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MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2012/2013

SECOND YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN INDUSTRIAL CHEMISTRY WITH INFORMATION TECHNOLOGY
(MAIN CAMPUS)

SIC 204: WATER IN CHEMICAL INDUSTRY

Date: 22nd July, 2013 *Time: 11.00 a.m. – 1.00 p.m.*

Important Information:

1. This paper contains 6 questions.
2. Question one (Q 1) (in Section A) is compulsory and carries 10 marks.
3. The rest of the questions carry 15 marks each
4. In addition to Q 1, attempt any other 4 questions in section B.
5. Graph paper is provided.

Section A: Compulsory

Question 1. A) Give a general definition of the following: **(4 Mks).**

i) Hydrogen bonding
ii) Recycled water
iii) Biological oxygen demand (BOD_5).
iv) Third step water treatment method.

B) Distinguish between the following as they concern water: **(6 mks).**
i) Impurity and contaminant
ii) Turbidity and colour
iii) Anoxic and anaerobic environmental conditions.

Section B; Select any 4 questions (each 15 mks).

Question 2: A) Define "water conditioning" as a process. **(3 mks).**

B) Explain the relevance of the following processes during the water conditioning:
i) cooling
ii) degassing
iii) pH neutralization
iv) Oxidation **(12 mks).**

Question 3: A) With appropriate chemical equations outline the origin of water hardness?. **(6 mks).**

B) Inorganic water pollutants are not given much attention in large water treatment works.
i) Name any 3 of the relevant treatment methods for the inorganic pollutants. **(3 mks).**
ii) Describe how any one of these methods operates. **(4 mks).**

Question 4: A) How does the chemical structure of water molecule contribute to the property of water as a universal solvent?. **(8 mks).**

B) i) Define the term Chemical oxygen demand (COD). **(2 mks).**
ii) Calculate the COD for a pure glucose ($C_6H_{12}O_6$) solution in water. **(5 mks).**

Question 5: A) Outline any three routes through which the world waters originated. **(6 mks).**

B) i) A student is presented with two 4 Lit. water jars of pHs 4 and 8. Without any restrictions on the amount of water to transfer, how would the student mix the waters so as to have water of pH 7? **(5 mks).**

ii) As compared to non-recycled water, the utilization of recycled water faces several challenges. Name any three of the challenges. (4 **mks**).

Question 6: A) Why is biological water treatment steps termed "second step" process?. (2 mks).

B) Name the three major categories into which bacteria are classified. **(3mks).**

C) The following equation;

$$v = k_2 \cdot [ES] = k_2 \cdot \frac{[E_{TOT}] \cdot [S]}{[S] + K_M} = v_{max} \cdot \frac{[S]}{K_M + [S]}$$

summarizes the Michaelis-Menten theory on enzymolysis. Where V, V_{max}, $[E_{Tot}]$, [ES], and [S] are velocity, maximum velocity, initial enzyme concentration, concentration of activated complex, and concentration of substrate. The K_2 is reaction rate for activated complex formation while K_m represents the derived Michaelis-Menten constant.

i) Show a fully labeled graph depicting the above equation. **(6 mks).**
ii) What are the key assumptions associated with the above equation?. **(3 mks).**