

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATIONS – 2022

AS 113 – CHEMISTRY FOR FOOD TECHNOLOGY

MONDAY 30<sup>TH</sup> MAY 2022 – 8:20 AM

TIME ALLOWED: 2 HOURS

**INFORMATION FOR CANDIDATES: -**

1. You will have 10 minutes to read the question paper. You **MUST NOT** begin writing in the answer book during this time.
2. **ANSWER ALL QUESTIONS.**
3. All answers **MUST** be written on the answer book provided
4. Calculators are permitted in the examination room. Lecture notes, notebooks plain papers and textbooks are **NOT** allowed.
5. Mobile phones are not allowed. **SWITCH OFF THE MOBILE PHONES.**
6. Show all workings and calculations in the answer book.
7. **DRAW** the **STRUCTURES** clear and visible.
8. **DO NOT** over write.
9. Write your name and student **ID number** clearly on the front page of the answer book. **DO IT NOW.**

**MARKING SCHEME: TOTAL 60 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) PbO<sub>2</sub> [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, KClO<sub>3</sub>(s), releases oxygen, leaving solid potassium chloride. [3 marks]
- (b) How many protons, neutrons and electrons are there in <sup>197</sup>Au? [3 marks]

- (c) Write the correct electron configuration of the ions below. [2 marks]
- (i)  $\text{Mg}^{2+}$
- (ii)  $\text{Cl}^-$

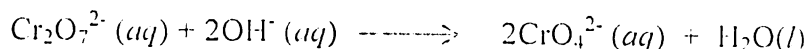
(Total = 10 Marks)

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  $2.70 \times 10^{24}$  Fe atoms. (Avagadro's number =  $6.02 \times 10^{23}$ ) [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]
- (i)  $\text{H}_2\text{SO}_4$ . (ii)  $\text{H}_2\text{O}_2$ .

- (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.

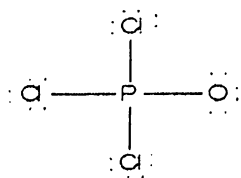
- (a) The formation of a chemical pine tree when copper wire is placed into silver nitrate solution. [4 marks]

- (b) Preparation of bromine by bubbling chlorine gas through a solution of NaBr. [4 marks]

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

- (i)  $\text{H}_2\text{O}$  (ii)  $\text{PBr}_3$  [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  $25.0^\circ\text{C}$  to  $31.7^\circ\text{C}$  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  $\text{C}_2\text{H}_6$  (ethane) burns (7 moles of  $\text{O}_2$ ) 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 ( $\text{NH}_3$ ) gas at a certain temperature and pressure:  $P_{(\text{ammonia})} = 2.9 \times 10^{-2}$  atm,  $P_{(\text{nitrogen})} = 8.9 \times 10^{-1}$  atm and  $P_{(\text{hydrogen})} = 2.9 \times 10^{-3}$  atm.

(i) Write the balanced equation.

(ii) Write the equilibrium pressure expression.

(iii) Calculate the equilibrium pressure  $K_p$  of the reaction. [6 marks]

(b) (i) Define chemical kinetics [1 mark]

(ii)  $\text{CaCO}_3$  reacts with  $\text{HCl}$  to produce  $\text{CO}_2$ . Sketch a graphical representation of the production of  $\text{CO}_2$  from decreased and increased surface area of  $\text{CaCO}_3$  [3 marks]

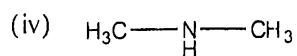
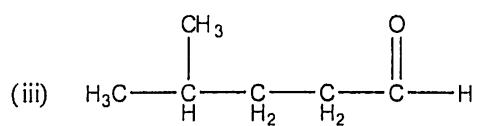
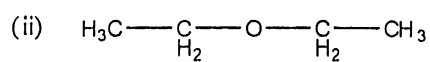
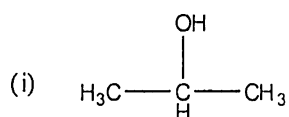
(Total = 10 Marks)

8. (a) (i) Ice is the solid form of  $\text{H}_2\text{O}$ . Explain why it floats on the 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  $2 \times 10^{-3}$  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)