



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

CHEMICAL PLANT OPERATION N6

29 JULY 2021

This marking guideline consists of 6 pages.

QUESTION 1

- 1.1 False
 1.2 False
 1.3 True
 1.4 True
 1.5 True

(5 × 1) [5]

QUESTION 2

- 2.1 F
 2.2 H
 2.3 E
 2.4 A
 2.5 B

(5 × 1) [5]

QUESTION 3

3.1 Distillation is the separation of the components of a liquid mixture by a process involving partial vaporisation.✓ Rectification is a single-unit distillation✓ operation in which vaporisation occurs in repeated steps✓ to give a much greater overall separation than would be obtained by one simple distillation.✓ (4)

- 3.2 A – Regeneration fluid
 B – Spent regeneration fluid
 C – Opening for changing adsorbent
 D – Feed
 E – Balls to distribute feed
 F – Screen
 G – Adsorbent
 H – Screen
 I – Gate for spent adsorbent removal
 J – Product
 K – Hinged head

(11 × 1) (11)

3.3 Valve trays are sieve trays with large variable openings for gas flow.✓ The perforations are covered with movable caps,✓ which rise as the flow of gas increases.✓ The gas rate and corresponding pressure drop remain low,✓ but not as low as that of the sieve tray or bubble cap tray.✓ (5)

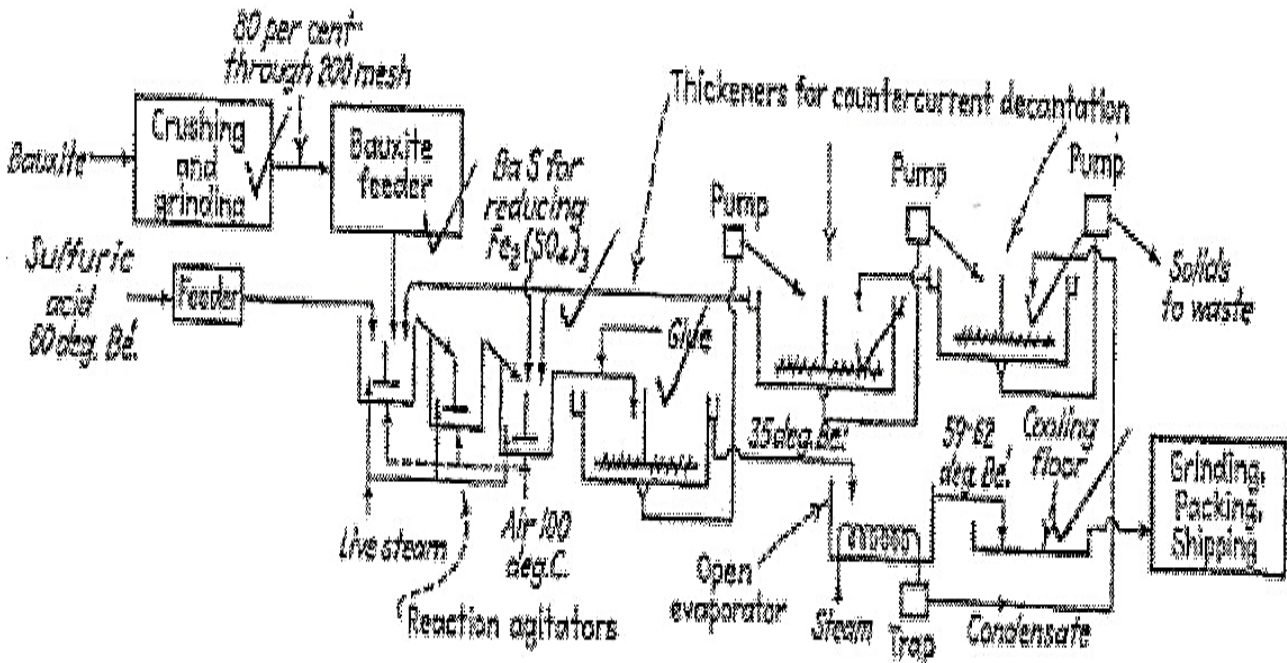
[20]

QUESTION 4

- 4.1 4.1.1 It is the breaking down of larger hydrocarbon molecules into smaller molecules by heat or catalytic action.
- 4.1.2 It is the alteration of the arrangement of the atoms in a molecule without changing the number of atoms.
- 4.1.3 It is the linking of similar molecules; the joining together of light or smaller (monomers) olefins to form larger molecules called polymers. (3 × 2) (6)
- 4.2
- Separation
 - Conversion
 - Treatment (3)
- 4.3
- Flame weeding
 - Tobacco curing
 - Grain drying
 - Motor vehicles
 - Tractors
 - Energy for cooking
 - As aerosol propellant (Any 5 × 1) (5)
- 4.4 4.4.1
- Water is removed through the dehydration process.
 - Hydrogen sulphide is removed using the Girbotol process. (2)
- 4.4.2 It can cause corrosion. (1)
- 4.4.3
- To prevent corrosion in the transmission line
 - To prevent the formation of hydrates, which may cause line stoppage
 - To prevent freezing of the valves and regulators in cold weather (3)
- [20]**

QUESTION 5

5.1



ONE mark for any 10 correct labels (10)

- The bauxite is grounded and conveyed to a storage bin.
- The reaction occurs in load-line steel tanks, where the reactions are thoroughly mixed and heated with the aid of an agitator and a live steam.
- These reactors are operated in series.
- Barium sulphide is added in the last reactor in the form of black ash to reduce ferric sulphate to the ferrous state and to precipitate the iron.
- The mixture from the reactors is sent through a series of thickeners, which remove undissolved matter so that it will contain practically no alum. (5)

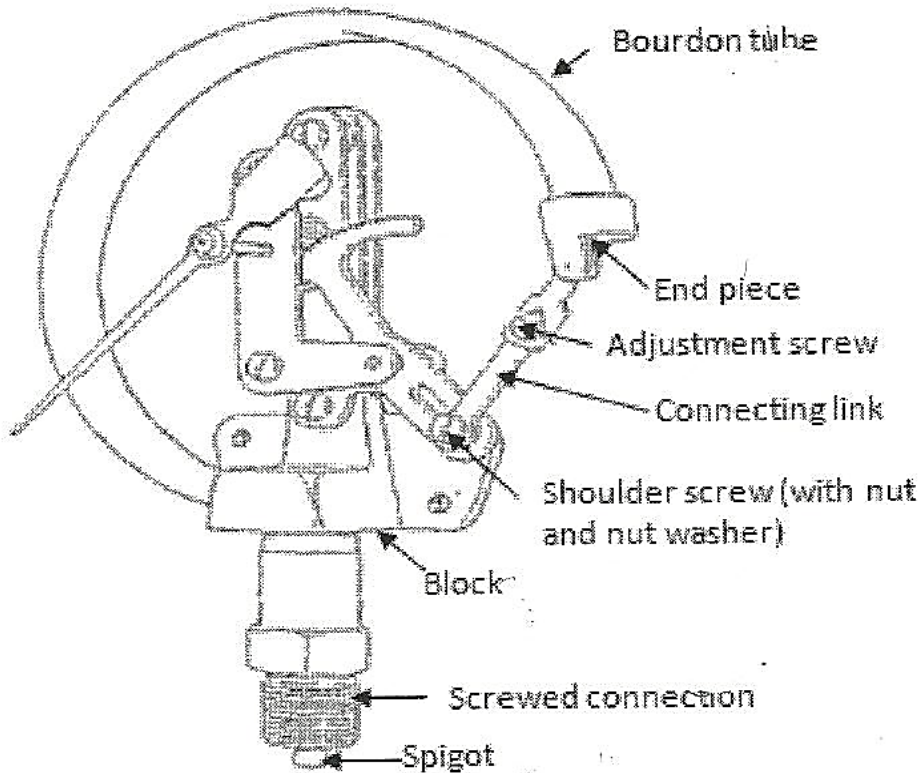
5.2

- Hydrogen
 - Methane
 - Ethylene
 - Carbon monoxide
 - Carbon dioxide
 - Hydrogen sulphide
 - Ammonia
 - Nitrogen
- (Any 5 × 1) (5)

[20]

QUESTION 6

6.1



ONE mark for each correct label (8)

The C-Bourdon tube consists of an oval-section, flexible tube bent in an arc. ✓
 One end of the tube is sealed and attached to the mechanism that operates the pointer. ✓
 The other end of the tube is fixed and connected to the pressure it has to measure. ✓
 The internal pressure tends to straighten out the tube. ✓
 The resulting movement of the free end of the tube causes the pointer to move over the scale. ✓

(5)

6.2 They may be divided into two groups. In the first group, the light of a given wavelength from the hot body ✓ is optically matched with the light from the constant comparison lamp ✓ in the instrument by means of an optical wedge or a polarising system. ✓

In the second group, the brightness of the light formed by the calibrated comparison lamp ✓ is varied to match the brightness of the light from the hot body. ✓
 The brightness of the lamp is judged to be the same as that of the source when it merges into the image of the source. ✓
 The instrument is therefore known as the disappearing filament pyrometer. ✓

(7)
[20]

QUESTION 7

- 7.1
- Reciprocating piston type
 - Rotating or oscillating piston type
 - Nutating disc type
 - Fluted spiral rotor type
 - Sliding vane type
 - Rotating vane type
 - Oval gear type
- (Any 5 × 1) (5)
- 7.2 The Kelvin scale is a fraction of $1/273,16$ of the thermodynamic temperature of the triple point of water.✓ The triple point is realised when ice, water and water vapour are in equilibrium.✓ It is the sole defining fixed point of the thermodynamic Kelvin scale and has the assigned value of $273,16\text{ K}$.✓ (3)
- 7.3 A solution with a higher concentration of hydrogen ions than a neutral solution (pH value of less than 7) (2)
- [10]**
- TOTAL: 100**