

	Determine the change in internal energy during each step and the work done during the adiabatic process.																							
5.	For the ideal gas phase reaction, $SO_2 + \frac{1}{2} O_2 \rightarrow SO_3$ Determine (a) the standard enthalpy change of reaction as a function of temperature (b) Standard enthalpy change of reaction at 880 K The following data are given : $\Delta H_{f,SO_2,298.15}^0 = -\frac{70.94 \text{ kcal}}{\text{mol}}, \Delta H_{f,SO_3,298.15}^0 = -94.39 \text{ kcal/mol}$ The molar heat capacity data in ideal gas state is given by below where $C_p^0 = a + bT + cT^2 + dT^3$, T is in K and C_p^0 is in cal/mol-K <table border="1"> <thead> <tr> <th>Species</th><th>a</th><th>$b \times 10^2$</th><th>$c \times 10^5$</th><th>$d \times 10^9$</th></tr> </thead> <tbody> <tr> <td>SO2</td><td>6.157</td><td>1.384</td><td>-0.9103</td><td>2.057</td></tr> <tr> <td>SO3</td><td>3.918</td><td>3.483</td><td>-2.675</td><td>7.744</td></tr> <tr> <td>O2</td><td>6.732</td><td>0.1505</td><td>-0.01791</td><td>-</td></tr> </tbody> </table>	Species	a	$b \times 10^2$	$c \times 10^5$	$d \times 10^9$	SO2	6.157	1.384	-0.9103	2.057	SO3	3.918	3.483	-2.675	7.744	O2	6.732	0.1505	-0.01791	-	10	CO2	BL3
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**VIT**Vellore Institute of Technology
(Approved by the Government of India)**Continuous Assessment Test -I (CAT-I) Win Semester (2023-24)**

Programme Name & Branch : B.TECH Chemical Engineering
Course Code : BCHE202L
Course Name : Chemical Engineering Thermodynamics
Faculty Name(s) : Dr. Dharmendra kumar Bal
Class Number(s) : VL2023240501183
Slot : ~~B2-102~~ A2 + TA2
Date of the Exam : 14-Feb-2024
Exam Duration : 90 minutes Maximum Marks: 50

General instruction(s):

Answer all the questions

Q.No.	Question	Max Marks	CO	BL
1.	(a) What is meant by the continuum hypothesis in thermodynamics? (2.5) (b) How are steady-state systems different from equilibrium states? (2.5) (c) What are the different thermodynamic properties expressed by P, V, and T? (2.5) (d) How do different phases of a pure fluid (e.g., liquid, gas) influence their P-V-T behavior? (2.5)	10	CO1	BL1
2.	The Antoine equation for benzene is given by $\ln P^{sat} = 13.8594 - \frac{2771.70}{T-53.08}$, where P^{sat} is in kPa and T is in K. Determine the boiling point of benzene at 1 atm and 2 atm.	10	CO1	BL2
3.	Air is compressed steadily by a reversible compressor from an initial state of 100 kPa and 300K to an exit pressure of 900 kPa. Determine the compressor work per unit mass for (a) Reversible adiabatic compression with $\gamma = 1.4$. (b) Isothermal compression	10	CO1	BL3
4.	A system consisting of a gas confined in a cylinder is undergoing the series of process before it is brought back to the initial conditions. Step 1: A constant pressure process when it receives 500 J of work and gives up 25 J of heat. Step 2: A constant volume process when it receives 75 J of heat. Step 3: An adiabatic process.	10	CO2	BL3