



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

SEPTEMBER 2014

**MECHANICAL TECHNOLOGY
MEMORANDUM**

MARKS: 200

This memorandum consists of 13 pages.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

- 1.1 C ✓ (1)
- 1.2 B ✓ (1)
- 1.3 A ✓ (1)
- 1.4 B ✓ (1)
- 1.5 D ✓ (1)
- 1.6 B ✓ (1)
- 1.7 B ✓ (1)
- 1.8 B ✓ (1)
- 1.9 D ✓ (1)
- 1.10 C ✓ (1)
- 1.11 C ✓ (1)
- 1.12 C ✓ (1)
- 1.13 D ✓ (1)
- 1.14 D ✓ (1)
- 1.15 B ✓ (1)
- 1.16 B ✓ (1)
- 1.17 A ✓ (1)
- 1.18 B ✓ (1)
- 1.19 C ✓ (1)
- 1.20 D ✓ (1)

[20]

QUESTION 2: SAFETY

- 2.1
- The predetermined pressure must never be exceeded. ✓
 - The wok pressure is always lower than the maximum safety pressure so pressure gauges must be tested regularly and adjusted or replaced. ✓
 - The platform on which the work piece rests must be rigid and square with the cylinder of the press. ✓
 - The platform must rest on the supports provided and should not be supported by the cable by which it is raised or lowered. ✓
 - Objects to be pressed must be placed in suitable jigs.
 - Ensure that the direction of pressure is always at 90° to the platform.
 - Relieve the cylinder of all pressure after use by opening the valve.
- (Any 4) (4)
- 2.2
- 2.2.1 True ✓ (1)
- 2.2.2 True ✓ (1)
- 2.2.3 False ✓ (1)
- 2.2.4 False ✓ (1)
- 2.3
- Name of manufacturer ✓
 - Country of origin ✓
 - Year of manufacture
 - Manufacturer's serial number
 - Name, number and date of the standard of design
 - Design gauge pressure in pascal's
 - Maximum permissible operating pressure in pascal's
 - Operating temperature
 - Mark of an approved inspection authority
- (Any 2) (2)
- [10]**

QUESTION 3: TOOLS AND EQUIPMENT

- 3.1
- Connect the analyser to the 12-volt terminals of the vehicle. ✓
 - The LCD will display '000' during the 30-seconds, until 0,00 is displayed. ✓
 - Do not connect the armoured hose of the condenser pickup to the rear of the machine until 0,00 is displayed. ✓
 - Insert the silicone hose probe and clamp it into the exhaust tailpiece with the stand to the right or left of the exhaust fumes to prevent the heat from affecting the stand. ✓
 - Unroll the armoured hose onto the brass inlet at the back of the analyser. ✓
 - Observe the readings on the display and make adjustments according to the manufacturer's specifications. ✓
- (6)

- 3.2
- **Cooling tester**
 - Function: To test the system for leaks. ✓
 - To determine if the pressure cap on the cooling system operates according to the prescribed pressure of the system. (Any 1)
 - Care: The meter should always be stored in its container to protect it from damage. ✓
 - Connecting pipes should be checked regularly for damage. (Any 1)
 - **Torsion tester**
 - Function: To investigate the momentum or torque applied to material and the influence of the material on torsional deflection. ✓
 - Care: All nuts and bolts to be secured properly on the tester.
 - Do not over tighten the chuck where the sample material is clamped.
 - Store the equipment in a dry place to prevent rust. (Any 1)
 - **Spring tester**
 - Function: To test the properties of a compression spring. ✓
 - Care: Moving parts should be cleaned properly and oiled fully before storing the machine. ✓
 - Moving parts should be lubricated. (Any 1) (6)
- [12]**

QUESTION 4: MATERIALS

- 4.1
- Ferrite ✓
 - Pearlite ✓
 - Cementite ✓
 - Austenite ✓ (4)
- 4.2
- A Lower critical point (AC_1) ✓
- B Second arrest point (AC_2) ✓
- C Higher critical temperature (AC_3) ✓ (3)
- 4.3
- 4.3.1 As the carbon content increases, ✓ the mechanical strength, hardness and hardening properties of steel improve, ✓ while properties like welding, cutting, forging, ductility and elasticity's abilities are adversely influenced. ✓ (3)
- 4.3.2 The temperature is the level of heat energy in a material as measured by a thermometer or thermostat and recorded on any of the several temperature scales, e.g. celsius, fahrenheit or kelvin. ✓
- The freezing temperature of water on the Celsius scale is 0°C and the boiling temperature is 100°C . ✓
- The freezing temperature of pure / clean water on the kelvin scale is 273 K and boiling temperature is 373 K at normal atmospheric pressure. ✓ (3)
- [13]**

QUESTION 5: TERMINOLOGY

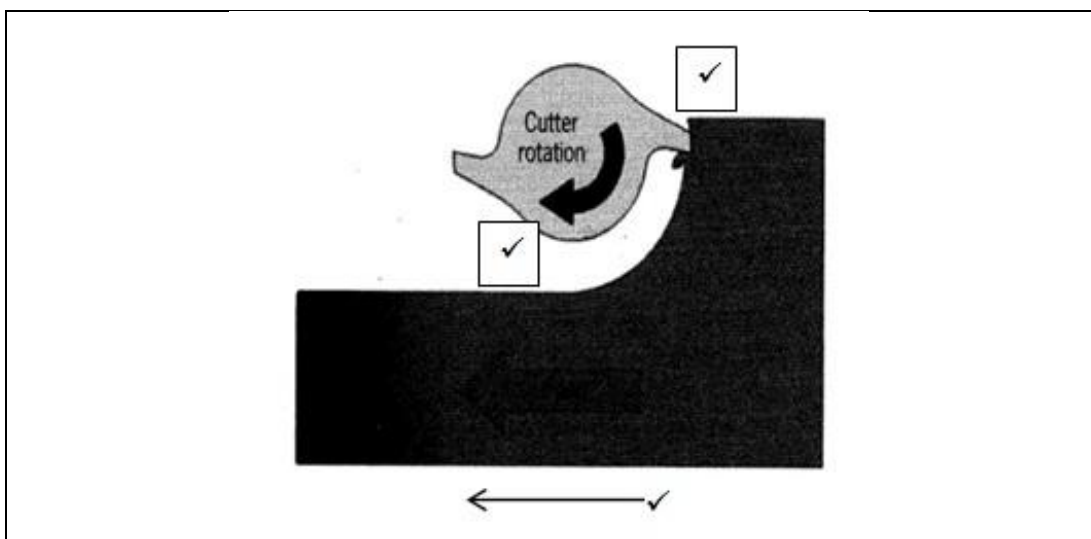
- 5.1 (a) Screw ✓
- (b) Thread angle ✓
- (c) Thickness of thread ✓
- (d) Single depth ✓
- (e) Minor or root diameter ✓
- (f) Pitch diameter ✓
- (g) Major or crest diameter ✓
- (h) Root ✓
- (i) Crest ✓
- (j) Helix angle ✓

(10)

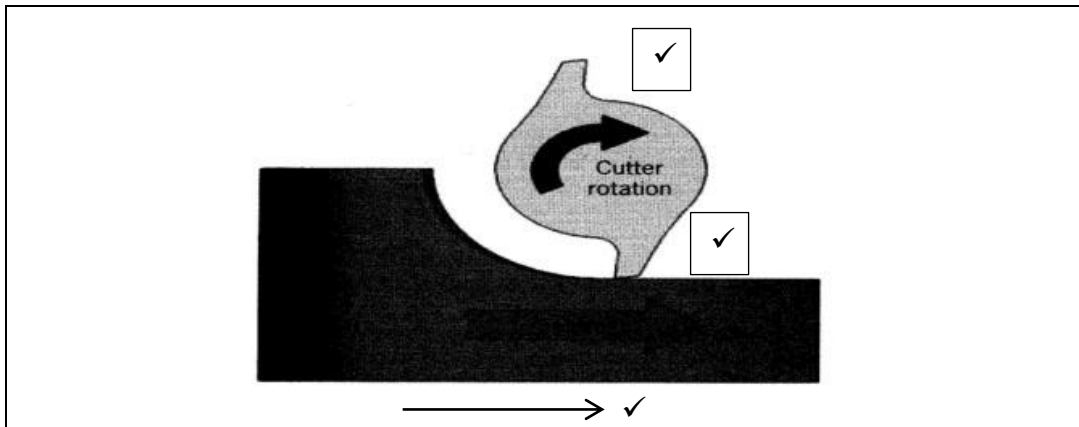
- 5.2 A – Equal angle cutter ✓
- B – Single corner rounding cutter ✓
- C – Convex cutter ✓
- D – Side and Face cutter ✓
- E – Single angle cutter ✓

(5)

5.3



(3)



(3)

$$\begin{aligned}
 5.4 \quad \text{Number of turns} &= \frac{40}{N} \\
 &= \frac{40}{32} \checkmark \\
 &= 1\frac{1}{4} \checkmark \\
 &= \frac{1}{4} \times \frac{6}{6} \\
 &= \frac{6}{24} \checkmark
 \end{aligned}$$

The crank handle must turn 1 full turn and 6 holes in a 24 holes plate. \checkmark (4)

$$\begin{aligned}
 5.5 \quad \text{Width of key (W)} & \\
 W &= \frac{D \text{ (Diameter)}}{4} \\
 W &= \frac{50}{4} \\
 W &= 12,5 \text{ mm } \checkmark
 \end{aligned}$$

Measure from the side of the square to the side of the cutter, \checkmark a distance equal to half the shaft diameter (-) minus the width of the cutter. \checkmark

$$\begin{aligned}
 &= 25 \text{ mm} - 10 \text{ mm} \\
 &= 15 \text{ mm } \checkmark
 \end{aligned}$$

When the distance of 15 mm is measured between the square and the cutter, the centre will coincide with the centre of the shaft. \checkmark

(5)
[30]

QUESTION 6: JOINING METHODS

6.1 Non-destructive testing does not damage the test piece. ✓
Destructive testing requires that a test piece is destroyed in the testing process. ✓ (2)

6.2

Defect		Causes		Cure	
6.2.1	Incomplete Penetration ✓	6.2.2	Speed too fast/Current too low ✓	6.2.3	Increase the current ✓
6.2.4	Undercutting ✓	6.2.5	Faulty electrode manipulation. Current too high ✓	6.2.6	Decrease the arc travel ✓

(6)

6.3

- A high frequency sound wave is sent into the metal for a very short period (1–3 micro seconds) and then the wave is stopped. ✓
- The same unit which was used to send the sound wave then acts as a receiver to listen to the ultrasonic wave as it is reflected through the metal. ✓
- The sound again flows, stop and it is reflected through the metal. (transmitter-receiver unit) and is repeated from half a million to five million times per second. ✓
- Each wave is usually represented on an oscilloscope. ✓
- This oscilloscope is calibrated to pick up only defects of a seize which would be considered harmful. ✓
- The oscilloscope wave pattern is also calibrated to show the distance between the searching unit and any defects found. ✓

(6)

6.4

- Shape of the profile ✓
- Uniformity of the surface ✓
- Overlap ✓
- Undercutting ✓
- Penetration bead ✓
- Root groove
- Freedom from cracks
- Freedom from surface defects (Any 5) (5)

6.5

- A – Gas shroud ✓
- B – Nozzle ✓
- C – Continuous feed electrode wire ✓
- D – Arc ✓
- E – Inert shielding gas ✓
- F – Molten weld pool ✓

(6)
[25]

QUESTION 7: FORCES

7.1 7.1.1
$$\text{Area} = \frac{\pi D^2}{4}$$

$$= \frac{\pi \times (0,05)^2}{4} \checkmark$$

$$= \frac{3,142 \times (0,05)^2}{4} \checkmark$$

$$\text{Area} = 0,0019637 \text{ m}^2 \checkmark \quad (3)$$

7.1.2
$$\text{Stress} = \frac{\text{Load}}{\text{Area}}$$

$$= \frac{100000}{0,0019637} \checkmark$$

$$= 509242275,6 \text{ Pa} \checkmark$$

$$\text{Stress} = 50,92 \text{ MPa} \checkmark \quad (3)$$

7.1.3
$$E = \frac{\text{Stress}}{\text{Strain}}$$

$$\text{Strain} = \frac{\text{Stress}}{E}$$

$$= \frac{509242275,6}{200 \times 10^9} \checkmark$$

$$\text{Strain} = 0,0002546 \checkmark \quad (2)$$

7.1.4
$$\text{Strain} = \frac{\text{Change in Length (Elongation)}}{\text{Original Length}}$$

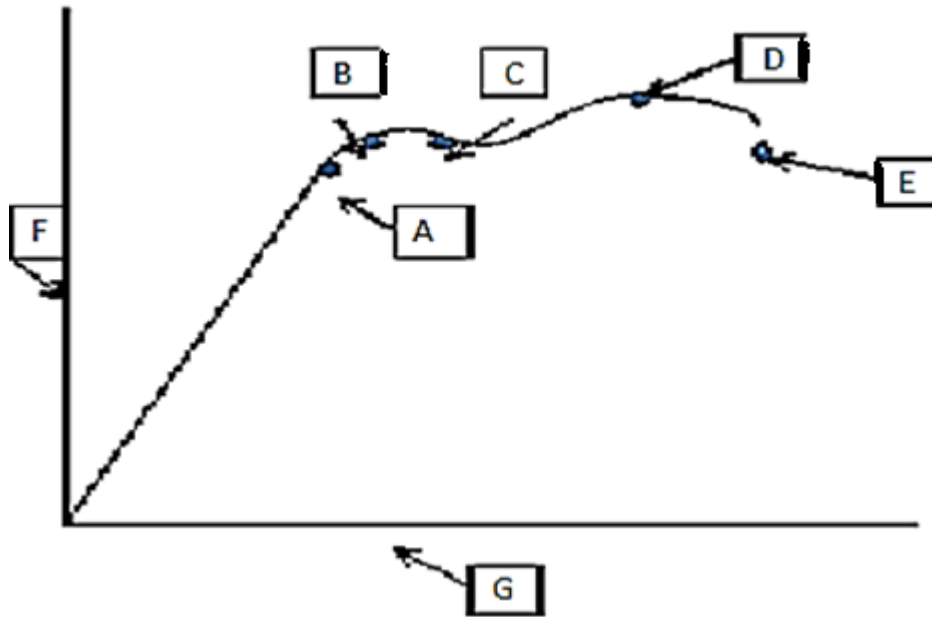
$$\text{Elongation} = \text{Strain} \times \text{Original Length}$$

$$= 0,0002546 \times 2 \text{ m} \checkmark$$

$$= 0,0005092 \text{ m} \checkmark$$

$$\text{Elongation} = 0,5092 \text{ mm} \checkmark \quad (3)$$

7.2



- A – Limit of proportionality ✓
 - B – Elastic Limit ✓
 - C – Yield point ✓
 - D – Maximum stress ✓
 - E – Breaking stress ✓
 - F – Strain ✓
 - G – Stress ✓
- (7)

7.3 7.3.1 RL: $(RR \times 12) = (4 \times 3) + (6 \times 8) + (4 \times 9) \checkmark$
 $RR \times 12 = 12 + 48 + 36$
 $R = \frac{96}{12}$
 $RR = 8 \text{ N} \checkmark$

(2)

RR: $(RL \times 12) = (4 \times 3) + (6 \times 4) + (4 \times 9) \checkmark$
 $RL \times 12 = 12 + 24 + 36$
 $RL = \frac{72}{12}$
 $RL = 6 \text{ N} \checkmark$

(2)

7.3.2 BM A = $6 \times 3 = 18 \text{ N} \checkmark$ (1)
 BM B = $(6 \times 8) - (4 \times 5) = 48 - 20 = 28 \text{ N} \checkmark$ (1)
 BM C = $(6 \times 10) - (4 \times 7) - (6 \times 2) - (4 \times 1) = 16 \text{ N} \checkmark$ (1)

- 7.4
- Assemble the equipment and select an appropriate beam and take a ruler and a dry-wipe marker, to draw a line across the beam 200 mm from the root.
 - Add a 10 kg weight hanger onto the dial indicator and slide the dial gauge down onto the beam until it reads 10 mm.
 - Remove the weight hanger and zero the outer scale using the bezel and add 100 g mass to the dial indicator to record the dial indicator reading.
 - Increase the previous step until you reach 500 g, increasing the mass in 100 g increments.
 - Plot the graph of deflection (x-axis) versus load (y-axis) to prove the relevant theories.

(5)

[30]**QUESTION 8: MAINTENANCE**

- 8.1 8.1.1 Viscosity refers to the measure of the resistance ✓ of oil to flow. ✓ (2)
- 8.1.2 The lowest temperature ✓ at which a liquid remains “pourable”, meaning it still behaves like a fluid. ✓ (2)
- 8.2
- Locate the link in the chain and remove the spring retainer or cotter pins and then remove the pin link plate. ✓
 - Chain systems must have their sprockets in alignment before the new chain is installed. ✓
 - Failure to do so could result in very expensive repairs later. ✓
 - Select the correct length and size of replacement chain and make sure that it is sufficiently lubricated before installation. ✓
 - When the new chain has been run over the sprockets, insert the chain link and tension the chain. ✓
 - Never lubricate a chain manually while it is in motion and check for alignment to make sure it is running true. ✓
- (6)
- 8.3
- Avoid contamination of the cutting fluid by draining and regularly replacing it. ✓
 - Always clean the machine’s splash tray of metal cuttings after use. ✓
 - Regularly wipe cutting-fluid splashes off machine parts (only when the machine is stationary). ✓
 - Ensure that the sump is topped up from time to time and check that there is sufficient flow of cutting fluid to the cutting tool. (Any 3) (3)
- 8.4
- Belts tend to stretch with prolonged use. ✓
 - They need to be tightened periodically ✓ and checked for correct alignment. ✓
- (2)

[15]

QUESTION 9: SYSTEMS AND CONTROL

$$\begin{aligned}
 9.1.1 \quad \text{Area of Piston 'B'} &= \frac{\pi D^2}{4} \\
 &= \frac{\pi \times 0,56^2}{4} \checkmark \\
 &= \frac{0,985}{4}
 \end{aligned}$$

$$\text{Area of Piston 'B'} = 0,246 \text{ m}^2 \checkmark$$

$$\begin{aligned}
 \text{Area of Piston 'A'} &= \frac{\pi D^2}{4} \\
 &= \frac{\pi \times 0,17^2}{4} \checkmark
 \end{aligned}$$

$$\text{Area of Piston 'A'} = 0,0227 \text{ m}^2 \checkmark \quad (4)$$

$$\begin{aligned}
 9.1.2 \quad \text{Pressure applied on Piston 'B'} &= \frac{\text{Force}}{\text{Area}} \\
 &= \frac{380}{0,246} \checkmark
 \end{aligned}$$

$$\text{Pressure on Piston 'B'} = 1\,544,72 \text{ Pa} \checkmark$$

$$P_A = \frac{F_A}{A_A}$$

$$F_A = P_A \times A_A$$

$$= 1544,72 \times 0,0227$$

$$F_A = 35,065 \text{ N} \checkmark$$

$$\text{Volume}_B = A_B \times L_B$$

$$= 0,246 \times 0,018$$

$$\text{Volume}_B = 0,004428 \text{ m}^3 \checkmark \quad (4)$$

$$9.1.3 \quad \text{Volume}_A = \text{Volume}_B$$

$$0,004428 = A_A \times L_A \checkmark$$

$$L_A = \frac{0,004428}{0,0227}$$

$$= 0,195 \text{ m}$$

$$L_A = 195 \text{ mm} \checkmark \quad (2)$$

$$9.2 \quad D_A \times N_A = D_B \times N_B$$

$$350 \times 450 = 150 \times N_B \quad \checkmark$$

$$N_B = \frac{350 \times 450}{150} \quad \checkmark$$

$$N_B = 1050 \text{ Rev/min} \quad \checkmark \quad (3)$$

9.3 Given:

$$N_C = 100 \text{ revs/sec}$$

$$T_C = 20 \text{ teeth}$$

$$N_D = ?$$

$$T_D = 50 \text{ teeth}$$

$$N_E = 25 \text{ revs/sec}$$

$$T_E = ?$$

9.3.1 The rotational frequency (revs) of gear D

$$N_C \times T_C = N_D \times T_D$$

$$100 \times 20 = N_D \times 50 \quad \checkmark$$

$$N_D = \frac{100 \times 20}{50} \quad \checkmark$$

$$N_D = 40 \text{ revs/ sec} \quad \checkmark \quad (3)$$

9.3.2 The number of teeth on gear E

$$N_D \times T_D = N_E \times T_E$$

$$40 \times 50 = 25 \times T_E \quad \checkmark$$

$$T_E = \frac{40 \times 50}{25} \quad \checkmark$$

$$T_E = 80 \text{ teeth} \quad \checkmark \quad (3)$$

$$9.4 \quad P_1 \times V_1 = P_2 \times V_2$$

$$3,8 \times 0,08 = P_2 \times 0,22 \quad \checkmark$$

$$P_2 = \frac{3,8 \times 0,08}{0,22}$$

$$P_2 = \frac{0,304}{0,22} \quad \checkmark$$

$$P_2 = 1,38 \text{ MPa (kN/m}^2) \quad \checkmark \quad (3)$$

$$P_1 \times V_1 = P_2 \times V_2$$

$$3,8 \times 0,08 = 7,9 \times V_2 \quad \checkmark$$

$$V_2 = \frac{3,8 \times 0,08}{7,9}$$

$$V_2 = \frac{0,304}{7,9} \quad \checkmark$$

$$V_2 = 0,038 \text{ m}^3 \quad \checkmark \quad \text{or } 0,39 \text{ m}^3$$

(3)
[25]

QUESTION 10: TURBINES

- 10.1
- The impulse turbine changes the velocity of a water jet, which pushes on the turbine's curved blades and changes the direction of the flow. \checkmark
 - The resulting change in momentum (impulse) causes a force on the turbine blades. \checkmark
 - Since the turbine is spinning, the force acts over a distance and the diverted water flow is left with diminishing energy. \checkmark
 - Prior to hitting the turbine blades, the water's pressure (potential energy) is converted to kinetic energy by a nozzle and focused on the turbine. \checkmark
 - No pressure occurs at the turbine blades and the turbine does not require a housing for operation. \checkmark
- (5)
- 10.2
- Condensing turbines \checkmark
 - Non-condensing turbines \checkmark
 - Reheat turbines \checkmark
 - Extracting turbines \checkmark
 - Induction turbines \checkmark
- (5)
- 10.3
- (a) Combustion chamber \checkmark
 - (b) Intake turbine \checkmark
 - (c) Spinner \checkmark
 - (d) Ignition \checkmark
 - (e) Intake \checkmark
- (5)
- 10.4
- A turbine is driven by the exhaust gas from a pump, \checkmark most often an internal combustion engine, to spin an impeller \checkmark whose function it is to force more air into the pump's intake or air supply, \checkmark with a third part being a centre hub, rotating assembly, which contains bearings, lubrication, cooling and a shaft that directly connects the turbine and impeller. \checkmark The shaft, bearings, impellers and turbine can rotate at speed in tens or hundreds of thousands of RPM (revolutions per minute). \checkmark
- (5)

[20]

TOTAL: 200

TOTAAL: 200

[20]

(5)

10.4 n Turbine word deur die uitlaatgas van n pomp dikwels n binnebandenjin, aangedryf n ten einde n stuur te laat draai, wat op sy beurt meer lug by die pomp se inlaat of lugtoevoer, indwing. n Die derde basiese onderdeel is n samestel wat om n spil draai n en laers, smering, verkoeling asook n as bevat wat die turbine en stuur regstreeks verbind. n Die as, laers, stuur en turbine kan teen snelhede van honderde, selfs duisende ommwentelings per minuut draai. n

(5)

- 10.3
- (a) Verbrandingskamer n
 - (b) Inlaat-turbine n
 - (c) Draaier n
 - (d) Ontsteking n
 - (e) Inlaat n

(5)

- 10.2
- Gekondenseerde-turbines n
 - Nie-gekondenseerde-turbines n
 - Herverhittings-turbines n
 - Uitlaat-turbines n
 - Induksie-turbines n

(5)

- 10.1
- Hierdie tipe turbine verander die snelheid van n waterstraal, wat bots met die turbine se geboe lemme, wat die vloei rigting verander. n
 - Die gevolglike verandering in momentum oefen krag uit op die turbinelemme. n
 - Omdat die turbine wentel, word die krag oor n afstand uitgeoefen, terwyl die weggekeerde water met minder energie gelaat word. n
 - Voordat dit die turbinelemme tref, word die waterdruk omgesit in kinetiese energie deur n straalpyp wat op die turbinelemme gekonsentreer word. n
 - Daar vind geen drukverandering by die lemme plaas nie en die turbine het dus nie n omhuysel nodig nie. n

VRAAG 10: TURBINES

[25]

(3)

$$V_2 = 0,038 \text{ m}^3 \text{ of } 0,39 \text{ m}^3$$

$$V_2 = \frac{0,304}{7,9}$$

$$V_2 = \frac{3,8 \times 0,08}{7,9}$$

$$3,8 \times 0,08 = 7,9 \times V_2$$

$$P_1 \times V_1 = P_2 \times V_2$$

9.2

$$D_A \times N_A = D_B \times N_B$$

$$350 \times 450 = 150 \times N_B \checkmark$$

$$N_B = \frac{350 \times 450}{150} \checkmark$$

$$N_B = 1050 \text{ Rev/min} \checkmark$$

(3)

9.3

Gegee:

$$N_C = 100 \text{ rev/sek}$$

$$T_C = 20 \text{ tande}$$

$$N_D = ?$$

$$T_D = 50 \text{ tande}$$

$$N_E = 25 \text{ rev/sek}$$

$$T_E = ?$$

9.3.1 Die rotasiegetal (revs) van rat D

$$N_C \times T_C = N_D \times T_D$$

$$100 \times 20 = N_D \times 50 \checkmark$$

$$N_D = \frac{100 \times 20}{50} \checkmark$$

$$N_D = 40 \text{ revs/sek} \checkmark$$

(3)

9.3.2 Die getal tande op rat E

$$N_D \times T_D = N_E \times T_E$$

$$40 \times 50 = 25 \times T_E \checkmark$$

$$T_E = \frac{40 \times 50}{25} \checkmark$$

$$T_E = 80 \text{ tande} \checkmark$$

(3)

9.4

$$P_1 \times V_1 = P_2 \times V_2$$

$$3,8 \times 0,08 = P_2 \times 0,22 \checkmark$$

$$P_2 = \frac{3,8 \times 0,08}{0,22}$$

$$P_2 = \frac{0,304}{0,22} \checkmark$$

$$P_2 = 1,38 \text{ MPa (kN/m}^2) \checkmark$$

(3)

VRAAG 9: STELSELS EN BEHEER

9.1.1

$$\text{Area van suier 'B'} = \frac{\pi D^2}{4} = \frac{\pi \times 0,56^2}{4} = 0,985 \text{ m}^2$$

$$\text{Area van suier 'B'} = 0,246 \text{ m}^2$$

$$\text{Area van suier 'A'} = \frac{\pi D^2}{4}$$

$$= \frac{\pi \times 0,17^2}{4}$$

$$\text{Area van suier 'A'} = 0,0227 \text{ m}^2$$

9.1.2

$$\text{Druk toegepas op Suier 'B'} = \frac{\text{Force}}{\text{Area}}$$

$$= \frac{380}{0,246}$$

$$\text{Druk op Suier 'B'} = 1\,544,72 \text{ Pa}$$

$$P_A = \frac{F}{A_A}$$

$$F_A = P_A \times A_A$$

$$= 1\,544,72 \times 0,0227$$

$$F_A = 35,065 \text{ N}$$

$$\text{Volume}_B = A_B \times L_B$$

$$= 0,246 \times 0,018$$

$$\text{Volume}_B = 0,004428 \text{ m}^3$$

9.1.3

$$\text{Volume}_A = \text{Volume}_B$$

$$0,004428 = A_A \times L_A$$

$$L_A = \frac{0,004428}{0,0227}$$

$$= 0,195 \text{ m}$$

$$L_A = 195 \text{ mm}$$

(2)

(4)

(4)

[15]

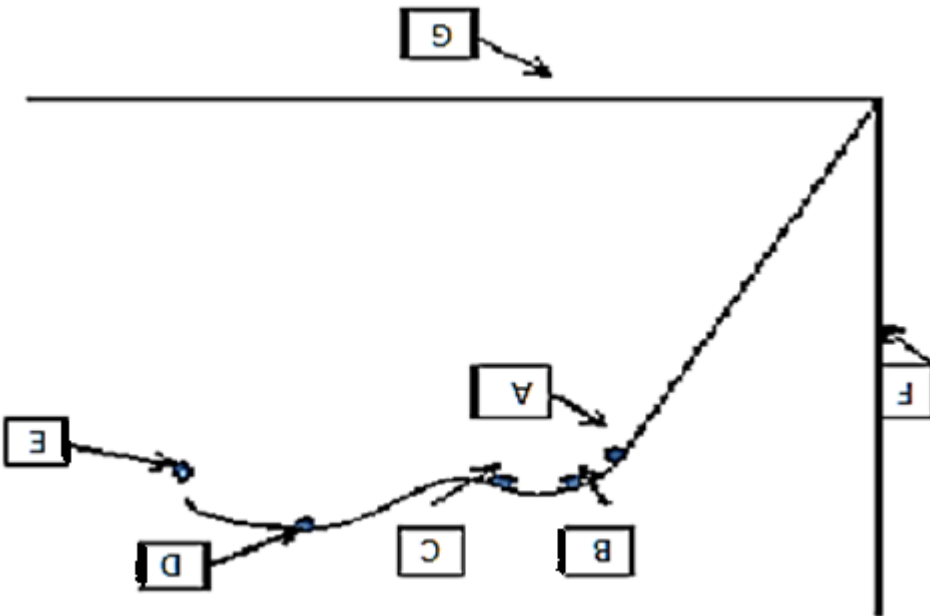
- 8.4
- Bande is geneig om na 'n ruk se gebruik te rek. ✓
 - Daarom moet hulle van tyd tot tyd stywer gespan ✓ en vir korrekte opstelling nagegaan word. ✓
- (2)
- 8.3
- Verhoed dat die snyvloeistof besmet word deur dit gereeld af te tap en te vervang. ✓
 - Verwyder altyd na gebruik alle metaalsnysets uit die masjien se spatbak. ✓
 - Verwyder gereeld snyvloeistofspatsels van masjienonderdele. ✓
 - Maak seker dat die opgaarbak van tyd tot tyd bygevuil word en dat daar 'n voldoende toevoer van snyvloeistof na die snywerktuig is. (Enige 3)
- (3)
- 8.2
- Vind die skakel in die ketting en verwyder die verkeerder of sluitpen sowel as die penskakelplaat. ✓ Dit sal jou instaat stel om die ketting uitmekaar te haal en te verwyder.
 - Let dat sekere kettingsstelsels se kettingsrat altyd belyn moet wees, soos die nok-en-kruk-as van 'n motorenjin voordat 'n ketting geïnstalleer word. ✓
 - Natigheid wat dit betref, kan groot onkoste later veroorsaak. ✓
 - Kies die ketting van die korrekte lengte en grootte vir 'n vervangings-ketting een maak seker dat dit genoegsaam voor installering gesmeer is. ✓
 - Wanneer die nuwe ketting oor die kettingsrat getrek is, kan die skakel ingesit word en die ketting gespan word. ✓
 - 'n Ketting moet nooit met die hand gesmeer word terwyl dit beweeg nie en kyk altyd na die belyning en sorg dat die ketting glad loop. ✓
- (6)
- 8.1.2
- Vloeiopunt is die laagste temperatuur ✓ waarop vloeistof vloeibaar bly. ✓
- (2)
- 8.1.1
- Die viskosititeit van 'n vloeistof is sy 'dikte' of 'meting' van sy weerstand ✓ teenvloeiing. ✓
- (2)

VRAAG 8: INSTANDHOUDING

[30]

- 7.4
- Monteer die toerusting en gebruik 'n linaal en 'n droogveemeter, trek 'n 100 g lyn oor die balk 200 mm van die wortel af.
 - Voeg 'n 10 kg-massa by die wysserplaatmeter en skuif die wyssermeter af op die balk totdat dit 10 mm lees.
 - Verwyder die gewighanger en stel die buitenste skaal op nul deur die skerp kant te gebruik. Voeg 'n 100 g-massa by die wyssermeter en teken die wyssermeterlesing aan.
 - Herhaal die vorige stap totdat jy 500 g bereik terwyl jy die massa in inkremente van 100 g verhoog.
 - Stip jou bevindinge aan op 'n defleksiegrafiek – (x-as) versus las (y-as) om die onderskeie teorieë te bewys.
- (5)

7.2



- A - Proporsionaliteitsgrens ✓
- B - Elastisiteitsgrens ✓
- C - Meeggepunt ✓
- D - Maksimum spanning ✓
- E - Brekspanning ✓
- F - Spanning ✓
- G - Verorming ✓

(7)

7.3 7.3.1 RL: $(RR \times 12) = (4 \times 3) + (6 \times 8) + (4 \times 9) \checkmark$

$$RR \times 12 = 12 + 48 + 36$$

$$R = \frac{96}{12}$$

$$RR = 8 \text{ N} \checkmark$$

(2)

$$RR: (RL \times 12) = (4 \times 3) + (6 \times 4) + (4 \times 9) \checkmark$$

$$RL \times 12 = 12 + 24 + 36$$

$$R = \frac{72}{12}$$

$$RL = 6 \text{ N} \checkmark$$

(2)

7.3.2

$$BMA = 6 \times 3 = 18 \text{ N} \checkmark$$

$$BMB = (6 \times 8) - (4 \times 5) = 48 - 20 = 28 \text{ N} \checkmark$$

$$BMC = (6 \times 10) - (4 \times 7) - (6 \times 2) - (4 \times 1) = 16 \text{ N} \checkmark$$

(1)

(1)

(1)

VRAAG 7: KRAAGTE

$$7.1 \quad 7.1.1 \quad \text{Area} = \frac{\pi D^2}{4}$$

$$= \frac{\pi \times (0,05)^2}{4} \checkmark$$

$$= \frac{3,142 \times (0,05)^2}{4} \checkmark$$

$$\text{Area} = 0,0019637 \text{ m}^2 \checkmark$$

(3)

7.1.2

$$\text{Spanning} = \frac{\text{Dwarsdeursnee Oppervlak}}{\text{Las}} = \frac{100000}{0,0019637} \checkmark$$

$$= 509242275,6 \text{ Pa} \checkmark$$

$$\text{Spanning} = 50,92 \text{ MPa} \checkmark$$

(3)

7.1.3

$$E = \frac{\text{Spanning}}{\text{Verorming}}$$

$$\text{Verorming} = \frac{E}{\text{SPANNING}}$$

$$= \frac{509242275,6}{200 \times 10^9} \checkmark$$

$$\text{Verorming} = 0,0002546 \checkmark$$

(2)

7.1.4

$$\text{Verorming} = \frac{\text{Verandering in Lengte}}{\text{Oorspronklike Lengte}}$$

$$\text{Verandering} = \text{Verorming} \times \text{Oorspronklike Lengte}$$

$$= 0,0002546 \times 2 \text{ m} \checkmark$$

$$= 0,0005092 \text{ m} \checkmark$$

$$\text{Verandering} = 0,5092 \text{ mm} \checkmark$$

(3)

VRAAG 6: HEGTINGSMETODES

- 6.1 Nie-destruktiewe toetsing is nie die vernietiging van 'n proefstuk nie. ✓
 Destruktiewe toetsing is die vernietiging van 'n proefstuk in die toetsproses. ✓ (2)
- 6.2
- | | | | | | | |
|-------|-------|--------------------------|-------|---|-------------------------|-------------|
| Defek | 6.2.1 | Onvolledige penetrasie ✓ | 6.2.2 | Spood te vinnig/
Sweisstrom | te laag ✓
Sweisstrom | Regstelling |
| | 6.2.4 | Insnyding ✓ | 6.2.5 | Gebruik van foutiewe elektrode.
Sweisstrom | te hoog ✓
Sweisstrom | |
- (6)
- 6.3
- Ultrasoniese toetsing gebruik hoëfrekwensie klankgolwe om deur proefstukke te dring vir ongeveer (1–3) mikrosekondes en die word die golf gestop. ✓
 - Die frekwensieklankgolf word vir 'n kort tydjie deur die metaal gestuur en wanneer die golf gestop word, dien dieselfde eenheid wat gebruik is om die klankgolf te stop dan as ontvanger. ✓
 - Wanneer die golf gestop word, dien dieselfde eenheid wat gebruik is om die klankgolf te stuur dan as ontvanger om na die ultrasoniese golf te luister soos wat die metaal dit terugkaats en word herhaal vanaf 'n half miljoen tot vyf miljoen keer per sekonde. ✓
 - Elke golf word visueel op 'n ossiloskoop uitgebied. ✓
 - Die ossiloskoop word gekalibreer om slegs foute waarvan die grootte as skadelik beskou word, op te spoor. ✓
 - Die ossiloskoop golfpatroon word ook gekalibreer om die afstand tussen die soekeenhed en enige opgespoorde fout aan te dui. ✓
- (6)
- 6.4
- Profielvorm ✓
 - Oppervlak-eenvormigheid ✓
 - Orvleueling ✓
 - Insnyding ✓
 - Deurdringingskraal ✓
 - Wortelgroef
 - Kraakvry
 - Afwesigheid van oppervlakdefekte
- (5) (Enige 5)
- 6.5
- A – Gasskerm ✓
 - B – Spuitstuk ✓
 - C – Ononderbroke elektrode draadtoevoer ✓
 - D – Boog ✓
 - E – Trae afskermingsgas ✓
 - F – Gesmelte sweisplaa ✓
- (6) [25]

5.4

Getal draaie = $\frac{40}{N}$

$\frac{32}{40}$ ✓

$= 1\frac{1}{4}$ ✓

$= \frac{1}{6} \times \frac{4}{6}$

$= \frac{4}{6}$ ✓

$= \frac{24}{6}$

Die kruk draai 1 volle draaibeweging en 6 gate in 'n 24-gat plaat. ✓

(4)

5.5

Breedte van die spy (W)

$W = \frac{D \text{ (Diameter)}}{4}$

$W = \frac{50}{4}$

$W = 12,5 \text{ mm}$ ✓

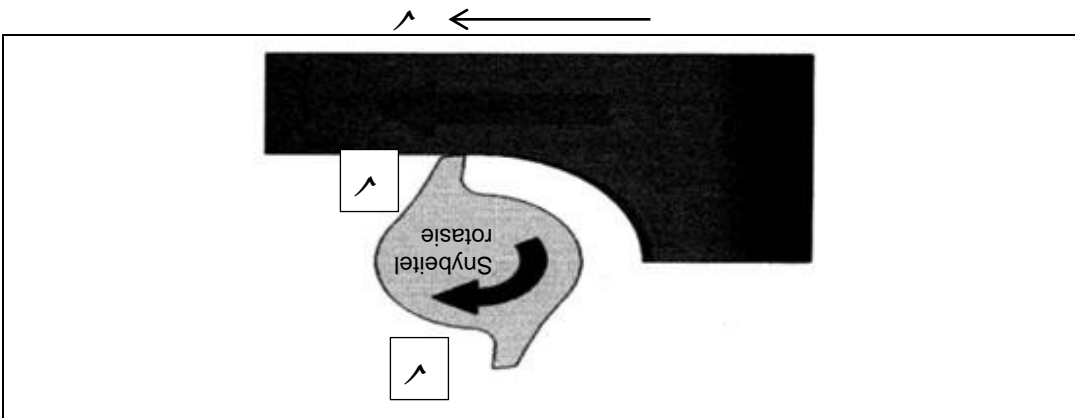
Meet van die kant van die winkelhaak na die kant van die snybeitel, 'n afstand gelykstaande aan halfsmiddellyn minus(-) hefte die breedte van die snybeitel. ✓

$= 25 \text{ mm} - 10 \text{ mm}$

$= 15 \text{ mm}$ ✓

Wanneer die afstand van 15 mm tussen die winkelhaak en die snybeitel gemeet is, sal die middel van die snybeitel ooreenstem met die middel van die as. ✓

(5)
[30]



(3)

VRAAG 5: TERMINOLOGIE

5.1 (a) Skroef ✓

(b) Draadhoek ✓

(c) Dikte van draad ✓

(d) Enkel diepte ✓

(e) Kern- of wortel middellyn ✓

(f) Steek middellyn ✓

(g) Boute- of top middellyn ✓

(h) Wortel ✓

(i) Top ✓

(j) Helikshoek ✓

(10)

5.2 A – Gelykhoekige snyer ✓

B – Enkelhoek ronde snyer ✓

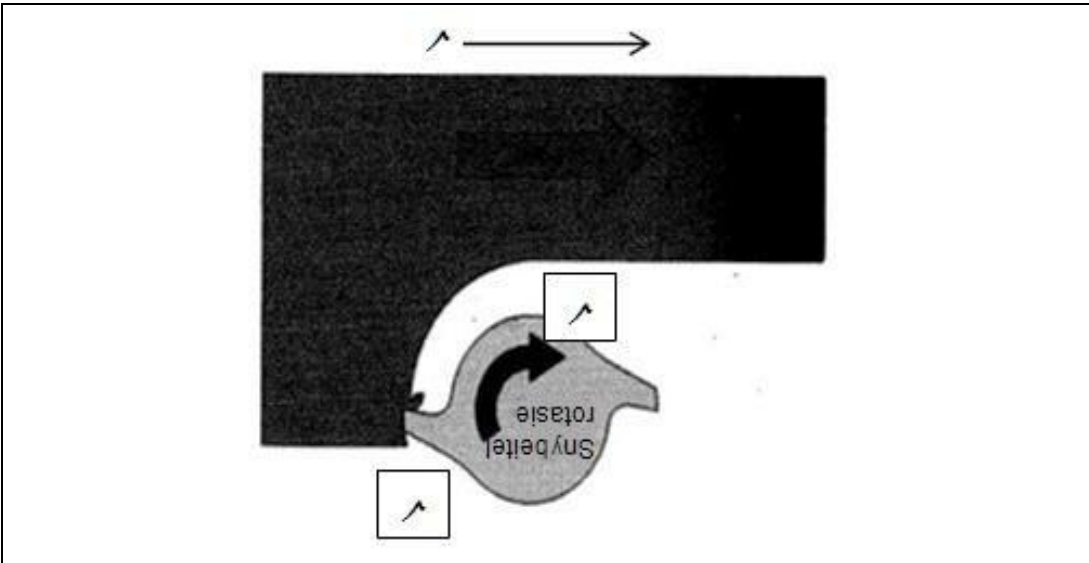
C – Konvekse snyer ✓

D – Sy- en vlaksnyer ✓

E – Enkelhoekige snyer ✓

(5)

5.3



(3)

[13]

(3)

Die vriespunt van suiwel water op die kelvinskaal is 273 K en die kookpunt 373 K teen normale atmosferiese druk. ✓

Die vriespunt van suiwel water op die celsiuskaal is 0 °C en die kookpunt 100 °C. ✓

Dit is die hittedvlak binne 'n materiaal wat gemeet word deur 'n termometer of termostaat ✓ en in enigeen van verskeie temperatuurskale, ✓ byvoorbeeld celsius, fahrenheit of kelvin aangeteke word. ✓

4.3.2

(3)

Soos die koolstofinhoud toeneem, ✓ verbeter die trekvasheid of meganiese sterkte, hardheid en verhardingsvermoëns van staal, ✓ terwyl eienskappe soos rekbaarheid, smeebaarheid, swais- en snybaarheid nadelig geaffekteer word. ✓

4.3.1

(3)

A Laer kritiese punt (A_{C1}) ✓
 B Tweede stuit punt (A_{C2}) ✓
 C Hoër kritiese punt (A_{C3}) ✓

(4)

- Ferriet ✓
- Pearlite ✓
- Sementiet ✓
- Austeniet ✓

4.1

VRAAG 4: MATERIAAL

[12]

(6)

- **Verkoelingsstelsel**
- Funksie: Kan getoets word vir lekkasie. ✓
- Om te bepaal of die verkoelersdruk van die verkoelingsstelsel opereer na gelang van die voorgeskrewe druk van die stelsel. (Enige 1)
- Versorging: Bêre die meter in sy houër om dit teen skade te beskerm. ✓
- Gaan die konnekteertyp gereeld vir lekkasies of skade na. (Enige 1)
- **Torsie toets**
- Funksie: Om die verband tussen draaimomente wat op 'n materiaal toegepas word en die torsionele defleksie wat oor 'n gegewe deel van die materiaal plaasvind, aan te dui. ✓
- Versorging: Alle boue en moere aan die toetsers moet stewig vas wees. ✓
- Moenie die klamp of kloukop te styf vasmaak waar die toetsmateriaal vasgeklem word nie. ✓
- Berg die toerusting in 'n droë plek om roes te voorkom. (Enige 1)
- **Veertoets**
- Funksie: Word gebruik om die elastiese eienskappe van die klepverre van motorenjins te toets. ✓
- Versorging: Alle bewegende dele moet skoonmaak word en volledig geolie word voordat die masjien gebêre word. ✓
- Bewegende dele moet versmeer word.

3.2

VRAAG 2: VEILIGHEID

- 2.1 Die voorafbeaalde druk moet nooit oorskry word nie. ✓

- Die werksdruk is altyd laer as die maksimum veilige druk en moet gereeld getoets en verstel of vervang word in geval van foute. ✓
- Die platform waarop die werkstuk rus, moet stewig en haaks met die perssiliinder wees. ✓
- Die platform moet op die stutte wat voorsien is, rus en nie aan die kabel waarmee dit verstel word, hang nie. ✓
- Voorwerpe wat gepers word moet in geskikte setstukke in plek gehou word.
- Maak seker dat die drukrigting altyd 90° teenoor die platform is.
- Maak na gebruik die klep oop om die druk in die silinder te verlig.

(4) (Enige 4)

2.2

2.2.1 Waar ✓

2.2.2 Waar ✓

2.2.3 Onwaar ✓

2.2.4 Onwaar ✓

2.3

- 2.3 Naam van fabrikant ✓
- Land van oorsprong ✓
- Vervaardigingsjaar
- Fabrikant se volgnummer.
- Naam, nommer en datum van die ontwerpstandaard
- Onwerpdruckmeter se druk in pascal.
- Maksimum toelaatbare werkdruk in pascal
- Werttemperatuur
- Merk van goedgekeurde inspeksie-owerheid

(2) (Enige 2)

[10]

VRAAG 3: GEREDSKAP

3.1

- 3.1 Konnekteer die ontleder aan die 12V-battery terminale van die voertuig. ✓
- Die diodeskermpie (LCD) sal '000' gedurende die 30 sekondes vertoon, totdat 0,00 vertoon word. ✓
- Moenie die versterkte versamelpyp van die kondensator agteraan die masjien verbind voordat 0,00 verskyn nie. ✓
- Steek die toetsstif in die silikonpyp en klem dit aan die uitlaattyp vas, aan die linker- of regterkant sodat die uitlaattgasse dit nie affekteer nie. ✓
- Rol die versterkte pyp af en steek in die geelkoperinlaat agteraan die ontleder. ✓
- Kyk na die lesings op diodeskermpie en verstel die brandstof/lugmengsel volgens die voertuigfabrikant se spesifikasies. ✓

(6)

VRAAG 1: MEERVOUDIGEKEUSE-VRAE

1.1	C ✓	(1)
1.2	B ✓	(1)
1.3	A ✓	(1)
1.4	B ✓	(1)
1.5	D ✓	(1)
1.6	B ✓	(1)
1.7	B ✓	(1)
1.8	B ✓	(1)
1.9	D ✓	(1)
1.10	C ✓	(1)
1.11	C ✓	(1)
1.12	C ✓	(1)
1.13	D ✓	(1)
1.14	D ✓	(1)
1.15	B ✓	(1)
1.16	B ✓	(1)
1.17	A ✓	(1)
1.18	B ✓	(1)
1.19	C ✓	(1)
1.20	D ✓	(1)

[20]

Hierdie memorandum bestaan uit 13 bladsye.

PUNTE: 200

**MEGANIESE TEGNOLOGIE
MEMORANDUM**

SEPTEMBER 2014

GRAAD 12

**NASIONALE
SENIOR SERTIFIKAAT**