

# Q - 1

## Applied Chemistry – 1 (ETCH – 113)

1. A fuel has the following percentage composition by mass :  $H_2 = 24.0$ ,  $CH_4 = 35.0$ ,  $C_2H_6 = 6.0$ ,  $C_2H_4 = 5.0$ ,  $C_4H_8 = 2.5$ ,  $CO = 7.6$ ,  $O_2 = 0.6$  and  $N_2$  rest . Calculate the minimum amount of air required at  $25^\circ C$  and 1 atm pressure for complete combustion per kg of fuel burnt. Also give the volumetric analysis of fuel gas obtained.
2. A sample of coal was found to have the following percentage composition :  
 $C = 75\%$ ,  $H = 5.2\%$ ,  $O = 12.1\%$ ,  $N = 3.2\%$  and ash = 4.5%.
  - (i) Calculate the minimum amount of air necessary for complete combustion of 1 kg of coal.
  - (ii) Also calculate the HCV and NCV of the coal sample.
3. The percentage composition of a sample of bituminous coal was found to be as under :  
 $C = 75.4$ ,  $H = 5.3$ ,  $O = 12.6$ ,  $N = 3.2$ ,  $S = 1.3$ , the rest being ash.  
Calculate the minimum weight of air necessary for complete combustion of 1 kg of coal and percentage composition of the dry products of combustion by weight.
4. The percentage composition of a sample of bituminous coal by weight was found to be :  $C = 76\%$ ,  $H = 5.25\%$ ,  $O = 12.8\%$ ,  $N = 2.7\%$ ,  $S = 1.2\%$ , ash = 2.1%.. Calculate the minimum  
(a) weight and (b) volume at NTP of air necessary for complete combustion of 1 kg of coal.  
And © the percentage composition by weight of dry products.

## Q - 2

### Applied Chemistry – 1 (ETCH – 113)

1. Write short notes on carbonization of coal .

2. A gaseous fuel has the following composition:

H<sub>2</sub> = 50%, CH<sub>4</sub> = 30%, C<sub>2</sub>H<sub>6</sub> = 6%, CO = 8%, N<sub>2</sub> = 6%.

Calculate the volume of air required per cubic meter of gas if 20% excess air is supplied for combustion. Also find out the % composition by volume of dry product of combustion. ( Assume air to be a mixture of 80% of N<sub>2</sub> and 20% of O<sub>2</sub> by volume.

3. Why is coke and not coal used as a fuel in metallurgical process?

4. Explain the ultimate analysis of coal. What is its significant?

5. Mention the names of important by products recovered in the manufacture of metallurgical coke.

6. Why is peat not considered as an economical fuel.

## Q - 3

### Applied Chemistry – 1 (ETCH – 113)

1. Differentiate between scale and sludge.
2. What is the principle of lime soda process?
3. 100 ml of a sample of hard water exactly 12 ml of 0.12N HCl using methyl orange as an indicator. What kind of hardness is present? Express the same in terms of an equivalent of  $\text{CaCO}_3$ .
4. Why is the ionexchange resin, water is first passed through the cation exchanger and then anion exchanger.
5. Why is presence of  $\text{NaAlO}_2$  in water equivalent to presence of equivalent of  $\text{Ca(OH)}_2$ .
6. List any two advantage of break point chlorination.

## Q - 4

### Applied Chemistry – 1 (ETCH – 113)

1. Discuss the electrochemical principle of corrosion. Illustrate with examples.
2. Explain the effect of the following factors on the rates of corrosion:
  - (i) Nature of corrosion product.
  - (ii) Anodic and cathodic area.
  - (iii) pH.
3. Write short notes on :
  - (i) Chemical corrosion.
  - (ii) Soil corrosion.

## Q - 5

### Applied Chemistry – 1 (ETCH – 113)

1. Why is calgon conditioning is better then phosphate conditioning.
2. Describe the principal involved in determination of hardness by EDTA methods.
3. A sample of water contains following impurities:  
 $\text{Mg}(\text{HCO}_3)_2 = 73 \text{ mg/l}$   
 $\text{CaCl}_2 = 222 \text{ mg/l}$   
 $\text{MgSO}_4 = 120 \text{ mg/l}$   
 $\text{Ca}(\text{NO}_3)_2 = 164 \text{ mg/l}$

Calculate the quantity of lime (75% pure) and soda (90% pure) needed for softening 5,000 L of water .

4. How is water analyzed for alkalinity? How the alkalinity due to various ion can be determined.

## **Q - 6**

### **Applied Chemistry – 1 (ETCH – 113)**

1. Write short notes on :

(i) Octane number and cetane number

(ii) Catalytic cracking

(iii) Carbonization

(iv) Boy's calorimeter

## Q - 7

### Applied Chemistry – 1 (ETCH – 113)

1. What happens when temporary hard water is boiled? (Give equations)
2. Name three substances used for sterilization of water.
3. Mention the common units used for expressing hardness of water.
4. What is desalination?
5. What is electro dialysis?
6. Why do we express hardness of water in term of calcium carbonate equivalent?
7. Chloramine is preferable to chlorine for sterilization of water. Give reason.
8. Why does  $\text{Mg}(\text{HCO}_3)_2$  required double amount of lime for softening.
9. What is sedimentation with coagulants.

## Q - 8

### Applied Chemistry – 1 (ETCH – 113)

1. Derive kinetics of an acid catalyzed reaction
2. Give the mechanism and kinetics of enzyme catalysed reaction.
3. Write short notes on
  - (i) Promoter
  - (ii) Inhibitor
  - (iii) Poison
  - (iv) Physical adsorption & chemisorption
  - (v) Theories of catalysis



## Q - 9

### Applied Chemistry – 1 (ETCH – 113)

1. Discuss the kinetics of heterogeneous catalysis.
2. Taking suitable reaction, give the mechanism of the surface reaction involving a heterogeneous catalyst.
3. Write short notes on
  - (i) Effect of temperature and pH on enzyme catalysed reaction
  - (ii) Wilkinson's catalyst
  - (iii) Criteria of the catalyst

## Q - 10

### Applied Chemistry – 1 (ETCH – 113)

1. Derive Gibb's phase rule, mention advantage and disadvantage of phase rule.
2. Draw and explain the phase diagram of lead-silver system and discuss practical application of the system.
3. Write short notes on
  - (i) Eutectic point
  - (ii) Triple point
  - (iii) Metastable state