higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS TECHNOLOGY
NQF LEVEL 4

21 November 2023

This marking guideline consists of 6 pages.

Copyright reserved

SECTION A

QUESTION 1

1.1 D
1.2 B
1.3 A
1.4 A
1.5 C

(5 × 1) **[5]**

QUESTION 2

2.1 C
2.2 H
2.3 D
2.4 E
2.5 B

(5 × 1) **[5]**

QUESTION 3

3.1 True ✓✓
3.2 True ✓✓
3.3 False ✓✓
3.4 True ✓✓
3.5 False ✓✓
3.6 True ✓✓
3.7 True ✓✓
3.8 True ✓✓
3.9 True ✓✓
3.10 True ✓✓

(10 × 2) **[20]**

TOTAL SECTION A: 30

Copyright reserved

SECTION B

QUESTION 4

4.1 4.1.1 It is a process where the boiling of the product on the heating surface must be avoided due to the fouling characteristics of the product or the formation of crystals. ✓✓

4.1.2 To bring the solution entering the system close to its boiling point.✓✓

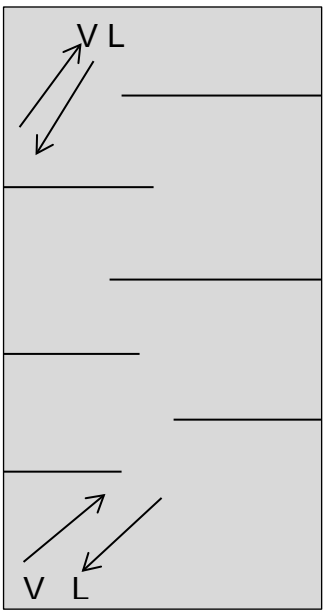
4.1.3 There will not be any movement of the feed into the heat exchange tube or the liquid will not be transported through the exchange tube into the heat exchanger. ✓✓

(3 × 2) (6)

4.2
- Fouling
- Leakages
- Vibration
- Mechanical failure (Any 3 × 1) (3)

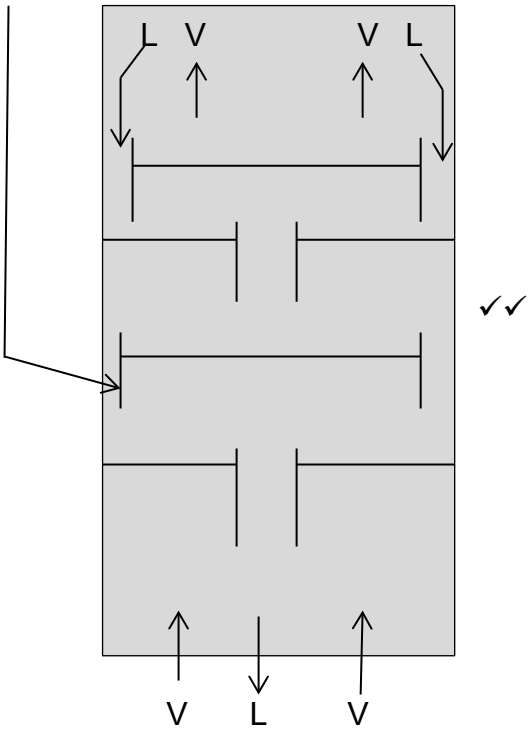
4.3
- To purify water
- To separate oils and spirits (2)

4.4 4.4.1



✓✓

4.4.2 Downcomer



✓✓

(2 × 2) (4)

4.5 Excessive corrosion. (1)

4.6 4.6.1 Clean the equipment continuously. ✓✓

4.6.2
- Controlling the amount of fouling present in the system ✓
- Lining the interior of the exchange tubes with anti-corrosive coatings. ✓

(2 × 2) (4)
[20]

QUESTION 5

5.1 5.1.1 $Area_{tube} = \pi r^2$ ✓

$= 3,14 \times (20\ mm/1000)^2$
$= 3,14 \times (0,02\ m)^2$ ✓
$= 0,00126\ m^2$ ✓

$Q_m = 100\ kg/s$
$\rho = 1\ 000\ kg/m^3$
$A = 0,00126\ m^2$
$U = ?$

$Q_m = \rho AU$ ✓
$U = Qm/\rho A$
$=100\ kgs^{-1}/1\ 000\ kg/m^3 \times 0,00126\ m^2$ ✓
$= 100\ kgs^{-1}/1,26\ m$
$= 79,365\ m/s$ ✓ (6)

5.1.2 Q_m = 100 kg/s ✓ 6 minutes = 6 × 60 = 360 s ✓
= 100 kg/s × 360 ✓
= 36 000 kg of water ✓

Since 1 000 kg of water = 1000 ℓ
Therefore 3 6000 kg = 36 000 ℓ ✓ (5)

5.2 5.2.1 Atomic weight = 14 + (1 × 4) + 16 + 1 ✓
NH_4OH = 35 g/mol ✓ (2)

5.2.2 Atomic weight = (27 × 2) + [12 + (16 × 3)] × 3 ✓
$Al_2(CO_3)_3$ = 54 + [12 + 48] × 3 ✓
= 234 g/mol ✓ (3)

5.3
- A *chemical equation* is a representation of real chemical reaction with the reactants on the left side of the arrow and products on the right hand side. ✓✓
- A *chemical reaction* is a process that involves the separation or combination of different atomic elements. ✓✓

(4)
[20]

QUESTION 6

6.1 6.1.1 Control mass system. ✓✓

6.1.2 Steady system or balanced system. ✓✓

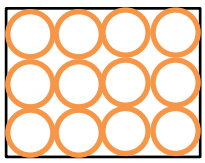
6.1.3 Control volume system. ✓✓

(3 × 2) (6)

6.2
- Conduction
- Convection
- Radiation

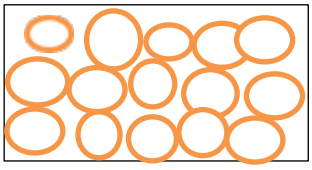
(3)

6.3 6.3.1

 ✓

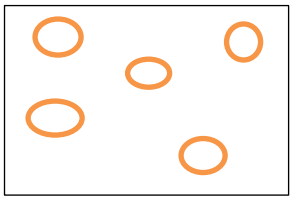
Particles are closely packed and cannot move around but only vibrate. ✓✓

6.3.2

 ✓

Particles are spaced together but move around and do not vibrate.✓✓

6.3.3

 ✓

Particles are far apart from one another and some are ionized. ✓✓
(3 × 3) (9)

6.4 It is the energy required to raise the temperature of one kilogram of a substance by one degree Celsius. ✓✓ (2)
[20]

QUESTION 7

7.1
- Have a smoother texture.
- Much harder and more brittle than thermoplastics.
- Their properties change when heated and do not soften when reheated.
- Stretch and elongate poorly.
- Have higher strength than thermoplastics.
- Have lower density than metals but slightly higher than thermoplastics with density between 1500 and 2000 kg/m^3. (Any 3 × 1) (3)

7.2 It is a thermal property that explains how the material reacts when heated. ✓✓ (2)

7.3 7.3.1 They are used to make small flat machine parts. ✓✓

7.3.2 They are used as supporting structures or they can carry lighter loads like plated roofs. ✓✓
(2 × 2) (4)

7.4
- Gears and bearings
- Weaponry and amour
- Small machine components
- Construction maintenance
- Bolts
- Pipe fittings (Any 1 × 1) (1)

[10]

TOTAL SECTION B: 70
GRAND TOTAL: 100

Copyright reserved