



FACULTY OF SCIENCE

DEPARTMENT OF CHEMICAL SCIENCES NATIONAL DIPLOMA: EMERGENCY MEDICAL CARE

MODULE CET1DB1
 BASIC SCIENCES: CHEMISTRY 1B

CAMPUS DFC

NOVEMBER EXAMINATION

DATE: 11/11/2019

SESSION: 08:30 – 10:30

ASSESSOR

MS L E MACKECHNIE

INTERNAL MODERATOR

PROF R M MOUTLOALI

DURATION 2 HOURS

MARKS 90

NUMBER OF PAGES: 5 PAGES AND 2 ANNEXURES

INSTRUCTIONS: ***THIS PAPER MUST BE HANDED IN***
 CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT)

REQUIREMENTS: 1 x UJ MULTIPLE-CHOICE ANSWER SHEET
 1 x EXAMINATION BOOKS

PHYSICAL CONSTANTS:

Avogadro's number: $N_A = 6.022 \times 10^{23} \text{ particles mol}^{-1}$

Particle \leftrightarrow mole: $n = \frac{N}{N_A}$

Mole \leftrightarrow mass: $n = \frac{m}{M}$

Volume: 1 litre, $L = 1000 \text{ mL} \equiv 1 \text{ dm}^3 = 1000 \text{ cm}^3$

Molarity: $1 \text{ mol.L}^{-1} \equiv 1 \text{ mol.dm}^{-3}$

Molarity $c = \frac{n}{V} = \frac{m}{MV}$

K_w : $1 \times 10^{-14} = [\text{H}_3\text{O}^+][\text{OH}^-]$

pH: $\text{pH} = -\log [\text{H}_3\text{O}^+]$

$\text{pH} + \text{pOH} = 14$

Gases: $pV = nRT$, where $R = 8.20578 \times 10^{-2} \text{ L.atm.K}^{-1}.\text{mol}^{-1}$

A Periodic Table and a list of cations and anions is attached to this question paper.

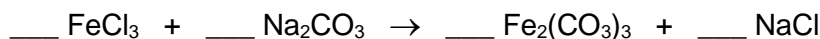
INSTRUCTIONS – SECTION 1

1. Write your name and fill out your student number on the multiple-choice answer sheet.
2. Do not fold or staple the multiple choice answer sheet.
3. Indicate each answer clearly by blocking out the chosen letter, preferably with a **soft pencil** although pen can be used.
4. Only **one** answer per question is correct. There will be no negative marking to penalise incorrect answers, but if you enter more than one choice per question you will receive zero for that question.
5. Mistakes may be corrected by carefully erasing the pencil marking or by using typex. Once erased, your new choice must be indicated as described on the multiple choice answer sheet.

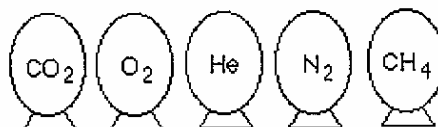
SECTION 1 – MULTIPLE CHOICE

1. An atom that has the same number of neutrons as ^{59}Co is
 - A. ^{58}Fe
 - B. ^{59}Ni
 - C. ^{57}Co
 - D. ^{60}Cu
2. The molar mass of carbon dioxide is the same as the molar mass of:
 - A. C_3H_8
 - B. CO
 - C. SO_2
 - D. C_2H_6
3. What is the percentage composition by mass of oxygen in $\text{Zn}(\text{NO}_3)_2$?
 - A. 8.45%
 - B. 25.3%
 - C. 37.8%
 - D. 50.7%

4. Calculate the mass in grams of 2.52 moles of NH_3 ?
- A. 0.0233
B. 0.148
C. 6.75
D. 43.0
5. When the equation below is balanced, the number (stoichiometric coefficient) in front of NaCl is



- A. 2
B. 3
C. 6
D. 8
6. Why is carbon monoxide toxic?
- A. It has a cumulative affect and eventually causes renal failure.
B. It blocks the transport of oxygen by haemoglobin.
C. It blocks acetylcholine receptor sites causing paralysis and rapid death.
D. It is causes leukaemia.
7. The diagram below shows five identical balloons filled to the same volume at 25°C and 1.0 atmosphere pressure with the pure gases indicated. Which balloon has the largest number of atoms?



- A. CO_2
B. O_2
C. He
D. N_2
E. CH_4
8. After swimming in the ocean for several hours, swimmers notice that their fingers appeared to be very wrinkled or shrivelled up. This is an indication that seawater is _____ relative to the fluid in cells.
- A. isotonic
B. hypertonic
C. hypotonic
D. none of these
9. Which statement about hydrogen bonding is correct?
- A. It causes water to be a liquid at room temperature.
B. It is nearly as strong as ionic bonding.
C. It is always present if hydrogen is covalently bonded in a compound.
D. It is the name given to the hydrogen-oxygen bond inside a water molecule.
10. Calculate the pH of a 0.0007 M ($\text{mol}\cdot\text{dm}^{-3}$) sodium hydroxide solution.
- A. 2.15
B. 3.15
C. 7.00
D. 10.85

11. A suspension is an example of a
A. homogeneous mixture
B. element
C. heterogenous mixture
D. compound
12. All of the following compounds are soluble in water, which one is a non-electrolyte?
A. $C_6H_{12}O_6$
B. $Cu(CH_3COOH)_2$
C. $(NH_4)_2SO_4$
D. KCl
13. Alkynes always contain a
A. $C=C$ bond
B. $C=H$ bond
C. $C\equiv C$ bond
D. $C-C$ bond
14. Which one of the following is the least soluble in water?
A. CH_3OH
B. CH_3CH_2OH
C. $CH_3CH_2CH_2OH$
D. $CH_3CH_2CH_2CH_2OH$
15. What name is given to compounds that have very high formula mass and have molecules made of repeating structural units?
A. Peptides
B. Polymers
C. Alkyl halides
D. Esters

[15 x 2 = 30]**SECTION 2****QUESTION 1**

- 1.1.1 Draw a Bohr model for oxygen gas and identify the core electrons and valence electrons. (4)
- 1.1.2 What type of bonding occurs in an oxygen molecule? (1)
- 1.1.3 What type of bond forms when oxygen gas reacts with sulphur? (1)
- 1.1.3 Draw the Lewis dot structure of an oxide ion and give the formula of this ion. (2)
- 1.2 Glyphosate is widely used as a weed killer in the agricultural industry and is known commercially as "round-up". It has recently been linked to cancer. It has the formula: $C_3H_8NO_5P$.
- 1.2.1 Calculate the molar mass of glyphosate. (2)
- 1.2.2 State the total number of atoms in one molecule of glyphosate. (1)
- 1.2.3 Calculate the mass percentage hydrogen in glyphosate. (2)
- 1.2.4 Calculate the mass in grams of 0.185 mol of glyphosate. (2)
- 1.2.5 If you have 55.7 g of glyphosate, how many moles do you have? (2)

[17]

QUESTION 2

2.1 The following table gives information about 3 radioactive isotopes.

Isotope	Type of radiation emitted	Half-life
Californium-241	Alpha (α)	4 minutes
Yttrium-90	Beta (β), Gamma (γ)	60 hours
Strontium-90	Beta (β)	28 years

Explain the following terms:

- 2.1.1 Isotope. (2)
- 2.1.2 Alpha radiation. (2)
- 2.1.3 Beta radiation. (2)
- 2.1.4 Gamma radiation. (2)
- 2.1.5 Half-life. (2)
- 2.1.6 Which one of the isotopes could be used as a chemotherapy agent? Explain the reason for your choice. (3)
- 2.1.7 Give the formula for the decay product formed when Californium-241 undergoes alpha decay. (2)
- 2.2.1 State Dalton's Law and give a mathematical expression for this law. (2)
- 2.2.2 What are partial pressures? (1)
- 2.2.3 Explain in detail why climbers at high altitude supplement the air they breathe with oxygen? (3)
- 2.2.4 If the atmospheric pressure on the summit of Mount Everest is 0.33 atm, what is the partial pressure oxygen on the summit? (2)

[23]**QUESTION 3**

- 3.1.1 Explain what chemists mean when they say that an acid is a WEAK acid. (2)
- 3.1.2 Give an example of a weak acid. (1)
- 3.1.3 Use your knowledge of weak acids to explain briefly how buffers work. (4)
- 3.1.4 Where would you find a buffer in the human body? (1)
- 3.2.1 Potassium metal reacts with liquid water to form aqueous potassium hydroxide and hydrogen gas. Give a balanced equation for the reaction and remember to include phase labels. (4)
- 3.2.2 Will the resulting solution be acidic or basic? (1)
- 3.2.3 If the concentration of OH^- ions is 0.0182 M, what is the pH of the solution? (2)
- 3.3.1 A vial of diazepam solution has a concentration of 20.0% m/v , calculate the mass in grams of diazepam in 2.50 mL of this solution. (2)
- 3.3.2 If the molar mass of diazepam is 284.7 g.mol^{-1} , what is the molarity of diazepam in the 20.0% solution? (2)
- 3.4 Ethanol is broken down in the body to form ethanal (also known as acetaldehyde) and then ethanoic acid. Give the structures of ethanol, ethanal and ethanoic acid. (3)
- 3.5 Give the molecular formula for $\text{CH}_2=\text{CH}-\text{C}\equiv\text{C}-\text{CHBr}-\text{CHBr}_2$ and state whether it is saturated or unsaturated. (3)

[25]**END OF EXAM**



Positive ions - CATIONS					
1+ Symbol	(Valency 1) Name	2+ Symbol	(Valency 2) Name	3+ Symbol	(Valency 3) Name
H ⁺	hydrogen	Be ²⁺	beryllium	Al ³⁺	aluminium
Li ⁺	lithium	Mg ²⁺	magnesium	Fe ³⁺	iron(III)
Na ⁺	sodium	Ca ²⁺	calcium	Cr ³⁺	chromium(III)
K ⁺	potassium	Sr ²⁺	strontium	As ³⁺	arsenic(III)
Ag ⁺	silver	Ba ²⁺	barium	Sb ³⁺	antimony(III)
Hg ⁺	mercury(I)	Sn ²⁺	tin(II)	Bi ³⁺	bismuth
Cu ⁺	copper(I)	Pb ²⁺	lead(II)		
NH ₄ ⁺	ammonium	Zn ²⁺	zinc		
		Fe ²⁺	iron(II)		
		Hg ²⁺	mercury(II)		
		Mn ²⁺	manganese(II)		
		Ni ²⁺	nickel(II)		
		Cd ²⁺	cadmium		
		Cr ²⁺	chromium(II)		

Negative ions - ANIONS					
1– Symbol	(Valency 1) Name	2– Symbol	(Valency 2) Name	3– Symbol	(Valency 3) Name
F [–]	fluoride	O ^{2–}	oxide	N ^{3–}	nitride
Cl [–]	chloride	S ^{2–}	sulphide	P ^{3–}	phosphide
Br [–]	bromide	CO ₃ ^{2–}	carbonate	PO ₄ ^{3–}	phosphate
I [–]	iodide	SO ₃ ^{2–}	sulphite		
OH [–]	hydroxide	SO ₄ ^{2–}	sulphate		
NO ₂ [–]	nitrite	CrO ₄ ^{2–}	chromate		
NO ₃ [–]	nitrate	Cr ₂ O ₇ ^{2–}	dichromate		
CN [–]	cyanide	S ₂ O ₃ ^{2–}	thiosulphate		
OCl [–]	hypochlorite				
ClO ₂ [–]	chlorite				
ClO ₃ [–]	chlorate				
ClO ₄ [–]	perchlorate				
MnO ₄ [–]	permanganate				
IO ₃ [–]	iodate				
CNS [–]	thiocyanide				
CH ₃ COO [–]	acetate				
HCO ₃ [–]	hydrogen carbonate				
HSO ₃ [–]	hydrogen sulphite				
HSO ₄ [–]	hydrogen sulphate				

Periodic Table of the Elements



PHYSICAL CONSTANTS:

Avogadro's number: $N_A = 6,022 \times 10^{23}$ particles.mol⁻¹
Volume: 1 litre, L = 1000 mL \equiv 1 dm³ = 1000 cm³
Molarity: $1\text{ M} \equiv 1\text{ mol.L}^{-1} \equiv 1\text{ mol.dm}^{-3}$
pH : $\text{pH} = -\log [\text{H}_3\text{O}^+]$
 K_w : $1 \times 10^{-14} = [\text{H}_3\text{O}^+][\text{OH}^-]$
pH + pOH = 14
Gases: $pV = nRT$

JOHANNESBURG

$\text{pH} = -\log [\text{H}_3\text{O}^+]$
 $1 \times 10^{-14} = [\text{H}_3\text{O}^+][\text{OH}^-]$
 $\text{pH} + \text{pOH} = 14$
 $\text{pV} = n\text{RT}$

Gases:

Groups																	VIIIA						
IA																	2	He					
Hydrogen	1	H															Helium						
1,01																	4,00						
3	Li	4	Be													9	F	10	Ne				
Lithium			Beryllium													Fluorine		Neon					
6,94			9,01													19,00		20,18					
11	Na	12	Mg													17	Cl	18	Ar				
Sodium			Magnesium													Chlorine		Argon					
22,99			24,31													35,45		39,95					
19	K	20	Ca													35	Br	36	Kr				
Potassium			Calcium													Bromine		Krypton					
39,10			40,08													79,90		83,80					
37	Rb	38	Sr													53	I	54	Xe				
Rubidium			Strontium													Iodine		Xenon					
85,47			87,62													126,90		131,29					
55	Cs	56	Ba													85	At	86	Rn				
Caesium			Barium													Astatine		Radon					
132,91			137,34													(210)		(222)					
87	Fr	88	Ra																				
Francium			Radium																				
(223)			226,03																				
</																							