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# higher education & training

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Department:  
Higher Education and Training  
REPUBLIC OF SOUTH AFRICA

T630(E)(N12)T  
NOVEMBER EXAMINATION  
NATIONAL CERTIFICATE  
FITTING AND MACHINING THEORY N2

(11022032)

12 November 2014 (Y-Paper)  
13:00–16:00

Calculators may be used.

This question paper consists of 9 pages and 1 formula sheet.

**DEPARTMENT OF HIGHER EDUCATION AND TRAINING**  
**REPUBLIC OF SOUTH AFRICA**  
NATIONAL CERTIFICATE  
FITTING AND MACHINING THEORY N2  
TIME: 3 HOURS  
MARKS: 100

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**NOTE:** If you answer more than the required number of questions, only the required number of questions will be marked. All work you do not want to be marked, must be clearly crossed out.

**INSTRUCTIONS AND INFORMATION**

1. Answer either QUESTION 1.1 or QUESTION 1.2 and ALL other questions in SECTION A.
  2. Answer only TWO questions from SECTION B.
  3. Read ALL the questions carefully.
  4. Number the answers according to the numbering system used in this question paper.
  5. Write neatly and legibly.
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**SECTION A**

**QUESTION 1: OCCUPATIONAL SAFETY**

Answer either QUESTION 1.1 or QUESTION 1.2.

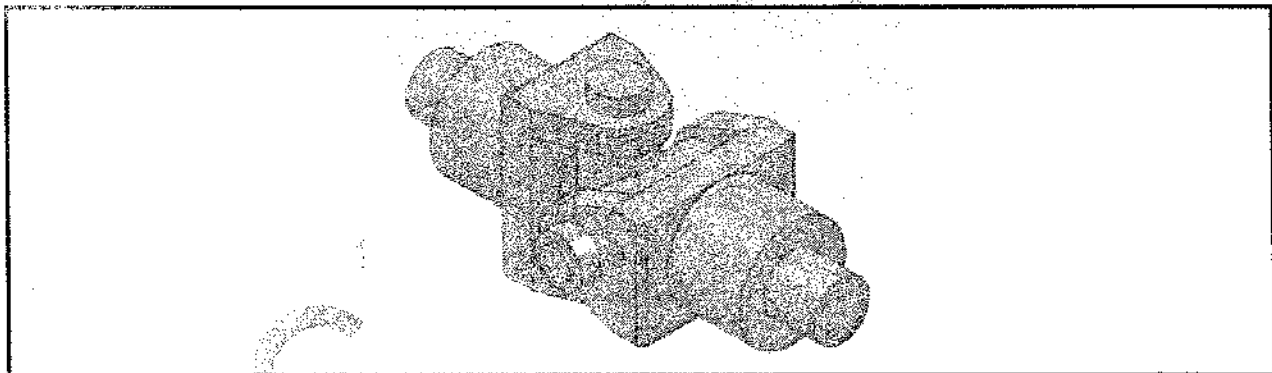
1.1 State FIVE rules for the safe handling and storage of compressed gas cylinders. [5]

OR

1.2 State FIVE precautions to be taken with regard to fire prevention in mines, according to the Minerals Act. [5]

**QUESTION 2: COUPLINGS**

FIGURE 1 below, shows a sketch of a coupling.



**FIGURE 1**

2.1 Name the type of coupling shown in FIGURE 1. (1)

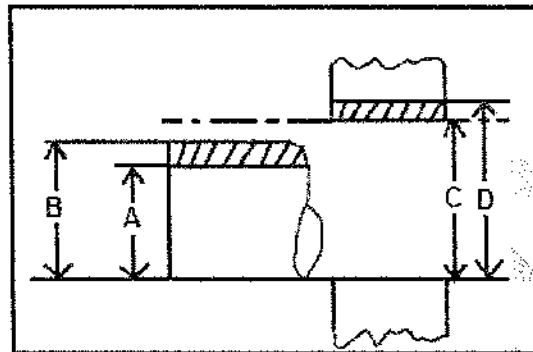
2.2 Describe the conditions under which this coupling may be used. (2)

2.3 Does this coupling fall in the group classification of fixed couplings? Write only 'yes' or 'no' and give a reason for your answer. (2)  
[5]

**QUESTION 3: LIMITS AND FITS**

3.1 FIGURE 2 below, shows an example of a clearance fit between a bush and shaft. Labels (A–D) represent various terms associated with limits.

Identify these terms. Write down the answers next to the letters (A–D) in the ANSWER BOOK.



**FIGURE 2**

(4 × 1) (4)

3.2 A precision running fit between shaft and a sliding bearing is given as:  
105H7- g6

What is meant by the following symbols represented by this fit? Write only the answer next to the question number (3.2.1–3.2.4) in the ANSWER BOOK.

3.2.1 The capital letter H

3.2.2 The number 7

3.2.3 The small letter g

3.2.4 The number 6

(4 × 1) (4)  
[8]

**QUESTION 4: BEARINGS**

4.1 List FOUR properties of the materials used for plain bearings. (4)

4.2 Give FOUR reasons for the failure of anti-friction bearings. (4)

[8]

**QUESTION 5: LUBRICATION AND VALVES**

5.1 State FIVE factors which must be considered when choosing a lubricant. (5)

5.2 Explain the working principles of a ball valve. (3)

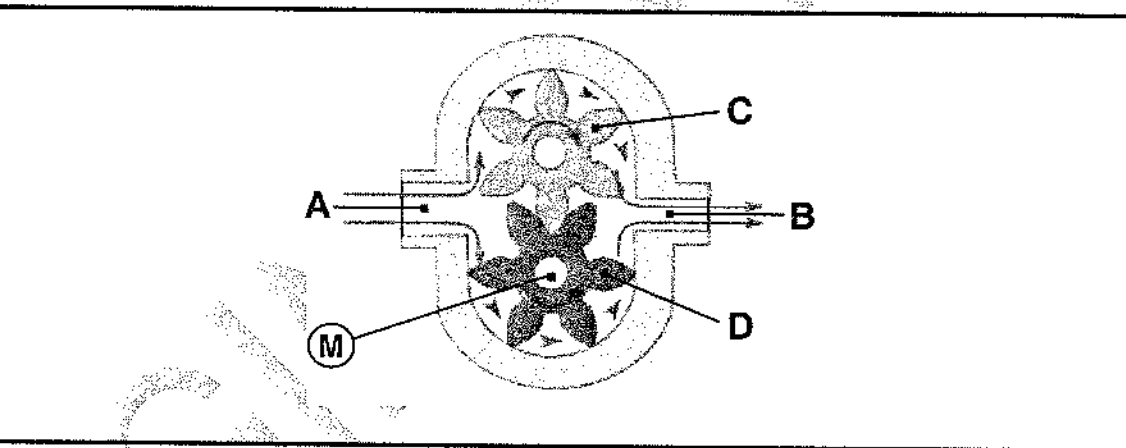
[8]

**QUESTION 6: PACKING, STUFFING BOXES AND JOINTS AND PIPE SYSTEMS**

- 6.1 State FIVE important guidelines to ensure the proper fitting of O-rings and seals in hydraulic systems, in order to prevent premature failure. (5)
- 6.2 Name FOUR common methods of joining steel water pipes. (4)  
[9]

**QUESTION 7: PUMPS**

- 7.1 Explain the function of a pump. (1)
- 7.2 FIGURE 3, below, shows a sketch of a gear pump where M represents the attachment to the pump motor. (4)  
[5]

**FIGURE 3****QUESTION 8: COMPRESSORS**

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (8.1–8.7) in the ANSWER BOOK.

- 8.1 Pneumatic tools are tools driven by liquid pressure.
- 8.2 Moisture traps are used on intercoolers and aftercoolers.
- 8.3 The low pressure cylinder is the second stage at which air is drawn in from the high pressure cylinder before being compressed, cooled and stored.
- 8.4 The device used to separate moisture from the air to prevent the presence of water in tools and machinery during pneumatic operation, is called the aftercooler.

- 8.5 Pistons and piston-rings are used in reciprocating compressors.
- 8.6 Start and stop control is operated on a compressor by a thermostat.
- 8.7 The air receiver is used for storing compressed air under high pressure until it is ready for use.

(7 × 1) [7]

**QUESTION 9: V-BELT, GEAR AND CHAIN DRIVES**

- 9.1 Explain the principles of the following concepts with regards to gear drives:
- 9.1.1 Velocity ratio (1)
- 9.1.2 Mechanical advantage (1)
- 9.2 State THREE advantages that V-belt drives have over chain drives. (3)

[5]

**TOTAL SECTION A: 60**

**SECTION B**

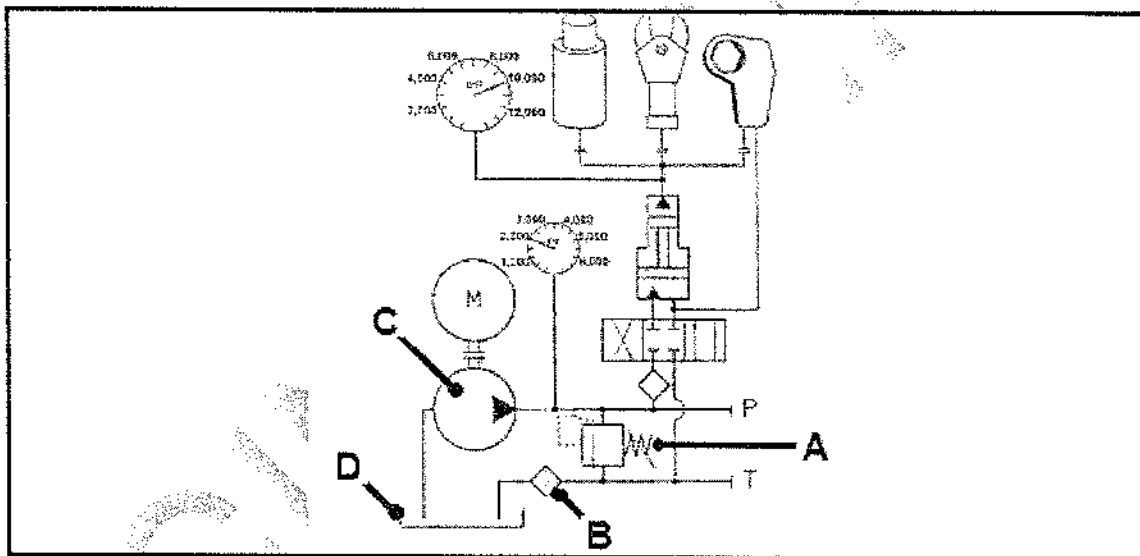
Answer only TWO questions from this section.

**QUESTION 10: PNEUMATICS AND HYDRAULICS**

10.1 Give the TWO scientific factors responsible for the force and speed in the actuator within a pneumatic system. (2)

10.2 FIGURE 4 shows a hydraulic circuit.

Identify the parts labelled (A–D). Write the answer next the letters (A–D) in the ANSWER BOOK.



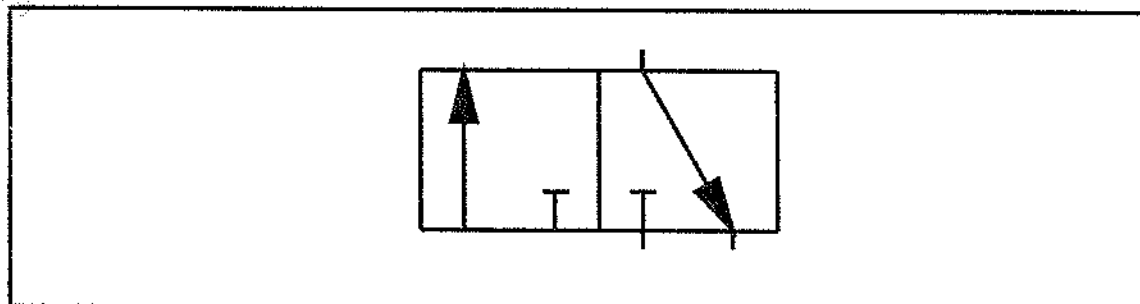
**FIGURE 4**

(4)

10.3 State THREE main functions of oil in a hydraulic flow system. (3)

10.4 State TWO functions of the reservoir. (2)

10.5 Answer the following questions based on the valve as shown in FIGURE 5 below.



**FIGURE 5**

10.5.1 How many ports are indicated in FIGURE 5 above?

10.5.2 How many switching positions are indicated?

10.5.3 Is this valve normally open or normally closed?

10.5.4 What is the name of this valve?

(4 × 1) (4)

10.6 Make neat freehand sketches of the symbols representing the following pneumatic components:

10.6.1 Pressure source

10.6.2 Compressor

10.6.3 Air receiver

10.6.4 Pneumatic motor (half-rotation)

10.6.5 Dryer

(5 × 1) (5)

[20]

### QUESTION 11: CENTRE LATHE

11.1 Name the THREE basic instructional forms applicable to a CNC lathe.

(3)

11.2 A spindle with a taper of 1 in 14 is to be turned to the dimensions given in FIGURE 6 below.

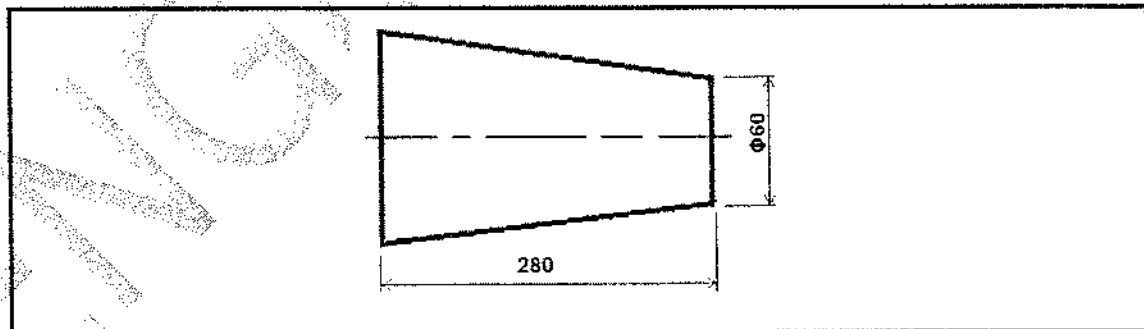


FIGURE 6

11.2.1 Calculate the amount of tailstock set-over.

(2)

11.2.2 Calculate the included angle of the tapered portion in degrees and minutes.

(3)

11.3 A carbon steel pin with a diameter of 10 mm is to receive a finishing cut on a centre lathe. The cutting speed for carbon steel is 56,55 m/min.

Calculate the speed, in revolutions per minute, that you would set as the lathe's rotational speed.

(3)



- 11.4 Steadies are important accessories to a centre lathe.
- 11.4.1 State TWO uses of lathe steadies (2)
- 11.4.2 Name the steady, which is mounted to the lathe-bed. (1)
- 11.4.3 Name the steady, which is mounted to the lathe-saddle. (1)
- 11.5 A two-start square thread of 10 mm pitch, has to be machined on a round shaft with an outside diameter of 70 mm. Assume the clearance angle to be  $3^\circ$ .
- Calculate the following:
- 11.5.1 The helix angle ( $\theta$ ) of the thread (3)
- 11.5.2 The lead angle of the cutting tool (1)
- 11.5.3 The following angle of the cutting tool (1)
- [20]

### QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

- 12.1 Name the THREE types of indexing as performed on a milling machine. (3)
- 12.2 A work piece must have 13 gear-teeth machined on its circumference.
- 12.2.1 What type of indexing would you perform on this gearblank? (1)
- 12.2.2 Give a reason for the answer in QUESTION 12.2.1. (2)
- 12.2.3 Calculate the required indexing, using a Cincinnati dividing head as shown in the TABLE below.

The Cincinnati dividing head											
Side 1	24	25	28	30	34	37	38	39	41	42	43
Side 2	46	47	49	51	53	54	57	58	59	62	66

TABLE

(3)

- 12.3 Grinding wheels have markings for identification purposes.
- List FIVE factors by which you would identify a grinding wheel. (5)
- 12.4 State FOUR advantages of using milling cutters with coarse teeth. (4)
- 12.5 Name TWO types of milling processes. (2)
- [20]

TOTAL SECTION B: 40  
GRAND TOTAL: 100

## FITTING AND MACHINING THEORY N2

## FORMULA SHEET

$$f = f_t \times T \times N$$

$$S = \frac{\pi DN}{60}$$

$$S = \pi DN$$

$$\frac{40}{N}$$

$$\frac{N}{9^\circ}$$

$$\text{Set-over} = \frac{D-d}{2} \times \frac{\text{length of workpiece}}{\text{length of taper}}$$

$$\tan \frac{\theta}{2} = \frac{X}{L}$$

$$\text{Leading angle} = 90^\circ - (\text{Helix angle} + \text{clearance angle})$$

$$\text{Following angle} = 90^\circ + (\text{Helix angle} - \text{clearance angle})$$

$$\text{Lead} = \text{No of starts} \times \text{pitch}$$