higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS CHEMISTRY
NQF LEVEL 4

7 November 2022

This marking guideline consists of 7 pages.

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INSTRUCTIONS TO MARKERS

1. Mark all the questions.
2. Follow the answers according to the numbering system used in this question paper.
3. Use only a red pen.
4. Put your ticks and crosses neatly and legibly.

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QUESTION 1

1.1 True
1.2 True
1.3 True
1.4 False
1.5 True

(5 × 1) **[5]**

QUESTION 2

2.1 D
2.2 G
2.3 F
2.4 B
2.5 C

(5 × 1) **[5]**

QUESTION 3

3.1 3.1.1

- Floor tiles
- Window frames
- Medical devices
- Vehicle parts manufacturing
- Electrical cable and wiring insulation
- Food wrappings
- Bottles
- Raincoats
- Sewage pipes
- Credit/Bank/loyalty cards

(Any 2 × 1)

3.1.2

- Car tyres and tyre retread
- Shoe soles and heals
- Conveyor belts and rubber belt drives
- Coated papers (E-SBR)
- Sealing and binding agent
- Brake, accelerator, and clutch pads
- Rubber toys
- Hoses and moulded-rubber goods
- Car and household carpets

(Any 2 × 1)

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3.1.3
- Mechanical engineering
- Automotive engineering
- Transport and conveyor technology
- Packaging and paper-processing machinery
- Printing and drink-dispensing machinery
- Electrical engineering
- Building machinery
- Agricultural machinery
- Clothing
- Carpets
- Stockings
- Parachutes
- Gear wheels (Any 2 × 1)

(3 × 2) (6)

3.2 3.2.1 Ethene, Ethylene or $CH_2 = CH$

3.2.2 Tetrafluoroethene or $CF_2 = CF_2$

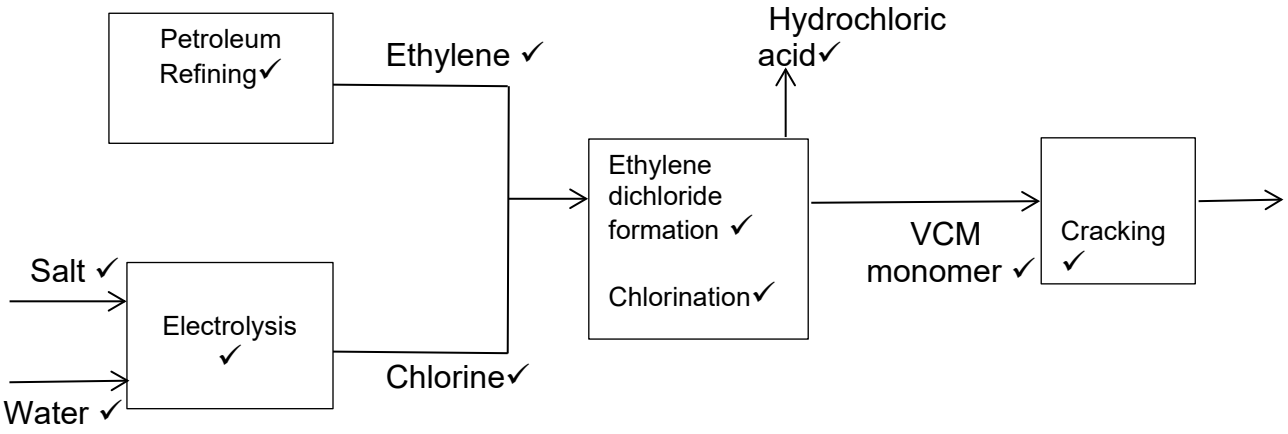
(2 × 2) (4)

3.3 The Ziegler-Natta catalyst is a titanium tetrachloride✓ and aluminium alkyl.✓ If the Ziegler-Natta catalyst comes in contact with water or oxygen,✓ it rapidly deactivates,✓ and for this reason this catalyst is prepared in dry, inert nitrogen atmospheres.✓ (5)

[15]

QUESTION 4

4.1



(11)

4.2
- Sasol Polymers
- Safripol
- SANS Fibres (Any 2 × 1) (2)

4.3 External lubricants are used to reduce the friction between the polymer and the processing tool. (2)

[15]

QUESTION 5

5.1 5.1.1
- Malleable
- Ductile
- Corrosion-resistant
- Good electrical conductivity properties
- Good thermal conductivity properties
- Fouling resistant
- Non-magnetic (Any 2 × 1)

5.1.2
- Hard
- Ductile
- Corrosion-resistant
- Malleable (Any 2 × 1)

(2 × 2) (4)

5.2 5.2.1 Flotation is a process for separating minerals from impurities✓; fine milled ore is added to water and surfactants, and the mixture is stirred vigorously to form bubbles. ✓

5.2.2 Comminution is a process through which the size of the ore is reduced✓ to be used in the next steps of the production of base metals. ✓

5.2.3 Smelting is a process of heating the metal concentrates to their melting points✓ to separate the liquid metal from the impurities. ✓

(3 × 2) (6)

5.3 A – Milled mate
B – Thickener
C – Lead cake
D – Sulphuric acid (H_2SO_4)
E – Cobalt precipitation
F – Selenium removal
G – Nickel electrowinning
H – Nickel cathode
I – Cu-electrowinning
J – Copper cathode (10)

5.4
- Ferrovanadium
- Ferrosilicon
- Ferromanganese (3)

[23]

QUESTION 6

6.1 6.1.1
- Gasification
- Gas cleaning
- Fischer-Tropsch synthesis
- Product work-up (4)

6.1.2 $3C(s) + O_2(g) + H_2O(l) \rightarrow H_2(g)$✓ + $3CO(g)$✓
(Additional 2 marks for balancing the equation) (4)

6.1.3
- Prewash:✓ Medium cold methanol is used to remove naphtha components like benzene, hexanes, and toluene.✓
- Main wash:✓ The prewashed gas is washed again with very cold methanol to remove a large percentage of H_2S and CO_2.✓
- Fine wash:✓ Gas from the main wash is washed for the last time to further remove H_2S and CO_2, and the resulting gas contains less than 0,1 ppm H_2S and 1,5% CO_2.✓ (3 × 2) (6)

6.1.4
- Ammonium sulphate
- Ammonium nitrate
- Limestone ammonium nitrate (LAN) (3)

6.2 6.2.1 Diesel is a dense liquid fuel designed for diesel engines.✓
Used as a fuel for trucks, buses, and generators.✓

6.2.2 Marine heavy fuel oil is a residual oil that remains after distillation of crude oil.✓
Used in large engines like marine vessels and container ships.✓

6.2.3 LPG is a mixture of propane and butane; it is stored in liquefied form in cylinders.✓
Used as a source of heat for domestic heating.✓
(3 × 2) (6)
[23]

QUESTION 7

7.1
- Pesticides
- Herbicides
- Fungicides
- Rodenticides (Any 2 × 1) (2)

7.2 7.2.1 Antiretroviral
7.2.2 HIV and Aids
(2 × 1) (2)

7.3 7.3.1 Antibiotics are chemical substances that are used to kill or stop the growth of diseases caused by bacteria. (2)

7.3.2 The fermentation of penicillin is carried out in a stainless-steel fermenter called a batch reactor.✓ The fermenter is loaded with a nutrient medium that is sterilised by superheated steam.✓ An inoculum (*Penicillium chrysogenum*) is added to the reactor, while glucose and nitrate are added periodically.✓ The fungus in the reactor produces ammonia which needs to be neutralised.✓ A cooling jacket is used to control the temperature within the reactor to prevent overheating that may kill the penicillin product.✓ The fungi are allowed to grow and multiply in the fermenter.

The fermenter conditions are:
- Temperature: 20–24 °C✓
- pH: 6,0–6,5✓
- Pressure: 1,02 atm/101 kPa✓

The product is purified by downstream processing.✓ (8)
[14]

TOTAL: 100

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