higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

WATER TREATMENT PRACTICE N3

30 JULY 2021

This marking guideline consists of 5 pages.

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QUESTION 1

1.1 1.1.1 Limestone (Calcium Carbonate)

1.1.2 Sulphurous acid

1.1.3 Magnesium Bicarbonate

1.1.4 Slaked Lime Or Calcium Hydroxide

1.1.5 Carbon Monoxide

(5 × 1) (5)

1.2 1.2.1 $Mr(NaOH)$✓ = 23 + 16 + 1✓
= 40 g/Mol✓ (3)

1.2.2 $Mr(Fe_2O_3)$✓ = (56 × 2)✓ + (16 × 3)✓
= 160 g/Mol✓ (4)

1.2.3 $Mr(Na_2CO_3)$✓ = (23 × 2) + 12 + (16 × 3)✓
= 106 g/Mol✓ (3)
[15]

QUESTION 2

2.1
- Bacteria✓ – some cause illness✓
- Algae, protozoa✓ – taste, smell and turbidity✓
- Silt and clay✓ – turbidity✓
- Plants✓ –colour and turbidity✓ (4 × 2) (8)

2.2
- Rainfall that remains after losses due to soil infiltration, evaporation and transpiration.
- Water released from storage
- Water emerging from underground reservoirs (3 × 1) (3)

2.3 2.3.1
- Water hardness is caused pre-dominantly by calcium✓ and magnesium which are polyvalent metallic cations.✓
- It results an increase in soap required to produce a lather when bathing.✓
- It forms scale on heat exchange surfaces such as cooking utensils, hot water, kettles and geysers.✓
- Increasing concentrations make water bitter and cause diarrhoea in man and animals.✓ (5)

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2.3.2
- Iron and manganese are not harmful to human health,✓ but such water has an unattractive appearance when iron is dissolved in water, it is usually present in the unstable ferrously state.✓
- When iron comes into contact with oxygen or some other oxidising agent such as chlorine it forms a red-brown precipitate.✓
- The same thing happens with manganese which forms a brown or black precipitate.✓
- The precipitate stain fabrics and other material when this type of water is used in laundries such water taste unpleasant and cause aesthetic problems.✓ (5)

[21]

QUESTION 3

3.1
- Water –washed diseases / water-scarce diseases
- Waterborne diseases
- Water –based diseased
- Water-vectored diseased (4)

3.2

DETERMINANT	RAW WATER	FINAL WATER	DISTRIBUTION SYSTEM
pH Value	Daily✓	Once / 8 hour shift Daily	Fortnightly✓
Turbidity	Daily✓	Once / 8 hour shift Daily✓	Fortnight
Conductivity or TDS	Daily	Daily✓	Not applicable✓

(6)

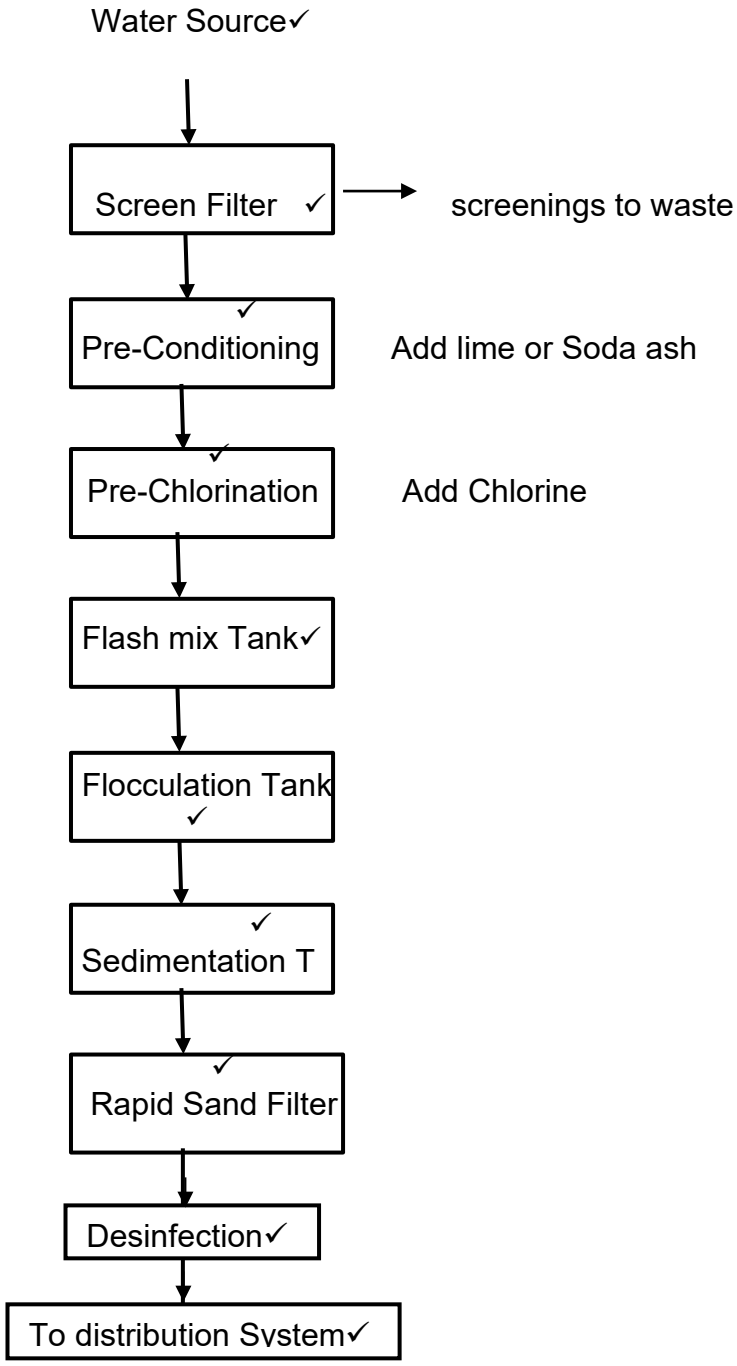
3.3
- Water in the blue and green classes is safe for lifetime use.
- Water in the yellow class may be safe for use under certain conditions but should be used with caution (may affect certain sensitive groups)
- Water into red class should be considered unsafe for use and should be treated.
- Water falling into purple class should be considered unsafe for use and should be treated. (4)

3.4 The Ryznar index is given by RSI = 2 pHS – pH.✓ This value is positive for all waters.✓ A water with an index greater than 7 indicates that scaling✓ is not likely to values greater than 7,5 indicate corrosive properties or tendencies.✓ The value greater than 10 and higher may indicate serious corrosive properties.✓ (5)

[19]

QUESTION 4

4.1



(10)

4.2

- Diaphragm (open)
- Pressure relief valve
- Cold water in pipe
- Hot water out pipe
- Water heating element

(5)

4.3 The purpose of sedimentation is to Remove (settle) suspended material ✓ from the water by means of gravity ✓so that the subsequent filtration can function most effectively. ✓ (3)

4.4 Floc formation in water is the collections of smaller particles that have come together into larger,✓ more settle able particles as a results of flocculation.✓ When the floc formation is distributed in water certain physical and chemical reactions occur.✓ The basic reaction which occurs is the neutralisation of the negative charges on the colloids by the positive charges on the flocculent.✓ Floccules result but are still too small to settle out quickly on their own.✓ (5)

4.5 Theoretical retention time = $\frac{\text{Volume of Tank}✓}{\text{Flow per unit time}✓}$ (2)

[25]

QUESTION 5

5.1 Pre-chlorination

- To oxidise substances such as hydrogen sulphide, iron, manganese and ammonia which occur in raw water
- To control algae and slime organisms in the plant
- Improves coagulation , reduces the load on the filters

Post chlorination

- It involves the chlorination of the final purified water
- To ensure the water is disinfected and free of harmful bacteria
- It can be done at the treatment plant or at points along the distribution line such as reservoirs (6)

5.2

$Cl_2 + H_2O \rightarrow HOCl + ClH$

$2\overset{✓}{\boldsymbol{NH_3}} + 2HOCl \rightarrow 2\overset{✓}{\boldsymbol{NH_2Cl}} + 2H_2O$

$2NH_2Cl + 2HOCl \rightarrow 2\overset{✓}{\boldsymbol{NHCl_2}} + 2H_2O$

$NHCl_2 + 3HOCl \rightarrow \overset{✓}{\boldsymbol{NCl_3}} + 3H_2O$

Or

$$NH_3 \overset{Cl_2}{✓\longrightarrow} NH_2Cl \overset{Cl_2}{✓\longrightarrow} NHCl_2 \overset{Cl_2}{\longrightarrow} NCl_3 ✓$$ (correct formula) (4)

5.3

- Chlorine
- Hypo chlorine
- Chlorine oxide
- Chloramines
- Ozone
- UV irradiation
- Heat (Any 6 × 1) (6)

5.4

- Red (4)

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- Yellow
- Green
- Light orange

[20]

TOTAL: 100

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