



UNIVERSITY OF SWAZILAND
Faculty of Health Science

Department of Environmental Health
Sciences

Final Examination 2009

Title of paper: INDUSTRIAL WASTEWATER

Course code: EHS 553

Time allowed: 2 hours

Marks allocation: 100 Marks

Instructions:

- 1) Read the questions and instructions carefully
- 2) Answer ALL FOUR (4) questions
- 3) Each question is weighted 25 marks
- 4) Write neatly and clearly
- 5) Begin each question on a separate sheet of paper

This paper is not to be opened until the invigilator has granted
permission

Question one

Under normal operation of a sewage treatment plant, Suspended solids, BOD₅, and nutrients are the main targets for treatment.

- a. Explain, giving two reasons for each, as to why these parameters are targets (5 Marks)
- b. Describe how suspended solids can be scientifically be quantified in wastewater effluent. (10 Marks)
- c. Describe how BOD₅ can be scientifically be quantified in wastewater effluent. (10 Marks)

Question two

- a) Municipalities restrict the quality of wastewater that is to be discharged into the sewerage system by industries explain three major reasons why it should be so. (10 Marks)
- b) Give the maximum limits for the listed parameters in the municipal effluent to be discharge to the environment as demanded by Laws and regulations in Swaziland.
 1. pH
 2. Ordour / taste
 3. Phosphorus
 4. Colour
 5. BOD (5 Marks)
- c) Compare the Swaziland limits with international limit on the above parameters (ii) and give your comments. (10 Marks)

Question three

- i. What does retention time mean in relation to wastewater treatment? (5 marks)
- ii. In a sedimentation tank with a detention time of 2.5hrs and a tank depth of 5m, what is the velocity of particles that could settle and be retained at the bottom of the tank? (7 marks)
- iii. In a circular sedimentation tank with an inflow of 30m³/s;
 - a. What is the flow area of the tank and (7 marks)
 - b. What is the volume of the tank (assume the depth)? (6 marks)

Question four

- a) The BOD_5 of a wastewater^h as been measured as 600mg/L. If $k_1 = 0.23$ per day (base e); What is the BOD_u of the wastewater? What proportion of the BOD_u would remain unoxidized after 20 day? (10 marks)
- b) Show that the ratio of the 2.5 days, at 35°C to 5 days at 20°C BOD is approximately the same. Take $\theta = 1.05$ (10 marks)
- c) Waste water was found to be oxidized as if it ~~where~~^{was} a mixture of components of 40% was oxidized at rate of 0.8/d, 40% at oxidized at rate 0.08/d and 20% at 0.008/d. How much BOD remaining in a day and in 5 days. (5 Marks)