

TAMIBIA UNIVERSITY

OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, APPLIED SCIENCES AND NATURAL RESOURCES

DEPARTMENT OF NATURAL AND APPLIED SCIENCES

QUALIFICATION: BACHELOR OF SCIE	NCE
QUALIFICATION CODE: 07BOSC	LEVEL: 5
COURSE CODE: GNC501S	COURSE NAME: GENERAL CHEMISTRY 1A
SESSION: JULY 2022	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

SUPPLEMEI	NTARY/SECOND OPPORTUNITY EXAMINATION QUESTION PAPER
EXAMINER(S)	DR. EUODIA HESS
MODERATOR:	DR. MARIUS MUTORWA

	INSTRUCTIONS
1.	Answer ALL the questions.
2.	Write clearly and neatly.
3.	Number the answers clearly
4.	All written work must be done in blue or black ink and sketches can
	be done in pencil
5.	No books, notes and other additional aids are allowed

PERMISSABLE MATERIALS

Non-programmable calculators

ATTACHMENTS

- 1. List of useful constants
- 2. Periodic Table

THIS QUESTION PAPER CONSISTS OF 8 PAGES (Including this front page, list of useful constants and Periodic Table)

•	Choose the best possible answer for each question, even if you think there is another
	possible answer that is not given.
1.	What type of ions have names ending with –ide? A. Only cations B. Only anions C. Only metal ions D. Only gaseous ions
2.	When Group 2A elements form ions, they A. Lose two protons B. Lose two electrons C. Gain two protons D. Gain two electrons
3.	What is the correct name for N ³⁻ ion? A. Nitrate ion B. Nitride ion C. Nitrogen ion D. Nitrite ion
4.	Aluminium is a Group 3A metal. Which ion does Al typically form? A. Al^{3-} B. Al^{3+} C. Al^{5-} D. Al^{5+}
5.	Bohr's atomic model A. proposes that electrons occupy specific energy levels. B. explains the emission spectra of hydrogen atoms. C. predicts the energy level of multi-electron atoms D. both A and B
6.	orbitals are spherically symmetrical. A. f B. d C. p D. s
7.	The n = 1 shell containsp sub-orbitals. All other shells containp sub-orbitals. A. 3, 6
	Page 2 of 8

• There are 20 multiple choice questions in this section. Each question carries 3 marks.

• Answer ALL questions by selecting the letter of the correct answer.

- B. 0, 3
- C. 6, 2
- D. 0,6
- 8. There are _____orbitals in the second shell.
 - A. 1
 - B. 2
 - C. 3
 - D. 4
- 9. An unknown amount of C_3H_8 was burned completely to H_2O and CO_2 , with 36 g of H_2O recovered.

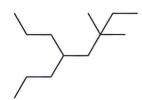
How many moles of the hydrocarbon were originally present?

- A. 0.25
- B. 0.50
- C. 2
- D. $\frac{36}{8}$
- 10. A compound having an empirical formula of SO_3 is found to have a molecular weight of 80. What is its molecular formula?
 - A. S₃O₉
 - B. S₂O₆
 - C. SO₃
 - D. SO₄
- 11. Balance the following reaction:

$$S + O_2 \rightarrow SO_3$$

- A. $S + O_3 \rightarrow SO_3$
- B. $4S + 2O_2 \rightarrow 4SO_3$
- C. $2S + 3O_2 \rightarrow 2SO_3$
- D. $3S + 2O_2 \rightarrow 3SO_3$
- 12. What is the formula weight of Al₂(SO₄)₃?
 - A. 150
 - B. 123
 - C. 342
 - D. 315
- 13. Standard conditions (STP) are:
 - A. 0°C and 2 atm
 - B. 32°F and 76 torr
 - C. 273 K and 760 mmHg
 - D. 4°C and 7.6 mmHg

14. What is the name of the following hydrocarbon according to the IUPAC rules?



- A. 3,3-dimethyl-5-propylhexane
- B. 6,6-dimethyl-4-propyloctane
- C. 3,3-diethyl-5-propyloctane
- D. 3,3-dimethyl-5-propyloctane

15. Which of the following alkanes would have the highest boiling point?

$$CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$$
 CH_3-C-CH_3 CH_3 CH_3

(c) (d)
$$CH_3-CH_2-CH_2-CH-CH_3$$
 $CH_3-CH-CH_2-CH-CH_3$ $CH_3-CH-CH_2-CH-CH_3$ CH_3 CH_3

- A. (a)
- B. (b)
- C. (c)
- D. (d)

16. Which of these would be least soluble in water?

- A. octanol (CH₃CH₂CH₂CH₂CH₂CH₂CH₂CH₂-OH)
- B. butanol (CH₃CH₂CH₂CH₂-OH)
- C. pentanol (CH₃CH₂CH₂CH₂CH₂-OH)
- D. hexanol (CH₃CH₂CH₂CH₂CH₂CH₂-OH)

17. The alcohol shown below is a:

(CH₃)₂CHOH

- A. Primary alcohol
- B. Secondary alcohol
- C. Tertiary alcohol
- D. Allylic alcohol

18. A hydrocarbon with the general formula C_nH_{2n-2} can be:

- A. an alkyne or a cycloalkene
- B. an alkyne or a cyclolkane
- C. a cycloalkane or an alkene
- D. a cycloalkene

 20. What is the boiling point in °C of a solution of a 2.15 m aqueous solution of glycerol? (K_b 0.512°C/m)? A. 101.1 B. 100.2 C. 100 D. 1.1 	=
SECTION B:	<u>40]</u>
There are FIVE questions in this section. Answer all Questions. Show clearly, where necessary, how you arrive at the answer as the working will carry marks to.	
Question 1	[10]
a) All alkali metals react with water to produce hydrogen gas and the corresponding alkali metal hydroxide. A typical reaction is that between lithium and water:	
Li (s) + H ₂ O (l) \rightarrow LiOH (aq) + H ₂ (g)	
How many grams of Li is needed to produce 9.89 g of H₂?	(2)
b) Titanium is prepared by the reaction of titanium(IV) chloride with molten magnesium between 950°C and 1150°C. $ \text{TiCl}_4\left(g\right) + \text{Mg}\left(l\right) \rightarrow \text{Ti}\left(s\right) + \text{MgCl}_2\left(l\right) $ If $3.54 \times 10^7 \text{g}$ of TiCl $_4$ reacts with $1.13 \times 10^7 \text{g}$ of Mg: (i) Calculate the theoretical yield of Ti in grams. (ii) Calculate the percent yield if $7.91 \times 10^6 \text{g}$ of Ti are actually obtained.	(6) (2)
Question 2	[6]
 a) How many grams of potassium dichromate are required to prepare a 250 mL solution whose concentration is 2.16 M? b) Describe how you would prepare 5.00 x 10² mL of a 1.75 M sulphuric acid solution, starting with a 8.16 M stock solution. 	(3)
Question 3	[8]
a) Sulfur hexafluoride is a colorless and odourless gas. Due to its lack of chemical reactivity, it is used as an insulator in electronic equipment. Calculate the pressure (in atm) exerted by 1.82 moles of gas in a steel vessel of volume 5.43 L at 69.5 °C. Page 5 of 8	(2)

19. Smoke is an example of a colloid termed:

A. a foamB. an aerosolC. a gelD. sol

c) A flammable gas made up of carbon and hydrogen is found to effuse through a porous barrier in 1.50 min. Under the same conditions and pressure it takes an equal volume of bromine vapour 4.73 min to effuse through the same barrier. Calculate the molar mass of the unknown gas.

Question 4

[12]

- a) Calculate the pH of (i) a 1.0×10^{-3} M HCl solution and (ii) 0.020 M Ba(OH)₂ solution.
- (6) (6)

b) Calculate the pH of a $0.036\ M$ nitrous acid (HNO₂) solution:

 HNO_2 (aq) \leftrightarrow H+ (aq) + NO_2 ⁻ (aq)

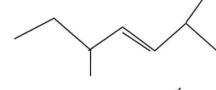
Question 5

[4]

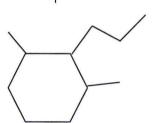
a) Write the IUPAC names of the following compounds:

(2)

(i)



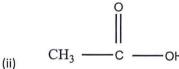
(ii)



(b) State the functional group in each of the following compounds:

(3)





END OF EXAMINATION

USEFUL CONSTANTS:

Gas constant, R = $8.3145 \text{ J} \cdot \text{mol}^{-1} \cdot \text{K}^{-1} = 0.083145 \text{ dm}^{3} \cdot \text{bar} \cdot \text{mol}^{-1} \cdot \text{K}^{-1} = 0.08206 \text{ L atm mol}^{-1} \cdot \text{K}^{-1} = 0.08206 \text{ L}$

 $1 \text{ Pa} \cdot \text{m}^3 = 1 \text{ kPa.L} = 1 \text{ N} \cdot \text{m} = 1 \text{ J}$

1 atm = 101 325 Pa = 760 mmHg = 760 torr

Avogadro's Number, $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$

Planck's constant, $h = 6.626 \times 10^{-34} \text{ Js}$

Speed of light, $c = 2.998 \times 10^8 \text{ ms}^{-1}$

PERIODIC TABLE OF THE ELEMENTS

_					***			-											
18	He 4.00260	10	Se	20.179	18	Ar	39.948	36	Kr	83.8	54	Xe	131.29	98	Rn	(222)	118	Uuo	
	17	6	1	15.9994 18.9984	17	Ü	35.453	35	Br	79.904	53	I	126.9	85	At	(210)			
	16	∞	0	15.9994	16	Ø	32.06	34	Se	78.96	52	Te	127.6	84	Po	(506)	116	Unh	
	15	7	Z	14.0067	15	Д	30.9738	33	As	74.9216	51	Sp	121.75	83	Bi	208.908	ı		
	14	9	Ü	12.011	14	Si	28.0855	32	g	72.59	50	Sn	69'811	82	Pb	207.2	114	Und	
	13	5	В	10.81	13	AI	26.9815 28.0855	31	Ga	69.72	64	In	114.82	18	I	204.383			
							12	30	Zn	65.38	48	S	112.41	80	Hg	200.59	112	Unb	(566)
							11	29	Cn	63.546	47	Ag	107.868	62	Au Hg	196.967	111	Unn	(272)
							10	28	Z	58.69	46	Pd	106.42	78	Pt	195.08	110	Unn	(566)
							6	27	ථ	58.9332	45	Rh	102.906	11	I,	192.22	109	Mt	(268)
								26	Fe	55.847	44	Ru	101.07	9/	ő	190.2	108	Hs	(265)
							7	25	Mn	54.9380	43	Tc	(86)	75	Re	183.85 186.207	107	Bh	(264)
							9	24	Ç	_	42	Mo	95.94	74	3	183.85	106	S	(263)
							2	23	>	50.9415 51.996	41	g	92.9064	73	Ta	180.948	105	Dp	(262)
							4	22	H	47.88	40	Zr	91.22	72	Hſ	178,49	104	Rf	(261)
							3	21	Sc	44.9559	39	>	88.9059	71	7	174.967	103	Ľ	(260)
	2	4	Be	9.01218	12	Mg	24.305	20	ů	40.08	38	Sr	87.62	26	Ba	137.33	88	Ra	226.025
-[-	H 1.00794	ю		6.941	11	Na	22.9898 24.305	19	X	39.0983	37	Rb	85.4678	55	S	132.905	87	Fr	(223)

:									-					
Lanthanides: 57	57	28	29	09		62	63	64	65	99	1.9	89	69	70
	La	ပီ	La Ce Pr Nd Pm	PN		Sm	Eu	Cd	Sm Eu Gd Tb Dy Ho Er Tm	Dy	Ho	E.	Tm	AV
	138.906	140.12	140.908	144.24		150.36	151.96	157.25	158.925	162.50	161.930	167.26	166.934	173.04
Actinides:	68	90	91	92	93	94	95	96	97	86	66	100	101	102
	Ac	Th	Ac Th Pa U Np Pu Am	Þ	Z	Pu	Am	Cm	Bk	C	Es	Fm	Md	No
	227.028	232.038	231.036	238.029	237.048	(244)	(243)	(247)	(247)	(251)	(252)	(757)	(356)	(950)