Subject Code: KAS102T

PAPER ID-411332

Roll No:

BTECH
(SEM I) THEORY EXAMINATION 2021-22
ENGINEERING CHEMISTRY

Time: 3 Hours **Max. Marks: 100**

Notes: *Attempt the questions as per the instructions given*
Assume missing data suitably

Section – A

Q.1	Attempt **all** the parts		**(2 x 10 =20)**
(a)	Arrange the following molecules or ions in increasing order of bond length. **O_2, O_2^+ & O_2^-**	CO1	2
(b)	What are nano materials? How they are different from bulk materials?	CO1	2
(c)	With the help of examples differentiate between Microwave active and microwave inactive compounds.	CO2	2
(d)	Explain why CO_2 is IR active and N_2 is IR inactive molecule.	CO2	2
(e)	Comment on the use of Al in place of Zn for cathodic protection of iron from rusting.	CO3	2
(f)	$\boldsymbol{Al^{3+}\,(1.2M) + Fe \rightarrow Al + Fe^{3+}(2.5M)}$**.** Calculate Ecell for the reaction if E°cell = -1.62 V.	CO3	2
(g)	Calculate the hardness of water sample containing impurity of **Ca $(HCO_3)_2$ = 81 mg/l.** Give your answer in ^oF also.	CO4	2
(h)	4.2 g of a sample of coal was Kjeldahalized and evolved ammonia gas was absorbed in 30 ml of 0.1N H_2SO_4. After absorption excess acid required 5 ml of 0.1N NaOH for neutralization. Calculate the % of nitrogen in coal sample.	CO4	2
(i)	Give the structure of vulcanized rubber.	CO5	2
(j)	Give two differences between addition and condensation polymers.	CO5	2

Section – B

Q.2	Attempt **any three** parts of the following		**(10 x 3 = 30)**
(a)	With the help of molecular orbital diagram, explain the formation of NO & N_2. Calculate their bond order and predict their magnetic behaviour.	CO1	10
(b)	Discuss the principle of Raman Spectroscopy. How Stokes and Antistokes lines appear in Raman spectroscopy. Also explain how it differs from microwave spectroscopy.	CO2	10
(c)	Define phase rule. Outline the salient features of the phase diagram of water system highlighting the curves, areas & points. Also explain the importance of triple point.	CO3	10
(d)	Write the different chemical reactions taking place in soda-lime process. A sample of water on analysis give following result: Analysis of Raw water: Ca^{2+} = 80 mg/l; Mg^{2+} = 24 mg/l, CO_2 = 33 mg/l, HCO_3^- = 132 mg/l, H^+ = 10 mg/l & NaCl = 4.3 ppm. Analysis of treated water: CO_3^{2-} = 12 mg/l and OH^- = 34 mg/l. Calculate the quantity of lime (74% pure) and soda (92% pure) needed for softening 50000 L of water.	CO4	10
(e)	Write down the preparation (structure of monomers and polymers) and uses of: (i) Nylon-6,6 (ii) Dacron (iii) BUNA-N (iv) Neoprene Rubber (v) Nylon-6	CO5	10

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	Section – C		
Q.3	Attempt **any one** part of the following		**(10x 1 = 10)**
(a)	Illustrate the concept of liquid crystals. Classify them on the basis of temperature and mention their important applications.	CO1	10
(b)	Give the structure, preparation, properties & applications of an allotrope of carbon having truncated icosahedron's structure.	CO1	10
Q.4	Attempt **any one** part of the following		**(10x 1 = 10)**
(a)	Explain the different types of electronic transitions involved in UV-Vis. Spectroscopy. Also explain the different types of absorption and intensity shifts taking place in UV-VIS spectroscopy.	CO2	10
(b)	Explain the different types of molecular vibrations taking place in IR Spectroscopy. Differentiate between Functional group region and finger print region.	CO2	10
Q.5	Attempt **any one** part of the following		**(10x 1 = 10)**
a)	Define the term batteries. Explain the construction of Lead acid battery. Write all the chemical reactions taking place during charging and discharging of lead acid battery.	CO3	10
(b)	Define the term corrosion. Describe the mechanism of electrochemical corrosion with the help of hydrogen evolution and oxygen absorption reactions. How it can be prevented using sacrificial anodic protection?	CO3	10
Q.6	Attempt **any one** part of the following		**(10x 1 = 10)**
(a)	Write the chemical name and molecular formula of zeolite. Give different chemical reactions taking place in zeolite process. A zeolite softner was regenerated by passing 50 ltrs of NaCl solution having strength of 14.625 g/l of NaCl. Calculate the hardness of water if 10000 ltrs of hard water was softened by using this zeolite.	CO4	10
(b)	Explain the construction and working principle of Bomb calorimeter. A sample of coal contains 80% C, 15% H, and 5% Ash. The following data were obtained when the above coal sample was tested in bomb calorimeter: Weight of coal burnt = 0.98 g Weight of water taken = 1000 g Water equivalent of bomb calorimeter = 2500 g Obseved rise in temperature = 2.5 °C Fuse wire correction = 8 cal Acid correction = 50 cal Cooling correction = 0.02 °C Calculate gross and net calorific value of coal if the latent heat of condensation of water is 580 cal/g.	CO4	10
Q.7	Attempt **any one** part of the following		**(10x1 = 10)**
(a)	What are polymer composites? Discuss the classification and applications of polymer composites.	CO5	10
(b)	What are Organometallic compounds? How Grignard reagents are prepared? Write any five synthetic applications of Grignard reagents.	CO5	10