higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS TECHNOLOGY
NQF LEVEL 3

2 December 2024

This marking guideline consists of 5 pages.

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SECTION A

QUESTION 1

1.1 B
1.2 D
1.3 A
1.4 C
1.5 B

(5 × 1) **[5]**

QUESTION 2

2.1 True
2.2 False
2.3 False
2.4 True
2.5 True

(5 × 1) **[5]**

QUESTION 3

3.1 H
3.2 A
3.3 C
3.4 F
3.5 E

(5 × 1) **[5]**

TOTAL SECTION A: 15

SECTION B

QUESTION 4

4.1 4.1.1 Sulphuric acid (1)

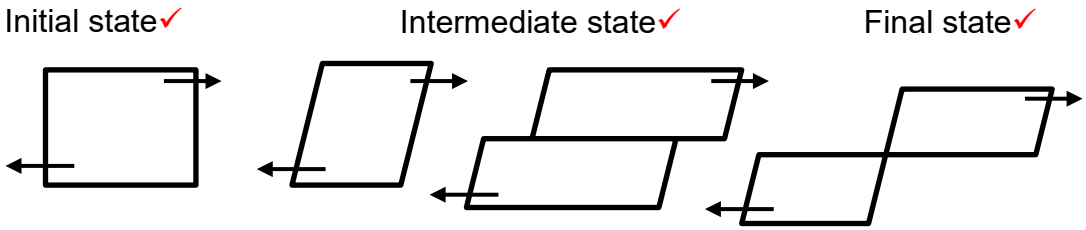
4.1.2 $H_2SO_4 = (1 \times 2) + 32 + (16 \times 4)$✓
$= 98$ g/mol✓ (2)

4.1.3
- Inhalation
- Ingestion
- Skin contact
- Eye contact

(Any 3 × 1) (3)

4.1.4
- Avoid runoff into storm sewers and ditches which lead to waterways.
- Clean up spills immediately, observing precautions in the protective equipment ventilation.
- Provide ventilation.
- Use water to reduce vapours, do not place water directly on a leak, spill area or inside the container.
- Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading and contact with water.
- Keep combustibles (wood, paper, oil, etc.) away from spill material. (6)

4.2.



(3)
[15]

QUESTION 5

5.1 5.1.1 Chemical fouling is the deposit of unwanted material✓ produced by chemical reactions within the process fluid.✓

5.1.2 Precipitation fouling is the build-up of unwanted materials✓ due to the settling of dissolved salts in the process fluid.✓

(2 × 2) (4)

5.2 Fin fan or air cooler/heater. (1)

5.3
- The plant can be anywhere and the air cooler/heater can easily be built over equipment in order to save space.
- It has lower environmental impact than other heat exchangers because no water is required for the cooling system.
- Less maintenance is needed, meaning that there is a reduction in maintenance costs.
- If a power failure occurs, air coolers/heaters will continue to operate due to radiation and heat convection air circulation.
- It is simple to install because there is no water piping or it is an easy bolted assembly.
- The high cost of water is eliminated. (6)

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5.4
- For the same amount of heat generation, natural gas combustion generates 30% less carbon dioxide than burning oil and 45% less than burning coal.
- It is a very cheap source of fuel.
- It can be stored and burned safely.
- There are a lot of reserves in nature that have not been used.
- It produces no ash.
- Vehicles that run on natural gas emit 60–90% less pollutants. (6)

5.5
- Conduction
- Convection
- Radiation (3)

5.6 The heat source of ire-tube boilers is inside the tubes while water to be heated is outside✓✓and water-tube boilers have the heat source outside with the water to be heated inside the tubes.✓✓ (2 × 2) (4)

5.7
5.7.1 Combustion takes place✓✓

5.7.2 Separates the steam from heated water✓✓

5.7.3 Reduces energy consumption✓✓

(3 × 2) (6)

5.8
- Stack thermometer
- Digital thermometer
- Smoke pump
- Combustion testing kit
- Psychrometer (5)

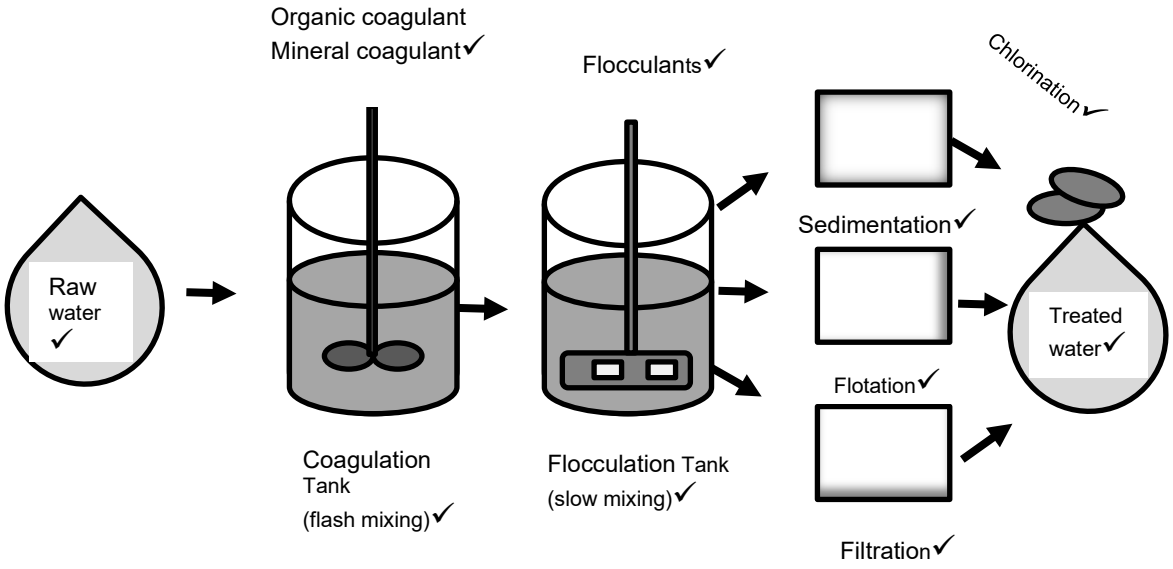
[35]

QUESTION 6

6.1 The function of coagulation is to overcome the factors that promote the stability of a mixture.✓✓ (2)

6.2
- Remove bacteria viruses and other small organic matter.
- Remove trace amounts of oils in industrial waste water.
- Remove process material from paper mill waste water. (3)

6.3



(1 mark for correct labelling of each step) (10 × 1) (10)

6.4 6.4.1 A membrane is a thin layer of material, acting as a physical barrier to separate substances✓ when a force is applied to it.✓

6.4.2 Permeability is the ability of a material to let fluids through.✓✓
(2 × 2) (4)

6.5
- Symmetric membrane
- Asymmetric membrane (2)

6.6
- Dead-end mode
- Cross-flow mode (2)

6.7
- The separation of suspended solids, colloids, bacteria and viruses
- Pre-treatment of water for nanofiltration or reverse osmosis
- The production of high-purity water in the biochemical, food and beverage and biopharmaceutical industries
- Paint recovery in automotive industries
- Protein isolation
- Removal of colloidal particles
- Pre-treatment of water for reverse osmosis
- Fractionation, concentration and purification purposes (8)

6.8
- Colloidal
- Biological
- Organic
- Scaling (4)

[35]

TOTAL SECTION B: 85
GRAND TOTAL: 100

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