



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
CHEMICAL PLANT OPERATION N6

(8050026)

29 July 2021 (X-paper)
09:00–12:00

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. Start each question on a new page.
 5. Only use a black or blue pen.
 6. Write neatly and legibly.
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QUESTION 1

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1–1.5) in the ANSWER BOOK.

- 1.1 70 °C is equal to 105,3 °F.
- 1.2 Multiple V-notch weirs are used to maintain the depth of a liquid.
- 1.3 In a fixed-bed adsorber, dried gas leaves the adsorber at the bottom.
- 1.4 The maximum temperature of a filled-system thermometer is more limited than in an electrical measuring system.
- 1.5 Viscosity is measured in poise or stokes.

(5 × 1)

[5]**QUESTION 2**

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

COLUMN A		COLUMN B	
2.1	Property of material by which it resists a shearing force	A	$V_a = \frac{P_a}{X_a}$
2.2	Another name for alkanes	B	valve tray <input type="radio"/>
2.3	Solution with a pH greater than 14	C	naphthenic hydrocarbon
2.4	Volatility <input type="radio"/>	D	strong acid
2.5	Sieve tray with variable openings for gas flow	E	strong alkaline
		F	viscosity
		G	counterflow tray
		H	paraffinic hydrocarbon
		I	$\alpha_{ab} = \frac{V_a}{V_b}$

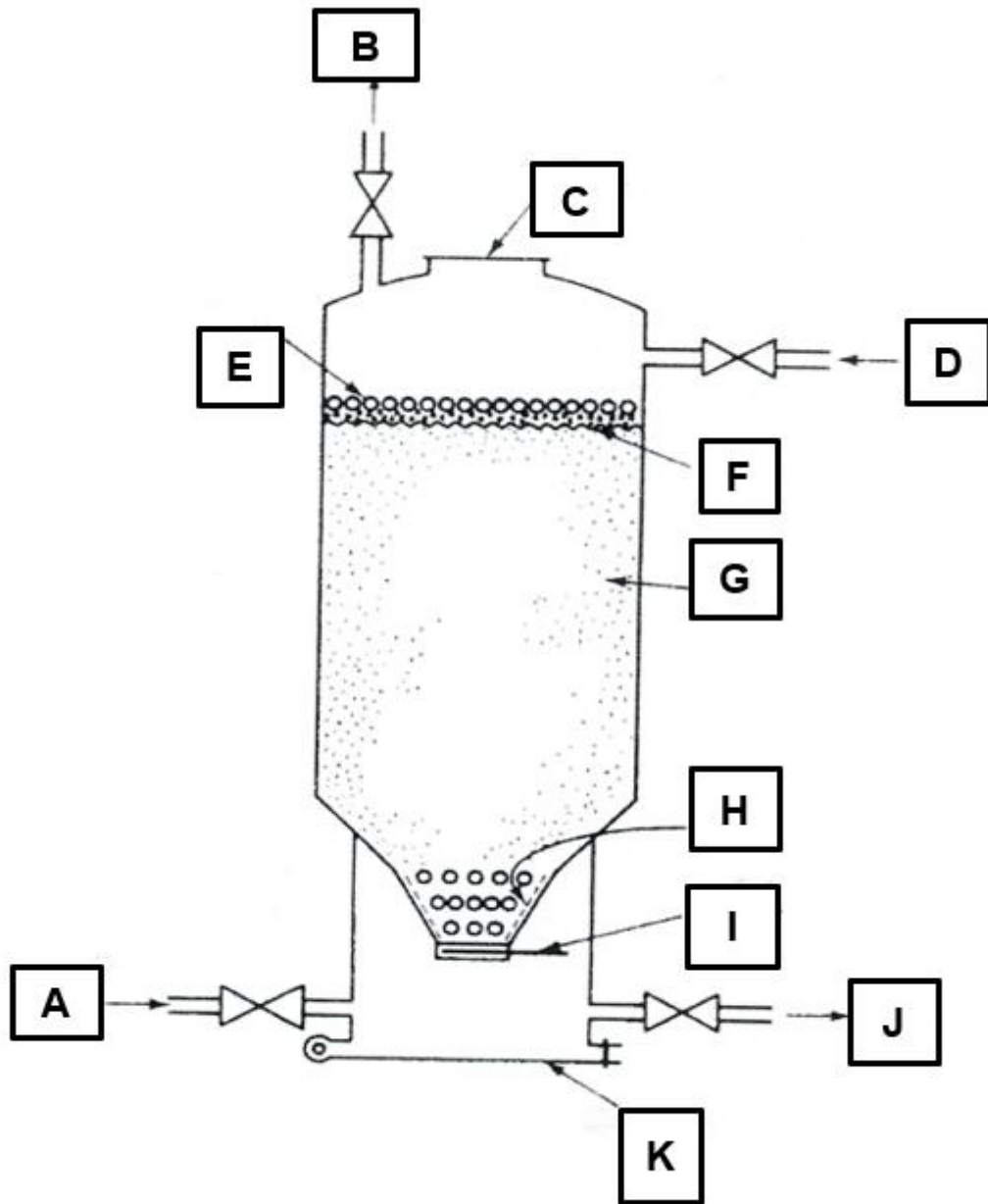
(5 × 1)

[5]

QUESTION 3

3.1 Differentiate between *distillation* and *rectification*. (4)

3.2 The following diagram represents a fixed-bed adsorber for vapour at high pressure. Complete the diagram by filling in the missing labels. Write only the letters (A–K) and your answer in the ANSWER BOOK.





(11)


3.3 Describe the working principles of a valve tray. (5)

[20]


QUESTION 4

- 4.1 Define the following processes:
- 4.1.1 Cracking or pyrolysis
 - 4.1.2 Isomerisation 
 - 4.1.3 Polymerisation
- (3 × 2) (6)
- 4.2 List THREE processes that are used to refine crude oil. (3)
- 4.3 State FIVE uses of LPG (liquid petroleum gas). (5)
- 4.4 Natural gas contains undesirable water and hydrogen sulphide that must be removed before entering a transmission line. 
- 4.4.1 Which processes would you use to remove water and hydrogen sulphide during the purification of natural gas? (2)
 - 4.4.2 Why is it important to remove the hydrogen sulphide from the natural gas? (1)
 - 4.4.3 Give THREE reasons for removing water from natural gas. (3)
- [20]**

QUESTION 5

- 5.1 Draw a labelled process flow diagram for the manufacturing of aluminium sulphate by means of the Dorr procedure and give a chronological description of the process.  (15)
- 5.2 List FIVE gaseous products that can be produced during high-temperature carbonisation of coal. (5)
- [20]**

QUESTION 6

- 6.1 Sketch a fully labelled diagram of a C-Bourdon tube and describe its operation. (13)
- 6.2 Discuss the operation of an optical pyrometer.  (7)
- [20]**

QUESTION 7

- 7.1 List FIVE types of positive displacement meters. (5)
- 7.2 Write brief, clarifying notes on Kelvin as a temperature scale. (3)
- 7.3 Define an *acidic solution*. (2)

[10]

TOTAL: 100