higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

WATER AND WASTE-WATER TREATMENT PRACTICE N2

30 November 2023

This marking guideline consists of 5 pages.

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QUESTION 1

1.1 1.1.1 Stabilisation refers to adjusting the pH of water to minimise the effects of corrosion,✓ aggression or precipitation.✓

1.1.2 Backwash is the process of reversing the flow of water back through filter media✓ to remove entrapped solids within the sand.✓

1.1.3 Bacteria are microscopic living organisms✓ usually consisting of a single cell.✓

1.1.4 Filtration is a chemical and physical process used to clarify water by removing suspended and colloidal particles✓ from water by passing it through a porous medium, normally sand.✓

1.1.5 A coagulant is a substance added to destabilise colloids✓ that will cause particles to form flocs.✓

1.1.6 Detention time refers to the time during which an amount of water is retained in a tank✓ at a given rate of flow.✓

1.1.7 Turbidity is an indication of how clear water is.✓ The fewer particles suspended in the water, the clearer the water.✓

1.1.8 Algae are microscopic plants✓ that contain chlorophyll and live floating or suspended in water.✓

1.1.9 Disinfection is a process used to kill most microorganisms in water✓ including all pathogenic bacteria.✓

1.1.10 pH is the measure of the acidity or alkalinity of water,✓ which is the balance of the H^+ and OH^- ions in the water. At a pH of 7 the water is neutral.✓

(10 × 2) (20)

1.2
- pH
- TDS
- Alkalinity
- Temperature
- Calcium concentration (5)

1.3 To determine how much matter in the sample is oxidisable✓ by using potassium permanganate.✓ (2)

[27]

QUESTION 2

2.1
- Disinfection
- Controlling odour and preventing septicity
- Aiding scum and grease removal
- Controlling activated sludge bulking
- Controlling foaming and filter flies
- Stabilising waste-activated sludge prior to disposal
- Scrubbing foul air
- Destroying cyanides and phenols
- Removing ammonia (Any 6 × 1) (6)

2.2 2.2.1 Phosphate can be removed by adding 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.✓

2.2.2 Any type of steel, even stainless steel, is entirely unsuitable for storing, transporting or controlling $FeC\ell_3$.✓ Concrete or cement-like products.✓ Only plastic and rubber-lined materials should be allowed to come into contact with $FeC\ell_3$, including diluted solutions.✓ Once the $FeC\ell_3$ has been added to the raw water, the solution is diluted and no longer a problem.✓

(2 × 4) (8)
[14]

QUESTION 3

3.1 3.1.1 True
3.1.2 True
3.1.3 True
3.1.4 False
3.1.5 True

(5 × 1) (5)

3.2 Floc formation takes place when chemicals are mixed with water and the charges are neutralised.✓ The neutralised particles will be drawn together by Van der Waals forces that are effective when two particles pass very closely.✓ In this way, the particles collect to form larger and bigger particles that can be seen by the naked eye.✓ Floc conditioning takes place when the particles are stirred slowly✓ to bump into one another and stick together to form bigger particles that can be filtered or settled.✓ To achieve this slow stirring, a slow-turning paddle may be used✓or the water may be passed through a long canal with baffles in it✓. As the water moves around the tips of the baffles it mixes because faster flowing water catches up with the water that has been slowed by the baffle✓ and therefore collisions take place.✓ (9)
[14]

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QUESTION 4

4.1 4.1.1 Cylindrical depth = 11 – 3✓
= 8 m✓

Vol = (π × r^2 × H) + (π × r^2 × H/3)✓
= (π × $3,5^2$ × 8)✓ + (π × $3,5^2$ × 3/3)✓
= 346,361 m^3✓ (4)

4.1.2 t = V/Q✓
= 346,361/0,5✓
= 692,722 s/60✓✓
= 11,545 minutes✓ (4)

4.2
- Water:✓ Sludge contains a vast number of organisms both harmful and harmless as well as stabilised organic matter. When sludge is dried, most of these microbes will die because they cannot live without water.✓ Microbes are very important because they eat raw organic material in the wastewater. Later, sludge is left in sludge-drying beds so that it can dry out and therefore become dewatered.✓
- Organic solids:✓ These are found in wastewater and normally comes from animal or vegetable sources. Bacteria generally consume this type of waste.✓
- Inorganic solids:✓ Waste materials such as sand, salt, iron, calcium and other mineral materials are sources of inorganic waste.✓ This type of material is normally removed by means of filters or settles in the sludge-drying beds.✓ (8)

4.3 ZONE 1: Occurs at low dosage. All the chlorine is removed through reaction with reducing compounds✓ and organic matter, and therefore no residual chlorine remains. No disinfection occurs.✓

ZONE 2: Increased dosage reacts with ammonia to form chloramines and other chloro-organic compounds.✓ A residual concentration of 0,1 to 0,5 mg/ℓ of combined chlorine is desirable. Disinfection occurs.✓

ZONE 3: Illustrates the breakpoint where higher chlorine dosages lead to oxidation of chloramine. Higher dosages produce lower residual concentrations.✓

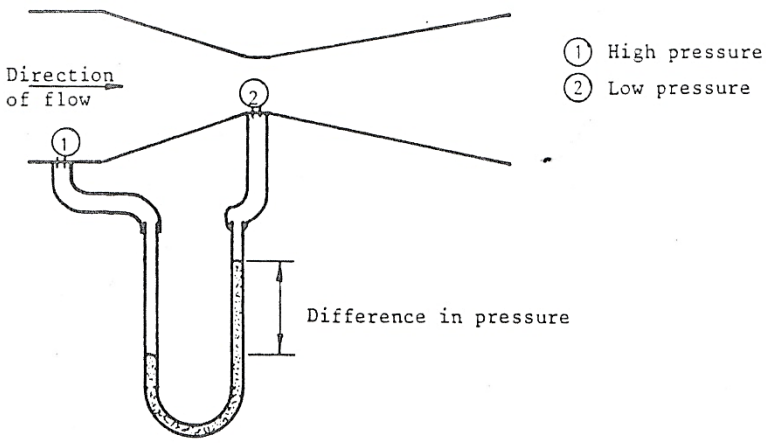
ZONE 4: Any increase in dosage produces free chlorine. A small concentration of combined residual chlorine may also remain, consisting of compounds not destroyed by free chlorine.✓ (6)

4.4
- Supply houses with fresh water.✓
- To remove wastewaters from buildings.✓
- Storm water pipe systems.✓ (3)

[25]

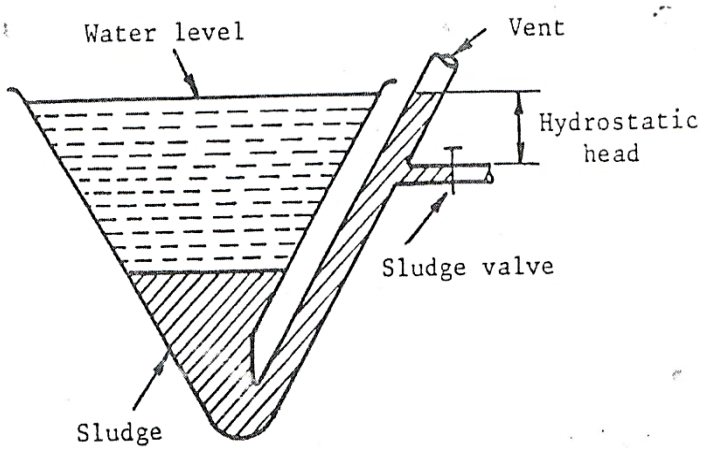
QUESTION 5

5.1 5.1.1



(2 for sketch + 3 for labels) (5)

5.1.2



(2 for sketch + 5 for labels) (7)

5.2
- Colour
- Turbidity
- pH
- Sludge volume
- Determination of solids
- Oxygen absorption
- Temperature (7)

5.3 The sludge volume index is an indication of the ease with which the sludge will settle. (1)

[20]

TOTAL: 100

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