higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS CHEMISTRY
NQF LEVEL 4

16 November 2023

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 True✓

1.2 False✓

1.3 True✓

1.4 True✓

1.5 False✓

(5 × 1) **[5]**

QUESTION 2

2.1 Catalytic cracking
2.2 Mining
2.3 Penicillin
2.4 Gold
2.5 Ultra-high molecular weight polyethylene (UHMWPE)

(5 × 1) **[5]**

QUESTION 3: POLYMERS

3.1 3.1.1
- It is cheap.
- It is tough.
- It is durable.
- It has good corrosion-resistant properties. (Any 2 × 1) (2)

3.1.2
- Carbon
- Hydrogen
- Chlorine (3)

3.1.3
- Lightweight
- Good electrical insulation properties
- Good corrosion resistance
- Easy to process (Any 2 × 1) (2)

3.2 3.2.1 $2NaCl(aq)$✓ + $2H_2O(l)$✓ → $Cl_2(g)$✓ + $H_2(g)$✓ + $2NaOH(aq)$✓ (5)

3.2.2 $Cl_2(g)$✓ + C_2H_4✓ → $C_2H_4Cl_2$✓ (3)

[15]

QUESTION 4

4.1 4.1.1

- Thermoplastic resins can be recycled and reused because when they are heated, the molecules move around much more and the bonds between the molecules are broken.✓
- The re-melting process can be repeated indefinitely.✓
- Examples: PVC,✓ PET, PE or PP (Any ONE example)

4.1.2

- Thermosetting or thermo-hardening resins undergo a permanent chemical reaction (cross-linking) when they are heated and therefore they cannot be recycled.✓
- This process prevents the molecules from moving and increases the strength between the bonds.✓
- Examples: Epoxy resins✓ or melamine (Any ONE example)

(2 × 3) (6)

4.2 4.2.1

- Acrylic rubber
- Butadiene rubber
- Nitrile rubber
- Silicon rubber
- Styrene butadiene rubber (Any 3 × 1) (3)

4.2.2

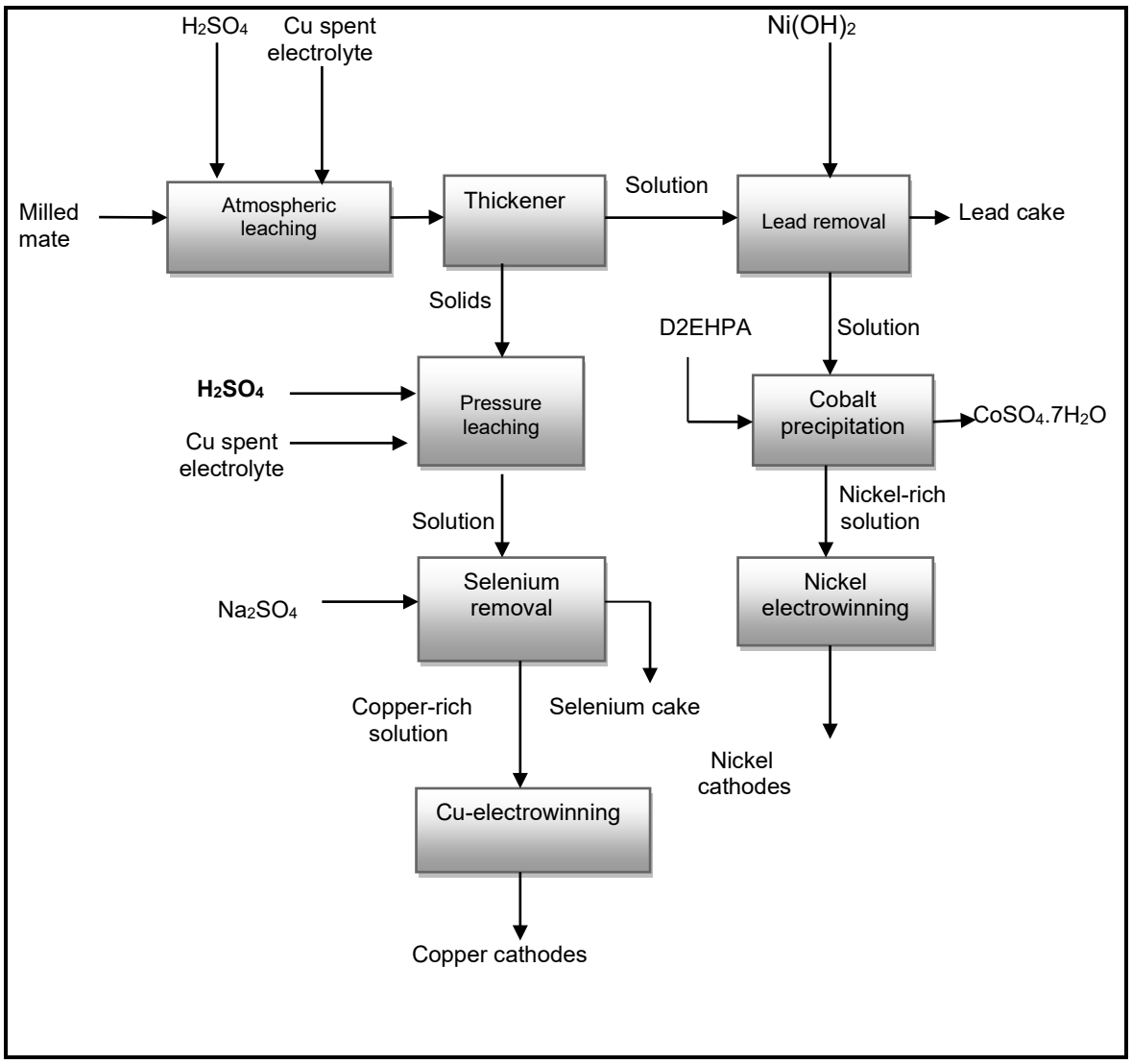
- Latex
- Fibre
- Powder
- Solution (Any 3 × 1) (3)

[12]

QUESTION 5: METALS

5.1
- Anglo platinum or Amplats
- Impala platinum or Implats
- African Rainbow Mineral or ARM Platinum
- Palaborwa Mining Company Limited (Any 2 × 1) (2)

5.2



(Any 11 correct labels) (11)
[13]

QUESTION 6

6.1 6.1.1 Ru
6.1.2 Pd
6.1.3 Au

(3 × 1) (3)

6.2
- The ore concentrate is dissolved in an HCl solution to produce chloro-complexes during the dissolution. ✓
- 98% of platinum, palladium and gold are dissolved. ✓
- 90% of ruthenium, rhodium and iridium are also dissolved. ✓
- Silver is precipitated into silver chloride and it is filtered and recovered as filter cake. ✓

(4)
[7]

QUESTION 7: COAL AND CRUDE OIL

7.1 7.1.1
- Production of PP
- Production of cumene
- Production of isopropanol
- Production of propylene oxide (Any 3 × 1) (3)

7.1.2
- Production of PE
- Ethyl oxide is used in the production of detergents and surfactants
- Production of styrene
- Production of alcohol
- Production of VCM
- Production of ethylene glycol
- Used in the acceleration of fruit ripening (Any 3 × 1) (3)

7.1.3
- Production of styrene-butadiene latex
- SBR and PBR are used in the production of tyres
- NPR is used in the production of gaskets, seals, hoses and gloves
- Neoprene is used in the production of gloves and wetsuits
- Production of nylon intermediates (Any 3 × 1) (3)

7.2 7.2.1 Paraffins, olefin, naphthenes and aromatics
7.2.2 High-temperature Fischer-Tropsch

(2 × 1) (2)

7.3 7.3.1
- Freeze point
- Flash point
- Smoke point (3)

7.3.2
- Used as fuel in lamps. ✓
- Also used for domestic heating and cooking. (Any 2 × 1) (2)

[16]

QUESTION 8

8.1 8.1.1
- Gasification
- Gas cleaning and recovery
- Fischer-Tropsch synthesis
- Product work-up (4)

8.1.2 A mixture of hydrogen and carbon monoxide or synthesis gas (1)

8.1.3 $3C(s)\checkmark + O_2(g)\checkmark + H_2O(l)\checkmark \rightarrow H_2(g)\checkmark + 3CO(g)\checkmark$ (5)

8.1.4 SBR rubber is a man-made rubber derived from a byproduct of oil fining✓ . It is produced by polymerizing Styrene and Butadiene in a controlled setting, then adding curatives and fillers like sulfur and carbon black ✓. The resulting material is then cured or vulcanized to make a rubber part ✓ . Solution-SBR is produced by an anionic polymerization process, initiated by alkyl lithium compounds, and takes place in a hydrocarbon solvent ✓. Emulsion polymerization is another process used to manufacture SBR, which involves polymerizing butadiene and styrene with a catalyst and soap solution✓ .

(Any 5 x 1)
[15]

QUESTION 9: BIOCHEMICALS AND AGROCHEMICALS

9.1 9.1.1 Adcock Ingram LTD
9.1.2 NCP Alcohols
9.1.3 Aspen Pharmacare

(3 × 1) (3)

9.2
- Barley
- Water
- Yeast
- Hops (Any 3 × 1) (3)

9.3
- Fermentation is a process through which dissolved sugars are changed into alcohols and carbon dioxide.✓
- The wort, yeast and air are added to the fermentation vessel.✓
- Air provides oxygen to the yeast to start the fermentation process.✓
- Once all the sugars are converted to alcohol, the process stops. ✓
- The fermentation process takes about four to five days to be complete.✓
- At the end of the process, yeast is recovered and removed by pumping.✓
- The product that is left is green beer which needs to be matured before it is sold to the customers. (Any 6 × 1) (6)

[12]

TOTAL: 100

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