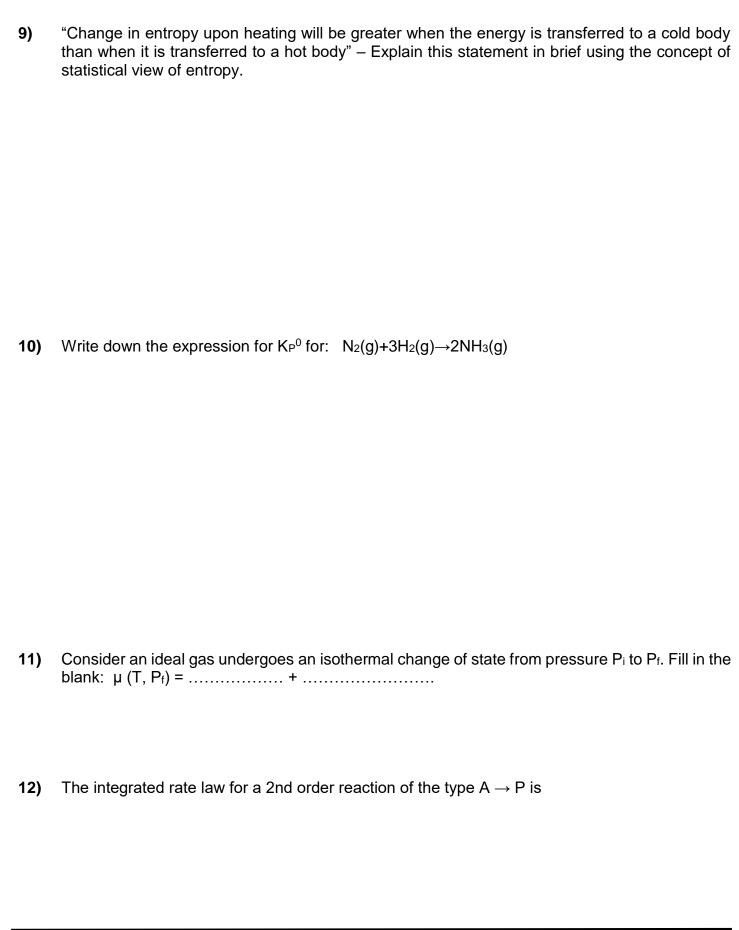
Birla Institute of Technology & Science, Pilani, Rajasthan - 333 031 Comprehensive Examination (make-up), First Semester, AY: 2017-2018 CHEM G553: Advanced Physical Chemistry,

Time: 60 min. (Total: 180 min.) Part – A (Close Book) Marks: 45 (Max. Marks: 120)

Name	: ID:	Marks
There are 15 questions, each of 3 Marks. Attempt all the questions. Pencil should not be used. Don't scribble on the question paper. Useful date: $h = 6.63 \times 10^{-34} J s$; Velocity of light = 2.998 $\times 10^8 ms^{-1}$; Mass of the electron = $9.1 \times 10^{-31} kg$, 1 amu = $1.66054 \times 10^{-27} kg$		
1)	Are the following function eigenfunctions of the operator $\frac{d^2}{dx^2}$ and if so, where eigen value? i) sin (8x+5) and ii) e $^{8x+5}$	nat is the corresponding
2)	What would be the outcome(s) of $\widehat{L_Z}$ & $\widehat{S_Z}$ operators on the hydrogen atom the probability of each outcome(s).	m 2p _y orbital. Determine
3)	1,4-dihydroxybenzene may exists in three different conformations depangle d_{θ} ($d_{\theta} = \angle H\text{-O-O-H}$). Those three conformers can be represented 90°, and (iii) $d_{\theta} = 180^{\circ}$. Comment on rotational activity of the individual of	d by (i) $d_{\theta} = 0^{\circ}$, (ii) $d_{\theta} =$
4)	What would be the magnitude of momentum of a particle confined to m box of length I.	ove in one-dimensional

5)	Write down three main differences between the fluorescence and phosphorescence.
6)	Determine the number of normal mode of vibrations in X_2Y_2 molecule. Also predict the number of stretching mode vibrations in the same molecule.
7)	Determine $\Delta_{rxn}G^\circ$ and $\Delta_{rxn}G$ for the following reaction at 25°C. 2CO(g, 0.650 bar) + O ₂ (g, 34 bar) \leftrightarrow 2CO ₂ (g, 0.0250 bar) (Δ_fG° (CO ₂ at 25°C) = -394.35kJ/mol; Δ_fG° (CO at 25°C) = -137.16kJ/mol)
8)	What is the change in entropy when 1 g of benzene, C_6H_6 , boils reversibly at its boiling point of 80.1°C and a constant pressure of 1 atm. The heat of vaporization of benzene is 395 J/g.



13)	The rate of reaction for $2NO_2$ (g) $\rightarrow 2$ $NO(g) + O_2$ (g) is given by (in terms of all the components)
14)	Determine f for a system consisting of solid 1,4-dihydroxybenzene in equilibrium with ar aqueous solution of 1,4-dihydroxybenzene.
15)	The chemical shift of the CH ₃ protons in CH ₃ CH ₂ Y is δ=1.56 and that of the CH ₂ protons is 3.76 What is the difference in local magnetic field between two regions of the molecule when the applied field is 16.5 T?