

**NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR (H.P)**  
**END SEMESTER EXAMINATION, MARCH, 2021**  
**ENGINEERING CHEMISTRY (CY-101)**

Time: 2 hours

MM: 50

Note: All questions are compulsory.

**Q.1****2×6=12**

- a) What is oxidative corrosion? Explain its mechanism.
- b) Why antioxidant and detergents are added to lubricating oils?
- c) Acetone absorbs at 279 nm in hexane whereas the value of  $\lambda_{\max}$  in water is 264.5 nm. Why?
- d) The OH stretching frequency of free O-H group is higher than O-H stretching frequency of hydrogen bonded O-H group in alcohol and phenols? Why?
- e) What is Differential thermal analysis? Explain DTA with the help of block diagram.
- f) Explain aniline point and slight oxidation number of a given lubricant.

**Q.2****3×6=18**

- a) What is cathodic protection? How is it done by using sacrificial anode?
- b) What is meant by hydrodynamic lubrication? Enlist the properties of lubricant to be used in hydrodynamic lubrication.
- c) Define the term nanochemistry. Classify nanomaterials based on the number of dimensions of materials outside the range of nanoscale.
- d) Calculate the force constant for the bond in HCl. The fundamental vibration frequency is  $8.667 \times 10^{13} \text{ s}^{-1}$ .
- e) What are carbon nanotubes? Discuss the method used to synthesize primarily MWNTs.
- f) What is stress corrosion? What will happen when mild steel is exposed to caustic alkaline solution?

**Q.3****7+3=10**

- a) What are the main objectives of waste water treatment? Why are artificial treatment methods generally used for waste water treatment? Discuss the steps generally employed in waste water treatment.
- b) What is the difference between London smog and photochemical smog? Name the primary and secondary pollutants associated with photochemical smog.

**Q.4****5+3+2=10**

- a) Calculate the quantity of lime (84% pure) and soda (90% pure) required for complete treatment of 50000 liters of hard water containing following impurities:  $\text{Mg}(\text{HCO}_3)_2 = 46 \text{ mg/L}$ ,  $\text{MgSO}_4 = 30 \text{ mg/L}$ ,  $\text{Ca}(\text{HCO}_3)_2 = 36 \text{ mg/L}$ ,  $\text{CaSO}_4 = 24 \text{ mg/L}$ ,  $\text{CaCl}_2 = 28 \text{ mg/L}$ ,  $\text{Na}_2\text{AlO}_2 = 10 \text{ mg/L}$ ,  $\text{NaCl} = 4.5 \text{ mg/L}$ .
- b) Calculate the COD of the effluent sample when  $25 \text{ cm}^3$  of an effluent requires  $8.3 \text{ cm}^3$  of  $0.001 \text{ M K}_2\text{Cr}_2\text{O}_7$  for oxidation. (Molecular mass of  $\text{K}_2\text{Cr}_2\text{O}_7 = 294$ ).
- c) For a solution of camphor in a  $10 \text{ cm}$  cell, the absorbance  $A$  was found to be 2.52 at  $295 \text{ nm}$  with  $\lambda_{\max} = 14 \text{ mol}^{-1} \text{ L cm}^{-1}$ . What is the concentration of the solution?

NATIONAL INSTITUTE OF TECHNOLOGY HAMIRPUR  
Department of Chemistry  
End Term Examination (odd semester)  
Subject-Engineering chemistry (CY-101)

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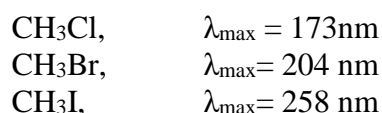
**Note: (i) Attempt all question.**

**(ii) Make suitable figures where required.**

**Q-1**

**2×5=10**

- Define the term nanotechnology. How the surface area to volume ratio is related to the size of a nanostructure?
- Discuss the formation of smog and photochemical smog
- What is BOD? How is it different from COD?
- Explain the variation in the value of  $\lambda_{\max}$  in the UV-Vis spectra of the following compounds,

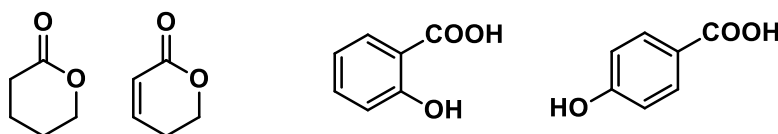


- Write two important properties and applications of fullerenes.

**Q-2**

**2×5=10**

- What is aniline point? Mention its significance.
- What is intergranular corrosion? How can it be prevented?
- Classify greases on the basis of the soap used.
- What are carbon nanotubes? Discuss the method used to synthesize primarily MWNT's.
- How will you distinguish between the following pairs on the basis of Infrared Spectroscopy?



**Q-3**

**4×4=16**

- What type of lubrication is applied to delicate instruments? Explain its mechanism. Suggest the type of lubricant used in such conditions.
- Explain what type of corrosion occurs when:
  - Screw and washer are made of different metals
  - Presence of NaOH in mild steel boiler under stress
- Discuss sacrificial anodic protection. What is the condition for the metal to act as sacrificial anode to iron?
- 50 ml of a water sample contains 840 ppm of dissolved oxygen. Five days later, the dissolved oxygen value becomes 230 ppm after the sample has been diluted to 80 ml. Calculate the BOD of the water sample.

**Q-4**

**ATTEMPT ANY TWO**

**5×2=10**

- a. Discuss the working principle and limitations of TGA. Draw a neat diagram of DTA. How is it different from TGA?
- b. What is AFM? Discuss its working principle. How it is different from SEM?
- c. Calculate the amount of lime (92% pure) and soda (98% pure) required for the treatment of the hardness of 30,000 litres of water whose analysis is as follows:  $\text{Ca}(\text{HCO}_3)_2 = 40.5 \text{ mg/L}$ ;  $\text{Mg}(\text{HCO}_3)_2 = 36.5 \text{ mg/L}$ ;  $\text{MgSO}_4 = 30 \text{ mg/L}$ ;  $\text{CaSO}_4 = 34 \text{ mg/L}$ ,  $\text{CaCl}_2 = 27.75 \text{ mg/L}$ ;  $\text{NaCl} = 10 \text{ mg/L}$

**Q-5**

**2×2=4**

Write notes on the following: (**ANY TWO**)

- a. Greenhouse effect
- b. Carbon credit
- c. Environmental impact assessment

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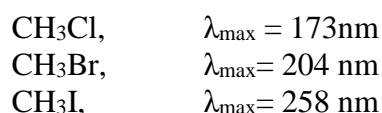
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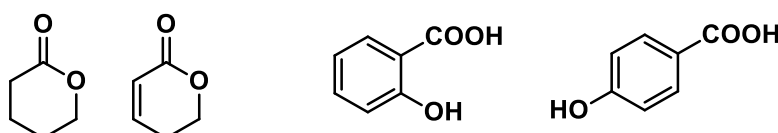


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