

THE PAPUN NEW GUINEA UNIVERSITY OF TECHNOLOGY

SECOND SEMESTER EXAMINATION - 2021

FORESTRY

FIRST YEAR DEGREE

AS113 – CHEMISTRY FOR NATURAL RESOURCES

MONDAY 25TH OCTOBER, 2021 12:50 PM

TIME ALLOWED: 3 HOURS

STUDENT NAME: _____

STUDENT NO: _____

COURSE: _____

SIGNATURE: _____

INFORMATION FOR CONDIDATES

1. You have 10 minutes to read the paper. You must **NOT** answer any question during this time.
2. **ANSWER ALL QUESTIONS.**
3. Answers must be written on the spaces provided. Show all workings and calculations for each step in a question on the space provided.
4. Write your name, number and course clearly on this page where indicated. **Do it now.**
5. Calculators are permitted in the examination room. Notes, textbooks, bags, **MOBILE PHONES** and other electronic devices are **NOT** allowed.

TOTAL [100 MARKS]

1. (a) Give the formula of the ionic compounds listed below.
- (i) Magnesium bromide.
 - (ii) Calcium oxide.
 - (iii) Magnesium nitrate.
 - (iv) Ammonium sulphate. [4 marks]
- (b) Name the following type II binary ionic compounds.
- (i) CuBr
 - (ii) FeS
 - (iii) PbO₂ [6 marks]
- (Total = 10 Marks)**
2. (a) For the following chemical statements write the corresponding balanced chemical equations including their appropriate states.
- (i) When water is electrolyzed it decomposes into its constituting elements. [2 marks]
 - (ii) Heating potassium chlorate, KClO₃(s), releases oxygen, leaving solid potassium chloride. [3 marks]

(b) How many protons, neutrons and electrons are there in ^{197}Au ? [3 marks]

(c) Write the correct electron configuration of the ions below. [2 marks]

(i) Mg^{2+}

(ii) Cl^-

(Total = 10 Marks)

3. (a) An element consists of 93.1% of an isotope with mass 38.963 amu and 0.001% of an isotope with mass 39.974 amu and 6.88% of an isotope with mass 40.961 amu. Calculate the average atomic mass and identify the element. [4 marks]

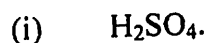
(b) Calculate the number of moles there are in 2.70×10^{24} Fe atoms. (Avagadro's number = 6.02×10^{23}) [2 marks]

(c) How many moles of carbon dioxide are produced when 2.4 moles of ethane reacts with oxygen (burns). [4 marks]

(Total = 10 Marks)

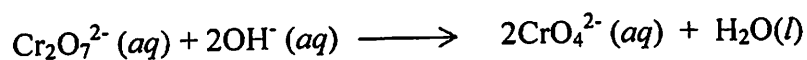
4. (a) What is the molarity (M) of 10 grams of silver nitrate dissolved in 500 mL of distilled water? [3 marks]

(b) Find the oxidation state of each of the elements below.



[5 marks]

(c) For the equation below, identify the oxidizing agent and the reducing agent.



[2 marks]

(Total = 10 Marks)

5. Use half equations to balance the following Redox equations.

(a) The formation of a chemical pine tree when copper wire is placed into silver nitrate solution.

[4 marks]

(b) Preparation of bromine by bubbling chlorine gas through a solution of NaBr.

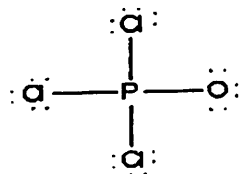
[4 marks]

(c) Draw Lewis structure for the compounds listed below.



[4 marks]

- (d) For the Lewis structure below, assign the formal charges of each constituting element. [3 marks]



(Total = 15 Marks)

6. (a) In a laboratory experiment a student observes an increase from 25.0°C to 31.7 °C when 141 grams of aluminium absorb 803 joules (192 cal) of heat. Calculate the specific heat of aluminium from these data. [3 marks]
- (b) The thermal decomposition of $\text{CaCO}_3(\text{s})$ to $\text{CaO}(\text{s})$ and $\text{CO}_2(\text{g})$ is an endothermic reaction requiring 176 KJ per mole of $\text{CaCO}_3(\text{s})$ to decompose. Write the two forms of thermo-chemical equations. [4 marks]
- (c) Two moles of C_2H_6 (ethane) burns (7 moles of O_2) to release 3080 KJ of heat. How many kilojoules of heat are evolved by the burning of 84.0 grams of ethane. [3 marks]

(Total = 10 Marks)

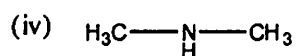
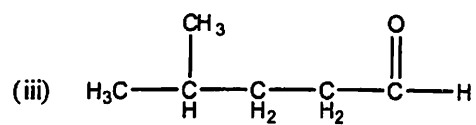
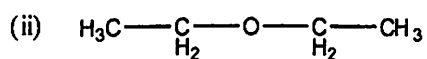
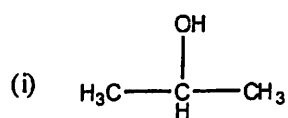
7. (a) Nitrogen and hydrogen gases reacted and produced ammonia (NH_3) gas at a certain temperature and pressure; $P_{(\text{ammonia})} = 2.9 \times 10^{-2} \text{ atm}$, $P_{(\text{nitrogen})} = 8.9 \times 10^{-1} \text{ atm}$ and $P_{(\text{hydrogen})} = 2.9 \times 10^{-3} \text{ atm}$.
- (i) Write the balanced equation. [6 marks]
- (ii) Write the equilibrium pressure expression. [6 marks]
- (iii) Calculate the equilibrium pressure K_p of the reaction. [6 marks]
- (b) (i) Define chemical kinetics. [1 mark]
- (ii) CaCO_3 reacts with HCl to produce CO_2 . Sketch a graphical representation of the production of CO_2 from decreased surface area of CaCO_3 and also increased surface area of CaCO_3 . [3 marks]
- (Total = 10 Marks)**
8. (a) (i) Ice is the solid form of H_2O . Explain why it floats on liquid water. [1 mark]

- (ii) Water has high specific heat index. Explain what this means. [1 mark]
- (iii) Water tends to clump together in drops rather than spread out in a thin film. Explain the reason for this behavior. [1 mark]
- (iv) As related to water quality, explain the difference between chemical oxygen demand (COD) and biological oxygen demand (BOD). [2 marks]
- (b) (i) Show the pH expression in terms of hydrogen ion concentration. [1 mark]
- (ii) Using the expression for ionic product of water, calculate the pH of 2×10^{-3} moles/L of NaOH. [4 marks]

(Total = 10 Marks)

9. (a) The hydrocarbon, C_5H_{12} has three structural isomers. Draw the three isomers and give their respective scientific (IUPAC) name. [8 marks]

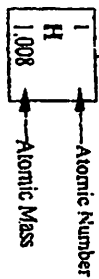
- (b) Give the scientific names of the structures given below.



[7 marks]

(Total = 15 Marks)

Periodic Table of Elements



Group	1	2	Transition Elements										11	12								18
Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18				
1	H 1.008	He 4.003																				
2	Li 6.941	Be 9.012	B 10.81	C 12.01	N 14.01	O 16.00	F 19.00	Ne 20.18														
3	Na 22.99	Mg 24.31	Al 26.98	Si 28.09	P 30.97	S 32.06	Cl 35.45	Ar 39.95														
4	K 39.10	Ca 40.08	Sc 44.96	Ti 47.90	V 50.94	Cr 52.00	Mn 54.94	Fe 55.85	Cu 63.55	Zn 65.38	Ga 69.72	Ge 72.59	As 74.92	Se 78.96	Br 79.90	Kr 83.80						
5	Rb 85.47	Sr 87.62	Y 88.91	Zr 91.22	Nb 92.91	Mo 95.94	Tc (98)	Ru 101.1	Rh 102.9	Pd 106.4	Ag 107.9	Cd 112.4	In 114.8	Sn 118.7	Sb 121.8	Te 127.6	I 126.9	Xe 131.3				
6	Cs 132.9	Ba 137.3	La* 138.9	Hf 178.5	Ta 180.9	W 183.9	Re 186.2	Os 190.2	Ir 192.2	Pt 195.1	Au 197.0	Hg 200.6	Tl 204.4	Pb 207.2	Bi 209.0	Po (209)	At (210)	Rn (222)				
7	Fr (223)	Ra (226.0)	Ac* (227)	Unq	Unp	Unh	Uns	Uno	Une													

*Lanthanides
*Actinides

58	Ce	59	Pr	60	Nd	61	Pm	62	Sm	63	Eu	64	Gd	65	Tb	66	Dy	67	Ho	68	Er	69	Tm	70	Yb	71	Lu
140.1	140.9	144.2	(145)	(150.4)	152.0	157.3	158.9	162.5	164.9	167.3	168.9	173.0	173.0	173.0	173.0	173.0	173.0	173.0	173.0	173.0	173.0	173.0	173.0	173.0	173.0	173.0	173.0
90	Pa	91	Pa	92	U	93	Np	94	Pu	95	Am	96	Cm	97	Bk	98	Cf	99	Es	100	Fm	101	Md	102	No	103	Lr
231	(231)	238.0	(244)	(242)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(260)	(260)	(260)	(260)	(260)	(260)	(260)	(260)	(260)	(260)	(260)	(260)	(260)	(260)	(260)	(260)

metals
nonmetals

Avogadro's number = 6.022×10^{23} GAS CONSTANT, $R = 0.0821 \text{ L.atm/K.mol}$ or $8.31 \text{ kPa dm}^3 \text{ K}^{-1}$ STP at 0°C (273 K) and 1 atm (760 mm Hg)
 $c = 2.9979 \times 10^8 \text{ m/s}$ Planck's constant = $6.626 \times 10^{-34} \text{ J.s}$