



# higher education & training

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Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

T320(E)(A1)T

**NATIONAL CERTIFICATE**

**CHEMICAL PLANT OPERATION N5**

(8050015)

**1 August 2018 (X-Paper)**  
**09:00–12:00**

**Calculators may be used.**

**This question paper consists of 5 pages.**

**DEPARTMENT OF HIGHER EDUCATION AND TRAINING**  
**REPUBLIC OF SOUTH AFRICA**  
NATIONAL CERTIFICATE  
CHEMICAL PLANT OPERATION N5  
TIME: 3 HOURS  
MARKS: 100

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**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. Write neatly and legibly.
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**QUESTION 1**

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.1–1.5) in the ANSWER BOOK.

- 1.1 Saturation temperature is the temperature at which water will change to steam.
- 1.2 Specific heat capacity is the sensible heat which increases the temperature to produce superheated steam.
- 1.3 Ribbon mixers are used for batches of heavy solids and pastes.
- 1.4  $\text{SO}_2$  is produced by the burning of sulphur.
- 1.5 A steady state operation is the one in which conditions within the process or system change with time, which is one moment to another.

(5 × 1)

**[5]****QUESTION 2**

- 2.1 Calculate the mol percentage composition of the following mixture:

$\text{Na}_2\text{SO}_4 = 18\%$  (m/m);  $\text{NaOH} = 36,5\%$  (m/m);  $\text{Na}_2\text{CO}_3 = 22,5\%$  (m/m) and  $\text{NaCl} = 23\%$  (m/m)

Given: Na = 23 g/mol ; S = 32 g/mol ; O = 16 g/mol ; H = 1 g/mol;  
C = 12 g/mol and Cl = 35,5 g/mol.

(10)

- 2.2 Describe the operation of the following:

2.2.1 Cyclone

2.2.2 Ribbon mixer

(2 × 5)

(10)

- 2.3 Draw a labelled diagram of the horizontal rotating-cup atomising oil burner.

(5)

**[25]**

**QUESTION 3**

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–H) next to the question number (3.1–3.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1	Energy due to motion	A	internal screw mixer
3.2	Mixer for heavy, stiff or gummy materials	B	impact wheels
3.3	Mixer for free-flowing grains and light solids	C	kinetic energy
3.4	Mixer used for fine light powders such as insecticides	D	potential energy
3.5	Mixer used for dry powders and thin pastes	E	change can mixer
		F	ribbon mixer
		G	two-arm kneader
		H	banbury mixer

(5 × 1)

**[5]****QUESTION 4**

4.1 Write brief, clarifying notes on each of the following:

4.1.1 Radial flow turbine

4.1.2 Axial flow turbine

(2 × 4)

**(8)**

4.2 A solution of common salt in water is prepared by adding 20 kgs of salt to 100 kgs of water to make a liquid density of  $1\,323\text{ kg/m}^3$ .

Calculate the concentration of salt in this solution as each of the following:

4.2.1 % weight fraction

4.2.2 Mole fraction

(2 × 4)

**(8)**

4.3 Write brief, clarifying notes on the operation of a disk centrifuge.

**(8)****[24]**

### QUESTION 5

- 5.1 State THREE disadvantages of a closed-circuit gas turbine. (3)
- 5.2 Sketch a labelled diagram of a premix burner. (11)
- 5.3 Write brief, explanatory notes on the vapourising burner. (4)
- 5.4 List THREE methods used in the preparation of nitric acid. (3)
- [21]**

### QUESTION 6

- 6.1 Write brief, clarifying notes to distinguish between a kneader, a dispenser and a masticator. (6)
- 6.2 Draw a neat, labelled diagram of the salt process for the production of hydrochloric acid and give a chronological description of the process. (14)
- [20]**

**TOTAL: 100**