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, 04/06/2019	End Semester Examination	Time: 3 hrs, Max Marks: 100 10·30 am to 11·00 am
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 is applicable if   1   L2   1

(a) the temperature and pressure are moderate

(b) the solubility of the gas in the solvent is low

(c) the gas does not react with the solvent to form a new species

(d) all of the above

2 Unit of Entropy is   1   L2   1

a) $JK^{-1} mol^{-1}$ b) $JK^{-2} mol$

c) $J^{-1} mol^{-1}$ d) $JK^{-2} mol^{-1}$

3 1 kg of a solution of $CaCO_3$ contains 1 g of calcium carbonate.   1   L1   1
Concentration of the solution will be

(a) 1 ppm   (b) 10 ppm

(c) 100 ppm   (d) 1000 ppm

4 Enzymes are   1   L2   2

(a) finely divided metals   (b) transition metal ions

(c) auto-catalysts   (d) proteins

5 A catalyst will affect the rate of the forward reaction by changing the   1   L2   2

(a) activation energy   (b) heat of reaction

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

6   A + B + C → products is :   1   L1   2

    (a) unimolecular   (b) trimolecular

    (c) bimolecular   (d) tetramolecular

7   Change in enthalpy of a system is the heat supplied for........   1   L2   3

    a) Constant pressure

    b) Constant temperature

    c) Constant volume

    d) Constant entropy

8   The change in entropy is.............   1   L2   3

    a) Positive in a reversible change

    b) Negative in an irreversible change

    c) Positive in an irreversible change

    d) Negative in a reversible change

9   The unit of pressure in S.I. unit is........   1   L3   3

    a) Kg/cm2

    b) mm of water column

    c) Pascal

    d) Bars

10   The Gibb's function G in thermodynamics is defined as $G = H - TS$. In an isothermal, isobaric, reversible process, G.............   1   L2   3

    a) Remains constant but not zero

    b) Varies linearly

    c) Varies non linearly

    d) is zero

11   Characteristic gas constant of a gas is equal to........   1   L1   3

    a) Cp/Cv

    b) Cv/Cp

    c) Cp-Cv

    d) Cp+Cv

12   In case of Bose - Einstein condensation...................   1   L1   3

    a) Number of particles increase in lower energy levels at low

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temperatures and high pressures

b) Number of particles decreases in lower energy levels at

low temperatures and high pressures

c) Number of particles increase in lower energy levels at

high temperatures and low pressures

d) Number of particles decreases in lower energy levels at

high temperatures and low pressures

13	The change in entropy is	1	L2	3

a) Positive in a reversible change

b) Negative in an irreversible change

c) Positive in an irreversible change

d) Negative in a reversible change

14	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

15	A nucleotide consists of	1	L1	4

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

16	Which of the following is an essential amino acid?	1	L2	4

a) Cysteine

b) Asparagine

c) Glutamine

d) Phenylalanine

17	The most stabilizing force for nucleic acids is	1	L3	4

a) hydrogen bonds

b) electrostatic bond

c) Van der Waals

d) conformational entropy

18 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

19 Which pyrimidine base contains an amino group at carbon 4?   1   L1   4

    a) Cytosine

    b) Thymine

    c) Uracil

    d) Adenine

20 The glycosidic bonds in DNA and RNA   1   L2   4

    a) connect the sugar to the base

    b) can be hydrolyzed by OH- ion

    c) stabilize Watson-Crick H-bonds

    d) are free to rotate over about 180°

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2018-19

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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 11·00 am to 1·30 pm.
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)	Derive the Maxwell's thermodynamic equations in detail.	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)	Derive an expression for rate constant of a bimolecular gaseous reaction on the basis of collision theory with its limitations.	6	L2	2

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c) **i)** The values of the rate constant (k) for the reaction $2N_2O_5(g)$ 6   L3   2

$\longrightarrow 4NO_2(g) + O_2(g)$ 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 $JK^{-1} mol^{-1}$).

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 rotational partition function of a diatomic molecule.   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: $1eV = 1.602 \times 10^{19}$ 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 proteins.	8	L2	4
	ii)	Explain in detail structure of nucleic acids.	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)	Discuss in detail Hydrogen bonding.	4	L1	4
	ii)	What are the structures of following nucleic acids? a)Thymine b) Cytosine c) Uracil d) Adenine e) Guanine	4	L2	4
	iii)	Explain in brief Van der Waals forces of attractions.	4	L1	4
	iv)	Explain in detail Salting-in and Salting-out.	4	L2	4

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