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 2019

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 13 pages.
Hierdie nasienriglyne bestaan uit 13 bladsye.

approved for Ant. mod DBE

Approved Examiner
12/11/19

QUESTION 1/*VRAAG 1*

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

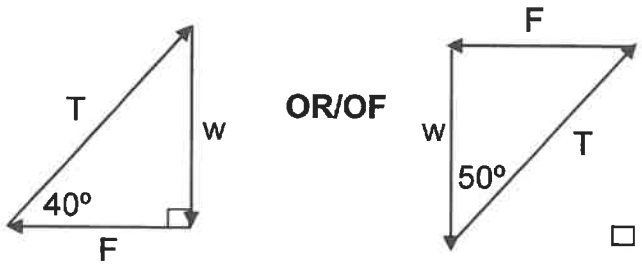
[20]

QUESTION 2/*VRAAG 2*

2.1 $F_{net} = 0$ / $\Sigma F = 0$ / Object in equilibrium/Resultant is zero ✓✓
$F_{net} = 0$ / $\Sigma F = 0$ / Voorwerp in ewewig / Resultante is nul. (2)

2.2 $w = mg$
$= (15)(9,8)$ ✓
$= 147$ N ✓ (2)

2.3



Accepted Labels/*Aanvaarbare byskrifte*		Mark/*Punt*
w	weight/ gravitational force/ F_g/147 N *gewig/gravitasiekrag/swaartekrag*	✓
F	Applied force/F/F_A/*Toegepaste krag*	✓
T	Tension/F_T/*Spanning*	✓
	Any angle correctly shown (40° or 50° or 90°) *Enige hoek korrek aangedui (40° of 50° of 90°)*	✓
	Triangle not closed/*Driehoek nie geslote* nie: *Max./maks.* $^3/_4$	

(4)

2.4 **POSITIVE MARKING FROM QUESTION 2.2 AND 2.3**
POSITIEWE NASIEN VANAF VRAAG 2.2 EN 2.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$T = \frac{w}{\sin 40°}$	$T = \frac{w}{\cos 50°}$
$= \frac{147}{\sin 40°}$ ✓	$= \frac{147}{\cos 50°}$ ✓
$= 228,69$ N ✓	$= 228,69$ N ✓

(2)

2.5 (The two forces) act on the same object (the billboard). ✓
(For the Newton's third law, the forces act on different objects.)

(Die twee kragte) werk op dieselfde voorwerp (die bord) in.
(Vir Newton se derde wet moet die kragte op verskillende voorwerpe inwerk.) (1)
[11]

QUESTION 3/*VRAAG 3*

3.1

Marking guidelines/*Nasienriglyne*
If any of the underlined key words/phrases in context are omitted: minus 1 mark
Indien enige van die onderstreepte sleutelwoorde/frases in konteks uitgelaat is: minus 1 punt

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 volhard tensy 'n nie-nul resulterende/netto krag daarop inwerk. (2)

3.

Accepted Labels/*Aanvaarbare byskrifte*		
w	weight/gravitational force / F_G/F_g *gewig/gravitasiekrag/swaartekrag*	✓
N	Normal force/F_N/*Normaalkrag*/F_N	✓
F	Force applied/ F /F_A/*Toegepaste krag*	✓
Any additional forces/*Enige addisionele kragte: Max./maks.* $^2/_3$		
If arrows are omitted / *Indien pyltjies uitgelaat is minus 1*		
If arrows do NOT touch object/*Indien pyle NIE voorwerp raak NIE: Max./maks.* $^2/_3$		

(3)

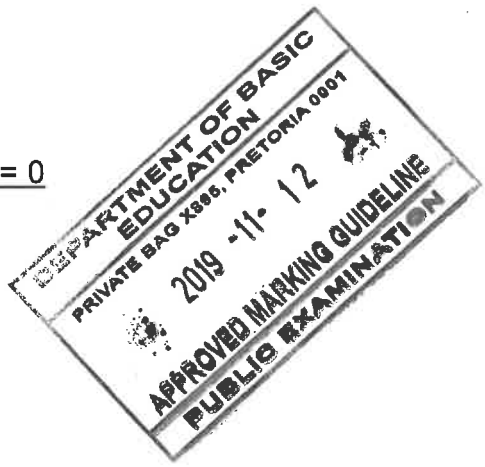
3.3.

3.3.1 $w_\perp = mg\cos\theta$ ✓
$= (4)(9,8)\cos 30°$ ✓ / $(4)(9,8)\sin 60°$
$= 33,95$ N ✓ (3)

3.3.2 $F_{net} = ma$
$F - w_{||} = 0$ } ✓ Any one/*Enige een*
$F - (4)(9,8)\sin 30° = 0$ ✓ / $F - (4)(9,8)\cos 60° = 0$
$F = 19,6$ N ✓ (3)

3.4

3.4.1 $F_{net} = ma$
$F - f_k - Fg_{//} = ma$ } ✓ Any one/*Enige een*
$25 - f_k - 4(9,8)\sin 30°$ ✓ $= 4(0,2)$ ✓
$f_k = 4,6$ N ✓ (4)



3.4.2 **POSITIVE MARKING FROM QUESTION 3.3.1 and 3.4.1.**
POSITIEWE NASIEN VANAF VRAAG 3.3.1 en 3.4.1.
$f_k = \mu_k N$ ✓
$4,6 = \mu_k(33,95)$ ✓
$\mu_k = 0,14$ ✓ (0,135) (3)

3.5

3.5.1 Same in magnitude ✓ and same in direction ✓
Dieselfde grootte en dieselfde rigting (2)

3.5.2 Increase in magnitude ✓ and opposite direction ✓
Toeneem in grootte en teenoorgestelde rigting (2)

3.5.3 Same in magnitude ✓ and opposite direction ✓
Dieselfde grootte en teenoorgestelde rigting (2)
[24]

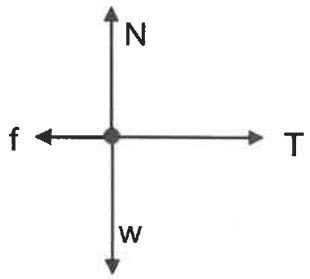
QUESTION 4/*VRAAG 4*

4.1

Marking guidelines/*Nasienriglyne*
If any of the underlined key words/phrases in context are omitted: minus 1 mark *Indien enige van die onderstreepte sleutelwoorde/frases in konteks uitgelaat is: minus 1 punt*

When a resultant/net force act on an object, the object will accelerate in the direction of the force at an acceleration directly proportional to the 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 teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp. (2)

4.2



(4)

Accepted Labels/*Aanvaarbare byskrifte*		
w	Weight/gravitational force / F_g / 58,8 N/ *gewig / gravitasiekrag / swaartekrag*	✓
N	Normal force/F_N/*Normaalkrag*/F_N	✓
T	Tension/*Spanning*	✓
f	Friction/F_f/*Wrywing*	✓
Any additional force/*Enige addisionele krag: Max./maks.* $^3/_4$		
If arrows are omitted / *Indien pyltjies uitgelaat is minus 1*		
If arrows do NOT touch object/*Indien pyle NIE voorwerp raak NIE: Max./maks.* $^3/_4$		

(4)

4.3 **6 kg block/*blok:***

$F_{net} = ma$ ✓
$T - f_k = ma$
$T - 24$ ✓ $= 6a$ ✓
$T = 6a + 24$ .....(1)

3 kg block/*blok:*

$F_{net} = ma$
$F_g - T = ma$
$(3)(9,8) - T$ ✓ $= 3a$ .....(2)

Substitute (1) into (2)/*Vervang (1) in (2):*
$29,4 - (6a + 24)$ ✓$= 3a$
$a = 0,6\ m{\cdot}s^{-2}$ ✓

Marking guidelines/*Nasienriglyne*
- Formule/*Formule:* $F_{net} = ma$ ✓
- $T - F_k = T - 24$ ✓
- $F_g - T = 3(9,8) - T$ ✓
- 3a **OR/*OF*** 6a ✓
- Substitute one into the other/*Stel twee vergelykings gelyk aan mekaar of vervang die een in die ander.* ✓
- Final answer/*Finale antwoord*: $0,6\ m{\cdot}s^{-2}$ ✓

(6)

4.4 The velocity changes with $0,6\ m{\cdot}s^{-1}$ during every second. ✓✓
Die snelheid verander met $0,6\ m{\cdot}s^{-1}$ gedurende elke sekonde (2)
[14]

QUESTION 5/*VRAAG 5*

5.1 g is directly proportional to $\frac{M}{R^2}$. ✓

g is direk eweredig aan $\frac{M}{R^2}$.

Accept/Aanvaar

As/*soos* $\frac{M}{R^2}$ increases/*toeneem*, g increases /*neem g toe* (1)

5.2 Any two points from the graph can be used for example:
Enige twee punte vanaf die grafiek kan gebruik word byvoorbeeld:

Gradient = $\frac{9 - 0}{1,35 \times 10^{11} - 0}$ ✓✓
$= 6,67 \times 10^{-11}$ ✓

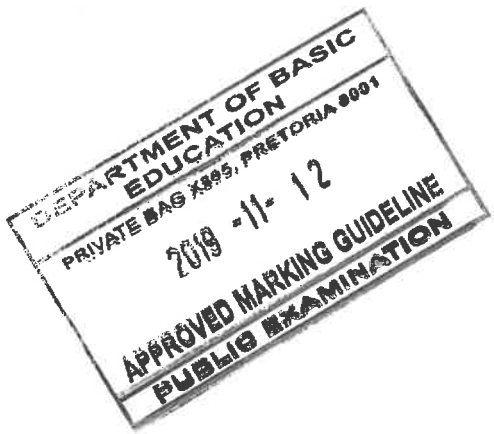
OR/*OF*

Gradient = $\frac{10 - 0}{1,5 \times 10^{11} - 0}$
$= 6,67 \times 10^{-11}$

OR/*OF*

Gradient = $\frac{20 - 0}{3 \times 10^{11}}$
$= 6,67 \times 10^{-11}$

Range/*Gebied* $(6,5 \times 10^{-11} - 6,67 \times 10^{-11})$ (3)



5.3 G / (Universal) Gravitational constant ✓
G / (Universele) Gravitasie konstante (1)

5.4 $1,35 \times 10^{11}\ (kg{\cdot}m^{-2})$ ✓✓
Range/*Gebied*: $1,34 - 1,36 \times 10^{11}\ (kg{\cdot}m^{-2})$ (2)

5.5 **POSITIVE MARKING FROM QUESTION 5.4.**
POSITIEWE NASIEN VANAF VRAAG 5.4.

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\frac{M}{R^2} = 1,35 \times 10^{11}$ $\frac{M}{(2,54\times10^7)^2} = 1,35 \times 10^{11}$ ✓ $M = 8,71 \times 10^{25}$ kg ✓ $(8,7097 \times 10^{25}$ kg)	$g = \frac{GM}{R^2}$ $9 = \frac{6,67\times10^{-11}M}{(2,54\times10^7)^2}$ ✓ $M = 8,71 \times 10^{25}$ kg ✓ $(8,705 \times 10^{25}$ kg)

(2)
[9]

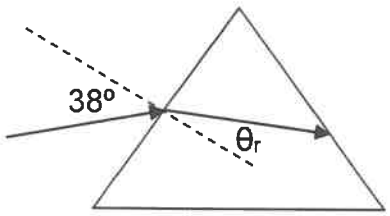
QUESTION 6/*VRAAG 6*

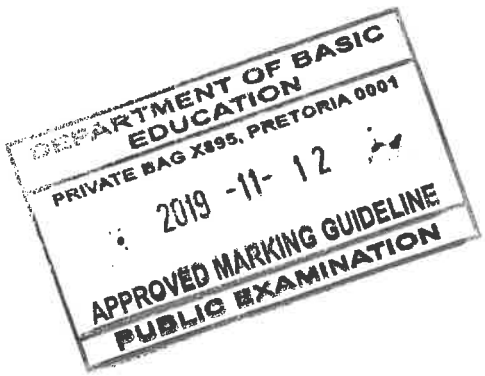
6.1 The angle between the normal to a surface and the refracted light ray. ✓✓
Die hoek tussen die normaal op die oppervlak en die gebreekte ligstraal. (2)

6.2 $n_i \sin\theta_i = n_r \sin\theta_r$ ✓
$1\sin 38° = 1,5\sin\theta_r$ ✓
$\theta_r = 24,23°$ ✓ (3)

6.3

Marking criteria/Nasienriglyne:
Light ray bends towards normal./ *Ligstraal breek na normaal toe* ✓
Angle of refraction correctly shown./ *Brekingshoek korrek aangetoon.*✓





(2)

6.4 $n_i \sin\theta_i = n_r \sin\theta r$
$1,5\sin 36° = n_r \sin 41°$ ✓
$n_r = 1,34$ ✓ (2)

6.5 Smaller than ✓ *Kleiner as* (1)

6.6 The refractive index of the glas prism is less than the refractive index of prism Q ✓
For a constant speed of light, c, the refractive index is inversely proportional to the speed of light in the medium (v). ✓
Therefore, the higher the refractive index, the lower the speed (v).

Die brekingsindeks van die glasprisma is minder as die brekingsindeks van prisma Q
Vir 'n konstante spoed van lig, c,is die brekingsindeks omgekeerd eweredig aan die spoed van lig in die medium (v).
Dus, hoe groeter die brekingsindeks, hoe kleiner die spoed (v). (2)

6.7 The angle of incidence when the angle of refraction is 90°. ✓✓
Die invalshoek wanneer die brekingshoek gelyk is aan 90°. (2)

6.8 Total internal reflection occurs ✓
because the light ray passes from an optical denser to less dense medium ✓
and the angle of incidence is greater than the critical angle. ✓
Totale interne weerkaatsing vind plaas
omdat die ligstraal van 'n opties meer dig na minder digte medium beweeg
en die invalshoek is groter as die grenshoek. (3)
[17]

QUESTION 7/*VRAAG 7*

7.1

Marking guidelines/*Nasienriglyne*
If any of the underlined key words/phrases in context are omitted: minus 1 mark
Indien enige van die onderstreepte sleutelwoorde/frases in konteks uitgelaat is: minus 1 punt

A wave front is an imaginary line joining the points on a wave that are in phase. ✓✓
'n Golffront is 'n denkbeeldige lyn wat punte op 'n golf, wat in fase is, verbind. (2)

7.2 Wave nature ✓
Golfgeaardheid (1)

7.3.1 Slit width /distance between slit and screen ✓
Spleetwydte/ afstand tussen spleet en skerm (1)

7.3.2 Colour of light/Wavelength of light /frequency✓
Kleur van lig/Golflengte van lig/frekwensie (1)

7.4 Width of central band /pattern increases from blue to red✓
Wavelength increases (from blue to red light.) ✓

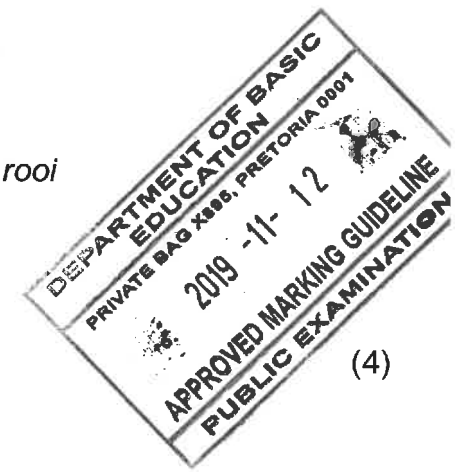
(Degree of) diffraction $\alpha \frac{\lambda}{w}$

For the same slit width, ✓
degree of diffraction increases (with wavelength.) ✓

Breedte van sentrale band/patroon neem toe vanaf blou na rooi
Golflengte neem toe (van blou na rooi lig.)

(Mate van) diffraksie $\alpha \frac{\lambda}{w}$

Vir dieselfde spleetwydte,
sal mate van diffraksie toeneem (met langer golflengte.) (4)



7.5 Increases ✓
(Degree of) diffraction is inversely proportional to slit width. ✓
OR
If slit width decreases, degree of diffraction increases.

Toeneem
(Mate van) diffraksie is omgekeerd eweredig aan spleetwydte
OF
As spleetwydte afneem, neem mate van diffraksie toe (2)
[11]

QUESTION 8/*VRAAG 8*

8.1

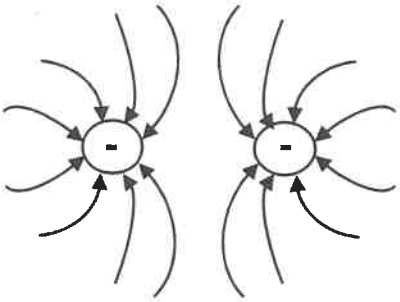
Marking guidelines/*Nasienriglyne*
If any of the underlined key words/phrases are in context omitted: minus 1 mark. If masses are mentioned (0/2)
Indien enige van die onderstreepte sleutelwoorde/frases in konteks uitgelaat is: minus 1 punt. Indien massas genoem word (0/2)

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 grootte van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. (2)

8.2
$$F = \frac{kQ_1Q_2}{r^2} \checkmark$$
$$= \frac{(9\times10^{9})(4{,}2\times10^{-9})(6{,}8\times10^{-9})}{(0{,}3)^2} \checkmark$$
$$= 2{,}86 \times 10^{-6}\text{N} \checkmark$$ (3)

8.3
$$Q = \frac{Q_1 + Q_2}{2}$$
$$= \frac{4{,}2\times10^{-9} + (-6{,}8\times10^{-9})}{2} \checkmark$$
$$= -1{,}3 \times 10^{-9}\,\text{C} \checkmark$$ (3)

8.4 **POSITIVE MARKING FROM QUESTION 8.3.**
POSITIEWE NASIEN VANAF VRAAG 8.3.



Criteria for marking/*Nasienkriteria*	
Shape of the field *Vorm van veld*	✓
Direction of the field *Rigting van veld*	✓

NOTE/LET WEL:
IF lines don't touch charges or lines cross etc.
INDIEN l*yne nie die ladings raak nie of lyne kruis ens.* *Max./maks.* ½

(2)

8.5 **POSITIVE MARKING FROM QUESTION 8.3.**
POSITIEWE NASIEN VANAF VRAAG 8.3.

$E = \frac{kQ}{r^2}$ ✓

$= \frac{(9\times10^{9})(1{,}3\times10^{-9})}{0{,}4^2}$ ✓

$= 73{,}125\ N\cdot C^{-1}$ $(73{,}13\ N\cdot C^{-1})$

$E = \frac{(9\times10^{9})(1{,}3\times10^{-9})}{0{,}1^2}$ ✓

$= 1\ 170\ N\cdot C^{-1}$

$E_{net} = 73{,}125 + 1\ 170$ ✓

$= 1\ 243{,}125\ N\cdot C^{-1}$ ✓ $(1\ 243{,}13\ N\cdot C^{-1})$

(5)
[15]

QUESTION 9/*VRAAG 9*

9.1 Faraday's law (of electromagnetic induction)✓
Faraday se wet (van elektromagnetiese induksie) (1)

9.2.1 $\Delta\Phi = \Delta BA\cos\theta$ ✓
$= (2,5)(2,8 \times 10^{-3})(\cos 90^\circ - \cos 0^\circ)$ ✓
$= -0,007$ Wb ✓ (3)

There was a typing error of area it was supposed to be squared, so teachers should credit learners who squared the area first and work with it.

Accept/Aanvaar
$\Delta\Phi = \Delta BA\cos\theta$ ✓
$= (2,5)(7,84 \times 10^{-6})(\cos 90^\circ - \cos 0^\circ)$ ✓
$= -1,96 \times 10^{-5}$ Wb ✓

9.2.2 **POSITIVE MARKING FROM QUESTION 9.2.1.**
POSITIEWE NASIEN VANAF VRAAG 9.2.1.

$\varepsilon = -\frac{N\Delta\phi}{\Delta t}$ ✓

$3,5 = -\frac{200(-0,007)}{\Delta t}$ ✓

$\Delta t = 0,4$ s ✓

Accept / Aanvaar

$\varepsilon = -\frac{N\Delta\phi}{\Delta t}$ ✓

$3,5 = -\frac{200(-1,96 \times 10^{-5})}{\Delta t}$ ✓

$\Delta t = 1,12 \times 10^{-3}$ s ✓ (3)

9.3 Emf will be halve/two times smaller ✓
Emf is directly proportional to number of windings ✓

Emk sal die helfte wees/twee keer kleiner
Emk is direk eweredig aan die aantal windings (2)
[9]

QUESTION 10/*VRAAG 10*

10.1

Marking guidelines/*Nasienriglyne*
If any of the underlined key words/phrases in context are omitted: minus 1 mark
Indien enige van die onderstreepte sleutelwoorde/frases in konteks uitgelaat is: minus 1 punt

The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature. ✓✓
Die potensiaalverskil oor die ente van 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur. (2)

10.2 More resistors connected in parallel. ✓
Therefore, the effective resistance of the circuit decreases. ✓

Meer resistors verbind in parallel.
Daarom neem die effektiewe weerstand van die stroombaan af. (2)

10.3

10.3.1 Any set of values form the table can be used for example:
Enige stel waardes vanaf die tabel kan gebruik word byvoorbeeld:

$R = \frac{V}{I}$ ✓
$= \frac{4,8}{2,4}$ ✓
$= 2\ \Omega$ ✓ (3)

10.3.2

POSITIVE MARKING FROM QUESTION 10.3.1. *POSITIEWE NASIEN VANAF VRAAG 10.3.1.*		
OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***	**OPTION 3/*OPSIE 3***
Switched 1 closed: *Skakelaar 1 gesluit:*	Switches 1 and 2 closed: *Skakelaar 1 en 2 gesluit:*	Switches 1, 2 and 3 closed *Skakelaar 1, 2 en 3 gesluit*
$R_{tot} = 3 + 2$ ✓ $= 5\ \Omega$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ $= \frac{1}{3} + \frac{1}{6}$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ $= \frac{1}{3} + \frac{1}{6} + \frac{1}{4}$
$V = IR$ ✓ $= (2,4)(5)$ ✓ $= 12\ V$ ✓	$R_p = 2\ \Omega$ $R_{tot} = 2 + 2$ ✓ $= 4\ \Omega$ $V = IR$ ✓ $= (3)(4)$ ✓ $= 12\ V$ ✓	$R_p = 1,33\ \Omega$ $R_{tot} = 1,33 + 2$ ✓ $= 3,33\ \Omega$ $V = IR_{tot}$ ✓ $= (3,6)(3,33)$ ✓ $= 12\ V$ ✓

(4)

10.4 Power is the rate at which work is done or energy is transferred: ✓✓
Drywing is die tempo waarteen arbeid verrig word of energie oorgedra word. (2)

10.5

POSITIVE MARKING FROM QUESTION 10.3.1 AND 10.3.2.
POSITIEWE NASIEN VANAF VRAAG 10.3.1 EN 10.3.2.

$V_{II} = V_{emf} - V_{series}$
$= 12 - 6$ ✓
$= 6$ V

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***	**OPTION 3/*OPSIE 3***
$P = \frac{V_{II}^2}{R}$ ✓ $= \frac{6^2}{6}$ ✓ $= 6$ W ✓	$I = \frac{V}{R}$ $I = \frac{6}{6}$ $= 1$A $P = VI$ ✓ $= 6(1)$ ✓ $= 6$ W ✓ **Accept if 1A is calculated with ratio/** ***Aanvaar indien 1A bereken word met verhouding***	$I = \frac{V}{R}$ $I = \frac{6}{6}$ $= 1$A $P = I^2R$ ✓ $= 1^2(6)$ ✓ $= 6$ W ✓ **Accept if 1A is calculated with ratio/** ***Aanvaar indien 1A bereken word met verhouding***

(4)

10.6 Increase/ *Neem toe* ✓ (1)

10.7 As more resistors are connected in parallel, the effective resistance decreases and the current increases. ✓
From $P = I^2R$, power is directly proportional to I^2 if R (of the bulb) stays constant. Increase in power increases brightness. ✓

Soos meer resistors in parallel verbind word, neem die effektiewe weerstand af en die stroom neem toe.
Volgens $P = I^2R$ is die drywing direk eweredig aan I^2 indien R (van die gloeilamp) konstant bly. Toename in drywing verhoog helderheid. (2)

[20]

TOTAL/*TOTAAL*: 150