111 : Applied Chemistry

P. Pages : 3

Time : Three Hours

GUG/S/18/3664

Max. Marks : 80

0839

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Notes : 1. All questions carry equal marks.
2. Assume suitable data wherever necessary.
3. Diagrams and Chemical equation should be given wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Discuss with diagram and chemical equations the demineralisation of hard water by Ion exchange resins and how the resin is regenerated? **6**

b) Explain phosphate conditioning. **6**

c) The hardness of 40,000 litres of a water sample was completely removed by passing it through a zeolite softener. The zeolite softener required 440 litres of NaCl solution for regeneration. If the water has a hardness equivalent to 342 ppm of $CaCO_3$, Calculate the concentration of the NaCl solution used. **4**

OR

2. a) How does scale formation occur in boilers? How scales are removed? What are its disadvantages? **6**

b) A water sample using $FeSO_4 \cdot 7H_2O$ as a coagulant at the rate of 27.8 ppm gave the following data on analysis :

$Ca^{2+} = 95.2\,ppm$, $Mg^{2+} = 36\,ppm$ $HCO_3^- = 396.5\,ppm$

Dissolved $CO_2 = 24.2\,ppm$

Calculate the amounts of 95% pure lime and 97% pure soda for softening Five million litres of water. **10**

3. a) What is Cathodic protection? How can it be achieved using impressed current and sacrificial anode? Explain with suitable examples. **6**

b) Why most of the metals have inherent property to undergo corrosion? What is meant by 'Electrochemical Corrosion'? Discuss its mechanism. **6**

c) Distinguish between Galvanising and Tinning. **4**

OR

4. a) What are fuel cells? Explain working of $H_2 - O_2$ alkaline fuel cell with its advantages and limitations. **6**

b) Explain pitting corrosion. **4**

c) Give Reasons : **6**

   i) Steel pipe connected to copper plumbing get corroded.

   ii) The part of nail inside wood undergoes corrosion.

5. a) State the various reactions taking place in the rotary Kiln during the manufacture of Portland cement with proper diagram. **8**

   b) Explain the role of gypsum in setting and Hardening. **3**

   c) What is Green Chemistry? Mention its principles and discuss its significance. **5**

OR

6. a) Write shorts notes on : **8**

   i) Microscopic constituents of ordinary Portland cement.

   ii) Soundness of cement.

   b) Differentiate dry and wet process of cement manufacturing. **4**

   c) Discuss concept of carbon credits. **4**

7. a) Find the gross as well as net colorific value of a coal which on ultimate analysis gave following results by Dulong's formula. **5**
   $C = 58.7\%$, $H = 9.0\%$, $O_2 = 28.4\%$, $S = 1.1\%$ and $N = 2.8\%$

   b) Explain working and principle of 'Bomb - Calorimeter' with a labelled diagram. **5**

   c) Write a note on : **6**

   i) Significance of Proximate analysis.

   ii) CNG.

OR

8. a) Explain Fischer - Tropsch process for synthesis of gasoline. **6**

   b) Calculate gross and net calorific value of a gaseous fuel by Boy's Calorimeter using following data : **4**
   i) Volume of gaseous fuel $= 0.08$ M^3.
   ii) Weight of water used for cooling $= 27$ kg.
   iii) Inlet temperature $= 20ºC$
   iv) Outlet temperature $= 45ºC$
   v) Weight of water produced $= 0.049$ kg.

   c) Explain : **6**
   i) Significance of ultimate analysis.
   ii) Distinguish between octane and cetane number.

9. a) What are Greases? Under what situations are greases used? Define consistency and drop point of grease. **6**

    b) Write notes on : **6**

        i) Hydrodynamic Lubricant

        ii) Extreme Pressure Lubricant

    c) A lubricating oil has the same viscosity as that of standard napthanilic and paraffinic type oils at 210ºF. Their viscosities at 100ºF are 320 SUS, 530 SUS and 270 SUS respectively. Find viscosity index of the lubricating oil. **4**

OR

10. a) Explain cloud point and pour point. **3**

    b) A coal sample on analysis shows following composition $C = 76\%$, $H - 4\%$, $S = 4.9\%$, $O = 3.1\%$, $N = 9\%$ and rest ash. If this coal is burnt with 40% excess air, calculate : **13**

        i) Air : fuel ratio.

        ii) Volume of air supplied in m^3 per kg of coal at NTP.

        iii) % Volumetric composition of dry flue gases.

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