



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE MECHANOTECHNOLOGY N3

(8190373)

**12 April 2021 (X-paper)
09:00–12:00**

This question paper consists of 7 pages, 2 tables and 1 formula sheet.


138Q1A2112

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
MECHANOTECHNOLOGY N3
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. Start each section on a new page.
 5. Use only blue or black ink.
 6. Write neatly and legibly.
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QUESTION 1: POWER TRANSMISSION, CLUTCHES AND COUPLING OF SHAFTS

- 1.1 A 40-kW electric motor with a speed of 1 250 r/min drives a maize sheller machine by means of a wedge belt rotating at 650 r/min. The machine has a heavy start and serves as a medium-duty operation during an eleven-hour man shift. 


Use the attached tables to answer the questions:

- 1.1.1 Calculate the speed ratio of the machine. (2)
- 1.1.2 Determine the service factor of the drive. (2)
- 1.1.3 Calculate the design power.  (2)
- 1.1.4 Assume the larger pulley has a diameter of 1 000 mm.
Determine the minimum pulley diameter. (2)
- 1.1.5 Calculate the torque developed by the electric motor. (3)
- 1.2 Explain the following terms:
- 1.2.1 Centre distance
- 1.2.2 Belt deflection
- 1.2.3 Clutch 
- 1.2.4 Coupling

(4 × 2) (8)
[19]

QUESTION 2: BRAKES

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 (2.1–2.2) in the ANSWER BOOK.


2.1.1 The purpose of a brake on a vehicle is to 

- A reverse the vehicle at an incline.
- B create enough centrifugal force to cause friction on the drum.
- C stop the vehicle within a certain distance or time period.
- D generate enough heat for the vehicle's heater.

2.1.2 is an advantage of an air brake system.

- A A fluid leak in the system that can cause brake failure
- B The time it takes to build up pressure
- C The fact that air brakes have lower braking force than other systems
- D The fact that air brakes can be extended to the trailer of a large truck

(2 x 1) (2)

2.2 State TWO advantages of mechanical brakes.  (2)

2.3 State TWO disadvantages of an electromagnetic braking system. (2)


[6]

QUESTION 3: BEARINGS

Describe the use of the following types of friction bearings:

3.1 Part bearings

3.2 Solid bearings

3.3 Split bearings 

3.4 Thrust bearings


3.5 Guide bearings

(5 x 2) **[10]**

QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION

4.1 Give FOUR reasons why compressors must be cooled. (4)

4.2 Name THREE groups of lubricants and give ONE example of each. (6)

4.3 Name THREE types of impellers used in centrifugal pumps.  (3)

[13]

QUESTION 5: HYDRAULIC AND PNEUMATIC

5.1 The pressure inside a hydraulic cylinder with an internal cross-sectional area of 0,00163 m² is 420 kPa. Take π as 3,1416.

Calculate the following:



5.1.1 The inside diameter of the cylinder in millimetres (mm)

5.1.2 The force of the plunger in Newton (N)

(2 × 2) (4)

5.2 Explain Pascal's law of fluid mechanics.

(2)

5.3 Draw the pneumatic symbols of the following:

5.3.1 Service unit (simplified symbol)

5.3.2 Filter

(2 × 2) (4)



[10]

QUESTION 6: INTERNAL COMBUSTION ENGINES

6.1. FIGURE 1 shows a combustion engine. Name the labelled components by writing only the answer next to the letter (A–E) in the ANSWER BOOK.

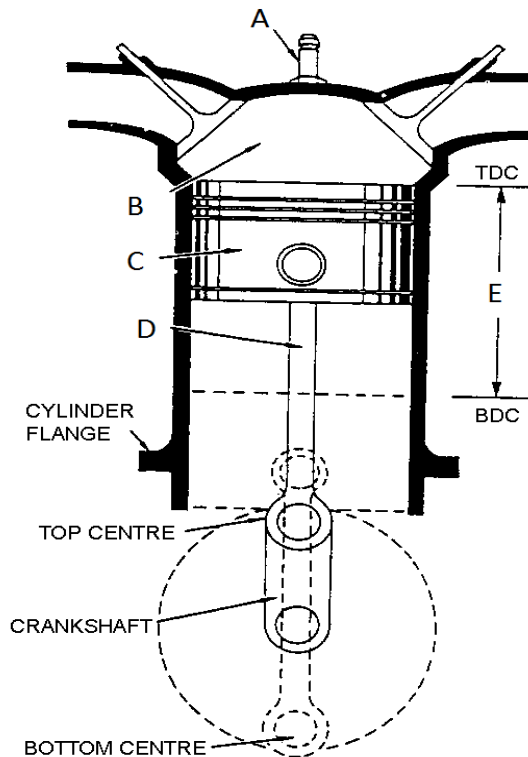


FIGURE 1

(5)


6.2 Name the last THREE strokes of a four-stroke petrol engine in the order of function.



(3)

[8]

QUESTION 7: CRANES AND LIFTING MACHINES

7.1 Briefly describe FOUR disadvantages of static tower cranes.  (4)

7.2 FIGURE 2 shows an overhead travelling crane. Name the labelled parts by writing only the answer next to the letter (A–C) in the ANSWER BOOK.

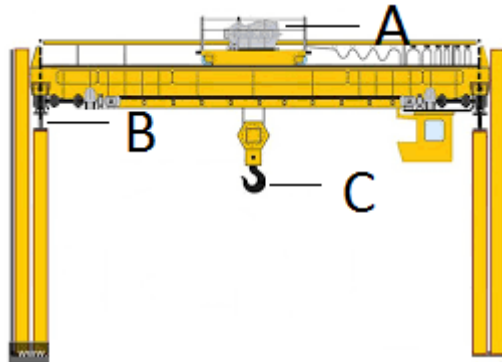


FIGURE 2

(3)
[7]

QUESTION 8: MATERIAL AND MATERIAL PROCESSES

8.1 Describe the general behaviour of the following metals when gas welding is applied:

8.1.1 Aluminium  (3)

8.1.2 Austenitic stainless steel (2)


8.2 Briefly describe the basic characteristics of the following polymers with reference to hardness as it appears from non-laboratory tests:

8.2.1 Nylon 


8.2.2 Perspex

(2 × 1) (2)
[7]

QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING

- 9.1 Briefly explain the purpose of a grievance procedure. (4)
- 9.2 Mention FIVE characteristics of a good report.  (5)
- 9.3 Name THREE types of information that appear on a requisition card about the ordering of goods in an organisation. (3)
- [12]**

QUESTION 10: ENTREPRENEURSHIP

- 10.1 Briefly explain the qualities of a good entrepreneur. (4)
- 10.2 Name FOUR factors that can influence the location of a small business enterprise.  (4)
- [8]**

TOTAL: 100

TABLE 1**SERVICE FACTORS FOR THE SELECTION OF WEDGE BELTS**

TYPE OF DRIVEN MACHINE	TYPE OF PRIME MOVER					
	Soft start			Heavy start		
	Hours duty per day			Hours duty per day		
	10 and under	Over 10 to 16	Over 16	10 and under	Over 10 to 16	Over 16
Class 1 – Light duty Blowers and fans Centrifugal compressors and pumps Belt conveyors (uniformly loaded)	1,0	1,1	1,2	1,1	1,2	1,3
Class 2 – Medium duty Blowers and fans Rotary compressors and pumps Belt conveyors (not uniformly loaded) Generators	1,1	1,2	1,3	1,2	1,3	1,4
Class 3 – Heavy duty Brick machinery Compressors and pumps (reciprocating) Conveyors (heavy duty) Hammer mills Punches and presses	1,2	1,3	1,4	1,4	1,5	1,6
Class 4 – Extra heavy duty Crushers Mills	1,3	1,4	1,5	1,5	1,6	1,8

TABLE 2**MINIMUM PULLEY DIAMETER (mm)**

Speed in r/min	Minimum pulley diameter (mm)																			
	Design Power (kW)																			
	To 1	3,0	4,0	5,0	7,5	10	15	20	25	30	40	50	60	75	90	110	130	150	200	250
500	67	90	100	112	125	140	180	200	212	236	250	280	280	315	375	400	450	475	500	560
600	67	85	90	100	112	125	140	180	200	212	224	250	265	280	300	335	375	400	475	500
720	67	80	85	90	90	106	132	150	160	170	200	236	250	265	280	300	335	375	450	500
960	67	75	80	85	95	100	112	132	150	180	180	200	224	250	280	280	300	335	400	450
1 200	67	71	80	80	95	95	106	118	132	150	160	180	200	236	236	250	265	300	335	355
1 440	67	67	75	80	85	85	100	112	125	140	160	170	190	212	236	236	250	280	315	335
1 800	67	67	71	75	80	85	95	106	112	125	150	160	170	190	212	224	236	265	300	335
2 800	67	67	67	67	80	80	85	90	100	112	125	140	160	170	180	212	224	236	-	-

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MECHANOTECHNOLOGY N3

FORMULA SHEET

Any other applicable formula may also be used.

1. *Corrected power per belt = (basic power per belt + power increment per belt) × correction factor*
2. *Force (F) = Pressure (P) × Area (A)*
3. *Work done (W) = Force (F) × Distance (s)*
4. *Volume (V) = Area of base (A) × Perpendicular height ($\perp h$)*