

University of Mumbai
Examination 2020 under cluster PCOE

Program: Chemical engineering
Curriculum Scheme: Rev 2012
Examination: Second Year Semester IV
Course Code: CHC403 and Course Name: Chemical Engineering
Thermodynamics-I

Time: 1 hour

Max. Marks: 50

For the students:- All the Questions are compulsory and carry equal marks .

Q1.	The fugacity coefficient for the Vander Waal Equation is given as
Option A:	$\ln f = \frac{b}{V-b} + \ln\left(\frac{RT}{V-b}\right) - \frac{2a}{RTV}$
Option B:	$\ln f = \frac{2a}{V-b} + \ln\left(\frac{RT}{V-b}\right) - \frac{2a}{RTV}$
Option C:	$\ln f = \frac{a}{V-b} + \ln\left(\frac{2RT}{V-b}\right) - \frac{2a}{RTV}$
Option D:	$\ln f = \ln\left(\frac{RT}{V-b}\right) - \frac{2a}{RTV}$
Q2.	For Soave Redlich Kwong the expression to determine constant b is given by
Option A:	$b = \frac{0.0866RT_c}{P_c}$
Option B:	$b = \frac{0.427480R^2T_c^2}{P_c}$
Option C:	$b = \frac{0.0866RT_c^2}{P_c}$
Option D:	$b = \frac{0.0866RT_c}{P_c^2}$
Q3.	Find the volume of the nitrogen gas obeying Peng Robinson Equation of State at 30 bar and 500 K, $T_c=600$ K, $S=0.4344$, $a=148.32$ Nm ⁴ /kmole ² , $b=0.024052$ m ³ /kmole
Option A:	1.372 m ³ /kmole
Option B:	2.172 m ³ /kmole
Option C:	2.3652 m ³ /kmole
Option D:	1.732 m ³ /kmole
Q4.	The value of Enthalpy Departure function for Ideal Gas is
Option A:	1
Option B:	2
Option C:	0
Option D:	Infinity
Q5.	The Entropy Departure Function for Vander Waal Equation is given by

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Option A:	$S^D = R \ln(Z - B)$
Option B:	$S^D = \frac{RTb}{V-b} - \frac{2a}{V}$
Option C:	$S^D = \frac{R \ln Z}{V-b} - \frac{2a}{V}$
Option D:	$S^D = \frac{\ln b}{V-b} - \frac{2a}{V}$
Q6.	The Enthalpy Departure can be calculated using expression in pressure expression
Option A:	$H^D = \int_0^P \left[V - T \left(\frac{\partial V}{\partial T} \right)_P \right] dP$
Option B:	$H^D = \frac{RTb}{V-b} - \frac{2a}{V}$
Option C:	$H^D = \int_0^V \frac{RTb}{V-b} dP - \int_0^V \frac{2a}{V} dP$
Option D:	$H^D = \frac{RT}{V-b} - \frac{2a}{V}$
Q7.	The Mollier Chart is the Plot of
Option A:	H-S chart
Option B:	P-V Chart
Option C:	T-S Chart
Option D:	T-P Chart
Q8.	Gibbs free energy (G) of a system is defined as
Option A:	G=U-TS
Option B:	G=U-PV
Option C:	G=H-TS
Option D:	G=A-TS
Q9.	Maxwell's equations consist of _____ equations.
Option A:	2
Option B:	3
Option C:	4
Option D:	5
Q10.	What must be the initial temperature of gas for achieving cooling effect in Joule-Thomson expansion?
Option A:	the initial temperature must be above the maximum inversion temperature
Option B:	the initial temperature must be below the maximum inversion temperature
Option C:	the initial temperature must be equal to the maximum inversion temperature

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Option D:	the maximum inversion temperature has nothing to do with cooling effect in Joule-Kelvin expansion
Q11.	At the maximum inversion temperature in the graph of isenthalpic or joule-kelvin expansion of a gas, the value of Joule- Thomson coefficient is
Option A:	negative
Option B:	positive
Option C:	zero
Option D:	positive, negative or zero depends upon initial temperature
Q12.	Which of the following relation is not correct?
Option A:	$dU=TdS-pdV$
Option B:	$dH=TdS+Vdp$
Option C:	$dG=Vdp-SdT$
Option D:	$dG=Vdp+SdT$
Q13.	Which of the following is not the equation of state?
Option A:	Van der Waals Equation
Option B:	Charles Equation
Option C:	Peng Robinson Equation
Option D:	Redlich Kwong Equation
Q14.	The relation between Second coefficient of the Virial Equation of Volume variant (B) and Pressure variant (B')
Option A:	$B'=B/RT$
Option B:	$B'=BRT$
Option C:	$B=B'/RT$
Option D:	$B'=B$
Q15.	Find the Volume for ethane at 100 ⁰ C and 10 bar pressure for gas obeying Virial Equation of state, $B=-156.7 \text{ cm}^3/\text{mole}$, $C=9659 \text{ cm}^6/\text{mol}^2$, $R=83.14 \text{ cm}^3 \text{ bar}/\text{mole K}$
Option A:	2940.509 cm ³ /mole
Option B:	0.947 cm ³ /mole
Option C:	905.12 cm ³ /mole
Option D:	25.68 cm ³ /mole
Q16.	Maximum work that could be secured by expanding the gas over a given pressure range is the _____ work.
Option A:	isothermal
Option B:	adiabatic
Option C:	isentropic
Option D:	isenthalpic
Q17.	Internal energy change of a system over one complete cycle in a cyclic process is
Option A:	zero
Option B:	+ve

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Option C:	-ve
Option D:	dependent on the path
Q18.	Heating of water under atmospheric pressure is an _____ process.
Option A:	Isochoric
Option B:	Isobaric
Option C:	Adiabatic
Option D:	Isothermal
Q19.	Which of the following is true?
Option A:	for an isolated system, $dS \geq 0$
Option B:	for a reversible process, $dS = 0$
Option C:	for an irreversible process, $dS > 0$
Option D:	all of the mentioned
Q20.	$PV^\gamma = \text{Constant}$ (where, $\gamma = C_p/C_v$) is valid for a/an _____ process
Option A:	isothermal
Option B:	isentropic
Option C:	isobaric
Option D:	adiabatic
Q21.	Find the work of compression of 1 kmol of an ideal gas when the pressure changes from 1 Mpa to 5 Mpa at temp. 298.15 k
Option A:	5800KJ/kmol
Option B:	3989.6 KJ/kmol
Option C:	4300KJ/kmol
Option D:	1600KJ/kmol
Q22.	Heat is transferred to a heat engine from a furnace at a rate of 80 MW. If the rate of waste heat rejection to a nearby river is 50 MW, determine the net power output for this heat engine.
Option A:	30 MW
Option B:	40 MW
Option C:	50 MW
Option D:	60 MW
Q23.	The food compartment of a refrigerator is maintained at 4°C by removing heat from it at a rate of 360 kJ/min. If the required power input to the refrigerator is 2kW, determine the coefficient of performance of the refrigerator.
Option A:	4
Option B:	3
Option C:	2
Option D:	1

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Q24.	A heat pump is used to meet the heating requirements of a house and maintain it at 20°C. On a day when the outdoor air temperature drops to 2°C, the house is estimated to lose heat at a rate of 80,000 kJ/h. If the heat pump under these conditions has a COP of 2.5, determine the power consumed by the heat pump.
Option A:	32000 kJ/h
Option B:	33000 kJ/h
Option C:	34000 kJ/h
Option D:	35000 kJ/h
Q25.	A reversible cycle has following processes.
Option A:	4 isothermal processes
Option B:	4 adiabatic processes
Option C:	2 isothermal and 2 adiabatic processes
Option D:	none of the mentioned