UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF CHEMICAL SCIENCES
BACHELOR OF HEALTH SCIENCE: EMERGENCY MEDICAL CARE
NATIONAL DIPLOMA: PODIATRY

MODULE CET1BH1, CHB1BB1
BASIC SCIENCE: CHEMISTRY

CAMPUS **DFC**

NOVEMBER EXAMINATION

DATE: 14/11/2019	**SESSION: 08:30 – 10:30**
ASSESSOR	**PROF R M MOUTLOALI**
INTERNAL MODERATOR	**MS L E MACKECHNIE**
DURATION 2 HOURS	**MARKS 90**

NUMBER OF PAGES: 6 PAGES AND 2 ANNEXURE

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

REQUIREMENTS: 1 x EXAMINATION BOOK

PHYSICAL CONSTANTS:

Avogadro's number: $N_A = 6{,}022 \times 10^{23}$ particles mol^{-1}

Gases: $pV = nRT$, where $R = 8.205\ 78 \times 10^{-2}$ $L.atm.K^{-1}.mol^{-1}$

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

INSTRUCTIONS – SECTION 1

1. *Answer directly in the main answer sheet, indicating answer next to the appropriate question number.*
2. *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.*

SECTION 1 – MULTIPLE CHOICE

1. Which pair correctly give the number of protons and electrons in the Arsenic ion? ${}^{75}_{33}As^{3-}$?

A. 33 proton and 33 electrons
B. 33 protons and 34 electrons
C. 33 protons and 36 electrons
D. 36 protons and 33 electrons
E. 36 protons and 34 electrons

2. Which one of the following transformations is not a chemical process?

A. Sublimation of dry ice
B. Rusting of an iron pipe
C. Explosion of nitroglycerine
D. Burning of wood

3. What is the percentage composition by mass of oxygen in $Zn(NO_3)_2$?

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

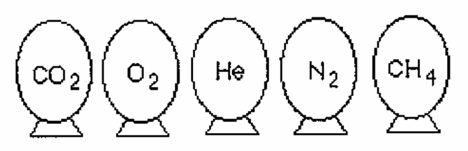
5. When the equation below is balanced, the number (stoichiometric coefficient) in front of NaCl is

$$\_\_\_\ FeCl_3 + \_\_\_\ Na_2CO_3 \rightarrow \_\_\_\ Fe_2(CO_3)_3 + \_\_\_\ NaCl$$

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* (mol.dm^{-3}) sodium hydroxide solution.
A. 2.15
B. 3.15
C. 7.00
D. 10.85

11. A colloid is an example of a
A. homogeneous mixture
B. element
C. heterogeneous 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≡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 a bond formed when a carboxylic acid reacts with an amine compounds?

A. ester
B. ketone
C. amide
D. ammonium **[15 x 2 = 30]**

SECTION 2

QUESTION 1

1.1 Ammonia is amphoteric liquid that is used as a disinfecting agent.
1.1.1 Draw a Lewis structure for ammonia gas. (3)
1.1.2 From your answer in 1.1.1, how many lone pairs does ammonia has? (1)
1.1.2 What type of bonding is present in ammonia molecule? (1)
1.1.3 Is it possible for ammonia to participate in hydrogen bonding? Give a reason for your answer. (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. All carbonates and bicarbonates are instantly decomposed by acids with brisk effervescence of CO_2, along with the formation of the salt of the acid and water. The total pressure above the closed system was found to be 98.25 kPa and the partial pressure of water was 3.1668 KPa. **Hint:** write the balanced equation of the reaction first.

2.2.1 Write the balanced equation for the reaction. (2)

2.2.2. What is the partial pressure for CO_2? (2)

2.2.3 Assuming that you started with the compound, Na_2CO_3, calculate the initial mass of Na_2CO_3 used to produce the gas volumes that are given in Question 2.2. (6)

[25]

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)

QUESTION 3 continued

3.5 Give the molecular formula for $CH_2{=}CH{-}C{\equiv}C{-}CHBr{-}CHBr_2$ and state whether it is saturated or unsaturated. (3)

[25]

END OF EXAM

Table 1: Common polyatomic ions and their names

Ion	Name (Alternate Name in Parentheses)
NH_4^+	Ammonium ion
H_3O^+	Hydronium ion[a]
OH^-	Hydroxide ion
CN^-	Cyanide ion
NO_2^-	Nitrite ion
NO_3^-	Nitrate ion
ClO^- or OCl^-	Hypochlorite ion
ClO_2^-	Chlorite ion
ClO_3^-	Chlorate ion
ClO_4^-	Perchlorate ion
MnO_4^-	Permanganate ion
$C_2H_3O_2^-$	Acetate ion
$C_2O_4^{2-}$	Oxalate ion
CO_3^{2-}	Carbonate ion
HCO_3^-	Hydrogen carbonate ion (bicarbonate ion)[b]
SO_3^{2-}	Sulfite ion
HSO_3^-	Hydrogen sulfite ion (bisulfite ion)[b]
SO_4^{2-}	Sulfate ion
HSO_4^-	Hydrogen sulfate ion (bisulfate ion)[b]
SCN^-	Thiocyanate ion
$S_2O_3^{2-}$	Thiosulfate ion
CrO_4^{2-}	Chromate ion
$Cr_2O_7^{2-}$	Dichromate ion
PO_4^{3-}	Phosphate ion
HPO_4^{2-}	Monohydrogen phosphate ion
$H_2PO_4^-$	Dihydrogen phosphate ion

[a]You will only encounter this ion in aqueous solutions.
[b]You will often see and hear the alternate names for these ions.

Table 2: Common monoatomic ions and their names

H^-	Hydride	N^{3-}	Nitride	O^{2-}	Oxide	F^-	Fluoride
C^{4-}	Carbide	P^{3-}	Phosphide	S^{2-}	Sulfide	Cl^-	Chloride
Si^{4-}	Silicide	As^{3-}	Arsenide	Se^{2-}	Selenide	Br^-	Bromide
				Te^{2-}	Telluride	I^-	Iodide

UNIVERSITY OF JOHANNESBURG

Department of Applied Chemistry

Atomic Number 2
He
4.0026 Atomic Weight

1 **H** *1.0079*																	2 **He** *4.0026*
3 **Li** *6.941*	4 **Be** *9.0122*											5 **B** *10.811*	6 **C** *12.011*	7 **N** *14.007*	8 **O** *15.999*	9 **F** *18.998*	10 **Ne** *20.179*
11 **Na** *22.990*	12 **Mg** *24.305*											13 **Al** *26.982*	14 **Si** *28.086*	15 **P** *30.974*	16 **S** *32.064*	17 **Cl** *35.453*	18 **Ar** *39.948*
19 **K** *39.098*	20 **Ca** *40.078*	21 **Sc** *44.956*	22 **Ti** *47.88*	23 **V** *50.942*	24 **Cr** *51.996*	25 **Mn** *54.938*	26 **Fe** *55.847*	27 **Co** *58.933*	28 **Ni** *58.69*	29 **Cu** *63.546*	30 **Zn** *65.39*	31 **Ga** *69.723*	32 **Ge** *72.61*	33 **As** *74.922*	34 **Se** *78.96*	35 **Br** *79.904*	36 **Kr** *83.80*
37 **Rb** *85.47*	38 **Sr** *87.62*	39 **Y** *88.906*	40 **Zr** *91.224*	41 **Nb** *92.906*	42 **Mo** *95.94*	43 **Tc** *(98)*	44 **Ru** *101.07*	45 **Rh** *102.91*	46 **Pd** *106.42*	47 **Ag** *107.87*	48 **Cd** *112.41*	49 **In** *114.82*	50 **Sn** *118.71*	51 **Sb** *121.75*	52 **Te** *127.60*	53 **I** *126.90*	54 **Xe** *131.29*
55 **Cs** *132.91*	56 **Ba** *137.33*	57 **La** *138.91*	72 **Hf** *178.49*	73 **Ta** *180.95*	74 **W** *183.85*	75 **Re** *186.2*	76 **Os** *190.2*	77 **Ir** *192.22*	78 **Pt** *195.08*	79 **Au** *196.97*	80 **Hg** *200.59*	81 **Tl** *204.38*	82 **Pb** *207.2*	83 **Bi** *208.98*	84 **Po** *(209)*	85 **At** *(210)*	86 **Rn** *(222)*
87 **Fr** *(223)*	88 **Ra** *226.03*	89 **Ac** *227.03*															

58 **Ce** *140.12*	59 **Pr** *140.91*	60 **Nd** *144.24*	61 **Pm** *146.92*	62 **Sm** *150.36*	63 **Eu** *151.97*	64 **Gd** *157.25*	65 **Tb** *158.93*	66 **Dy** *162.50*	67 **Ho** *164.93*	68 **Er** *167.26*	69 **Tm** *168.93*	70 **Yb** *173.04*	71 **Lu** *174.97*
90 **Th** *232.04*	91 **Pa** *231.04*	92 **U** *238.03*	93 **Np** *237.05*	94 **Pu** *(244)*	95 **Am** *(234)*	96 **Cm** *(247)*	97 **Bk** *247*	98 **Cf** *(251)*	99 **Es** *(252)*	100 **Fm** *(257)*	101 **Md** *(258)*	102 **No** *(259)*	103 **Lr** *(260)*