

National Open University of Nigeria Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi - Abuja Faculty of Science 2021_2 Examination Questions

1¹/₂ marks

2 marks

(2 Marks)

COURSE CODE: CHM405 TIME ALLOWED: 2 Hours

COURSE TITLE: CHEMICAL THERMODYNAMICS CREDIT: 2 Units

Instruction: Answer question 1 and any other three questions **QUESTION 1**

a. Define the following:

i. Thermodynamics

ii. Chemical thermodynamics 1¹/₂ marks

iii. What are the major objectives of chemical thermodynamics? **2 marks**

b. i. What is an equation of state?

ii. State the Boyle's law

c. Derive the following equations

i. Gibbs-Duhem equation
ii. Clausius-Clapeyron
6 ¹/₂ marks

d. i. Describe the effect of inter and intra molecular forces on the various physical states of water $2\frac{1}{2}$ marks

ii. Given the following thermochemical equations,

 $S_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow SO_{3(g)} \Delta H^{\theta} = -396 \, kJ/mol$ $SO_{2(g)} + \frac{1}{2}O_{2} \rightarrow SO_{3(g)} \Delta H^{\theta} = -99 \, kJ/mol$ Calculate the standard enthalpy change for the reaction; $S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)} \qquad 3 \text{ marks}$

QUESTION 2

- a. Explain the following major types of intermolecular forces that operate between molecules;
 6 marks
- i. Ion-induced dipole forces
- ii. Ion-dipole forces
- iii. Van der Waals forces

b. Explain how the London force or induced dipole-induced dipole interaction operates in atom or molecules with non-zero dipole moments. 4 marks

c. i. State the third law of thermodynamics	(2 Marks)
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- iii. What is main application of the third law of thermodynamics? (1 Mark)
- iv. Which one is stronger between intermolecular forces and intra molecular forces? Why? 2 marks

QUESTION 3

a. i. State the Dalton's law of parti	(2 Marks)	
ii. What is the mathematical repres	(2 Marks)	
b. Explain the terms of partial mol	6 marks	
c. Explain the following;		
i. cyclic process	2 ¹ / ₂ marks	
ii. phase	2 ½ marks	

QUESTION 4

- a. i. What is Van der Waal equation of state? 2 marks
- ii. Give reasons why the London force is said to be universal among all intermolecular forces 1 ¹/₂ mark
- iii. What is the mathematical expression of Van der Waal equation? $1\frac{1}{2}$ marks

iv. Describe the relationship between the ideal gas equation and the Van der Waals equation of state Solution **3 marks**

b. i. What is a state function? 2 marks

ii.	What	is a	therm	odyn	amic	process?
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2 marks

c. Describe the following;

i. Heat

ii. Work

1 ½ marks

 $1\frac{1}{2}$ marks

QUESTION 5

a. Mention and explain the major types of intermolecular forces 6 marks
b. Mention and describe the types of processes involved in temperature-entropy conjugate pair that involve transfer of thermal energy as the result of heating. 6 marks
i. An isothermal process 2 marks
ii. An adiabatic process 2 marks
iii. An isentropic process 2 marks

c. Give three limitations of the third law of thermodynamics. **3 marks**