Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE/*GRAAD* 12

SEPTEMBER 2015

PHYSICAL SCIENCES P1
FISIESE WETENSKAPPE V1
MEMORANDUM

MARKS: 150

This memorandum consists of 16 pages.
Hierdie memorandum bestaan uit 16 bladsye.

QUESTION/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 B ✓✓ (2)

1.3 D ✓✓ (2)

1.4 A ✓✓ (2)

1.5 D ✓✓ (2)

1.6 A ✓✓ (2)

1.7 B ✓✓ (2)

1.8 A ✓✓ (2)

1.9 A ✓✓ (2)

1.10 D ✓✓ (2)

(10 x 2) **[20]**

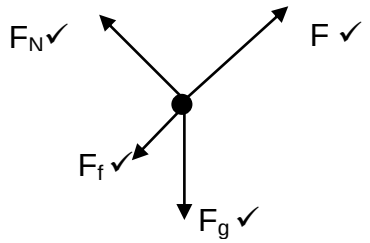
QUESTION 2/*VRAAG 2*

2.1 When a resultant/net force acts on an object, the object accelerates in the direction of the force. This 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. Hierdie versnelling is direk eweredig aan die krag ✓n omgekeerd eweredig aan die massa van die voorwerp. ✓

OR/OF

The resultant/net force acting on an object is equal to the rate of change in momentum of the object (in the direction of the force).✓✓ *Die resulterende/netto krag wat op 'n voorwerp inwerk, is gelyk aan die tempo van verandering van momentum van die voorwerp* (*in die rigting van die resulterende/netto krag.)* ✓✓ (2)

2.2



(4)

2.3 2.3.1 **Up the incline as positive/Teen die skuinste op as positief:**

$F_{net} = ma$
$F + (f_{kA} + f_{kB} + F_{gll}) = ma$ ✓ Any ONE/Enige EEN
$F + (f_{kA} + f_{kB} + mg\sin 30^0) = (m_A + m_B)a$
$F - \underline{6,8 - 3,4}$ ✓ $- \underline{(12)(9,8)\sin 30^0}$ ✓ $= 0$ ✓
$F = 69$ N ✓ (5)

2.3.2 $f_k = \mu_k F_N$ ✓
$3,40 = \mu_k (4)(9,8) \cos 30^0$ ✓
$\mu_k = 0,10$ ✓ (3)

2.4 2.41 REMAIN THE SAME/*BLY DIESELFDE* ✓ (1)

2.4.2 DECREASES/*NEEM AF* ✓
Θ
Since Θ increases, $F_g\perp$ decreases,✓ therefore F_N decrease*s* ✓/f_k α F_N ✓ *Omdat Θ toeneem, sal $F_g\perp$ afneem,* ✓*dus sal F_N afneem* ✓/f_k α F_N. ✓ (3)
[18]

QUESTION 3/*VRAAG 3*

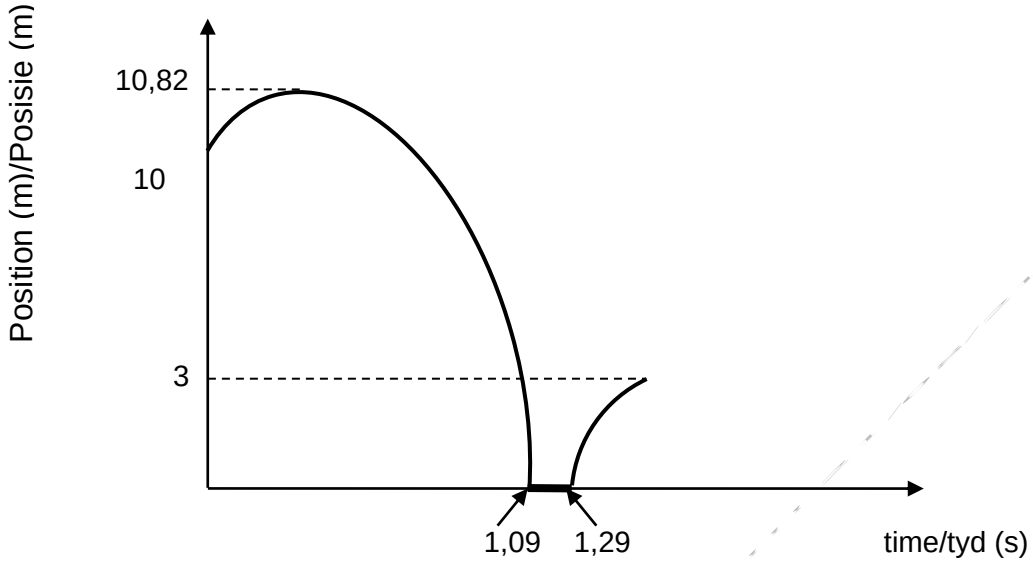
3.1 3.1.1

OPTION1/*OPSIE 1* **Upwards as positive** ***Opwaarts as positief*** $v_f = v_i + a\Delta t$ ✓ $0 = 4 + (-9,8)\Delta t$ ✓ $\Delta t = 0,41$ s ✓ (3)	**Downwards as positive** ***Afwaarts as positief*** $v_f = v_i + a\Delta t$ ✓ $0 = -4 + (9,8)\Delta t$ ✓ $\Delta t = 0,41$ s ✓ (3)
OPTION2/*OPSIE2* **Upwards as positive** ***Opwaarts as positief.*** $v_f^2 = v_i^2 + 2a\Delta y$ $0^2 = 4^2 + 2(-9,8)\Delta y$ ✓ $\Delta y = 0,82$s $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ $0,82 = \left(\frac{4 + 0}{2}\right)\Delta t$ ✓ $\Delta t = 0,41$ s ✓ (3)	**Downwards as positive** ***Afwaarts as positief*** $v_f^2 = v_i^2 + 2a\Delta y$ $0^2 = (-4^2) + 2(9,8)\Delta y$ ✓ $\Delta y = 0,82$s $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ $-0,82 = \left(\frac{-4 + 0}{2}\right)\Delta t$ ✓ $\Delta t = 0,41$ s ✓ (3)
NOTES/*AANTEKENINGE:* Accept/*Aanvaar* $s = \left(\frac{u+v}{2}\right)t$	$v^2 = u^2 + 2as$ g instead of *a* *g* in plaas van *a*

3.1.2

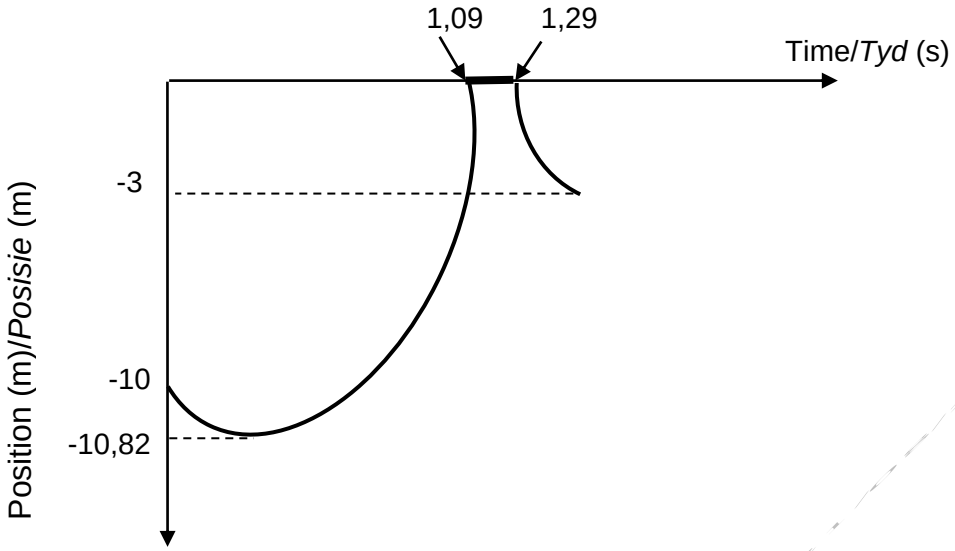
OPTION 1/*OPSIE1* **Upwards as positive** ***Opwaarts as positief*** $\Delta y = v_i\Delta t + ½ a \Delta t^2$ ✓ $= (4)(0,41) + ½ (-9,8)(0,41)^2$ ✓ $= 0,82$ m Maximum height/Maksimum hoogte $= \underline{10}$ ✓ + 0,82 = 10,82 m ✓ (4)	**OPTION 1/*OPSIE1*** **Downwards as positive** ***Afwaarts as positief*** $\Delta y = v_i\Delta t + ½ a \Delta t^2$ ✓ $= (-4)(0,41) + ½ (9,8)(0,41)^2$ ✓ $= -0,82$ m Maximum height/Maksimum hoogte $= \underline{10}$ ✓ + 0,82 = 10,82 m ✓ (4)
OPTION 2/*OPSIE 2* **Upwards as positive** ***Opwaarts as positief*** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = (4)^2 + 2(-9,8)\Delta y$ ✓ $\Delta y = 0,82$m Maximum height/*Maksimum hoogte* $= \underline{10}$ ✓ + 0,82 = 10,82 m ✓ (4)	**OPTION 2/OPSIE 2** **Downwards as positive** ***Afwaarts as positief*** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = (-4)^2 + 2(9,8)\Delta y$ ✓ $\Delta y = 0,82$m Maximum height/*Maksimum hoogte* $= \underline{10}$ ✓ + 0,82 = 10,82 m ✓ (4)

3.3 **Upwards as positive/*Opwaarts as positief*:**



Criteria for graph/*Kriteria vir grafiek:*	**Marks/*Punte***
Graph starts at 10 m at t = 0. *Grafiek begin by 10 m by t = 10s*.	✓
Positive marking from QUESTION 3.1.2 ***Positiewe nasien vanaf VRAAG 3.1.2*** Maximum height at 10,82 m *Maksimumhoogte by 10,82 m*	✓
Strikes ground at 0 $m.s^{-1}$ at t = 1,09 s *Tref grond by 0 $m.s^{-1}$ by t = 1,09 s*	✓
Rebounds on ground at 0 $m.s^{-1}$ at t = 1,29 s *Bons van grond af by 0 $m.s^{-1}$ by t = 1,29 s*	✓
Maximum height after bounce at 3 m. *Maksimumhoogte van bal by 3 m.*	✓

3.3 **Downwards as positive/*Afwaarts as positief***



Criteria for graph/*Kriteria vir grafiek:*	**Marks/*Punte***
Graph starts at -10 m at t = 0s. *Grafiek begin by -10 m by t = 0s.*	✓
Positive marking from QUESTION 3.1.2 ***Positiewe nasien vanaf VRAAG 3.1.2*** Maximum height at -10,82 m *Maksimumhoogte by -10,82 m*	✓
Strike ground at 0 m.s^{-1} at t = 1,09 s. *Tref grond by 0 m.s^{-1} by t = 1,09 s*	✓
Rebounds on ground at 0 m.s^{-1} at t = 1,29 s *Bons van grond af by 0 m.s^{-1} by t = 1,29 s*	✓
Maximum height after bounce at 3 m. *Maksimumhoogte van bal by 3 m.*	✓

(5)
[13]

QUESTION 4/*VRAAG 4*

4.1 TO THE LEFT/*NA LINKS* ✓ (1)

4.2 (Newton's) Third Law (of motion)/(*Newton) se Derde (Bewegingswet*).✓ (1)

4.3 In an isolated/closed system, ✓ the total mechanical energy is conserve remains constant. ✓
In 'n geïsoleerde/geslote sisteem ✓ bly die totale meganiese energie behoue/bly konstant. ✓

OR/*OF*

The total mechanical energy of a system remain constant ✓ provided the net work done by external non conservative forces is zero. ✓
Die totale meganiese energie van 'n sisteem bly konstant, ✓ mits die arbeid verrig deur eksterne nie-konservatiewe kragte, nul is. ✓

OR/*OF*

In the absence of a non-conservative force, ✓ the total mechanical energy is conserved/remain constant. ✓
In die afwesigheid van 'n nie-konservatiewe krag, ✓ bly die totale meganiese energie behoue/konstant. ✓

OR/*OF*

In an isolated/closed system, ✓ the sum of kinetic and gravitational potential energy is conserved/remains constant. ✓
In 'n geïsoleerde/geslote sisteem, ✓bly die som van kinetiese en gravitasionele potensiële energie behoue/bly konstant. ✓

Notes/*Aantekeninge*:
Allocate ONE mark for 'isolated system" only in conjunction with energy.
Ken EEN punt toe vir "geïsoleerde/geslote sisteem" slegs indien saam met energie gebruik. 1/2

(2)

4.4

OPTION 1/*OPSIE 1*

$E_{mechanical\ at\ A} = E_{mechanical\ at\ B}$
$(E_p + E_k)_A = (E_p + E_k)_B$
$(mgh + \frac{1}{2}mv^2)_A = (mgh + \frac{1}{2}mv^2)_B$
✓ Any ONE/*Enige EEN*

$66(9,8)(0) + \frac{1}{2}(66)v^2$ ✓ $= \underline{66(9,8)(1,6)}$ ✓ $+ \frac{1}{2}(66)(0)^2$
$v = 5,6\ m.s^{-1}$ ✓ (4)

OPTION 2/*OPTION 2*

$E_{mechanical\ at\ A} = E_{mechanical\ at\ B}$
$(E_p + E_k)_A = (E_p + E_k)_B$
$(mgh + \frac{1}{2}mv^2)_A = (mgh + \frac{1}{2}mv^2)_B$
✓ Any ONE/*Enige EEN*

$v^2 = 2gh$ ✓
$= (2)(9,8)(1,6)$ ✓
$v = 5,6\ m.s^{-1}$ ✓ (4)

OPTION 3/*OPSIE 3*

$W_{net} = \Delta E_k$
$F_{net}\Delta y.\cos\theta = \frac{1}{2}m(v_f^2 - v_i^2)$
✓ Any ONE/Enige EEN

$m(9,8)(1,6)\cos 0^\circ$ ✓ $= \frac{1}{2}m(v_f^2 - 0^2)$ ✓
$v_f = 5,6\ m.s^{-1}$ ✓ (4)

NOTES/*AANTEKENINGE*:
Accept/*Aanvaar*
$(E_p + E_k)_{top} = (E_p + E_k)_{bottom}$
$(U + K)_A = (U + K)_B$
$(U + K)_{top} = (U + K)_{bottom}$
$\Delta E_p + \Delta E_{kA} = 0 / \Delta U + \Delta K = 0$ (4)

4.5 **POSITIVE MARKING FROM QUESTION 4.4**
POSITIEWE NASIEN VAN VRAAG 4.4

OPTION1/*OPSIE1*

$\sum p_i = \sum p_f$

$(m_B + m_P)v_{BPi} = m_B v_f + m_P V_{fP}$ ✓ Any ONE/*Enige EEN*

$(70)(5)$✓ $= (66)(5,6) + 4v_{fP}$✓

$v_{Pf} = -4,9\ m.s^{-1}$

$= 4,9\ m.s^{-1}$ to the left/na links ✓ (4)

OPTION2/*OPSIE2*

$\Delta p_{Boy} = -\Delta p_{parcel}$✓

$m_{boy}(v_f - v_i) = -m_p(v_f - v_i)$

$(66)(5,6 - 5)$✓ $= -4(v_{pf} - 5)$ ✓

$v_{Pf} = -4,9\ m.s^{-1}$

$= 4,9\ m.s^{-1}$ to the left/Na links ✓ (4)

OPTION 3/*OPSIE3*

$F_{BP} = -F_{PB}$ ✓

$m_B a_B = -m_P a_P$

$m_B \left[\frac{v_{Bf} - v_{Bi}}{\Delta t}\right] = -m_P \left[\frac{v_{Pf} - v_{Pi}}{\Delta t}\right]$

$\frac{(66)(5,6 - 5)}{\Delta t}$ ✓ $= \frac{-(4)(v_{Pf} - 4,5}{\Delta t}$ ✓

$V_{pf} = -4,9\ m.s^{-1}$

$= 4,9\ m.s^{-1}$ to the left/na links✓ (4)

Other formulae/*Ander formules*:

$m_1v_{i1} + m_2v_{i2} = m_1v_{f1} + m_2v_{f2}$

$(m_1 + m_2)\ v = m_1v_{f1} + m_2v_{f2}$

$m_1v_{iB} + m_2v_{iP} = m_1v_{fB} + m_2v_{fP}$

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

$p_{\text{total before}} = p_{\text{total after}}$

Accept/*Aanvaar*:

$p_{\text{before}} = p_{\text{after}}$ or/of $p_i = p_f$ (4)

4.6 INCREASES/VERHOOG ✓

Δp parcel increases, thus Δp boy increases. ✓
For the same mass of boy, v will be greater. ✓

Δp pakkie vermeerder, dus Δp seun vermeerder. ✓
Vir dieselfde massa, van die seun sal v groter wees. ✓

OR/*OF*

If v of parcel increases, the momentum of the boy increases. ✓
For the same mass of boy, the velocity of parcel increases. ✓

Indien v van die pakkie toeneem, neem die momentum van die seun toe. ✓
Vir dieselfde massa van die seun, vermeerder die snelheid van die pakkie. ✓

OR/*OF*

F on parcel increases, therefore F on boy increases. ✔
FΔt(boy) increases, for the same mass of boy, thus v will increase. ✔

F op pakkie neem toe, dus neem F op seun toe. ✔
FΔt(seun) neem toe, dus vir dieselfde massa van seun sal V verhoog. ✔

OR/*OF*

$-m_Bv_{Bf} = m_Pv_{Pf}$ **AFR**: $-m_Sv_{Sf} = m_Pv_{Pf}$

$v_B = -\frac{m_Pv_{Pf}}{m_B}$ ✔for same m_B, if v_P increases, ✔then v_B increases.

$v_S = -\frac{m_Pv_{Pf}}{m_S}$ ✔ *vir dieselfde* m_S, as v_P *toeneem*, ✓ *neem* v_S *toe* (3)

[15]

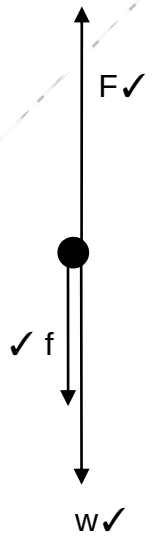
QUESTION 5/VRAAG 5

5.1 The net/total work done ✔is equal to the change in the object's kinetic energy.✔
Die netto/totale arbeid verrig ✔op 'n voorwep is gelyk aan die verandering in kinetiese energie van die voorwerp. ✔

OR/*OF*

The work done on an object by a resultant/net force ✔is equal to the change in the object's kinetic energy.✔
Die arbeid verrig op die voorwerp deur 'n resulterende/netto krag ✔is gelyk aan die verandering in kinetiese energie van die voorwerp. ✔ (2)

5.2



Accepted labels/*Aanvaarde benoemings*	
w	F_g/F_w/mg/gravitational force/weight F_g/F_w/*gravitasiekrag/gewig*
F	$F_{applied}/F_{cable}$/Tension/T/17 000 N $F_{toegepas}/F_{kabel}$/*Spanning*/T/17 000 N
f	$F_f/F_{friction}$/friction/air resistance $F_f/F_{wrywing}$/*wrywing/lugweerstand*

(3)

5.3

OPTION 1/*OPSIE1*

$W_{net} = \Delta E_k$

$W_T + W_W + W_f = \Delta E_k$ ✓ Any ONE/*Enige EEN*

$F_T \Delta y \cos\theta + F_g \Delta y \cos\theta + W_f = 0$

$(17000)(20)\cos 0°$ ✓ + $(1680)(9,8)(20)\cos 180°$ ✓ + $W_f = 0$ ✓

$W_f = -10720$ J ✓ (5)

OPTION 2/*OPSIE 2*

Downwards as positive

$F_{net} = ma$

$-F + f + W = ma$

$-17000 + f + (1680)(9,8)$ ✓ $= 0$ ✓ ✓

$f = 536$ N

$W_f = f \Delta y \cos\theta$

$= (536)(20)\cos 180°$ ✓

$= (536).(20).(-1)$

$= -10\,720$ J ✓ (5)

Upwards as positive

$F_{net} = ma$

$F + f + W = ma$

$17000 - f - (1680)(9,8)$ ✓ $= 0$ ✓ ✓

$f = 536$ N

$W_f = f \Delta y \cos\theta$

$= (536)(20)\cos 180°$ ✓

$= (536)(20)(-1)$

$= -10720$ J ✓ (5) **[10]**

QUESTION 6/*VRAAG 6*

6.1 The apparent change in the detected frequency (or pitch)(or wavelength) ✓ as a result of the relative motion between a source and an observer (listener). ✓

Die skynbare verandering in waargenome frekwensie (of toonhoogte)(of golflengte) ✓as gevolg van die relatiewe beweging tussen die bron en waarnemer/luisteraar. ✓ (2)

6.2 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓ **OR/*OF*** $f_L = \frac{v + v_L}{v - v_s} f_s$ ✓

✓

$f_L = \frac{340 + (340-310)}{340}\ 280$ ✓

✓

$= 304,71$ Hz ✓ (5)

6.3 SMALLER/KLEINEER ✓

Θ The listener moves away from the siren, <u>with constant velocity/speed</u> ✓
λ <u>increases</u> and the frequency decreases.✓
Die luisteraar beweeg weg van die sirene met <u>konstante snelheid/spoed.</u> ✓
<u>λ neem toe</u> en frekwensie neem af.✓

OR/*OF*

$\lambda \alpha \frac{1}{f}$ or/*of* $f \alpha \frac{1}{\lambda}$ ✓ At constant velocity (speed) ✓
By kontante snelheid (spoed) ✓

(3)

6.4 Determines the rate at which blood flow.
Monitor and measures the heartbeat of a foetus } ✓ Any ONE
Bep*aal die tempo waarteen bloed vloei.*
Monitor en meet die hartklop van 'n fetus. } ✓ *Enige EEN*

(1)

6.5

AWAY/*WEG*✓

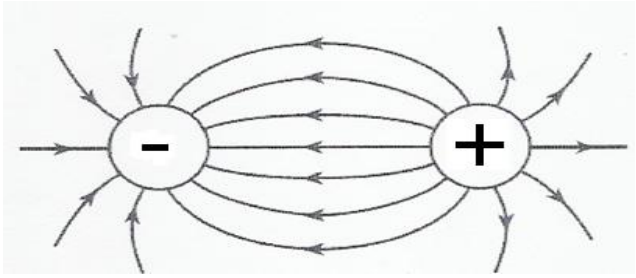
Θ

Light from a star is shifted towards a longer wavelength/towards the red end of the spectrum. ✓
Die ster se lig word verskuif na 'n langer golflengte/na die rooi kant van die spektrum. ✓

(2)
[13]

QUESTION 7/*VRAAG 7*

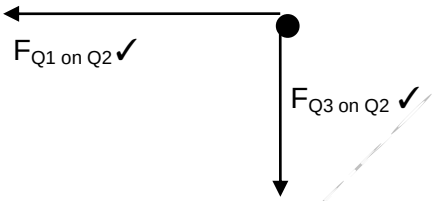
7.1



Criteria for sketch/*Kriteria vir skets:*	Marks/*Punte*
Correct shape *Korrekte vorm*	✓
Correct direction *Korrekte rigting*	✓
Field lines must be perpendicular to surfaces of spheres. (Field lines not touching each other/cross). Field lines start on sphere/NOT entering the spheres. *Veldlyne moet reghoekig wees aan oppervlak van sfere.* *(Veldlyne raak nie mekaar nie/kruis nie.)* *Veldlyne begin op sfere/moet NIE die sfere binnegaan NIE.*	✓

(3)

7.2



(2)

7.3 $F_{Q1\ on\ Q2} = \frac{kQ_1Q_2}{r^2}$ ✔ $= \frac{(9 \times 10^9)(3 \times 10^{-9})(3 \times 10^{-9})}{(10 \times 10^{-2})^2}$ ✔ $= 8{,}1 \times 10^{-6}$N

$F_{Q3\ 0n\ Q2} = \frac{kQ_3Q_2}{r^2} = \frac{(9 \times 10^9)(2 \times 10^{-9})(3 \times 10^{-9})}{(5 \times 10^{-2})^2}$ ✔ $= 2{,}16 \times 10^{-5}$ N

$F_{net} = \sqrt{(F_{Q1\ on\ Q2})^2 + F_{Q3\ on\ Q2})^2}$ $= \sqrt{(8{,}1 \times 10^{-6})^2 + (2{,}16 \times 10^{-5})^2}$ ✔ $= 2{,}31 \times 10^{-5}$ N

$\text{Tan } \theta = \frac{2{,}16 \times 10^{-5}}{8{,}1 \times 10^{-6}}$ ✔ $= 2{,}67$

$\theta = 69{,}44°$

OR/*OF*

$\theta = \tan^{-1}\left(\frac{2{,}16 \times 10^{-5}}{8{,}1 \times 10^{-6}}\right)$ ✓

$\theta = 69{,}44°$

$F_{net} = 2{,}31 \times 10^{-5}$ N ✔ 69,44°/On a bearing of 200,56° (Or any appropriate direction) ✓
In 'n rigting van 200,56° (Of enige toepaslike rigting) ✓ (8)

7.4 $E_{net} = 0$
$E_P + E_R = 0$

$\frac{kQ_P}{r_P^2} + \frac{kQ_R}{r_R^2} = 0$

✓ Any ONE/*Enige EEN*

$\frac{(9 \times 10^9)(8 \times 10^{-9})}{(2 \times 10^{-2})^2}$ ✓ $- \frac{(9 \times 10^9)\ Q_R}{(1 \times 10^{-2})^2}$ ✓ $= 0$

$Q_R = +2 \times 10^{-9}$ C (+2 nC) ✓ (5)
[18]

QUESTION 8/*VRAAG 8*

8.1 Alternating current/*Wisselstroom* ✓ (1)

8.2 The bulb converts 100 J of energy per second (to heat and light). ✓
Die gloeilamp sit 100 J energie per sekonde om (in hitte en lig). ✓ (1)

8.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$P_{ave} = V_{rms}I_{rms}$ ✓ $100 = \frac{V_{max}}{\sqrt{2}}$ ✓ x I_{rms} $= \frac{311}{\sqrt{2}}$ x I_{rms} ✓ I_{rms} = 0,45 A ✓ (4)	$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ ✓ = $\frac{311}{\sqrt{2}}$ = 219,91 V $P_{ave} = V_{rms}I_{rms}$ ✓ 100 = 219,91 x I_{rms} ✓ I_{rms} = 0,45 A ✓ (4)

(4)

8.4 AC can be stepped up at power stations. ✓(AC voltage can be stepped down)
Reduced energy loss during transmission. ✓ /AC can be stepped up of stepped down using transformers at substations.

WS kan by kragstasies verhoog word. ✓(WS spanning kan verlaag word)
Verminderde energieverlies tydens transmissie. ✓ WS kan met behulp van transformators by substasie verhoog of verlaag word. (2)
[8]

QUESTION 9/*VRAAG 9*

9.1 9.1.1 1,5 V ✓ (1)

9.1.2 **POSITIVE MARKING FROM QUESTION 9.1.1**
POSITIEWE NASIEN VANAF VRAAG 9.1.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2*** (Or any other gradient) *Gradient* (*Of enige ander gradient*)
Gradient = $\frac{\Delta I}{\Delta V}$ = $\frac{0 - 1,8}{1,5 - 0}$ ✓ = - 1,20 ✓ $\frac{1}{r}$ = 1,20 r = $\frac{1}{1,20}$ ✓ = 0,83 Ω ✓ (4)	= $\frac{0 - 0,9}{1,5 - 0,75}$ ✓ = - 1,20 $\frac{1}{r}$ = 1,20 r = $\frac{1}{1,20}$ ✓ = 0,83 Ω ✓ (4)

(4)

9.2. 9.2.1 INCREASES/*VERMEERDER* ✓
Θ
(1)

9.2.2 ε remains constant/ε *bly konstant* ✓
Ir decreases ✓, V_{ext} Increases ✓
Ir *neem af* ✓, V_{eks} *Neem toe* ✓ (3)

9.3 9.3.1 6 V ✓✓ (2)

9.3.2 (a) $R = \frac{V}{I}$ ✓

$4 = \frac{2}{I}$ ✓

$I = 0,5$ A (3)

(b) **POSITIVE MARKING FROM QUESTION 9.3.1**
POSITIEWE NASIEN VAN VRAAG 9.3.1

OPTION 1/*OPSIE 1*

$\varepsilon = I(R + r)$ ✓

6 ✓ $= \frac{0,5[R_p + 4}{\text{✓}} + \frac{4(0,25)]}{\text{✓}}$ ✓

$R_p = 7\ \Omega$

$\frac{1}{R_p} = \frac{1}{r_1} + \frac{1}{r_2}$ ✓

$\frac{1}{7}$ ✓ $= \frac{1}{14} + \frac{1}{R_x}$ ✓

$R_x = 14\ \Omega$ ✓ (8)

OPTION 2/*OPSIE 2*

$\varepsilon = V_{external} + V_{internal}$ ✓

$\varepsilon = V_{external} + Ir$

6 ✓ $= V_{external} + (0,5)(4)(0,25)$ ✓

$V_{external} = 5,50$ V

$V_{external} = V_P + V_S$

$5,50 = V_P + 2$ ✓

$V_P = 3,50$ V

$R_P = \frac{V_P}{I_P}$

$= \frac{3,50}{0,50}$

$= 7\ \Omega$

$\frac{1}{R_P} = \frac{1}{R_{14}} + \frac{1}{R_X}$ ✓

$\frac{1}{7}$ ✓ $= \frac{1}{14} + \frac{1}{R_X}$ ✓

$R_X = 14\ \Omega$ ✓ (8)

OPTION 3/*OPSIE 3*

$\varepsilon = V_{external} + V_{internal}$ ✓

$\varepsilon = V_{external} + Ir$

6 ✓ $= V_{external} + (0,5)(4)(0,25)$ ✓

$V_{external} = 5,50$ V

$V_{external} = V_P + V_S$

$5,50 = V_P + 2$ ✓

$V_P = 3,50$ V

$R_{14} = \frac{V_{14}}{I_{14}}$

$14 = \frac{3,50}{I_{14}}$

$I_{14} = 0,25$ A

$I_P = I_X + I_{14}$

$0,5 = Ix + 0,25$ ✓

$I_X = 0,25$ A

$R_X = \frac{V_P}{I_X}$ ✓

$= \frac{3,5}{0,25}$ ✓

$= 14\ \Omega$ ✓ (8)

(8)

[20]

QUESTION 10/*VRAAG 10*

10.1 Photo-electric effect/*Fotoëlektriese effek* ✓ (1)

10.2 The minimum frequency of light needed to emit electrons ✓from a metal surface.✓
Die minimum frekwensie van lig benodig om elektrone te verwyder ✓ *vanaf die oppervlak van 'n metaal*.✓ (2)

10.3 $n = \frac{Q}{e^-}$ OR/OF $n = \frac{Q}{q_{e-}}$ ✓

$(1{,}01 \times 10^{9}) = \frac{Q}{(1{,}6 \times 10^{-19})}$ ✓SS

$Q = 1{,}62 \times 10^{-10}$ C ($1{,}616 \times 10^{-10}$ C)

$Q = I\Delta t$ ✓

$1{,}62 \times 10^{-10} = I\ (1)$ ✓

$I = 1{,}62 \times 10^{-10}$ A ✓ (5)

10.4 DECREASES/*NEEM AF* ✓ (1)

10.5.1 SMALLER/*KLEINER AS*✓ (1)

10.5 10.5.2 The wavelength/frequency/energy of the incident light remains constant. ✓
Since the threshold frequency is greater, the work function is greater. ✓
Die golflengte/frekwensie/energie van die inkomende lig bly konstant. ✓
Aangesien die drumpel frekwensie vergroot, is die werksfunksie groter. ✓ (2)

10.6 The wavelengths of light that are absorbed in the absorption spectrum✓ correspond exactly to the wavelength of light that is emitted in the line emission spectrum of the same gas.✓

Die golflengte van lig geabsorbeer in die absorpsie spectrum, ✓*stem presies ooreen met die golflengte van lig wat vrygestel is in die lynemissiespektrum van dieselfde gas.* ✓

OR/*OF*

The dark lines in the absorption spectrum correspond ✓ exactly with the colour lines present in the line emission spectrum of the same gas.✓

Die donkerlyne in die absorpsie spektrum,✓ *stem presies ooreen met die kleurlyne in die lynemissie spektrum van dieselfde gas.*✓ (2)

[14]

TOTAL/*TOTAAL*: 150