education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE/*GRAAD* 12

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

MEMORANDUM

NOVEMBER 2008

MARKS/*PUNTE*: 150

This memorandum consists of 17 pages.
Hierdie memorandum bestaan uit 17 bladsye.

Learning Outcomes and Assessment Standards ***Leeruitkomste en Assesseringstandaarde***		
LO 1/*LU 1*	**LO 2/*LU 2***	**LO 3/*LU 3***
AS 12.1.1: Design, plan and conduct a scientific inquiry to collect data systematically with regard to accuracy, reliability and the need to control variables. *Ontwerp, beplan en voer 'n wetenskaplike ondersoek uit om data te versamel ten opsigte van akkuraatheid, betroubaarheid en die kontroleer van veranderlikes.* **AS 12.1.2:** Seek patterns and trends, represent them in different forms, explain the trends, use scientific reasoning to draw and evaluate conclusions, and formulate generalisations. *Soek patrone en tendense, stel dit in verskillende vorms voor, verduidelik tendense, gebruik wetenskaplike beredenering om gevolgtrekkings te maak en te evalueer, en formuleer veralgemenings.* **AS 12.1.3:** Select and use appropriate problem-solving strategies to solve (unseen) problems. *Kies en gebruik geskikte probleemoplossingstrategieë om (ongesiene) probleme op te los.*	**AS 12.2.1:** Define, discuss and explain prescribed scientific knowledge. *Definieer, bespreek en verduidelik voorgeskrewe wetenskaplike kennis.* **AS 12.2.2** Express and explain prescribed scientific principles, theories, models and laws by indicating the relationship between different facts and concepts in own words. *Verduidelik en druk voorgeskrewe wetenskaplike beginsels, teorieë, modelle en wette uit deur die verwantskap tussen verskillende feite en konsepte in eie woorde aan te dui.* **AS 12.2.3:** Apply scientific knowledge in everyday life contexts. *Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.*	**AS 12.3.2:** Research case studies and present ethical and moral arguments from different perspectives to indicate the impact (pros and cons) of different scientific and technological applications. *Vors gevallestudies na en lewer etiese en morele argumente uit verskillende perspektiewe om die impak (voordele en nadele) van verskillende wetenskaplike en tegnologiese toepassings aan te dui.*

SECTION A/*AFDELING A*

QUESTION 1/*VRAAG 1*

1.1	Power/ rate of work /*drywing/arbeidstempo* ✓	[12.2.1]	(1)
1.2	elastic/*elastiese* ✓	[12.2.1]	(1)
1.3	(continuous/light) spectrum*/(aaneenlopende/lig) spektrum* ✓ Continuous emission spectrum/*aaneenlopende emissiespektrum*	[12.2.1]	(1)
1.4	capacitor/*kapasitor* ✓	[12.2.1]	(1)
1.5	population inversion/*besettingsomkering* ✓	[12.2.1]	(1) **[5]**

QUESTION 2/*VRAAG 2*

2.1	D ✓	[12.2.2]	(1)
2.2	C ✓	[12.2.1]	(1)
2.3	A✓	[12.2.1]	(1)
2.4	H✓	[12.2.1]	(1)
2.5	G ✓	[12.2.3]	(1) **[5]**

QUESTION 3/*VRAAG 3*

3.1	False/Onwaar ✓ … the kinetic energy changes/decreases/increases/does not remain the same ✓ *… die kinetiese energie verander/neem toe/neem af /bly nie dieselfde nie*	[12.2.3]	(2)
3.2	True/*Waar* ✓✓	[12.2.3]	(2)
3.3	False/Onwaar ✓ … is inversely proportional/*is omgekeerd eweredig*✓ …is directly proportional to wavelength/*is direk eweredig aan golflengte*	[12.2.2]	(2)
3.4	False/*Onwaar* ✓ … by decreasing the net electric field/opposing electric field set up by the voltage source✓ *…deur die netto elektriese veld te verlaag/deur die elektriese veld wat deur die battery(spanningsbron) opgewek word, teen te werk*	[12.2.3]	(2)
3.5	True/*Waar* ✓✓	[12.2.1]	(2) **[10]**

QUESTION 4/*VRAAG 4*

4.1 C ✓✓✓ [12.2.3] (3)

4.2 B ✓✓✓ [12.2.3] (3)

4.3 A ✓✓✓ [12.2.3] (3)

4.4 D ✓✓✓ [12.2.2] (3)

4.5 B ✓✓✓ [12.1.3] (3)
[15]

TOTAL SECTION A: 35
***TOTAAL AFDELING A:* 35**

SECTION B/*AFDELING B*
QUESTION 5 / *VRAAG 5*

5.1 Consider to the left as positive/*Beskou na links as positief*

$\Sigma m_i v_i = \Sigma m_f v_f$

$p_{before} = p_{after}$ /$p_{voor} = p_{na}$ OR $m_A v_{iA} + m_B v_{iB} = m_A v_{fA} + m_B v_{fB}$

OR $m_A u_A + m_B u_B = m_A v_A + m_B v_B$ ✓

1 000)(0) + (1 200)(18) ✓= (1000)(12) + (1 200)v_{fB}✓

9 600 = (1 200)v_{i2}

$V_{fB} = 8\ m \cdot s^{-1}$ ✓

[12.2.3] (4)

5.2 Not an isolated system / external forces present / frictional forces present / driver in front car has his foot on the brake. ✓✓
Nie 'n geïsoleerde sisteem nie/ eksterne kragte is teenwoordig/ wrywingskragte teenwoordig / bestuurder van voorste motor het sy voet op die rem.
[12.2.3] (2)

5.3

During the collision, both cars experience a force of equal magnitude ✓
This net force on the car with larger mass causes it to experience a smaller acceleration✓
therefore the passenger will experience a smaller change in velocity and will be less injured. ✓

Tydens die botsing ondervind beide motors 'n krag van gelyke grootte.
Hierdie netto krag op die motor met groter massa veroorsaak 'n kleiner versnelling
en dus ondergaan die passasier 'n kleiner verandering in snelheid en word minder beseer. .

For a specific/Vir spesifieke $F_{net}\Delta t$:
Δp(heavy car) = Δp(light car) ✓
$m_H(v_f - v_i)_H = m_L(v_f - v_i)_L$
but $m_H > m_L$
$(v_f - v_i)_H < (v_f - v_i)_L$ ✓
Therefore a passenger will experience a smaller change in velocity ✓and gets injured less/*Dus sal 'n passasier 'n kleiner verandering in snelheid ondervind en minder beseer word.*

[12.3.2] (3)
[9]

QUESTION 6/*VRAAG 6*

6.1 [12.1.2] (3)

Gradient/*gradient* = $\frac{\Delta v}{\Delta t}$ ✓= $\frac{-20-(-10)}{3-2}$ ✓= $\frac{-10}{1}$ = -10 m·s^{-2}✓ or 10 m·s^{-2} downwards

Accept / Aanvaar $\frac{\Delta y}{\Delta x}$

Upwards/*Opwaarts*+
$v_f = v_i + a\Delta t$ ✓
- 20 = - 10 + a(1) ✓
a = -10 m·s^{-2}✓

[12.1.2] (3)

6.2 0,5 s ✓ and/*en* 1,5 s ✓ [12.1.2] (2)

6.3 1 s ✓ [12.1.2] (1)

6.4

DETERMINING AREAS/ *BEPALING VAN OPPERVLAKTE*
Option 1 / *Opsie 1* :Area of trapezium / *Oppervlakte van trapesium*

Height of cliff/ *Hoogte van krans* = area of trapezium/area of trapezium
= ½ (sum of parallel sides/som van ewewydige sye)h ✓
= ½ (10 + 25) ✓ (1,5) ✓
= 26,25 m✓

Option 2 / *Opsie 2* :Difference between areas of two triangles */ Verskil tussen die oppervlaktes van twee driehoeke*

Height of cliff /Hoogte van krans
= area of larger triangle/van groter driehoek – area of smaller triangle/van kleiner driehoek
= ½ bh – ½ bh✓
= ½ (2,5)(25) ✓– ½ (1)(10) ✓ = 31,25 - 5
= 26,25 m✓

Option 3 / *Opsie 3* :The sum of areas of rectangle and triangle / *Die som van die oppervlaktes van reghoek en driehoek*

Height of cliff */Hoogte van krans*
= area of rectangle/van reghoek + area of triangle/van driehoek
= (l x b) + ½ bh ✓
=(1,5)(10) ✓ + ½ (1,5)(15) ✓ = 15 + 11,25
= 26,25 m✓

USING EQUATIONS OF MOTION / GEBRUIK VAN BEWEGINGSVERGLYKINGS

Option 1 / *Opsie 1*: Initial velocity 10 m·s^{-1} upwards and total time 3,5 s / *Beginsnelheid 10 m·s^{-1} opwaarts en totale tyd 3,5 s*

Consider upward motion as positive / *Beskou opwaartse beweging as positief:*

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

$\therefore \Delta y = (10)(3,5)$ ✓ $+ \frac{1}{2}(-10)(3,5)^2$ ✓

$\Delta y = -26,25$ m

Height of cliff/*hoogte van krans* = 26,25 m ✓

Option 2 / *Opsie 2*: Initial velocity 10 m·s^{-1} upwards and final velocity of 25 m·s^{-1} downwards / *Beginsnelheid 10 m·s^{-1} opwaarts en eindsnelheid 25 m·s^{-1}afwaarts*

Consider upward motion as positive/*Beskou opwaartse beweging as positief*

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$\therefore (-25)^2$ ✓ $= (10)^2 + 2(-10)\ \Delta y$ ✓

$\therefore \Delta y = -26,25$ m

Height of cliff/*hoogte van krans* = 26,25 m ✓

Option 3 / *Opsie 3*: Initial velocity 10 m·s^{-1} upwards and final velocity of 25 m·s^{-1} downwards / *Beginsnelheid 10 m·s^{-1} opwaarts en eindsnelheid 25 m·s^{-1}afwaarts*

Consider upward motion as positive/*Beskou opwaartse beweging as positief*

$\Delta y = \frac{(v_i + v_f)}{2} \Delta t$ ✓

$= \frac{(-10 - 25)}{2}(1,5)$ ✓

$= -26,25$ m

Height of cliff/*hoogte van krans* = 26,25 m ✓

Option 4 / *Opsie 4*: Initial velocity 10 m·s^{-1} downwards and total time of 1,5 s / *Beginsnelheid 10 m·s^{-1} en totale tyd van 1,5 s*

Consider upward motion as positive/*Beskou opwaartse beweging as positief:*

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

$\therefore \Delta y = (-10)(1,5)$ ✓ $+ \frac{1}{2}(-10)(1,5)^2$ ✓ $= -15 - 11,25$

$\Delta y = -26,25$ m

Height of cliff/*hoogte van krans* = 26,25 m ✓

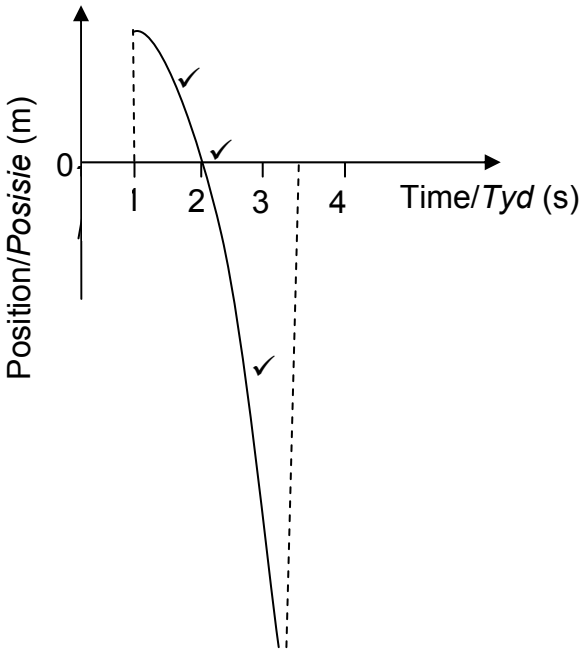
Option 5 / *Opsie 5*: Initial velocity 0 $m \cdot s^{-1}$ and final velocity 25 $m \cdot s^{-1}$ downwards / *Beginsnelheid 0 $m \cdot s^{-1}$ en eindsnelheid van 25 $m \cdot s^{-1}$ afwaarts*

Consider upward motion as positive/*Beskou opwaartse beweging as positief:*
Maximum height above the ground/*Maksimum hoogte bokant grond:*
$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$(-25)^2 = (0)^2 + 2(-10)\Delta y$ ✓
$\therefore \Delta y = -31{,}25$ m

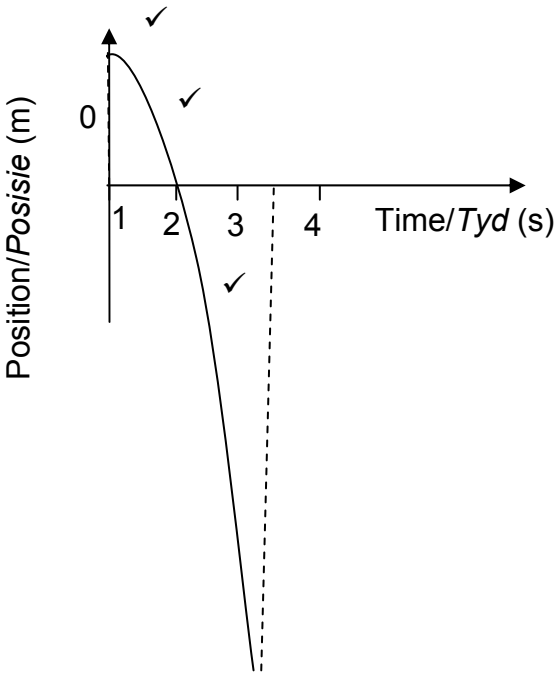
From cliff to maximum height/*vanaf rots tot maksimum hoogte*:
$v_f^2 = v_i^2 + 2a\Delta y$
$0^2 = (-10)^2 + 2(-10)\Delta y$ ✓
$\therefore \Delta y = 5$ m
Height of cliff/*hoogte van rots* = = 31,25 – 5 = 26,25 m ✓

[12.1.2] (4)

6.5

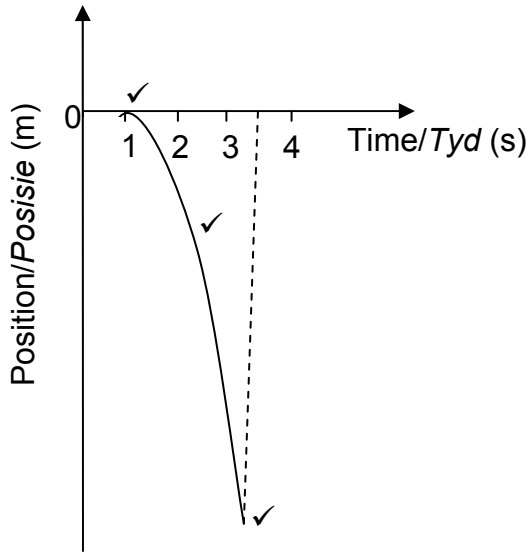


Height of cliff as zero position
Hoogte van krans as nulposisie



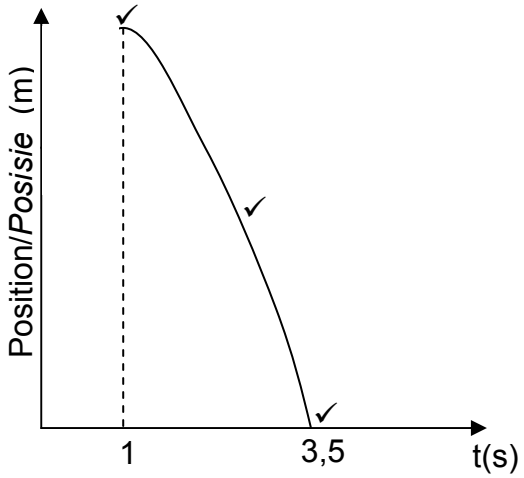
Height of cliff as zero position
Hoogte van krans as nulposisie

Checklist/*Kontrolelys* Criteria for graph/*Kriteria vir grafiek*	Marks/ *Punte*
t = 1s – 3,5 s: shape of curve representing constant acceleration / *Verplasing neem af (kurwe stel konstante versnelling voor)*	✓
At 2 s: Displacement is 0 (intersects time axis) / *Verplasing is 0 (sny tydas)*	✓
Curve stops at 3,5 s/ **Kurwe** *eindig by 3,5 s*	✓



Checklist/*Kontrolelys* Criteria for graph/*Kriteria vir grafiek*	Marks/ *Punte*
t = 1s Displacement is 0 (intersects with x-axis)/ *Verplasing is 0 (sny x-as)*	✓
From 1 – 3,5 s: Curve representing constant acceleration / *kurwe stel konstante versnelling voor*	✓
Graph stops at 3,5 s/ *Grafiek eindig by 3,5 s*	✓

Maximum position zero, upward positive / *Maksimum posisie nul , opwaarts positief*



Checklist/*Kontrolelys* Criteria for graph/*Kriteria vir grafiek*	Marks/ *Punte*
t = 1s: maximum displacement/*maksimum verplasing*	✓
t = 1 s – 3,5 s: curve representing constant acceleration/ *kurwe stel konstante versnelling voor*	✓
t = 3,5 s: Displacement is zero/*Verplasing is nul*	✓

Height of cliff at t = 0 s / *Hoogte van krans by 0 s*

[12.1.2] (3)
[13]

QUESTION 7/*VRAAG 7*

7.1 $200 \times 1\,000 = 2 \times 10^5$ kg ✓ [12.2.3] (1)

7.2 $E_{ki} + E_{pi} = E_{kf} + E_{pf}$ ✓ or/of $E_{mech\ i} = E_{mech\ f}$ or/*of* $\Delta E_p = \Delta E_k$

$0 + mgh_i = E_{kf} + 0$

$0 + (2 \times 10^5)(9,8)(150)$ ✓ $= E_{kf} + 0$ ✓

$\therefore E_{kf} = 2,94 \times 10^8$ J ✓

OR/*OF*

$W_{net} = \Delta E_k$

$F\cos\theta\ \Delta y = E_{kf} - E_{ki}$ ✓

$(200\,000)(9,8)(\cos 0^o)(150)$ ✓ $= E_{kf} - 0$ ✓

$\therefore E_{kf} = 2,94 \times 10^8$ J ✓ [12.2.3] (4)

7.3 $E_{kf} = \frac{1}{2}m v_f^2$ ✓

$2,94 \times 10^8$ J $= \frac{1}{2}(2 \times 10^5)v_f^2$ ✓

$v_f = 54,22\ m \cdot s^{-1}$ ✓ [12.2.3] (3)

7.4 $P = \frac{85}{100} \times \frac{W}{\Delta t} = \frac{85}{100} \times \frac{2,94 \times 10^8}{1}$ ✓

$= 2,499 \times 10^8$ W ✓ Accept/*Aanvaar* $2,5 \times 10^8$ W

OR/*OF*

E_k(effective/*effektief*) $= \frac{85}{100} \times 2,94 \times 10^8$ ✓ $= 2,499 \times 10^8$ J

$P = \frac{W}{\Delta t} = 2,499 \times 10^8$ W ✓ Accept/*Aanvaar* $2,5 \times 10^8$ W [12.2.3] (2)

7.5 Converted to sound / heat in turbine / other forms of energy. ✓
O*mgeskakel na klank / hitte in die turbine / ander vorms van energie* [12.2.3] (1)
[11]

QUESTION 8/*VRAAG 8*

8.1 Doppler effect/*Dopplereffek* ✓ [12.2.1] (1)

8.2.1 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓OR/*OF* $f_s = \frac{v \pm v_s}{v \pm v_L} f_L$ OR/OF

approach/*nader*: $f_L = \frac{v \pm v_L}{v - v_s} f_s$ OR/*OF* $f_L = \frac{v}{v - v_s} f_s$

move away/*beweeg weg:* $f_L = \frac{v \pm v_L}{v + v_s} f_s$ OR/OF $f_L = \frac{v}{v + v_s} f_s$

Ambulance approaching/*Ambulans nader dame:*

$445 \overset{\checkmark}{=} f_s \frac{343}{343 - v_s}$ ✓ $\therefore 445(343 - v_s) = 343 f_s$ …… (i)

Ambulance moving away/*Ambulans beweeg weg*:

$380 \overset{\checkmark}{=} f_s \frac{343}{343 + v_s}$ ✓ $\therefore 380(343 + v_s) = 343 f_s$ ……(ii)

$445(343 - v_s) = 380(343 + v_s)$ ✓

$v_s = 27{,}02 \text{ m·s}^{-1}$ ✓

[12.1.3] (7)

8.2.2 $445 = f_s \frac{343 \pm 0}{343 - v_s}$ OR/*OF* $445(343 - v_s) = 343 f_s$

$\therefore 445(343 - 27{,}02) \overset{\checkmark}{=} 343 f_s$ ✓

$f_s = 409{,}94$ Hz ✓

OR/*OF*

$380 = f_s \frac{343 \pm 0}{343 + v_s}$ OR/*OF* $380(343 + v_s) = 343 f_s$

$380(343 + 27{,}02) \overset{\checkmark}{=} 343 f_s$ ✓

$f_s = 409{,}94$ Hz ✓

[12.2.3] (3)
[11]

QUESTION 9/*VRAAG 9*

9.1 The spreading (or bending) of a wave passing through a small aperture/slit/around a sharp edge/obstacle ✓✓/*Die verspreiding (of buiging) van 'n golf as dit deur 'n nou spleet/om 'n skerp hoek beweeg/versperring.* (2 or/*of* 0) [12.2.1] (2)

9.2 $\sin\theta = m\frac{\lambda}{a}$ ✓ $= 3 \times \frac{644{,}4 \times 10^{-9}}{3437 \times 10^{-9}}$ ✓ $\therefore \theta = 34{,}23°$ ✓

OR/OF

Using radians: $\theta = m\frac{\lambda}{a}$ ✓ $= 3 \times \frac{644{,}4 \times 10^{-9}}{3437 \times 10^{-9}}$ ✓

$\therefore \theta = (0{,}597)(57{,}3) = 34{,}23°$ ✓ [12.2.3] (3)

9.3 A <u>broad central red / bright/ light fringe (bands)</u> ✓followed by <u>alternate dark and red (bright) fringes (bands)</u> on either side ✓/'*n <u>Breë sentrale rooi (helder) band</u> gevolg deur <u>alternatiewe donker en rooi (helder) bande</u> aan beide kante* [12.2.3] (2)

9.4 <u>Similarity/*Ooreenkoms*</u>:
Alternate red and dark bands✓
Afwisselende rooi en donker bande

<u>Difference/*Verskil*</u>:
The red bands are of equal width / no broad central band is observed / The red bands are of equal intensity (brightness) ✓
Die rooi bande is van dieselfde wydte/ geen sentrale breë band word waargeneem nie / Die rooi bande is van gelyke intensiteit (helderheid) [12.1.2] (2)

9.5 No✓, it is not a coherent source / not monochromatic / bands of different colours✓
Nee, dit is nie 'n koherente bron nie / nie monochromaties nie / bande van verskillende kleure [12.2.3] (2)
[11]

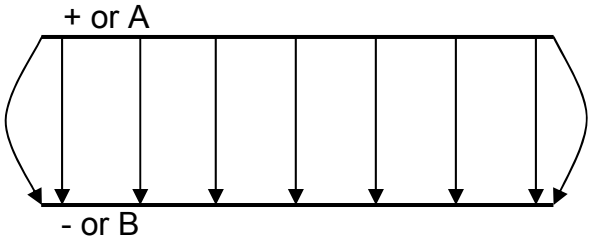
QUESTION 10/*VRAAG 10*

10.1 (Electric) force experienced per (positive) charge placed at the point.✓✓
(Elektriese) krag ondervind per (positiewe) lading geplaas by die punt

OR/*OF*
A point /space where a charge will experience an (electric) force ✓ ✓
'n Punt / ruimte waar 'n lading 'n (elektriese) krag sal ondervind. [12.2.1] (2)

10.2 Negative/*Negatief* ✓
Negative ink droplets deflect away from B / are attracted towards A / repels P / like charges repel✓
Negatiewe inkdruppels word vanaf B gedeflekteer / word deur A aangetrek / stoot P af / gelyksoortige ladings stoot mekaar af [12.1.2] (2)

10.3



Checklist/Kontrolelys Criteria for sketch vir diagram/*Kriteria vir diagram*	Marks/ *Punte*
Field lines parallel and evenly spaced between plates, slightly bent at sides. *Veldlyne parallel en eweredig tussen die plate gespasieer, effens gebuig by die ente*	✓
Direction of field lines from A to B. /*Rigting van veldlyne van A na B.*	✓

[12.1.2] (2)

10.4 $E = \frac{F}{q}$ ✓ = $\frac{2{,}1\times10^{-7}}{1{,}5\times10^{-13}}$ ✓ = 1,4 x 10^6 NC^{-1}

$E = \frac{V}{d}$ ✓ ∴ $1{,}4\times10^{6} = \frac{V}{6{,}4\times10^{-4}}$ ✓

V = 8,96 x 10^2 V✓

OR/*OF*

$V = \frac{Fd}{q}$ ✓✓ = $\frac{(2{,}1\times10^{-7})(6{,}4\times10^{-4})}{1{,}5\times10^{-13}}$ ✓ = 8,96 x 10^2 V✓

(5)

[12.1.3] **[11]**

QUESTION 11/*VRAAG 11*

11.1 Any two/*Enige twee*:
Temperature / *Temperatuur*✓
Cross sectional area (thickness) of material / *Deursnitoppervlak (dikte) van materiaal.* ✓
Length/*Lengte* [12.1.1] (2)

11.2

Option 1 / Opsie 1

Conductor Q✓/*Geleier Q* ✓

For the same potential difference, ✓ wire Q has a higher current than wire P. ✓ Therefore wire Q has a lower resistance than wire P. ✓
Vir dieselfde potensiaalverskil, het draad Q 'n hoër stroom as draad P. Dus het draad Q 'n laer weerstand as draad P

Option 2 / Opsie 2

Conductor Q✓/*Geleier Q*
The gradient of the graph for wire Q is bigger than that for wire P. ✓
Die gradiënt van die grafiek vir draad Q is groter as dié vir draad P
Gradient = $\frac{I}{V}$ is bigger ✓, thus $\frac{V}{I}$ = R is smaller. ✓
Gradiënt = $\frac{I}{V}$ *is groter , dus* $\frac{V}{I}$ *= R is kleiner*

Option 3 / Opsie 3

Conductor Q✓/*Geleier Q* ✓

The gradient of the graph for wire Q is bigger than that for wire P. ✓
Die gradiënt van die grafiek vir draad Q is groter as dié vir draad P
Gradient = $\frac{1}{R}$ is bigger ✓, thus R is smaller. ✓
Gradiënt = $\frac{1}{R}$ *is groter , dus R is kleiner*

Option 4 / Opsie 4

Conductor Q✓/*Geleier Q* ✓
Gradient / Gradiënt = $\frac{I}{V}$ = conductance ✓✓ / konduktansie (geleidings vermoë)
Wire Q has a higher conductance than wire P✓/*Draad Q het 'n hoër konduktansie (geleidingsvermoë) as draad P*

[12.1.2] (4)
[6]

QUESTION 12/*VRAAG 12*

12.1 $V_{int} = 45 - 43,5 = 1,5$ V ✓

$I = \frac{V}{R}$ ✓ $= \frac{1,5}{0,5}$ ✓ $= 3$ A OR/OF

emf/*emk* = $V_{ext} + V_{int}$ ✓
45 = 43,5 ✓ + I(0,5) ✓

I = 3 A

$V_{12\,\Omega} = IR_{12\,\Omega} = 3 \times 12$ ✓ $= 36$ V OR/OF

$V_{//} = 43,5$ ✓ $- 36 = 7,5$ V ✓

$I = \frac{V_{//}}{R} = \frac{7,5}{10}$ ✓ $= 0,75$ A ✓

emf/emk = I(R+r) OR/*OF* V = IR
45 = 3(R + 0,5) ✓ 45 = 3R ✓
R = 14,5 Ω R = 15 Ω

$R_p = 14,5 - 12 = 2,5\ \Omega$ ✓ $R_p = 15 - 12 - 0,5 = 2,5\ \Omega$ ✓

$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2}$

$\frac{1}{2,5} = \frac{1}{10} + \frac{1}{r}$

R = 3,33 Ω ✓

Current divides in ratio 3:1

$\frac{1}{4} \times 3$ ✓ = 0,75 A ✓

[12.1.3] (8)

12.2 $I_R = 3 - 0,75 = 2,25$ A ✓

$R = \frac{V_{//}}{I} = \frac{7,5}{2,25}$ ✓ $= 3,33\ \Omega$ ✓ OR/OF

emf/*emk* = I(R+r)
45 = 3(R + 0,5) ✓
R = 14,5 Ω

$R_p = 14,5 - 12 = 2,5\ \Omega$ ✓

$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2}$ ∴ $\frac{1}{2,5} = \frac{1}{10} + \frac{1}{r}$ ∴ R = 3,33 Ω ✓

[12.1.3] (3)

12.3 Increases/*Toeneem* ✓
The total resistance increases, ✓
therefore the current decreases ✓ therefore $V_{internal}$ decrease ✓ therefore reading on V increases
Die totale weerstand neem toe Stroom neem af, V_{intern} neem af en dus neem V toe (4)

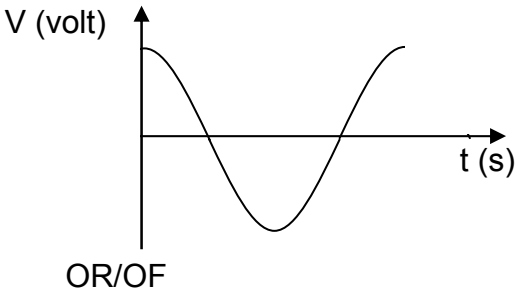
[12.2.3] **[15]**

QUESTION 13/*VRAAG 13*

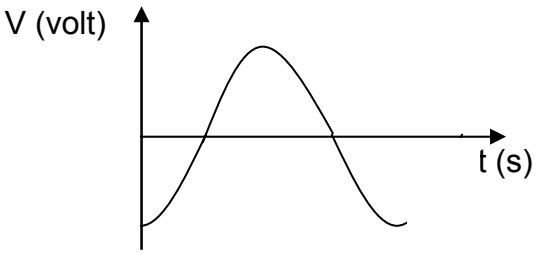
13.1 AC (generator) / *WS* (*generator*)✓
OR/OF Alternator/*Alternator*✓
(Separate) slipring ✓ (for each side of the loop).
(*Aparte*) *sleepring*✓ *(vir elke kant van die winding).* [12.1.2] (2)

13.2 X to/*na* Y ✓✓ [12.1.2] (2)

13.3

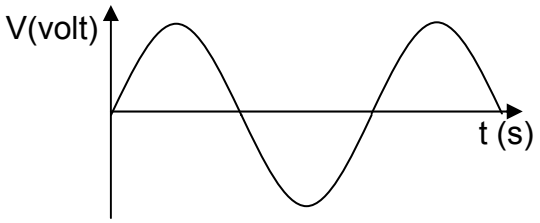


OR/OF



Checklist/Kontrolelys Criteria for sketch graph *Kriteria vir sketsgrafiek*	Marks/ *Punte*
Correct labelling of axes *Korrekte benoeming van asse*	✓
Shape of graph – at least one cycle *Vorm van grafiek- ten minste een siklus*	✓

Accept / *Aanvaar*



[12.1.2] (2)
[6]

QUESTION 14/*VRAAG 14*

14.1 $V_{rms/wgk} = \frac{V_{max}}{\sqrt{2}}$ ✓ ∴ 200 ✓= $\frac{V_{max}}{\sqrt{2}}$ = ∴ $V_{max/maks}$ = 282,84 V✓ [12.2.3] (3)

14.2 $P_{ave} = \frac{V^2_{rms}}{R}$ ✓∴ 1 200 = $\frac{220^2}{R}$ ✓∴ R = 40,33 Ω OR/*OF*

$P_{ave} = V_{rms}I_{rms}$
$1200 = (220)I_{rms}$
I_{rms} = 5,45 A ✓

V = IR
220 = (5,45)R ✓
R = 40,33 Ω

At 200 V: $P_{ave} = \frac{V_{rms}^{\ 2}}{R} = \frac{200^2}{40,33}$ ✓ = 991,82 W ✓

OR/OF
$P_{ave} = V_{rms}I_{rms}$ ∴ 1200 = (220)I_{rms} ∴ I_{rms} = 5,45 A ✓

Using ratio's: 220 V uses current of 5,45 A
∴ 200 V uses current of 4,95 A } ✓

$P_{ave} = V_{rms}I_{rms}$ ∴ = (200)(4,95) ✓ ∴ = 990,91 W✓ [12.1.3] (4)

14.3 V stays constant ✓
As more appliances are connected to the multi-plug the total resistance decreases✓
causing the main current drawn by the multi-plug to increase.✓
Due to the high current the heating effect will increase ✓and can cause damage/trips the main switch
V bly konstant✓
Soos wat meer meer toestelle aan die meervoudige kragprop geskakel word, neem die totale weerstand af
En gevolglik neem die hoofstroom wat deur die meervoudige kragprop getrek word toe
As gevolg van die hoë stroom neem die verhittingseffek toe wat skade kan veroorsaak/die hoofskakelaar kan afskop.

OR/OF

V remains constant ✓; $P_{ave} = V_{rms}I_{rms}$ ∴ $I_{rms} = \frac{P_{ave}}{V_{rms}}$ ✓

As the number of appliances increase, the current drawn will increase✓Due to the high current the heating effect will increase ✓and can cause damage/trips the main switch

V bly konstant; $P_{gem} = V_{wgk}I_{wgk}$ ∴ $I_{wgk} = \frac{P_{gem}}{V_{wgk}}$

Soos die aantal toesetelle toeneem, sal die totale stroom toeneem
As gevolg van die hoë stroom neem die verhittingseffek toe wat skade kan veroorsaak/die hoofskakelaar kan afskop.

[12.3.2] (4)
[11]

QUESTION 15/*VRAAG 15*

15.1 Photo-electric effect/*Foto-elektriese effek* ✓ [12.2.1] (1)

15.2

Option 1 / *Opsie 1*

$c = f\lambda$ ✓ ∴ $3 \times 10^8 = f(200 \times 10^{-9})$ ✓ ∴ $f = 1{,}5 \times 10^{15}$ Hz

$f_0 = \frac{W_0}{h}$ ✓ $= \frac{7{,}57 \times 10^{-19}}{6{,}63 \times 10^{-34}}$ ✓ $= 1{,}14 \times 10^{15}$ Hz ✓

Frequency ($1{,}5 \times 10^{15}$ Hz) greater than threshold frequency ($1{,}14 \times 10^{15}$ Hz) ✓ – photo-electrons will be emitted./ *Frekwensie groter as drumpelfrekwensie – foto-elektrone word vrygestel.*

Option 2 / Opsie 2

$c = f\lambda$ ✓ ∴ $3 \times 10^8 = f(200 \times 10^{-9})$ ✓ ∴ $f = 1{,}5 \times 10^{15}$ Hz

E(photon/*foton*) = hf✓ = $(6{,}63 \times 10^{-34})(1{,}5 \times 10^{15})$ ✓= $9{,}95 \times 10^{-19}$ J ✓
E(photon/*foton*) > work function/*werkfunksie* ✓– photo-electrons will be emitted/*foto-elektrone sal vrygestel word*.

Option 3 / *Opsie 3*

$E = h\frac{c}{\lambda}$ ✓✓= $\frac{(6{,}63 \times 10^{-34})(3 \times 10^8)}{(200 \times 10^{-9})}$ ✓ $= 9{,}95 \times 10^{-19}$ J ✓

E(photon/*foton*) > work function/*werkfunksie* ✓– photo-electrons will be emitted/*foto-elektrone sal vrygestel word*

Option 4 / *Opsie 4*

$hf = W_o + E_k$ ✓ ∴ $h\frac{c}{\lambda} = W_o + E_k$

$\frac{(6{,}63 \times 10^{-34})(3 \times 10^8)}{(200 \times 10^{-9})}$ ✓ $= 7{,}57 \times 10^{-19} + E_k$ ∴ $E_k = 2{,}375 \times 10^{-19}$J ✓

∴ will emit electrons as the electrons have a kinetic energy ✓∴ *sal elektrone vrystel aangesien die elektrone kinetiese energie het*

[12.1.3] (6)

15.3.1 The energy of the photo-electrons remains unchanged ✓
as the frequency / wavelength of the photons did not change. ✓
Die energie van die foto-elektrone bly dieselfde, omdat die frekwensie /golflengte van die fotone nie verander het nie. [12.2.2] (2)

15.3.2 Number of photo-electrons (per second) is increased✓
When the intensity is increased the number of photons will increase, releasing an increased number of electrons. ✓ *Aantal foto-elektrone vrygestel (per sekonde) vermeerder. Verhoging van intensiteit vermeerder die aantal fotone wat meer elektrone vrystel.* (2)
[12.2.2] **[11]**

TOTAL SECTION B/*TOTAAL AFDELING B*: 115
GRAND TOTAL/*GROOTTOTAAL*: 150