higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

WATER AND WASTE-WATER TREATMENT PRACTICE N2

14 April 2021

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 poisoning
1.2 bulk fluid
1.3 anaerobic
1.4 Chemical
1.5 composite

(5 × 1) **[5]**

QUESTION 2

2.1 2.1.1 pH is a measure of the acidity or alkalinity of water✓ that is the balance of H^+ and OH^- ions in the water.✓

2.1.2 Turbidity refers to the clarity of water.✓ The fewer particles suspended in water, the clearer the water will be.✓

2.1.3 The activated sludge process is a process of treating sewage and industrial waste water✓ using air and biological floc composed of bacteria and protozoa.✓

2.1.4 Laterite is a clay-like soil horizon rich in iron and aluminium oxides✓ formed by the weathering of igneous rocks in moist warm climates.

2.1.5 A grab sample, also known as a catch sample,✓ consists of a single sample taken at a specific time.✓

(5 × 2) (10)

2.2 2.2.1

- Measuring device must be robust, resistant to acids,✓
- Not block easily and be able to register a wide range of flows.✓
- Most commonly used measuring device is a venturi-type measuring flume.✓
- The venturi restriction causes the water upstream of it to rise to a particular height for a particular flow.✓
- The flow can be read manually from a graduated scale, registered by a float, an electrical sensor or by an ultrasonic device and converted into a flow.✓

2.2.2

- Handraked screens are normally used on smaller works although find on larger works as well, especially as a standby to mechanically raked screens.✓
- Screens are placed in an inclined position across a channel.✓
- Screens are usually constructed of flat mild-steel bars spaced at 20mm to 50 mm centres.✓
- Screens are raked as often as necessary to maintain a clear flow through them.✓
- Screenings are sorted on a draining slab and any excreta or soft paper is returned to the main flow.✓

(2 × 5) (10)
[20]

QUESTION 3

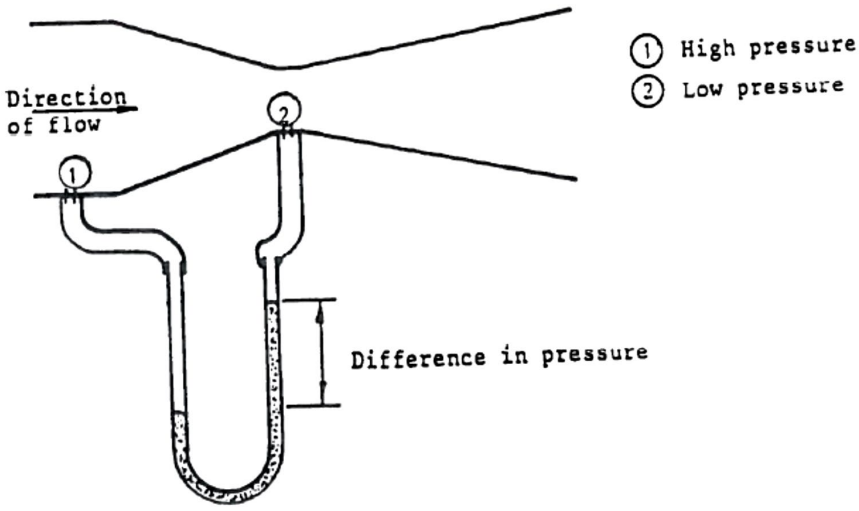
3.1 3.1.1 Coagulation is the chemical process that involves a neutralising charge to the particles. ✓This occurs when a coagulant is added to water to destabilise colloidal suspensions.✓ (2)

3.1.2 Clarification is the removal of suspended solids✓ through gravity settling. ✓ (2)

3.1.3 Filtration removes suspended matter,✓ which can consists of floc, microorganisms, algae, silt, iron and manganese precipitates from groundwater sources✓ as well as precipitants that remain after the softening process.✓ These suspended materials are filtered out when water passes through beds of granular material, usually composed of layers of sand, gravel, coal, garnet or related substances.✓ (4)

3.1.4 During disinfection disease-causing organisms are destroyed or disabled.✓ Chlorine is the most common disinfectant because it is practical, effective and economical.✓ (2)

3.2



(4 for labels + 1 for correct diagram) (5)

3.3 Water flowing through an insulated tube passes through an induced magnetic field which is at right angles to the line of flow.✓ According to Faraday's law, an emf is generated by a conductor moving in an electromagnetic field.✓ A potential difference is therefore setup between two electrodes placed at right angles to both the magnetic field and the direction of flow.✓ The greater the flow, the greater the potential difference (pd).✓ The potential difference is transmitted to a recorder which converts the signal and displays the flow rate.✓ (5)
[20]

QUESTION 4

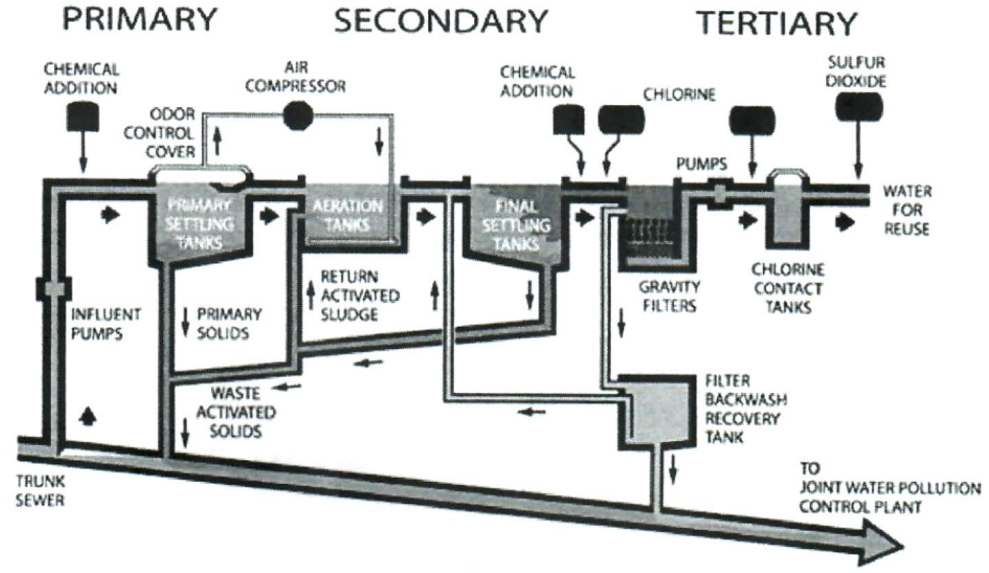
4.1
- Adjusting the treatment and type and volume of reagents used✓ to the characteristics of the water or residues✓
- Ensuring the regular supply of treatment products,✓ correct storage✓ and maintenance of recipients✓ and dosing device✓
- Controlling the elimination of waste and by-products✓
- Controlling the efficiencies of the processes✓ and establishing✓ and monitoring critical control points✓ (10)

4.2 Aluminium sulphate is a metal salt.✓ When it is added to water it ionises to form $A\ell^{3+}$ ✓and SO_4^{2-} ions.✓ When a metal salt dissolves in water, it makes the water more acidic so that it becomes necessary to add a basic substance to maintain the pH.✓ Aluminium sulphate may be obtained as a solid or as a liquid.✓ Aluminium sulphate can treat most types of water and is an excellent flocculent for removing colour from water.✓ (6)

4.3
- Hydrolysis
- Acidogenesis
- Acetogenesis
- Methanogenesis (4)
[20]

QUESTION 5

5.1



(13 marks for label + 2 for correct diagram) (15)

5.2

- Size, shape and weight of floc
- Temperature and viscosity of water
- Design of inlet and outlet works
- Average effective time available for sedimentation
- Effective depth of the tank
- Area of the tank
- Rate of overflow
- Rate of flow (Any 5 × 1) (5)

[20]

QUESTION 6

6.1 6.1.1

- Tanks can be used in conjunction with zigzag or baffled canals or some other form of flocculator.✓
- Flocculated water is admitted at one end of the rectangular tank and flows horizontally to the opposite end where it is drawn-off.✓
- Tanks have hoppers at the bottom in which the sludge concentrates or thickens and from where it may be drawn off by opening one or more valves.✓
- Tanks may only have hoppers at the inlet side and a flat or slightly sloping bottom rising to the opposite side fitted with a scraper that moves the sludge towards the hopper.✓

6.1.2

- Tanks may be circular or square in plan, having a conical or pyramidal base respectively with a single inlet at the centre of the tank or at below the level where the sides begin to slope.✓
- The off-take is around the top perimeter or, if the tank is square, it can also be at intervals across the top of the tank.✓
- Tanks are operated on the sludge-blanket principle.✓
- The force exerted by the rising water on the floc particles is balanced by the force of gravity acting downwards and a deep layer of particles forms.✓

6.1.3

- Tanks can be seen as two concentric tanks. The centre tank is for the conditioning of the floc and normally fitted with paddles which slowly rotate.✓
- Water to which the chemicals have been added, enters the chamber where the floc forms, it moves through holes or slots in the chamber wall into the outer tank where sedimentation takes place.✓
- A scraper that rotates around the tank moves the sludge to one or more hoppers in the floor from where it can be withdrawn via valves.✓
- The clear water flows over a weir and is collected in a flume or channel running around the circumference of the outer tank.✓

(3 × 4) (12)

6.2 Sampling is the process used to select a small portion of water or waste water✓ for the purpose of determining the characteristics✓ of an entire batch of water or waste water.✓ (3)

[15]

TOTAL: 100

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