

education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

**FITTING AND TURNING
NQF LEVEL 4**

NOVEMBER 2009

(6011044)

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

This question paper consists of 12 pages.

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. Write neatly and legibly.
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QUESTION 1: DIAGNOSE AND REPAIR FAULTS ON EQUIPMENT AND MACHINERY DURING PRODUCTION/OPERATION

1.1 Choose a description from COLUMN B that matches the statement or activity in COLUMN A. Write only the letter (A – E) next to the question number (1.1.1 – 1.1.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1.1	The maintenance and repair of gas equipment	A	requires the dismantling and assembly of the equipment
1.1.2	Planning a major shut-down of a milk bottling plant	B	requires proper monitoring and inspection of the production equipment
1.1.3	The quality and manufacture of products	C	requires a list with specifications of all the parts that need to be repaired
1.1.4	Scheduling of repairs on production machines and equipment	D	requires the use of heavy duty lifting equipment
1.1.5	The replacement of heavy plant equipment	E	requires the proper ventilation of the working area

(5)

1.2 The breakdown of machines and equipment is a direct result of poor maintenance and improper use.

Give TWO examples of activities you would put in place to prevent the slippage of belts.

(2)

1.3 Give TWO reasons why it is very important to schedule minor repairs on all workshop machinery.

(2)

1.4 Give TWO reasons why you would regard planning as the most important activity of the maintenance manager.

(2)

1.5 One of the four V-belts breaks on the water pump pulley on a milk production plant. The machine operator decides to remove the broken belt and continues with the production process.

Do you think that this was a good decision? Answer YES or NO. Substantiate the answer by giving ONE reason.

(2)

1.6 What would you regard as the difference between *minor* and *major* repairs?

(2)

[15]

QUESTION 2: MAINTAIN FLUID POWER AND PNEUMATIC SYSTEMS

2.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A – D) next to the question number (2.1.1 – 2.1.5) in the ANSWER BOOK.

2.1.1 Which of the following factors would you consider as the most important in the selection of a hydraulic fluid?

- A Cleanliness of the fluid
- B Flash point of the fluid
- C Viscosity of the fluid
- D The colour of the fluid

(1)

2.1.2 Which of the following factors would you consider to be the root cause of the break-down of a pneumatic system?

- A The V-belts are slipping on the pulleys
- B The compressor broke down
- C The bearings of the rollers on the conveyor belt need lubrication
- D The air filter is dirty

(1)

2.1.3 ONE of the visual inspection checks on a hydraulic system is ...

- A the bolts are tight on the motor base.
- B the leaks on the hoses.
- C the alignment of the shafts.
- D the safety guards are secured.


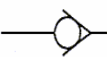


(1)

2.1.4 Which ONE of the following parts or components does NOT belong in a pneumatic system?

- A Air filter
- B Control valve
- C Water pump
- D Pressure gauge

(1)

2.1.5 Which ONE of the following parts or components does NOT belong in a pneumatic system?

- A 
- B 
- C 
- D 

(1)

- 2.2 What is the difference between a *hydraulic system* and a *pneumatic system*? (2)
- 2.3 State TWO functions of oil in a hydraulic system. (2)
- 2.4 Name TWO areas that you would check for excessive air leaks in a pneumatic system. (2)
- 2.5 There are two factors that determine the operation of any hydraulic or pneumatic system. State BOTH of the factors. (2)
- 2.6 To work safely with pneumatic systems we need to consider the importance of high air pressure. Explain why. (2)
- 2.7 The four basic components of any hydraulic system are identified as:
- Reservoir
 - Pump
 - Valves
 - The actuator (cylinder)
- Make a neat labelled drawing of the above-mentioned system showing it in the symbolic format. (8)
- 2.8 Why is it very important to de-pressurise the hydraulic system before the maintenance of the machines can commence? (2)
- [25]**

QUESTION 3: PRODUCE COMPLEX COMPONENTS USING LATHES

- 3.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A – D) next to the question number (3.1.1 – 3.1.5) in the ANSWER BOOK.
- 3.1.1 Which of the following lathe attachments would you use when you are required to work with a long thin shaft? (1)
- A Mandrel
 - B Fixed steady
 - C Travelling steady
 - D Face plate
- 3.1.2 Which of the following tools would you use if you are required to machine a 60 mm internal diameter on a brass bush? (1)
- A Thread cutting tool
 - B Parting tool
 - C Drill bit
 - D Boring bar

- 3.1.3 You are required to set-up an octagonal steel bar to be machined between centres. Which of the following methods would you choose? (1)
- A Four jaw chuck and tailstock with revolving centre
 - B Standard chuck and tailstock with dead centre
 - C Face plate with lathe carrier and tailstock with revolving centre
 - D Standard chuck and tailstock with revolving centre
- 3.1.4 You have machined and measured a workpiece with an outside diameter of 45,521 mm. Which measuring instrument did you use? (1)
- A Vernier height gauge
 - B Outside micrometer
 - C Clock gauge
 - D Vernier calliper
- 3.1.5 You have to machine a taper of 60° onto a shaft. Which part of the lathe would you adjust to the required angle? (1)
- A Tailstock
 - B Compound slide
 - C Cross slide
 - D Carriage
- 3.2 Calculate the rotational speed in r/min when turning an aluminium round bar with a diameter of 40 mm. The cutting speed for aluminium is given as 90 m/min. (3)
- Formula $S = \pi \times D \times N$
- 3.3 FIGURE 1 below shows the operations that are required to drill and ream a 20 mm hole on a centre lathe.

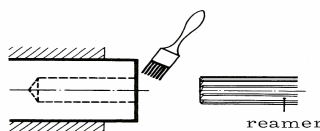
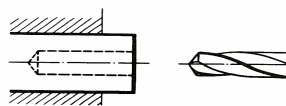


FIGURE 1

- 3.3.1 Determine the appropriate drill bit for the hole. (1)
- 3.3.2 Differentiate between the speed needed for drilling and reaming. (2)
- 3.3.3 Why should you use the cutting fluid in the process? (1)

- 3.4 Demonstrate, by means of a neat sketch, how you would check the alignment of the headstock and tailstock on the centre lathe. (3)
- 3.5 A shaft needs to be machined over its entire length in a centre lathe. Describe what preparation needs to be done before the shaft can be mounted between the headstock and the tailstock centres. (3)
- 3.6 What is the function of the travelling steady on the lathe? (1)
- 3.7 Why is it recommended that the operator wear a hair-net when working on machines? (1)
- [20]**

QUESTION 4: PRODUCE COMPLEX COMPONENTS USING MILLING MACHINES

- 4.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A – D) next to the question number (4.1.1 – 4.1.5) in the ANSWER BOOK.
- 4.1.1 The end mill cutter is used for ...
- A cutting grooves.
 - B milling slots.
 - C machining steps and slots.
 - D machining large flat surfaces. (1)
- 4.1.2 Which of the following milling accessories, attachments or parts would you use when you need to machine five flat sides onto a round bar?
- A Dividing head
 - B Off-set clamp with bolts and nuts
 - C Arbour with corner
 - D Machine table (1)
- 4.1.3 Clamping and holding down a workpiece correctly onto the milling machine table is important because of the following:
- A The best position for the machining of the workpiece must be found
 - B The cutting force onto the workpiece
 - C The accuracy of the finished component
 - D All the above-mentioned (1)

4.1.4 On which part of the horizontal milling machine would you fit a slitting cutter?

- A Over-arm
- B Arbour
- C Spindle
- D Base plate

(1)

4.1.5 What would be the safest way to remove cutting chips during the milling operation?

- A Your hands
- B Compressed air
- C A piece of cloth
- D A brush

(1)

4.2 FIGURE 2 below shows the profile of a flat plate that needs to be milled. Only the top and the side profiles need to be machined.

4.2.1 Name TWO types of milling cutters you will use for the milling process.

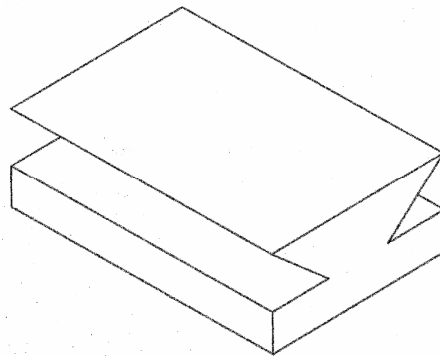


FIGURE 2

(2)

4.2.2 The plate needs to be quality assured and checked if the top and bottom faces are parallel to each other.

Briefly explain how you would check the work piece by using a dial test indicator on the marking-off table.

(3)

4.3 Calculate the indexing required to machine a number of grooves into a shaft when the angle measured between the grooves is 50°.

$$\text{INDEXING} = \frac{40}{N} \text{ or } \frac{\theta}{9^\circ}$$

DIVIDING HEAD											
CINCINNATI INDEX PLATES											
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

(3)

- 4.4 FIGURE 3 below shows a 10 mm slot drill that must machine a slot into a 50 mm diameter shaft. Briefly explain how you would set-up and align the slot drill centrally with the shaft.

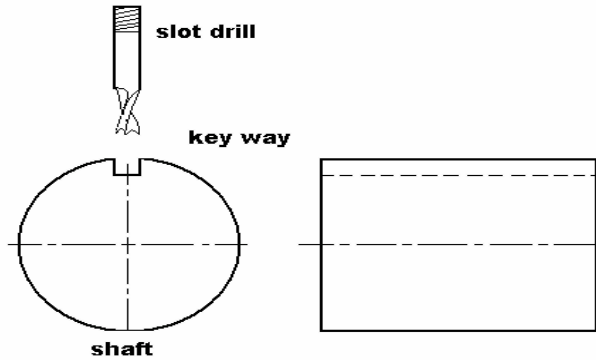


FIGURE 3

- 4.5 A plain helical milling cutter is centrally fitted on the milling machine arbor. The machine vibrates during the machining process. You observe that the cutter chatters onto the work piece. Find TWO possible causes of this problem and also recommend a solution.

(3)

(4)
[20]

QUESTION 5: PRODUCE COMPLEX COMPONENTS BY PERFORMING INTERNAL AND EXTERNAL GRINDING OPERATIONS

- 5.1 When working on the grinding machine, the operator must make sure that he/she knows the rules regarding safety. State any THREE safety rules the operator must follow to operate a grinding machine.
- 5.2 State THREE important steps that must be followed when dressing the grinding wheel on a surface grinding machine with a diamond dresser.

(3)

(3)

- 5.3 Choose a description from COLUMN B that matches the statement or activity in COLUMN A. Write only the letter (A – D) next to the question number (5.3.1 – 5.3.4) in the ANSWER BOOK.

COLUMN A		COLUMN B	
5.3.1	The grinding wheel is not running	A	could be a result of vibrations due to a worn out wheel spindle
5.3.2	Burn marks on the work piece	B	could be that the wheel is too hard
5.3.3	Chatter marks on the work piece	C	could be as a result of dirty coolant being used
5.3.4	Some scratches on the work piece	D	could mean that the grinding machine gearbox is not engaged

(4)
[10]

QUESTION 6: WRITE SIMPLE COMPUTER NUMERICAL CONTROLLED (CNC) PROGRAMMES AND SET AND OPERATE A CNC MACHINE

- 6.1 Explain the method of absolute dimensioning in CNC programming. (2)
- 6.2 When setting up the CNC machine to machine a new component, it is important to first have a trial run. Why do you think this is recommended? (1)
- 6.3 A CNC machine has various safety devices that protect the operator from injury during the machining process. Name ONE such device and explain how it operates. (2)

6.4 FIGURE 4 below shows the top view of a work piece that will be machined in a CNC lathe.
The machine spindle is turning in clock-wise direction. The work piece zero symbol is placed at the centre.

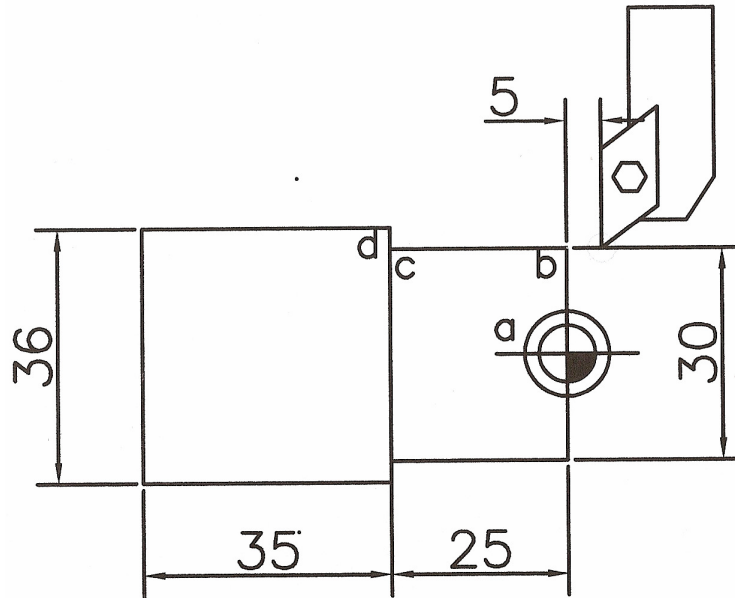


FIGURE 4

6.4.1 When setting up the machine the CNC programmer must determine the positive direction of the X-axis and the Z-axis. Copy the work piece zero symbol and clearly show, by means of direction arrows, the positive X-axis and the positive Z-axis. (2)

6.4.2 The following table provides part of a simple CNC program that was used to machine the work piece shown in Figure 2. The absolute dimensioning method is used.

Study the drawing and programme carefully and complete the program to machine the part from position b to c.
Do NOT copy the complete table, only complete the missing codes and descriptions for G, X and Z in line number N30.

LINE	CODES	DESCRIPTION
00	G90	Absolute programming
N10	G00 X0,0 Z5,0 S1500	Move to start position G00 rapid traverse S1500 spindle speed
N20	G01 X30.0 Z0.0 F0.2	Tool cuts from a to b G01 rapid feed X 30.0 Z0.0 F0.2 feed rate
N30		Tool cuts from b to c G X Z

(3)
[10]

TOTAL: 100