higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

TOOLMAKERS' THEORY N2

(11020202)

20 April 2021 (X-paper)
09:00–12:00

Nonprogrammable calculators and drawing instruments may be used.

This question paper consists of 6 pages.

266Q1A2120

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
TOOLMAKERS' THEORY N2
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. All calculations should consist of at least the following THREE steps:
   - 4.1 Formula or manipulation thereof
   - 4.2 Substitution of the given data in the formula
   - 4.3 Answer with the correct SI unit
5. Keep subsections of questions together.
6. Rule off across the page on completion of each question.
7. Use drawing instruments for all drawings/diagrams.
8. Fully label all drawings/diagrams.
9. Use g = 9,8 m/s^2.
10. Round off answers to THREE decimal places.
11. 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–C) next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 When working with pliers …

A the jaws should be aligned and have proper claw grooves for gripping.
B it is acceptable if the handle covers are off.
C the pliers can be placed with chemicals after finishing.

1.2 When working with a drilling machine …

A cuttings can lie around everywhere.
B ensure that the spindle is turning in the correct direction for the work to be done.
C clean the table with your hands.

1.3 Something is brittle when it …

A can withstand friction.
B breaks before the shaping of its form.
C changes shape permanently.

1.4 The clamping mechanism on a jig should …

A have softer material where the pressure takes place.
B allow for maximum manpower to move the clamp.
C require the minimum effort to clamp a workpiece properly in the minimum amount of time.

1.5 To check an outside taper, a … gauge can be used.

A taper plug
B limit gap
C taper ring

(5 × 1) **[5]**

QUESTION 2: SAFETY IN THE WORKPLACE

2.1 State THREE safety precautions to take when working with a milling machine in the toolmakers' workshop. (3)

2.2 Give THREE examples of personal protective equipment (PPE) used in a toolmakers' workshop. (3)

2.3 State TWO precautions to take when using a hammer. (2)

2.4 Why do you have to wash your hands after working and before you eat? (1)

2.5 Who may enter the workshop? (1)

[10]

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QUESTION 3: STEEL AND TOOL TYPES

3.1 Name the TWO forms of carbon in cast-iron steel. (2)

3.2 Define the term *alloy.* (1)

3.3 Give the main characteristics of each of the following metals when combined with steel:

3.3.1 Nickel

3.3.2 Vanadium

3.3.3 Molybdenum

(3 × 1) (3)

3.4 A shaft must be turned to transmit a huge amount of power.

State which type of material should be used and give a reason for your answer. (2)

3.5 Name the type of material used to make each of the following tools and give the characteristics of the steel type:

3.5.1 Reamers

3.5.2 Milling-machine carbide-tip cutters

(2 × 1) (2)

[10]

QUESTION 4: TYPES OF HARDNESS TESTERS

4.1 Explain the Rockwell hardness testing method. (3)

4.2 How can the hardness of a flat piece of material be determined with a Vickers hardness tester? (2)

[5]

QUESTION 5: GAUGES AND LIMIT SYSTEMS

5.1 Define each of the following:

5.1.1 Basic size

5.1.2 Negative tolerance

5.1.3 Two-sided tolerance

(3 × 1) (3)

5.2 Make a drawing of a screw thread and label its FOUR components. (4)

5.3 Draw a diagram of a limit-plug gauge showing the go/no go limits. (3)

[10]

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QUESTION 6: JOHANSSON GAUGE BLOCKS

6.1 Calculate the minimum number of Johansson gauge blocks of a M50 set required to draw a diameter of 81,4275 mm. Use 2,5 mm wear blocks on both sides. (5)

6.2 A sinus bar of 250 mm is supported by a table at an angle of 3° 15'.

Determine the height difference of one roller. (5)

6.3 Draw a diagram to show how toolmaker buttons are set up. (5)

[15]

QUESTION 7: GAUGE MANUFACTURING

7.1 Name TWO characteristics to consider when a plug gauge is manufactured. (2)

7.2 If a gauge is under extensive friction and wear when used, which material can be considered for the manufacturing of the gauge? (1)

7.3 Draw a neat, labelled diagram of a gauge-manufacturing process. (5)

[8]

QUESTION 8: CARBIDE CUTTING TOOLS

8.1 Give a short description of a carbide throw-away tip cutting tool. (2)

8.2 Show, by means of THREE drawings, a positive angle, straight angle and negative angle on lathe-cutting tools. (3)

8.3 Explain the preparation process to mount a carbide tip onto a cutting-tool shaft. (5)

[10]

QUESTION 9: CARBIDE CUTTING-TOOL GRINDING

9.1 Explain each of the following Wimet tool grades:

9.1.1 H

9.1.2 N

9.1.3 G

(3 × 1) (3)

9.2 Where could each of the following be used?

9.2.1 Aluminium-oxide grinding wheel

9.2.2 Silicon-carbide grinding wheel

(2 × 1) (2)

[5]

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QUESTION 10: DRILLS

10.1 Make a neat, labelled drawing of a drill. (5)

10.2 State TWO important criteria to consider when grinding a spiral drill. (2)
[7]

QUESTION 11

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (11.1–11.8) in the ANSWER BOOK.

11.1 A hammer needs a wedge to keep the head firmly in position.

11.2 When cutting mild steel, a hacksaw blade with 24 teeth per 25 mm must be used.

11.3 An advantage of a centre lathe is that it can cut a hexagon.

11.4 When drilling a hole of 50 mm, the speed should be 500 r/min for the spindle.

11.5 A clamp jig is designed to hold the workpiece in a movable position.

11.6 Tempering can be used to get rid of the brittleness in the steel after hardening.

11.7 A gas oven will be installed to get more heat from the oven for the hardening of steel.

11.8 A fixture is provided to locate the workpiece and guide the tool.

(8 × 1) **[8]**

QUESTION 12

Complete the following sentences by writing only the missing word or words next to the question number (12.1–12.5) in the ANSWER BOOK.

12.1 The user should check if he/she has sufficient clear and ... space at every machine before using it. (1)

12.2 The size on a shaft is kept ... and the hole must obtain the desired fit. (1)

12.3 A progressive plug gauge can measure ... and ... in one movement. (2)

12.4 A telescopic gauge is designed to measure the ... of a material. (1)

12.5 The precision level should be used for both ... and ... the lathe bed at both the headstock and tailstock ends. (2)
[7]

TOTAL: 100

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