

**GAUTENG DEPARTMENT OF EDUCATION
SENIOR CERTIFICATE EXAMINATION**

TECHNIKA (MECHANICAL) SG

QUESTION 1

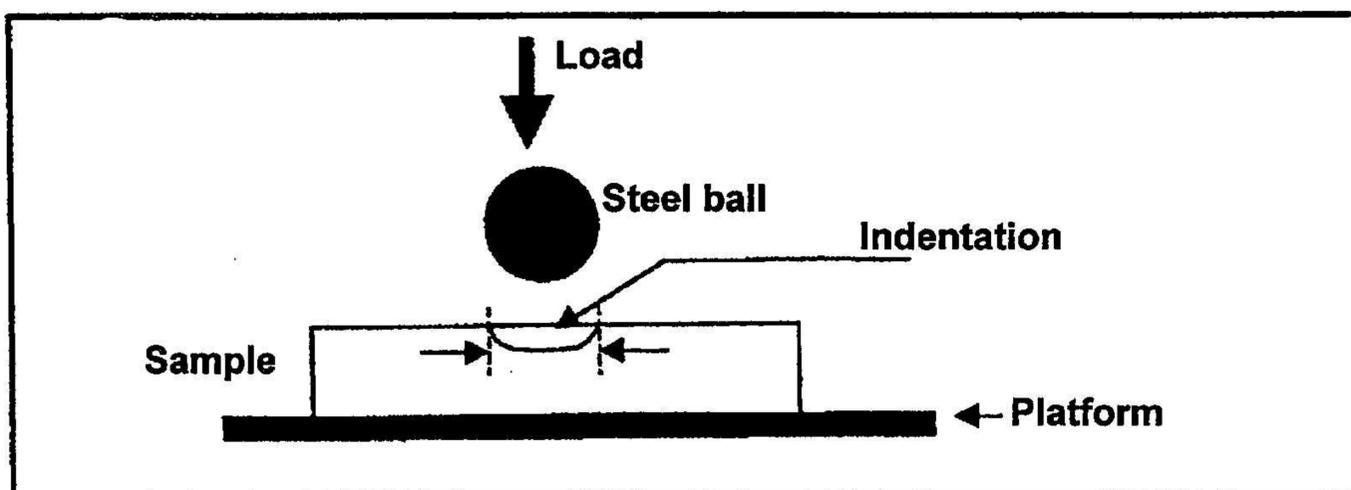
- 1.1 Open flames
Heated electrical wiring
Heated surfaces
Matches and cigarettes
Self ignition
Chemical reaction
Static electricity
Friction
Lightning (6)
- 1.2 To control working conditions in factories. To limit accidents and occupational illnesses (diseases). (2)
- 1.3 Deafness – noise
Blindness – lacking safety measures
Poisoning – insufficient control measures
Radiation – lacking control measures
Tuberculosis – insufficient ventilation
Heat exhaustion – lacking ventilation (12)
- 1.4 1) Ventilation
2) Illumination
3) Hygiene
4) Recreation (4)
- 1.5 1) Observe all rules and regulations
2) Immediately report all abnormal incidents
3) Avoid danger zones
4) Observe precautions (4)
- 1.6 1) Safety of workers
2) Increased productivity
3) Quality of product
4) Job satisfaction (4)

- 1.7
- 1) Accidents
 - 2) Low production
 - 3) Absenteeism
 - 4) Unemployment
 - 5) Neglected families
 - 6) Child abuse
- (5)
- 1.8
- 1) Well trained and intelligent
 - 2) Fair
 - 3) Good judgement
- (3)
[40]

QUESTION 2

- 2.1
- a) Temperature
 - b) Austenite and Ferrite
 - c) Pure Austenite
 - d) Austenite and Cementite
 - e) Ferrite and Perlite
 - f) Perlite and Cementite
 - g) Pure Perlite
 - h) % Carbon
 - i) $\pm 800^{\circ}\text{C}$
- (10)
- 2.2
- 1) Piramidial
 - 2) Calcite
 - 3) Cubic
- (3)
- 2.3 2.3.1 The Brinell – Hardness test

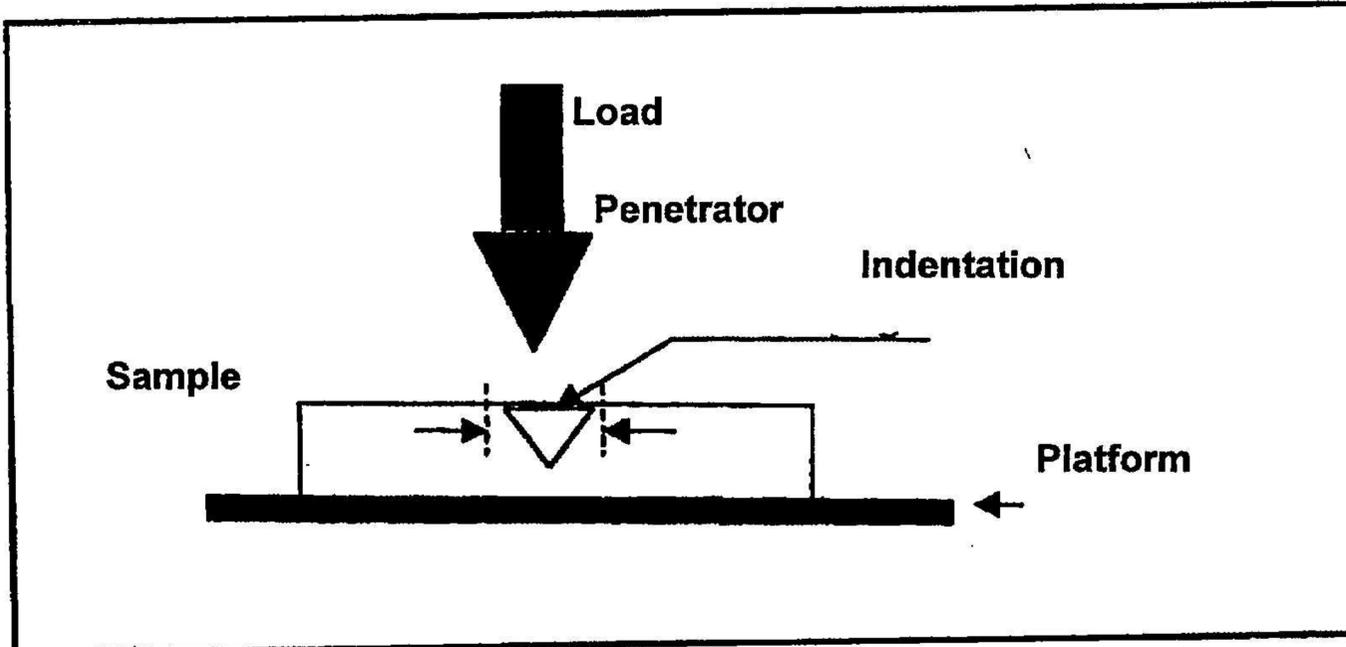
Place the workpiece in position.
Choose the correct load for the type of material.
Activate the lever that forces the steel ball into the material.
Calculate indentation by means of a microscope.



(6)

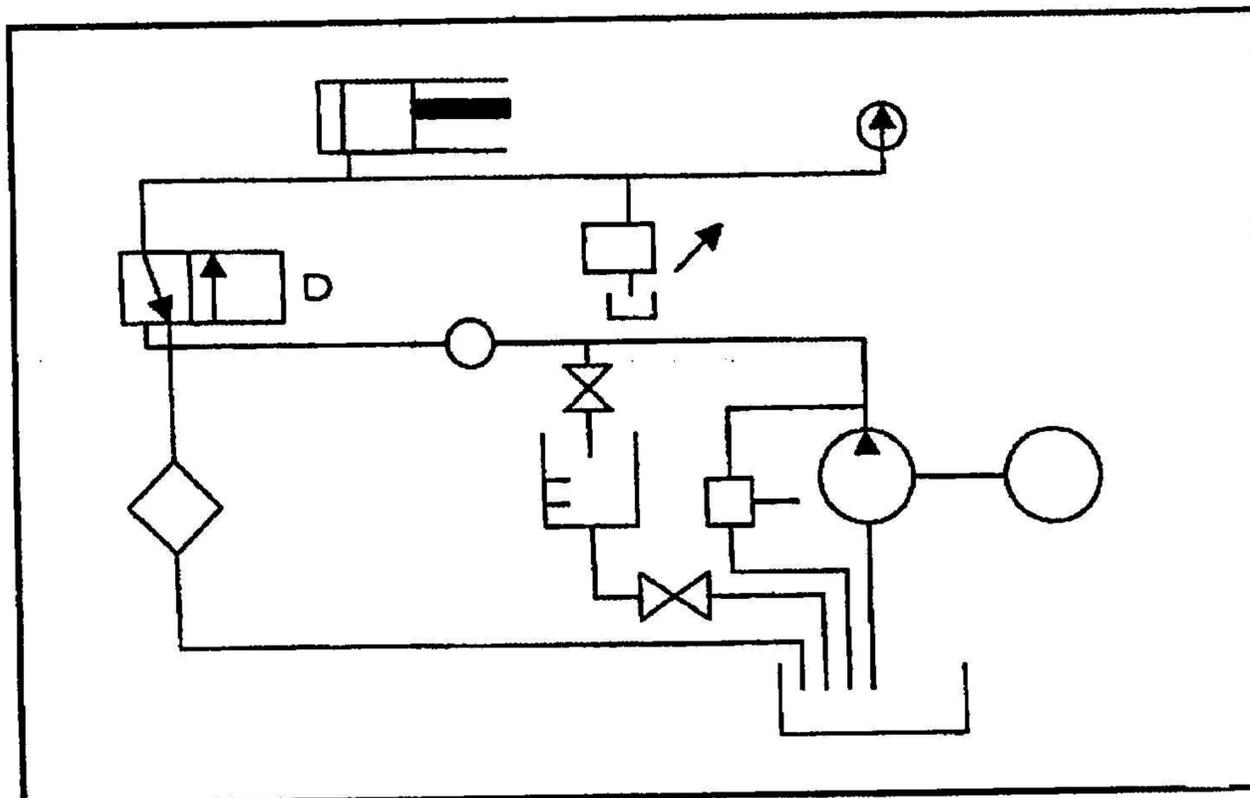
2.3.2 The Rockwell hardness test

Bring workpiece into contact with penetrator.
 Apply primary load.
 Adjust reading of the meter to zero.
 Apply secondary load and take final reading.



(6)

2.4



(12)

2.5 Pressure is the size indicating the extent and distribution of a force per unit surface.

(3)
 [40]

QUESTION 3

3.1.1 Indexing = $\frac{40}{70} = \frac{4}{7} = 24$ holes on a 42 hole circle (2)

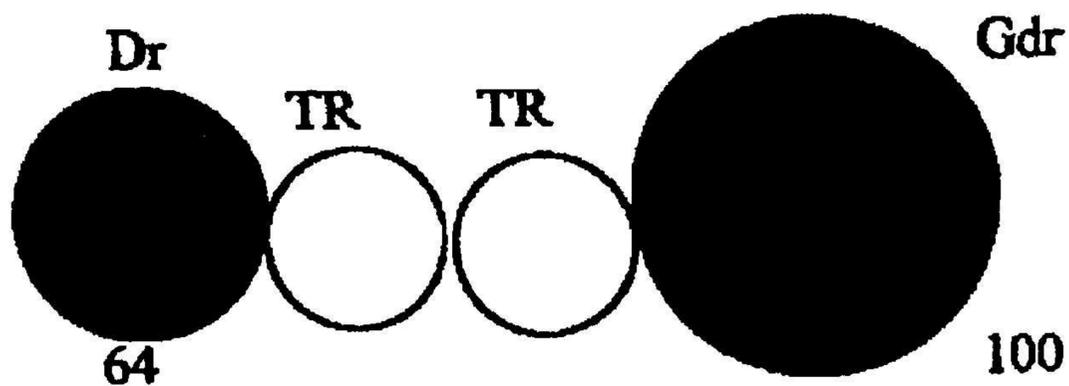
3.1.2 Exchange gears: $\frac{\text{Driver}}{\text{Driven}} = \frac{(A - N) \times 40}{A}$

$$= \frac{(70 - 67) \times 40}{125}$$

$$= \frac{3 \times 40}{70}$$

$$= \frac{120}{70} \quad (5)$$

3.1.3 Turning direction is positive (opposite direction than index lever). (2)



(4)

3.2 There is no index plate available with a suitable hole circle. The denominator cannot be simplified with the amount (number). A chosen number must therefore be used to compensate for the mistake made with the change gears. (2)

$$3.3.1 \quad \sin \underline{\theta} = \frac{R - r}{\frac{M - \pi}{2} + r - R}$$

$$\text{Where } R = \frac{1,01 \times 5}{2} \\ = 2,525$$

$$r = \frac{0,505 \times 5}{2} \\ = 1,263$$

$$\sin \underline{\theta} = \frac{2,525 - 1,263}{\frac{7,03}{2} + 1,263 - 2,525} \\ = 0,56$$

$$\frac{Q_1}{2} = 34,06 \quad \theta = 68,13$$

(7)

$$3.3.2 \quad \text{Error in corner} = 68,13 - 60 = 8,13$$

(2)

3.4 Upmilling
Ascending milling

(2)

3.5

$$\text{Stress} = \frac{\text{Tension}}{\text{Surface}}$$

$$S = \frac{F}{a}$$

$$\frac{F}{a} = S$$

$$a = \frac{F}{s}$$

$$a = \frac{80\,000\text{ N}}{120\,000\,000\text{ Pa}}$$

$$a = 0,00667\text{m}^2 \div 60 \text{ wires} = 0,0000111\text{m}^2$$

$$a = \frac{\pi d^2}{4}$$

$$0,0067 = \frac{3,142 \times d^2}{4}$$

$$\frac{3,142 \times d^2}{4} = 0,000012$$

$$d^2 = \frac{0,0000111\text{m}^2 \times 4}{3,142}$$

$$d^2 = \frac{0,0000444}{3,142}$$

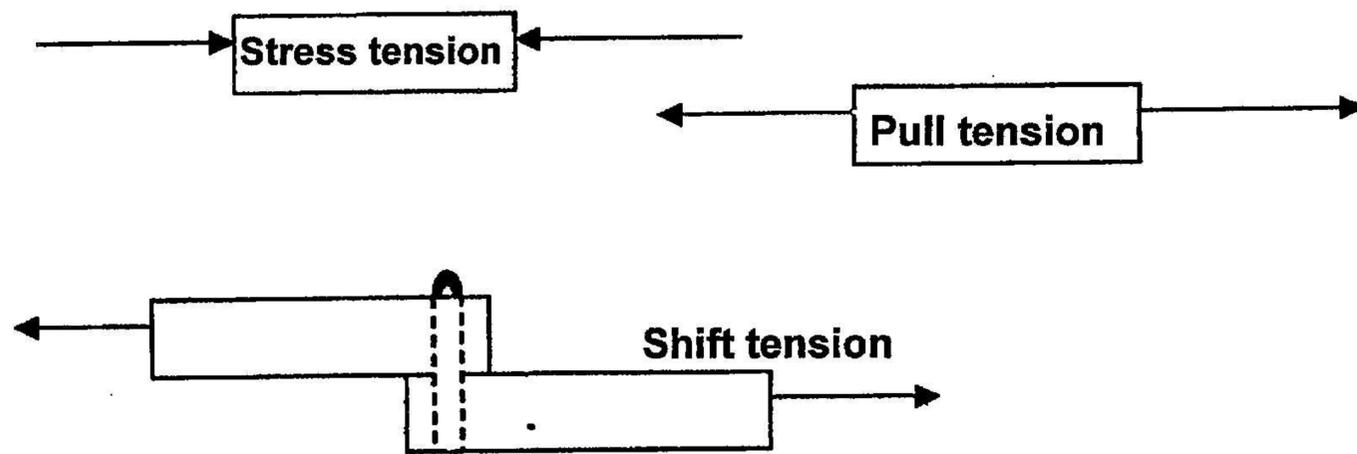
$$d^2 = 0,000014131\text{m}^2$$

$$d = 0,003759122$$

$$d = 3,759\text{mm}$$

(8)

3.6

(6)
[40]

QUESTION 4

4.1.1 Indicated power

$$AD = PLAN_n$$

$$AD = 928 \times 10 \times 0,11 \times \frac{\pi \times 45 \times 45}{1000 \times 1000} \times \frac{3500}{60 \times 2} \times 6$$

$$AD = 928 \times 10 \times 0,11 \times 0,006361725 \times 29,16 \times 6$$

$$AD = 113,64 \text{ kW}$$

(7)

4.1.2 Work done for ONE stroke

$$W = PLA$$

$$W = 928 \times 10 \times 0,11 \times \frac{\pi \times 45 \times 45}{1000 \times 1000}$$

$$W = 649 \text{ Joules}$$

(3)

4.1.3 Brake power

$$RD = 2\pi N T$$

$$\text{Waar } T = FR$$

$$T = 160 \times 1,2$$

$$= 192 \text{ Nm}$$

$$RD = 2 \times \pi \times \frac{3500}{60} \times 192$$

$$RD = 70,371 \text{ kW}$$

(4)

4.1.4 Mechanical efficiency

$$\text{Efficiency} = \frac{RD}{AD} \times 100$$

$$= \frac{70,371}{113,64} \times 100$$

$$= 61,9\%$$

(3)

4.2.1 Mean effective pressure is the mean positive pressure exerted on the piston during one full cycle.

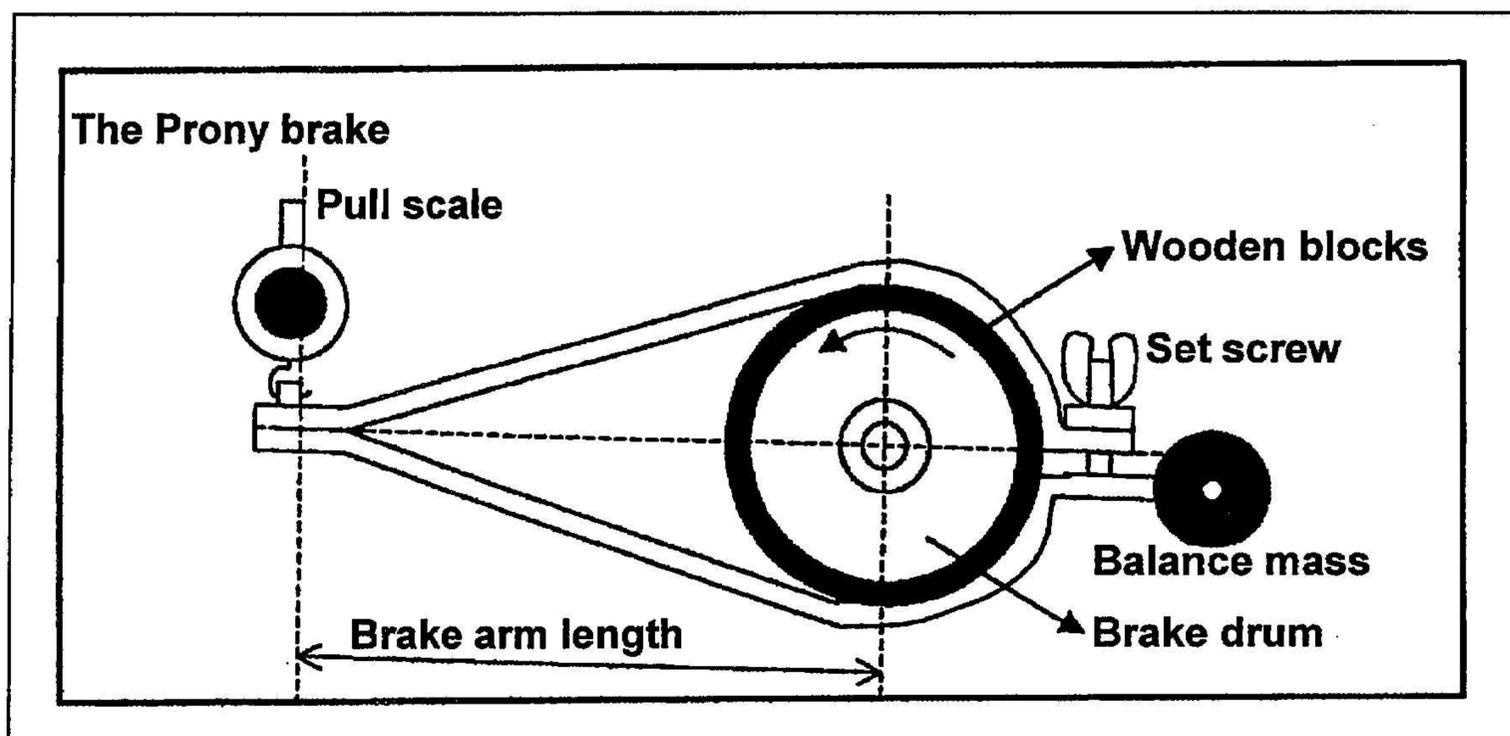
(3)

4.2.2 Indicated power

This is the theoretic pressure developed in an internal combustion engine without consideration of any losses.

(3)

4.3



4.3.1 Pull scale

4.3.2 Wooden blocks

4.3.3 Set screw

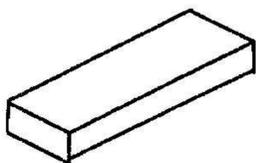
4.3.4 Balance mass

4.3.5 Brake drum

4.3.6 Brake arm length

(6)

4.4 (1) Parallel key



(2) Woodruff key



(3) Nose key



(3)

$$4.5 \quad \text{Width (W)} = \frac{D}{4} = \frac{50}{4} = 12,5 \text{ mm}$$

(2)

$$\text{Length (L)} = 1,5 \times D = 1,5 \times 50 = 75 \text{ mm}$$

(2)

$$\text{Thickness of key (T)} = \frac{D}{6} = \frac{50}{6} = 8,33 \text{ mm}$$

(2)

4.6 Prevents relative turning between an axle and a hub.

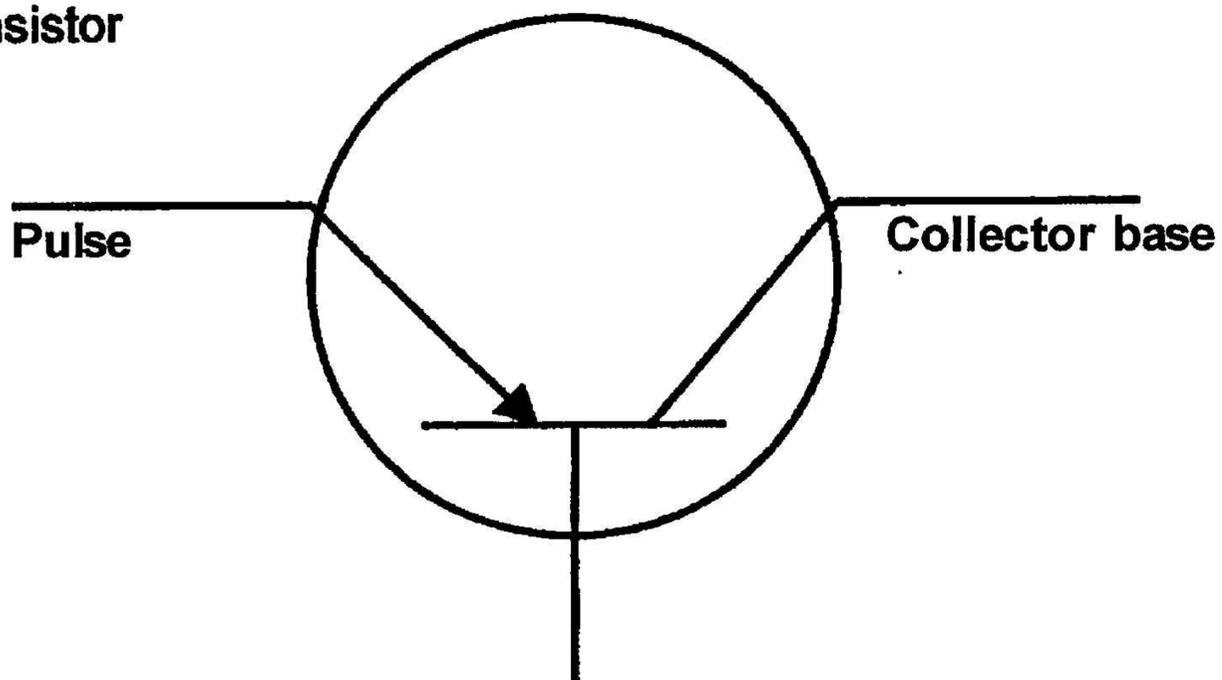
(2)

[40]

QUESTION 5

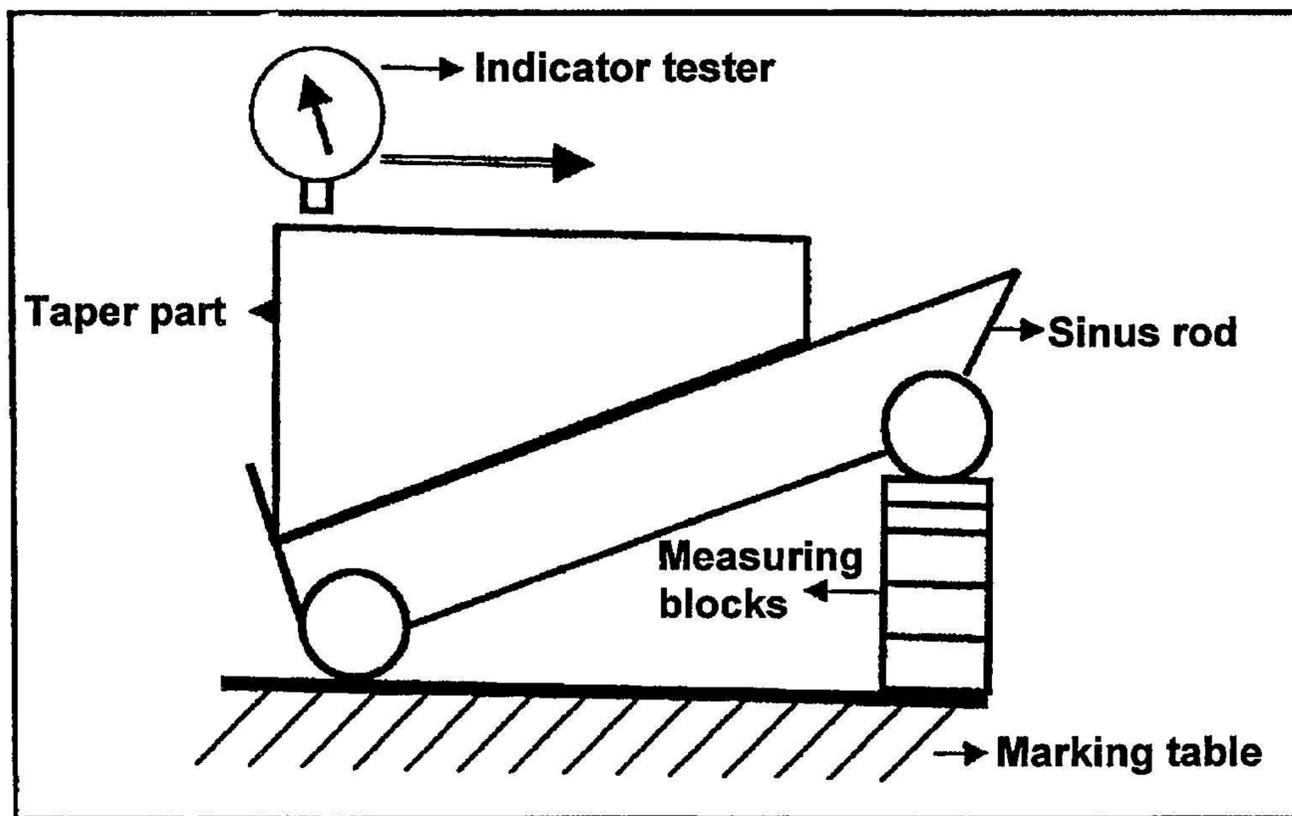
5.1

Transistor



(6)

5.2



(5)

5.3.1 I5H7 – p6

	Hole	Axle
High end	15,018	15,029
Low end	15,000	15,018

(4)

5.3.2 Type of fit: Stay fitting

(1)

5.3.3 Allowance = High level axle – Low level hole
= 15,029 - 15,00
= 0,029

(3)

5.4 Posters
SeminarsVideos
Guest speakers**Any 3**

(3)

5.5 5.5.1 $E_p = mgh$ $E_p = 540 \times 10 \times 1,2$ $E_p = 6480J$ (3)

5.5.2 $F = m.a.$ $F = 540 \times 10$ $F = 5400N$ (3)

5.5.3 $W = Fxs$ $W = 5400 \times 1,2$ $W = 6480J$ (3)

5.6 5.6.1 Fly wheel
5.6.2 Pressure plate
5.6.3 Pressure springs (coils) (helical coils)
5.6.4 Clutch plate
5.6.5 Discoupling levers (fingers)
5.6.6 Enter axle
5.6.7 Supply axle
5.6.8 Pressure (thrust) bearing
5.6.9 Lead bearing

(9)

[40]

TOTAL: 200

**GAUTENGSE DEPARTEMENT VAN ONDERWYS
SENIORSERTIFIKAAT-EKSAMEN**

TECHNIKA (MEGANIES) SG

VRAAG 1

- 1.1 Oop vlamme
Verhitte elektriese bedrading
Verhitte oppervlaktes
Vuurhoutjies en sigarette
Selfontsteking
Chemiese reaksie
Statiese elektrisiteit
Wrywing
Weerlig (6)
- 1.2 Om werksomstandighede in fabriek te beheer. Om ongelukke en bedryfsiektes uit te skakel. (2)
- 1.3 Doofheid – geraas
Blindheid – gebrekkige veiligheidsmaatreëls
Vergifting – onvoldoende beheermaatreëls
Bestraling – gebrekkige beheermaatreëls
Tering – onvoldoende ventilasie
Hitte-uitputting – gebrekkige ventilasie (12)
- 1.4 1) Ventilasie
2) Beligting
3) Higiëne
4) Ontspanning (4)
- 1.5 1) Kom alle reëls en regulasies na
2) Rapporteer alle abnormale gebeure onmiddellik
3) Vermoed gevaargebiede
4) Handhaaf voorsorgmaatreëls (4)
- 1.6 1) Veiligheid van werkers
2) Verhoogde produktiwiteit
3) Kwaliteit van produk
4) Werkstevredenheid (4)

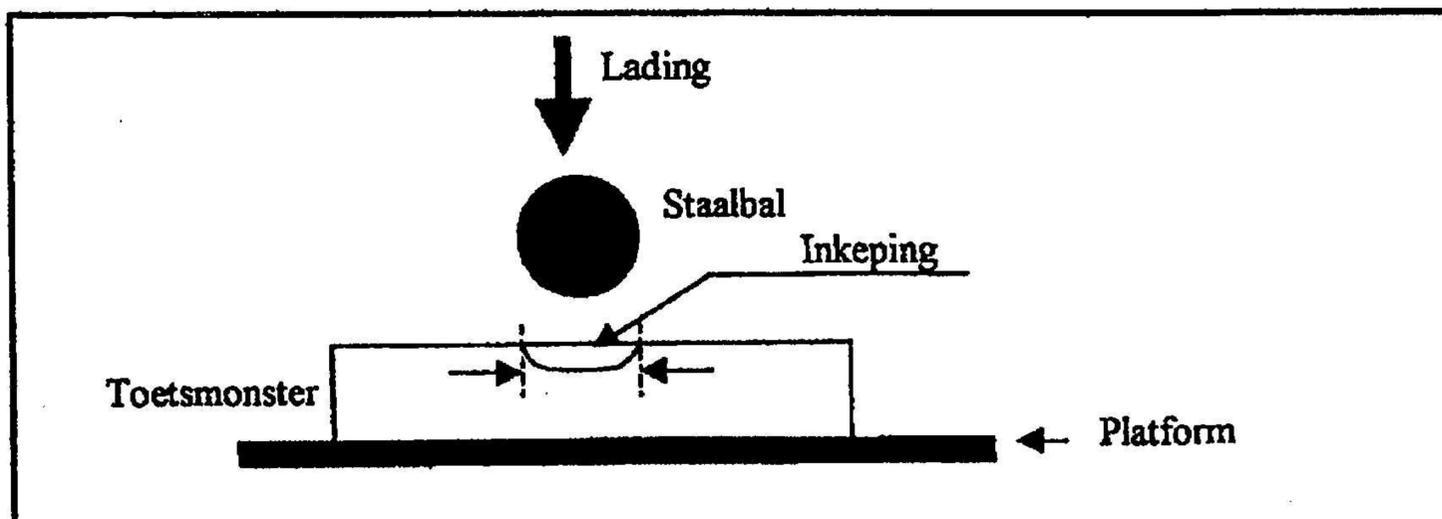
- 1.7
- 1) Ongelukke
 - 2) Lae produksie
 - 3) Afwesigheid
 - 4) Werkloosheid
 - 5) Verwaarloosde huisgesinne
 - 6) Mishandeling van kinders
- (5)
- 1.8
- 1) Goed opgelei en intelligent wees
 - 2) Regverdig wees
 - 3) Goeie oordeelsvermoë
- (3)
[40]

VRAAG 2

- 2.1
- a) Temperatuur
 - b) Austeniet en Ferriet
 - c) Suiwer Austeniet
 - d) Austeniet en Sementiet
 - e) Ferriet en Perliet
 - f) Perliet en Sementiet
 - g) Suiwer Perliet
 - h) % Koolstof
 - i) $\pm 800^{\circ}\text{C}$
- (10)
- 2.2
- 1) Piramidaal
 - 2) Kalsiet
 - 3) Kubies
- (3)

2.3.1 Die Brinell – Hardheidstoets

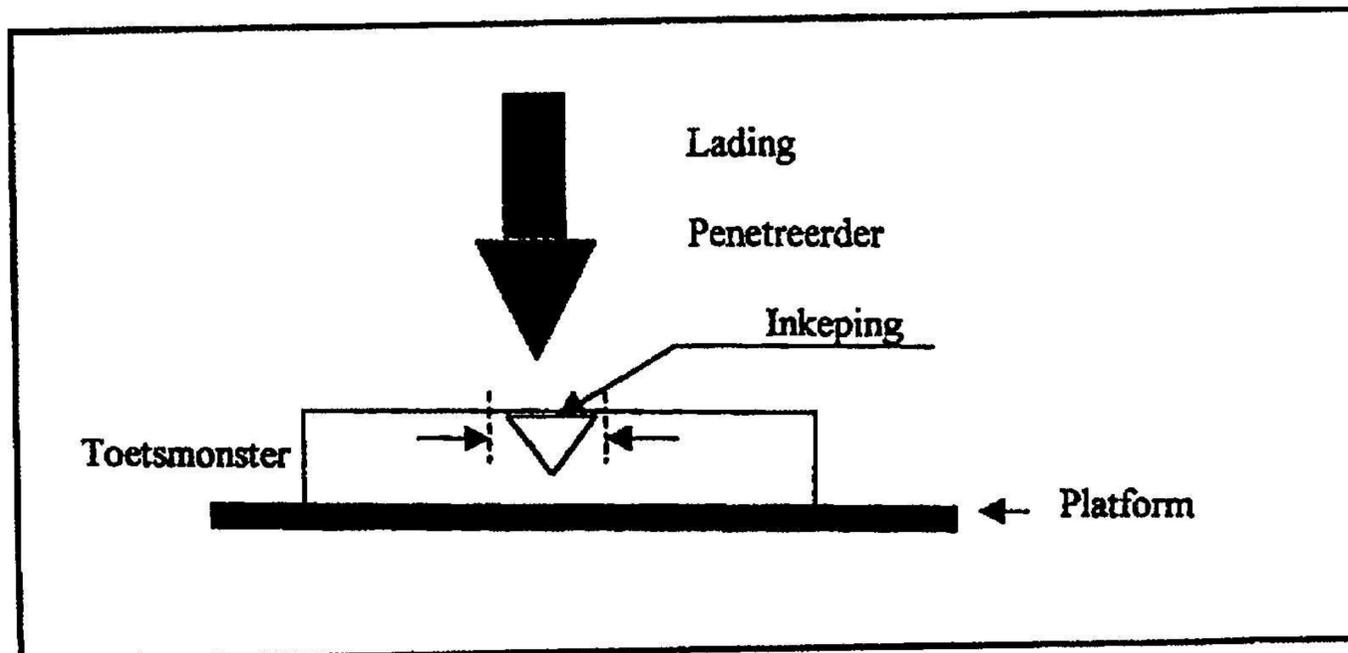
Plaas die werkstuk in posisie.
Kies die korrekte belasting vir die tipe materiaal.
Aktiveer die hefboom wat die staalbal in die materiaal forseer.
Bereken induiking m.b.v. 'n mikroskoop.



(6)

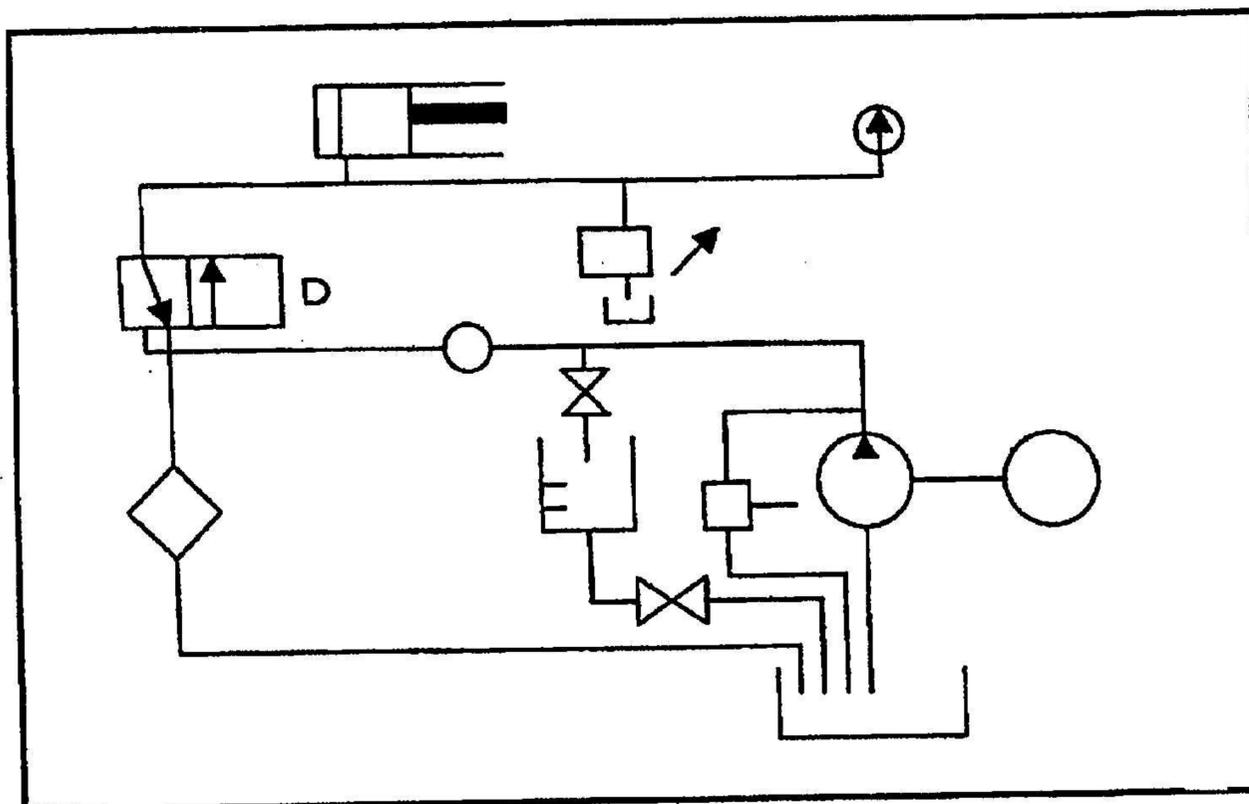
2.3.2 Die Rockwell-hardheidstoets

Bring die werkstuk in kontak met die penetreerder.
 Pas primêre lading toe.
 Verstel die lesing van die meter na zero.
 Pas sekondêre lading toe en neem finale lesing.



(6)

2.4



(12)

2.5 **Druk** is die eenheid wat die omvang van die verspreiding van 'n krag per eenheidsoppervlakte aandui.

(3)
[40]

VRAAG 3

3.1.1 Indeksering = $\frac{40}{70} = \frac{4}{7} = 24$ gate op 'n 42 gatsirkel (2)

3.1.2 Wisselratte: $\frac{\text{Drywer}}{\text{Gedrewe}} = \frac{(A - N) \times 40}{A}$

$$= \frac{(70 - 67) \times 40}{70}$$

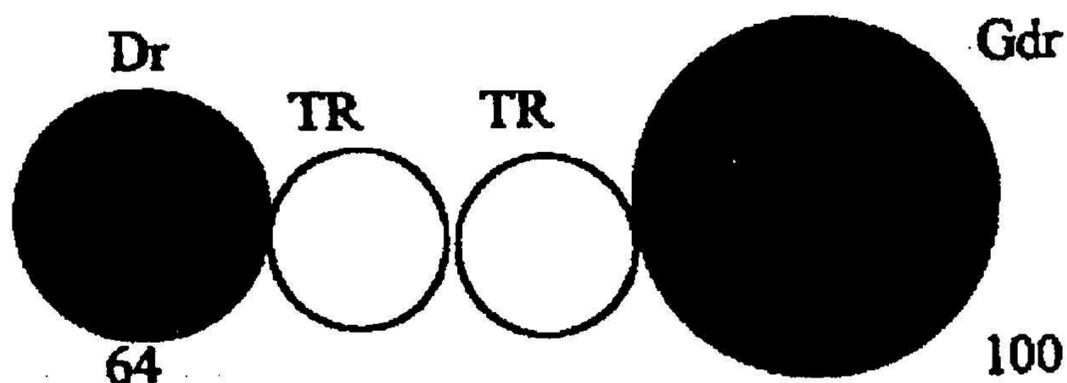
$$= \frac{3 \times 40}{70}$$

$$= \frac{120}{70}$$

$$= \frac{48}{28}$$

(5)

3.1.3 Draairigting as positief (teenoorgestelde rigting as die indeksslinger). (2)



(4)

3.2 Daar is nie 'n indeksplaat met 'n geskikte gatsirkel beskikbaar nie. Die noemer van die breuk kan nie vereenvoudig word met die getal nie. Daar moet dus van 'n gekose getal gebruik gemaak word om te kompenseer vir die fout wat met die wisselratte gemaak is. (2)

$$3.3.1 \quad \sin \underline{\varnothing} = \frac{R-r}{\frac{M-n}{2} + r - R}$$

$$\text{Waar } R = \frac{1,01 \times 5}{2} = 2,525 \quad r = \frac{0,505 \times 5}{2} = 1,263$$

$$\sin \underline{\varnothing} = \frac{2,525 - 1,263}{\frac{7,03}{2} + 1,263 - 2,525} = 0,56$$

$$\frac{\underline{\varnothing}}{2} = 34,06 \quad \underline{\varnothing} = 68,13 \quad (7)$$

$$3.3.2 \quad \text{Fout in hoek} = 68,13 - 60 = 8,13 \quad (2)$$

3.4 Opfreeswerk
Klimfreeswerk (2)

3.5 Spanning = $\frac{\text{Belasting}}{\text{Oppervlakte}}$

$$S = \frac{F}{a}$$

$$\frac{F}{a} = S$$

$$a = \frac{F}{s}$$

$$a = \frac{80\,000\text{ N}}{120\,000\,000\text{ Pa}}$$

$$a = 0,00667\text{m}^2 \div 50 \text{ draadjies} = 0,0000111\text{m}^2$$

$$a = \frac{\pi d^2}{4}$$

$$0,00667 = \frac{3,142 \times d^2}{4}$$

$$\frac{3,142 \times d^2}{4} = 0,000012$$

$$d^2 = \frac{0,0000111\text{m}^2 \times 4}{3,142}$$

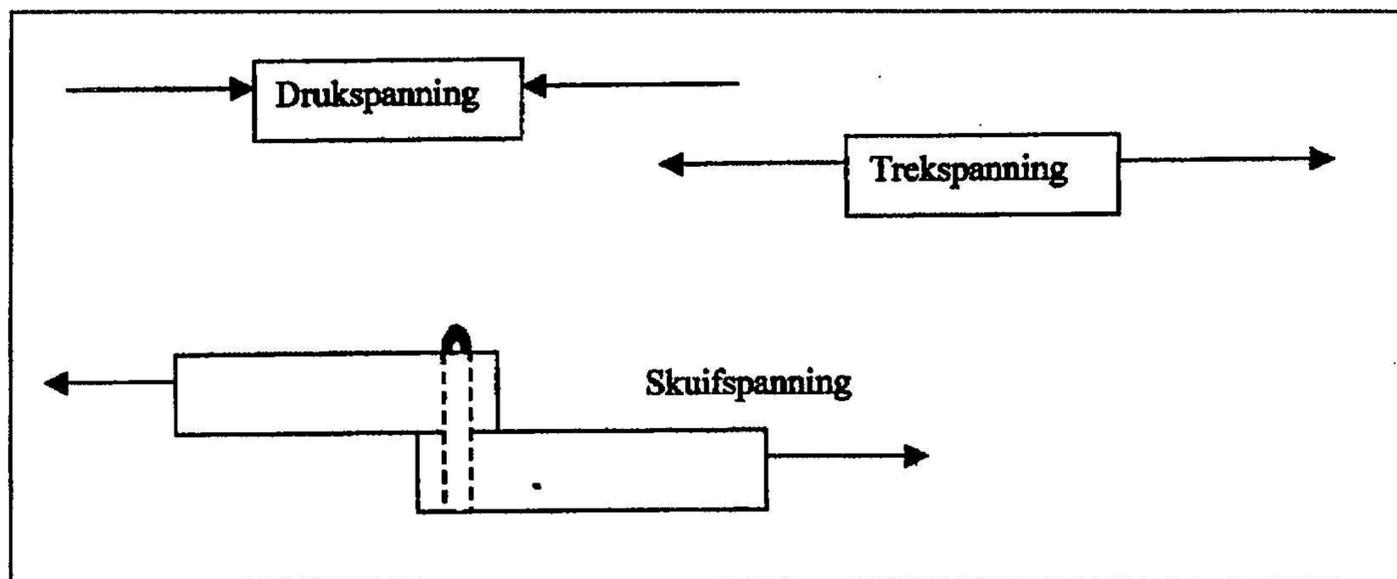
$$d^2 = \frac{0,0000444}{3,142}$$

$$d^2 = 0,000014131\text{m}^2$$

$$d = 0,003759122$$

$$d = 3,759\text{ mm}$$

3.6

(6)
[40]

VRAAG 4

4.1.1 Aangeduide Drywing

$$AD = PLANn$$

$$AD = 928 \times 10 \times 0,11 \times \frac{\pi \times 45 \times 45}{1000 \times 1000} \times \frac{3500}{60 \times 2} \times 6$$

$$AD = 928 \times 10 \times 0,11 \times 0,006361725 \times 29,16 \times 6$$

$$AD = 113,64 \text{ kW}$$

(7)

4.1.2 Arbeid verrig vir EEN slag

$$W = PLA$$

$$W = 928 \times 10 \times 0,11 \times \frac{\pi \times 45 \times 45}{1000 \times 1000}$$

$$W = 649 \text{ Joule}$$

(3)

4.1.3 Remdrywing

$$RD = 2\pi N T$$

$$\text{Waar } T = FR$$

$$T = 160 \times 1,2$$

$$= 192 \text{ Nm}$$

$$RD = 2 \times \pi \times \frac{3500}{60} \times 192$$

$$RD = 70,371 \text{ kW}$$

(4)

4.1.4 Meganiese Rendement

$$\text{Rendement} = \frac{RD}{AD} \times 100$$

$$= \frac{70,371}{113,64} \times 100$$

$$= 61,9\%$$

(3)

4.2.1 G.E.D. is die gemiddelde positiewe druk wat tydens een volledige siklus op die suier uitgeoefen word.

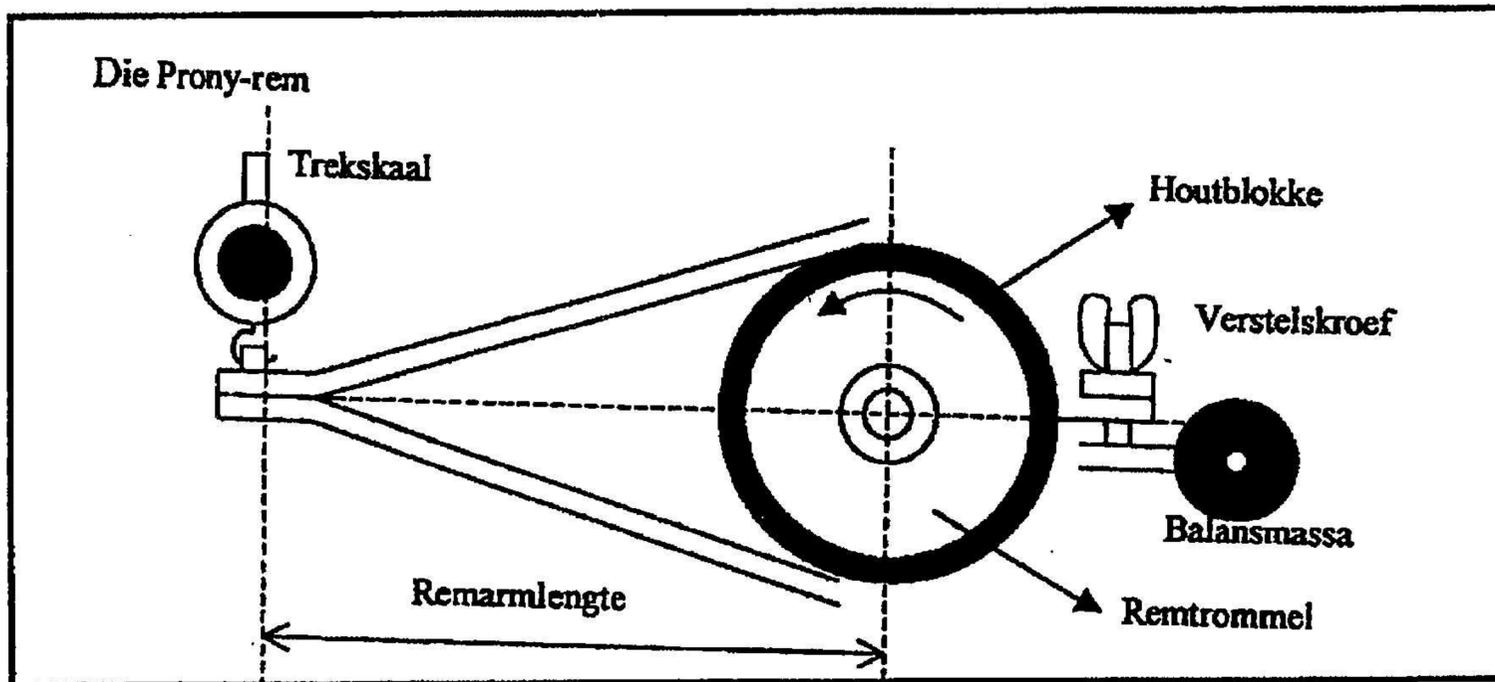
(3)

4.2.2 Aangeduide drywing

Dit is die teoretiese drywing wat in die silinder van 'n binnebrand-enjin ontwikkel word, sonder inagneming van enige verliese:

(3)

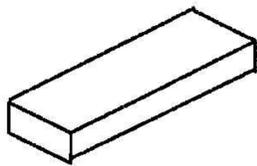
4.3



- 4.3.1 Trekkaal
- 4.3.2 Houtblokke
- 4.3.3 Verstelskroef
- 4.3.4 Balansmassa
- 4.3.5 Remtrommel (-drom)
- 4.3.6 Remarm lengte

(6)

4.4 (1) Parallelspy



(2) Woodruff=spy



(3) Neusspy



(3)

$$4.5 \quad \text{Wydte (W)} = \frac{D}{4} = \frac{50}{4} = 12,5 \text{ mm}$$

(2)

$$\text{Lengte (L)} = 1,5 \times D = 1,5 \times 50 = 75 \text{ mm}$$

(2)

$$\text{Dikte van spy (T)} = \frac{D}{6} = \frac{50}{6} = 8,33 \text{ mm}$$

(2)

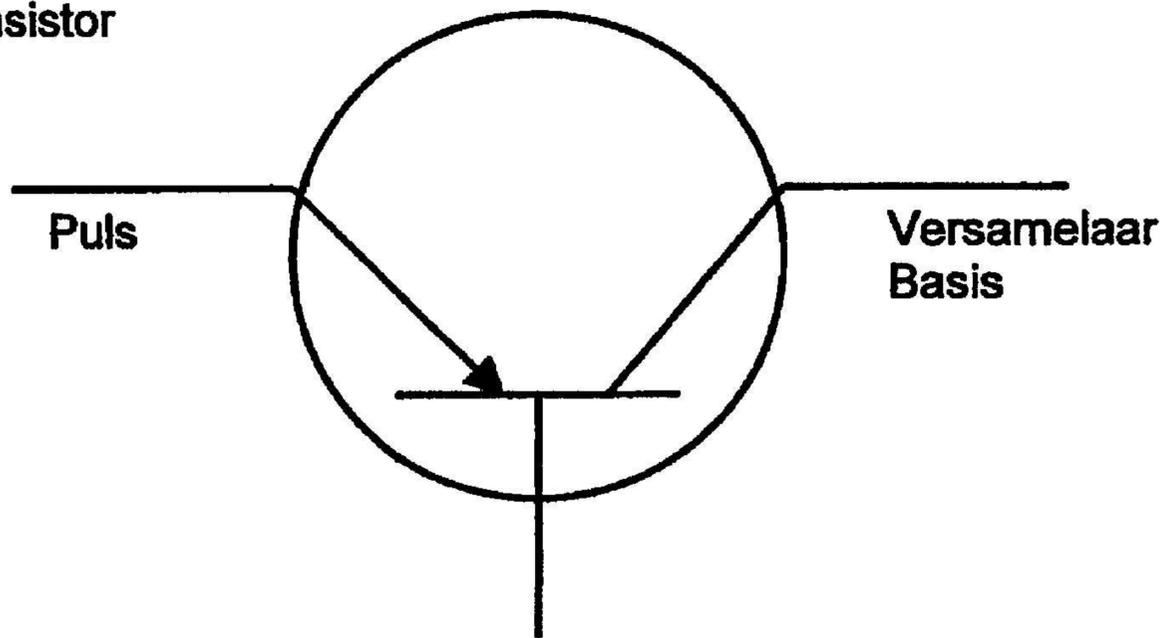
4.6 Verhoed relatiewe draaiing tussen 'n as en 'n naaf asook entwaartse beweging.

(2)

[40]

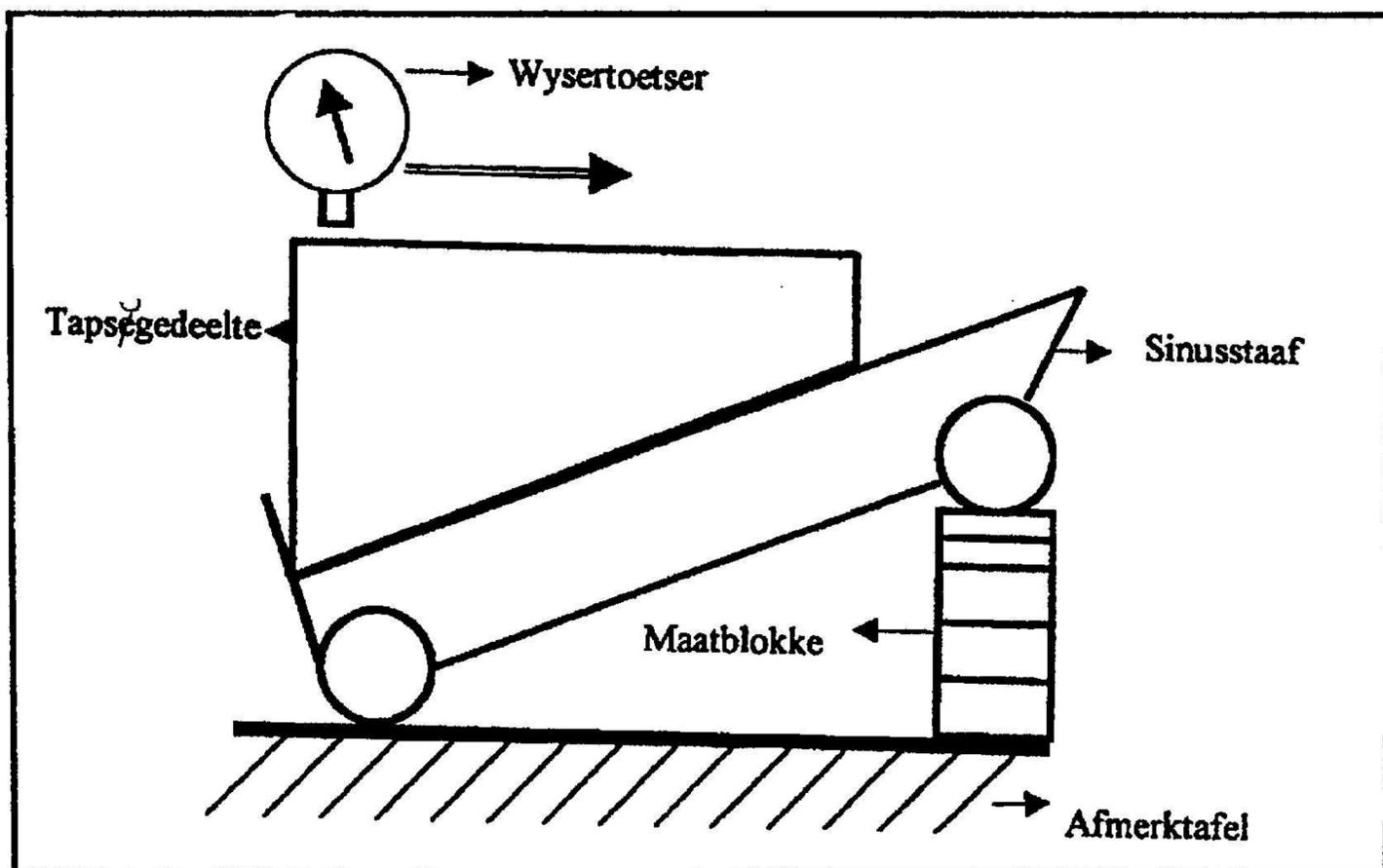
VRAAG 5

5.1 Transistor



(6)

5.2



(5)

5.3.1 I5H7 – p6

	Gat	As
Hoë grens	15,018	15,029
Lae grens	15,000	15,018

(4)

5.3.2 Tipe passing: Stuitpassing

(1)

$$\begin{aligned}
 5.3.3 \text{ Toelating} &= \text{Hoë grens As} - \text{Lae grens gat} \\
 &= 15,029 - 15,00 \\
 &= 0,029
 \end{aligned}$$

(3)

5.4 Plakkate
SeminareVideo's
Gassprekers

(3)

$$5.5 \quad 5.5.1 \quad E_p = mgh \quad E_p = 540 \times 10 \times 1,2 \quad E_p = 6480J \quad (3)$$

$$5.5.2 \quad F = m.a. \quad F = 540 \times 10 \quad F = 5400N \quad (3)$$

$$5.5.3 \quad W = Fxs \quad W = 5400 \times 1,2 \quad W = 6480J \quad (3)$$

- 5.6
- 5.6.1 Vliegwiel
 - 5.6.2 Drukplaat
 - 5.6.3 Drukvere (heliese vere)
 - 5.6.4 Koppelaarplaat
 - 5.6.5 Ontkoppelingshefbome (ontkoppelingsvingers)
 - 5.6.6 Ingangsas
 - 5.6.7 Leweringsas
 - 5.6.8 Druklaer
 - 5.6.9 Leilaer

(9)
[40]**TOTAAL: 200**