EXM/P/09/00
2018-19

Sanjay Ghodawat University, Kolhapur

Established as State Private University under Govt. of Maharashtra. Act No XL, 2017

Year and Program:2018-19 | **School of Science** | **Department of Chemistry**

Course Code: CHS 505 | **Course Title: Physical Chemistry-I** | **Semester – Odd (I)**

Day and Date: Tuesday, 4/12/2018 | **End Semester Examination** | **Time: 3 hrs, Max Marks: 100**

PRN: | **Seat No:** | **Section A Marks out of 20:**

Jr. Supervisor Sign: | **Student Sign:**

Section A

Instructions: 1) All Questions are compulsory.
2) For MCQs mark tic (√) for correct answer. No marks for multiple tics (√).
3) Section A should be submitted to Jr. Supervisor immediately after first 30 min.

Q.1	**Multiple choice questions.**	**Marks 20**	level	CO
1	The Henry's law gives the relationship between (a) the pressure and solubility of a gas in a particular solvent (b) the temperature and solubility of a gas in a particular solvent (c) the composition of the mixture and solubility of a gas in a particular solvent (d) none of these	1	L2	1
2	Unit of Entropy is a) $JK^{-1} mol^{-1}$ b) $JK^{-2} mol$ c) $J^{-1} mol^{-1}$ d) $JK^{-2} mol^{-1}$	1	L2	1
3	Mathematically, Henry's law can be expressed as (C is the concentration of the gas in solution and P is the pressure of the gas) (a) $C \propto P$ (b) $C = k P$ (c) $k = C/P$ (d) all of these	1	L1	1
4	Which of the following statements is incorrect (a) enzymes are catalysts (b) urease is an enzyme (c) enzymes can catalyze any reaction (d) enzymes are in colloidal state	1	L2	2
5	A catalyst will affect the rate of the forward reaction by	1	L2	2

changing the

(a) activation energy (b) heat of reaction

(c) heat of formation (d) potential energy of the products

6	Reaction rates can change with (a) temperature (b) the addition of a catalyst (c) reactant concentrations (d) all of these	1	L1	2
7	Change in enthalpy of a system is the heat supplied for..... a) Constant pressure b) Constant temperature c) Constant volume d) Constant entropy	1	L2	3
8	Identify the amino acids containing nonpolar, aliphatic R groups a) Phenylalanine, tyrosine, and tryptophan b) Glycine, alanine, leucine c) Lysine, arginine, histidine d) Serine, threonine, cysteine	1	L2	3
9	The unit of pressure in S.I. unit is..... a) Kg/cm2 b) mm of water column c) Pascal d) Bars	1	L3	3
10	An open system is one in which..... a)Mass does not cross boundaries of the system, through energy may do so b) Neither mass nor energy crosses the boundsries of the system c) Both energy and mass cross the boundaries of the system d) Mass crosses the boundary but not the energy	1	L2	3
11	Characteristic gas constant of a gas is equal to..... a) Cp/Cv b) Cv/Cp c) Cp-Cv d) Cp+Cv	1	L1	3

12	The unit of energy in S.I. unit is..... a) Watt b) Joule c) Joule/sec d) Joule/m	1	L1	3
13	The change in entropy is ..... a) Positive in a reversible change b) Negative in an irreversible change c) Positive in an irreversible change d) Negative in a reversible change	1	L2	3
14	Thymidine a) can participate in hydrophobic interactions due to its methyl group b) is replaced by uracil in RNA c) normally forms two hydrogen bonds with adenosine d) all of the above	1	L2	4
15	A nucleotide consists of a) a sugar, a base and a phosphate b) a sugar and a phosphate c) paired bases d) a sugar, a base and three phosphates	1	L1	4
16	A five carbon sugar lacking a hydrogen at the number 2 carbon is found in a) DNA b) RNA c) mRNA d) rDNA	1	L2	4
17	The most stabilizing force for nucleic acids is a) hydrogen bonds b) electrostatic bond c) Van der Waals d) conformational entropy	1	L3	4

18	Identify the amino acids containing nonpolar, aliphatic R groups	**1**	L2	4
	a) Phenylalanine, tyrosine, and tryptophan			
	b) Glycine, alanine, leucine			
	c) Lysine, arginine, histidine			
	d) Serine, threonine, cysteine			
19	Which of the following is an essential amino acid?	**1**	L1	4
	a) Cysteine			
	b) Asparagine			
	c) Glutamine			
	d) Phenylalanine			
20	Nucleoside is a pyrimidine or purine base	**1**	L2	4
	a) covalently bonded to a sugar			
	b) ionically bonded to a sugar			
	c) hydrogen bonded to a sugar			
	d) none of the above			

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Day and Date: Tuesday, 4/12/2018 | **End Semester Examination** | **Time: 3 hrs, Max Marks: 100**

PRN: | **Seat No:** | **Section A Marks Out of 80**

Section B

		Marks	level	CO
Q.2	**Answer the following questions (Solve any Two)**	**12**		
a)	Explain the term partial molar volume. Derive the Gibbs-Duhem equation.	6	L2	1
b)	Explain thermodynamic properties (any three).	6	L2	1
c)	**i)** The solubility of pure oxygen in water at 20°C and 1.00 atmosphere pressures is 1.38×10^{-3} mole/litre. Calculate the concentration of oxygen at 20°C and partial pressure of 0.21 atmospheres. **ii)** Calculate the molarity and normality of a solution containing 5.3 g of Na_2CO_3 dissolved in 1000 ml solution.	6	L4	1
Q.3	**Answer the following questions (Solve any Two)**	**12**		
a)	Explain Arrhenius equation. Discuss Arrhenius concept of activation energy. Give graphical representation of activation energy diagram.	6	L2	2
b)	Explain in detail how to determine the order of a reaction.	6	L2	2

	c)	i) The values of the rate constant (k) for the reaction $2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)$ were determined at several temperatures. A plot of ln k versus 1/T gave a straight line of which the slope was found to be -1.2×10^4 K. What is the activation energy of the reaction? R = 8.314 JK^{-1} mol^{-1}).	6	L3	2
		ii) In the reduction of nitric oxide, 50% of reaction was completed in 108 seconds when initial pressure was 336 mm Hg and in 147 seconds initial pressure was 288 mm Hg. Find the order of the reaction.			
Q.4	a)	**Answer the following questions (Solve any Two)**	**12**		
	i)	Derive an expression for Fermi-Dirac statistics.	6	L4	3
	ii)	Illustrate the expression for the translational partition function of an ideal gas.	6	L3	3
	iii)	Discuss in detail Bose-Einstein statistics.	6	L1	3
	b)	**Answer the following questions (Solve any Four)**	**16**		
	i)	Derive the expression for the vibrational partition function of a diatomic molecule.	4	L2	3
	ii)	Define the term: a) Ensemble b) Macrostates c) Degeneracy d) Thermodynamic probability.	4	L2	3
	iii)	Calculate the translational partition function for hydrogen atom at 3000K confined to move in a box of volume of 2.494×10^5 cm^3. Given: ($h = 6.626 \times 10^{-34}$ J s) (J= kg m^2 s^{-2}), Avagadro's number $N = 6.023 \times 10^{23}$ mol^{-1}, $k = 1.38 \times 10^{-23}$ JK^{-1})	4	L4	3
	iv)	The rotational constant of gaseous HCl, determined from microwave spectroscopy, is 10.59 cm^{-1}. Calculate the rotational partition function of HCl at (a) 100 K and (b) 500 K. (Given: B = 10.59 cm^{-1}, $\sigma = 1$, $c = 3 \times 10^{10}$ cm s^{-1}).	4	L3	3
	v)	The first excited state of chlorine atom, $^2P_{1/2}$, lies at 0.11 eV above the ground state, $^2P_{3/2}$. Calculate the electronic partition	4	L3	3

function of Cl atom at 1000 K. (Given: 1eV = 1.602 X 10^{19} J/eV).

Q.5	**a)**	**Answer the following questions (Solve any Two)**	**16**		
	i)	What is protein? Discuss in detail structure of primary, secondary, tertiary and quaternary structure of proteins.	8	L2	4
	ii)	What are peptides? Discuss in detail types of nucleic acids with its proper structures.	8	L1	4
	iii)	Explain Viscometry method for the determination of molar mass of biological macromolecules.	8	L3	4
	b)	**Answer the following questions (Solve any Three)**	**12**		
	i)	Write a short note on Lenard-Jones potential.	4	L1	4
	ii)	What is the structures of following nucleic acids a)Thymine b) Cytosine c) Uracil d) Adenine e) Guanine	4	L2	4
	iii)	Discuss in detail Hydrophobic Hydration interaction.	4	L1	4
	iv)	Explain in detail Salting-in and Salting-out.	4	L2	4

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