higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

CHEMICAL PLANT OPERATION N4

2 AUGUST 2018

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 False
1.2 False
1.3 True
1.4 True
1.5 True

(5 × 1) **[5]**

QUESTION 2

2.1 C
2.2 F
2.3 E
2.4 I
2.5 B

(5 × 1) **[5]**

QUESTION 3

3.1 3.1.1 It is the pressure exerted on a plane parallel✓ to the direction of flow of a moving fluid.✓

3.1.2 It is defined as the ratio of the shearing force per unit of parallel areas to the resultant velocity gradient✓ perpendicular to the direction of the shear force.✓

3.1.3 It is the difference between the impact pressure and the static pressure,✓ when both are measured at the same point in the fluid.✓

(3 × 2) (6)

3.2 $N_{RE} = \frac{DV\rho}{\mu}$

$= \frac{m✓ \times \frac{m}{s}✓ \times \frac{kg}{m^3}✓}{\frac{kg}{ms}✓}$

(5)

$= 1✓$

3.3
- Potential energy:✓ It is the energy due to its position relative to the reference plane.✓
- Kinetic energy:✓ It is the energy due to the velocity of flow.✓
- Internal energy:✓ It is the energy due to the temperature level and state.✓

(6)

3.4 The total amount of energy put into the system in unit time✓ must be equal to the amount of energy leaving the system in unit time✓ plus any accumulation.✓ (3)

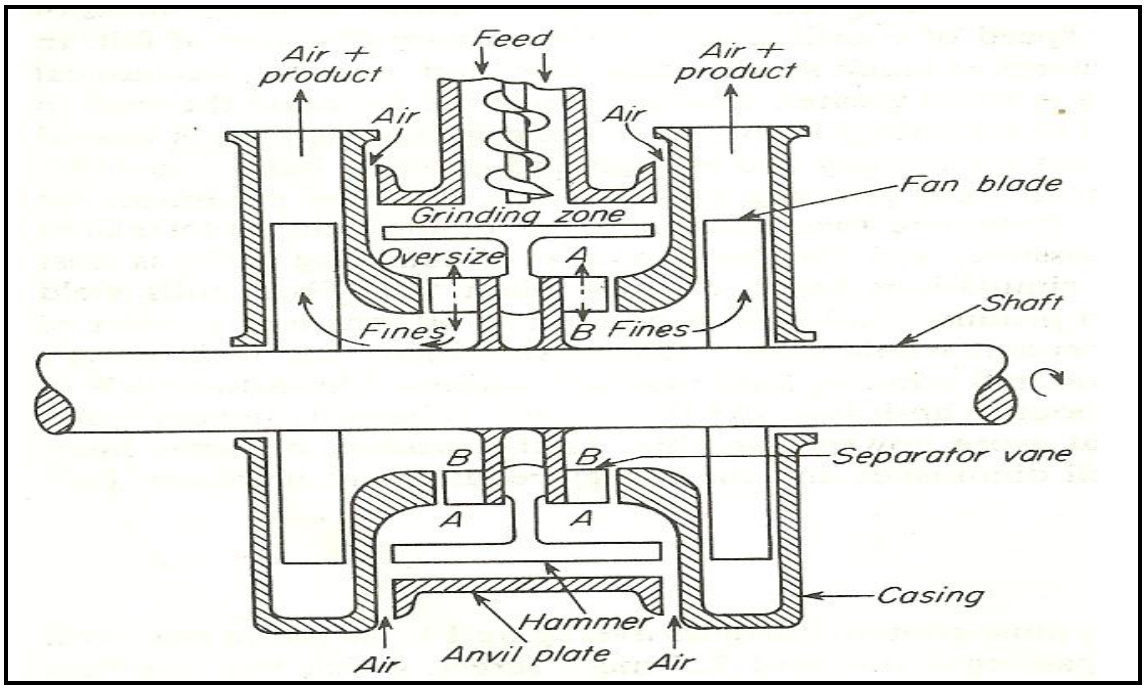
[20]

QUESTION 4

4.1 4.1.1
- Rod mills
- Ball mills, pebble mills
- Tube mills, compartment mills (Any 2 × 1) (2)

4.1.2
- Bowl mills
- Roller mills (2 × 1) (2)

4.2



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

4.3 Ultrafine grinding of dry powders is done by grinders such as high-speed hammer mills, provided with internal or external classification and by fluid energy mills.✓ Ultrafine wet grinding is done in agitated mills.✓ (2)

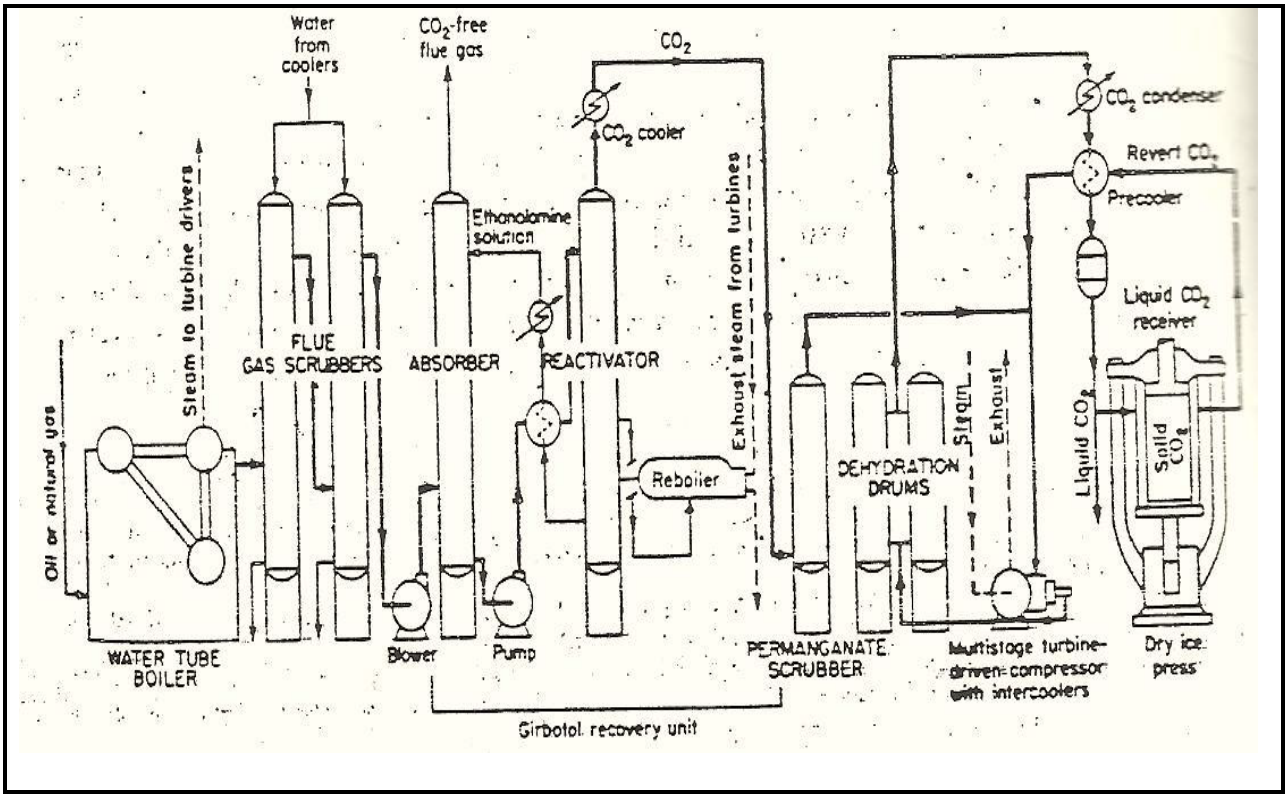
4.4
- Two heavy smooth faced metal rolls turning parallel on horizontal axes are the working element of the crusher.
- Particles of the feed caught between the rolls are broken by compression and drop out below.
- The rolls turn towards each other at the same speed.
- To allow unbreakable materials to pass through without damaging the machine, at least one roll should be spring-mounted. (4)

[20]

QUESTION 5

5.1
- Electrolysis of water
- Steam reforming of hydrocarbons
- Thermal dissociation of neutral gas
- Partial oxidation of hydrocarbons
- Reaction of acid and some metals (Any 4 × 1) (4)

5.2



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

5.3
- In the production of steel
- Metal working
- Underground gasification
- Medical purposes
- Liquid oxygen as fuel in aerospace application (NASA)
- Aviation and diving
- Synthetic fuel production
- Aeration of waste water (Any 4 × 1) (4)

5.4
- Liquefaction
- Rectification (distillation) (2)

[20]

QUESTION 6

6.1
- Heat and corrosion resistant
- Noncontaminating
- Easily welded into complex shapes (3)

6.2
- Nickel
- Chromium
- Silicon
- Molybdenum (Any 2 × 1) (2)

6.3
- Lightweight
- Good thermal and electrical insulators
- Easy to fabricate and install
- Have a low friction factor
- Can be recycled (Any 4 × 1) (4)

6.4 6.4.1 Sulfonation: It is the process where sulfur is chemically bonded to hydrocarbons✓ to make hydrocarbons more reactive✓ for the purpose of further synthesis.✓

OR

Sulfonation: It is a chemical conversion to effect variation in properties so as to introduce greater solubility✓ or to make hydrocarbon more reactive✓ for the purpose of further synthesis.✓

6.4.2 Oxidation: It involves the scission of carbon to carbon (C–C)✓ and carbon to hydrogen (C–H)✓ bonds with the formation of carbon to oxygen (C–O) bonds.✓ The cheapest reagent and the one often employed is air, but more and more oxygen is being used.

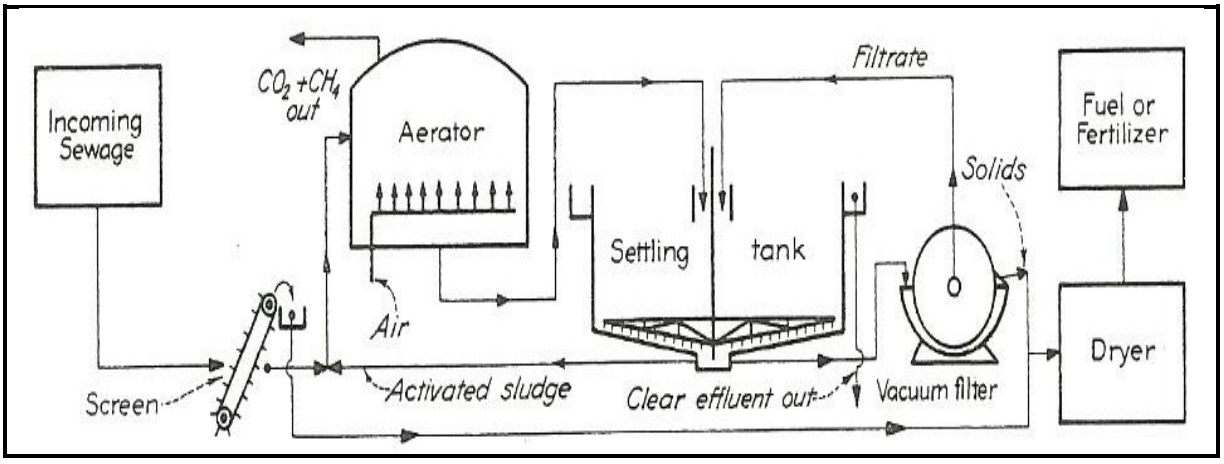
(2 × 3) (6)

[15]

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QUESTION 7

7.1



(1 mark for each correct label) (Any 8 × 1) (8)

7.2 7.2.1 Ion exchange: It is a chemical reaction in which mobile hydrated ions of solids are exchanged, equivalent for equivalent for ions of like-charge in the solution. (3)

7.2.2 Softening: It refers to a process which removes or reduces the hardness of water. (2)

7.2.3 Temporary hardness: It is the hardness that is caused by bicarbonates of calcium and magnesium. (2)

[15]

TOTAL: 100

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