Time: 2 hours **Maximum marks: 60**

Note the following instructions.

1. **Question 1 is compulsory. Attempt any three questions out of remaining questions.**
2. **Draw neat diagrams and write chemical reactions wherever necessary.**
3. **Assume data, if missing, with justification.**
4. **Atomic Weight: H=1, C=12, O=16, Ca=20, Mg=24, S=32**

Q.1. Attempt any five.

a.	A hard water sample contains following impurities (in mg/L) $Ca(HCO_3)_2 = 4.86$, $MgSO_4 = 36$.Calculate temporary, permanent and total hardness of the given sample of water.	**3M**
b.	State Huckel's rule of aromaticity.	**3M**
c.	Draw orbital diagrams for p_x, $dx^2 - y^2$ and dz^2 orbitals	**3M**
d.	Define Eutectic system with suitable example.	**3M**
e.	Draw molecular orbital picture of benzene.	**3M**
f.	Compare the properties of thermoplastic and thermosetting polymers.	**3M**
g.	Mention the role of ion selective membranes in electro dialysis process.	**3M**

Q.2.a.	Explain one component water system with the help of labelled phase diagram. Calculate degree of freedom for areas, curves and point.	**6M**
b.	Explain transfer moulding with the help of neat diagram.	**5M**
c.	i) An alloy of tin and lead contains 30% lead. Find the mass of eutectic in 1 kg of solid alloy if the eutectic contains 58% of tin. Calculate the mass of tin separated out.	**4M**

Q.3.a.	Explain the process of ion exchange process with the help of suitable diagram and chemical reactions involved in softening process.	**6M**
b.	0.5 g of $CaCO_3$ was dissolved in dilute HCl and diluted to 1000 ml. 50 ml of this solution required 25 ml of EDTA solution for titration. 100 ml of hard water sample required 25 ml of EDTA solution for titration. 100 ml water sample after boiling, filtering requires 12 ml of EDTA solution for titration. Calculate the temporary, permanent and total hardness of water.	**5M**
c.	Write preparation, properties and uses of PMMA.	**4M**

Q 4.a	i) Define Gibb's phase rule and write advantages of phase rule. ii) Mention phase, component and degree of freedom for following system: $PCl_5(s) \rightleftharpoons PCl_3(s) + Cl_2(g)$	**6M**
b.	i) Define temporary and permanent hardness and write the salts responsible for these hardness. ii)Write difference between ideal gas and real gas.	**3M+2M**

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c.	Explain Reverse Osmosis method and mention its applications.	**4M**
Q 5.a	Draw the molecular orbital structure of O_2 molecule. Write its electronic configuration. Also calculate its bond order and comment on magnetic behavior.	**6M**
b.	i) If a polymer sample has following population: 6 molecules of molecular mass = 5000 10 molecules of molecular mass = 7000 5 molecules of molecular mass = 2000 Calculate Number- average and Weight- average molecular weight of the polymer.	**5M**
c.	i) Discuss the role of Stabilizers in compounding of plastic and mention an example also. ii) Write difference between bonding and anti-bonding molecular orbitals	**4M**
Q 6.a	Explain the conductive behavior of n-doped and p-doped conducting polymers with one example of each. Mention applications of conducting polymers.	**6M**
b.	i) Define BOD and COD. ii) A 20 ml of wastewater refluxed with 25 ml of potassium dichromate solution and after refluxing excess unreacted dichromate required 15 ml 0.1 N FAS solution. In blank titration 25 ml of dichromate solution mixed with 20 ml of distilled water required 30 ml 0.1N FAS solution. Calculate COD value of wastewater	**5M**
c.	Define Glass transition Temperature. Explain following factors affecting it: i)Presence of cross links ii)Presence of aromatic rings in polymer chain	**4M**

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