

GARISSA UNIVERSITY

UNIVERSITY EXAMINATION 2017/2018 ACADEMIC YEAR <u>**TWO</u>** <u>**SECOND**</u> SEMESTER EXAMINATION</u>

SCHOOL OF BIOLOGY AND PHYSICAL SCIENCES

FOR THE DEGREE OF BACHELOR OF EDUCATION

COURSE CODE: CHE 213

COURSE TITLE: BASIC KINETICS AND THERMODYNAMICS

EXAMINATION DURATION: 3 HOURS

DATE: 18/04/18

TIME: 2.00-5.00 PM

INSTRUCTION TO CANDIDATES

- The examination has SIX (6) questions
- Question ONE (1) is COMPULSORY
- Choose any other THREE (3) questions from the remaining FIVE (5) questions
- Use sketch diagrams to illustrate your answer whenever necessary
- Do not carry mobile phones or any other written materials in examination room
- Do not write on this paper

This paper consists of THREE (3) printed pages

please turn over

QUESTION ONE (COMPULSORY)

(a) Define the following terms in Thermodynamics	[5 marks]	
i. Path function		
ii. Isobaric process		
iii. Internal energy		
iv. Exact differential		
(b) State the first law of Thermodynamics	[2 marks]	
(c) One mole of an ideal gas at 300k is allowed to expand isothermally against a constant external		
pressure of 1atm from a volume of 1.0 litres to a volume of 5.0 litres. Calculate the	work done by	
the gas	[4 marks]	
(d) Starting from a weightless, frictionless piston, show that the work done in expansion of a gas is		
given by $W = -P \Delta V$	[4 marks]	
QUESTIONS TWO		
(a) Name and define the three Thermodynamics systems	[3 marks]	

- (b) Name any three characteristics of an exact differential [3 marks]
- (c) Calculate the work done when 50g of iron reacts with dilute hydrochloric acid in an open beaker at 25°c

$$(R=8.314 \text{ JK}^{-1}\text{mol}^{-1} \text{ Fe} = 55.85 \text{gmol}^{-1})$$
 [2 marks]

(d) Given that H = E + PV Derive the expression $C_p-C_v = R$ Apply the ideal gas equation for one mole of gas [7 marks]

QUESTIONS THREE

- (a) State Hess¹ Law
- (b) From the following equation and Enthalpy changes
 - Reaction equation ΔH^{o} reaction kJ

 $\begin{array}{cccc} C_{(graphite)} + O_{2(g)} & \longrightarrow O_{2(g)} & -393.5 \\ H_{2(g)} + \frac{1}{2} O_{2(g)} & \longrightarrow H_2O_{(1)} & -285.8 \\ 2_{C2}H_{2(g)} + 5O_{2(g)} & \longrightarrow 4CO_{2(g)} + 2H_2O_{(1)} & -2598.9 \\ \end{array}$ Calculate the standard enthalpy of formation of a cetylene (C₂H₂) from its elements

Example of the standard entitling f of formation of a conjective $(O_2 H_2)$ from its crosser

 $2C_{(graphite)} + H_{2(g)} \longrightarrow C_2 H_{2(g)}$

(c) A 0.242g of sample is burned in a bomb calorimeter containing 1025g of water.

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[2 marks]

[6 marks]

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- (d) The molecular mass of the sample is given as 128gmol. Calculate the rise in temperature given that: [7 marks]
 - i. Heat capacity of the calorimeter = $802 \text{J}^{0}\text{C}$
 - ii. Heat of combustion of the sample = -5.15×10^3 KJ/mol
 - iii. Specific heat of water = $4.184 \text{J/g}^{\circ}\text{C}$

QUESTION FOUR

(a)	(Describe with diagram the Joule Thomson experiment	[10 marks]
(b)	Write the mathematical expression for the Joule Thomson Co efficient ($\mu\pi$) and give it	s meaning
		[3 marks]
(c)	State why an ideal gas does not show Joule – Thomson effect	[2 marks]

QUESTION FIVE

(a)	What are the physical significance of 'a' and 'b' in vander waals equation.	[2 marks]
(b)	Comment on the statement 'the vander waals equation' is an improvement over the idea	ıl gas

- equation [1 mark] (c) (i) Two van der waals gases have the same value of 'b' but different 'a' values which of these would occupy greater volume under identical conditions? [2 marks]
 - (ii) If the gases have same 'a' values different values of 'b'which would be more compressible

[2 marks]

(d) Calculate the pressure in atmospheres exerted by 2.0mole of chlorobenzene vapours confirmed to 10.0 litres vessel at 298k using:-

i.	The ideal gas equation	[3 marks]
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ii. The van der waals equation $a = 25.43L^2 \text{ atmmol}^{-2} \text{ b} = 0.1453L\text{mol}^{-1}$ [5 marks]

QUESTIONS SIX

(a) Explain the technique "cooling byJoule - Thomson method" as used in liquefaction of gases

[2 marks]

- (b) Other than cooling by Joule Thomson method describe any other three technique used in liquefaction of gases
 [6 marks]
 - i. Deduce the law of corresponding states from the van der waals equation [7 marks]

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