higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

CHEMICAL PLANT OPERATION N5

(8050015)

15 April 2021 (X-paper)
09:00–12:00

Nonprogrammable calculators and drawing instruments may be used.

This question paper consists of 4 pages and 1 addendum.

185Q1A2115

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
CHEMICAL PLANT OPERATION N5
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Sketches must be large, neat and fully labelled.
5. Write neatly and legibly.

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QUESTION 1

Complete the sentences by writing the missing word or words next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 The saturation temperature depends on the ... exerted on the surface of the water.

1.2 In axial-flow turbines, steam flow is … to the turbine axis.

1.3 Steam turbines consist of nozzles and …

1.4 Nozzle-mix burners mix … and gas at the burner tile.

1.5 Equilibrium is an inverse function of … and a direct function of the O_2/SO_2 ratio.

(5 × 1) **[5]**

QUESTION 2

2.1 State the specific procedure used for solving material balance problems. (5)

2.2 Complete the reactions:

2.2.1 $4NH_3 + 3O_2 \rightarrow$

2.2.2 $NaNO_3 + H_2SO_4 \rightarrow$

(2 × 2) (4)

2.3 Name SIX mixers and what they are used for. (12)

2.4 Explain the advantages and disadvantages of closed-circuit gas turbines. (4)
[25]

QUESTION 3

3.1 Write brief notes on:

3.1.1 Reaction turbine (4)

3.1.2 Impulse turbine (4)

3.1.3 The design of nozzle (9)

3.2 Name FIVE factors that affect the efficiency of the cyclone. (5)
[22]

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QUESTION 4

4.1 Discuss the operation of centrifugal decanters. (5)

4.2 Heavy Naphtha A from the crude fractionators is combined with heavy Naphtha B. After mixing, the combined feed enters the catalytic reformer.

Assume that A contains 65% C_6 hydrocarbons and 35% C_8 hydrocarbons, while B contains 55% C_6 hydrocarbons and 45% C_8 hydrocarbons.

If 250 kg of A and 150 kg of B are mixed per minute, calculate:

4.2.1 The number of kilograms of mixture produced per minute (6)

4.2.2 The composition of the mixture (12)
[23]

QUESTION 5

Indicate whether the statements are TRUE or FALSE by writing 'True' or 'False' next to the question number (5.1–5.5) in the ANSWER BOOK.

5.1 Heat is the form or manifestation of energy that flows from one object to another under the influence of temperature difference.

5.2 Enthalpy is the heat required to produce steam at constant pressure.

5.3 Pony mixers consist of two counteracting ribbons mounted on the same shaft.

5.4 The main purpose of fuel combustion is to release heat energy.

5.5 The heat of reaction equals the sum of the heat of formation of reactants minus the heat of formation of the products.

(5 × 1) **[5]**

QUESTION 6

6.1 Draw a labelled diagram of a tubular centrifuge and explain its principle of operation. (12)

6.2 Give a chronological description of the production of the sulphur-burning sulphuric acid process. (8)
[20]

TOTAL: 100

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THE PERIODIC TABLE OF ELEMENTS
DIE PERIODIEKE TABEL VAN ELEMENTE

