higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T320**(E)**(A8)T

NATIONAL CERTIFICATE

CHEMICAL PLANT OPERATION N5

(8050015)

8 April 2019 (X-Paper)
09:00–12:00

REQUIREMENTS: Steam tables

Calculators may be used.

This question paper consists of 4 pages.

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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

Give a word/term for each of the following descriptions. Write only the word/term next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 Energy of an object due to its position or state of tension

1.2 The temperature at which water will change to steam

1.3 The difference in energy between the products of the reaction and the reactants

1.4 The agitator which consists of several vertical blades on a rotating head

1.5 An operation in which conditions within the process or system do not change with time, that is it does not change from one moment to another

(5 × 1) **[5]**

QUESTION 2

2.1 Determine the heat required to change 7 kg of water at a pressure of 4,5 kPa and 31 °C to dry saturated steam at 14 MPa. (5)

2.2 Draw a fully labelled diagram of an impulse reaction turbine. (6)

2.3 State FIVE specific procedures for solving material balance problems. (5)

2.4 Define the following:

2.4.1 Kopp's rule

2.4.2 Hess' law of heat summation

(2 × 2) (4)

[20]

QUESTION 3

3.1 A mixture of hydrogen and methane is burned to its final products of combustion in a boiler using air. The analysis of the stack gas on a dry basis is 84% N_2, 11,1% O_2 and 4,9% CO_2.

3.1.1 Calculate the amount of methane (CH_4) in the fuel. (5)

3.1.2 Calculate the amount of hydrogen (H_2) in the fuel. (7)

3.1.3 What is the ratio of H_2 to CH_4 in the fuel? (2)

3.1.4 What is the ratio of fuel to the air? (2)

3.2 Define the term *tie substance.* (4)
[20]

QUESTION 4

4.1 Explain the following:

4.1.1 Tubular centrifuge (5)

4.1.2 Impact wheels (4)

4.1.3 Tumbling mixers (6)

4.1.4 Two-arm kneaders (7)

4.2 Draw a labelled diagram of an internal Banbury mixer. (8)
[30]

QUESTION 5

5.1 State FOUR major sources of hydrochloric acid. (4)

5.2 State FIVE uses of nitric acid. (5)

5.3 What are the FOUR conditions to be considered when maximising the chemical conversion of sulphur dioxide to sulphur trioxide? (4)

5.4 Discuss the chronological steps to follow in the salt process for the manufacturing of hydrochloric acid. (12)
[25]

TOTAL: 100

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