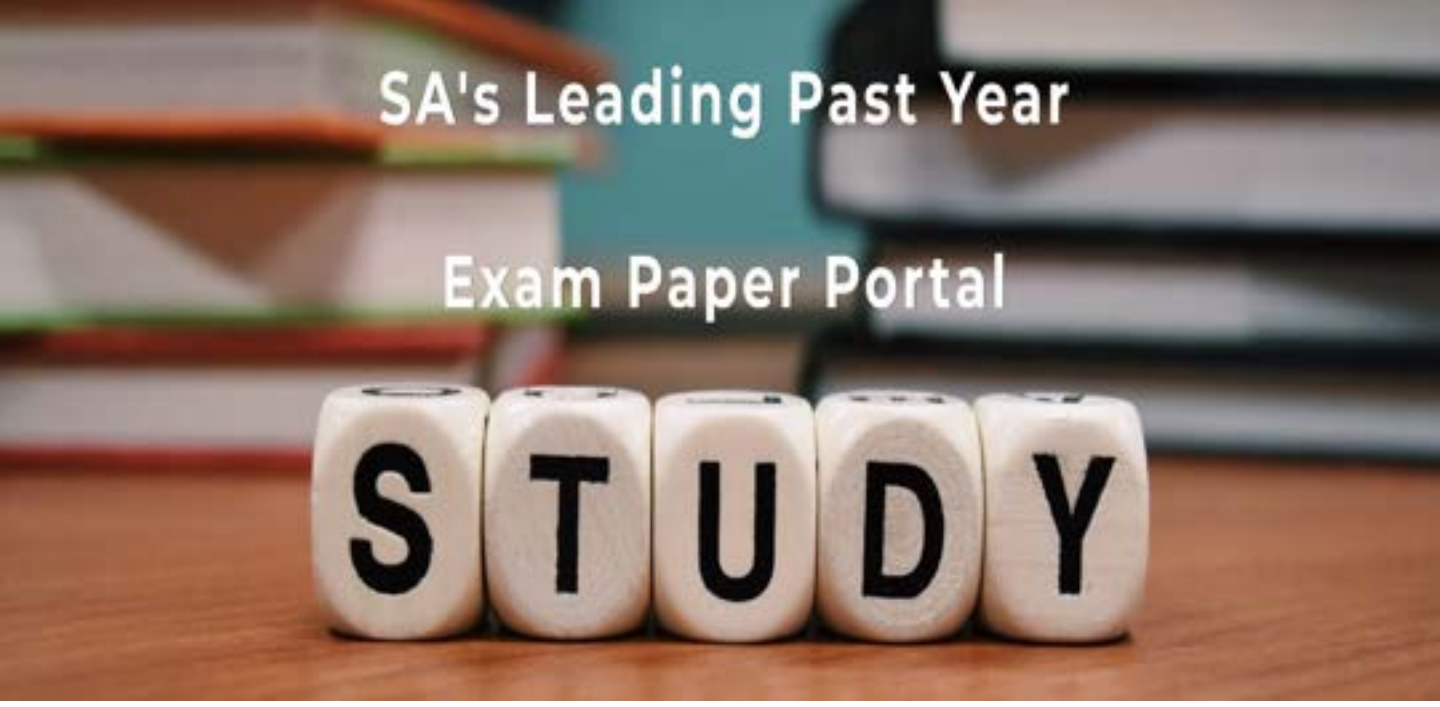

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GRADE/*GRAAD* 12

TECHNICAL SCIENCES P1/
TEGNIESE WETENSKAPPE V1

NOVEMBER 2022

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 12 pages.
Hierdie nasienriglyne bestaan uit 12 bladsye.

QUESTION 1/*VRAAG* 1

1.1	D	✓✓	(2)
1.2	B	✓✓	(2)
1.3	A	✓✓	(2)
1.4	D	✓✓	(2)
1.5	C	✓✓	(2)
1.6	A	✓✓	(2)
1.7	B	✓✓	(2)
1.8	B	✓✓	(2)
1.9	C	✓✓	(2)
1.10	A	✓✓	(2)

[20]

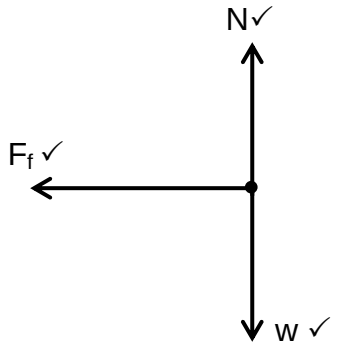
QUESTION 2/*VRAAG* 2

2.1.1 The crate will slide✓ to the right. ✓/*Die krat sal na regs gly.*
Accept: The crate will move forward
Aanvaar: die krat sal vorentoe beweeg. (2)

2.1.2 Newton's First Law of Motion. ✓
An object will continue in a state of rest or uniform velocity ✓ unless acted upon by a non-zero resultant / net force ✓

Newton's se eerste bewegingswet
'n Voorwerp sal in sy toestand van rus of uniforme beweging volhard tensy 'n nie-nul resulterende/ netto krag daarop inwerk. (3)

2.1.3



NOTES/*NOTAS*:	**ACCEPTABLE LABELS/ *AANVAARBARE BYSKRIFTE*:**
• One mark for each arrow with a correct label./*Een punt vir elke pyl met die korrekte byskrif.* • Penalise ONCE for each: *Penaliseer een keer vir elk.* ➢ No arrows/*Geen pylpunt* ➢ No dot/ *Geen kol.* ➢ Gap between the line and the dot./ *Spasie tussen die lyn en die kol.* ➢ Dotted lines are used./*Stippellyne gebruik*. ➢ Additional force is included./*Ekstra kragte ingesluit.* ➢ A force diagram is given./*'n Kragtediagram geteken.*	N/F_N: Normal/ *Normaal* F_g/w: Force due to gravity/weight *Gravitasiekrag/ gewig* F_f/f/f_k: friction/ *wrywing*

(3)

2.1.4

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$a=\frac{\Delta v}{\Delta t}$ $a=\frac{v_f - v_i}{t}$ ✓ $=\frac{(17,22-29,17)}{7}$ ✓ $= -1,71\ m\cdot s^{-2}$ = 1,71 m·s^{-2} to the left / opposite direction✓/*Na links/ teenoorgestelde rigting*	$F_{net}\Delta t = m\Delta v$ ✓ $F_{net}(7) = 4910(17,22 - 29,17)$ ✓ $F_{net} = -8382,07$ N $F_{net} = ma$ $-8382,07 = 4910a$ ✓ a = 1,71 m·s^{-2} to the left / opposite direction✓/ *Na links/ teenoorgestelde rigting*

(4)

2.1.5

POSITIVE MARKING FROM 2.1.4/ *POSITIEWE NASIEN VANAF 2.1.4*	
OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$F_{net} = ma$✓ $= (4910)(-1,71)$ ✓ $= -8396,10$ = 8 396,10 N✓ to the left✓/*na links*	$F_{net} = \frac{m(v_f - v_i)}{\Delta t} = \frac{\Delta P}{\Delta t}$ ✓ $= \frac{(4910)(17,22-29,17)}{7}$ ✓ = 8382, 07 N ✓to the left✓/*na links*
Range/*Gebied*: 8382, 07 N - 8 396,10 N	

(4)

2.2.1 When a net force, F_{net}, is applied on an object of mass (m), it accelerates the object in the direction of the net force. ✓✓ This acceleration is directly proportional to the net force and inversely proportional to the mass of the object./ *Wanneer 'n resulterende/netto krag op 'n voorwerp met massa(m), inwerk, versnel die voorwerp in die rigting van die krag. Die versnelling is direk eweredig aan die resulterende/netto krag en omgekeerd eweredig aan die massa van die voorwerp.*

NOTE/*NOTA*:

- 2 marks if the word "net force" is in the first part. */2 punte indien die woorde "netto krag' in die eerste deel voorkom.*
- 1 mark if the word "net force" is in the second part only./ *1 punt indien die word "netto krag" slegs in die tweede deel voorkom.*
- 0 if the word "net force" is missing./ *0 indien die woorde "netto krag" weggelaat was.*

(2)

2.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
m_1 F_{net} = ma✓ $F_{applied}$ + (-F) = ma 6,5 – F = 0,75a ..... (1) ✓ **m_2** F_{net} = ma F = ma F = 0,8a .....(2) ✓ (1) + (2) 6,5 = 0,75a + 0,8a ∴ a = 4,19 m·s^{-2} to the right✓/*na regs*	F_{net} = ma✓ 6,5 ✓ = 1,55a ✓ $\frac{6,5}{1,55}$ = a a = 4,19 m·s^{-2} = 4,19 m·s^{-2} to the right✓/*na regs*

(4)

2.2.3 **POSITIVE MARKING FROM 2.2.2/*POSITIEWE NASIEN VANAF 2.2.2***

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
F_{net}= ma F = 0,8 x 4,19 ✓ = 3,35 N ✓ to the right✓/na *regs* **NOTE**: Penalise 1 mark for the formula if the subscript "net" is omitted./ *Penaliseer met 1 punt vir die formule indien die onderskrif "net" weggelaat is.*	F_{net} = ma $F_{applied}$ – F = ma 6,5 – F = 0,75(4,19) ✓ – F= – 3,35 N F = 3,36 N✓ to the right✓/*na regs*
Range/*Gebied*: 3,35 N – 3,36 N	

(3)
[25]

QUESTION 3/*VRAAG* 3

3.1.1 The product of the resultant/net force acting on an object and the time the net force acts on the object.✓✓

Die produk van die resulterende/netto krag wat op die voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk. (2)

3.1.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
Positive to the right/*Regs as positief* Impulse = Δp $F_{net}\Delta t$ = Δp ✓ Anyone = m(v_f – v_i) = 0,16(65 – (- 40) ✓ = 16,8 kg·m·s^{-1}✓to the right✓/ opposite direction to the original direction. *Na regs / teenoorgestelde rigting as oorspronklike.*	Positive to the left/*Links as positief*. Impulse = Δp $F_{net}\Delta t$ = Δp ✓ Anyone = 0,16(-65 - 40) ✓ = -16,8 Answer : 16,8 kg·m·s^{-1}✓to the right✓ opposite direction to the original direction. *Na regs/ teenoorgestelde rigting as oorspronklike.*

(4)

3.1.3

POSITIVE MARKING FROM 3.1.2/ *POSITIEWE NASIEN VANAF 3.1.2*	
OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$F_{net} = \frac{\Delta p}{\Delta t}$ ✓ $= \frac{16,8}{4\times10^{-3}}$ ✓ = 4 200 N ✓	$F_{net} = \frac{\Delta p}{\Delta t}$ ✓ $= \frac{-16,8}{4x10^{-3}}$ ✓ = - 4200N = 4200 N✓
OPTION 3/*OPSIE 3*	
$a = \frac{v_f - v_i}{\Delta t}$ $= \frac{65 - (-40)}{4\times10^{-3}}$ ✓ = 26 250 m·s^{-2}	F_{net} = ma ✓ = 0,16)(26 250) = 4200 N ✓

(3)

3.2.1 The <u>total linear momentum in an isolated system</u> ✓ <u>remains constant/ is conserved</u> in magnitude and direction✓
OR
In an <u>isolated system, the total momentum before a collision/explosion is equal</u> to the <u>total momentum after the collision/explosion</u> in magnitude and direction.

Die <u>totale liniêre momentum in 'n geslote stelsel</u> <u>bly konstant</u>.
OF
Die <u>totale liniêre momentum van 'n geslote stelsel is voor die botsing/ ontploffing gelyk aan die totale liniêre momentum na die botsing/ ontploffing</u>. (2)

3.2.2

$\Sigma p_{before/voor} = \Sigma p_{after/na}$ ✓
$m_1v_{i1} + m_2v_{i2} = m_1v_{f1} + m_2v_{f2}$
<u>(1) (5) + (1,8) (2,5)</u> ✓ = <u>(1) (v) + (1,8) (3)</u> ✓
5 + 4,5 = v + 5,4
4,1 = v
∴ <u>v = 4,1 m·s^{-1} to the right</u> ✓/ in the direction of motion.
<u>Na regs</u>/ in die bewegingsrigting. (4)

3.2.3 **POSITIVE MARKING FROM 3.2.2./*POSITIEWE NASIEN VANAF 3.2.2***

$\Sigma k_{before/voor} = \frac{1}{2}mv^2 + \frac{1}{2}mv^2$ ✓ $= \frac{1}{2}(1)(5)^2 + \frac{1}{2}(1,8)(2,5)^2$ ✓ = 12,5 + 5,63 = 18,13 J	$\Sigma k_{after/na} = \frac{1}{2}mv^2 + \frac{1}{2}mv^2$ $= \frac{1}{2}(1)(4,1)^2 + \frac{1}{2}(1,8)(3)^2$ ✓ = 8,41 + 8,1 = 16,51 J

$\Sigma k_{before/voor} \neq \Sigma k_{after/na}$ ✓
<u>Inelastic</u>✓ /*Onelasties* (5)
[20]

QUESTION 4/*VRAAG* 4

4.1 Total mechanical energy (sum of gravitational potential energy and kinetic energy) in an isolated system ✓remains constant. ✓

Accept: The total (mechanical) energy of an isolated system remains constant

Die totale meganiese energie (som van die gravitasie- potensiële en kinetiese energie) van 'n geïsoleerde stelsel bly konstant.

Aanvaar: *Die totale (meganiese) energie van 'n geisoleerde sisteem bly konstant.* (2)

4.2 $E_p = mgh$ ✓
$= (2)(9.8)(1,2)$ ✓
$= 23,52J$ ✓ (3)

4.3 **POSITIVE MARKING FROM QUESTION 4.2/*POSITIEWE NASIEN VANAF 4.2***
$ME = E_p + E_k$ ✓
$= 23,52$ ✓ $+ (½)(2)(0,88)^2$ ✓
$= 24,29$ J ✓ (4)

4.4 **POSITIVE MARKING FROM QUESTION 4.3/POSITIEWE NASIEN VANAF 4.3**
ME at C = ME at B
$(E_p + E_k)_{at\ C} = (E_p + E_k)_{at\ B}$ ✓
$0 + (½)(2)v^2$ ✓$= 24,29$ ✓
$v = 4,93\ m.s^{-1}$ ✓ (4)

4.5 Power is the rate at which work is done. ✓✓
OR
Power is the rate at which energy is expended/ transferred.
Drywing is die tempo waarteen arbeid verrig word.
OF
Drywing is die tempo waarteen energie verbruik/oorgedra word. (2)

4.6 $P_{ave/gem} = Fv_{ave/gem}$ ✓
43000 ✓ $= F(2)$ ✓
$F = 21500$ N
$T = 21500$ N ✓ (4)
[19]

QUESTION 5/*VRAAG* 5

5.1.1 A force that changes the shape and size of a body✓✓

'n Krag wat die vorm en grootte van 'n voorwerp verander. (2)

5.1.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\text{Area} = \frac{\pi d^2}{4}$ $= \frac{\pi(0,5)^2}{4}$ ✓ $= 1,96 \times 10^{-1}\ m^2$ $\sigma = \frac{F}{A}$ ✓ $5,5 \times 10^6$ ✓ $= \frac{F}{1,96 \times 10^{-1}}$ ✓ $F = 1,08 \times 10^6$ N ✓	$\sigma = \frac{F}{A}$ ✓ $= \frac{F}{\frac{\pi d^2}{4}}$ $5,5 \times 10^6$ ✓ $= \frac{F}{\frac{\pi(0,5)^2}{4}}$ ✓ ✓ $F = 1,08 \times 10^6$ N ✓
OPTION 3/*OPSIE 3*	**OPTION 4/*OPSIE 4***
$\text{Area} = \pi r^2$ $\text{Area} = \pi(0,25)^2$ ✓ $= 1,96 \times 10^{-1}\ m^2$ $\sigma = \frac{F}{A}$ ✓ $5,5 \times 10^6$ ✓ $= \frac{F}{1,96 \times 10^{-1}}$ ✓ $F = 1,08 \times 10^6$ N ✓	$\sigma = \frac{F}{A}$ ✓ $5,5 \times 10^6$ ✓ $= \frac{F}{\pi(0,25)^2}$ ✓ ✓ $F = 1,08 \times 10^6$ N ✓

(5)

5.1.3 $K = \frac{\sigma}{\varepsilon}$ ✓

$85 \times 10^9 = \frac{5,5 \times 10^6}{\varepsilon}$ ✓

$\varepsilon = 6,47 \times 10^{-5}$ ✓ (3)

5.1.4 **POSITIVE MARKING FROM 5.1.3/*NASIEN VANAF 5.1.3***

$\varepsilon = \frac{\Delta \ell}{L}$ ✓

$6,47 \times 10^{-5} = \frac{\Delta \ell}{3,5}$ ✓

$\Delta \ell = 2,26 \times 10^{-4}$ m ✓ (3)

5.2.1 In a continuous liquid in equilibrium, the pressure applied at a point is transmitted equally to other parts of the liquid. ✓✓

In 'n kontinue vloeistof by ewewig, sal die druk by 'n punt eweredig oorgedra word na al die ander dele van die vloeistof. (2)

5.2.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓ $\frac{40}{4,8\times10^{-4}}$ ✓ $= \frac{F_2}{6,2\times10^{-2}}$ ✓ F_2 = 5 166,67 N✓	$P = \frac{F}{A}$ ✓ $P = \frac{40}{4,8\times10^{-4}}$ ✓ = 83 333,33 Pa $P = \frac{F}{A}$ $83333,33 = \frac{F}{6,2\times10^{-3}}$ ✓ F = 5 166,67 N✓

(4)
[19]

QUESTION 6/*VRAAG* 6

6.1 Bending of light ✓when it passes from one medium to another (of a different optical density).✓

Die buiging/breking van lig wanneer dit van een medium na 'n ander beweeg. (wat verskil in optiese digtheid). (2)

6.2.1 Incident (ray)✓/*Invallende straal* (1)

6.2.2 Refracted (ray)✓*Gebuigde/ gebroke/ gebreekte straal* (1)

6.2.3 (Angle of) incidence✓/*invalshoek* (1)

6.2.4 (Angle of) refraction✓*Brekingshoek* (1)

6.2.5 Normal ✓/ *Normaal* (1)
[7]

QUESTION 7/*VRAAG* 7

7.1.1 Microwave✓/ *Mikrogolwe*
7.1.2 Infrared✓/ *Infrarooi*
7.1.3 Gamma ✓/ *Gamma* (3)

7.2
- Sterilise medical equipment✓/ *Steriliseer mediese apparaat*
- Treat skin conditions✓/ *Behandeling velkondisies*
- Production of vitamin D/ *Vervaardiging van vitamiene D*
- To check the counterfeit notes/ *Verifieer vals geldnote. (any two/enige twee)*

Accept: any other correct answer ***Aanvaar:*** *enige ander korrekte antwoord* (2)

7.3 A quantum/packet of (electromagnetic) energy.✓✓/ *'n Kwantum/pakkie van (elektomagnetiese) energie.*
(2)

7.4 $E = hf$ ✓
$= \underline{(6{,}63 \times 10^{-34})\ (102{,}5 \times 10^{6})}$ ✓
$= 6{,}8 \times 10^{-26}$ J✓ (3)

7.5
- Red✓/ *Rooi*
- Orange✓/ *Oranje*
- Yellow✓/ *Geel*
- Green/ *Groen*
- Blue/ *Blou*
- Indigo/ *Indigo*
- Violet/ *Violet* (any three/ *enige drie*) (3)

[13]

QUESTION 8/*VRAAG* 8

8.1

Anyone/enige een✓

$C = \frac{\varepsilon_o A}{d}$

$= \frac{(8{,}85\times10^{-12})(5\times10^{-2})}{6\times10^{-3}}$ ✓

$= 7{,}38 \times 10^{-11}$ F

$C = \frac{Q}{V}$

$7{,}38\times10^{-11} = \frac{Q}{100}$ ✓

$Q = 7{,}38 \times 10^{-9}$ C ✓ (5)

8.2.1 Capacitance will be decreased ✓by half ✓/ reduced by 50%/decrease by a factor of 2 / it will reduce to the ration 2:1.

Accept/*Aanvaar*: reduce to 3,69 x 10^{-9} F
Kapasitansie sal verminder/ halfeer/ met 50% / verminder met 'n faktor van 2/ dit sal veminder tot verhouding van 2:1. (2)

8.2.2 Capacitance is inversely proportional to the distance between the plate.✓✓
OR
Distance between the plates increases the capacitance will decrease with the same ratio/ factor.
Kapasitansie is omgekeerd eweredig aan die afstand tussen die plate.
OF
Indien die afstand tussen die plate verhoog sal die kapasitansie verlaag met dieselfde faktor/ verhouding. (2)
[9]

QUESTION 9/*VRAAG* 9

9.1

OPTION 1/ *OPSIE 1*	**OPTION 2/ *OPSIE 2***
$\frac{1}{Rp} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $= \frac{1}{22} + \frac{1}{44}$ ✓ $\therefore R_T$ = 14,67 Ω✓	$R_P = \frac{R_1 \times R_2}{R_1 + R_2}$ ✓ $R_P = \frac{22 \times 44}{22 + 44}$ ✓ R_T = 14,67 Ω✓

(3)

9.2

OPTION 1/ *OPSIE 1*	**OPTION 2/ *OPSIE 2***	**OPTION 3/ *OPSIE 3***
$P = \frac{V^2}{R}$ ✓ $= \frac{230^2}{22}$ ✓ = 2404,55 W✓	$I = \frac{V}{R}$ $I = \frac{230}{22}$ = 10,45 A P = VI✓ = (230)(10,45) ✓ = 2404,55 W✓	$I = \frac{V}{R}$ $I = \frac{230}{22}$ = 10,45 A $P = I^2 R$✓ = ($10,45^2$)(22) ✓ = 2402,46 W✓
Range/*Gebied*: 2402,45 – 2404,55		

(3)

POSITIVE MARKING FROM QUESTION 9.2/*POSITIEWE NASIEN VANAF 9.2*

9.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$W = VI\Delta t$ ✓ $= (230)(10,45)(120)$✓ $= 288\ 420$ J✓	$W = \frac{V^2}{R}\Delta t$ ✓ $= \frac{230^2}{22}(120)$ ✓ $= 288\ 545,45$ J✓
OPTION 3/ *OPSIE 3*	**OPTION 4/ *OPSIE 4***
$W = I^2R\Delta t$ ✓ $= (10,45^2)(22)(120)$ ✓ $= 288\ 294$ J✓	$W = P\Delta t$ ✓ $= (2404,55)(120)$✓ $= 288\ 546$ J✓ (or 288 295,2 J)
Range/*Gebied*: 288 294 – 288545,45	

(3)
[9]

QUESTION 10/*VRAAG* 10

10.1 The needle in the galvanometer deflects✓/ Galvanometer reading will change.
Die naald van die galvanometer sal uitwyk./ Galvanometer lesing sal verander. (1)

10.2 When the magnet is moved in and out of the coil an <u>emf is induced in the coil</u>. ✓ The induced emf <u>produces a current</u> which then moves the needle. ✓

Wanneer die magnet in en uit die spoel beweeg word, word n <u>emk in die spoel geinduseer</u>.Die geinduseerde emk <u>wek n stroom op</u> wat die naald laat uitwyk. (2)

10.3 Faraday's law, ✓ states that when the magnetic flux linked with the coil changes, an emf is induced in the coil. ✓The magnitude of the induced emf is directly proportional to the rate of change of magnetic flux. ✓

Faraday se wet bepaal dat, wanneer die magnetiese vloed wat met die spoel verbind is, verander, 'n emk in die spoel geïnduseer word. Die grootte van die geïnduseerde emk is direk eweredig aan die tempo van verandering van die magnetiese vloed. (3)

10.4
- Increase the number of windings/ turns on the coil. ✓
- Increase the speed at which the magnet is moving. ✓
- Use a stronger magnet. ✓

- *Verhoog die aantal windings op die spoel.*
- *Verhoog die spoed waarmee die magneet beweeg word.*
- *Gebruik 'n sterker magnet.* (3)

[9]

TOTAL: 150