GAUTENG DEPARTMENT OF EDUCATION
GAUTENGSE DEPARTEMENT VAN ONDERWYS

SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

TECHNIKA (MECHANICAL/*MEGANIES*) SG

Possible Answers / Moontlike Antwoorde
Feb / Mar / Maart 2006

QUESTION/*VRAAG* 1A

1.1 B. Faulty electrical wiring of machines
Foutiewe elektriese bedrading van masjiene

D. Inadequate tooling.
Onvoldoende gereedskap

E. Broken-down machines
Onklaar masjiene (3)

1.2 D. They have the same pitch and module
Hulle het dieselfde steek en module (1)

1.3 B. The outside diameter of the screw-thread
Die buitediameter van die skroefdraad

C. The lead of the screw-thread
Die styging van die skroefdraad (2)

1.4 B. Backlash has to be avoided
Dooiegang moet geëlimineer word (1)

1.5 C. The quantity inclined to change the form or state of motion of an object
Die hoeveelheid wat neig om die vorm of bewegingstoestand van ? liggaam te verander (1)

1.6 A. Inertia
Traagheid (1)

1.7 A. Energy
Energie (1)

1.8 B. $5\ m.s^{-1}$ (1)

1.9 D. All three simultaneously.
Al drie gelyktydig (1)

1.10 B. The aluminium block
Die aluminiumblok (1)

1.11 D. Velocity
Snelheid (1)

1.12 C. 100 kW.h (1)

1.13 E. 72 000 J (1)

1.14 A. Is the same for both
Is dieselfde vir albei (1)

1.15 E. 10 m/s in direction 216°
10 m/s in rigting 216° (1)

1.16 D. The pressure is inversely proportional to the volume
Die druk is omgekeerd eweredig aan die volume (1)

1.17 C. Convert alternating current to direct current
Wisselstroom in gelykstroom om te skakel (1)

QUESTION/*VRAAG* 1B

1.18 1.18.1 False/*Onwaar* (1)

1.18.2 False/*Onwaar* (1)

1.18.3 True/*Waar* (1)

1.18.4 True/*Waar* (1)

1.18.5 True/*Waar* (1)

1.19 Tools are implements or means that enable man to accomplish various working processes. Tools are in fact extensions of man's physical ability as well as his mind.
Gereedskap is werktuie of hulpmiddels wat die mens in staat stel om verskillende werkprosesse uit te voer. Gereedskap is verlengstukke van die mens se hand en verstand. (6)

1.20 – Hand tools / *Handgereedskap*
– Clamping tools / *Klemgereedskap*
– Machine tools / *Masjiengereedskap*
– Measuring tools / *Meetgereedskap* (2)

1.21 To control working conditions in factories. To limit accidents and occupational illnesses.
Om werksomstandighede te beheer in fabrieke. Om ongelukke en beroepsiektes te beperk. (2)

1.22 a) Dry heat e.g. flames, hot metal or electricity.
Droë hitte soos ? vlam, warm materiaal of elektrisiteit.

b) Moist heat e.g. steam, boiling water or hot oil.
Vogtige hitte soos stoom, kookwater of warm olie.

c) Chemical substances, usually strong acids or alkalis.
Chemiese stowwe, gewoonlik deur sterk sure of alkalieë. (3)

[40]

QUESTION/*VRAAG* 2

2.1

Load/Las = 55 kN

$$\delta = \frac{F}{A}$$

$$A = \frac{F}{\delta}$$

$$= \frac{55 \times 10^3}{175 \times 10^6}$$

$$= 0{,}0003143\ m^2$$

But/Maar $A = \frac{\pi \times d^2}{4}$

$$d^2 = \frac{A \times 4}{\pi}$$

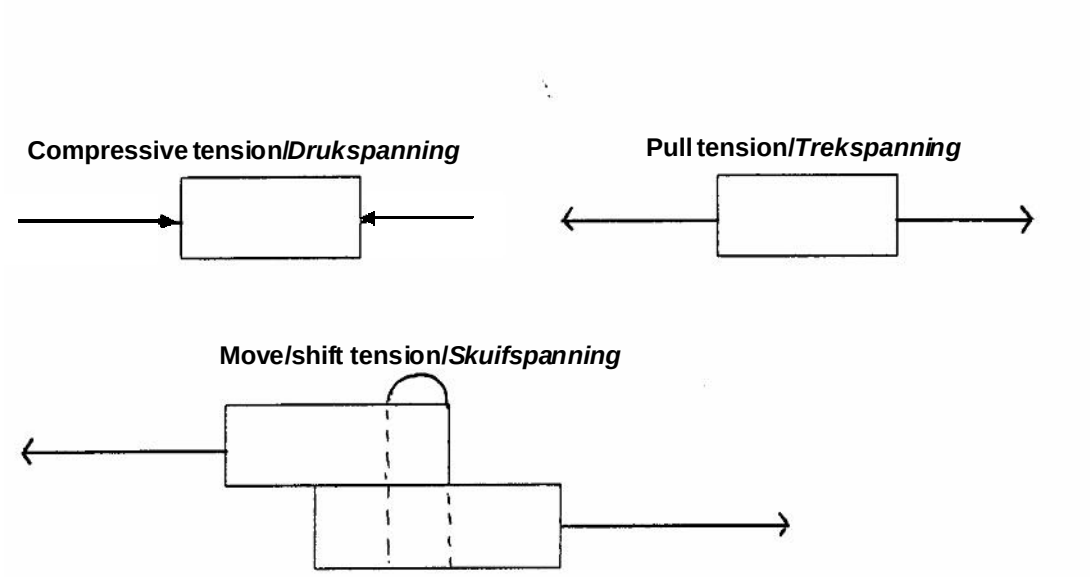
$$d = \sqrt{0{,}000400161\ m}$$

$$= 0{,}020004025\ m$$

$$= 20\ mm$$

(7)

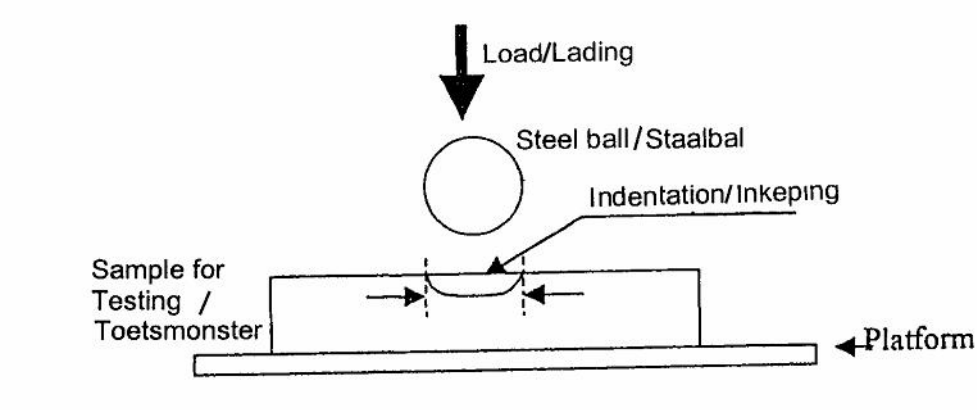
2.2



(9)

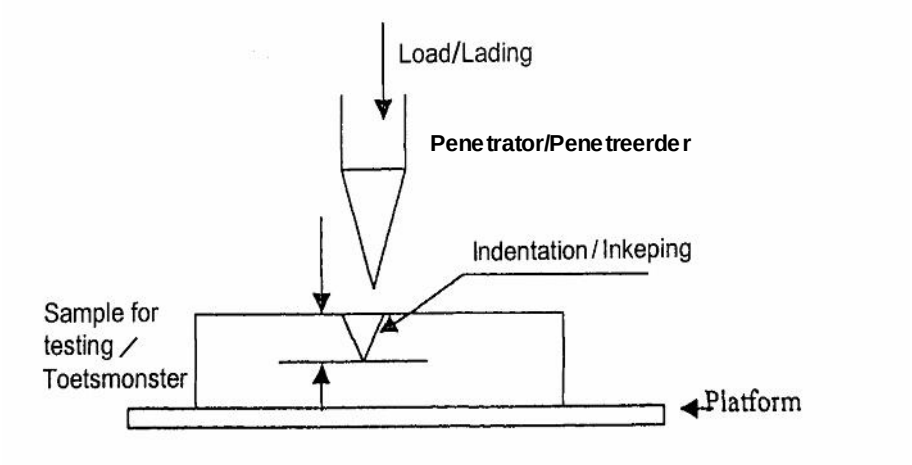
2.3 2.3.1 **Brinell**

Place the work-piece in position.
Choose the correct load for the type of material.
Activate the lever which forces the steel ball into the material.
Calculate indentation by means of microscope.
Plaas werkstuk in posisie.
Kies korrekte belasting vir tipe materiaal.
Aktiveer die hefboom wat die staalbal in die materiaal forseer.
Bereken induiking met behulp van mikroskoop. (8)



2.3.2 **Rockwell**

Bring work-piece in contact with penetrator.
Apply primary load.
Reset meter to zero.
Apply secondary load.
Take final reading.
Bring die werkstuk in kontak met penetreerder (diamant/bal).
Pas primêre lading toe.
Verstel die lesing op die meter na zero
Pas sekondêre lading toe
Neem finale lesing op meter. (8)



2.4 Observe all rules and regulations.
Report all abnormal incidents.
Avoid danger zones.
Observe precautions.
Kom alle reëls en regulasies na.
Rapporteer alle abnormale insidente.
Vermy gevaargebiede.
Tref voorsorgmaatreëls. (4)

2.5 Climate/*Klimaat*
Ventilation/*Ventilasie*
Hygiene/*Higiëne*
Recreation/*Ontspanning*
Noise/*Geraas*
Lighting/*Beligting* (4)
[40]

QUESTION/*VRAAG* 3

3.1

$$A = \frac{\pi X d^2}{4}$$

$$A = \frac{\pi X 0,12^2}{4}$$

$$= \underline{0,0113097\ m^2}$$

$$P = \frac{F}{A}$$

$$F = P X A$$

$$= 350 X 10^6 X 0,0113097$$

$$= \underline{3,958\ MN}$$

(9)

3.2 Presses and jacks/
Brake systems/
Hoists and heavy earthmoving equipment/ Vehicle drives
Vehicle drives
Movement of machine parts
Perse en domkragte
Remstelsels
Hyskrane en swaar grondverskuiwingsmasjinerie
Aandrywing van voertuie
Beweging van masjiendele (4)

3.3 (a) Electric motor/*Elektriese motor*
(b) Hydraulic gear pump/*Hidrouliese ratpomp*
(c) Ventilated reservoir/*Geventileerde opgaartenk*
(d) Non-adjustable pressure-relief valve/*Nie-verstelbare drukontlas-klep*
(e) Shut-off valve/*Afsluitklep*
(f) Measuring vessel/*Maatbak*
(g) Shut-off valve/*Afsluitklep*
(h) Pressure gauge/*Drukmeter* (8)

3.4 – Measuring vessel helps the operator to measure the flow through the system at any given time.
Maatbak stel die operateur in staat om die vloei deur die stelsel op enige gegewe oomblik te monitor.
– Non-return valve permits liquid to flow in one direction only.
Eenrigting-klep laat vloeistof slegs in een rigting vloei. (4)

3.5 – Kinetic energy is the energy a body possesses to perform work due to its movement.
Kinetiese energie is die energie wat ? liggaam besit weens sy beweging.

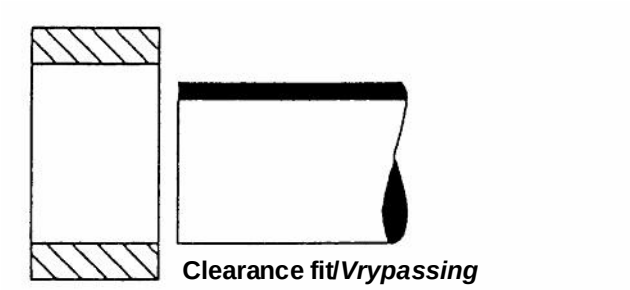
– Potential energy is the energy a body or a substance possesses to perform work because of gravitation or relative to the reference level of its position or form.
Potensiële energie is die energie wat ? voorwerp besit weens gravitasie en die relatiewe posisie van die voorwerp relatief tot die verwysingsvlak.
(6)

3.6 Law of moments is a system of powers in equilibrium when the sum of the left-hand side moments are equal to the right-hand side moments around the same point.
Wet van momente is ? stelsel van kragte in ewewig wanneer die som van die regsom-momente om ? spulpunt gelyk is aan die som van die linksom-momente om dieselfde spulpunt. (4)

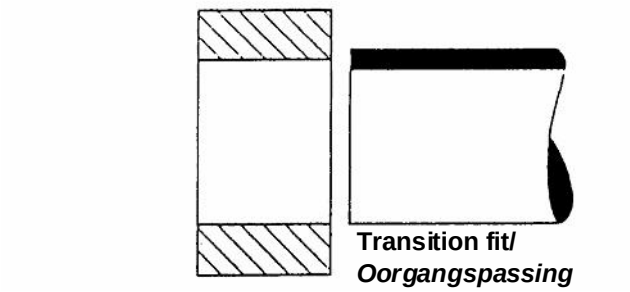
3.7 – Molecules are identical
– Distances between molecules are very big
– Gas only takes up volume because of movement and collisions of molecules
– No power between molecules except between collisions
– Collisions are fully elastic
– *Molekules is identies aan mekaar*
– *Afstand tussen molekules is baie groot*
– *Gas beslaan slegs volume weens die beweging van botsende molekules.*
– *Geen kragte tussen molekules, behalwe tussen botsings*
– *Botsings is volkome elasties.*
(5)

QUESTION/*VRAAG* 4

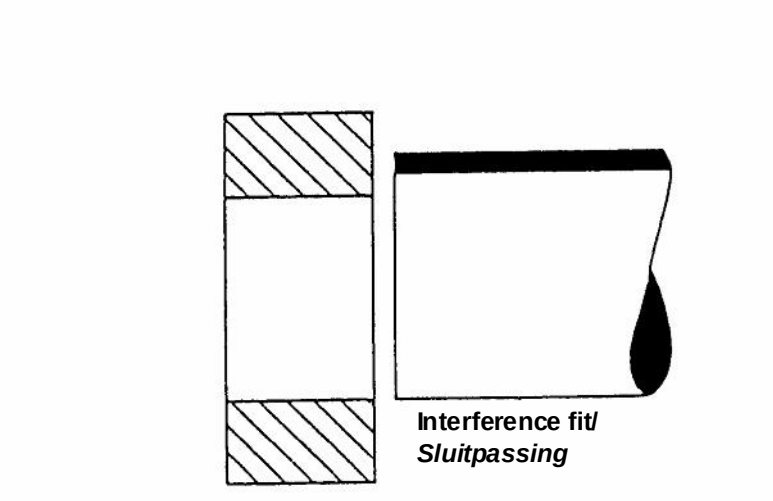
4.1 Clearance fit/*Vrypassing*
Transition fit/*Oorgangspassing*
Interference fit/*Sluitpassing*



Clearance fit/*Vrypassing*



Transition fit/
Oorgangspassing



Interference fit/
Sluitpassing

(9)

4.2 From tables/*Vanaf tabelle*:

Hole/*Gat* 45H9 = $45{,}00\ ^{+0{,}062}_{-0{,}000}$

Shaft/*As 45d10* = $45\ ^{-0{,}080}_{-0{,}180}$

4.2.1 Low limit of hole/*Lae grens van gat*
= 45 + 0,000
= 45,000 mm

High limit of hole/*Hoë grens van gat*
= 45 + 0,062
= 45,062 mm (4)

4.2.2 Low limit of shaft/*Lae grens van as*
= 45 - 0,180
= 44,82 mm

High limit of shaft/*Hoë grens van as*
= 45 - 0,080
= 44,92 mm (4)

4.2.3 Tolerance of shaft/*Toleransie van as*
= 44,92 - 44,82
= 0,10 mm (2)

4.2.4 Tolerance of hole/*Toleransie van gat*
= 45,062 - 45,000
= 0,062 mm (2)

4.2.5 Maximum allowance/*Maksimum toelating*
= Biggest hole -- smallest shaft/*Grootste gat -- kleinste as*
= 45,062 - 44,820
= 0,242 mm (2)

4.2.6 Minimum allowance/*Minimum toelating*
= Smallest hole -- biggest shaft/*Kleinste gat -- grootste as*
= 45,00 - 44,92
= 0,08 mm (2)

4.2.7 Clearance fit/*Vrypassing* (1)

4.3

Width/*Wydte* (W) $= \frac{D}{4} = \frac{20}{4} = 5\ mm$

Length/*Lengte* (L) $= 1,5 \times D = 1,5 \times 20 = 30\ mm$

Thickness of key/*Dikte* (T) $= \frac{D}{6} = \frac{20}{6} = 3,33\ mm$

(6)

4.4 Planning/*Beplanning*
Organisation/*Organisasie*
Leadership/*Leiding*
Control/*Beheer* (4)

4.5 This is the mean effective pressure placed on the piston of an internal combustion engine during one cycle.
Die gemiddelde positiewe druk wa tvan ? binnebrand-enjin op die suier gedurende een volledige kringloop uitgeoefen word. (4)

[40]

QUESTION/*VRAAG* 5

5.1	Design and development	*Ontwikkeling en ontwerp*
	Construction and installation	*Konstruksie en installasie*
	Marketing and sales	*Bemarking en verkope*
	Research	*Navorsing*
	Management	*Bestuurswese*
	Operational supervision and management	*Bedryfstoesig en instandhouding* (6)

5.2 Engineering – ingenuity, alertness and competence
Ingenieurswese – dui op vindingrykheid, skerpsinnigheid en bekwaamheid (4)

5.3 5.3.1 $T = F \times R$

$= 135\ x\ \frac{168}{1\ 000}$

$= 22\ ,68\ Nm$

(5)

5.3.2 $RD = 2\pi\ x\ \frac{50}{60}\ x\ 22,68$

$= 118,75\ W$

$= 0,118\ kW$ (5)

5.4 5.4.1

$$P = \frac{875}{1}$$

$$L = \frac{86}{1\ 000}$$

$$A = \frac{\pi D^2}{4}$$

$$= \frac{\pi}{4} \times \frac{84}{1\ 000} \times \frac{84}{1\ 000}$$

$$N = \frac{1\ 850}{60}$$

$$n = 2$$

I.P.(AD) = PLANn

$$= \frac{875}{1} \times \frac{86}{1\ 000} \times \frac{\pi}{4} \times \frac{84}{1\ 000} \times \frac{84}{1\ 000} \times \frac{1850}{60} \times \frac{2}{1}$$

$$= 25{,}716 \text{ kW}$$

(9)

5.4.2 $RD = 2\pi\ NFR$

$$= 2 \times \pi \times \frac{1850}{60} \times 25 \times 9{,}8 \times \frac{410}{1\ 000}$$

$$= 19\ 460{,}334 \text{ Watt}$$

$$= 19{,}46 \text{ kW}$$

(7)

5.4.3 $$MD = \frac{RD}{AD} = \frac{100}{1}$$

$$= \frac{19{,}46}{25{,}716} \times \frac{100}{1}$$

$$= 75{,}67\%$$

(4)

[40]

TOTAL/*TOTAAL:* 200