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 5 pages.

080Q1E2324

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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 blue or black pen.
5. Write neatly and legibly.

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QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

1.1.1 The movement of the molecules of the vapour decreases as a result of cooling.

A Evaporation
B Precipitation
C Condensation
D Transpiration

1.1.2 The vapour pressure of a solvent above a solution is equal to the vapour pressure of the pure solvent at the same temperature scaled by the mole fraction of the solvent present.

A Dalton's law
B Charles's law
C Boyle's law
D Raoult's law

1.1.3 This type of tower is filled with Raschig rings, charcoal and grit.

A Bubble plate tower
B Packed tower
C Cooling tower
D Counterflow plates

1.1.4 This is NOT one of the typical process applications for contact filtration of liquids.

A Hydrogenation
B Carbon used to adsorb odorous substances
C Collection of insulin
D Adsorption onto carbon of iodine

1.1.5 This refers to the process in which a substance accumulates on the surface of a solid, forming a thin film.

A Absorption
B Filtration
C Extraction
D Adsorption

(5 × 1) (5)

1.2 List FOUR types of heavy distillates in refining operations using fractionation. (4)

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

Name FOUR examples of trays that are used for this purpose. (4)

1.4 Make a labelled sketch of a Higgins contactor indicating the position of the piston and valve. (6)

1.5 Write brief, explanatory notes on the following processes that are used for the purification or separation of petroleum products:

1.5.1 Filtration

1.5.2 Crystallisation

1.5.3 Extraction

(3 × 2) (6)
[25]

QUESTION 2

2.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1.1–2.1.5) in the ANSWER BOOK.

2.1.1 Methane is one of the main components of LPG.

2.1.2 Purification of natural gas involves the removal of H_2S.

2.1.3 LPG condenses to a liquid at five-bar pressure.

2.1.4 Naphthene base crude oil consists of relatively high-octane grade straight-run gasoline.

2.1.5 The boiling point of anthracene that is refined from cold tar continuous distillation is between 170 ºC and 300 ºC.

(5 × 1) (5)

2.2 Briefly discuss liquid petroleum gas as a fuel. (7)

2.3 Draw a fully labelled flow chart of a coal tar continuous distillation plant and list the products of the procedure. (13)
[25]

QUESTION 3

3.1 Briefly explain the following terms:

3.1.1 Acids (4)

3.1.2 Bases (4)

3.2 Make a labelled sketch of a pH scale indicating the different stages from a strong acid to a strong base (alkali). (6)

3.3 Explain *ion exclusion*. (3)

3.4 List FIVE properties of acids. (5)

3.5 Write brief explanatory notes on brine purification. (3)

[25]

QUESTION 4

4.1 Sketch a labelled diagram of an optical pyrometer and describe its operation. (12)

4.2 Write brief explanatory notes on the following:

4.2.1 Inductance-bridge hydrometer (4)

4.2.2 The law of intermediate metals (4)

4.3 Name FIVE types of pressure-measuring instruments used in the industry. (5)

[25]

TOTAL: 100

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