higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS TECHNOLOGY
NQF LEVEL 4

XX FEBRUARY 2020

This marking guideline consists of 4 pages.

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QUESTION 1

1.1 A
1.2 B
1.3 C
1.4 D
1.5 D

(5 × 2) **[10]**

QUESTION 2

2.1 By covalent or ionic bond or by a mixture of both covalent and ionic bonds. (2)

2.2 Aluminium trioxide. (2)

2.3
- Expensive to make
- Time consuming
- Requires highly detailed dies that are difficult to create (Any 1 × 1) (1)

2.4
- Motors
- Generators
- Pumps
- Pipes
- Fittings
- Joints (Any 2 × 1) (2)

2.5
- Lower rate of heat transfer compared to other vessels
- Limited heat transfer surface (2)

2.6
- Extended surface plate
- Fin fan
- Shell and tube (3)

2.7 It is a reaction between two or more reactants that produce a certain combination of products. (2)

2.8
- Inlet
- Feed tank
- Heating coils
- Pump
- Rotor
- Outlet pipe
- Exchanger
- Distillation column (8)

2.9
- Physical solution absorption is the process whereby no chemical reaction takes place.
- In the reaction absorption a chemical reaction takes place between the gas being absorbed and the liquid. (2 × 2) (4)

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2.10 2.10.1 Corrosion is caused by fouling. Some substances fed into the system during decantation can have a detrimental effect on the piping of the decantation system. Acids are particularly harmful to equipment and can cause corrosion. ✓✓

2.10.2 Tiny cracks are usually a sign of imminent failure, and these cracks are caused by excessive corrosion. ✓✓

(2 × 2) (4)
[30]

QUESTION 3

3.1
- Conduction ✓
  It is the transfer of energy of faster moving particles from the higher temperature to the lower temperature of slower moving particles due to the interaction between particles. ✓ During conduction there is no actual visible physical movement or flow of the material. ✓ The particles vibrate in one spot ✓ and energy is transmitted. ✓
- Convection ✓
  Heat is transferred from one point to another by the actual physical movement of particles. ✓ If hot and cold liquids are mixed by a mechanical stirrer, heat is transferred from the hot liquid by convection. ✓ Heat transfer by convection can occur as a result of any type of physical mixing such as agitation or flow due to density differences. ✓
- Radiation ✓
  A body emits radiant energy in all directions. ✓ If energy strikes, the receiver part of it may be absorbed and part of it may be reflected. ✓ Heat transfer from a hot to a cold body in this manner is known as heat transfer by radiation. ✓

(13)

3.2 3.2.1 Latent energy is the energy absorbed by a substance in order to bring about a change in the substance phase.✓✓ The latent heat can either be latent heat of fusion (Lf) or latent heat of vaporisation (Lv)✓ which represents the fusion or vaporisation latent heat coefficient.✓ (4)

3.2.2 $Q = mL$ ✓✓ (2)

3.3 $^0C = 5/9(^0F - 32)$ ✓
$= 5/9(54{,}2 - 32)$ ✓
$= 5/9(22{,}2)$ ✓
$= 12{,}33\ ^0F$ ✓✓ (5)

3.4 Heat capacity is a measure of how much heat is required to raise the temperature of an object by a certain amount ✓✓ while the specific heat capacity is a measure of how much heat is required to raise the temperature of an object weighing one kilogram by exactly one Kelvin. ✓✓ (4)

3.5 It is an atom or small group of atoms with an electrical charge due to the loss or gain of one or more electrons. (2)
[30]

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QUESTION 4

4.1 The measure of mass per unit volume. (2)

4.2 $\rho = m/v$ ✓

where m = 5,854 g and v = 7,57 cm3 (Given)

Thus 5,854 g = 0,005854 kg and 7,57 cm3 = 0,00000757 m3 ✓

From: $\rho = \frac{m}{v}$

$= \frac{0{,}005854\ \text{kg}}{0{,}00000757\ \text{m3}}$ ✓

= 773,3157 kg/m3 ✓✓ (5)

4.3 4.3.1 $2H2S + O2 \longrightarrow 2H2O + 2S$ ✓✓✓✓ (5)

4.3.2 $Cl_2 + H_2O \longrightarrow HOCl + HCl$ ✓✓ (2)

4.4 1 mN = 0,001 N
Thus: 22,7 mN = 22,7 mN ÷ 1000 ✓ = 0,0227 N ✓

$V_{cylindrical} = \pi \times r^2 \times h$ ✓
$= 3{,}14 \times (0{,}008\ \text{m})^2 \times 0{,}9\ \text{m}$ ✓
$= 0{,}00018\ \text{m}^3$ ✓

W = mg
m = W/g ✓
= 0,0227 N / 9,8 m/s2 ✓
= 0,0227 kg.m/s2 / 9,8 m/s2 ✓
= 0,00232 kg ✓

ρ = m/v ✓
= 0,00232 kg / 0,00018 m3 ✓
= 12,889 kg/m3 ✓

OR ALTERNATIVELY:

W = mg
m = W/g ✓
= 0,0227 N / 9,81 m/s2 ✓
= 0,0227 kg./ 9,81✓
= 0,00231 kg ✓

ρ = m/v✓
= 0,00231 kg / 0,00018 m3 ✓
= 12,8833 kg/m3 ✓ (12)

4.5 $SO_2 + O_2 +$ ✓ $2H_2O \longrightarrow$ ✓ $2H_2SO_4$
1 mole SO_2 + 1 mole O_2 + 2 moles $H_2O \longrightarrow$ 2 moles H_2SOB_4 ✓
Ratio is 1:1:2:2 ✓ (4)
[30]

TOTAL: 100

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