higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# MARKING GUIDELINE

## NATIONAL CERTIFICATE (VOCATIONAL)

## PROCESS TECHNOLOGY
## NQF LEVEL 3

## 18 February 2025

**This marking guideline consists of 7 pages.**

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## SECTION A

### QUESTION 1

1.1 D
1.2 A
1.3 B
1.4 C
1.5 C

(5 × 1) **[5]**

### QUESTION 2

2.1 True
2.2 True
2.3 False
2.4 True
2.5 True

(5 × 1) **[5]**

### QUESTION 3

3.1 E
3.2 G
3.3 A
3.4 J
3.5 B

(5 × 1) **[5]**

**TOTAL SECTION A: 15**

## SECTION B

## QUESTION 4

4.1 Absorption is the process or action by which one thing soaks up or is soaked by another or taken up by another substance.✓ (1)

4.2.
- Blending of homogeneous liquids
- Suspending solids
- Blending and emulsifying of liquids
- Dispersing of gas in liquids
- Homogenising viscous and complex liquids
- Transferring heat (Any 5 × 1) (5)

4.3. $\rho = \frac{mass}{volume}$

$m_{water} = \rho \times volume$
$= 1000 \times 0.7$✓
$= 700$ kg✓

$Mass\%_{salt} + mass\%_{water} = 100$✓

$X_{salt} + X_{water} = 1$✓
$X_{water} = 1 - X_{salt}$
$= 1 - 0.6$
$= 0.4$✓

$m_{water} = mass\%_{water} \times m_T$
$m_T = \frac{m_{water}}{X_{water}}$✓
$= \frac{700}{0.4}$✓
$= 1750$ kg✓

$m_{salt} = m_T - m_{water}$
$= 1750 - 700$✓
$= 1050$ kg ✓ (9)

**[15]**

## QUESTION 5

5.1
- Visually inspect the parts for defects.
- Mark the defective parts using one of the marking methods.
- Record the defects.
- Report the defects. (4)

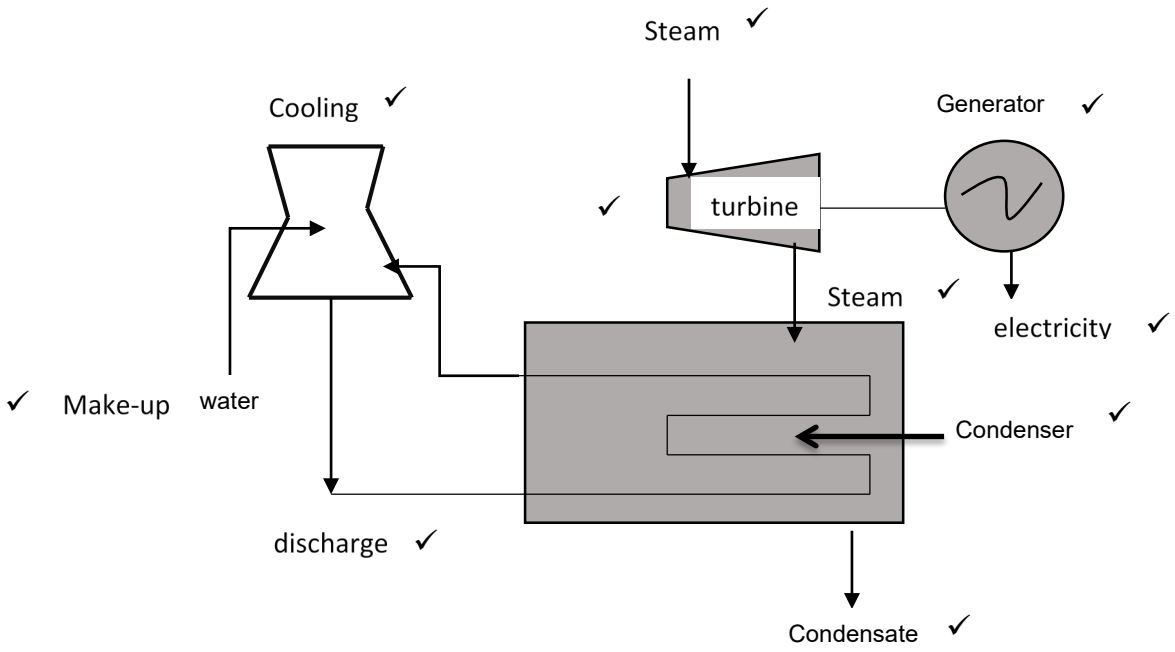
5.2
- The age of the material
- The type of the tower
- The materials used in construction
- Weather effects
- The water treatment
- Exceeding the pressure limit
- Debris, such as sludge build-up, accumulating on the packing. (7)

5.3.1 Fouling is a build-up of various kinds of deposits✓ on the internal surface of the cooling tower.✓ (2)

5.3.2
- Fouling may be caused by impurities in the fluids passing through a cooling tower.
- Calcium dissolved in the water is a major cause of scale formation in some cooling tower components.
- Extremely small plants and animals such as algae and bacteria can grow on the parts and form slime.
- Besides solids contaminants, other impurities such as dissolved gases can react with the metal in a cooling tower and cause corrosion products to build up.
- When fouling substances accumulate on the tube walls of a cooling tower, they form a layer of material that reduces the effectiveness of heat transfer through the tubes.
- An excessive build-up on the tube walls can be also reduce the size of the tube openings and restrict the flow of fluids through the tubes. (Any 3 × 1) (3)

5.4
- Engraving
- Punching
- Labelling
- Inking
- Colour (5)

5.5




(10)

5.6
- The plant can be anywhere and their air cooler/heater can be easily being built over other 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.
- If power failure happens, air cooler/heaters will continue to operate due to radiation and heat convection air circulation.
- It is simple to install because there is no water piping.
- The high cost of water is eliminated. (Any 4 × 1) (4)

**[35]**

**QUESTION 6**

6.1
- Flow meters
- Pressure gauge
- pH meters (3)

6.2 A single bed contains only one type of resin which is either a cation or an anion resin, which are also used to initially treat incoming water supply ✓whereas the mixed bed contains both resin types mixed together✓ which are used to purify the water further to a high quality. (Any 2 × 2) (4)

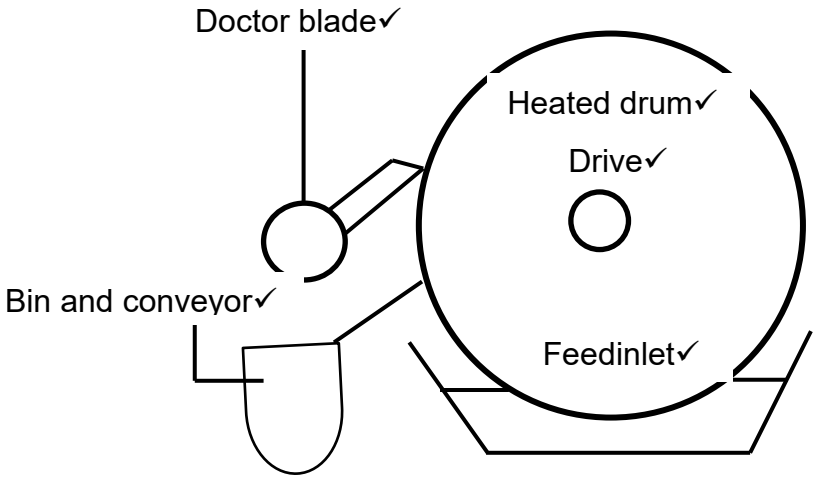
6.3 6.3.1 Fuller's earth is a type of clay used to remove impurities✓ from fats and oil.✓

6.3.2 Polar molecules are molecules in which there is separation of charge in the chemical bonds,✓so that one part of the molecule has a slight positive charge and the other and the other a slight negative charge.✓

(2 × 2) (4)

6.4
- Dyes and pigments
- Plastics
- Foodstuffs
- Cellulose products
- Chemicals (agricultural, speciality, fine)
- Pharmaceutical products
- Inorganic and organic chemicals (Any 2 × 1) (2)

6.5 A drum dryer




(1 mark for correct diagram and 4 marks for any correct labelling) (1 + 4) (5)

6.6
- The inside of a rotating drum is heated to a very high temperature, usually using steam.
- A suitable feed mechanism is used to supply the feed to the outer surface of the dryer.
- The product or solution covers the drum and heat from the dryer surface heats it up, making sure that the liquid from the feed is changed into a vapour.
- The liquid vaporises as the product comes into contact with the drum and more vaporisation happens as the drum rotates.
- The vapour is removed using vents and the dried product is scraped off the drum with the doctor blade.
- The drum does not stop rotating and some products are dried in a single rotation.
- The steam in the dryer condenses and is removed to allow more steam to come into the drum and continue heating it.
- The vapour produced is also removed by vents usually just above the drums and used for other processes.
- The operation of the drum dryer is controlled by adjusting the heat applied as well as the rotation speed of the drum. (9)

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6.7
- Flow rate per day
- The number of effective cycles in the adsorbent's life
- The operation pressure
- The operation temperature
- A fixed amount of time in months (5)

6.8
- Batch method
- Column or tower method (2)

6.9
- Exposing the resin to strong oxidisers like chlorides shortening the life of resin.
- Using wrong chemicals to clean the resin can result in the breakdown of the resin.
- Hydrogen peroxide
- Nitric acid
- Chromic acid
- Chloric acid (Any 1 × 1) (1)

**[35]**

**TOTAL SECTION B: 85**
**GRAND TOTAL: 100**

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