



UNIVERSITY OF SWAZILAND  
Faculty of Health Sciences  
Department of Environmental Health Science

DEGREE IN ENVIRONMENTAL HEALTH SCIENCE  
SUPPLEMENTARY EXAMINATION PAPER 2017

TITLE OF PAPER : URBAN WATER TREATMENT  
COURSE CODE : EHS 222  
DURATION : 2 HOURS  
MARKS : 100

INSTRUCTIONS : READ THE QUESTIONS & INSTRUCTIONS CAREFULLY  
: ANSWER **ANY FOUR** QUESTIONS  
: EACH QUESTION **CARRIES 25** MARKS.  
: WRITE NEATLY & CLEARLY  
: NO PAPER SHOULD BE BROUGHT INTO THE EXAMINATION ROOM.  
: BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR.

**QUESTION ONE**

(Note each question below carries 5 marks)

- 1A. The diagram shown in Figure Q1-1 below is a vertical section through an intake structure constructed for abstracting water from a river. State the functions of the piles and large boulders shown in the figure.

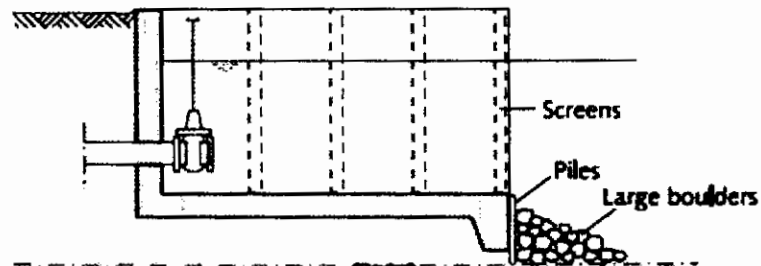


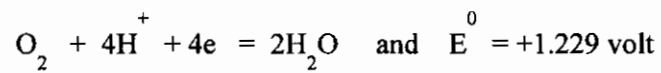
Figure Q1-1

- 1B. Define a coffer dam and state its role in the construction of intakes.
- 1C. Discuss the principle of operation of ultrasonic flow measurement
- 1D. Apart from water treatment, discuss other options that can be explored in order to reduce the effect of fluoride in water.
- 1E. Discuss the water treatment methods available for the removal of organic matter from water.

**QUESTION TWO**

(Note each question below carries 5 marks)

- 2A.** For the chemical reaction shown below related to corrosion processes, indicate the type of reaction, the role of oxygen molecule and whether the reaction can occur spontaneously or not.

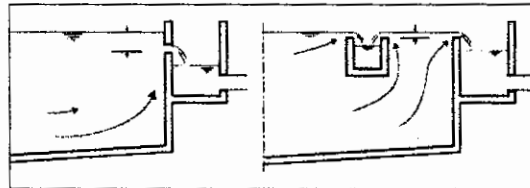


- 2B.** Compare the health risks of i) inhaled asbestos fiber and ii) ingested asbestos fiber. Indicate the type of water that can lead to corrosion of asbestos cement pipes.
- 2C.** Define the i) Langelier saturation Index and ii) Ryzner stability index. Indicate also the scales that the different scales of values that these indices represent.
- 2D.** List the different types of aerators used for aeration of water.
- 2E.** Discuss the variation of efficiency of aeration with respect to i) temperature of water ii) temperature of air.

**QUESTION THREE**

(Note each question below carries 5 marks)

- 3A.** Give reason why sedimentation tanks can be effective in tropical climates.
- 3B.** Discuss with the help of a sketch the design features of inlets of sedimentation tanks.
- 3C.** Compare the two outlet weir arrangements shown in the figure below and indicate their relative advantages and disadvantages.



- 3D.** What are the advantages of providing storage as water treatment?
- 3E.** What are the factors to put into account when determining the capacity of storage tanks?

**QUESTION FOUR**

(Note each question below carries 5 marks)

- 4A) Discuss the factors that are involved in the formation of stable colloids in water.
- 4B) Explain how the ionic strength of water affects the magnitude of the zeta potential. Indicate also if this mechanism of destabilization of colloids practically possible for water treatment.
- 4C) Describe the process of adsorption and inter-particle bridging for the destabilization of colloids.
- 4D) What are the objectives and benefits of providing coagulant aids?
- 4E) What are the major shortcomings of hydraulic flocculators?

**QUESTION FIVE**

(Note each question below carries 5 marks)

- 5A)** List the application categories of rapid sand filters.
  
- 5B)** Describe the function of air during the backwashing process of rapid sand filters.
  
- 5C)** What are the advantages slow sand filters compared to rapid sand filters?
  
- 5D)** List the possible disinfectants that may be used for the disinfection of water.
  
- 5E)** Discuss the effectiveness of ultraviolet radiation for the inactivation of spores, cysts and viruses.