B.Tech. Second Semester (All Branches) / (Fire Engineering) (C.B.C.S.) Winter 2022

Applied Chemistry

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Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Assume suitable data whenever necessary.
8. Diagrams and chemical equations should be given whenever necessary.
9. Use of non programmable calculator is permitted.

1. a) What is the trend in the variation of electronegativity across a period and group? Mention factors affecting electronegativity.   **5**

b) Draw the molecular orbital diagram of hydrogen fluoride molecule HF and calculate the bond order.   **5**

c) Determine the effective nuclear charge (Z^*) using Slater's rule   **4**

    i) Copper atom having atomic number 29.
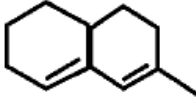
    ii) 2p electron in F where $Z = 9$.

OR

2. a) Discuss the magnetic properties of complexes with d^3 and d^5 configuration with suitable examples.   **4**

b) Draw the molecular orbital diagram of Boron molecule B_2 and calculate the bond order.   **5**

c) Discuss diamagnetism and ferromagnetism with suitable diagram.   **5**

3. a) A gas has constant pressure in a system. There is loss of 55J of heat in the surrounding around the system 550J of work is done onto the system. Find the system's internal energy.   **3**

b) Define Reversible and irreversible process.   **3**

c) How cathodic protection is controlled using sacrificial anode.   **4**

d) Discuss :   **4**
    i) Pitting corrosion   ii) Intergranular corrosion

OR

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4. a) What is the nature of oxide film on magnesium $(Mg \rightarrow MgO)$. Given the density of $MgO = 3.65 \, mg/m^3$ and of $Mg = 1.74 \, mg/m^3$. The molecular weight of $MgO = 40.3$ and atomic weight of $Mg = 24.3$.   3

   b) Mention role of Gibbs free energy in oxidation – reduction reaction.   3

   c) Define and state basic equation of enthalpy.   4

   d) How collision can be prevented with proper design and material selection.   4

5. a) A 0.25M solution in a test tube with path length of 1cm has an absorbance of 0.075 at 560nm. What is the molar absorptivity of the solution.   3

   b) What is meant by phosphorescence? Mention its applications.   4

   c) Discuss in brief chemical shift.   4

   d) Write applications of ultraviolet and visible spectroscopy.   3
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<div align="center">OR</div>

6. a) Using Woodward – Fischer Rule find out the absorption maxima for   3

   b) What is meant by fluorescence? Mention its application.   4

   c) Discuss in brief magnetic resonance imaging (MRI)   4

   d) Explain the various electronic transitions in electronic spectroscopy.   3

7. a) Explain :   4
   1) Prevention of waste   2) Less Hazardous synthesis

   b) State properties and application of supercritical carbon dioxide.   4

   c) Write note on: 6
   1) Carbon credit   2) Polyadipic acid

<div align="center">OR</div>

8. a) Which properties of dimethyl carbonate make it a Green Reagent?   4

   b) State the applications of polycaprolactone.   4

   c) What is Green chemistry? Mention its significance.   4

   d) Calculate the atom economy for the reaction   2
   $$C_6H_5CHO + CH_3CHO \rightarrow C_6H_5CH = CHCHO + H_2O$$

9. a) A zeolite softener was completely exhausted by passing 20,000 lit of water sample through it. If the zeolite requires 250 lit of 7.5% NaCl solution for complete regeneration. Calculate the hardness of the water sample. — **3**

    b) Write short note on: — **6**

        a) Caustic embrittlement.

        b) Electrodialysis process for desalination of seawater.

    c) Discuss the process of clean water production from biological waste water. — **5**

OR

10. a) Explain demineralization of hard water by ion exchange resin with its reaction, regeneration and limitation. — **6**

    b) What are the causes of scale formation in boilers? Discuss its disadvantages. — **4**

    c) Explain membrane bioreactor. — **4**

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