GAUTENG DEPARTMENT OF EDUCATION
GAUTENGSE DEPARTEMENT VAN ONDERWYS

SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

ELECTRICIANS WORK SG
ELEKTRISIËNSWERK SG

QUESTION / *VRAAG 1*
ELECTRICAL CURRENT THEORY / *ELEKTRIESE STROOMTEORIE*

1.1 R = V / I (1)
= 120 / 1,5 (1)
= 80 ohms (1)

Z = V / I (1)
= 220 / 0,6
= 366,7 ohms (1)

since $Z = \sqrt{R^2 + XL^2}$ (1)

$XL = \sqrt{Z^2 - R^2}$ (1)

$= \sqrt{366,7^2 - 80^2}$ (1)

= 357,8 ohms (1)

XL = 2π FL (1)
L = XL / 2πf (1)
= 357,8 / 2π*50 (1)
L = 1,139 H (1)
(13)

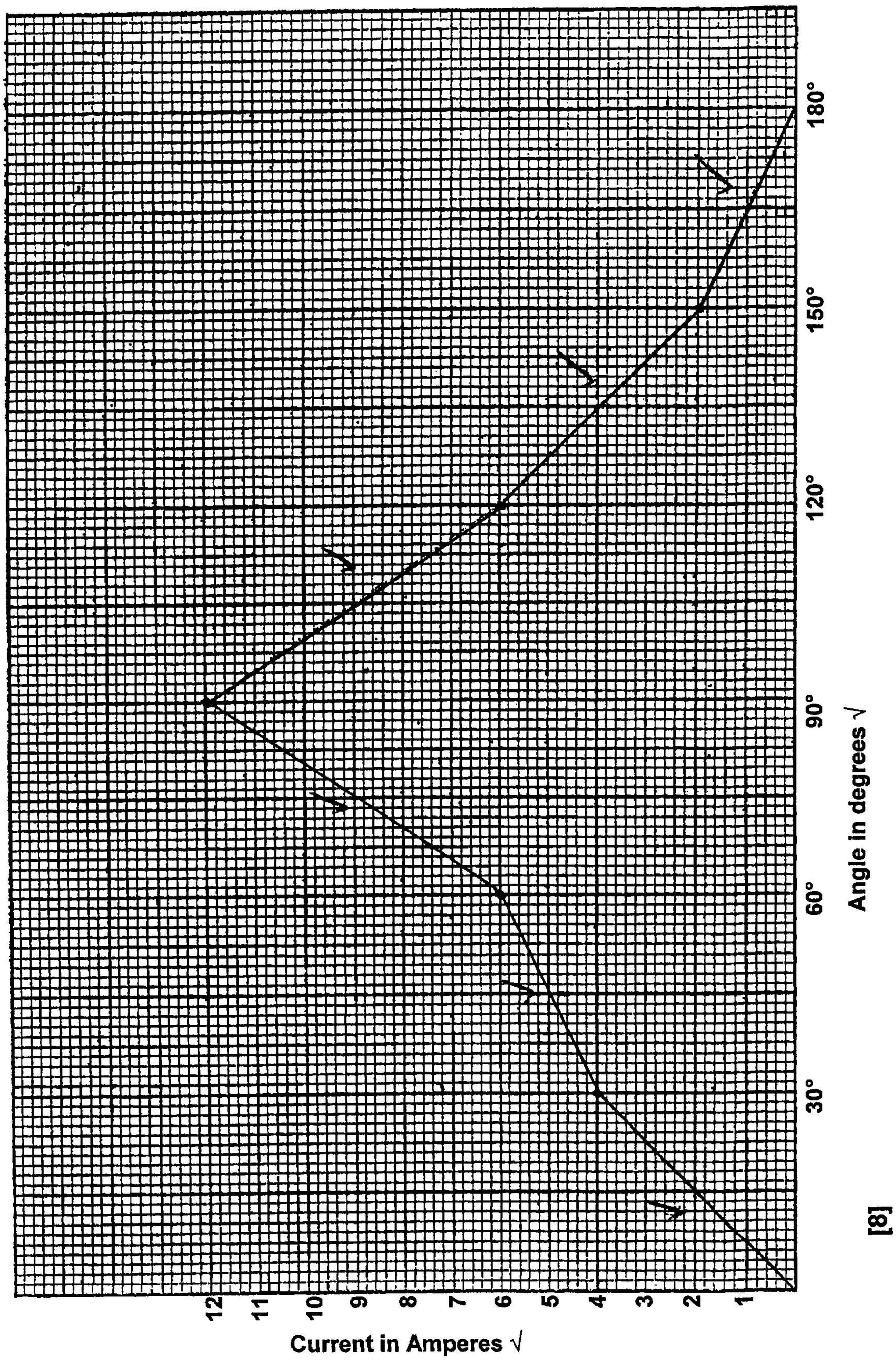
1.2 Welding machine / Sweismasjien (1)
Induction motors / Induksiemotors (1)
Transformers / Transformators (1)
(3)

1.3 Power factor can be defined as the ratio between the true power and the apparent power. (3)

OR / *OF*

Arbeidsfaktor kan gedefinieer word as die verhouding tussen die werklike drywing en skyndrywing. (3)
(3)

1.4


Scale 40 mm = 30° on x-axis
10 mm = / Ampere on Y-axis
180°
150°
120°
90°
60°
30°
Angle in degrees √
12
11
10
9
8
7
6
5
4
3
2
1
Current in Amperes √

[8]

1.4

Mid-ordinates	Mid-ordinates^2
2	4
5	25
9	81
9	81
4	16
1	1
30	**208**

I_{gem} = som van middel-ordinate / getal middel-ordinate
I_{av} = sum of mid-ordinates / no of mid-ordinates (1)
= 30 / 6 (1)
= 5A (1)

as: Irms = $\frac{\sqrt{1_2^1+1_2^2+1_3^2+.....1_6^2}}{6}$ / Iwgk = $\frac{\sqrt{1_2^1+1_2^2+1_3^2+.....1_6^2}}{6}$ (1)

= $\sqrt{208/6}$ (1)

= 5,9 A (1)

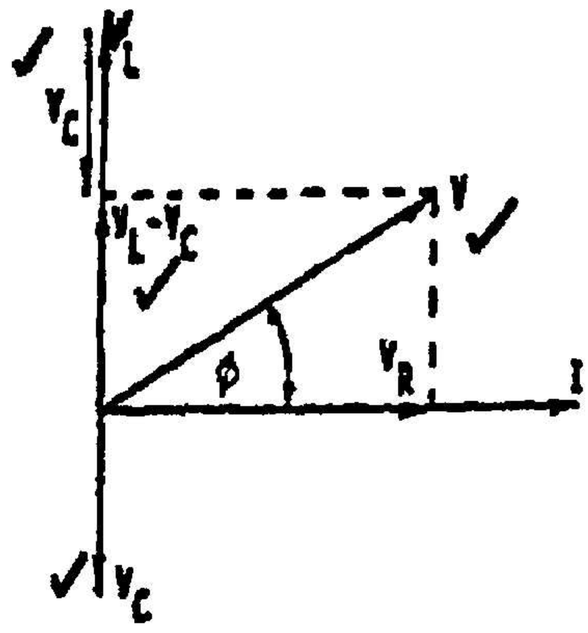
Form factor / Vormfaktor = rms (wgk) / ave (gemiddeld) (1)

= 5,9 / 5 (1)

= 1,177 (1)
(9)

1.5.1	XL	=	2πFL	(1)
		=	2π*100*0,3	
		=	188,5 ohms	(1)
	XC	=	1 / 2π FC	(1)
	XC	=	$1 / 2\pi*100*160*10^{-6}$	
		=	9,95 ohms	(1)
	Z	=	$\sqrt{R^2+(XL-XC)^2}$	(1)
		=	$\sqrt{25^2+(188,5-9,95)^2}$	(1)
		=	$\sqrt{32505,1}$	
		=	180,3 ohms	(1)
		=	V / Z	(1)
		=	100 / 180,3	
		=	0,55 A	(1)
				(9)
1.5.2	cosØ	=	R/Z	(1)
	Ø	=	$\cos^{-1}$ 25 / 180,3	(1)
	Ø	=	82,03°	(1)
				(3)
1.5.3	cosØ	=	R / Z	
	cosØ	=	25 / 180,3	(1)
	cosØ	=	0,138 = P.F	(1)
				(2)
1.5.4	I_{active} (I_{aktief})	=	I cosØ	(1)
		=	0,55*0.138	(1)
		=	0,07 A	(1)
				(3)
1.5.5	P	=	VI COSØ	(1)
		=	100*0,55*0,138	(1)
	P	=	7,59 W	(1)
			OR / *OF*	
	P	=	I^2R	(1)
		=	$0,55^2*25$	(1)
		=	7,5 W	(1)
				(3)

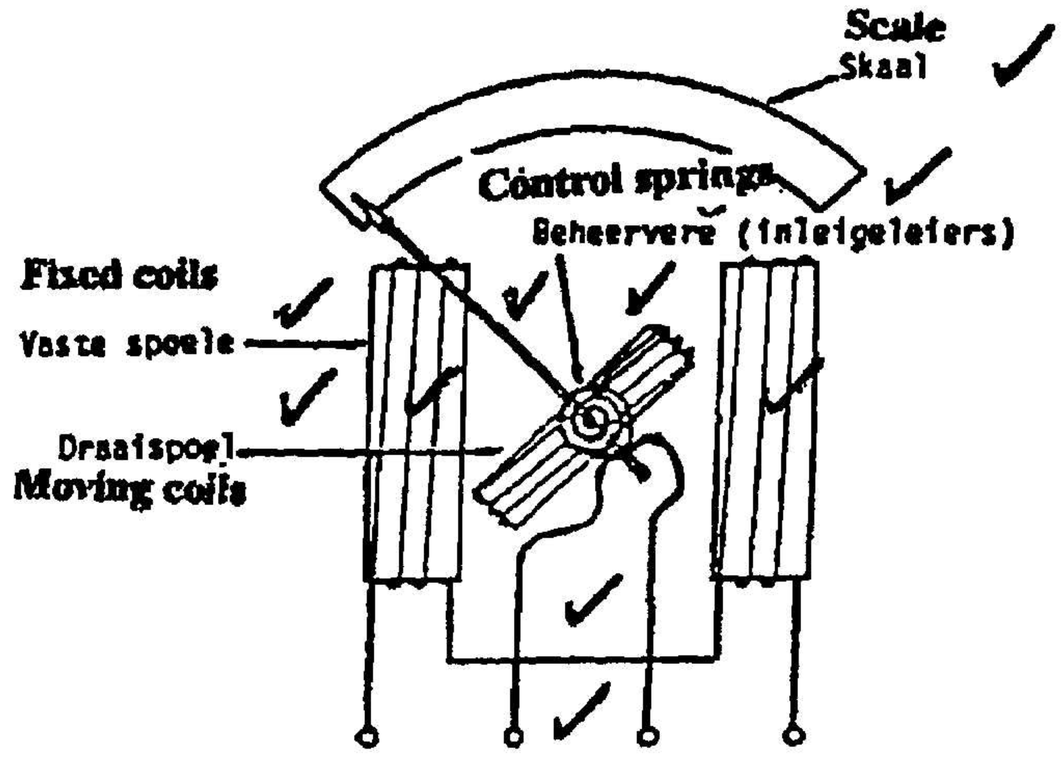
1.5.6 XL > XC PHASOR DIAGRAM



(4)
[60]

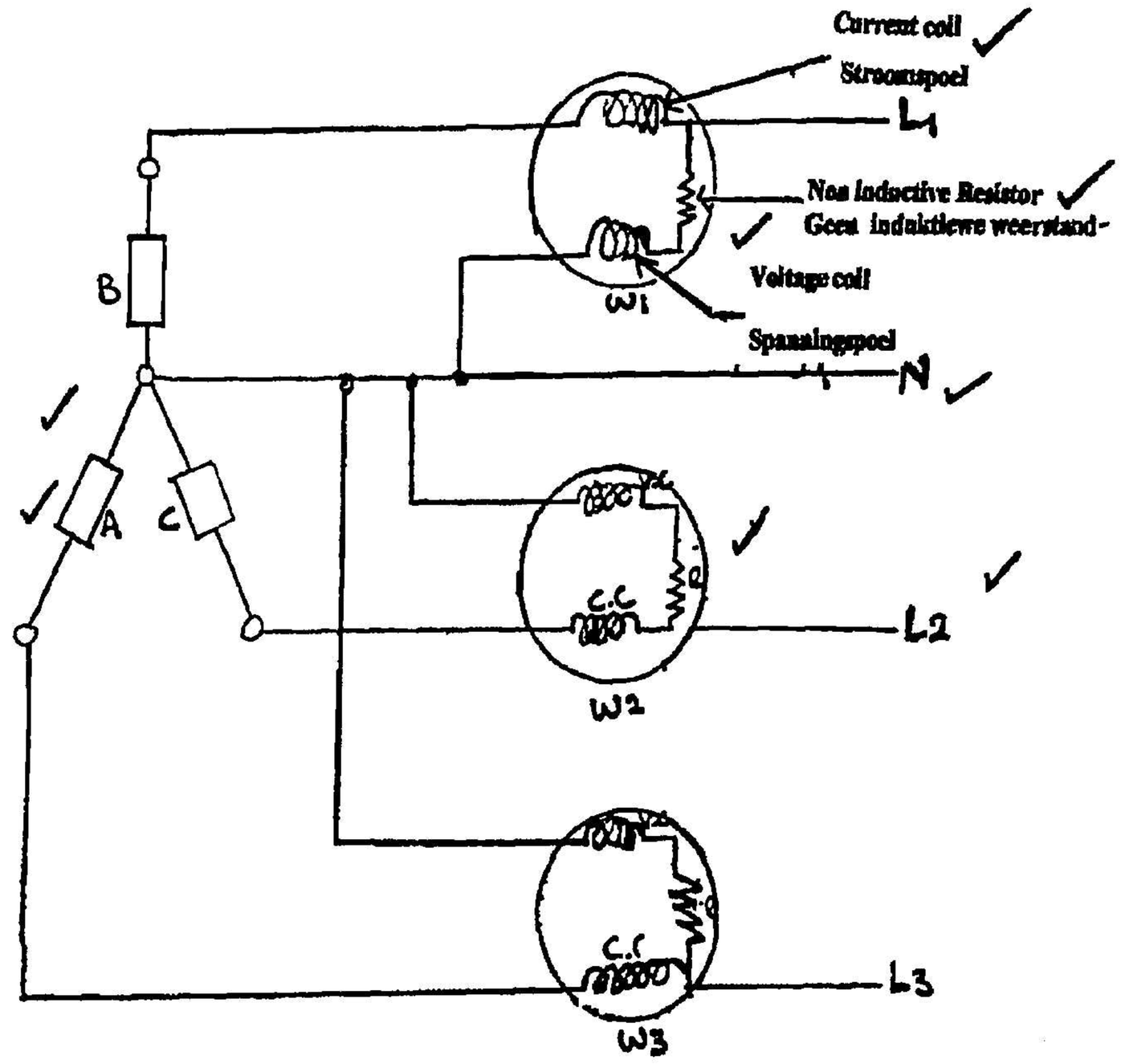
QUESTION / *VRAAG 2*

2.1 Dynamometer-type instrument (10)



(10)

2.2 Three wattmeters three phase four-wire (8)



2.3

2.3.1 P_{in} = $\sqrt{3}$ VL IL COSØ (1)
= $\sqrt{3}$ *380*30*0,9 (1)
= 17,8 kW (1)

2.3.2 S = $\sqrt{3}$ VL IL (1)
= $\sqrt{3}$ *380*30 (1)
= 19,7 kVA (1)

2.3.3 IL = $\sqrt{3}$ IP
IP = IL / $\sqrt{3}$ (1)
= 30 / $\sqrt{3}$ (1)
= 17,3 A (1)

2.3.4 Efficiency (Rendement) = output (lewering) / input (inset) * 100% (1)
= 12 / 17,8*100 (1)
= 67,4% (1)
(12)

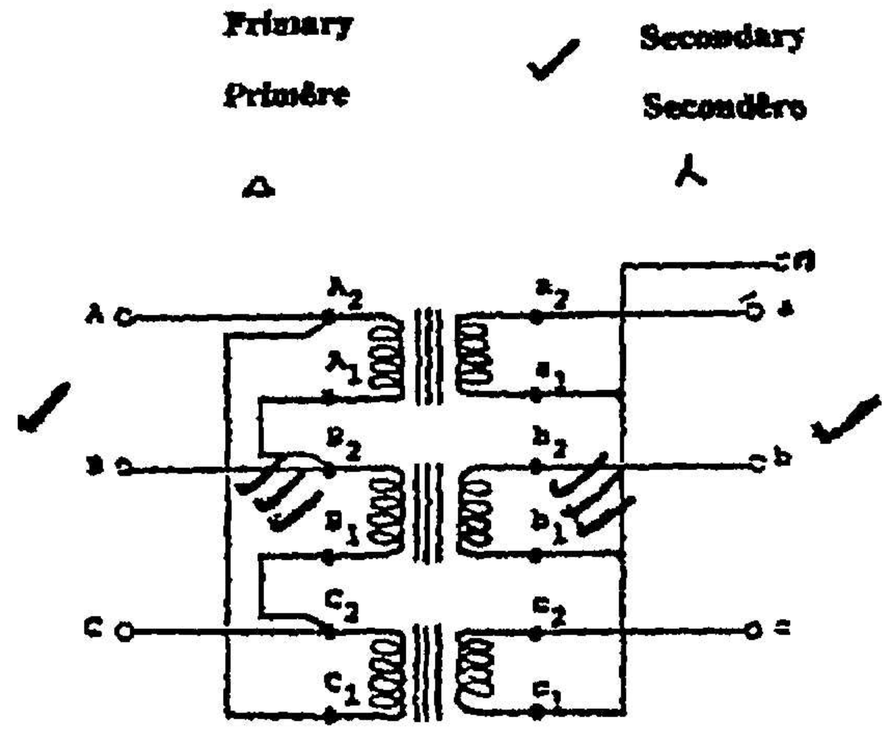
2.4 Ammeter (1)
Voltmeter (1)
Wattmeter (1)
(3)

2.5	VL	=	$\sqrt{3}$ VP	(1)
		=	$\sqrt{3}$ *220	(1)
		=	381 V	(1)
				(3)
2.6	P	=	V I COS	(1)
	COSØ	=	P / VI	(1)
		=	0,85*1 000 / 220*5	(1)
		=	850 / 1 100	
	COSØ	=	0,7 = PF	(1)
				(4)

QUESTION / *VRAAG 3*

3.1				
3.1.1	V1 / V2	=	N1 / N2	(1)
	2 000 / 250	=	N1 / 100	
	N1	=	2 000*100 / 250	(1)
	N1	=	800 turns	(1)
				(3)
3.1.2	S	=	V2*I2	
	I2	=	S / V2	(1)
		=	140 000 / 250	(1)
	I2	=	5 600 A	(1)
				(3)
3.2.1	Star – Delta			
	VL	=	$\sqrt{3}$ VP	
	VP	=	VL / $\sqrt{3}$	(1)
		=	3 300 / $\sqrt{3}$	(1)
		=	1 905,3 V	(1)
	V1 / V2	=	N1 / N2	(1)
	1 905,3 / V2	=	400 / 30	
	V2	=	1 905,3*30 / 400	(1)
	V2	=	142,9 V	(1)
	In delta VL2	=	VP2 = 142,9 V	(1)
				(7)
3.2.2	Delta – Star			
	VL1 = VP1 = 3 300 V			(1)
	V1 / V2	=	N1 / N2	(1)
	3 300 / V2	=	400 / 30	
	V2	=	3 300*30 / 400	(1)
	V2P	=	247 5 V	(1)
	VL	=	$\sqrt{3}$ VP	(1)
		=	$\sqrt{3}$ *247,5	(1)
		=	428,7 V	(1)
				(7)

3.3 DELTA-STAR CONFIGURATION



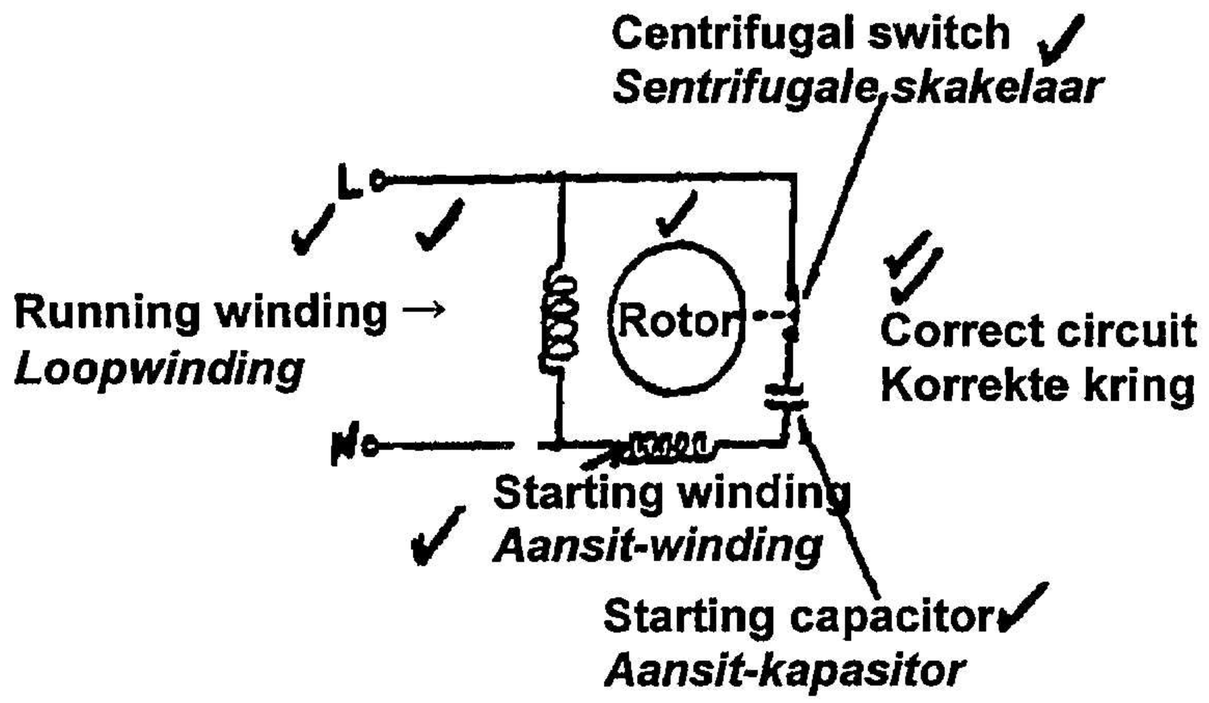
(9)

3.4 Open-circuit test / oopkring-toets (2)
Short-circuit test / kortsluit-toets (2)
(4)

3.5 Copper losses / Koperverliese (1)
Iron losses / Kernverliese (1)
[35]

QUESTION / *VRAAG 4*

4.1 CAPACITOR-INDUC MOTOR



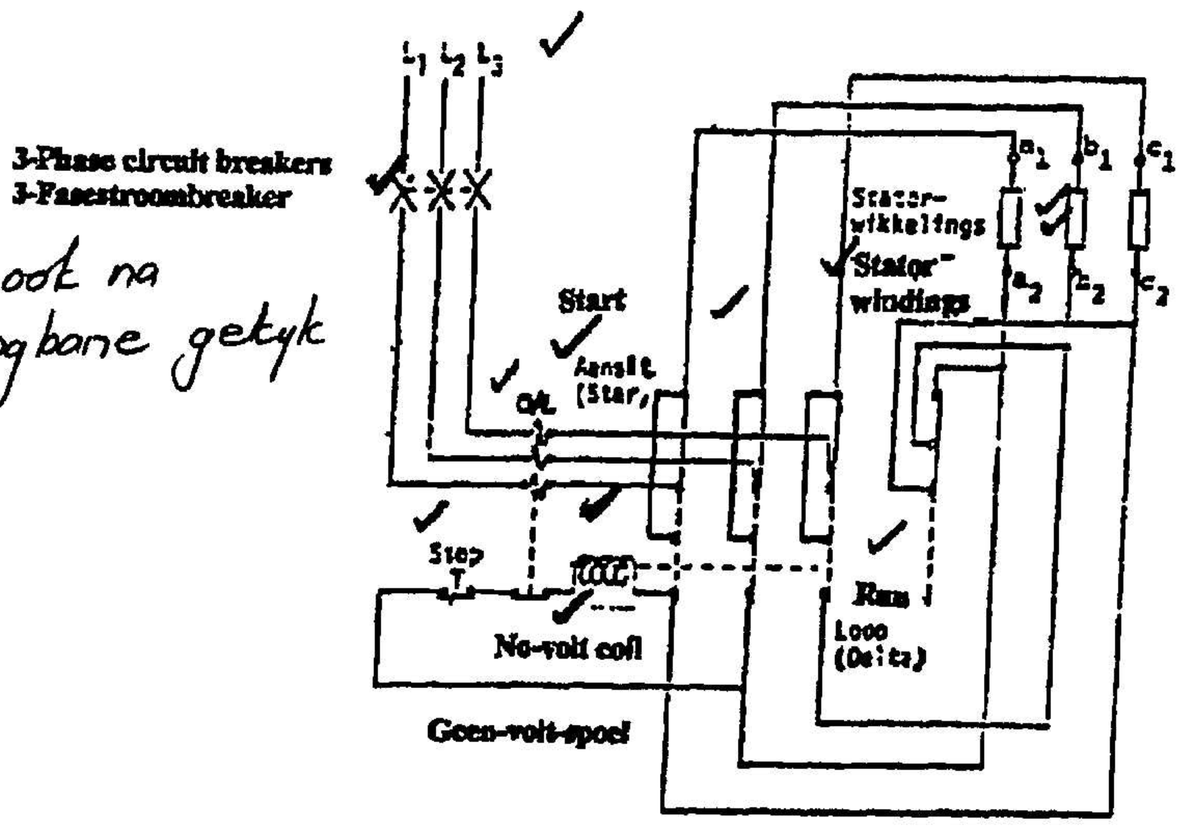
(8)

4.2 1. It is much more expensive than an ordinary induction motor. (2)
2. It has a very low starting torque. (2)
3. It requires more auxiliary equipment. (2)
4. It can be operated only by trained personnel. (2)

OR / *OF*

1. Dit is duurder as 'n gewone motor. (2)
2. Dit het 'n lae aansitwringkrag. (2)
3. Dit het meer hulptoerusting nodig. (2)
4. Dit kan alleenlik bedien word deur 'n persoon met kennis van sulke toerusting. (2)
(8)

4.3 Direct on-line starter no volt coil



Hier moet ook na ander keringbare getyk word.

(12)

4.4 N = F*60 / P (1)
= 50*60 / 1
= 3 000 r/min (1)
Rotor speed (Rotorspoed) = N – Slip (Glip) (1)
= 3 000 – 3% (1)
= 3 000 / 100*3 (1)
= 90
= 3 000 – 90 (1)
= 2 910 r/min (1)
(7)
[35]

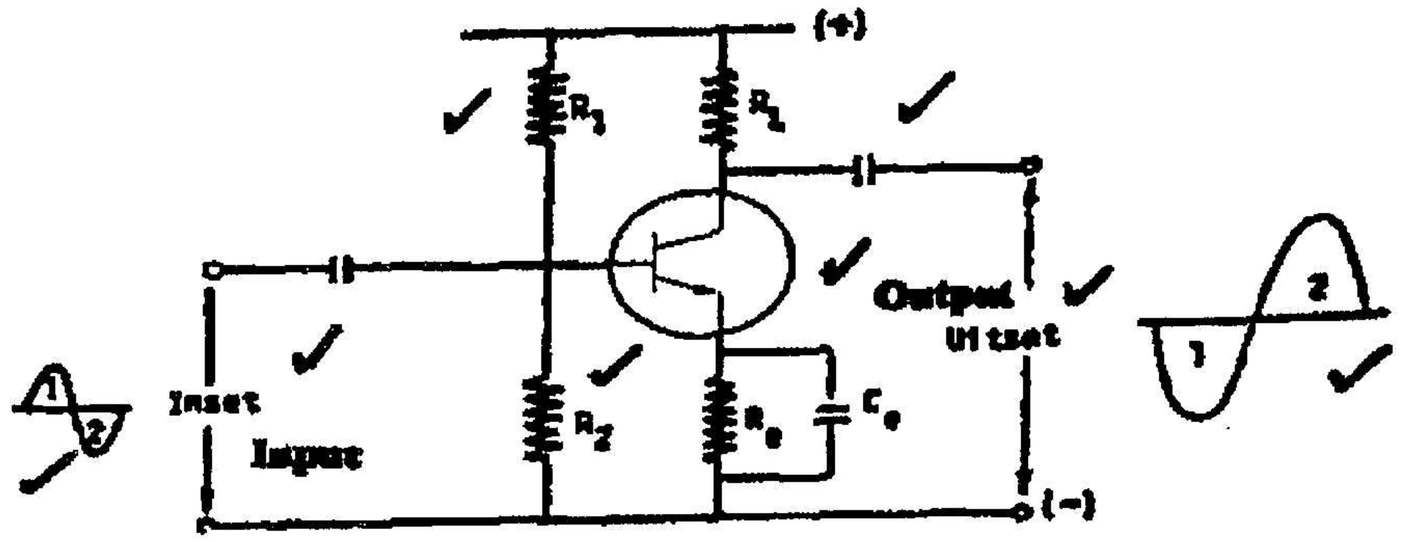
QUESTION / *VRAAG 5*

5.1
1. Current amplification is obtained from this configuration. The voltage gain is less than 1. (2)
2. There is no inversion of the signal. (2)
3. The input impedance is high while the output impedance is low. (2)
4. In addition to current amplification this configuration can also be used to match a high impedance input source to a low impedance output. (2)

OR / *OF*

1. Stroomversterking word vanaf hierdie konfigurasie verkry. Die spanningswins is minder as 1. (2)
2. Die sein word nie omgekeer nie. (2)
3. Die inset-impedansie is hoog, terwyl die uitset-impedansie laag is. (2)
4. Buiten die stroomversterking kan hierdie konfigurasie ook gebruik word om 'n hoë-impedansie-insetsein by 'n lae-impedansie-uitset te pas. (2)
(8)

5.2 TRANSISTOR AS AN AMPLIFIER



PNP-transistor configuration may also be drawn. **(8)**

5.3
1. It does not require a heater element and thus requires no heater voltage. (2)
2. The semiconductor takes up very little space. (2)
3. It is much cheaper than a tube diode. (2)
4. It offers very little resistance and has a consequent low voltage drop. (2)
5. It is very efficient at low voltages and current. (2)
6. It has only two terminals, making the circuit very simple. (2)

OR / *OF* (any 4 / enige 4)

1. Dit het geen verhitterfilament en dus ook verhitterspanning nodig nie. (2)
2. 'n Diode (halfgeleier) neem min spasie op. (2)
3. Dit is baie goedkoper as buisdiodes. (2)
4. Dit het baie min weerstand en daar is dus minder spanningsval. (2)
5. Dit werk baie doeltreffend by lae spannings en stroom. (2)
6. Omdat dit net twee verbindingspunte het, is die kring soveel eenvoudiger. (2)

(8)

5.4
Bloodtransfusion (infected blood). (2)
Sharing of needles for drugs with an infected person. (2)
Infected blood entering the body through an injury. (2)
Not using latex gloves when a person is treated for blood loss / injuries. (2)
Having sex with an infected person without protection. (2)

OR / *OF*

Bloedoortapping (besmette bloed). (2)
Deur 'n naald vir dwelms met 'n vigslyer te deel. (2)
Deur besmette bloed wat deur 'n seerplek op die vel die liggaam binnedring. (2)
Deur nie lateks-handskoene te dra nie wanneer 'n persoon vir bloedverlies / beserings behandel word. (2)
Deur seks te hê met 'n vigslyer sonder beskerming. (2)

Any 3 / enige 3 **(6)**

The marker must consider all possible answers.

Die nasiener moet hier sy eie diskresie gebruik. **[30]**