higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS TECHNOLOGY
NQF LEVEL 4

10 November 2022

This marking guideline consists of 5 pages.

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SECTION A

QUESTION 1

1.1 B
1.2 B
1.3 D
1.4 A
1.5 C

(5 × 3) **[15]**

QUESTION 2

2.1 Desalination
2.2 bottom
2.3 stripping
2.4 Mass
2.5 deposition

(5 × 1) **[5]**

QUESTION 3

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

(10 × 1) **[10]**

TOTAL SECTION A: 30

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SECTION B

QUESTION 4

4.1 Smaller coils are used for evaporation of viscous liquids ✓✓ while larger coils are used to distil water fed into boilers on power plants. ✓✓ (4)

4.2
- By pumping a liquid at higher speed.
- By keeping the liquid under high pressure to prevent early evaporation. (2)

4.3 4.3.1 Shell and tube condenser. (1)

4.3.2
A – Coolant outlet
B – Coolant inlet
C – Vapour inlet
D – Baffles
E – Incondensable outlet
F – Condensable
G – Tubes (7)

4.3.3 Ensures that any vapour that condenses goes to the bottom of the shell ✓ where the liquid can be extracted. ✓ (2)

4.4
- Primary absorber
- Column
- Flash drum
- Solvent stripper and cooler (4)

[20]

QUESTION 5

5.1 It has a boundary ✓ that closes off from its surroundings, ✓ and it does not allow the exchange of matter or energy ✓ between the surroundings and itself.✓ (4)

5.2 $\rho_x A_x U_x + \rho_y A_y U_y + \rho_z A_z U_z = \rho_{mix} A_{out} U_{out}$ ✓
$(600\ kg/m^3)(\pi r^2)(5\ m/s) + (500\ kg/m^3)(\pi r^2)(4\ m/s) + (250\ kg/m^3)(\pi r^2)(1\ m/s) = \rho_{mix}(\pi r^2)(4\ m/s)$ ✓
$(600 \times 3{,}14 \times 2^2 \times 5) + (500 \times 3{,}14 \times 2^2 \times 4) + (250 \times 3{,}14 \times 2^2 \times 1) = \rho_{mix}(3{,}14 \times 0{,}4^2 \times 4\ m/s)$ ✓
$37\ 680 + 25\ 120 + 3\ 140 = 2{,}0096\ \rho_{mix}$ ✓
$2{,}0096\ \rho_{mix} = 65\ 940$ ✓
$\rho_{mix} = 65\ 940 / 2{,}0096$
$= 32\ 812{,}50\ kg/m^3$ ✓ (6)

5.3 Cv = Vp / V ✓
= 800 L / (8 L + 800 L) ✓
= 800 L / 808 L ✓
= 0,990 ✓
= 99,01% ✓ (5)

5.4 M_{NaOH} = (23 + 16 + 1) g/mol ✓
= 40 g/mol ✓

n = m/M ✓
= 20g/40 g/mol ✓
= 0,5 mol ✓ (5)
[20]

QUESTION 6

6.1 Q = mc∆T
= mc(T2 – T1) ✓
= 400 g × 0,129 J/g/K × (315 – 425) K ✓
= 51,6 J/g/K × (-110 K)
= -5 676 J ✓

Negative value means that the energy has been released. ✓ (4)

6.2 6.2.1 Sublimation ✓✓

6.2.2 The dry ice changed from solid to a gas ✓ without passing through a liquid phase. ✓

6.2.3 At temperatures and pressures below the substances' triple point. ✓✓

(3 × 2) (6)

6.3 ρ = m/V ✓
m = ρ × V
= 958 × (5 × 3 × 2) ✓
= 958 × 30
= 28 740 kg ✓

Q = mL ✓
L = Q/m
= 6,8/28 740 kg ✓
= 0,0002366
= 2,366 × 10^{-4} J ✓ (6)

6.4 6.4.1 A way of transferring heat by circulation or a method of heat transfer in which heat is exchanged by means of direct contact. ✓✓

6.4.2 A way of transferring heat that takes place in liquid and gas as the molecules move in currents. ✓✓

(2 × 2) (4)
[20]

QUESTION 7

7.1 An ion that carries a positive charge / A particle that is positively charged. ✓✓ (2)

7.2
- High hardness
- High ductility
- Low elasticity
- High toughness
- High electrical conductivity
- High thermal conductivity

(Any 3 × 1) (3)

7.3
- Mild steel
- Carbon steel
- Stainless steal
- Brass copper
- Galvanised steel
- Bronze
- Plastics
- Rubbers
- Glass-reinforced plastic
- Titanium
- Teflon
- Ceramics
- Aluminium

(Any 5 × 1) (5)
[10]

TOTAL SECTION B: 70
GRAND TOTAL: 100

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