. Cl

B C

C N

D Ne

E None of the above

Question 2.2 (3)

25 00 cm^3 of a 0 7892 mol dm^{-3} solution of sodium hydroxide is transferred to an empty 350 00 cm^3 volumetric flask This flask is made up to the mark with distilled water and then shaken well The concentration of the hydroxide in this second flask is

A 0 05637 mol dm^{-3}

B 0.1127 mol dm^{-3}

C 5 626 x 10^{-5} mol dm^{-3}

D 1 127 x 10^{-4} mol dm^{-3}

E None of the above.

Question 2.3 (3)

Which of the following is true for a 0 25 M acetic acid solution at 25°C·

A pH = 0 60

B. pOH = 0 60

C $[H^+]$ = 0 25 mol.dm^{-3}

D K_a is needed to calculate $[H^+]$

E None of the above

Question 2.4 (3)

Consider the following redox reaction

$$Na_2CrO_4(aq) + NaI(aq) \rightarrow Cr(OH)_3(s) + NaIO_3(aq)$$

The *change* in oxidation state of the element that is reduced is

A - 4
B. - 3
C - 2
D +2
E +5

Question 2.5 (3)

Consider the following redox reaction:

$$Na_2CrO_4(aq) + NaI(aq) \rightarrow Cr(OH)_3(s) + NaIO_3(aq)$$

The number of electrons involved in the balanced oxidation half reaction is:

A $3e^-$
B $4e^-$
C. $5e^-$
D $6e^-$
E None of the above

Question 2.6 (3)

A solution is prepared by dissolving 50 0 g (0 297 mol) of cesium chloride (CsCl) in 50.0 g (2 77 mol) of water The volume of the solution is 63.3 mL Which of the following is true for this solution?

A Molarity = 5 94 mol/kg and molality = 4 71 mol/L
B Molarity = 4.71 mol/kg and molality = 5 94 mol/L
C. Molarity = 5 94 mol/L and molality = 4.71 mol/kg
D Molarity = 4 71 mol/L and molality = 5.94 mol/kg
E None of the above.

Section B: Long questions

Section Total: 62 Marks

WRITE YOUR ANSWERS IN THE BOX PROVIDED

Show all your calculations!!
Marks are awarded for the steps as well as the answers.

Marks may be lost for missing or incorrect units.

Section B has a total of 62 marks. You should pace yourself so as not to spend more than approximately 75 – 80 minutes on this section.

QUESTION 3 [10]

Question 3.1 (3)

Complete the following table:

Atomic symbol	Name	Neutrons	Electrons
${}^{1}_{1}H$	Hydrogen		
${}^{2}_{1}H$	Deuterium		
${}^{3}_{1}H$	Tritium		

Question 3.2

3.2.1) Give the full electron configuration for Cu and specify a possible set of quantum numbers for the highest energy electron in the valence shell. (3)

3.2.2) Give the condensed (noble core) electron configuration of the magnesium *ion* (2)

3 2 3) How many electrons in V^{3+} have ℓ=1 quantum number? (2)

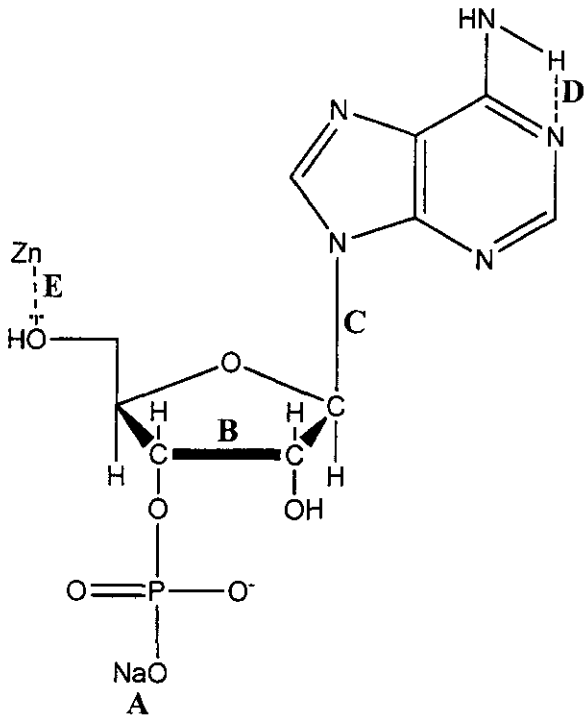
QUESTION 4 [14]

Question 4.1 (5)

Draw the most stable *Lewis structures* for the ion SCN^- Use formal charges and electronegativity of the atoms to support your final answer.

Question 4.2 (5)

For each letter A – E, identify the type of bond



A: _____

B: _____

C: _____

D: _____

E: _____

Question 4.3 (4)

Use VSEPR theory to determine the molecular geometry of XeF_2 and BeF_2

QUESTION 5 [16]

Question 5.1 (4)

A compound used to boost the properties of petrol has the following composition: 49 5% C, 3.2% H, 22.1% O, and 25 2% Mn. What is the empirical formula of this compound?

Question 5.2 (4)

The mineral ilmenite, $FeTiO_3$, is a source of titanium Calculate what mass of ilmenite, in grams, is required if you wish to obtain 685 g of titanium

Question 5.3 (8)

Sulfur tetrafluoride reacts with water as follows

$$SF_4(g) + 2H_2O(l) \rightarrow SO_2(g) + 4HF(aq)$$

50 0 g of each of the two reactants are mixed and allowed to react to completion. Calculate the mass (in grams) of hydrogen fluoride formed if the yield of the reaction is 67 5%

QUESTION 6 [10]

The sulfur dioxide produced by emissions of motor vehicles reacts with oxygen in the air to produce sulfur trioxide In this reaction 198 kJ is produced with every mole of oxygen used up

Question 6.1 (3)

Write the balanced thermochemical equation for this reaction

Question 6.2 (1)

Is the reaction exothermic or endothermic?

Question 6.3 (3)

How many *grams* of oxygen are used when 22 00 kJ of heat is produced?

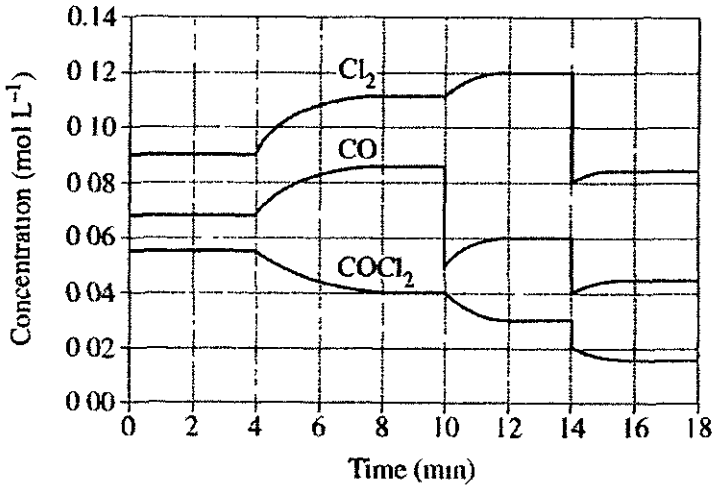
Question 6.4 (3)

What environmental problem can this reaction cause? Explain your answer and include subsequent chemical reactions

QUESTION 7 [8]

Consider the following diagram and information the reaction takes place in a sealed container.

$$COCl_2(g) \rightleftharpoons Cl_2(g) + CO(g) \quad \Delta H = +108 \text{ kJ}$$



Question 7.1 (2)

Write the *equilibrium expression* for the chemical equation above.

Question 7.2 (1)

What could have caused the change in concentrations at t = 4 min?

Question 7.3 (2)

What change in concentration is observed at t = 10 min? How is equilibrium restored?

Question 7.4 (2)

What is the value of K_{eq} at t = 12 min?

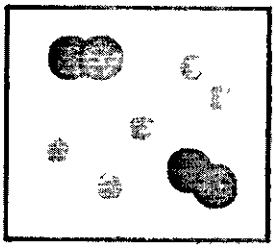
Question 7.5 (1)

What could have caused the change in concentrations at t = 14 min?

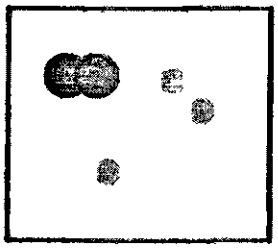
QUESTION 8

[4]

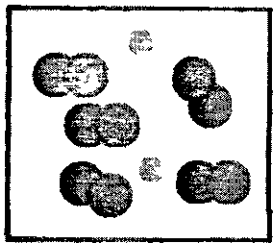
Consider the following samples of gases all at the same temperature:



A



B



C

Question 8.1 (1)

Which sample(s) has the highest total pressure?

Question 8.2 (1)

Which sample(s) has the highest partial pressure?

Question 8.3 (1)

Which sample(s) has the highest density?

Question 8.4

Which sample(s) has the highest average kinetic energy of particles? (1)

ROUGH WORK

ROUGH WORK

ROUGH WORK

ROUGH WORK

ROUGH WORK

PHYSICAL CONSTANTS:

Constant	Symbol	Value
Atomic mass unit	amu	1.66054×10^{-27} kg
Avogadro's number	N	$6\ 02214 \times 10^{23}$ mol^{-1}
Boltzmann constant	k	1.38066×10^{-23} $J.K^{-1}$
Charge of an electron	e	1.60218×10^{-19} C
Gas constant	R	0.08206 L atm $K^{-1}.mol^{-1}$ 8.31451 $J.K^{-1}.mol^{-1}$
Mass of an electron	m_e	5.48580×10^{-4} amu
Mass of a neutron	m_n	1.00866 amu
Mass of a proton	m_p	1.00728 amu
Planck's constant	h	6.626×10^{-34} Js
Speed of light	c	2.9979×10^{8} $m.s^{-1}$
Natural logarithm	e	2 71828

CONVERSION FACTORS:

Temperature: K = °C + 273

Pressure 1 atm = 101.325 kPa

1 atm = 760 Torr

1 atm = 760 mmHg

1 L = 1000 mL

Periodic Table of Elements

1 1A											
1 H 1 008	2 IIA										
3 Li 6 941	4 Be 9 012										
11 Na 22 99	12 Mg 24 31	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 VIIIB	9 VIIIB	10 VIIIB	11 IB	
19 K 39 10	20 Ca 40 08	21 Sc 44 96	22 Ti 47 88	23 V 50 94	24 Cr 52 00	25 Mn 54 94	26 Fe 55 85	27 Co 58 93	28 Ni 58 69	29 Cu 63 55	6
37 Rb 85 47	38 Sr 87 62	39 Y 88 91	40 Zr 91 22	41 Nb 92.91	42 Mo 95 94	43 Tc (98)	44 Ru 101 1	45 Rh 102 9	46 Pd 106 4	47 Ag 107 9	1
55 Cs 132 9	56 Ba 137.3	57 La* 138 9	72 Hf 178 5	73 Ta 180 9	74 W 183 8	75 Re 186 2	76 Os 190 2	77 Ir 192 2	78 Pt 195 1	79 Au 197 0	2
87 Fr (223)	88 Ra (226)	89 Ac** (227)	104 Unq (257)	105 Unp (260)	106 Unh (263)	107 Uns (262)	108 Uno (265)	109 Une (266)			

1 H 1 008 — Atomic number, Symbol, Atomic weight

*Lanthanides	58 Ce 140 1	59 Pr 140 9	60 Nd 144 2	61 Pm (147)	62 Sm 150 4	63 Eu 152 0	64 Gd 157 3	1
**Actinides	90 Th 232 0	91 Pa (231)	92 U 238 0	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	(

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Examination period

Student number

Surname

First Names

Subject

Code of paper — Number of paper

Centre Date

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That the information supplied by me in this answer book is correct and valid

I undertake to adhere to the procedures, rules and regulations of the University of South Africa as published in the official brochures

Signature of candidate

ID Number

Batch No
28092015MCQ

Signature of invigilator

UNISA invigilator's personnel number

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