

Roll No.....	MODEL PAPER	Total no. of pages: 1
Time: 60 min.	Engineering Chemistry (2FY2-03)	Max. Marks: 05.04.2025
Computer Science & Engineering (CSE-A)		

Q.N.	CO Mapped	Blooms Taxonomy Level	Question	Marks
1.	CO-1	Remember	Define disinfection of water. Name any two chemical used for this purpose?	1
2.	CO-1	Understand	Define Secondary fuel. Justify coke is secondary fuel.	1
3.	CO-2	Apply	Why chlorine is used in municipal water supply. Explain and name the phenomenon.	2
4.	CO-2	Apply	A water sample contain $\text{Ca}(\text{HCO}_3)_2 = 81$ ppm, $\text{MgCl}_2 = 47.5$ ppm, $\text{CaSO}_4 = 68$ ppm, $\text{Mg}(\text{HCO}_3)_2 = 146$ ppm. Calculate its temporary and permanent hardness in terms of CaCO_3 equivalent.	2
5.	CO-3	Apply	(a) How Ash content and fixed carbon % can be determined in the coal sample. OR A sample of coal contains C=93%, H = 6% and ash =1%. The following data were obtained when the coal was tested in bomb Calorimeter. Weight of coal burnt = 0.95g, Weight of water taken = 2000 g, Water equivalent of bomb calorimeter = 700g, Rise in temperature = 2.48°C , Fuse wire correction = 10 cal, Acid correction = 60 cal, cooling correction = 0.02°C Calculate the HCV of coal.	4

SOLUTION

- Removal of disease producing microorganisms from water and ensure for drinking purpose is called disinfection. The chemicals used for disinfection of water are chlorine gas, chlorine water, ozone, bleaching powder etc.
- Secondary / Synthetic fuels: Those fuels which are derived from primary fuels by using various physical and chemical procedures, for example coke, petrol, kerosene, diesel, coal gas, producer gas etc. Coke is derived from coal, hence it is secondary fuel.
- Chlorine gas is a very good disinfectant, which can be bubbled in the water. In this process calculated amount of chlorine gas is passed in order to destroy the pathogenic bacteria is called chlorination. Chlorine is also reacts with water and generates hypochlorous acid and nascent oxygen, which acts a powerful oxidizing agent and kills

the bacteria. The amount of chlorine required to kill bacteria and to remove organic matter is called break-point chlorination.

4.

Salt	Amount (ppm)	Multiplication factor	Hardness in terms of CaCO ₃ eq.	
Ca(HCO ₃) ₂	81	100 / 162	81 x 100 / 162	= 50
MgCl ₂	47.5	100 / 95	47.5 x 100 / 95	= 50
CaSO ₄	68	100 / 136	68 x 100 / 136	= 50
Mg(HCO ₃) ₂	146	100 / 146	146 x 100 / 146	= 100

Temporary hardness = Ca(HCO₃)₂ + Mg(HCO₃)₂ = 50 + 100 = 150 ppm CaCO₃ eq.

Permanent hardness = MgCl₂ + CaSO₄ = 50 + 50 = 100 ppm CaCO₃ eq.

5. **Ash Content:** After determination of moisture and volatile matter, the residual sample in the crucible is heated without covering at 700-750°C for 30 minutes in a muffle furnace. Loss in weight is reported as ash content by following formula:

$$\% \text{ of Ash content} = \frac{\text{Weight of residue left}}{\text{Weight of coal taken}} \times 100$$

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Weight of coal taken

$$\text{HCV} = \frac{[(W + w) (t_2 - t_1 + \text{cooling correction})] - (\text{acid} + \text{fuse wire correction})}{\text{Weight of Fuel}}$$

$$\text{HCV} = \frac{(2000 + 700) (2.48 + 0.02) - (10 + 60)}{0.95} = 7031.6 \text{ Cal /g.}$$