higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# NATIONAL CERTIFICATE (VOCATIONAL)

## PULP AND PAPERMAKING TECHNOLOGY
**NQF LEVEL 4**

(6050394)

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

**This question paper consists of 7 pages.**



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**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. Start each section on a new page.
5. Use only a blue or black 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 correct answer and write only the letter (A–D) next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 The ease of repulping depends on ONE of the following factors:

A Washing
B Refining
C Wetting time
D Porosity

1.2 It is ONE of the important parameters in de-flaking:

A Flake size
B Passes
C Gap clearance
D Repulping

1.3 Excess water from the pulp slurry follows the following procedure:

A Pressed out, drained out, then dried out
B Dried out, pressed out, then drained
C It is first drained out, pressed out, and dried
D Drained out, dried out, then pressed out

1.4 Apparent density is calculated by dividing the grammage by …

A weight.
B thickness.
C density.
D diameter.

1.5 The process of removing particles and fibres from paper surfacing during the printing process is known as …

A tainting.
B drying.
C opacity.
D linting.

(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 | Pulp screens that separate larger particles of various shape from fibre | A | multiwire formers |
| 2.2 | Forming section that produces paper, board or tissue | B | steam usage per unit mass of water evaporated |
| 2.3 | It is a test used to test the surface properties of paper | C | slotted screens |
| 2.4 | Drying efficiency is measured in terms of this | D | steam usage per unit mass of paper dried |
| 2.5 | It is known as a reaction that consumes energy | E | tensile strength |
| | | F | endothermic reaction |
| | | G | perforated screens |
| | | H | twin-wire formers |
| | | I | exothermic reaction |
| | | J | roughness |

(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 (3.1–3.10) in the ANSWER BOOK.

3.1 Recycled paper tends to require more ink for printing due to its increased porosity.

3.2 A table roll improves web formation by introducing stock shear to the mix.

3.3 The evaporation process does not require a large amount of heat energy.

3.4 Indirect contact evaporators increase the solid content of the spent liquor to ± 65%.

3.5 Firing liquor with a high solids content can cause explosions in the furnace.

3.6 The purpose of the tube in the orifice plate is to distribute the air evenly through the reactor bed material.

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3.7 Sulphite cooking liquor is made up of a mixture of sulfuric acid and bisulphite ions combined with a base.

3.8 The liquor produced from the soda process is known as weak black liquor.

3.9 The removal of impurities from the furnace and smelt tank improves the causticising and washing efficiency of the upcoming stages.

3.10 Hagglund towers are constructed using aluminium.

(10 × 2) **[20]**

**TOTAL SECTION A: 30**

## SECTION B

## QUESTION 4

4.1 Define *recycled waste paper.* (2)

4.2 Tests must be performed on pulp to ensure its quality and processability.

Write brief notes on the *kappa number test*. (4)

4.3 Explain how the temperature at which refining occurs can affect the pulp. (2)

4.4 List TWO types of contraries that the pulp-cleaning process must remove to ensure the highest quality pulp. (2)

4.5 State THREE advantages of wire formers. (3)

4.6 Uneven formation results from the natural tendency of fibres to flocculate and the random nature of the forming process.

Describe the FOUR consequences that uneven formation has on papermaking. (4)

4.7 Why should the density of printing paper be low? (2)

4.8 What happens to tear strength when density increases? (1)

**[20]**

## QUESTION 5

Study the graph below and answer the questions that follow:

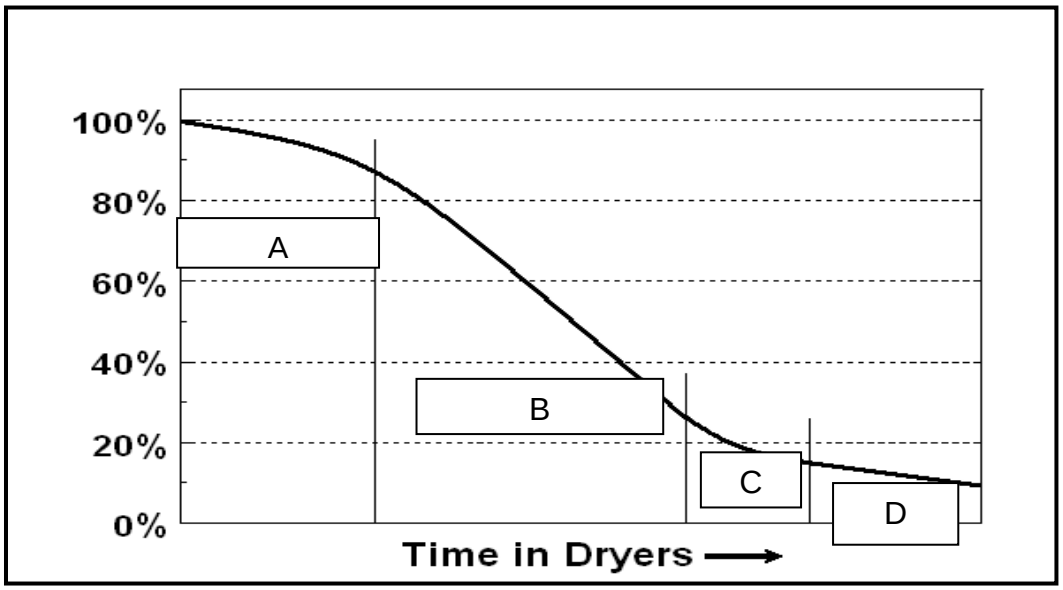



**FIGURE 1**

[Translated from: *Sparrow Consulting, 2012*]

5.1 Identify and provide the name of the graph in FIGURE 1. (2)

5.2 Name the stages labelled A–D. Write only the name next to the letter (A–D) in the ANSWER BOOK. (4)

5.3 Explain what is happening in Stage A. (7)

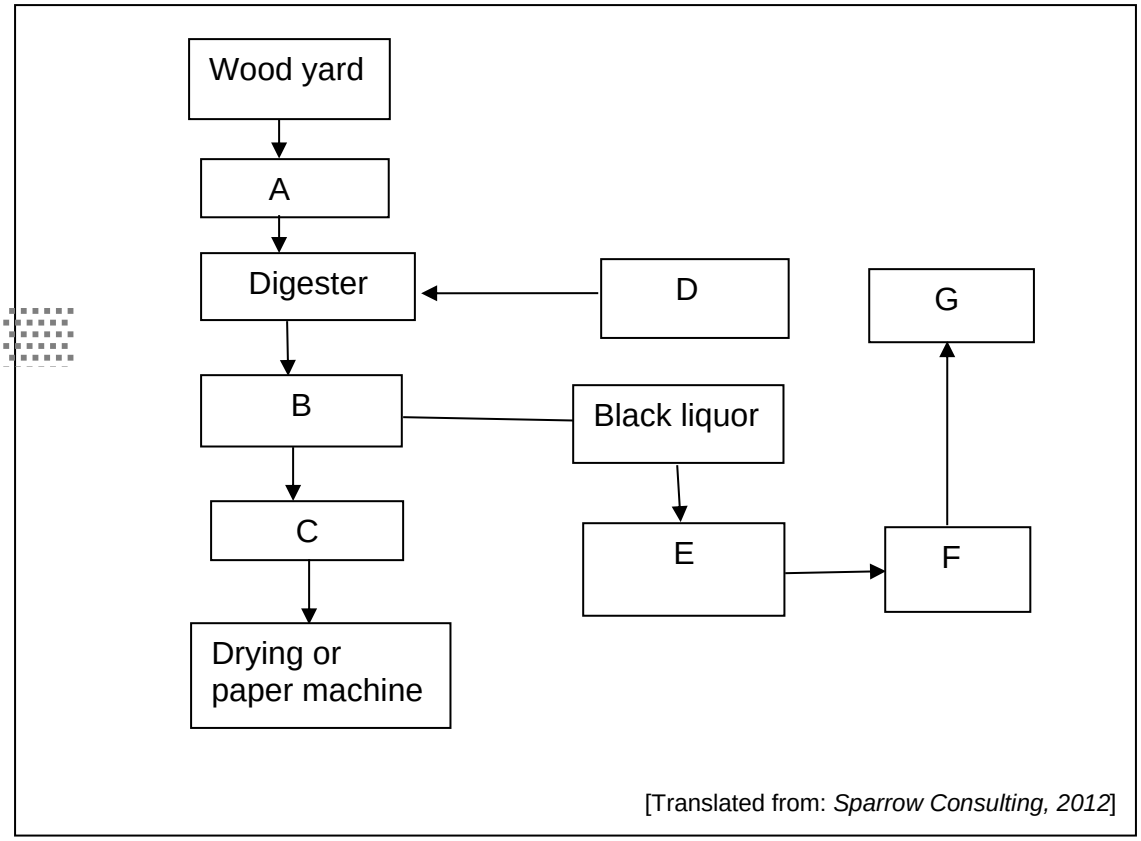
5.4 Define *Stage D.* (2)
**[15]**

## QUESTION 6

6.1 Draw a flow diagram indicating the pulping liquor production process. (7)

6.2 Explain how *contaminant composition* affects the quality of any liquor. (6)

6.3 FIGURE 2 below indicates the Kraft recovery process. Provide the names for labels A–G. Write only the correct name next to the letter (A–G) in the ANSWER BOOK.




[Translated from: *Sparrow Consulting, 2012*]

**FIGURE 2** (7)

**[20]**

## QUESTION 7

7.1 Calcium oxide is produced by the calcination reaction.

Write down this reaction equation. (3)

7.2 Describe the strong white liquor clarifier process. (10)

7.3 Explain the *acid-soluble sodium test*. (2)

**[15]**

**TOTAL SECTION B: 70**
**GRAND TOTAL: 100**

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