basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

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

NOVEMBER 2011

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 13 pages.
Hierdie memorandum bestaan uit 13 bladsye.

SECTION A

QUESTION 1 / *VRAAG 1*

1.1 Power ✓
Drywing / Arbeidstempo ✓ (1)

1.2 Coherent / *Koherent* ✓ (1)

1.3 Dielectric / *Diëlektrikum* ✓ (1)

1.4 Alternating (current) / AC / ac ✓
Wissel(stroom) / WS / ws ✓ (1)

1.5 $N \cdot C^{-1}$ / $V \cdot m^{-1}$ / newton per coulomb / volt per meter ✓ (1)
[5]

QUESTION 2 / *VRAAG 2*

2.1 C ✓✓ (2)

2.2 D ✓✓ (2)

2.3 D ✓✓ (2)

2.4 C ✓✓ (2)

2.5 B ✓✓ (2)

2.6 A ✓✓ (2)

2.7 C ✓✓ (2)

2.8 C ✓✓ (2)

2.9 D ✓✓ (2)

2.10 B ✓✓ (2)
[20]

TOTAL SECTION A / *TOTAAL AFDELING A*: 25

SECTION B / *AFDELING B*

QUESTION 3 / *VRAAG 3*

3.1 The initial velocity / speed of the camera is the same ✓
(as that of the balloon).
Die beginsnelheid / spoed van die kamera is dieselfde ✓(as dié van die ballon). (1)

3.2 **Downward positive:**
Afwaarts positief:

$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓

$\therefore 92,4$ ✓$= v_i(6) + ½(9,8)(6)^2$ ✓

$\therefore v_i = -14\ m \cdot s^{-1}$

$\therefore v_i = 14\ m \cdot s^{-1}$ ✓

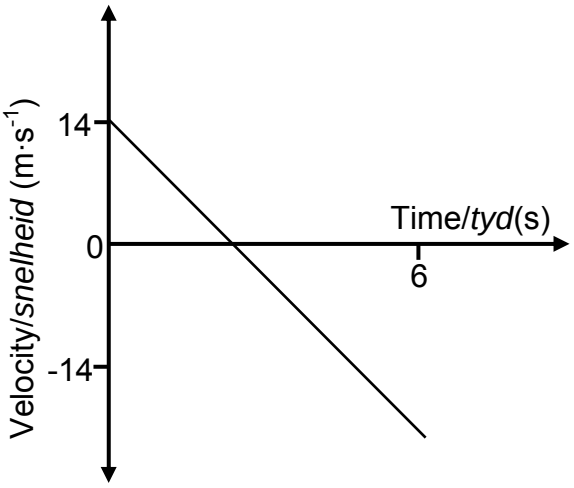
Downward negative:
Afwaarts negatief:

$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓

$\therefore -92,4$ ✓$= v_i(6) + ½(-9,8)(6)^2$ ✓

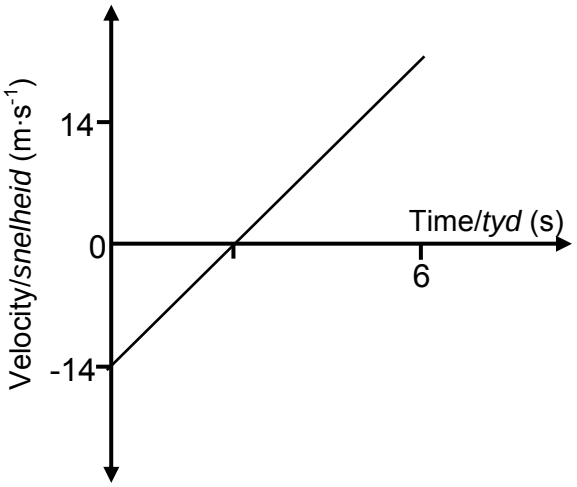
$\therefore v_i = 14\ m \cdot s^{-1}$ ✓ (4)

3.3 Upward positive/*Opwaarts positief*:



Criteria for graph/*Kriteria vir grafiek:*	Marks/ *Punte*
Correct shape as shown.(straight line with gradient) Korrekte *vorm soos getoon.(reguitlyn met gradient)*	✓
Graph starts at v = 14 $m \cdot s^{-1}$ / v_i at t = 0 s. *Grafiek begin by v = 14 $m \cdot s^{-1}$ / v_i by t = 0 s.*	✓
Graph extends below t axis until t = 6 s. *Grafiek verleng onder t-as tot t = 6 s.*	✓
Section of graph below t axis longer than section above t axis. *Gedeelte van grafiek onderkant t-as langer as gedeelte bokant t-as.*	✓

Upward negative / *Opwaarts negatief:*



Criteria for graph/*Kriteria vir grafiek:*	Marks/ *Punte*
Correct shape as shown. Korrekte *vorm soos getoon.*	✓
Graph starts at v / v_i = -14 m·s^{-1} at t = 0 s. *Grafiek begin by v/v_i = -14 m·s^{-1} by t = 0 s.*	✓
Graph extends above t axis until t = 6 s. *Grafiek verleng bokant t-as tot t = 6 s.*	✓
Section of graph above t axis longer than section below t axis. *Gedeelte van grafiek bokant t-as langer as gedeelte onderkant t-as.*	✓

(4)

3.4

Option 1 / *Opsie 1*:

$\Delta x = v\Delta t$ ✓

$\therefore 10$ ✓$= (2)\Delta t$ ✓

$\therefore \Delta t = 5$ s ✓

Yes/ Will catch the camera, time is less than 6 s. ✓

Ja / Sal die kamera vang, tyd is kleiner as 6 s. ✓

Option 2/*Opsie 2*:

$\Delta x = v\Delta t$ ✓

$= (2)$✓(6) ✓

$= 12$ m ✓

Yes / Will catch the camera, distance covered is greater than 10 m. ✓

Ja / Sal die kamera vang , afstand afgelê is groter as 10 m. ✓

Option 3 / *Opsie 3*:

$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

$\therefore 10$ ✓$= (2)\Delta t$ ✓$+ ½(0)\Delta t$

$\therefore \Delta t = 5$ s ✓

Yes/ will catch the camera, time is less than 6 s✓.

Ja / Sal die kamera vang, tyd is kleiner as 6 s. ✓

Option 4 / *Opsie 4*:

$\Delta x = (\frac{v_i + v_f}{2})\Delta t$ ✓ $\therefore 10$ ✓$= (\frac{2+2}{2})\Delta t$ ✓ $\therefore \Delta t = 5$ s ✓

Yes / Will catch the camera, time is less than 6 s.✓

Ja / Sal die kamera vang, tyd is kleiner as 6 s. ✓

Option 5 / *Opsie 5*:

$\Delta x = (\frac{v_i + v_f}{2})\Delta t$ ✓ $= (\frac{2+2}{2})$ ✓6 ✓ $= 12$ m·✓

Yes / Will catch the camera, distance covered is greater than 10 m. ✓

Ja / Sal die kamera vang , afstand afgelê is groter as 10 m. ✓

(5)
[14]

QUESTION 4 / *VRAAG 4*

4.1 $30\ m{\cdot}s^{-1}$ ✓east / *oos* ✓

Notes / *Aantekeninge*:
$v_{TP} = v_{TG} - v_{PG} = 40 - 10 = 30$
$\therefore v_{TP} = 30\ m{\cdot}s^{-1}$ east/*oos*

OR/*OF*
$v_{TP} = v_{TG} + v_{GP} = 40 + (-10) = 30$
$\therefore v_{TP} = 30\ m{\cdot}s^{-1}$ east/*oos*

(2)

4.2 $70\ m{\cdot}s^{-1}$ ✓ east / *oos* ✓

Notes / *Aantekeninge*:

Solution 1 / *Oplossing 1*:
$v_{BT} = v_{BP} - v_{TP}$
$= 100 - 30 = 70$
$\therefore v_{BT} = 70\ m{\cdot}s^{-1}$ east / *oos*

Solution 2 / *Oplossing 2*
$v_{BT} = v_{BP} + v_{PT}$
$= 100 + (-30) = 70$
$\therefore v_{BT} = 70\ m{\cdot}s^{-1}$ east/*oos*

OR / OF
$v_{BT} = v_{BP} + v_{PG} + v_{GT}$
$= 100 + 10 + (-40)$
$= 70$
$\therefore v_{BT} = 70\ m{\cdot}s^{-1}$ east / *oos*

Solution 3 / *Oplossing 3*
$v_{BT} = v_{BP} + v_{PG} + v_{GT}$
$= 100 + 10 + (-40)$
$= 70$
$\therefore v_{BT} = 70\ m{\cdot}s^{-1}$ east / *oos*

Solution 4 / *Oplossing 4*
$v_{BG} = v_{BP} + v_{PG}$
$= 100 + 10 = 110$
$\therefore v_{BG} = 110\ m{\cdot}s^{-1}$
$v_{BT} = v_{BG} + v_{GT}$
$= 110 + (-40) = 70$
$\therefore v_{BT} = 70\ m{\cdot}s^{-1}$ east / *oos*

(2)

4.3 The <u>total (linear) momentum remains constant</u>/is conserved / does not change. ✓
in <u>an isolated</u>/a closed system/the absence of external forces. ✓

Die <u>totale (liniêre) momentum bly konstant /</u> behoue / verander nie ✓
in '<u>n geïsoleerde sisteem /</u> geslote sisteem / die afwesigheid van eksterne kragte. ✓

(2)

4.4

Option 1 / *Opsie 1*:

To the right as positive / *Na regs as positief:*

$\Sigma p_{before/\ voor} = \Sigma p_{after/\ na}$ ✓

$\underline{(1\ 000)(40)}$ ✓+ $\underline{(5\ 000)(-20)}$ ✓ = $\underline{(1\ 000 + 5\ 000)v_f}$ ✓

$\therefore v_f = -10\ m\cdot s^{-1}$ ✓

$\therefore v_f = 10\ m\cdot s^{-1}$ $\underline{\text{left / } na\ links}$ ✓ **OR / *OF*** west / *wes*

Option 2 / *Opsie 2*:

To the right as positive / *Na regs as positief:*

$\Delta p_{car} = -\Delta p_{truck}$✓

$m(v_f - v_i) = -m(v_f - v_i)$

$\underline{(1000)(v_f - (40))}$ ✓= $\underline{-(5\ 000)(v_f}$ ✓– (-20)) ✓

$6\ 000v_f = -60\ 000$

$\therefore v_f = -10\ m\cdot s^{-1}$ ✓

$\therefore v_f = 10\ m\cdot s^{-1}$ $\underline{\text{left / } na\ links}$ ✓ **OR/*OF*** west / *wes* (6)

4.5

Option 1 / *Opsie 1:*	
Force on car / *Krag op motor:*	Force on car / *Krag op motor:*
To the right as positive / *Na regs as positief:*	To the left as positive / *Na links as positief:*
$F_{net}\Delta t = \Delta p$ ✓$= mv_f - mv_i$	$F_{net}\Delta t = \Delta p$ ✓$= mv_f - mv_i$
$F_{net}(0,5)$ ✓ = $\underline{1\ 000(-10 - 40)}$ ✓	$F_{net}(0,5)$ ✓ = $\underline{1\ 000(10 - (-40))}$ ✓
$\therefore F_{net} = -1 \times 10^5$ N ✓ OR/*OF*	$\therefore F_{net} = 1 \times 10^5$ N ✓ (100 000 N)
$\therefore F_{net} = 1 \times 10^5$ N (100 000 N)	$\therefore F_{net} > 85\ 000$ N
$\therefore F_{net} > 85\ 000$ N	Yes, collision is fatal. / *Ja, botsing is fatal.* ✓
Yes, collision is fatal. / *Ja botsing is fataal.* ✓	
Option 2 / *Opsie 2:*	
Force on truck / *Krag op vragmotor:*	Force on truck / *Krag op vragmotor:*
To the right as positive / *Na regs as positief:*	To the left as positive / *Na links as positief:*
$F_{net}\Delta t = \Delta p$ ✓$= mv_f - mv_i$	$F_{net}\Delta t = \Delta p$ ✓$= mv_f - mv_i$
$F_{net}(0,5)$ ✓ = $\underline{5\ 000(-10 - (-20))}$ ✓	$F_{net}(0,5)$ ✓ = $\underline{5\ 000(10 - 20)}$ ✓
$\therefore F_{net} = 1 \times 10^5$ N ✓ (100 000 N)	$\therefore F_{net} = -1 \times 10^5$ N ✓
$\therefore F_{net} > 85\ 000$ N	$\therefore F_{net} = 1 \times 10^5$ N (100 000 N)
Yes, collision is fatal. / *Ja, botsing is fataal.* ✓	$\therefore F_{net} > 85\ 000$ N
	Yes, collision is fatal / *Ja, botsing is fataal.* ✓
Option 3 / *Opsie 3:*	
Force on car / *Krag op motor:*	Force on car / *Krag op motor:*
To the right as positive / *Na regs as positief:*	To the left as positive / *Na links as positief:*
$v_f = v_i + a\,\Delta t$ ✓ Both formulae/ *Beide formules*	$v_f = v_i + a\,\Delta t$ ✓ Both formulae/ *Beide formules*
$\therefore -10 = 40 + a(0,5)$ ✓	$\therefore 10 = -40 + a(0,5)$ ✓
$\therefore a = -100$	$\therefore a = 100$
$F_{net} = ma = (1\ 000)(-100)$ ✓	$F_{net} = ma = (1\ 000)(100)$ ✓
$\therefore F_{net} = -1 \times 10^5$ N ✓ (-100 000 N)	$\therefore F_{net} = 1 \times 10^5$ N ✓ (100 000 N)
$\therefore F_{net} = 1 \times 10^5$ N (100 000 N)	
$\therefore F_{net} > 85\ 000$ N	$\therefore F_{net} > 85\ 000$ N
Yes, collision is fatal. / *Ja, botsing is fataal.* ✓	Yes, collision is fatal. / *Ja, botsing is fataal.* ✓

Option 4 / *Opsie 4*:	
Force on truck / *Krag op vragmotor:* To the right as positive / *Na regs as positief:* $v_f = v_i + a\,\Delta t$ $\therefore$ -10 = -20 + a(0,5) ✓ $\therefore a = 20$ $F_{net} = ma = (5\,000)(20)$ ✓ $\therefore F_{net} = 1 \times 10^5$ N ✓ (100 000 N) $\therefore F_{net} > 85\,000$ N Yes, collision is fatal. / *Ja, botsing is fatal.* ✓	Force on truck / *Krag op vragmotor:* To the left as positive / *Na links as positief:* $v_f = v_i + a\,\Delta t$ $\therefore$ 10 = 20 + a(0,5) ✓ $\therefore a = -20$ $F_{net} = ma = (5\,000)(-20)$ ✓ $\therefore F_{net} = -1 \times 10^5$ N ✓ (-100 000 N) $\therefore F_{net} = 1 \times 10^5$ N (100 000 N) $\therefore F_{net} > 85\,000$ N Yes, collision is fatal. / *Ja, botsing is fatal.* ✓

✓ Both formulae/ *Beide formules*

✓ Both formulae/ *Beide formules*

(5)

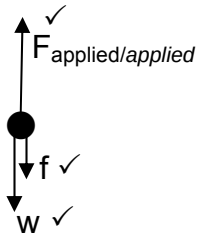
[17]

QUESTION 5 / *VRAAG 5*

5.1 The net (total) work (done on an object) ✓
is equal to the change in kinetic energy (of the object.) ✓
Die netto (totale) arbeid (verrig op 'n voorwerp) ✓
is gelyk aan die verandering in kinetiese energie (van die voorwerp) ✓

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

5.2



(3)

5.3 Gravitational force/weight (of soldier) ✓
Gravitasiekrag/gewig (van soldaat) (1)

5.4 $W_{net} = \Delta K$ ✓

$F\Delta y\cos\theta + F_w\Delta y\cos\theta + W_f = \Delta K$

(960)(20)cos0° ✓+ (80)(9,8)(20)cos180° ✓ + W_f = 0 ✓

19 200 – 15 680 + W_f = 0

W_f = - 3 520 J ✓ (5)

[11]

QUESTION 6 / *VRAAG 6*

6.1 Doppler effect / *Doppler-effek* ✓ (1)

6.2 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓

$\therefore f_L = \frac{340 \pm 0}{340 - 20}$ ✓ (458) ✓

$\therefore f_L = 486{,}63$ Hz ✓ (4)

6.3 Decreases/*Verlaag* ✓ (1)

6.4 Equal to/*Gelyk aan* ✓

Velocity of train driver relative to the whistle is zero. ✓
Snelheid van treindrywer relatief tot fluitjie is nul.

OR / *OF*
Train driver has same velocity as whistle.
Treindrywer het dieselfde snelheid as die fluitjie.

OR / *OF*
There is no relative motion between source and observer.
Daar is geen relatiewe beweging tussen bron en waarnemer. (2)
[8]

QUESTION 7 / *VRAAG 7*

7.1 Light of a single wavelength **OR** single frequency. ✓✓
*Lig van 'n enkele golflengte **OF** enkele frekwensie.* ✓✓ (2)

7.2

Criteria for investigative question: ***Kriteria vir ondersoekende vraag:***	**Mark/** ***Punt***
The dependent and independent variables are stated. *Die afhanklike en onafhanklike veranderlikes is genoem.*	✓
Asks a question about the relationship between dependent and independent variables. *Vra 'n vraag oor die verwantskap tussen die afhanklike en onafhanklike veranderlikes.*	✓

Examples/*Voorbeelde:*
- How will the broadness / width of the central band change / differ when slit width changes / is increased / is decreased?
  Hoe sal die breedte / wydte van die sentrale helderband verander / verskil wanneer die spleetwydte verander / toeneem / afneem?

- What is the relationship between the broadness of the central bright band and slit width?
  Wat is die verwantskap tussen die breedte van die sentrale helderband en spleetwydte? (2)

7.3 Wavelength (of light) / Frequency (of light) / Colour of light/ Light source ✓
Distance between slit and screen. ✓

Golflengte (van lig) / Frekwensie (van lig) / Kleur van lig / Ligbron ✓
Afstand tussen spleet en skerm. ✓ (2)

7.4 Increases / *Vermeerder* ✓
Diffraction is inversely proportional to slit width. ✓
Diffraksie is omgekeerd eweredig aan spleetwydte. ✓

OR/*OF*
Increases / *Vermeerder* ✓
Diffraction / *Diffraksie* OR/*OF* $\sin\theta \propto \frac{1}{a}$ ✓ (2)

7.5 **Option 1 / *Opsie 1:***

$\sin\theta = \frac{m\lambda}{a}$ ✓

$\sin\theta = \frac{(2)(4\times10^{-7})}{2{,}2\times10^{-6}}$ ✓ ✓

$\therefore\ \theta = 21{,}32°$ ✓

Option 2 / *Opsie 2:*

$\sin\theta = \frac{m\lambda}{a}$ ✓

$\sin\theta = \frac{(-2)(4\times10^{-7})}{2{,}2\times10^{-6}}$ ✓ ✓

$\therefore\ \theta = -21{,}32°$ ✓ (5)
[13]

QUESTION 8 / *VRAAG 8*

8.1 T to/*na* P ✓ (1)

8.2 $Q = \frac{3\times10^{-9} + (-6\times10^{-9})}{2}$ ✓ = -1,5 x 10^{-9} C

$\Delta Q_P = Q_P(\text{final}) - Q_P(\text{initial})$
= -1,5 x 10^{-9} – 3 x 10^{-9} ✓
= -4,5 x 10^{-9} C ✓

OR / *OF*
$\Delta Q_T = Q_T(\text{final}) - Q_T(\text{initial})$
= -1,5 x 10^{-9} – (-6 x 10^{-9}) ✓
= 4,5 x 10^{-9} C ✓ (3)

8.3 Number of electrons / *Getal elektrone* = $\frac{-4{,}5\times10^{-9}}{-1{,}6\times10^{-19}}$ ✓
= 2,81 x 10^{10} ✓ (2)

8.4

Option 1 / *Opsie 1*

$F_{TR} = \frac{kQ_1Q_2}{r^2}$ ✓

$= \frac{(9\times10^{9})(1{,}5\times10^{-9})(3\times10^{-9})}{1^2}$ ✓

$= 4{,}05 \times 10^{-8}$ N to the left/towards P
na links/na P toe

✓Any one
Enige een

$F_{PR} = \frac{kQ_1Q_2}{r^2}$

$= \frac{(9\times10^{9})(1{,}5\times10^{-9})(3\times10^{-9})}{0{,}5^2}$ ✓

$= 1{,}62 \times 10^{-7}$ N to the right/towards T
na regs/na T toe

To the right / towards T as positive: / *Na regs* / *na T toe as positief*
$F_{net} = 1{,}62 \times 10^{-7} - 4{,}05 \times 10^{-8}$
$= 1{,}22 \times 10^{-7}$ N $(1{,}215 \times 10^{-7}$ N)
$= 1{,}22 \times 10^{-7}$ N ✓ to the right / towards T / *na regs / na T toe* ✓ (6)

[12]

QUESTION 9 / *VRAAG 9*

9.1 Current / I / *stroom* ✓ (1)

9.2
9.2.1 (4,0 ✓ ; 0,64) ✓ (2)

9.2.2 Temperature was not kept constant. ✓✓
Temperatuur is nie konstant gehou nie. ✓✓ (2)

9.3 Gradient/m = $\frac{\Delta y}{\Delta x} = \frac{0{,}64 - 0}{4 - 0}$ ✓ ✓ = 0,16

$R = \frac{1}{0{,}16}$ = 6,25 Ω ✓✓ (4)

[9]

QUESTION 10 / *VRAAG 10*

10.1 12 V ✓ (1)

10.2.1

Option 1 / *Opsie 1:*	**Option 2 / *Opsie 2:***
$I = \frac{V}{R}$ ✓ $= \frac{9{,}6}{2{,}4}$ ✓ = 4 A	emf = IR + Ir✓ 12 = I(2,4) + 2,4✓ ∴ I = 4 A✓

(3)

10.2.2

Option 1 / *Opsie 1:*
emf/*emk* = IR + Ir ✓
12 = 9,6 + 4r ✓
∴ r = 0,6 Ω ✓

Option 2 / *Opsie 2*:
$V_{lost/verlore}$ = Ir ✓
2,4 = 4r ✓
∴ r = 0,6 Ω ✓

Option 3 / *Opsie 3*:
emf/*emk* = I(R + r) ✓
12 = 4(2,4 + r) ✓ ∴ r = 0,6 Ω ✓

(3)

10.3

Option 1 / *Opsie 1*:

emf/*emk* = I(R + r) ✓
12 = 6(R + 0,6) ✓
$R_{ext/eks}$ = 1,4 Ω

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$\frac{1}{1,4} = \frac{1}{2,4} + \frac{1}{R}$ ✓

∴ R = 3,36 Ω

Each tail lamp/*Elke agterlig:*
: R = 1,68 Ω ✓

Option 2 / *Opsie 2*:
Emf = $V_{terminal}$ + Ir ✓
12 = $V_{terminal}$ + 6(0,6) ✓
∴ $V_{terminal}$ = 8,4 V

$I_{2,4\ \Omega} = \frac{V}{R} = \frac{8,4}{2,4}$ = 3,5 A

$I_{\text{tail lamps/}agterligte}$ = 6 – 3,5 = 2,5 A

$R_{\text{tail lamps/}agterligte} = \frac{V}{I}$ ✓ $= \frac{8,4}{2,5}$ ✓ = 3,36 Ω

$R_{\text{tail lamp/}agterlig}$ = 1,68 Ω ✓

Option 3 / *Opsie 3:*
V = IR ✓
12 = (6)R ✓
R_{ext} = 2 Ω

∴$R_{parallel}$ = 2 – 0,6 = 1,4 Ω

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$\frac{1}{1,4} = \frac{1}{2,4} + \frac{1}{R}$ ✓

∴ R = 3,36 Ω

Each tail lamp/*Elke agterlig*: R = 1,68 Ω ✓

Option 4 / *Opsie 4:*
For parallel combination: $I_1 + I_2$ = 6 A
Vir parallelle kombinasie: $I_1 + I_2$ = 6 A

∴ $\frac{V}{2,4} + \frac{V}{R_{taillamps}}$ ✓ = 6 ✓

8,4✓ $(\frac{1}{2,4} + \frac{1}{R_{taillamps}})$✓ = 6

∴ $R_{\text{tail lamps/}agterligte}$ = 3,36

$R_{\text{tail lamp/}agterligte}$ = 1,68 Ω ✓

(5)

10.4 Increases / *Vermeerder* ✓
Resistance increases, current decreases ✓
Ir (lost volts) decreases ✓

Vermeerder ✓
Weerstand verhoog, stroom verlaag ✓
Ir (verlore volts) verminder / neem af. ✓

(3)
[15]

QUESTION 11 / *VRAAG 11*

11.1.1 Electrical (energy) to mechanical / kinetic (energy) ✓
Elektriese (energie) na meganiese / kinetiese (energie) ✓ (1)

11.1.2 Mechanical / kinetic (energy) to electrical (energy) ✓
Meganiese / kinetiese (energie) na elektriese (energie) ✓ (1)

11.1.3 Motor effect / *Motor-effek* ✓ (1)

11.1.4 Electromagnetic induction ✓
Elektromagnetiese induksie ✓ (1)

11.2 BC / conductor is parallel ✓ to the magnetic field. ✓
BC / geleier is parallel ✓ aan die magneetveld. ✓

OR / *OF*
Open switch ✓, no current. ✓
Oop skakelaar ✓, geen stroom. ✓ (2)

11.3

Option 1 / *Opsie 1*:	**Option 2 / *Opsie 2*:**
$P_{ave} = V_{rms}I_{rms}$ ✓ $= \frac{V_{max}}{\sqrt{2}}$ ✓ . $\frac{I_{max}}{\sqrt{2}}$ ✓ $= \frac{(311)(21)}{2}$ ✓✓ = 3 265,5 W ✓ **OR / OF** $P_{max} = V_{max}I_{max}$ ✓ = (311) ✓ (21) ✓ = 6531 W $\therefore P_{ave} = \frac{P_{max}}{2}$ ✓✓ $= \frac{6531}{2}$ = 3 265,5 W ✓	$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ ✓ $= \frac{311}{\sqrt{2}}$ ✓ = 219,91 V $I_{rms} = \frac{I_{max}}{\sqrt{2}}$ ✓ $= \frac{21}{\sqrt{2}}$ ✓ = 14,85 A $P_{ave} = V_{rms}I_{rms}$ ✓ = (219,91)(14,85) = 3 265,66 W ✓
Option 3 / *Opsie 3*	**Option 4 / *Opsie 4***
$R = \frac{V}{I}$ ✓ $= \frac{311}{21}$ ✓ = 14,81 Ω $I_{rms} = \frac{I_{max}}{\sqrt{2}}$ ✓ $= \frac{21}{\sqrt{2}}$ ✓ = 14,85 A $P_{ave} = I^2_{rms}R$ ✓ $= (14,85)^2(14,81)$ = 3 265,83 W ✓	$R = \frac{V}{I}$ ✓ $= \frac{311}{21}$ ✓ = 14,81 Ω $V_{rms} = \frac{V_{max}}{\sqrt{2}}$ ✓ $= \frac{311}{\sqrt{2}}$ ✓ = 219,91 V $P_{ave} = \frac{V^2_{rms}}{R}$ ✓ $= \frac{219,41^2}{14,81}$ = 3 265,83 W ✓

(6)
[12]

QUESTION 12 / *VRAAG 12*

12.1 Photo-electric effect / *Foto-elektriese effek* ✓ (1)

12.2 Work function / *Werkfunksie / Arbeidsfunksie* ✓ (1)

12.3 $c = f\lambda$ ✓
3×10^8 ✓ $= f(330 \times 10^{-9})$ ✓
$\therefore f = 9{,}09 \times 10^{14}$ Hz ✓

OR/*OF*

$E = \frac{hc}{\lambda} = \frac{(6{,}63 \times 10^{-34})(3 \times 10^8)}{330 \times 10^{-9}}$ ✓ $= 6{,}03 \times 10^{-19}$ J

$E = hf$

$6{,}03 \times 10^{-19} = (6{,}63 \times 10^{-34})f$ ✓

$\therefore f = 9{,}09 \times 10^{14}$ Hz ✓

✓ for both equations
vir beide vergelykings

(4)

12.4

Option 1 / *Opsie 1*:

$E = W_o + K$
$\frac{hc}{\lambda} = W_o + K$
} ✓ Any one / *Enige een*

$\therefore \frac{(6{,}63 \times 10^{-34})(3 \times 10^8)}{330 \times 10^{-9}}$ ✓ $= 3{,}5 \times 10^{-19} + K$ ✓

$\therefore K = 2{,}53 \times 10^{-19}$ J ✓

Option 2 / *Opsie 2*:

$E = W_o + K$
$hf = W_o + K$
} ✓ Any one / *Enige een*

$\therefore (6{,}63 \times 10^{-34})(9{,}09 \times 10^{14})$ ✓ $= 3{,}5 \times 10^{-19} + K$ ✓

$\therefore K = 2{,}53 \times 10^{-19}$ J ✓

(4)

12.5

12.5.1 Remains the same / *Bly dieselfde* ✓ (1)

12.5.2 Increases / *Vermeerder* ✓ (1)

12.6

12.6.1 Ultraviolet radiation / *Ultraviolet-straling* ✓ (1)

12.6.2 High energy / high frequency ✓
Hoë energie / hoë frekwensie (1)

[14]

TOTAL SECTION B/TOTAAL AFDELING B: 125
GRAND TOTAL/*GROOTTOTAAL*: 150