higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

WATER TREATMENT PRACTICE N3

30 JULY 2018

This marking guideline consists of 4 pages.

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QUESTION 1

1.1
1.1.1 True
1.1.2 True
1.1.3 True
1.1.4 True
1.1.5 False
1.1.6 False
1.1.7 False
1.1.8 True
1.1.9 True
1.1.10 True

(10 × 1) (10)

1.2
1.2.1 D
1.2.2 J
1.2.3 G
1.2.4 A
1.2.5 B
1.2.6 C
1.2.7 E
1.2.8 I
1.2.9 F
1.2.10 H

(10 × 1) (10)
[20]

QUESTION 2

2.1 2.1.1 Na_2SO_4✓
$M_r(Na_2SO_4) = (23 \times 2) + 32 + (16 \times 4)$✓
$= 46 + 32 + 64$
$= 142$ g/mol✓

2.1.2 $CaCl_2$✓
$M_r(CaCl_2) = 40 + (35,5 \times 2)$✓
$= 111$ g/mol✓

2.1.3 HOCl✓
$M_r(HOCl) = 1 + 16 + 35,5$✓
$= 52,5$ g/mol✓

2.1.4 $CuSO_4$✓
$M_r(CuSO_4) = 63,55 + 32 + (16 \times 4)$✓
$= 159,55$ g/mol✓

(4 × 3) (12)

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2.2 2.2.1 $4Fe$✓ + $3O_2$✓ $\longrightarrow$ $2Fe_2O_3$ ✓ ✓correct balancing (4)

2.2.2 $Mg(HCO_3)_2$✓+ $Ca(OH)_2$✓ $\longrightarrow$ $CaCO_3$ ✓+ $MgCO_3$✓ + $2H_2O$✓ (5)

2.3 Diameter = 30 metres Height = 9 metres
r = $\frac{D}{2} = \frac{30}{2}$ = 15 metres✓
v = πr^2h ✓
= 3,142 × 15^2 × 9✓
= 6 362,55 m^3✓ (4)
[25]

QUESTION 3

3.1 3.1.1 Few calcium✓ and magnesium salts✓ (2)

3.1.2
- $MgSO_4$
- $NaCO_3$
- NaCl (3)

3.1.3
- Calcium bicarbonate
- Magnesium bicarbonate
- Calcium chloride
- Magnesium chloride (4)

3.2 The magnesium sulphate content must be considered together because these ions are normally associated as magnesium sulphate (Epsom salts). Increasing concentrations make the water bitter✓ and cause diarrhoea in humans and animals. Increasing concentrations also affect the taste of the water.✓ People receiving medical attention for diabetes, high blood pressure, etc.✓ should restrict their salt intake and it is therefore important to be aware of the mineral content of the water in their area.✓ Water with a high sodium chloride content is usually corrosive.✓ The ingestion of larger quantity of sodium chloride can induce ✓ irritation of gastrointestinal ✓ tract, vomiting, hypernatremia, respiratory distress, convulsion and death✓ (8)

3.3 3.3.1 Danger, fire-protection equipment, stop buttons and emergency-stop controls

3.3.2 Indicates places where caution should be exercised or places where warnings of hazards are required

3.3.3 Indicates safety/first-aid equipment and colour for starting buttons on machines

3.3.4 Used on the inside surfaces of machine guards or dangerous parts of a machine capable of cutting or shearing, the surfaces of protruding shafts, the faces of gear wheels and any rotating part of a machine

(4 × 1) (4)

3.4
- Excess calcium carbonate
- Magnesium hydroxide scale
- After precipitation
- Carryover of sludge solids
- Unstable water
- Interference with other treatment (6)

3.5 The purpose of sedimentation is to remove settable solids✓ from the water and reduce loading on the filter✓ and subsequent treatment processes.✓ (3)
[30]

QUESTION 4

4.1
- Because the water is fed to the filters under pressure, it is difficult to dose any chemicals which may be needed.✓ It is therefore also difficult to get proper mixing and flocculation.✓
- Pressure filters are completely closed and the water and sand is therefore visible.✓ The efficiency of the backwashing process can therefore not be observed.✓
- The shape of a pressure filter makes it almost impossible to obtain an effective design✓ for the washwater distribution manifold.✓
- Inspection of the sand, nozzles, draw-off system, etc. as well as any repairs which may be necessary is difficult.✓
- Because these units operate under pressure there is always the temptation to pass amounts of water through them.✓ (6)

4.2 DPD is a method where DPD tablets are added to a water sample and the colour obtained is compared against a disc in a Lovibond comparator while the orthotolidine method is followed where chlorine reacts with orthotolidine and a yellow-brown colour is formed. (4)

4.3 Chlorine gas can only occur in water in its free form if the pH of the water is less than 5,0.✓

Cl_2✓ + H_2O✓ ⟶ HOCL✓+ HCl✓

HOCl✓ ⇌ H^+✓+ OCl^-✓ (8)

4.4
- The region where the chlorine is broken down by reducing substances.
- The region where chlorine-organic compounds and chloramines are formed.
- The region where chloramines and chlorine-organic compounds are broken down.
- The last region beyond the break-point where free residual chlorine and a limited amount of organic chlorine compounds, which are not destroyed by excess chlorine, are found. (4)

4.5
- Chlorine added to water
- Chlorine residual remaining after one hour
- Chemical and bacteriological analysis done on water samples (3)

[25]

TOTAL: 100

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