Total No. of Questions – [3] Total No. of Printed Pages: 4

| G.R. No. | |
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# DECEMBER 2021 (INSEM+ ENDSEM) EXAM

## F.Y. B. TECH. (SEMESTER - I)

## 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 19 mg/L of $MgCl_2$ can be expressed in terms of $CaCO_3$ equivalent as_____. **[2]**

a) 10 ppm
b) 20 ppm
c) 5 ppm
d) 0.19 ppm

ii) 100 ml of water sample requires 12.5 ml of 0.08M EDTA during titration. Calculate total hardness of water sample. **[2]**

a) 1000 ppm
b) 100 ppm
c) 500 ppm
d) 50 ppm

iii) An exhausted Zeolite softener was regenerated by passing 80 litres of NaCl solution having strength of 6% NaCl. Calculate the $CaCO_3$ equivalent hardness retained on zeolite bed which was replaced by NaCl solution. **[2]**

a) 410.256 mg
b) 410.256 gm
c) 4102.56 mg
d) 4102.56 gm

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

| | | | |
|---|---|---|---|
| P | Zeolite softener | I | Regenerated by dil HCl |
| Q | Cation Exchanger | II | Desalination of water |
| R | Anion Exchanger | III | Regenerated by NaCl solution |
| S | Electrodialysis | IV | Regenerated by dil NaOH |

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 510 mg/L. Convert this hardness **in degree French, degree Clarke and ppm** respectively. **[2]**

a) 35.7, 510 and 51
b) 510, 35.7 and 51
c) 255, 71 and 153
d) 51, 35.7 and 510

vi) Calculate temporary and permanent hardness of water from following data. Ca $(HCO_3)_2$ = 16.2 ppm, Mg $(HCO_3)_2$ = 7.3 ppm, $CaSO_4$ = 13.6 ppm, $MgCl_2$ = 9.5 ppm and NaCl = 10 ppm. **[2]**

a) 20 and 15 ppm
b) 15 and 20 ppm
c) 40 and 30 ppm
d) 30 and 40 ppm

vii) 25 ml of standard hard water containing 1 mg/ml $CaCO_3$ when titrated against EDTA using EBT indicator required 20 ml for the end point. Hence 1 ml of EDTA solution reacts with_____of $CaCO_3$ hardness. **[2]**

a) 125 mg
b) 12.5 mg
c) 2.50 mg
d) 1.25 mg

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

| | | | |
|---|---|---|---|
| P | Zeolite method | I | The reversal of solvent flow, from higher concentration solution to lower concentration solution through a semipermeable membrane |
| Q | Ion exchange method | II | Exchange of Sodium ion with hardness causing Calcium ion from water |
| R | Electrodialysis | III | Exchange of Hydrogen ion with hardness causing Calcium ion from water |
| S | Reverse osmosis | IV | Salt water is allowed to pass through ion selective membranes under electric field to get salt free water. |

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

ix) **Select the correct statements of the following:** **[2]**

Structural weaknesses arise in final product after polymer recycling because of,
i) Different types of recycling techniques are used
ii) Same types of plastics are melted together
iii) Different types of plastics are melted together
iv) Same type of recycling technique is used
v) Number of times polymer is recycled

a) (i) and (ii)
b) (iii) and (iv)
c) (iii) and (v)
d) (i) and (v)

x) Which of the following is responsible for high strength in cement? **[2]**

(i) $C_2S$ (ii) $C_3S$ (iii) $C_3A$ (iv) $C_4AF$

a) (i) and (ii)
b) (ii) and (iii)
c) (iii) and (iv)
d) (i) and (iii)

xi) Liquid crystal display work on the principle of_____and it uses _____ liquid crystal. **[2]**

a) blocking light for display and Nematic Liquid crystal
b) emitting light for display and Smectic Liquid crystal
c) generating light for display and Cholesteric Liquid crystal
d) refracting light for display and Nematic Liquid crystal

xii) _____ is used for thermal insulation in construction industry and _____is used for core of Polymer optical fibers [2]

a) Polyethylene and Polystyrene
b) Expanded Polystyrene and Polymethyl Methacrylate
c) PPV and Nylon 6,6
d) Polycarbonate and Nylon 6,6

xiii) In PLED, _____ is used as anode and _____ is used as cathode [2]

a) Calcium and Aluminium
b) Aluminium and Indium Tin Oxide
c) Indium Tin Oxide and Aluminium
d) PPV and Aluminium

xiv) **Select the sentences that are applicable for Glass fiber reinforced polymer** [2]

(i) They use glass fibers reinforced in polymer matrix containing nylons, polyesters
(ii) They show very low tensile strength and very low impact resistance
(iii)They show excellent resistance to corrosion and chemicals.
(iv) They are used in making racing bicycles.
(v) They are used in making storage tanks

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

xv) Following characteristics are applicable for Lithium Ion Batteries. (**Select correct options**) [2]

(i) They have high energy density than other rechargeable batteries
(ii)They produce high voltage out about 6V as compared with other batteries.
(iii) Aqueous electrolyte is used in Lithium Ion Batteries
(iv) They are inexpensive.
(v)They are used in cardiac pacemakers and other implantable device.
(vi)They are used to operate laptop computers and mobile phones and aerospace application

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

**Q2 Solve any three out of four**

a) Predict the electrode system used for pH metric titration. If acetic 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) HCl 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) $CH_2=CH-CH_3$
ii) $CH_3-CO-CH_3$ (acetone)

**2)** Why trans Stilbene absorbs at higher wavelength than cis Stilbene in UV-Visible spectroscopy?
**3)**Identify the type of shift in $\lambda_{max}$ value observed when aniline is treated with acid in UV-Visible spectroscopy.

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

i) $C_6H_6$
ii) $CH_4$

**2)** Why carbonyl frequency in acetone absorbs at lower frequency than that of acetaldehyde in IR spectroscopy?
**3)** How intermolecular and intramolecular hydrogen bonding is identified by IR spectroscopy?

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

a) What is Pilling-Bedworth rule? How will it help in identifying porous or non- porous oxide film? 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) Mg
ii) Cu
iii) Cr

b) If steel tank is storing industrial acidic waste water and a small Copper scrap piece is in contact with the tank and water, which metal will undergo corrosion? Write reactions that will take place at anode and cathode. Suggest any two methods to minimize the corrosion of the metal that will undergo corrosion **[5]**

c) Identify in the following pairs, which metal will undergo corrosion in Case 1 and Case 2? In which case there will be faster corrosion and why? **[5]**

| Sr. No. | Case 1 | Case2 |
|---|---|---|
| 1 | Galvanized sheets fixed with brass screws | Brass sheets fixed with galvanized screws |
| 2 | Galvanized sheets with galvanized screws | Galvanized sheets with brass screws |

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

1)Concentrated hydrochloric acid stored in steel tank, chemical reactors
2) Outdoor Iron furniture, galvanized windows, electrical components
3) Ship hull of the ship sailing in the sea for 6 months, buried steel pipeline
4) Transmission line towers, Marine piers
5) Steel Food can storing baked beans, brass vessel used for cooking

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