



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T330(E)(A3)T

NATIONAL CERTIFICATE

CHEMICAL PLANT OPERATION N6

(8050026)

3 April 2018 (X-Paper)

09:00–12:00

This question paper consists of 5 pages.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
CHEMICAL PLANT OPERATION N6
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. Write neatly and legibly.
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QUESTION 1

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.1–1.5) in the ANSWER BOOK.

- 1.1 Steady-state moving-bed absorbers require continuous movements of both liquid and adsorbent through the equipment.
- 1.2 By means of crystallisation, salt is removed from crude oil.
- 1.3 Rectification is defined as a single-unit distillation operation in which vaporisation occurs in repeated steps.
- 1.4 A filled system thermometer is advantageous in the process industries as its measuring system is self-contained.
- 1.5 The C-Bourdon tube consists of two fixed ends open for pressure application.

(5 × 1)

[5]**QUESTION 2**

Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–H) next to the question number (2.1–2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.1	A method used to separate mixtures into various components by a process involving partial vaporisation	A	alkylation
		B	base
2.2	Petroleum-base crudes consist of open-chain compounds and furnish a low-octane number	C	cracking
		D	distillation
2.3	It is the breaking up of any hydrocarbon in such a way that carbon-carbon bonds break up to form a new hydrocarbon product	E	naphthene base
		F	evaporation
2.4	A substance which ionises when dissolved in water to form hydroxide ions	G	paraffin base
		H	acid
2.5	This process takes place as a result of heating which provides the molecules of the liquid with greater molecular movement		

(5 × 1)

[5]

QUESTION 3

3.1 Most adsorbents are highly porous materials and adsorption takes place on the walls of the pores or at specific sites inside the particles.

Discuss contact filtration with regard to the following:

- 3.1.1 The method of dealing with spent adsorbents (8)
- 3.1.2 Adsorbent to be used (6)
- 3.2 Describe the operation of a Higgins contractor. (7)

[21]

QUESTION 4

4.1 In counter trays, liquid and vapour flow counter-currently through the same openings.

Give FOUR examples of trays that can be used for this purpose. (4)

4.2 Differentiate between *volatility* and *relative volatility*. (4)

4.3 Define the following terms:

4.3.1 Octane number (3)

4.3.2 Naphtha (2)

4.4 Petroleum crudes and products contain paraffinic, olefinic, aromatic and naphthenic hydrocarbons (PONA), but in different proportions.

Write brief notes on the following:

4.4.1 Paraffinic crude (2)

4.4.2 Intermediate-base crude (4)

4.4.3 Naphthene-base crude (4)

4.5 Name FOUR products obtained from coal tar distillation. (4)

[27]

QUESTION 5

- 5.1 Draw a labelled flowchart for the manufacturing of NaOH by means of a caustic cell. (10)
- 5.2 Optical pyrometers are used industrially to work out the unknown temperature of a hot body by comparing its brightness with a known temperature.
- Draw a labelled diagram of an optical pyrometer, and describe its operation. (11)
[21]

QUESTION 6

- 6.1 The diaphragm level gauge is a pressure switch that should be installed at a certain point in a container.
- Describe the operation of the diaphragm-type depth-measuring instrument. (6)
- 6.2 Make a fully labelled sketch of a chain-balance plummet hydrometer. (8)
- 6.3 Write brief, explanatory notes on the following scales that are used industrially:
- 6.3.1 Rankine scale (4)
- 6.3.2 Celsius scale (2)
- 6.4 What does the value of 7 represent on the pH scale? (1)
[21]

TOTAL: 100