higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

CHEMICAL PLANT OPERATION N4

19 April 2021

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 The law of conservation of energy
1.2 Critical speed
1.3 Electrolysis
1.4 Reynolds number
1.5 De-ionisation

(5 × 1) **[5]**

QUESTION 2

2.1 E
2.2 B
2.3 F
2.4 H
2.5 D

(5 × 1) **[5]**

QUESTION 3

3.1 3.1.1 This is a hammering sound heard✓ when a valve is suddenly closed in a long pipe containing flowing water.✓ (2)

3.1.2
- Length of the pipe
- Velocity of water
- How fast the valve closes (how fast the water is being stopped) (3)

3.1.3
- By closing the valve slowly
- By using a surge chamber
- By using a relief valve
- By lowering the water pressure
- By reducing the velocity of the water (Any 3 × 1) (3)

3.2 3.2.1
$A = \pi r^2$
= $\pi\ (0,25)^2$✓
= 0, 196 m^2✓✓ (3)

3.2.2
$volume = flow\ rate\ in\ litres\ per\ seconds$
$= 760$✓ $\times 22 \times 3\ 600$✓
$= \frac{60192000\ L}{1\ 000\ ✓}$✓
$=\ 60\ 192\ m^2$ ✓ (5)

3.3 3.3.1 This is a property of the material by virtue of which it resists✓ shearing force.✓

3.3.2 This is a flow expressed as volume per unit time,✓ divided by the cross-sectional area of the pipe.✓

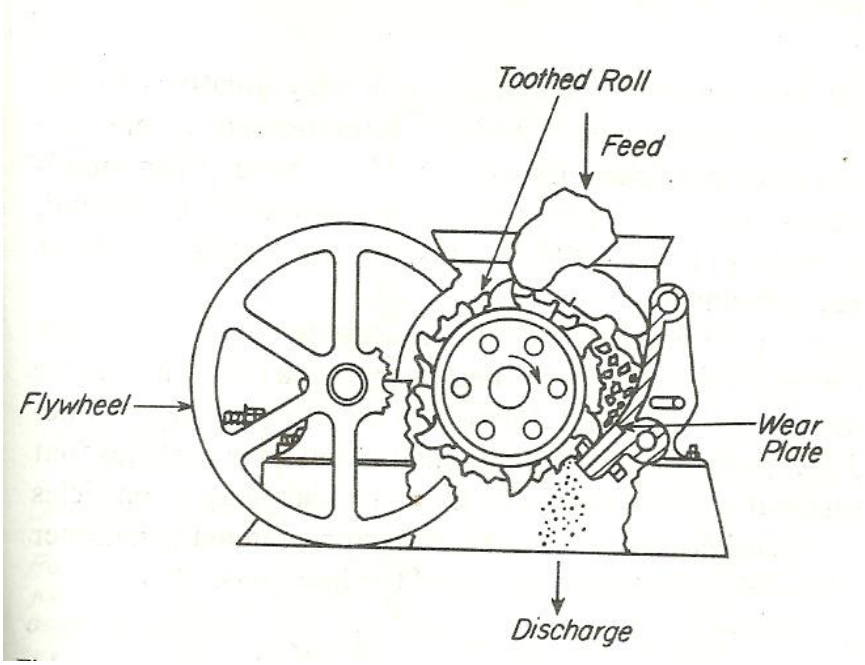
(2 × 2) (4)
[20]

QUESTION 4

4.1 4.1.1

- Coal
- Bones
- Shale (3)

4.1.2



(6)

It contains two corrugated rollers✓ turning at different speed,✓ which tear the feed apart,✓ or a small high-speed roll with transverse breaker bars✓ on its face turning towards a large slow-speed smooth roll.✓ Crushing rolls for coarse feeds material carry heavy pyramidal teeth.✓ They are more versatile than smooth-roll crusher but cannot handle very hard solids.✓ They operate by compression, impact and shear.✓ (8)

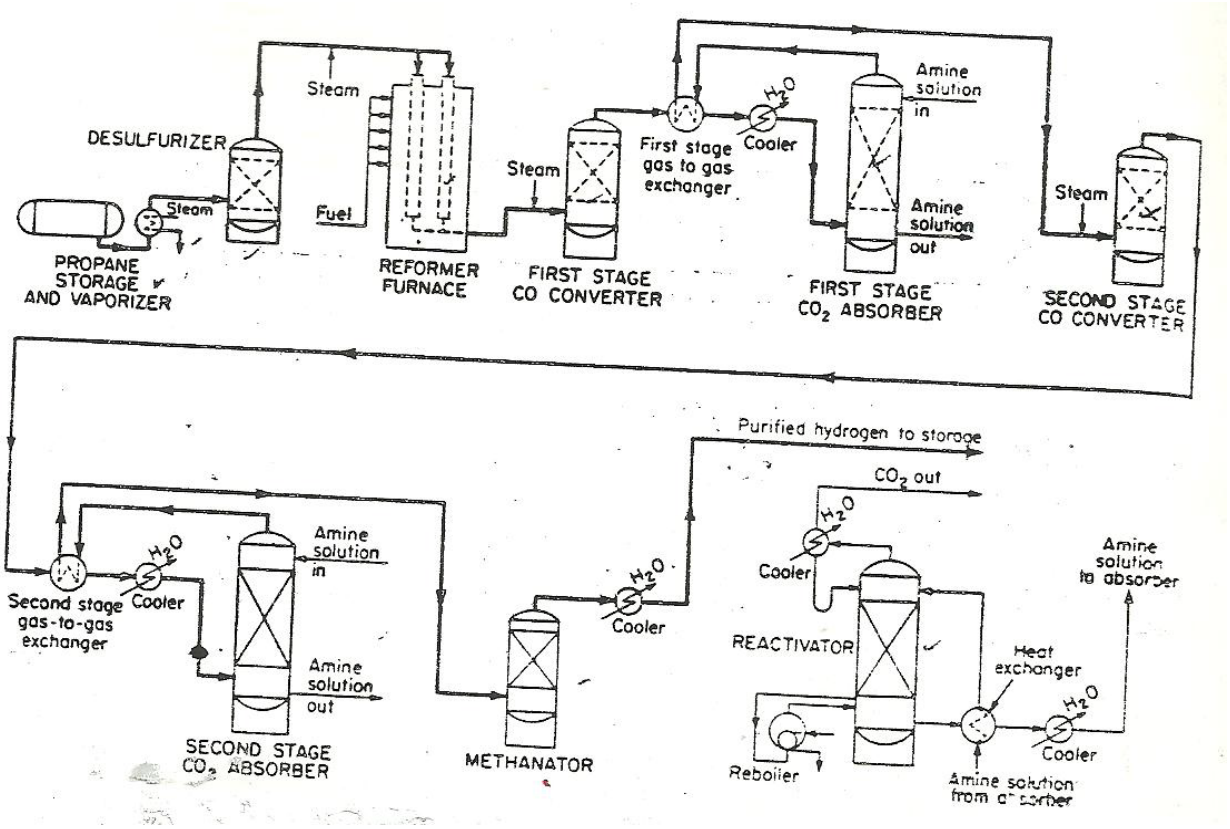
4.2

- Rod mills
- Ball mills or pebble mills
- Tube mills or compartment mills (3)

[20]

QUESTION 5

5.1



Any 11 correct labelling. (11)

5.2
- Oxygen
- Nitrogen (2)

5.3 $2H_2O_{(\ell)}$✓ ⟶ $2H_{2\,(g)}$✓ + $O_{2\,(g)}$✓ (4)

5.4
- Burning of sulphur
- Roasting of metal sulphides
- Recovery from waste gases (3)

[20]

QUESTION 6

6.1
- Purification refers to the removal of organic matter✓ and micro-organisms from water.✓
- Softening is the term applied in the process which removes or reduces✓ hardness of water.✓ (4)

6.2
- Cold-lime process
- Hot-lime-soda process (2)

6.3
- Free from pathogenic microorganisms
- Free from suspended solids
- Water must be soft
- Water must be colourless
- Water must be odourless
- Water must be tasteless (Any 5 × 1) (5)

6.4
- Chlorination
- UV light
- Ozone
- Heat treatment
- Ultrafiltration
- Iodine (Any 3 × 1) (3)

6.5 This is the amount of molecular oxygen required by a microbial population✓ to stabilise biodegradable organic materials.✓ (2)

6.6 6.6.1 $MgR_2 + H_2SO_4 \rightarrow 2HR$✓ + $MgSO_4$✓

6.6.2 $CaR_2 + 2NaCl \rightarrow 2NaR$✓ + $CaCl_2$✓

(2 × 2) (4)
[20]

QUESTION 7

7.1 Copper has high resistance to industrial✓ and marine atmosphere, sea water, alkalis and solvents.✓ (2)

7.2
- Has higher melting point
- Ductile and malleable
- Can be worked into intricate forms
- Can be welded
- Low density
- High strength (Any 2 × 1) (2)

7.3
7.3.1 Air
7.3.2 Concentrated sulphuric acid
7.3.3 Chlorine gas or hydrochloric acid
7.3.4 Nitric acid
(4 × 1) (4)

7.4
7.4.1 Sulphuric acid (H_2SO_4)
7.4.2 To remove alcohol returned to the system
(2 × 1) (2)
[10]

TOTAL: 100

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