higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

PLANT OPERATION THEORY N3

7 April 2020

This marking guideline consists of 6 pages.

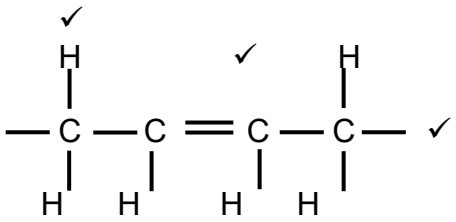
Copyright reserved

QUESTION 1: CHEMISTRY AND CATALYSTS

1.1 1.1.1 Polycondensation is the process where molecules condense and emit small molecules such as water, hydrochloric acid and ammonia. (2)

1.1.2
- Natural polymers,✓ e.g. rubber, cellulose✓
- Half-synthetic/semisynthetic polymers,✓ e.g. cellulose nitrate, cellulose acetate✓
- Synthetic polymers,✓ e.g. nylon, Perspex, PVC✓ (6)

1.1.3



(3)

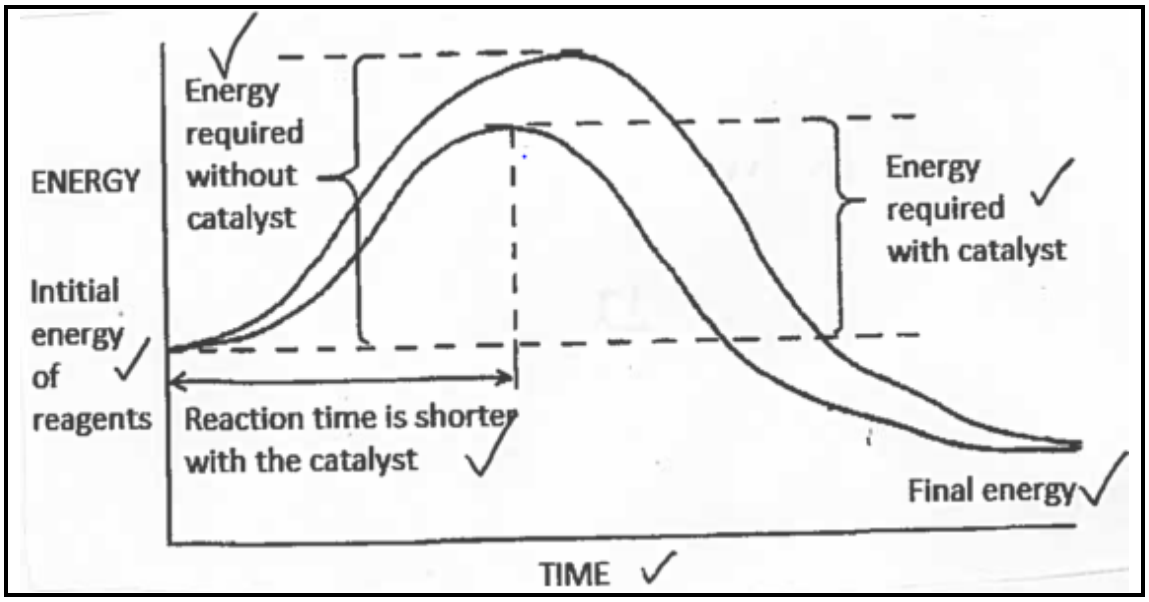
1.2 1.2.1 Vulcanisation (1)

1.2.2 Carbonisation (1)

1.2.3 Carbonisation (1)

1.2.4 Vulcanisation (1)

1.3



(6)

1.4 1.4.1 MnO2 (1)

1.4.2 Homogenous (1)

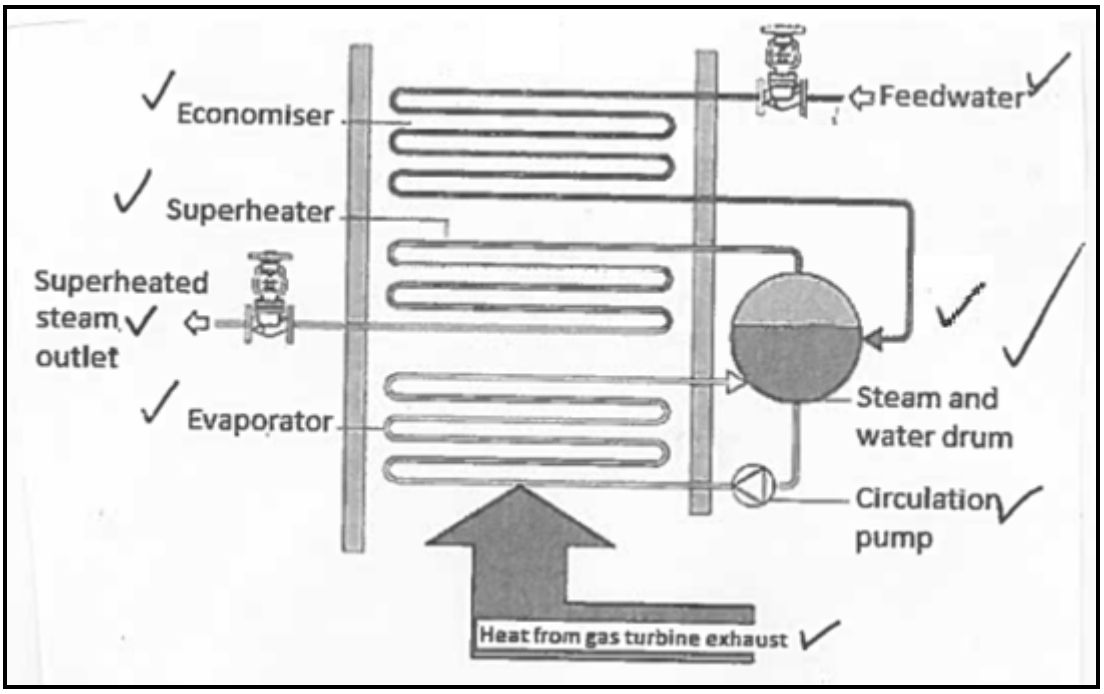
1.4.3 This is an endothermic reaction which mean that it uses heat from the surrounding to react. (2)

[25]

QUESTION 2: COMBUSTION, COKING AND GASIFICATION OF COAL

2.1
- Carbon dioxide
- Water
- Sulphur dioxide
- Ash
- Nitrogen
- Excess oxygen (Any 5 × 1) (5)

2.2



(9)

2.3
- Aliphatic carbon – the carbon bonds break first
- When temperatures approach and exceed 600 °C the carbon-hydrogen bonds are broken.
- The formation of complex ring bonds and aromatics are largely inhibited during coking.
- The average molecular mass of the volatile intermediate products gradually decreases as the temperature increases.
- Breaking of bonds reaches a maximum at temperatures between 300 °C and 600 °C. (5)

2.4 Ash from coal is the portion which remains after complete combustion of the coal. (1)

[20]

QUESTION 3: HEAT TRANSFER, HEAT EXCHANGER AND THERMAL INSULATION

3.1
- Change of phase or state
- Change of colour
- Change of dimensions (expansion)
- Electrical effect
- Change of composition (4 × 1) (4)

3.2 C_2H_4✓ + H_2O✓ $\rightleftharpoons$ C_2H_5OH (4)

3.3
- Thick viscous liquids
- The condition of the liquid (2)

3.4 3.4.1
- Keep to the specifications and limits set by the designers.
- When heat exchangers operate beyond these limits and specifications, their efficiency is affected.
- It is also uneconomical to exceed the limits especially for long periods.
- Superheated steam for instance must be used when saturated steam is specified. (4)

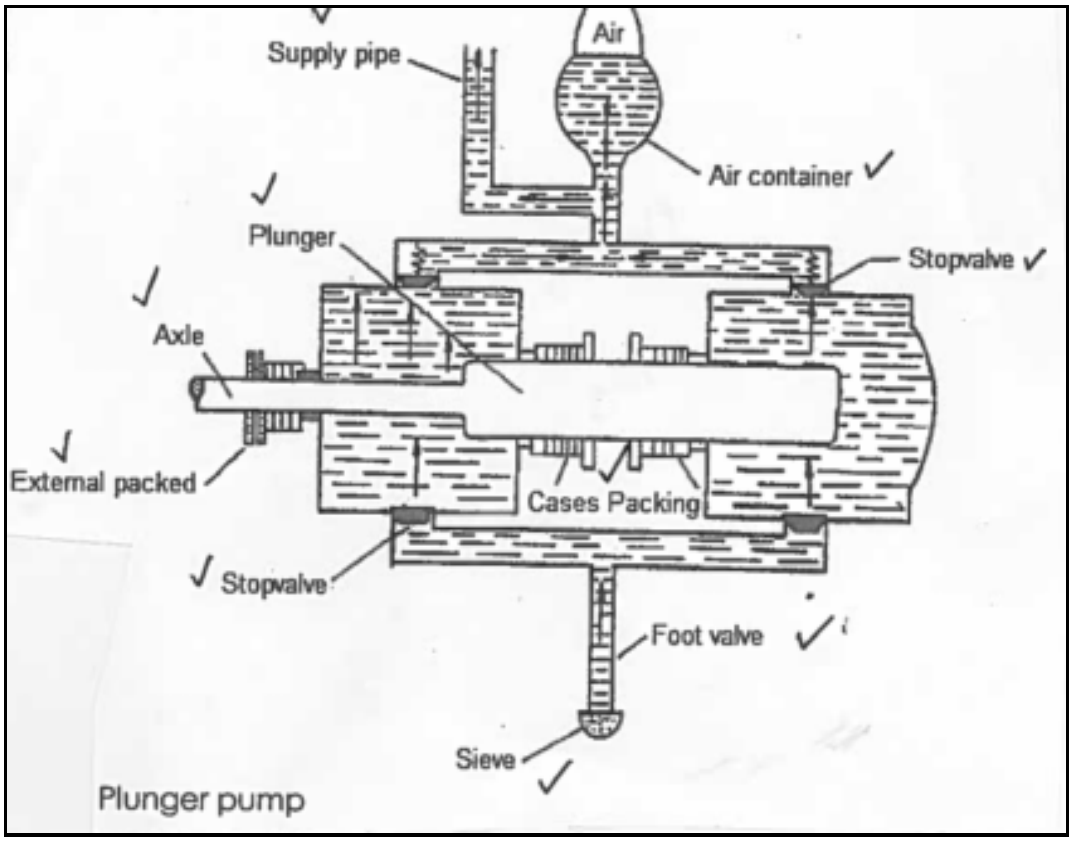
3.4.2
- Corrosive material which attacks and corrodes the material of the heat exchanger, must go through the tubes.
- It is more economical to replace the tubes than the shells. (2)

3.5
- Long life
- Vermin proof
- High insulating value
- Non-corrosive
- Ease of application and installation
- Ability to retain its shape and insulating value when wet (6 × 1) (6)

3.6 3.6.1 True
3.6.2 True
3.6.3 False
(3 × 1) (3)
[25]

QUESTION 4: PUMPS AND COMPRESSION

4.1



(10)

4.2
- Less force or work is required per unit volume of the gas.
- The final temperature of the gas is lower.
- The final volume of the gas is less but the density of the gas is higher.
- Moisture present in the gas and vapours which condensate at or under these pressures and temperatures, are drained from the intermediate cooler avoiding damage to the compressor by the liquid which is non-compressible. (Any relevant 2 × 2) (4)

4.3
- Induced counterflow draught towers
- Double-flow towers packed with filling (2)

[16]

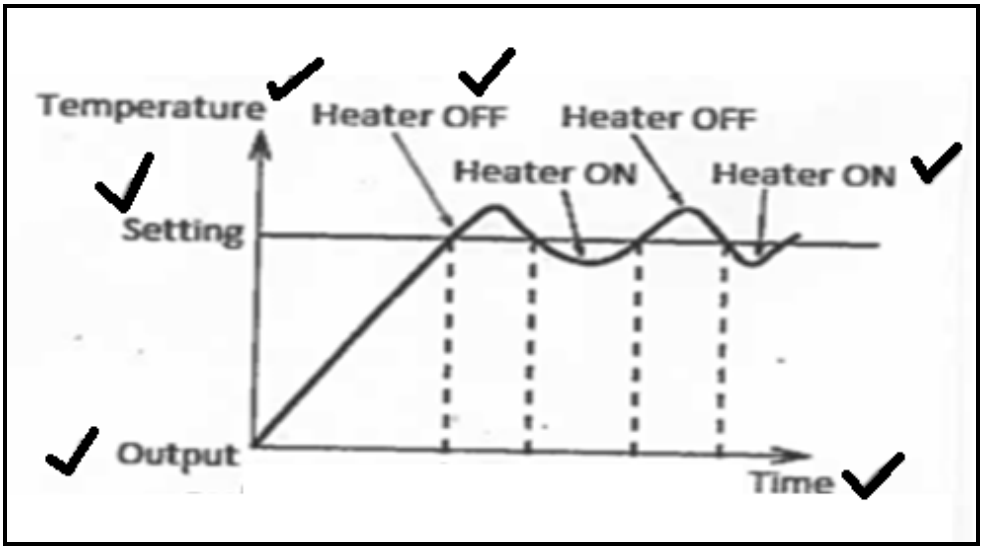
QUESTION 5: INSTRUMENTATION AND CONTROL SYSTEM

5.1 5.1.1 It is a system with a measuring element such as a level gauge or bellows-type gauge having a sliding contact moving across a resistance coil.

5.1.2 It is a system with a type of crystal/s which generates an EMF when pressure is applied to it or removed.

(2 × 2) (4)

5.2



(6)

5.3
- The distance over which they may be used is practically unlimited.
- The signal or impulse is transmitted rapidly causing no delays or lags.
- The electrical systems are usually more easily installed and replaced.
- They take up less space. (4)

[14]

TOTAL: 100

Copyright reserved