Total No. of Questions – [3]

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May 2022 (INSEM+ ENDSEM) EXAM

F.Y. B. TECH. (SEMESTER - 2)

COURSE NAME: ENGINEERING CHEMISTRY

COURSE CODE: ES10204B

(PATTERN 2020)

Time: [2Hr] [Max. Marks: 60]

(*) Instructions to candidates:

1) **Figures to the right indicate full marks.**
2) **Use of scientific calculator is allowed**
3) **Use suitable data where ever required**

Q.1 **Solve the following**

i) Hardness due to 11.1 mg/L of $CaCl_2$ can be expressed in terms of $CaCO_3$ equivalent as_____. [2]

a) 10 ppm
b) 20 ppm
c) 1 ppm
d) 2 ppm

ii) 25 ml of water sample requires 18 ml of 0.02M EDTA during titration. Calculate total hardness of water sample. [2]

a) 1440 ppm
b) 144 ppm
c) 720 ppm
d) 72 ppm

iii) An exhausted Zeolite softener was regenerated by passing 100 litres of NaCl solution having strength of 10% NaCl. Calculate the $CaCO_3$ equivalent hardness retained on zeolite bed which was replaced by NaCl solution. [2]

a) 8547 gm
b) 8547 mg
c) 85.47 mg
d) 85.47 gm

iv) **Match the following**: [2]

P	Zeolite treatment	I	Purification of water by passing through semipermeable member
Q	Cation exchanger	II	Exchange of Calcium ions with Sodium ions
R	Anion exchanger	III	Exchange of Calcium ions with hydrogen ions
S	Reverse osmosis	IV	Exchange of Chloride ions with hydroxyl ions

a) P-I, Q-II, R-III, S-IV

b) P- II, Q-III, R – IV, S-I
c) P- III, Q-I, R-IV, S-II
d) P-II, Q-III, R – I, S-IV

v) A sample of hard water has a hardness of 200 mg/L. Convert this hardness **in degree French, degree Clarke and ppm** respectively. [2]
a) 14, 200 and 20
b) 20, 14 and 200
c) 200, 20 and 14
d) 200, 14 and 20

vi) Select the **incorrect** statement from the following option. [2]
1) Osmosis is the phenomenon by virtue of which flow of solvent takes place from high concentration to low concentration through a semi-permeable membrane
2) In osmosis, the flow continues till the concentration is equal on both the sides
3) The driving force of osmosis is osmotic pressure
4) Osmosis is used for the treatment of waste water
5) Reverse osmosis is used for removal of non-ionic impurities

a) 2 and 4
b) 2 and 3
c) 1 and 4
d)3 and 4

vii) A sample of hard water contains following dissolved salts per liter. $Mg(HCO_3)_2$= 14.6 mgs, $CaCl_2$= 22.2 mgs, $MgSO_4$= 12 mgs, NaCl= 58.5 mgs. Calculate total hardness of water in degree French. [2]
(Atomic weight Ca=40, Mg=24, S= 32, Cl=35.5, O=16, N = 14, C=12, Na=23 and H=1).
a) 140 °Fr
b) 14 °Fr
c) 4 °Fr
d) 40 °Fr

viii) Which of the following sentence is **not true** for the electrodialysis process? [2]
1)Electrodialysis uses semipermeable membrane to remove contaminants
2) Electrodialysis uses an electric current to remove contaminants
3) In the process, cell pair consist of membranes that will either allow cations or anions to pass through
4) Electrodialysis is based on reverse osmosis phenomenon
a) 1 and 3
b) 2 and 4
c) 1 and 4
d) 3 and 4

ix) In Polymer LED display, _____ is used as anode and in Liquid crystal display _____ is used. [2]
a) Calcium and Smectic liquid crystal
b) Aluminium and Nematic liquid crystal
c) PPV and Aluminium
d) Indium Tin Oxide and Nematic liquid crystal

x) Heat of hydration of C_3S is _____ and that of C_2S is _____ respectively. [2]
a) 500 KJ/Kg and 880 KJ/Kg
b) 880 KJ/Kg and 250 KJ/Kg
c) 880 KJ/Kg and 420 KJ/Kg
d) 500 KJ/Kg and 250 KJ/Kg

xi) In Lithium-ion battery, during discharging, Li-ions are dissociated from anode and migrate through electrolyte to cathode which is called as _____ and during charging, lithium from cathodic material is ionized and move towards negative electrode which is called as _____ respectively. [2]

a) Deintercalation and Intercalation
b) Intercalation and Deintercalation
c) Deactivation and Activation
d) Activation and Deactivation

xii) On doping of conducting polymer like polyacetylene with iodine, increase in conductivity is observed because of___ [2]

a) Formation of conjugated system
b) Formation of Polaron, Bipolaron and Soliton
c)Increase in planarity of molecule
d) Increase in rigidity of molecule

xiii) _____is used in making sports goods (rockets, archery, racing bicycles), laptops, fishing rods, musical instruments (violin bows, guiter pickguards) and _____ is used for making automobile parts, storage tanks, industrial flooring [2]

a) Jute fiber reinforced polymer and Glass fiber reinforced polymer
b) Glass fiber reinforced polymer and Carbon fiber reinforced polymer
c) Carbon fiber reinforced polymer and Glass fiber reinforced polymer
d) Aramid fiber reinforced polymer and Carbon fiber reinforced polymer

xiv) **Select the sentences that are applicable and true for polymer recycling** [2]

(i)Primary recycling includes regrinding, remelting and reforming. Product contain similar feature of original plastic
(ii)Tertiary recycling refers to the process of physical and thermal reprocessing into secondary product
(iii)Secondary recycling involves chemical or thermal treatment to transform waste plastic into their monomers and fuels
(iv) Quaternary recycling uses energy from plastic by burning or incineration
(v) Scraped tyres can be ground into crumb for use in pads, mats, carpet backing, moisture barriers, rubber modified asphalt
(vi) Thermoplastics are sorted by IPC introduced by Society of Plastic Industry (SPI)

a) (i), (ii), (iii)
b) (i), (ii), (iv)
c) (ii), (iv), (vi)
d) (i), (iv), (v)

xv) Match the following for the types of nanomaterials: [2]

P	Zero-dimensional nanomaterial	I	nanofilms
Q	One dimensional nanomaterial	II	Multi nanolayers
R	Two-dimensional nanomaterial	III	nanoparticles
S	Three-dimensional nanomaterial	IV	nanowires

a) P-I, Q-II, R-III, S-IV
b) P- II, Q-III, R – IV, S-I
c) P- III, Q-IV, R-II, S-I
d) P-III, Q-IV, R – I, S-II

Q2 **Solve any three out of four**

a) Predict the electrode system used for pH metric titration. If hydrochloric acid is to be titrated with NaOH, what will be the steps involved in the titration? Predict and draw the nature of graph of pH verses volume of NaOH added from burette. How end point of the titration is calculated? [5]

b) Predict and draw graphs in the following conductometric titration and show equivalence point of titration. Explain the nature of graph before and after equivalence point [5]

1) CH_3COOH vs NaOH (NaOH taken in burette)
2) NH_4OH vs HCl (NH_4OH taken in burette)

c) **1)**What are the possible electronic transitions in the following molecules when they are exposed to UV-Visible radiations? [5]

i) $CH_2=CH-CH_2-CH= CH_2$
ii) $CH_3- CH_2-CH_2-CH_2- CH_3$

2) Explain any 3 applications of UV -Visible spectroscopy

d) **1)**Calculate fundamental modes of vibration for the following in IR spectroscopy [5]

i) NO
ii) NH_3
iii) H_2O

2) How the course of oxidation reaction of cyclohexanol to cyclohexanone is identified by IR spectroscopy?

Q.3 **Solve any three out of four**

a) What is Pilling-Bedworth rule? Identify the nature of oxide film formed after oxidation corrosion in the following metals and predict whether the film will be protective or non-protective [5]

i) Na
ii) Cu
iii) Ag
iv) Mo

b) Give principle of cathodic protection. Explain sacrificial anodic protection with method, figure and any 2 applications. [5]

c) Identify in the following pairs, which will undergo faster corrosion, Case 1 or Case 2? why? [5]

Sr. No.	Case 1	Case2
1	Pure copper sheet	Copper sheet with zinc impurity
2	Steel tank with water at room temperature	Steel tank with water at high temperature

d) **Identify the most appropriate and economical corrosion protection method for the following situations:** [5]

1) Water tanks, buried pipe lines, Transmission line towers
2) Steel table tops, mild steel doors cladded with brass, window panels, mild steel pipe cladded internally and externally with brass
3) Chemical reactors, Pipe lines for carrying corrosive liquids or solutions
4) Office furniture, domestic appliances, industrial shelving, hand and power tools, heating and air conditioning units, computers, cars
5) Nuts, bolts, screws, spanners, screw drivers
