basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 11

PHYSICAL SCIENCES: PHYSICS (P1)
FISIESE WETENSKAPPE: FISIKA (V1)

NOVEMBER 2018

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 16 pages.
Hierdie nasienriglyne bestaan uit 16 bladsye.

QUESTION 1/*VRAAG 1*

1.1 A ✓✓ (2)

1.2 C ✓✓ (2)

1.3 C ✓✓ (2)

1.4 D ✓✓ (2)

1.5 B ✓✓ (2)

1.6 D ✓✓ (2)

1.7 B ✓✓ (2)

1.8 A ✓✓ (2)

1.9 B ✓✓ (2)

1.10 C ✓✓ (2)
[20]

QUESTION 2/*VRAAG 2*

2.1 Resultant (net) vector/*Resultante (netto) vektor* ✓ (1)

2.2.1 $F_y = F\sin\theta$
$= 50\sin 30°$ ✓ **OR/OF** $50\cos 60°$
$= 25$ N ✓ (2)

2.2.2 **POSITIVE MARKING FROM QUESTION 2.2.1**
POSITIEWE NASIEN VANAF VRAAG 2.2.1

$F_x = 50\cos 30°$ ✓
$= 43,3$ N

✓
$R_x = 80 - 43,3$ ✓
$= 36,7$ N

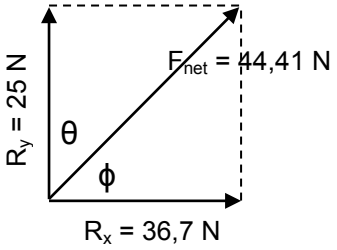
$F_{net}^2 = R_x^2 + F_y^2$
$= 36,7^2 + 25^2$ ✓
$= 44,41$ N ✓

Substitution marks awarded within the question even if calculations for F_x and R_x are wrong
Substitusiepunte toegeken in die vraag selfs indien berekeninge vir F_x en R_x verkeerd bereken word.

(5)

2.2.3 **POSITIVE MARKING FROM QUESTION 2.2.1 AND 2.2.2**
POSITIEWE NASIEN VANAF VRAAG 2.2.1 EN 2.2.2
OPTION 1/OPSIE 1

$\tan\theta = \frac{36,7}{25}$ ✓
$\theta = 55,74°$ ✓



OPTION 2/*OPSIE 2*

$\cos\theta = \frac{25}{44,41}$ ✓
$\theta = 55,74°$ ✓

OPTION 3/*OPSIE 3*

$\sin\theta = \frac{36,7}{44,41}$ ✓
$\theta = 55,74°$ ✓

Accept direction as /*Aanvaar rigting as*
$\phi = 90° - \theta$
$= 34,26°$ ✓✓

OPTION 4/*OPSIE 4*

$\cos\theta = \frac{25}{44,41}$ ✓
$\theta = 55,74°$ ✓

(2)
[10]

QUESTION 3/*VRAAG 3*

3.1 The force that opposes the motion of a moving object relative to a surface.✓✓
Die krag wat die beweging van 'n bewegende voorwerp relatief tot 'n oppervlak teenwerk.
[2 or/of 0] (2)

3.2 A body will remain in its state of rest or motion at constant velocity ✓unless a non-zero resultant/net force acts on it. ✓
'n Liggaam sal in sy toestand van rus of beweging teen konstante snelheid bly/volhard tensy 'n nie-nul resulterende/netto krag daarop inwerk.
[Penalise -1 if key words/phrase is omitted/
Penaliseer -1 indien sleutelwoorde/frase is uitgelaat] (2)

3.3 $F_x = 90\cos 50° \checkmark$ **OR/OF** $90\sin 40º$
$= 57,85$ N ✓ (2)

3.4 $N = F_g - F_y$ ✓
$N = 45(9,8)$ ✓ $- 90\sin 50°$ ✓
$N = 372,06$ N ✓ (4)

NOTE/NOTA:
Weight and the vertical component can be calculated separately, award one mark each even if the formula for N is incorrect
Gewig en vertikale komponent kan apart bereken word, een punt elk selfs indien die formule vir N verkeerd is.

3.5 **POSITIVE MARKING FROM QUESTION 3.3 and 3.4**
POSITIEWE NASIEN VANAF VRAAG 3.3 en 3.4

$f_k = \mu_k N$ ✓
$57,85$ ✓ $= \mu_k(372,06)$ ✓
$\mu_k = 0,16$ ✓ (4)

3.6 No ✓ The coefficient is dependent on the (nature of) the surfaces / type of material in contact. ✓
Nee. Die koëffisiënt is afhanklik van die (tipe) oppervlakke / soort materiaal in kontak. (2)
[16]

QUESTION 4/*VRAAG 4*

4.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force. The 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 inwerk, sal die voorwerp in die rigting van die krag versnel. Die versnelling is direk eweredig aan die netto krag en omgekeerd eweredig aan die massa van die voorwerp.
[Penalise -1 if key words/phrase is omitted/
Penaliseer -1 indien sleutelwoorde/frase is uitgelaat] (2)

4.2 Accept any set of coordinates from the graph, e.g.:
Aanvaar enige kombinasie van koördinate vanaf die grafiek, bv.:

$$\text{Gradient/}\textit{Helling} = \frac{2,5 - 0}{1,25 - 0} \quad \checkmark \quad \checkmark = 2 \checkmark$$

OR/*OF*

$$\text{Gradient/}\textit{Helling} = \frac{2,1 - 1,7}{1,05 - 0,85} \quad \checkmark \quad \checkmark = 2 \checkmark$$

(3)

4.3 **OPTION 1/*OPSIE 1***

$$\text{Gradient/}\textit{Helling} = \frac{1}{ma} = \frac{1}{F_{net}} = 2 \checkmark$$

$$F_{net} = \frac{1}{2} = 0,5 \text{ N} \checkmark \qquad \text{Accept/}\textit{Aanvaar}\ F_{net} = 0,5 \text{ N} \checkmark\checkmark$$

OPTION 2/*OPSIE 2*

$F_{net} = ma$
$= (1)(^1/_2)$ ✓
$= 0,5$ N ✓

Accept any coordinates from graph Aanvaar enige koördinate vanaf grafiek

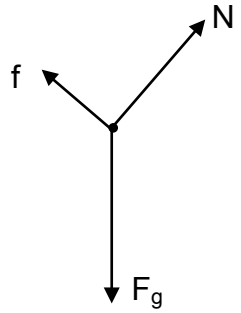
(2)

4.4 Acceleration is inversely proportional to the mass of an object (if the net force is kept constant) ✓✓
Accept: The inverse of acceleration is directly proportional to the mass of the object (if the net force is kept constant)
OR $\frac{1}{a} \alpha m$
Versnelling is omgekeerd eweredig aan die massa van die voorwerp (indien die netto krag konstant bly)
Aanvaar: Die omgekeerde van die versnelling is direk eweredig aan die massa van die voorwerp (indien die netto krag konstant bly)
OF $\frac{1}{a} \alpha m$

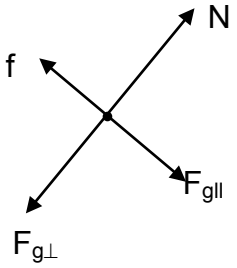
(2)
[9]

QUESTION 5/*VRAAG 5*

5.1



OR/OF



(3)

Accepted Labels/*Aanvaarbare Byskrifte*		**Mark/*Punt***
w	weight/F_G/F_g OR Both components for one mark *gewig/gravitasiekrag/swaartekrag OF* *Beide komponente vir een punt*	✓
N	Normal force/F_N *Normaalkrag/F_N*	✓
f	Friction/F_f *Wrywingskrag/F_f*	✓
	Any additional force: deduct 1 mark (maximum ⅔) *Enige addisionele krag: trek 1 punt af (maksimum ⅔)*	
	Omission of arrow heads: deduct 1 mark (maximum ⅔) *Pylpunte uitgelaat: trek 1 punt af (maksimum ⅔)*	
	Lines must touch object otherwise (maximum ⅔) *Lyne moet voorwerp raak anders (maksimum ⅔)*	
	Do not penalise if vectors are not to scale Moenie penaliseer indien vektore nie op skaal is nie	

5.2 $F_{net} = ma$ / $mg\sin\theta = ma$ ✓ Any one/*Enige een*

$25(9,8)\sin 15°$ ✓ $= 25a$ ✓

$a = 2,54\ m\cdot s^{-2}$ ✓

OR/*OF*

$25(9,8)\cos 75º$ ✓ $= 25a$ ✓

$a = 2,54\ m\cdot s^{-2}$ ✓

NOTE/*NOTA*:
Award one mark for the parallel component if calculated separately
Ken een punt toe indien die parallel komponent apart bereken is

(4)

5.3 Up the slope/*Teen die helling op* ✓ (1)

5.4 $F_{net} = ma$ / $F_{g//} + (-f) = ma$ ✓ Any one/*Enige een*

$25(9,8)\sin 15° - f$ ✓ $= 25(-1,2)$ ✓

$f = 93,41$ N ✓

OR/*OF*

$25(9,8)\cos 75° - f$ ✓ $= 25(-1,2)$ ✓

$f = 93,41$ N ✓

Note/*Let wel:*

Accept if calculation is done with direction up the slope as positive
Aanvaar indien berekening gedoen is met rigting teen die helling op as positief

(4)

[12]

QUESTION 6/*VRAAG 6*

6.1 Each particle in the universe attracts every other particle with a gravitational force that is directly proportional to the product of their masses ✓and inversely proportional to the square of the distance between their centres. ✓
Elke deeltjie in die heelal trek elke ander deeltjie aan met 'n krag wat direk eweredig is aan die produk van hulle massas en omgekeerd eweredig is aan die kwadraat van die afstand tussen hulle middelpunte.
[Penalise -1 if key words/phrase is omitted/
Penaliseer -1 indien sleutelwoorde/frase is uitgelaat] (2)

6.2 $F = \frac{Gm_1m_2}{r^2}$ ✓

$3\ 338$ ✓ $= \frac{\left(6{,}67 \times 10^{-11}\right)\left(6{,}39 \times 10^{23}\right)(m)}{\left(3\ 390 \times 10^{3}\right)^2}$ ✓

$m = 900$ kg ✓

OR/*OF*

$g = \frac{Gm}{r^2}$ ✓

$g = \frac{\left(6{,}67 \times 10^{-11}\right)\left(6{,}39 \times 10^{23}\right)}{\left(3\ 390 \times 10^{3}\right)^2}$ ✓

$g = 3{,}71\ m \cdot s^{-2}$

$F_g = mg$
$3\ 338 = m(3{,}71)$ ✓
$m = 900$ kg ✓ (899,73 kg) (4)

6.3 **POSITIVE MARKING FROM QUESTION 6.2**
POSITIEWE NASIEN VANAF VRAAG 6.2

$w = mg$
$= 900(9{,}8)$ ✓
$= 8\ 820$ N ✓ (2)
[8]

QUESTION 7/*VRAAG 7*

7.1 Refraction/*Refraksie* ✓ (1)

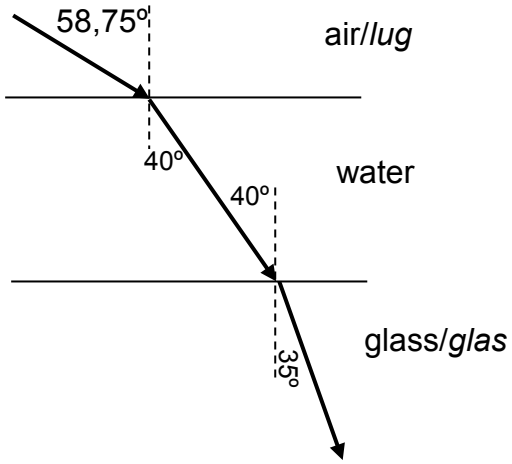
7.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$n_i \sin \theta_i = n_r \sin \theta_r$ ✓ $1\sin \theta_i = 1{,}33\sin 40^o$ ✓ $\theta_i = 58{,}75°$	$n = \frac{\sin \theta_i}{\sin \theta_r}$ ✓ $1{,}33 = \frac{\sin \theta_i}{\sin 40°}$ ✓ $\sin \theta_i = 1{,}33\sin 40^o$ $\theta_i = 58{,}75°$
Therefore the angle between ray and surface/*Daarom is die hoek tussen invallende straal en oppervlak* $\theta = \underline{90° - 58{,}75°}$ ✓ $= 31{,}25°$✓	

(4)

7.3 $n_i \sin\theta_i = n_r \sin\theta_r$
$1{,}33\sin 40°$ ✓ $= n_r \sin 35^o$ ✓
$n_r = 1{,}49$ ✓ (3)

7.4



Allocation of marks/*Toekenning van punte*: (5)

Light ray bends towards normal in water *Ligstraal breek na die normaal in water*	✓
Light ray bends further towards normal in glass *Ligstraal breek nog meer na die normaal in glas*	✓
Angle of incidence 58,75º shown (OR 31,25º) *Invalshoek 58,75º aangedui (OF 31,25º)*	✓
Angles in water (40º) *Hoeke in water (40º)*	✓
Angle in glass (35º) *Hoeke in glas (35º)*	✓
If normal lines are not indicated, penalise with one mark *Indien normaal lyne nie aangedui is nie, penaliseer met een punt*	
If arrows are omitted, penalise -1 (maximum $^4/_5$) Indien pylpunte weggelaat word, penaliseer -1 (maks $^4/_5$)	

7.5 $n = \frac{c}{v}$ ✓

$1,5 = \frac{3 \times 10^8}{v}$ ✓

$v = 2 \times 10^8 \text{ m·s}^{-1}$ ✓ (3)

7.6 No/*Nee* ✓ (1)

[17]

QUESTION 8/*VRAAG 8*

8.1 Diffraction is the ability of a <u>wave to spread out in wave fronts</u> ✓ as the wave <u>passes through a small aperture or around a sharp edge</u>. ✓
Diffraksie is die vermoë van 'n <u>golf om uit te sprei in golffronte</u> soos wat die golf <u>deur 'n klein opening of om 'n skerp rand/kant beweeg</u>. (2)

8.2

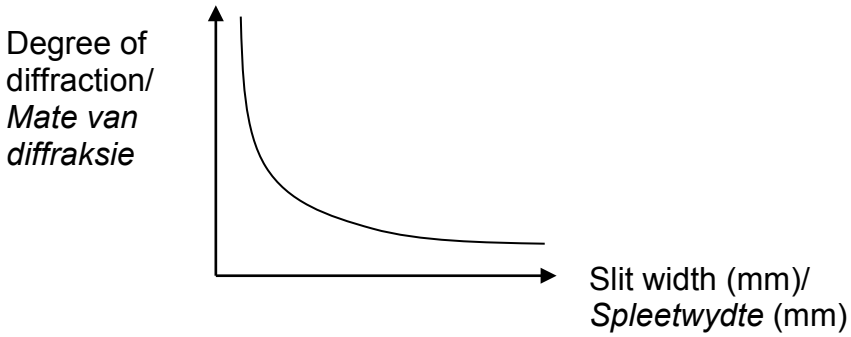
Criteria for investigative question/*Riglyne vir ondersoekende vraag*	
The dependent and independent variables are stated correctly. *Die afhanklike en onafhanklike veranderlikes korrek genoem.*	✓
Ask the relationship between the dependent and independent variables in a question, not as a statement. The question may not be written in a way that the answer is yes or no. *Vra die verband tussen die afhanklike en onafhanklike veranderlike as 'n vraag, nie 'n stelling nie. Die vraag mag nie op so 'n manier geformuleer word dat die antwoord ja of nee is nie.*	✓
Dependent variable/*Afhanklike veranderlike*: degree of diffraction/*mate van diffraksie* Independent variable/*Onafhanklike veranderlike*: wavelength/*golflengte*	

Examples/*Voorbeelde*:
What is the relationship between the wavelength of a light ray and the degree of diffraction?
Wat is die verband tussen die golflengte van 'n ligstraal en die mate van diffraksie?
OR/*OF*
How does a change in wavelength affect the degree of diffraction?
Hoe beïnvloed 'n verandering in golflengte die mate van diffraksie? (2)

8.3 Degree of diffraction is <u>directly proportional</u> to the wavelength. ✓✓
Mate van diffraksie is direk eweredig aan die golflengte.
OR/*OF*
Degree of diffraction α λ. ✓✓
Mate van diffraksie α λ. (2)

8.4 Red/*Rooi* ✓ (1)

8.5 Line should indicate inverse proportionality ✓✓
Lyn moet omgekeerde eweredigheid aandui (2)

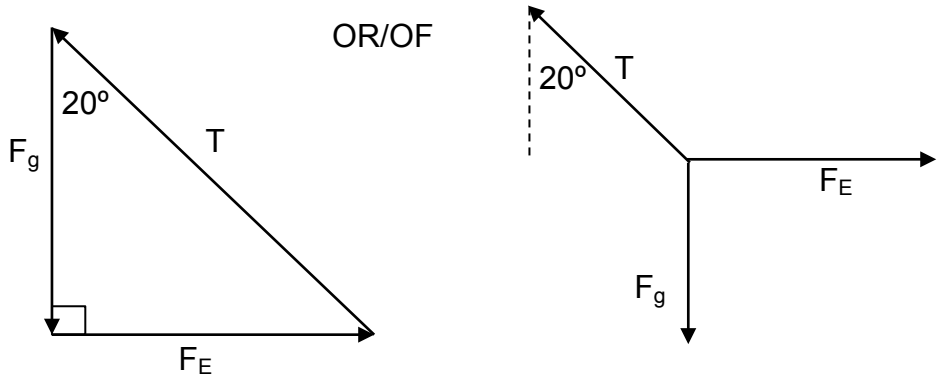


[9]

QUESTION 9/*VRAAG 9*

9.1 The magnitude of the electrostatic force exerted by two point charges on each other is directly proportional to the product of the (magnitudes of the) charges ✓ and inversely proportional to the square of the distance between them. ✓
Die grootte van die elektrostatiese krag wat deur twee puntladings op mekaar uitgeoefen word, is direk eweredig aan die produk van die (groottes van die) ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.
[Penalise -1 if key words/phrase is omitted/
Penaliseer -1 indien sleutelwoorde/frase is uitgelaat]
NOTE: If learners refers to masses, no marks awarded
NOTA: Indien leerder na massa verwys, geen punte (2)

9.2



Accepted Labels/*Aanvaarbare Byskrifte*		**Mark/*Punt***
w	weight/F_G/F_g *gewig/gravitasiekrag/swaartekrag*	✓
T	Tension/F_T *Spanning/F_T*	✓
F_E	Electrostatic force *Elektrostatiese krag*	✓
	One angle indicated *Een hoek aangedui*	✓

(4)

9.3 **OPTION 1/*OPSIE 1***

If F_A and F_B were used/*Indien F_A en F_B gebruik word*

$F = \frac{kQ_1Q_2}{r^2}$ ✓

$= \frac{(9 \times 10^9)(8 \times 10^{-9})(7 \times 10^{-9})}{0,03^2}$ ✓ ✓

$= 5,60 \times 10^{-4}$ N ✓

NOTE/NOTA:
Due to information given in the question, accept all possible options
As gevolg van die inligting in die vraag gegee, aanvaar alle moontlike opsies

OPTION 2/*OPSIE 2*

If F_g and F_E were used/*Indien F_g en F_E gebruik word*

$F_g = mg$

$= (0,2 \times 10^{-3})(9,8)$ ✓

$= 1,96 \times 10^{-3}$ N ✓

$F_E = (1,96 \times 10^{-3})\tan 70°$ ✓

$= 7,13 \times 10^{-4}$ N ✓

OPTION 3/*OPSIE 3*

If F_g and F_E were used/*Indien F_g en F_E gebruik word*

$F_g = mg$

$= (0,2 \times 10^{-3})(9,8)$ ✓

$= 1,96 \times 10^{-3}$ N

$\frac{F_E}{\sin 20°} = \frac{F_g}{\sin 70°}$

✓ $\frac{F_E}{\sin 20°} = \frac{(1,96 \times 10^{-3})}{\sin 70°}$ ✓

$F_E = 7,13 \times 10^{-4}$ N ✓ (4)

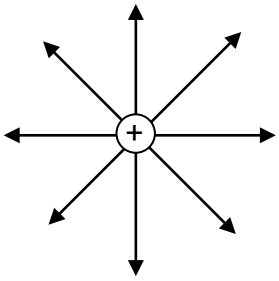
9.4 **POSITIVE MARKING FROM QUESTION 9.3**
POSITIEWE NASIEN VANAF VRAAG 9.3

OPTION 1/*OPSIE 1* Using F_g and F_E/*Gebruik F_g en F_E* $F_g = mg$ $= (0,2 \times 10^{-3})(9,8)$ ✓ $= 1,96 \times 10^{-3}$ N $T^2 = (1,96 \times 10^{-3})^2 + (5,6 \times 10^{-4})^2$ ✓ $T = 2,04 \times 10^{-3}$ N ✓	**OPTION 2/*OPSIE 2*** Using F_g and angle/*Gebruik F_g en hoek* $T = \frac{F_g}{\sin 70°}$ $T = \frac{1,96 \times 10^{-3}}{\sin 70°}$ ✓ ✓ $T = 2,09 \times 10^{-3}$ N ✓
OPTION 3/*OPSIE 3* Using F_E and angle/*Gebruik F_E en hoek* $T = \frac{F_E}{\cos 70°}$ $T = \frac{5,6 \times 10^{-4}}{\cos 70°}$ ✓ ✓ $T = 1,64 \times 10^{-3}$ N ✓	NOTE/*NOTA*: Due to information given in the question, accept all possible options *As gevolg van die inligting in die vraag gegee, aanvaar alle moontlike opsies*

(3)
[13]

QUESTION 10/*VRAAG 10*

10.1



Criteria for marking/*Nasienkriteria*	
Shape of the field (minimum of 4 field lines) *Vorm van veld (minimum van 4 veldlyne)*	✓
Direction of the field *Rigting van veld*	✓
Lines don't touch charge/lines cross etc. (maximum ½) *Lyne raak nie lading/lyne kruis ens. (maksimum ½)*	

(2)

10.2.1 16 : 1 ✓ (1)

10.2.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$E_P : E_T$ 16 : 1 ✓ Because/*Omdat* $E \alpha \frac{1}{r^2}$ ✓ $r_P : r_T$ 1 : 4 ✓ r : r + 3 mm r = 1 mm ✓ (0,001 m)	$E_p = \frac{kQ}{r^2}$ ✓ $4 \times 10^6 = \frac{9 \times 10^9 Q}{r^2}$ ✓ $9 \times 10^9 Q = (4 \times 10^6) r^2$ …(1) $E_T = \frac{kQ}{r^2}$ $2{,}5 \times 10^5 = \frac{9 \times 10^9 Q}{(r + 0{,}003)^2}$ ✓ $9 \times 10^9 Q = (2{,}5 \times 10^5)(r + 0.003)^2$ …(2) Equation/*Vergelyking* (1) = (2) $(4 \times 10^6) r^2 = (2{,}5 \times 10^5)(r + 0{,}003)^2$ $16r^2 = r^2 + 0{,}006r + 9 \times 10^{-6}$ r = 1 mm ✓ (0,001 m)

(4)

10.2.3 **POSITIVE MARKING FROM QUESTION 10.2.2**
POSITIEWE NASIEN VANAF VRAAG 10.2.2

$E_p = \frac{kQ}{r^2}$

$4 \times 10^6 = \frac{9 \times 10^9 Q}{(0{,}001)^2}$ ✓

$Q = 4{,}44 \times 10^{-10}$ C ✓

OR/*OF*

$E_T = \frac{kQ}{r^2}$

$2{,}5 \times 10^5 = \frac{9 \times 10^9 Q}{(0{,}004)^2}$ ✓

$Q = 4{,}44 \times 10^{-10}$ C ✓

(2)
[9]

QUESTION 11/*VRAAG 11*

11.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓
Die grootte van die geïnduseerde emk oor die punte van 'n geleier is direk eweredig aan die tempo van verandering van die magnetiese vloedkoppeling met die geleier.
[2 or/of 0] (2)

11.2 $\varepsilon = \frac{-N\Delta\phi}{\Delta t}$ ✓
$7 = \frac{-400\,\Delta\phi}{0,08}$ ✓
$\Delta\Phi$ = - 1,4 x 10^{-3} Wb ✓ (-0,0014) (3)

11.3 **POSITIVE MARKING FROM QUESTION 11.2**
POSITIEWE NASIEN VANAF VRAAG 11.2

$\Delta\Phi = AB(\cos\theta_f - \cos\theta_i)$
-0,0014 ✓ = $(0,03)^2 B(\underline{\cos 45^\circ - \cos 0^\circ})$ ✓ ✓
B = 5,31 T ✓ (4)

11.4 Increase/*Toeneem* ✓ (1)

11.5 $\varepsilon \alpha \frac{1}{\Delta t}$ ✓
OR/*OF*
Emf is inversely proportional to time.
Emk is omgekeerd eweredig aan tyd.
If the time decreases, the emf will increase.
Indien die tyd verminder, sal die emk toeneem. (1)

11.6 North/*Noord* ✓ (1)

11.7 From A to B/*Van A na B* ✓ (1)
[13]

QUESTION 12/*VRAAG 12*

12.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $\frac{1}{4,8} = \frac{1}{4R} + \frac{1}{6R}$ ✓ R = 2 Ω ✓	$R_p = \frac{R_1 R_2}{R_1 + R_2}$ ✓ $4,8 = \frac{4R \times 6R}{4R + 6R}$ ✓ R = 2 Ω ✓

(3)

12.2

POSITIVE MARKING FROM QUESTION 12.1
POSITIEWE NASIEN VANAF VRAAG 12.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$V_{4R} = IR_{4R}$ = 1,8(4)(2) ✓ = 14,4 V $I_{6R} = \frac{V}{R_{6R}}$ $I_{6R} = \frac{14,4}{12}$ ✓ = 1,2 A $V_{2R} = IR$ ✓ = 1,2(4) ✓ = 4,8 V ✓	$V_{4R} = IR_{4R}$ = 1,8(4)(2) ✓ = 14,4 V $I_T = \frac{V}{R_T}$ $I_T = \frac{14,4}{4,8}$ = 3 A I_{2R} = 3 – 1,8 ✓ = 1,2 A $V_{2R} = IR$ ✓ = 1,2(4) ✓ = 4,8 V ✓
OPTION 3/*OPSIE 3*	**OPTION 4/*OPSIE 4***
$R_1 : R_2$ 4 : 6 $I_1 : I_2$ 6 : 4 $\frac{6}{10}$ x I = 1,8 A ✓ I_T = 3 A I_{2R} = 3 – 1,8 ✓ = 1,2 A $V_{2R} = IR$ ✓ = 1,2(4) ✓ = 4,8 V ✓	$V_{4R} = IR_{4R}$ = 1,8(4)(2) ✓ = 14,4 V R : 2R : 3R 1 : 2 : 3 $V_R : V_{2R} : V_{3R}$ 1 : 2 : 3 ✓ $V_{2R} = \frac{2}{6}$ x 14,4 ✓ = 4,8 V ✓

(5)

12.3

POSITIVE MARKING FROM QUESTION 12.1 AND 12.2 *POSITIEWE NASIEN VANAF VRAAG 12.1 EN 12.2*		
OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***	**OPTION 3/*OPSIE 3***
$W = I^2R\Delta t$ ✓ $= 1,8^2(8)(120)$ ✓ $= 1036,8$ J ✓	$W = VI\Delta t$ ✓ $= (14,4)(1,8)(120)$ ✓ $= 3110,4$ J ✓	$W = \frac{V^2\Delta t}{R}$ ✓ $W = \frac{(14,4)^2(120)}{8}$ ✓ $W = 3110,4$ J ✓

(3)

12.4 Decrease/*Neem af* ✓ (1)

12.5 The ammeter has such a <u>low resistance</u> ✓
It short circuits the parallel part and <u>all current flows through the ammeter</u>. ✓
OR
The ammeter short circuits the resistors ✓
No current flows through resistor 2R ✓

Die ammeter het so 'n <u>lae weerstand</u>
Dit kortsluit die parallelgedeelte en <u>al die stroom vloei deur die ammeter</u>.
OF
Die ammeter kortsluit die resistors
Daar vloei geen stroom deur resistor 2R nie (2)
[14]

TOTAL/*TOTAAL*: 150