higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

TOOLMAKERS' THEORY N2

(11020202)

20 November 2020 (X-paper)
09:00–12:00

This question paper consists of 6 pages and 2 addenda.

209Q1E2020

Copyright reserved

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
TOOLMAKERS' THEORY N2
TIME: 3 HOURS
MARKS: 150

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. Sketches must be large, neat and fully labelled.
5. Write neatly and legibly.

Copyright reserved

QUESTION 1: OCCUPATIONAL SAFETY

1.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

1.1.1 Sit or lean against a machine while it is in motion.

1.1.2 If filing is done near the chuck, use the file right-handed.

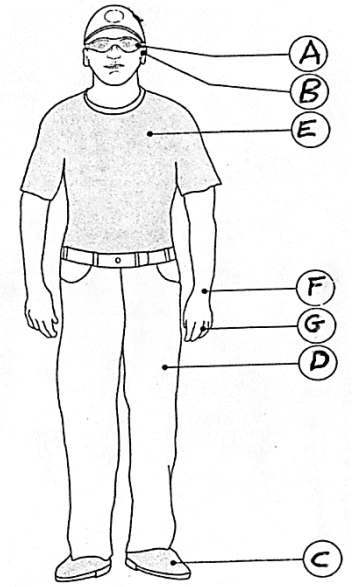
1.1.3 A hacksaw should be used for cutting material that is clamped in the lathe while it is in motion.

1.1.4 Leave the chuck key in the chuck while you work on a lathe.

1.1.5 Do not take measurements while the machine is in motion.

(5 × 1) (5)

1.2 Name the PPE in the following sketch that a person has to wear in a work shop.



(7)
[12]

QUESTION 2: STEELS AND TOOL STEELS

2.1 Explain the FOUR effects of tungsten on steel. (4)

2.2 Explain the TWO effects of nickel on steel. (2)

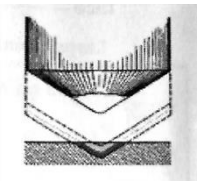
2.3 Name the THREE effects of chromium on steel. (3)

2.4 Describe the alloy element chromium. (1)
[10]

Copyright reserved

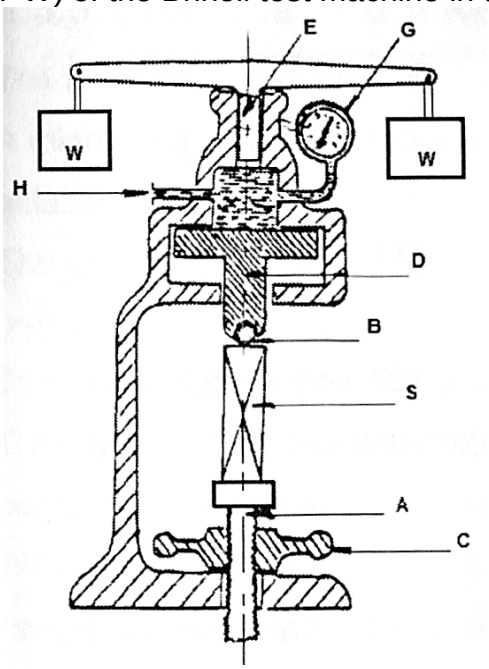
QUESTION 3: HEAT TREATMENT AND HARDNESS TESTING

3.1 Identify the part we use in the Brinell test machine.



(1)

3.2 Name the parts (A–W) of the Brinell test machine in the sketch below.



(9)
[10]

QUESTION 4: LIMITS AND FITS

4.1 Name the THREE types of fits that we use in the engineering industry. (3)

4.2 A a shaft and a bush must be manufactured on a lathe.

The sizes are as follows:

Bush = φ32 $^{+0.03}_{-0.00}$ Shaft = φ32 $^{+0.00}_{-0.02}$

Calculate the maximum and minimum tolerances between the bush and the shaft. (6)

4.3 What type of fit should be used to fit a bearing on a shaft? (1)
[10]

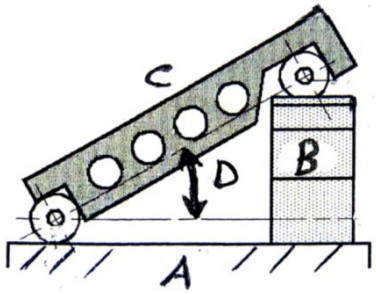
Copyright reserved

QUESTION 5: PRECISION MEASURING

5.1 Give THREE reasons why a sine bar has to be accurate. (3)

5.2 How many gauge blocks are in a M50 set? (1)

5.3 Name the components (A–D) in the sketch below.



(4)
[8]

QUESTION 6: GAUGES

6.1 Name the THREE main groups in which gauges are divided. (3)

6.2 Name THREE common materials that are used to manufacture gauges. (3)

6.3 Make a neat sketch of a limit gap gauge. (2)

6.4 What is the meaning of the 'go' and 'no go' on gauges? (2)
[10]

QUESTION 7: JIGS AND FIXTURES

7.1 Name the advantages of using jigs. (5)

7.2 Name FIVE requirements for a good jig. (5)
[10]

QUESTION 8: CEMENTED-CARBIDE TIP AND CUTTING TOOLS

8.1 When is a left-hand cutting tool used? (1)

8.2 When is a right-hand cutting tool used? (1)

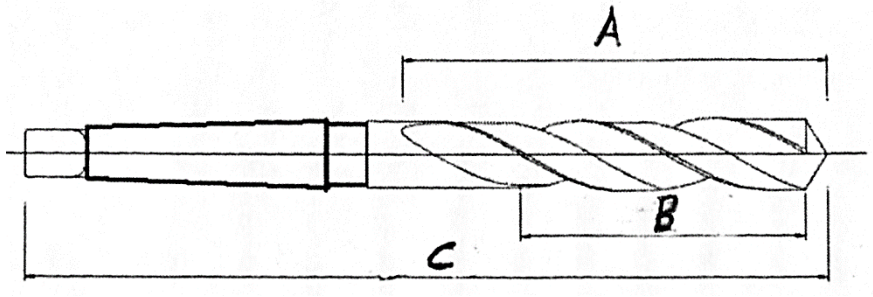
8.3 Make a neat sketch of the neutral cutting tool of a lathe that shows the primary and secondary clearance angles. (3)

8.4 Make neat sketches that demonstrate the positive rake or angle, zero rake or angle, and the negative rake or angle of cutting tools. (6)
[11]

Copyright reserved

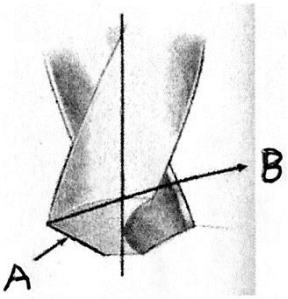
QUESTION 9: DRILLS AND REAMERS

9.1 Name the following parts (A–C) of an HSS drill.



(3)

9.2 What are the two angles in the following drawing of a drill?



(2)

9.3 If the cutting speed of mild steel is 25 m/min (S) and the rotational speed of the drill is 198 r.p.m. (N), what drill size in mm was used?

USE THE FORMULA: $N=\frac{1\,000\ S}{\pi D}$

(3)

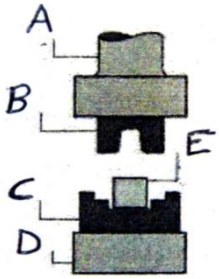
9.4 Explain why reamers have left-hand spirals. (2)

[10]

QUESTION 10: DIE SINKING AND FORGING

10.1 Give a definition of *dies.* (2)

10.2 Name the components (A–E) of the following die set:



(5)

10.3 Is the die set in an open or closed operation? (1)

10.4 Is hand forging for a small or a large number of items? (1)

[9]

TOTAL: 100

Copyright reserved

ADDENDUM 1

6. Table of primary fits (hole basis system) / *Tabel van primêre passings (gatbasisstelsel)*

Nominal sizes *Nominale groottes*		CLEARANCE FITS VRYPASSINGS												TRANSITION FITS OORGANGSPASSINGS				INTERFERANCE FITS STUITPASSINGS			
		Tolerance *Toleransie*		Tolerance *Toleransie*		Tolerance *Toleransie*		Tolerance *Toleransie*		Tolerance *Toleransie*		Tolerance *Toleransie*		Tolerance *Toleransie*		Tolerance *Toleransie*		Tolerance *Toleransie*		Tolerance *Toleransie*	
Over *Oor* mm	To *Tot* mm	H11	c11	H9	d10	H9	e9	H8	f7	H7	g6	H7	h6	H7	k6	H7	n6	H7	p6	H7	s6
		UNIT / *EENHEID* 0,001 mm																			
10	18	+ 110	- 95	+ 43	- 50	+ 43	- 12	+ 27	- 16	+ 18	- 6	+ 18	- 11	+18	+ 12	+18	+ 23	+ 18	+ 29	+ 18	+ 39
		0	- 205	0	- 120	0	- 75	0	- 34	0	- 17	0	0	0	+ 1	0	+ 12	0	+ 18	0	+ 28
18	30	+ 130	- 110	+ 52	- 65	+ 52	- 40	+ 33	- 20	+ 21	- 7	+ 21	- 13	+ 21	+ 15	+ 21	+ 28	+ 21	+ 35	+ 21	+ 48
		0	- 204	0	- 149	0	- 92	0	- 41	0	- 20	0	0	0	+ 2	0	+ 15	0	+ 22	0	+ 35
30	40	+ 160	- 120																		
		0	- 280	+ 62	- 80	+ 62	- 50	+ 39	- 25	+ 25	- 9	+ 25	- 16	+ 25	+ 18	+ 25	+ 33	+ 25	+ 42	+ 25	+ 59
40	50	+ 160	- 130	0	- 180	0	- 112	0	- 50	0	- 25	0	0	0	+ 2	0	+ 17	0	+ 26	0	+ 43
		0	- 290																		

Copyright reserved

ADDENDUM 2

GAUGE BLOCK SETS

Set No. M105

Range or size (mm)	Increment in mm	No. of pieces
1,01 – 1,49	0,01	49
0,50 – 24,50	0,50	49
25 – 100	25	4
1,0025 – 1,0075	0,0025	3
	Total	105

Set No. M88

Range or size (mm)	Increment in mm	No. of pieces
1,001 – 1,009	0,001	9
1,01 – 1,49	0,01	49
0,5 – 9,5	0,5	19
10 – 100	10	10
1,0005	-	1
	Total	88

Set No. M78

Range or size (mm)	Increment in mm	No. of pieces
1,01 – 1,49	0,01	49
0,50 – 9,50	0,5	19
10, 20, 30, 40, 50, 75, 100	-	7
1,0025 – 1,0075	0,0025	3
	Total	78

Set No. M50

Range or size (mm)	Increment in mm	No. of pieces
1,0025 – 1,0075	0,0025	3
1,01 – 1,09	0,01	9
1,1 – 1,9	0,1	9
1 – 25	1	25
50 – 100	25	3
0,50	-	1
	Total	50

Set No. M45

Range or size (mm)	Increment in mm	No. of pieces
1,001 – 1,009	0,001	9
1,01 – 1,09	0,01	9
1,1 – 1,9	0,1	9
1 – 9	1	9
10 – 90	10	9
	Total	45

Copyright reserved