higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS TECHNOLOGY
NQF LEVEL 3

(6050353)

04 November 2022 (X-paper)
09:00–12:00

Calculators may be used.

This question paper consists of 6 pages.

067Q1N2204

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

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QUESTION 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 (1.1–1.5) in the ANSWER BOOK.

1.1 A liquid that cannot mix with oil is known to be …

A product.
B miscible liquid.
C reagent.
D blending.

1.2 … is the component of a shell-and-tube heat exchanger

A Tube outlet
B Twin flange
C Threaded adapter
D Hot fluid inlet

1.3 One of the advantages of plate heat exchangers is that corrugations … the surface area for heat transfer.

A also decrease
B remain unchanged
C also increase
D increase and decrease at the same time

1.4 Plasma as used in the drying process is …

A an opening in the equipment through which substances are released.
B a beam of ions moving in the same direction at the same speed.
C a soft, smooth, and thick mixture.
D a specific phase of matter that differs from the traditional solids, liquids, and gases.

1.5 The purpose of this dryer is to dry solids that have been dewatered or that have low moisture content.

A Flash dryer
B Spray dryer
C Paddle dryer
D Screw conveyor dryer

(5 × 1) **[5]**

QUESTION 2

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1–2.5) in the ANSWER BOOK.

2.1 Surge is a heavy up and down motion like that of great waves.

2.2 It is not easy to clean and install hairpin heat exchangers.

2.3 Gaskets prevent leakages and mixing of fluids in the plate and frame heat exchanger.

2.4 The conveyor system uses a nozzle and trays to carry materials and move them from one place to another.

2.5 Evaporator coils are heating coils.

(5 × 1) **[5]**

QUESTION 3

3.1 Define the following terms:

3.1.1 Absorption (2)

3.1.2 Combustion (1)

3.2 Briefly discuss the main purpose of using solids suspension. (3)

3.3 Explain how mixing time affects the mixing process. (2)

3.4 Describe general guidelines to be followed when taking gas samples. (4)

3.5 If the total volume of a mixture made up of acetic acid and water is 250 m^3 and the volume of acetic acid in the mixture is 50 m^3,

3.5.1 What will the volume of water be? (2)

3.5.2 Calculate the volume percentage of a mixture. (4)

[18]

QUESTION 4

4.1 Choose the description from COLUMN B that matches a term in COLUMN A. Write only the letter (A–E) next to the question number (4.1.1–4.1.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
4.1.1	Heat transfer coefficient	A	the direction in which the stream flows
4.1.2	Draft	B	a separate space provided for air circulation for heating, ventilation, air-conditioning
4.1.3	Buoyancy	C	… used to calculate the total heat transfer through a wall or heat exchanger
4.1.4	Plenum	D	… is a current or flow of air in an enclosed area
4.1.5	Flow path	E	… is a force exerted by a fluid that opposes an object's weight

(5 × 1) (5)

4.2 State FIVE disadvantages of shell-and-tube heat exchangers. (5)

4.3 With an aid of a schematic diagram, briefly discuss how an open cycle once-through cooling tower operates. (8)

4.4 List THREE types of cooling towers. (3)

4.5 What are the THREE ways in which heat can be transferred? (3)

4.6 Briefly write notes on how air is used for combustion. (6)

4.7 What is the type of gas formed due to the process of combustion? (1)

4.8 What happens to natural gas when it is burned at a power plant? (2)

4.9 Explain THREE common reasons for economiser failure during the production process. (3)

[36]

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QUESTION 5

5.1 Define the following terms:

5.1.1 Ion- exchange

5.1.2 Catalysis

5.1.3 Backwash

(3 × 2) (6)

5.2 Drying is a process where the liquid is removed from products in the solid, liquid or gas phase. The liquid removed is usually water but can be any other solvent in a liquid form at room temperature.

5.2.1 Write notes on the importance of drying products. (3)

5.2.2 Name at least THREE types of dryers except for a drum dryer. (3)

5.2.3 Draw a fully labelled sketch of a prilling tower. (4)

5.3 State FIVE advantages of a spray dryer. (5)

5.4 What is the use of a drying chamber in the spray dryer? (2)

5.5 Describe FIVE uses of zeolites in chemistry processes (5)

5.6 Give a brief description of the THREE classes of adsorption. (3 × 2) (6)

5.7 Explain how size exclusion separates solutes from a solution. (2)

[36]

TOTAL: 100

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