higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

CHEMICAL PLANT OPERATION N6

(8050026)

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This question paper consists of 6 pages.

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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. Use only a black or blue pen.
5. Write neatly and legibly.

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QUESTION 1

Various options are given as possible answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 This type of tower is designed for vapours at high pressure because the gas move through the adsorbent and is dried.

A Absorption tower
B Fractionation tower
C Adsorption tower
D Packed tower

1.2 These designs have involved improvement both in perforation design and the tray arrangement.

A Linde plates
B Bubble plates towers
C Linde plates
D Counter-flow plates

1.3 Where distillation only produces an overhead and bottom product, … still produces blends between overhead and bottom.

A distillation
B extraction
C fractionation
D filtration

1.4 A reflux drum is one of the components of a …

A fix-bed adsorber.
B fractionation tower.
C typical absorption unit.
D Higgens contractor.

1.5 In the operation of this type, the unit can be brought to a steady operating condition where the amount of feed exactly equals the amount of material removed.

A Relative volatility
B Distillation
C Continuous distillation
D Vapour-liquid equilibrium

(5 × 1) **[5]**

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QUESTION 2

2.1 Discuss the differences between *Raoult's law* and *Dalton's law* and also give applicable equations of each. (4)

2.2 Describe discharge gutters as a component of distillation and fractionation columns. (6)

2.3 Explain the purpose of using the fractionation process in the refining industry. (5)

2.4 Absorption works on the principle of diffusion and chemical reactions.

2.4.1 What is the purpose of the absorption process in industry? (1)

2.4.2 Draw a labelled diagram of a typical absorption unit. (4)

[20]

QUESTION 3

3.1 Briefly explain the alkylation of hydrocarbons. (5)

3.2 Write brief, explanatory notes on crude petroleum oil as a liquid fuel. (5)

3.3 Describe the purification of natural gas. (5)

3.4 Explain each of the following concepts with the aid of an example:

3.4.1 Cracking (2)

3.4.2 Hydrogenation (3)

3.5 Explain the following:

3.5.1 The olefin series (3)

3.5.2 The naphthalene series (2)

[25]

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QUESTION 4

4.1 A salt is formed when an acid reacts with base. Write in words reaction equations which result in the formation of the following type of salts:

4.1.1 Acidic salt

4.1.2 Basic salt

(2 × 2) (4)

4.2 Explain ion exclusion. (4)

4.3 Write brief explanatory notes on the preparation steps concerning special purification of caustic soda using a diaphragm cell. (3)

4.4 Write brief notes on each of the following pH values:

4.4.1 3

4.4.2 12

4.4.3 A change of 1 pH unit

(3 × 2) (6)

4.5 Draw a neatly labelled diagram to show how sodium hydroxide is being prepared by means of electrolysis using mercury cells. (8)

[25]

QUESTION 5

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

5.1 Measuring one or more process variables and regulating the process according to the measurement controls a modern industrial process.

5.2 1 – 70 bars; solid heat – treated beryllium copper is one kind of bourdon tube that is applicable when the fluid has no corrosion problems concerning pressure conditions.

5.3 Bi-metal strip thermometers are thermometers of the same type of metal, with different co-efficients of expansion.

5.4 RTDs are pressure-measuring instruments.

5.5 A positive displacement meter is an indirect flow-measuring instrument.

(5 × 1) **[5]**

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QUESTION 6

6.1	List FIVE types of positive displacement meters.	(5)
6.2	Sketch a fully labelled installed orifice plate to measure flow and write a brief description of the plate.	(10)
6.3	Briefly explain Rankine as a temperature scale.	(2)
6.4	Name THREE instruments used to measure density and gravity.	(3)
		[20]

TOTAL: 100

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