higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

WATER TREATMENT PRACTICE N3

1 AUGUST 2019

This marking guideline consists of 5 pages.

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QUESTION 1

1.1 Sedimentation
1.2 Disinfection
1.3 Breakpoint
1.4 Coagulation
1.5 Valve
1.6 Adsorption
1.7 Flocculation
1.8 Actual colour
1.9 Corrosion
1.10 Algae

(10 × 1) **[10]**

QUESTION 2

2.1 2.1.1 0,2 m^3
2.1.2 0,0002 ML
2.1.3 1 900 L
2.1.4 500 000 L
2.1.5 0,5 ML
2.1.6 888 m^3
2.1.7 0,88 ML

(7 × 1) (7)

2.2 2.2.1 $2\ FeC\ell_3$✓ + $3Ca(HCO_3)_2$✓⟶ $2Fe(OH)_3$✓ + $3CaC\ell_2$✓ + $6CO_2$✓ (5)

2.2.2 $NH_3 + HOC\ell \longrightarrow NH_2C\ell$ ✓+ H_2O✓ (2)

2.2.3 $MgCO_3 + Ca(OH)_2 \longrightarrow Mg(OH)_2$ ✓+ $CaCO_3$✓ (2)

2.3 2.3.1 Mr(HOCℓ)✓
= (1 + 16 + 35,5) g/mol✓
= 52,5 g/mol✓ (3)

2.3.2 Mr(CO)✓
= (12 + 16) g/mol
= 28 g/mol✓ (2)
[21]

QUESTION 3

3.1

Chemical	Coagulant or aid	Alkalinity and pH control	Disinfection	Taste and odour	Mineral oxidation	Softening
Aluminium sulphate	X					
Calcium carbonate	X	X				
Calcium oxide		X				X
Chlorine			X	X	X	
Ozone			X	X	X	
Sodium carbonate		X				X
Sodium hydroxide		X				X

(15 × 1) (15)

3.2 $r = \frac{60}{2} = 30 \text{ m}$ ✓

$\text{V} = \pi r^2 h$

$= 3{,}14 \times 30^2 \times 12$ ✓

$= 33\,912 \text{ m}^3$ ✓

$= 33\,912\,000$ litres ✓

$\text{V} = \pi \frac{D^2}{4} h$ ✓

$= 3{,}14 \times \frac{60^2}{4} \times 12$ ✓

(4)

[19]

QUESTION 4

4.1
- Water with high suspended solids content but low colour intensity.
- Water with low suspended solids content but high colour intensity.
- Water with low turbidity, low colour and low in dissolved minerals.
- Resources of which the physical, chemical and bacteriological properties deteriorate annually due to pollution (polluted water resources). (4)

4.2
- Because the water is fed under pressure it is difficult to dose any chemical needed.
- Pressure filters are completely closed and the water and sand are therefore not visible. The efficiency of the backwashing process can thus not be observed.
- The shape of the filter makes an effective wash-water distribution-manifold design impossible.
- Inspection of sand, nozzles, draw-off system, etc. as well as any repairs needed, is difficult.
- Because these units operate under pressure there is always the temptation to pass excessive amounts through. (5)

4.3
- Aeration
- Oxidation with chlorine
- Oxidation with potassium permanganate
- pH adjustment in combination with previous option
- Ion exchange (5)

4.4
- Temperature
- Turbidity
- Colour
- pH
- Alkalinity
- Time and effectiveness of mixing
- Agitation during floc formation
- Characteristics of coagulants being used
- Hydraulic conditions during flocculation (Any 6 × 1) (6)

[20]

QUESTION 5

5.1
- Suspended matter
- Dissolved solids
- Gases (3)

5.2 5.2.1 Backwashing is the reversal of flow through a filter✓ to remove the material trapped within the grains of the media.✓ (2)

5.2.2
- Mud-ball formation
- Filter bed shrinkage and cracking
- Gravel displacement (3)

5.3
- Temperature and viscosity of water
- Size, shape and specific gravity of the particles
- Surface area of the tank
- Effective depth of the tank
- Effective retention time must be long enough to allow floc particles to settle
- Rate of flow through the tank must be fairly slow
- Design of inlet and outlet
- Overflow rate or upward flow velocity (Any 7 × 1) (7)

5.4
- Chlorine is very dangerous.
- It is yellowish-green in colour.
- Chlorine gas in the dry form is not corrosive to metal.
- Chlorine liquid will produce gas at normal temperature.
- Chlorine is a strong oxidising agent. (5)

[20]

QUESTION 6

6.1
- Hydrogen sulphide✓ is removed by aeration or chlorination.✓
- Dissolved oxygen✓ is removed by deaerating or other methods.✓
- Carbon dioxide✓ is removed by adding lime or soda ash.✓ (3 × 2) (6)

6.2
- Alum or aluminium sulphate
- Ferric sulphate (2)

6.3
- Clogged equipment
- Broken diaphragms (2)

[10]

TOTAL: 100

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