



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

WATER TREATMENT PRACTICE N3

9 April 2021

This marking guideline consists of 5 pages.

QUESTION 1

- | | | | | |
|-----|--------|---|----------|-------------|
| 1.1 | 1.1.1 | <ul style="list-style-type: none"> • Pre-sedimentation is a pre-treatment process used to remove gravel, sand and other gritty material • from raw water before it enters the main treatment. | | |
| | 1.1.2 | <ul style="list-style-type: none"> • Floc is a collection of small particles that have come together into larger more settleable particles • as a result of the coagulation/flocculation process. | | |
| | 1.1.3 | <ul style="list-style-type: none"> • Aerobic organisms require free oxygen in air or dissolved in water in decomposing organic matter • to gain energy for growth and multiplication. | | |
| | 1.1.4 | <ul style="list-style-type: none"> • Jar tests are a laboratory procedure for evaluating coagulation, flocculation and sedimentation processes • used to estimate a proper coagulant. | | |
| | 1.1.5 | <ul style="list-style-type: none"> • A sedimentation tank is a tank in which water is retained to allow settleable matter • such as floc to settle with gravity. | (5 × 2) | (10) |
| 1.2 | 1.2.1 | NH ₄ | | |
| | 1.2.2 | Ca(OH) ₂ | | |
| | 1.2.3 | CaCO ₃ | | |
| | 1.2.4 | NaOH | | |
| | 1.2.5 | NaHCO ₃ | | |
| | 1.2.6 | H ₂ SO ₄ | | |
| | 1.2.7 | Na ₂ CO ₃ | | |
| | 1.2.8 | Na ₂ SO ₄ | | |
| | 1.2.9 | FeCl ₃ | | |
| | 1.2.10 | CaO | (10 × 1) | (10) |
| | | | | [20] |

QUESTION 2

- | | | | | |
|-----|-------|----------|---------|-----|
| 2.1 | 2.1.1 | Chemical | | |
| | 2.1.2 | Physical | | |
| | 2.1.3 | Chemical | | |
| | 2.1.4 | Toxic | | |
| | 2.1.5 | Toxic | (5 × 1) | (5) |

- 2.2
- Check for any unusual noises or excessive vibration.
 - Check all pump connections for evidence of leaking.
 - Check the pump for overheating.
 - Check the suction strainer and clean if necessary.
 - Be especially alert for unusual sounds when pumping liquids containing solids.
- (5)
- 2.3
- Pump not properly primed
 - Suction head too large
 - Air leakages at inlet pipes and packed stuffing boxes
 - Strainer blocked, and liquid cannot flow to pump casing ✓
 - Pump speed too low for pressure build-up
 - Pump may be badly worn or there may be another mechanical fault
 - Strainer not properly submerged under water thus permitting air to be drawn in with water
- (7)
- 2.4
- Mostly requires no treatment
 - Cheaper than impounding reservoirs
 - The available amounts are more certain (i.e. they are not affected by draught in the short run)
- (3)

[20]**QUESTION 3**

- 3.1
- Bacteria
 - Algae/protozoa
 - Silt and clay
 - Plants
- (4)
- 3.2
- Dysentery
 - Polio
 - Trachoma
 - Arsenicosis
 - Thyroid fever
 - Cholera
 - Diarrhoea
- (Any 4 × 1) (4)
- 3.3
- Personal health and safety
 - Representative sample collection
 - Keep record of all samples collected
- (3)
- 3.4
- 3.4.1 $\text{Fe}(\text{HCO}_3)_2 \checkmark + 2\text{Ca}(\text{OH})_2 \checkmark \longrightarrow \text{Fe}(\text{OH})_2 \checkmark + 2\text{CaCO}_3 \checkmark + 2\text{H}_2\text{O} \checkmark$
(✓ for correct balancing) (6)
- 3.4.2 $\text{Cl}_2 + \text{H}_2\text{O} \checkmark \longrightarrow \text{HOCl} \checkmark + \text{HCl} \checkmark$ (3)

[20]

QUESTION 4

- 4.1
- Addition of the flocculants
 - Initial formation of floccules
 - Conditioning (flocculation)
- (3)
- 4.2
- Gas
 - Granular form (powder form)
- (2)
- 4.3
- Temperature
 - Turbidity
 - Colour
 - pH
 - Alkalinity
 - Time and effectiveness of mixing
 - Agitation during floc formation
 - Characteristics of coagulants being used
 - Hydraulic conditions during flocculation
- (Any 5 × 1) (5)
- 4.4
- $$r = \frac{D}{2} = \frac{40}{2} = 20m \checkmark$$
- $$V = \pi r^2 h$$
- $$= 3,142 \times (20)^2 (6) \checkmark$$
- $$= 7540,8 \text{ m}^3 \checkmark$$
- (3)
- 4.5
- $$12 \text{ l/s} = 12 \times 60 = 720 \text{ l/min} \checkmark$$
- $$\frac{720}{1000} = 0,72 \text{ m}^3/\text{min}$$
- $$\frac{7540,8 \text{ m}^3}{0,72 \text{ m}^3 \text{ min}} = \frac{10473,333 \text{ min}}{60} \checkmark$$
- $$= 174,555$$
- $$= 175 \text{ hrs} \checkmark$$
- (3)
- [16]**

QUESTION 5

- 5.1
- Desalination of brackish water supplies and seawater can be very costly.
 - Some of the processes of removing salts from water are distillation, demineralisation, electro dialysis, reverse osmosis, etc.
 - Reverse osmosis and electrodialysis are used to desalt brackish groundwater
 - or to reduce the concentration of contaminants such as nitrate and fluoride.
- (4)

- 5.2
- Differential pressure and filter runs
 - Volume of wash water used and time backwashed
 - To avoid deterioration of filtered water it is important to see whether the air and water are evenly distributed over the sand bed
 - Check for mud balling
 - Measure the filter bed at least twice per year and record the depth
 - Brush the filter walls daily to keep it free from growths
 - Regularly measure and record turbidity of filtered water
 - Regularly fill recording instruments with ink and change flow charts
- (Any 5 × 1) (5)
- 5.3
- Open the water supply to the injector.
 - Start the pump and check to see that the needed pressure is obtained.
 - Open the valve on the chlorine cylinder.
 - Note the mass of the mass.
 - Check whether the pressure gauge and vacuum gauge are registering correctly.
- (5)
- 5.4
- Saturation index = pH – pHs
 - If the index is zero the water is in chemical equilibrium
 - If the index is positive the water has scale forming properties.
 - If the index is negative the water has corrosive properties.
- (4)
- 5.5
- Paint the object.
 - Apply oil, grease, Vaseline or lard.
 - Metal coating
 - Hot dipping – dip mild steel into molten zinc to produce galvanisation.
 - Electroplating
 - Spraying coatings such as tin, copper, aluminium, etc. onto base metals.
 - Nonmetallic coating: anodising, chromating, etc.
- (Any 6 × 1) (6)
- [24]**
- TOTAL: 100**