higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS TECHNOLOGY
NQF LEVEL 3

XX February 2020

This marking guideline consists of 5 pages.

Copyright reserved

SECTION A

QUESTION 1

1.1 A
1.2 A
1.3 D
1.4 C
1.5 B

(5 × 1) **[5]**

QUESTION 2

2.1 True
2.2 False
2.3 True
2.4 True
2.5 True

(5 × 1) **[5]**

QUESTION 3

3.1 ion exchange
3.2 Flocs
3.3 inert
3.4 diffusion
3.5 Dirt impurities

(5 × 1) **[5]**

TOTAL SECTION A: 15

SECTION B

QUESTION 4

4.1 Batch mixing is the mixing of various ingredients in a specific sequence to produce a homogenous material. (2)

4.2 Solid-removal equipment is a simple cylindrical gravity settling tank✓ with a cone-shaped bottom.✓ The material is fed into the tank and allowed to stand for a while.✓ The liquid is then drawn off at the top✓ while the solids are removed from the bottom of the tank.✓ Other solid-removal methods include centrifuges.✓ (6)

4.3
- Insert the samples into the product.
- Pull up the handle at the required depth.
- The sample will be drawn into the samplers.
- Withdraw the samples.
- Push the handle down to expel the sample. (5)

4.4
- Beakers
- Spatulas
- Measuring containers (Any 2 × 1) (2)

4.5
- Gas-fired burners
- Oil burners
- Coal-fired burners
- Wood-fired burners (4)

4.6
- Coal-fired burning causing lung cancer
- Coal burning until a large amount of sulphur causes acid rain
- Contamination of land and waterways
- Coal-fired power plants without effective fly-ash capture causing radiation exposure
- Climate change due to carbon dioxide in the atmosphere (5 × 2) (10)

4.7 Liquefied petroleum gas (1)

[30]

QUESTION 5

5.1
- Counter-flow cooling towers
- Cross-flow cooling towers
- Spray-filled cooling towers (3)

5.2 This system is used in plants situated close to large water bodies.✓ Water is pumped from the water source to the condensers.✓ The used water is discharged at a point away from the intake to prevent recycling of warm-water discharge.✓ Open systems have high flow rates✓ and relatively low temperature rises to limit the rise in temperature.✓ (5)

5.3
- Fouling
- Debris
- Humidity
- Environmental heat
- Splashback damage
- Corrosion and leakage
- Poor water distribution
- Nozzle blockage
- Cooling tower water contamination
- Cooling tower water quality (Any 5 × 1) (5)

Copyright reserved

5.4
- Hand tools
- Power tools
- Hydraulic drills
- Pneumatic tools
- Workshop equipment such as compressors and hoists
- Consumables like oil
- Materials such as nuts and bolts (Any 5 × 1) (5)

5.5 Combustion is the chemical reaction between oxygen and fuel. (2)

5.6
- A dry product is lighter than a wet product making it less expensive and easier to handle and transport.
- Dry products can be reserved longer than wet products.
- Product yields and assays can be calculated from a sample of dry products.
- Drying is often needed to make products compatible with downstream processes. (4)

5.7
- A single drum dryer has one drum.
- Double-drum dryers have two drums rotating outwards.
- Twin-drum dryers have two drums rotating inwards. (3 × 2) (6)

[30]

QUESTION 6

6.1
- Cast iron
- Gun metal
- Stainless steel (3)

6.2 The inside of a rotating drum is heated to a very high temperature 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, changing the liquid from the feed 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 a doctor blade.✓ The drum does not stop rotating and some products are dried in a single rotation.✓ The dry product is either dropped into a bin or onto a conveyer system.✓ 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.✓ (10)

6.3
- It can be done by taking samples of the product and sending it to a lab to be analysed.
- It can be done by instruments plated in the product flows to measure the concentration of a certain chemical.
- Some systems divert a small stream of fluid that can be analysed by viscosity or by processing the fluid to determine the constituents.
- The quality or concentration of the products can also be determined by using chromatography. (4 × 2) (8)

6.4
- Columns with freeboard: The freeboard design has extra space above the resin bed that allows backwashing.
- Packed-bed columns: Columns that do not have space for backwashing are known as packed-bed columns that have only enough space for swelling of the resin during operation. (4)

[25]

TOTAL SECTION B: 85
GRAND TOTAL: 100

Copyright reserved