higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

WATER AND WASTE-WATER TREATMENT PRACTICE N2

5 April 2018

This marking guideline consists of 5 pages.

Copyright reserved

QUESTION 1

1.1 Total viable organisms
1.2 Coagulation
1.3 Turbidity
1.4 Chlorine
1.5 Methanogen

(5 × 1) **[5]**

QUESTION 2

2.1 E
2.2 F
2.3 A
2.4 B
2.5 C

(5 × 1) **[5]**

QUESTION 3

3.1

Parameter	**General Standard**	**Special Standard**
Suspended solids	3.1.1 (25 mg/ℓ)✓	3.1.2 (10 mg/ℓ)✓
Faecal coliforms	3.1.3 (nil per 100 ml)✓	3.1.4 (nil per 100 ml)✓
Mercury	3.1.5 (0,02 mg/ℓ)✓	3.1.6 (0,02 mg/ℓ)✓
Arsenic	3.1.7 (0,5 mg/ℓ)✓	3.1.8 (0,1 mg/ℓ)✓

(8 × 1) (8)

3.2 3.2.1 Toxic substances are substances which have a poisoning effect on man, animals or plants.✓ Many such substances are metals and have a more serious effect on some species than on others.✓ For example, copper is essential in minute amounts in the human diet, but small amounts of copper are detrimental to marine life.✓
Nitrate is another toxic substance, as it can lead to a sickness called methaemaglobinaemia which causes the death of children under the age of 2 years.✓ (4)

3.2.2 Flow measurement is the quantification of bulk fluid movement.✓ Flow can be measured in a variety of ways.✓ Positive-displacement flow meters accumulate a fixed volume of fluid✓and then count the number of times the volume is filled to measure the flow.✓
Other methods of measuring the flow rely on forces produced by the flowing stream as it overcomes a known constriction, to indirectly calculate the flow.✓ Flow may be measured by measuring the velocity of fluid over a known area.✓ (6)

3.2.3 Poly-electrolytes are also non-metallic flocculating agents, but unlike floccotan✓ they are synthesised from synthetic chemicals and not plant material.✓ They are available as cationic or positively charged substances, anionic or negatively charged substances or non-ionic charged substances.✓

The cationic poly-electrolytes work in exactly the same way as the metallic flocculants.✓ They have the advantage that they are concentrated and only small doses are needed, they do not influence the pH of the water and are very clean to work with.✓

The anionic types and non-ionic types cannot be used as primary flocculants,✓ but are only useful to build up heavier flocs from the finer ones produced by another flocculent or to make those flocs stronger and less likely to break.✓ (7)

[25]

QUESTION 4

4.1
- Liquids
- Solids followed by solutioning
- Suspensions (3)

4.2
- An electrically driven paddle or propeller
- Orifice in pipeline
- Vortex created in a conical chamber
- Adding chemicals just after a waterfall (4)

4.3 It must be handled carefully with the correct equipment✓ and it must be stored in equipment✓ which is able to withstand its corrosive properties.✓ Steel of any kind, even stainless steel, is entirely unsuitable for storing, transporting or controlling $FeCl_3$.✓ Concrete or cement-like products are equally unsuitable.✓ Only plastic and rubber-lined materials should be allowed to come into contact with $FeCl_3$ including diluted solutions.✓✓ (7)

4.4 Phosphate can be removed from sewage by the addition of chemicals✓ such as alum, ferric chloride, ferrous sulphate, sodium aluminate or waste pickle liquor✓ to the activated sludge process, or by biological means in which phosphates are incorporated into the biological sludge✓ and removed with the sludge.✓ (6)

[20]

QUESTION 5

5.1 Constant velocity channels are fairly long channels✓ which are so shaped or have the outlets so controlled by weirs✓ or flumes that the velocity of flow is constant whatever the sewage flow.✓ The length and depth of the channel is selected to remove all inorganic matter✓ above a chosen particle size while ensuring minimum deposition of inorganic matter.✓ Grit accumulates at the bottom of the tank and is removed manually or mechanically.✓ (6)

5.2
- Rotodynamic pumps
- Positive displacement pumps
- Diaphragm pumps
- Air lift pumps (4)

5.3 Nitrification is a process occurring in both biological filtration and activated sludge processes✓ and refers to the TWO stages of the biological process whereby ammonia is biochemically oxidised to nitrite in the presence of oxygen✓ and the bacterial species nitrosamines. The nitrites in turn are converted into nitrates.✓

Nitrifiers are sensitive organisms, easily upset by slugs of chemicals or other poisonous substances, directly affected by pH and dissolved oxygen and they are highly temperature-dependent.✓

The conversion of ammonia to nitrates results in the formation of nitric acid.✓ This acid reacts with the alkalinity of the mixed liquor (in the activated sludge reactor) against pH changes✓ and leads to a lowering of pH in the mixed liquor which in turn will lead to reduced nitrification rates and possibly cessation thereof.✓

When starved of oxygen, nitrifiers go into a dormant phase. Thus nitrification stops when sludge is passed through the clarifiers and resumes when the sludge returns to the aeration basin.✓ (8)

5.4 When it shows no corrosive or scale-forming properties,✓ i.e. pHs = pH.✓ (2)

[20]

QUESTION 6

6.1 Zone one: occurs at low dosage and all the chlorine is removed by reaction.✓

Zone two: an increase in chlorine dosage occurs with the chlorine reacting with ammonia to form chloramines.✓

Zone three: this is the breakpoint, where higher chlorine dosages will lead to oxidation of the chloramines.✓ In this zone a higher dosage will produce lower residual concentrations.✓

Zone four: in this zone the conditions that prevail will represent reactions that started in zone three as having been completed.✓ A further increase in chlorine dosage will produce free residual chlorine.✓ (6)

6.2.1 A grab sample, also known as a catch sample, consists of a single sample taken at a specific time.✓
A grab sample has certain limitations. In essence, a grab sample takes a snapshot of the characteristics of the water at a specific point and time, so it may not be completely representative of the entire flow.✓
Grab samples are most appropriate for small plants with low flows.✓

Grab samples must be collected carefully to make them as representative as possible of the water as a whole.✓ They should be taken at a time of day when the plant is operating near its average daily flow rate.✓ (5)

6.2.2 A composite sample, also known as an integrated sample,✓ is a sample which consists of a mixture of several individual grab samples collected at regular✓ and specified time periods, each sample taken in proportion to the amount of flow at that time.✓
Composite samples give a more representative sample of the characteristics of water at the plant over a long period of time.✓
The greatest strength of composite samples is their ability to take into account changes in flow and other characteristics of the water over time.✓ (5)

6.3 There are a variety of techniques which can be used to preserve samples during storage to prevent their deterioration,✓including chemical addition and refrigeration.✓

The type of chemical added to a sample will depend on the nature of the test to be performed,✓ but most samples can benefit from refrigeration during storage.✓ When refrigerating samples, keep the temperature at or below 4 ^{o}C but do not allow the samples to freeze,✓ because at this temperature, biological activity is significantly reduced.✓

However, you should be aware that no preservation technique✓ will completely stop biological and chemical action,✓ so samples cannot be preserved for great lengths of time.✓ (9)

[25]

TOTAL: 100

Copyright reserved