higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS TECHNOLOGY
NQF LEVEL 3

(6050353)

8 December 2020 (Y-paper)
13:00–16:00

This question paper consists of 6 pages.

445Q1N2008

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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 section on a new page.
5. Use only a black or blue pen.
6. Write neatly and legibly.

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SECTION A

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 The equipment that transfer energy from one process stream to another is known as a/an …

A cooling tower.
B air heater.
C heat exchanger.
D burner.

1.2 … is the type of fouling where unwanted materials build up due to the settling of dissolved salts in the process fluid.

A Corrosion
B Biological fouling
C Crystallisation
D Chemical fouling

1.3 The main function of the fin tubes is to …

A increase the heat transfer from the hot fluid in the tubes to the airflow surrounding the tubes.
B transfer energy from molecule to molecule by direct contact.
C transfer heat in a liquid or gas by circulation of currents from one region to another.
D direct the air through the air cooler or heater.

1.4 The hyperbolic shape of hyperbolic cooling towers helps to …

A accelerate the upward convective airflow to improve the cooling efficiency of the tower.
B generate power in the industries.
C decrease airflow velocity.
D minimise vibrations.

1.5 One way of cleaning dismantled components of a cooling tower is by …

A using sanders.
B de-inking.
C stopping water flow.
D unblocking filters.

(5 × 1) **[5]**

QUESTION 2

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

COLUMN A		COLUMN B	
2.1	Type of dryers where heat flows from an object with high temperature to one with a lower temperature	A	sensors
2.2	Dryers with two drums rotating inwards	B	adsorbate
2.3	Solid surface where water molecules adhere to	C	convection
2.4	They detect when the ion exchange bed is either saturated or clear	D	dissolved air flotation
2.5	The process where pressurized air is added into wastewater	E	conduction
		F	adsorbent
		G	double drum dryer
		H	vacuum flotation
		I	controllers
		J	twin drum dryer

(5 × 1) **[5]**

QUESTION 3

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (3.1–3.5) in the ANSWER BOOK.

3.1 The floating heat exchanger is type of a shell and tube heat exchanger.

3.2 Forced air draft air coolers pull the air across the bundles.

3.3 Fuel in a gas furnace is supplied to the stack.

3.4 Agitation of the suspension induces velocity gradients.

3.5 Hydraulic pressure is the pressure applied by a fluid.

(5 × 2) **[10]**

TOTAL SECTION A: 20

SECTION B

QUESTION 4

4.1 Define the terms below:

4.1.1 Blending

4.1.2 Chemical reaction

(2 × 2) (4)

4.2 Describe FOUR basic steps of batch mixing. (4)

4.3 List FIVE factors influencing the mixing process. (5)

4.4 Calculate the volume percentage of propanol if it is mixed with 320 ℓ of water to create a total volume of 460 ℓ. (7)

[20]

QUESTION 5

5.1 List THREE common flow arrangements of heat exchangers. (3)

5.2 Explain the working principles of a traditional shell and tube heat exchanger. (7)

5.3 Explain how fin separation can be prevented in air coolers/heaters. (2)

5.4 Write brief notes on the plenum chamber as one of the components of air coolers/heaters. (6)

5.5 Draw a labelled sketch of a basic cooling system in an industrial facility. (7)

5.6 Combustion is a chemical reaction between Oxygen and fuel.

Name FOUR things upon which the exothermic reaction in the furnace depends. (4 × 1) (4)

[29]

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QUESTION 6

6.1 Define the following terms:

6.1.1 Dehumidifier

6.1.2 Contamination

6.1.3 Flocculation

6.1.4 Ultrafiltration

(4 × 2) (8)

6.2 Spray driers dry slurry into a powder in industries.

List SIX components of a spray dryer. (6)

6.3 Adsorption is a process in which molecules adhere or stick to the surface of material.

Describe the THREE main classifications of adsorption. (10)

6.4 Mention THREE instruments needed to monitor the operation of ion exchange. (3)

6.5 Differentiate between oxidation and reduction. (2 × 2) (4)

[31]

TOTAL SECTION B: 80
GRAND TOTAL: 100

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