higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

PLANT OPERATION THEORY N1

13 April 2021

This marking guideline consists of 6 pages.

Copyright reserved

QUESTION 1: CHEMISTRY

1.1 1.1.1 True
1.1.2 True
1.1.3 False
1.1.4 False
1.1.5 False

(5 × 1) (5)

1.2 1.2.1 0
1.2.2 2
1.2.3 1
1.2.4 3

(4 × 1) (4)

1.3 A salt is formed when an acid reacts with a base.✓

$NaOH$✓ + $HC\ell$✓ ⟶ $NaC\ell$✓ + H_2O✓
salt water

(1 mark for balanced equation) (6)

1.4 Mr $(Mg(HCO_3)_2$ = Mg:1 × 24 = 24✓
= H:2 × 1 = 2✓
= C:2 × 12 = 24✓
= O:2(3 × 16) = 96✓
146 g/mol✓ (5)
[20]

QUESTION 2: VALVES AND PIPES

2.1 **Advantages:**

- Easier to handle
- Easier to join
- Lightweight
- Cheap (Any THREE)

Disadvantages:

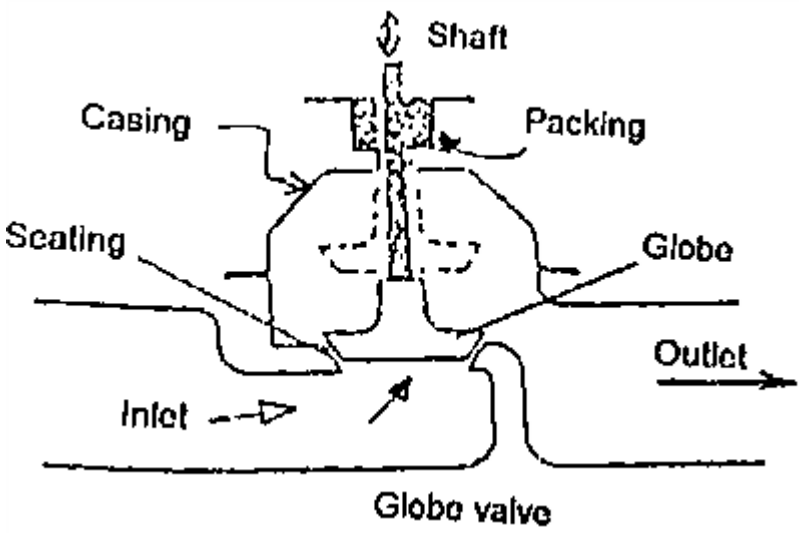
- Cannot resist high pressure
- Moderates temperature
- Corrosion resistance
- Chemical abuse resistance (Any THREE)

(3 + 3) (6)

2.2 P = pgh
= 481,3 kg/m^3 × 9,81 × 6 m✓
= 28 329,381 Pa✓
= 28,329 kPa✓

Total pressure = gauge pressure + atmosphere
= 101,3 kPa + 28,329 kPa✓
= 129,629 kPa✓ (5)

2.3



(7)

2.4
- Gate valves
- Plug valves
- Globe valves
- Needle valves
- Diaphragm valves (Any 2 × 1) (2)

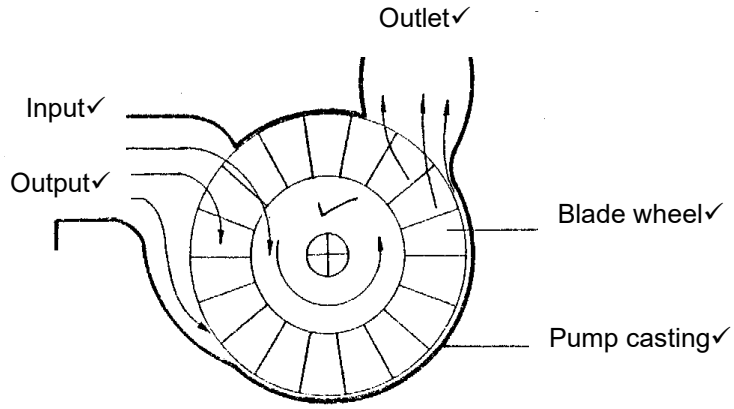
[20]

QUESTION 3: PUMPS AND INSTRUMENTATION

3.1
- Quantity (mass) to be displaced by the pump
- Distance or height to be displaced
- Time in which it has be done
- Supply pressure (4)

3.2
- Open-vane impellers:✓ suitable for fluids containing solids like sewerage✓
- Semi-closed or web impellers:✓ utilised to handle fluids containing sand or less suspended sediments✓
- Open-sided or ribbed impellers: excellently suited for pumping water containing fibrous material✓
- Closed or shielded impellers:✓ popular for all types of centrifugal pumps✓ as it is strong and capable of high revolution (velocities), easy to mix and easily balanced✓ (8)

3.3



Neatness✓ (6)

3.4 A vacuum occurs when the pressure is lower than atmosphere. This is measured with a mechanical pressure gauge like a bourdon tube with a negative scale.

OR

It can be measured with a U-tube manometer filled with negative scuttle or a U-tube manometer filled with mercury with the one leg sealed off having an absolute vacuum inside. (2)

[20]

QUESTION 4: DISTILLATION AND WATER TREATMENT

4.1
- Economic
- Prevents scaling
- Prevents corrosion
- Improves working processes (4)

4.2 4.2.1 It is caused by bicarbonate of calcium and magnesium and calcium carbonate.

4.2.2 It is caused by sulphates and chlorides of calcium and magnesium.

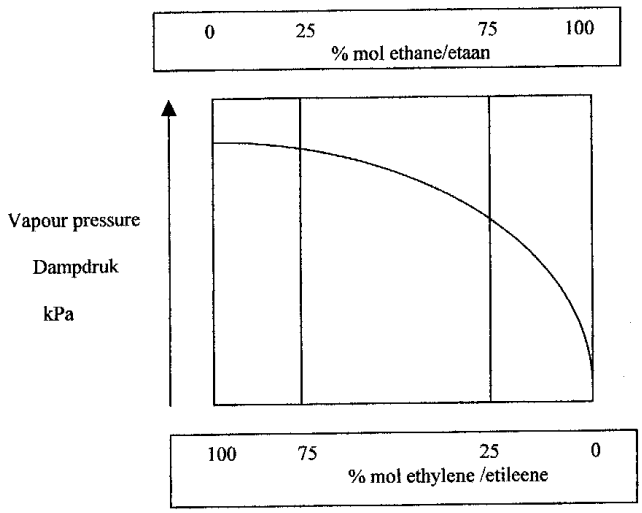
4.2.3 It is the process to remove or reduce hardness.

4.2.4 It is the removal of organic matter and microorganisms from water.

(4 × 2) (8)

4.3
- Temperature
- Pressure (2)

4.4

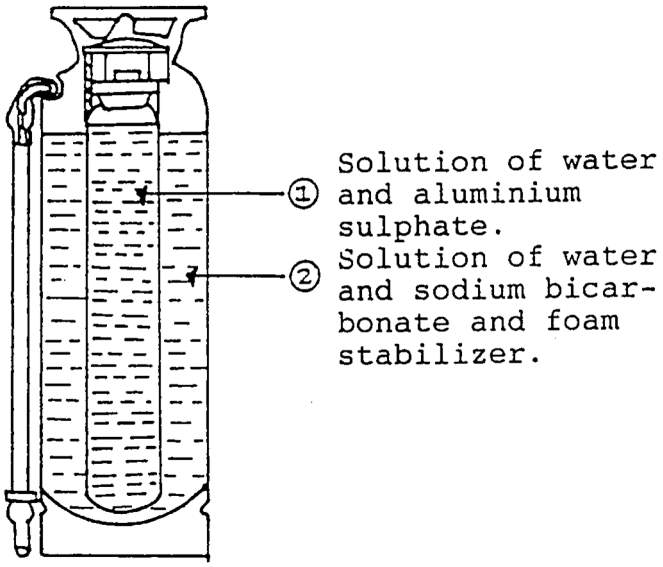


(4)

4.5 It is a fluid with high vapour pressure evaporating easy with low boiling points. (2)
[20]

QUESTION 5: SAFETY AND STORAGE

5.1



Neatness✓

This type must be used upside down.✓ The handle is turned so that the aluminium sulphate solution in the inner container comes into contact with the sodium bicarbonate (bicarbonate of soda), reacts and releases the foam.✓ The foam forms its own high pressure and blows out of the nozzle.✓ (7)

5.2
- Fuel
- Oxygen
- Ignition (heat) (3)

5.3 $V = \pi r^2 h + 4\pi r^3 \div 3)$✓
$= (\pi(2)^2 6 + 4\pi r^3 \div 3) \times 0,4$✓
$= (75,398 + 33,510) \times 0,4$✓
$= 75,398 \times 3,4668$✓
$= 43,564\ m^3$✓ (6)

5.4
- Sodium
- Potassium
- Magnesium
- Lithium
- Zirconium
- All metal hydrides (Any 4 × 1) (4)

[20]

TOTAL: 100

Copyright reserved