higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

CHEMICAL PLANT OPERATION N4

9 APRIL 2018

This marking guideline consists of 5 pages.

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QUESTION 1

1.1 True
1.2 False
1.3 False
1.4 True
1.5 True

(5 × 1) **[5]**

QUESTION 2

2.1 D
2.2 E
2.3 H
2.4 C
2.5 B

(5 × 1) **[5]**

QUESTION 3

3.1 $$V = \frac{V}{t \times A}$$

$$= \frac{250\ m^3}{60sxnr^2}$$

$$= \frac{250\ m^3 \quad ✓}{60s\ xn(1{,}5)^2\ m^2} \quad ✓ \quad ✓$$

$$= 0{,}589\ m \setminus s \ ✓$$

(4)

3.2
- Determine the Reynolds number.✓
- Determine the relative roughness (E/D)✓ by dividing the average roughness (E)✓ by the diameter D.✓
- Read *f* from the applicable graph.✓ (5)

3.3 3.3.1 Impact pressure is the pressure measured on the plane perpendicular✓ to the direction of the fluid flow.✓

Static pressure is the pressure exerted on the plane parallel✓ to the direction of the flow of a moving fluid. ✓ (4)

3.3.2 Turbulent flow is when the course followed by the individual particles of the fluid deviates greatly from the straight line,✓ so that vortices and eddies are formed in the fluid.✓

Streamline flow is when the flow of all the fluid particles is along lines parallel✓ to the axis of the pipe.✓ (4)

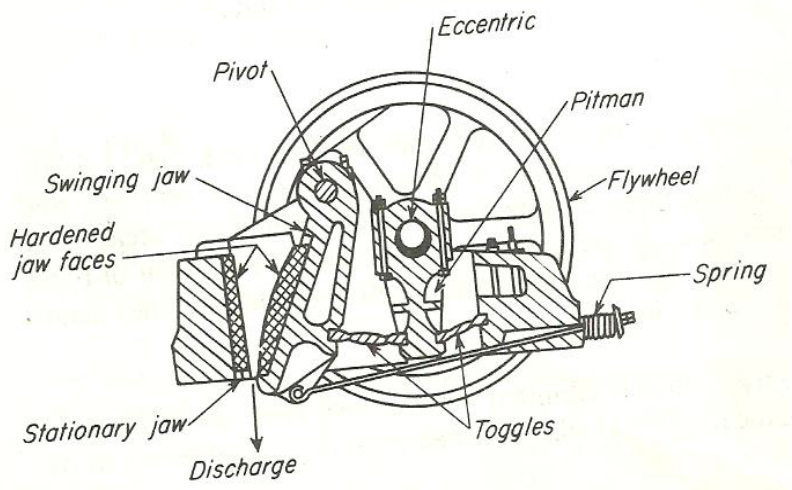
3.4
- Diameter
- Velocity
- Viscosity
- Density (Any 3 × 1) (3)

[20]

QUESTION 4

4.1
- Hammer mills/impactors
- Rolling compression mills
- Attrition mills
- Revolving mills (4)

4.2



(1 mark for each correct label) (10 × 1) (10)

4.3 4.3.1 This is the speed at which the ball will be carried over the centrifuging✓ and drawn off into the crushing zone.✓

4.3.2 This is a size reduction machine✓ for intermediate duty.✓

4.3.3 This is the angle between the roll faces at the level where they will just take hold of the particles✓ and draw it into the crushing zone.✓

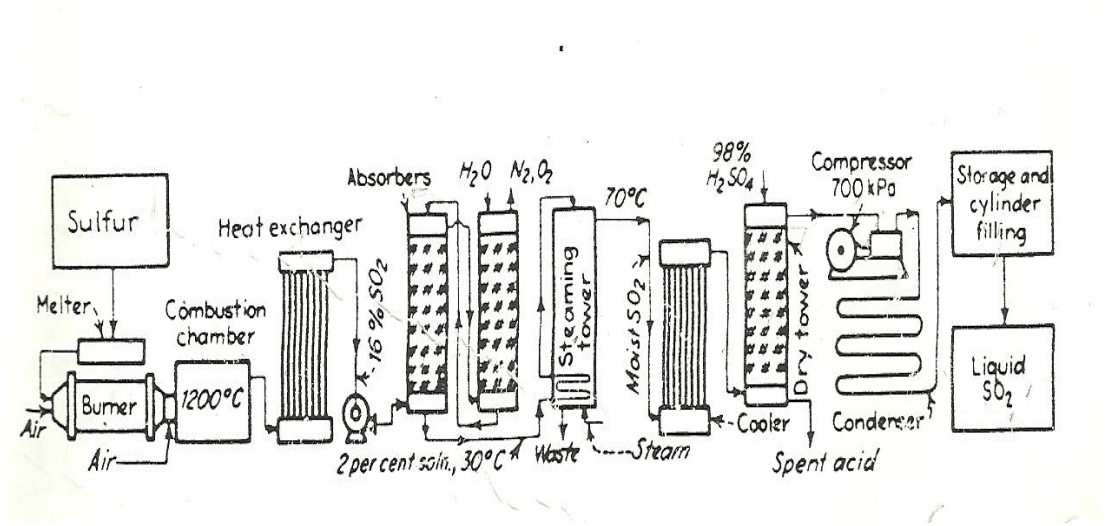
(3 × 2) (6)

[20]

QUESTION 5

5.1
- Flue gases which result from burning carbonaceous materials (fuel oil, gas and coke).
- Recovery from the production of ethanol by fermentation.
- By-product of lime-kiln operation.
- Recovery from synthesis gas in ammonia production. (Any 3 × 1) (3)

5.2 5.2.1



(1 mark each for any 10 correct labels) (10 × 1) (10)

5.2.2
- Sulphur is burned, releasing gases.
- As the gases from the combustion chamber pass through the heat exchangers, they heat water for the boilers.
- The cooled gases are pumped into the absorbers through acid-proof pumps.
- The temperature of the vapours coming from the steaming tower usually runs at about 70 °C.
- The vapours are cooled and passed through a drying tower with sulphuric acid.
- The sulphur dioxide is liquefied by compression and cooled.
- It is stored in steel cylinders. (7 × 1) (7)

[20]

QUESTION 6

6.1 6.1.1
- Brazing
- Soldering
- Welding (Any 2 × 1) (2)

6.1.2
- Brass
- Bronze/Phosphor bronze
- Cupronickel (3)

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6.2
- It is important as a construction material.
- It is strong and of medium weight.
- Its corrosion resistance is superior in oxidising and mild reduction media.
- Its general resistance to sea water is superior to to that of stainless steel.

(Any 2 × 1) (2)

6.3
- Acetic acid
- Ethyl alcohol
- Sulphuric acid (3)

6.4
- Enhanced yield
- Reduced recycle intervals
- High reaction rate
- Reduced equipment size
- Reduced heat loss to nitrogen (5)

[15]

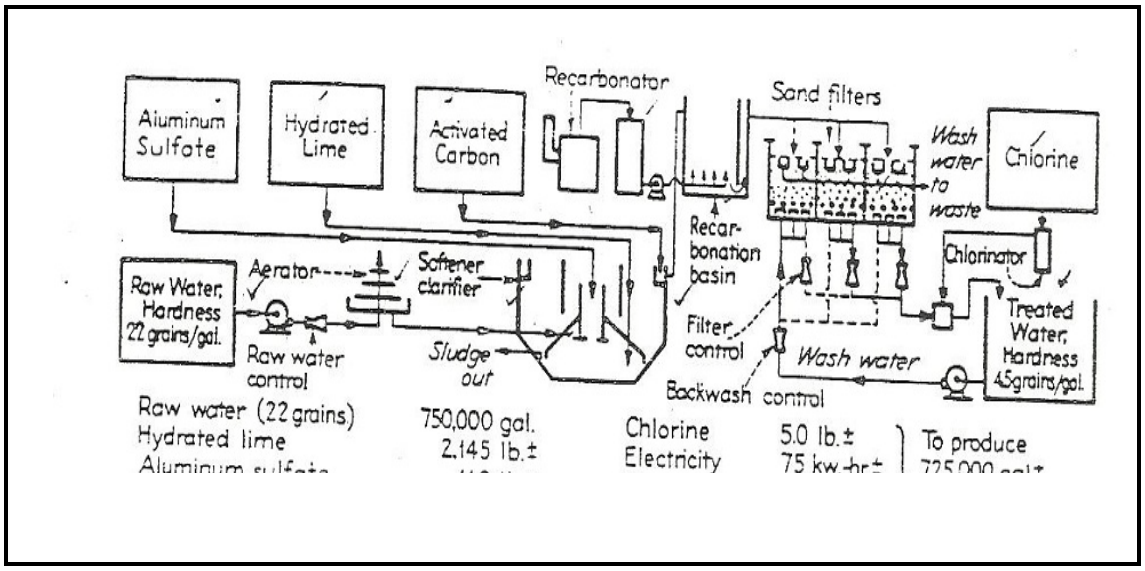
QUESTION 7

7.1 7.1.1 Permanent hardness is due to sulphates and chlorides of calcium and magnesium.✓ It can be reduced by adding chemicals.✓

Temporary hardness is due to bicarbonates of calcium and magnesium.✓ It can be easily reduced by boiling.✓ (4)

7.1.2 It is caused by dissolved salts✓ of calcium and magnesium.✓ (2)

7.2



(1 mark each for any 9 correct labels) (9 × 1) (9)

[15]

TOTAL: 100

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