higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

WASTE-WATER TREATMENT PRACTICE N3

(8120003)

5 December 2023 (X-paper)
09:00–12:00

This question paper consists of 6 pages.

272Q1G2305

Copyright reserved

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
WASTE-WATER TREATMENT PRACTICE N3
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each section on a new page.
5. Use only a blue or black pen.
6. Write neatly and legibly.

Copyright reserved

SECTION A

QUESTION 1

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 Electrical potential is a derived unit measured in siemens.

1.2 Concentration in water treatment plants is expressed as mass per volume.

1.3 Pitting corrosion occurs once the protective film or corrosion layers break down.

1.4 Mesophilic digestion occurs between 38 °C and 65 °C.

1.5 Too little water in a sludge causes pumping problems.

(5 × 2) **[10]**

QUESTION 2

Choose a/an word/item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–J) next to the question number (2.1–2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.1	A valve that opens automatically when the pressure builds up to a dangerous level	A	Cl
		B	underground water
2.2	Water that penetrates the soil directly	C	gate valve
2.3	The chemical symbol for chlorine	D	manholes
2.4	They are used as a means of access for inspection	E	activated sludge process
		F	relieve valve
2.5	It is the process that decomposes organic carbonaceous and nitrogenous matter with the aid of aerobic bacteria	G	sewerage
		H	surface water
		I	biological filtration process
		J	Cl_2

(5 × 1) **[5]**

TOTAL SECTION A: 15

Copyright reserved

SECTION B

QUESTION 3

3.1 Convert the following:

3.1.1 8 litres = … cm^3

3.1.2 3 mega litres = … m^3

3.1.3 6 kilolitres/min = … litres/sec

(3 × 2) (6)

3.2 Calculate the relative density of iron(III) chloride if the mass of the empty volumetric flask is 440 g and the mass of the flask filled with one litre $FeCl_3$ at 20 °C is 8000 g.

NB: Convert your answer to kg/m^3 (5)

3.3 Calculate the volume of a cylindrical biological filter with a diameter of 8 m and a height of 2,35 m. (5)

3.4 The flow of a fluid in a pipe can be calculated by the formula below:

$$Q = v \times A$$

What is the meaning of each symbol (include units of each)? (6)

[22]

QUESTION 4

4.1 Name and provide a brief description of any THREE zones that exist in the self-purification process of rivers, dams or streams. (3 × 2) (6)

4.2 Briefly explain the purpose of the following in the waste-water treatment plant:

4.2.1 An emergency bypass

4.2.2 Storm water overflow

4.2.3 Distribution balancing system

4.2.4 Rag catchers

(4 × 2) (8)

4.3 The main purpose of screens is to remove debris, rags, papers etc.

Indicate THREE problems that may be experienced with screens. (3)

4.4 Name FOUR types of sedimentation tanks. (4)

[21]

Copyright reserved

QUESTION 5

5.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (5.1.1–5.1.10) in the ANSWER BOOK.

5.1.1 Purging of a sand filter bed in a water treatment plant, is necessary to maintain voids for passage of waste-water and air.

5.1.2 The media of a filter must be flat to allow bacterial growth on it.

5.1.3 A percolating filter is an open structure with a graded floor.

5.1.4 The biological layer is anaerobic at the bottom.

5.1.5 The majority of COD is extracted in the upper part of the filter.

5.1.6 Hydraulic load is expressed as m^3 of sewage per day per m^3 of sewage per m^2 filter media per day.

5.1.7 Organic load is the O_2 absorbed in grams per m^3 of filter media per day.

5.1.8 It is good for the filter to stand dry for extended periods to prevent bad smells.

5.1.9 Relative stability tests are performed on effluents prior to biological filtration.

5.1.10 The required COD level for a biofilter effluent is 150 g/l maximum.

(10 × 1) (10)

5.2 Calculate the hydraulic load of a biofilter if the filter is 200 m^3/d and the surface area of the filter is 100 m^2. (3)

5.3 Draw a flow diagram illustrating the double filtration process. (5)

5.4 Explain the purpose of the bottom zone of a biofilter. (2)

5.5 What is a standard set for suspended solids for biofilter efficiency? (1)

[21]

Copyright reserved

QUESTION 6

6.1 What actions should be taken when dealing with chlorine gas during an emergency situation? (7)

6.2 Name THREE types of records that must be kept in the chlorine dosing room. (3)

6.3 State FIVE advantages of removing phosphate by chemical addition in the activated sludge process. (5)

6.4 Describe the following processes:

6.4.1 *Reclamation*

6.4.2 *Trenching*

(2 × 2) (4)

6.5 Provide the temperature range at which the following digestion processes take place.

6.5.1 Thermophilic digestion

6.5.2 Cold digestion

(2 × 1) (2)

[21]

TOTAL SECTION B: 85
GRAND TOTAL: 100

Copyright reserved