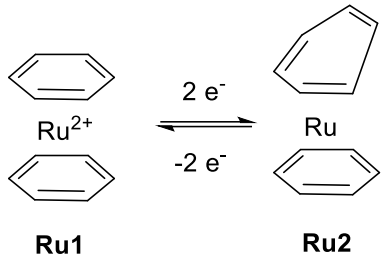
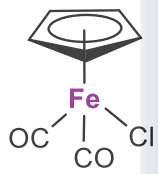
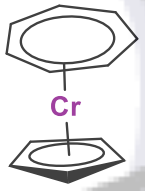
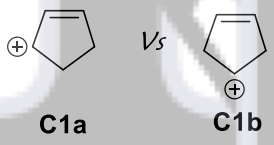
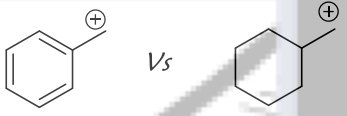
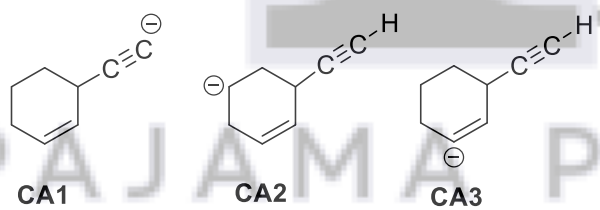
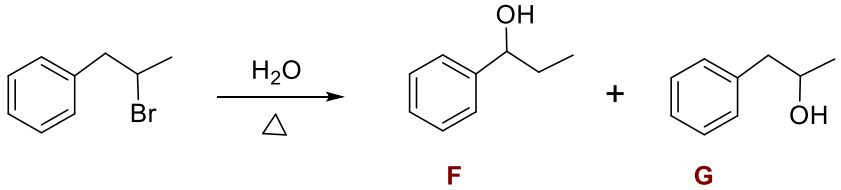
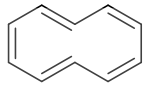
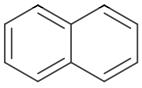
Q. No.	Sub-division	Question Text	Marks	CO	BL
		Answer **ALL** Questions Total Marks: 3 X 10 Marks = 30			
1.	a	How the solid catalyst surface effect the chemical reactions. Discuss with an example.	**5**		
	b	Four moles of monoatomic gas neon expands isothermally at 300 K, from an initial volume of $V_i = 0.025\ m^3$ to a final volume of $V_f = 0.050$ m3. Assuming that neon is an ideal gas. Find the work done by above-mentioned gas.	**5**		
		(OR)			
	a	Mere random hitting of reactants each other does not result in products. Justify this statement with an example.	**5**		
	b	Four moles of monoatomic gas neon expands isothermally at 298 K, from an initial volume of $V_i = 0.020\ m^3$ to a final volume of $V_f = 0.045\ m^3$. Assuming that neon is an ideal gas. Find the work done by above-mentioned gas.	**5**		L3
		(OR)			
	a	Increase in the concentration of reactants will increase the rate of the reaction. Explain.	**5**	1	
	b	Four moles of monoatomic gas neon expands isothermally at 300 K, from an initial volume of $V_i = 0.015\ m^3$ to a final volume of $V_f = 0.040\ m^3$. Assuming that neon is an ideal gas. Find the work done by above-mentioned gas.	**5**		
		(OR)			
	a	Protein catalyzes the biochemical reactions at ambient conditions. Explain its significance using rate law.	**5**		
	b	Four moles of monoatomic gas neon expands isothermally at 298 K, from an initial volume of $V_i = 0.025\ m^3$ to a final volume of $V_f = 0.050\ m^3$. Assuming that neon is an ideal gas. Find the work done by above-mentioned gas.	**5**		
2.		What are hapto ligands and discuss the hapitcity exhibited by allyl and butadiene? Sequential addition of $P(Me)_3$ to Mn complexes leads to change in hapticity of the cyclopendienyl ligand. Are all these complexes **A**, **B** & **C** ~~are~~ stable. 	**10**	2	L2 & L3
		(OR)			
		What are hapto ligands and discuss the hapitcity shown by allyl and cyclopentadienyl ligand. Reason out the benzene ring slippage in **Ru2**.	**10**		

		 Ru1 Ru2			
		(OR)			
	a	The cisodial ligands are crucial for fundamental steps involved in organometallic reactions. Justify with reactions.	**10**		
	b	Comment the stability of the following compounds **D** and **E** with 18-electron rule.  **D**  **E**			
		(OR)			
		Write a short note on metalloenzymes which assist in generation and utilization of O_2 in a biological process.	**10**		
3.		Write down the various factors that stabilizes the carbocation. Which carbocation is more stable in the given pair? Explain your reasoning. i)  **C1a** **C1b** ii)  **C2a** **C2b**	**10**		
		(OR)			
		How carbanions are produced and stabilized? Discuss its geometry. Arrange the given carbanions in increasing order of stability.  **CA1** **CA2** **CA3**	**10**	3	L3 and L4
		(OR)			
	a	Predict the predominant product.  **F** **G**	**5**		

	b	This organic based drug used to treat Kawasaki disease. Discuss its synthetic method and other applications.	**5**		
		(OR)			
	a	Disclose the various conditions for a molecule to be aromatic. Describe the aromaticity shown by these cyclic compounds **H** and **I**.  H  I	**5**		
	b	Discuss the synthetic method and the applications of acetaminophen.	**5**		
4.		The Nominal voltage of this battery is around 3.6 V/cell. Discuss its chemistry, benefits and disadvantages.	**10**	5	L3 and L4
		(OR)			
		Ruthenium-based dyes improved the efficiency of photovoltaic cells. Explain the general mechanism, advantages and disadvantages of such cells.	**10**		
		(OR)			
	a.	This energy device operates at high temperature and produces steam as a by-product. Discuss the working function of it.	**5**		
	b.	This component bridges the gap between batteries and conventional capacitor. Identify and discuss its functions and applications.	**5**		
		(OR)			
		Why photovoltaic modules are still expensive and scarce? Does any research and development replace this traditional modules? Discuss these advances in solar cells.	**10**		
5.	a	The metal oxides discovered by Gustav Rose show interesting structural features and applications. Write a short note of it.	**5**	5	L3 and L6
	b	Discuss the interesting features exhibited when a bulk semiconductor are reduced to nanoscale.	**5**		
		(OR)			
		This trio Heeger, MacDiarmid and Shirakawa work went against the conventional polymers and invented a new materials which is used in electronics. Discuss its type and mechanism exhibited by this material.	**10**		
		(OR)			
		This versatile organic-based composite broadly used in high performance sport's equipment and other vehicles. Discuss its components, types and applications. Compare this material with other composites.	**10**		
		(OR)			
		Although these materials are in their early stage of commercialization, they are used as disc brakes and bake pads. Identify this composite material, and discuss its properties and compare it with other composite materials.	**10**		
6.	a	Discuss the principle and application of powder X-ray diffraction.	**5**		
	b	What are all the possible electronic transitions observed in organic compounds? Pick the least energy transition among them.	**5**		

		(OR)			
	a	Compare the single crystal and powder XRD measurement.	**5**		
	b	Chromophore and auxochrome are very crucial in UV-Vis spectroscopic studies. Justify.	**5**		
		(OR)			
	a	What are the common peak shifts observed in UV-Vis spectroscopy measurements. For which compounds the d-d transitions are expected?	**5**		
	b	PXRD is a perfect tool to differentiate the atomic arrangements. Validate the statement.	**5**		
		(OR)		4	L3 and L4
	a	What are the possible electronic transitions observed in organic compounds? Pick the highest energy transition among them.	**5**		
	b	How the particle size is computed from PXRD data?	**5**		
7.	a	The temperature of 3,500 g of water was increased from 26.5 ^{o}C to 29.2 ^{o}C while flaming 0.75 g of lignite in a bomb calorimeter. The water equivalent of the calorimeter and latent heat of steam is 410.0 g and 587.0 cal/g, respectively. If this fuel possesses 0.8% hydrogen, calculate its gross and net calorific value.	**5**		
	b	The different grades of petrol and diesel are available in gas stations. How they are graded? Discuss its significance.	**5**		
		(OR)			
	a	The temperature of 3,700 g of water was increased from 26.5 ^{o}C to 29.2 ^{o}C while flaming 0.85 g of lignite in a bomb calorimeter. The water equivalent of the calorimeter and latent heat of steam is 390.0 g and 587.0 cal/g, respectively. If this fuel possesses 0.9% hydrogen, calculate its gross and net calorific value.	**5**	**3**	L3 and L4
	b	This odourless, colourless and toxic gas binds to hemoglobin with a more than 200-fold greater affinity than O_2. Identify this gas and discuss any one of the gas sensing method.	**5**		
		(OR)			
	a	The temperature of 3,400 g of water was increased from 26.5 ^{o}C to 29.2 ^{o}C while flaming 0.85 g of lignite in a bomb calorimeter. The water equivalent of the calorimeter and latent heat of steam is 370.0 g and 587.0 cal/g, respectively. If this fuel possesses 0.8% hydrogen, calculate its gross and net calorific value.	**5**		
	b	Highly porous and insoluble material is effective in softening the hard water. Identify this material and discuss its process with pros and cons.	**5**		
		(OR)			
	a	The temperature of 3,450 g of water was increased from 26.5 ^{o}C to 29.2 ^{o}C while flaming 0.92 g of lignite in a bomb calorimeter. The water equivalent of the calorimeter and latent heat of steam is 360.0 g and 587.0 cal/g, respectively. If this fuel possesses 0.6% hydrogen, calculate its gross and net calorific value.	**5**		

	b	TiN coating on a steel tool improves the life and performance of this tool. Elaborate on the suitable method of coating metal nitrides on steel substrate.			