UNIVERSITY OF ZAMBIA

SCHOOL OF NATURAL SCIENCES

2019/20 ACADEMIC YEAR MID-YEAR DEFERRED EXAMS

CHE 2001: AGRICULTURAL AND VETERINARY CHEMISTRY

INSTRUCTIONS TO THE CANDIDATES

TIME ALLOWED: Three (**3**) hours

All questions carry equal marks (**20 marks** EACH)

Answer **Any Five (5)** questions

Write your computer number on all Answer booklets

This examination consists of six (6) questions and **FIVE** (5) printed pages and the DATA sheet.

QUESTION ONE

(a) Calculate the $[H_3O^+]$ in a 0.45 M solution of hydrogen sulphide (H_2S). **[3 marks]**

(b) Calculate the pH in a 0.60 M solution of ammonium chloride (NH_4Cl). **[4 marks]**

(c) The pH in a 0.25 M solution of the acid HBrO is 4.65 . Using this, calculate the value of Ka for the acid HBrO. **[4 marks]**

(d) The pH in a solution of benzoic acid is 2.355. Determine the molar concentration of the benzoic acid. **[4 marks]**

(f) The value of Kb for the weak base methylamine (CH_3NH_2) is 4.4×10^{-4}. Calculate the value of Ka for the acid $CH_3NH_3^+$. **[1 mark]**

(h) A 0.40 M solution of the lactate ion ($C_3H_5O_3^-$) (a weak base), has a pH of 8.728.

(i) Calculate the Kb of the lactate ion ($C_3H_5O_3^-$). **[4 marks]**

QUESTION TWO

The unique properties of water make life possible on Earth. Approximately three-quarters of the Earth's surface is covered by water. Cells are made up of around 70-95% water. Water comprises roughly 70% of the human body.

a) Describe the major physical and chemical properties of water that make it unique from other liquids. **[10 marks]**

b) Explain the properties of water that enable it to travel up through the roots and stems of plants to reach the leaves. **[10 marks]**

QUESTION THREE

Given that at **600°C** acetone **(CH_3COCH_3)** decomposes to form several compounds.

Experiment	$[CH_3COCH_3]$ (M)	Initial Rates (M/s)
1	6×10^{-3}	5.2×10^{-5}
2	6×10^{-3}	7.8×10^{-5}

a) Calculate the reaction order for this reaction at 600°C and determine the complete rate law.

[6 marks]

b) Calculate the rate constant for this reaction.

[4 marks]

c) Calculate the concentration of acetone after 45 minutes if the initial concentration of acetone is 0.0100M at 600°C.

[6 marks]

d) Calculate the half-life for this reaction at 600°C? **[4 marks]**

QUESTION FOUR

a) A 150.0 g of water in a cup goes from 20.1°C to 48.5°C. How much heat was absorbed by the water?

[4 marks]

b) 38.1 g of zinc and 25.9 g of aluminum are heated to 100.2 °C, and dropped into a container with 200.0 g of water at 22.4°C. Assuming that no heat is lost, what is the final temperature of the water? Note: $C_{Al} = 0.897$ J/g°C and $C_{Zn} = 0.388$ J/g°C

[6 marks]

c) Consider the following reaction, which occurs at standard state:

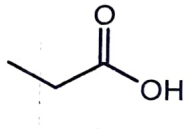
$$\mathbf{2\ Mg_{(s)} + O_{2(g)} \rightarrow 2\ MgO_{(s)} \qquad \Delta H = -1204\ kJ.}$$

(i) Explain briefly why this reaction could be either exothermic or endothermic?
(ii) Calculate the amount of heat transferred when 2.4 g of Mg(s) reacts at constant pressure.
(iii) How many grams of MgO are produced during an enthalpy change of 96.0 kJ?

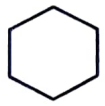
[10 marks]

QUESTION FIVE

(a) Classify each of the following compounds as an alkane, alcohol, carboxylic acid, aldehyde and an ester **(5 marks)**



(i)



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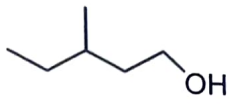

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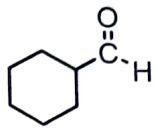

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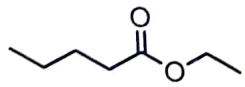


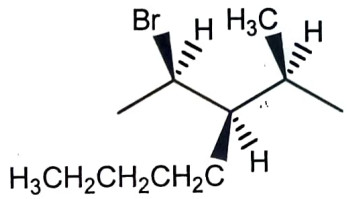
(v)

(b) Using the **bond-line** formula, draw the structures of the following: **[8 marks]**

(i) 3-ethyl-3-methylpentane
(ii) 3-methyl-5-propylnonane
(iii) 3-methylcyclohexanol
(iv) 4-hydroxy-2-methylpentantoic acid

(c) Draw the structures of Cis-2-butene and Trans-2-butene **[4 marks]**

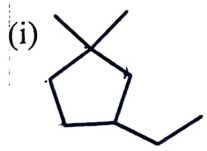
(d) Determine the absolute configuration of any stereogenic centres in the following molecule. Show your reasoning for full credit. **[3 marks]**



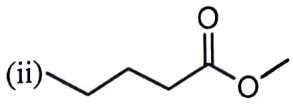
QUESTION SIX

(a) Name the following compounds: **[3 marks]**

(i)



(ii)



(iii)