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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 2012

MEMORANDUM

MARKS/PUNTE: 150

**This memorandum consists of 12 pages.
Hierdie memorandum bestaan uit 12 bladsye.**

SECTION A

QUESTION 1/VRAAG 1

- 1.1 Frequency/*Frekwensie* ✓ (1)
- 1.2 Capacitor/*Kapasitor* ✓ (1)
- 1.3 Split ring commutator ✓
Splitringkommutator (1)
- 1.4 Photons/*Fotone* ✓ (1)
- 1.5 Relative velocity/*Relatiewe snelheid* ✓ (1)
- [5]

QUESTION 2/VRAAG 2

- 2.1 D ✓✓ (2)
- 2.2 C ✓✓ (2)
- 2.3 D ✓✓ (2)
- 2.4 D ✓✓ (2)
- 2.5 A ✓✓ (2)
- 2.6 A ✓✓ (2)
- 2.7 D ✓✓ (2)
- 2.8 C ✓✓ (2)
- 2.9 C ✓✓ (2)
- 2.10 A ✓✓ (2)
- [20]

TOTAL SECTION A/TOTAAL AFDELING A: 25

SECTION B/AFDELING B

QUESTION 3/VRAAG 3

3.1 Downward/afwaarts ✓

(1)

3.2

3.2.1 **Upwards positive/Opwaarts positief:**

$$\begin{aligned} v_f &= v_i + a\Delta t \checkmark \\ &= 8 \checkmark + (-9,8)(4) \checkmark \\ &= -31,2 \text{ m}\cdot\text{s}^{-1} \\ \therefore v_f &= 31,2 \text{ m}\cdot\text{s}^{-1} \checkmark \end{aligned}$$

Downwards positive/Afwaarts positief:

$$\begin{aligned} v_f &= v_i + a\Delta t \checkmark \\ &= -8 \checkmark + (9,8)(4) \checkmark \\ \therefore v_f &= 31,2 \text{ m}\cdot\text{s}^{-1} \checkmark \end{aligned}$$

(4)

3.2.2

OPTION 1/OPSIE 1

Upwards positive/Opwaarts positief:

$$\begin{aligned} \Delta y &= v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark \\ &= (8)(4) \checkmark + \frac{1}{2}(-9,8)(4)^2 \checkmark \\ &= -46,4 \text{ m} \end{aligned}$$

Height of balcony/Hoogte van balkon:

$$60 - 46,4 \checkmark = 13,6 \text{ m} \checkmark$$

Downwards positive/Afwaarts positief:

$$\begin{aligned} \Delta y &= v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark \\ &= (-8)(4) \checkmark + \frac{1}{2}(9,8)(4)^2 \checkmark \\ &= 46,4 \text{ m} \end{aligned}$$

Height of balcony/Hoogte van balkon:

$$60 - 46,4 \checkmark = 13,6 \text{ m} \checkmark$$

OPTION 2/OPSIE 2

Upwards positive/Opwaarts positief:

$$\begin{aligned} \Delta y &= v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark \\ &= (27,13) \checkmark (6) \checkmark + \frac{1}{2}(-9,8)(6)^2 \checkmark \\ &= -13,62 \text{ m} \end{aligned}$$

Height of balcony/Hoogte van balkon:

$$= 13,62 \text{ m} \checkmark$$

Downwards positive/Afwaarts positief:

$$\begin{aligned} \Delta y &= v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark \\ &= (-27,13) \checkmark (6) \checkmark + \frac{1}{2}(9,8)(6)^2 \checkmark \\ &= 13,62 \text{ m} \end{aligned}$$

Height of balcony/Hoogte van balkon:

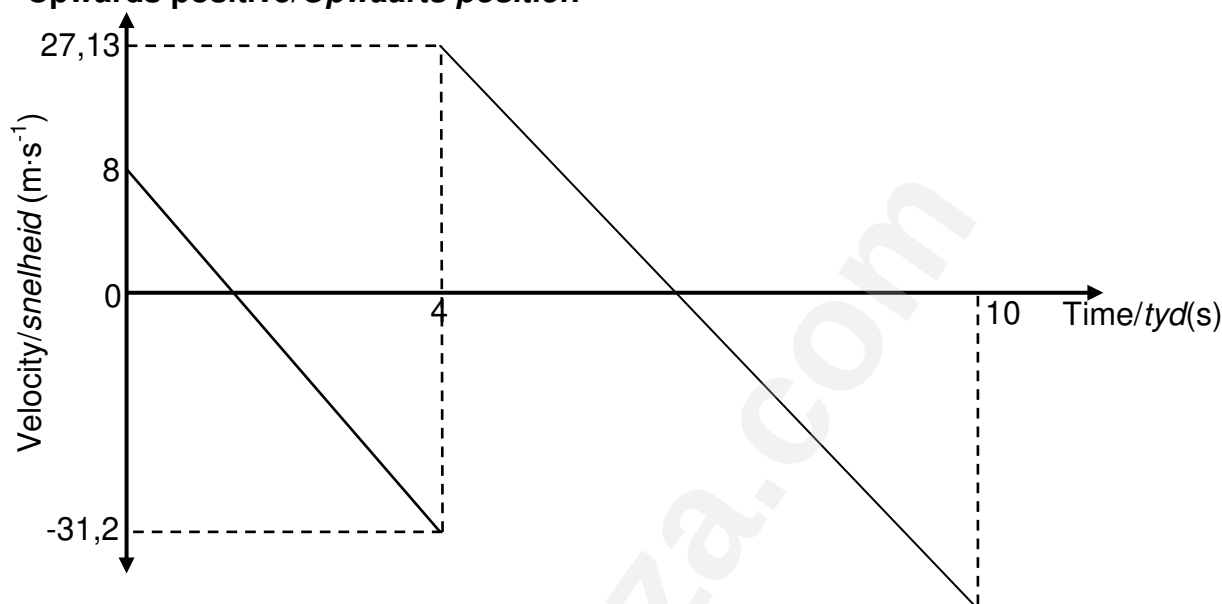
$$= 13,62 \text{ m} \checkmark$$

(5)

3.3

OPTION 1/OPSIE 1

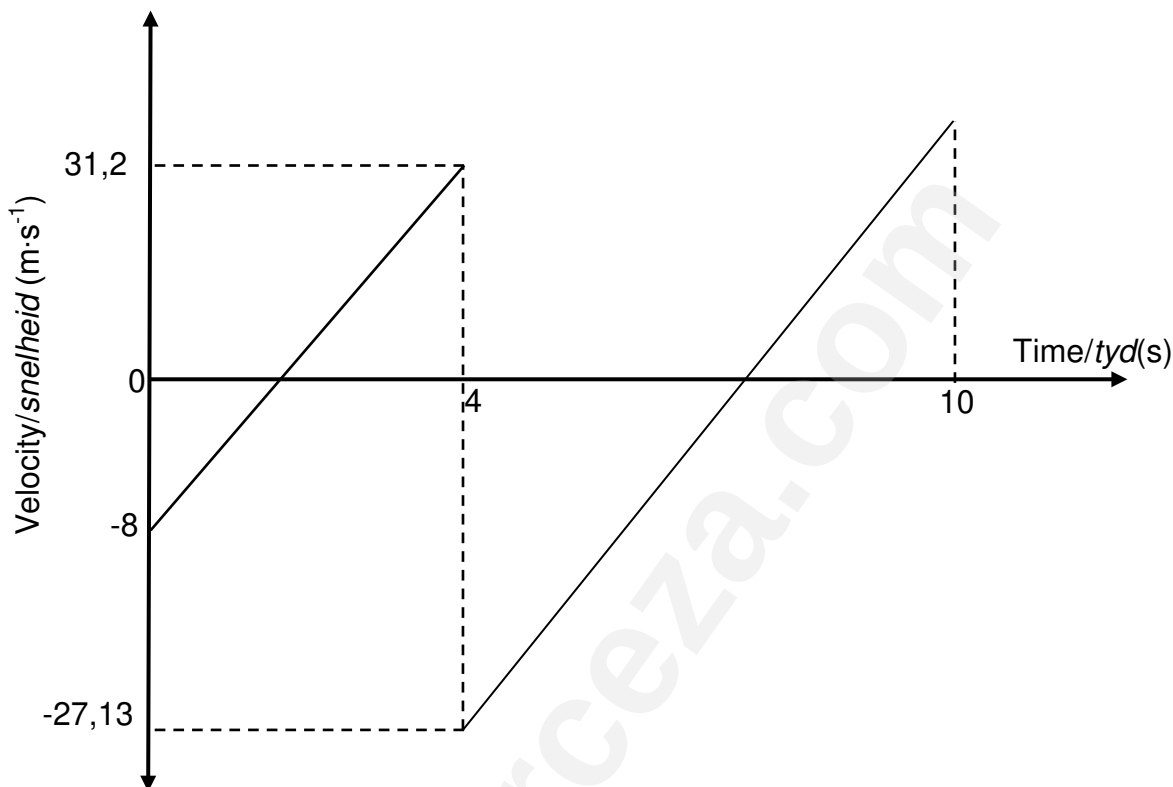
Upwards positive/Opwaarts positief:



Criteria for graph/ <i>Kriteria vir grafiek:</i>	Marks/ Punte
Shape has two parallel lines with a gradient. <i>Vorm het twee ewewydige lyne met gradient.</i>	✓
First part of graph starts at $v = 8 \text{ m}\cdot\text{s}^{-1}$ at $t = 0 \text{ s}$ <i>Eerste deel van grafiek begin by $v = 8 \text{ m}\cdot\text{s}^{-1}$ by $t = 0 \text{ s}$.</i>	✓
Positive marking from QUESTION 3.2.1: <i>Positiewe nasien vanaf VRAAG 3.2.1:</i> First part of the graph extends below the x axis until $v = -31,2 \text{ m}\cdot\text{s}^{-1}$ at $t = 4 \text{ s}$. <i>Eerste deel van die grafiek verleng onder x-as tot $v = -31,2 \text{ m}\cdot\text{s}^{-1}$ by $t = 4 \text{ s}$.</i>	✓
Graph is discontinuous and object changes direction at 4 s. <i>Grafiek is nie kontinu nie en voorwerp verander van rigting by 4 s.</i>	✓
Second part of graph starts at $v = 27,13 \text{ m}\cdot\text{s}^{-1}$ at $t = 4 \text{ s}$. <i>Tweede deel van grafiek begin by $v = 27,13 \text{ m}\cdot\text{s}^{-1}$ by $t = 4 \text{ s}$.</i>	✓
Second part of graph extends below the x axis until $t = 10 \text{ s}$. <i>Tweede deel van grafiek verleng onder x-as tot $t = 10 \text{ s}$.</i>	✓

OPTION 2/OPSIE 2

Upwards negative/Opwaarts negatief:



Criteria for graph/Kriteria vir grafiek:	Marks Punte
Correct shape as shown (two parallel lines). <i>Korrekte vorm soos aangetoon (twee ewewydige lyne).</i>	✓
First part of graph starts at $v = -8 \text{ m}\cdot\text{s}^{-1}$ at $t = 0 \text{ s}$ <i>Eerste deel van grafiek begin by $v = -8 \text{ m}\cdot\text{s}^{-1}$ by $t = 0 \text{ s}$</i>	✓
Positive marking from QUESTION 3.2.1. Positiewe nasien vanaf VRAAG 3.2.1. First part of the graph extends above the x axis until $v = 31,2 \text{ m}\cdot\text{s}^{-1}$ at $t = 4 \text{ s}$. <i>Eerste deel van die grafiek verleng bokant x-as tot $v = 31,2 \text{ m}\cdot\text{s}^{-1}$ by $t = 4 \text{ s}$.</i>	✓
Graph is discontinuous and object changes direction at 4 s. <i>Grafiek is nie kontinu en voorwerp verander van rigting by 4 s.</i>	✓
Second part of graph starts at $v = -27,13 \text{ m}\cdot\text{s}^{-1}$ at $t = 4 \text{ s}$. <i>Tweede deel van grafiek begin by $v = -27,13 \text{ m}\cdot\text{s}^{-1}$ by $t = 4 \text{ s}$.</i>	✓
Second part of graph extends above the x axis until $t = 10 \text{ s}$. <i>Tweede deel van grafiek verleng bokant x-as tot $t = 10 \text{ s}$.</i>	✓

(6)
[16]

QUESTION 4/VRAAG 4

4.1 $40 \text{ m} \cdot \text{s}^{-1}$ ✓ east/oos ✓ (2)

4.2 The total (linear) momentum remains constant/is conserved ✓
in an isolated/a closed system/the absence of external forces/ if the impulse of external forces is zero. ✓

*Die totale (liniêre) momentum bly konstant/behoue ✓
in 'n geïsoleerde sisteem/geslote sisteem/ die afwesigheid van eksterne kragte./ indien die impuls van eksterne kragte nul is. ✓* (2)

4.3 **East positive/Oos positief:**

$$\Sigma p_i = \Sigma p_f \quad \checkmark$$

$$m(20) \checkmark + 2m(-20) \checkmark = (m + 2m)v_f \checkmark$$

$$\therefore v_f = -6,67 \text{ m} \cdot \text{s}^{-1}$$

$$\therefore v_f = 6,67 \text{ m} \cdot \text{s}^{-1} \checkmark \text{ west /wes } \checkmark$$

East negative/Oos negatief:

$$\Sigma p_i = \Sigma p_f \quad \checkmark$$

$$m(-20) \checkmark + 2m(+20) \checkmark = (m + 2m)v_f \checkmark$$

$$\therefore v_f = 6,67 \text{ m} \cdot \text{s}^{-1} \checkmark \text{ west /wes } \checkmark$$

(6)

4.4

4.4.1 F ✓
Newton's Third Law of motion/*Newton se Derde Bewegingswet* ✓ (2)

4.4.2 $-\frac{1}{2} a$ / $\frac{1}{2} a$ ✓
(Same/*Dieselfe* F_{net}), $a \propto \frac{1}{m}$ ✓ (2)

4.4.3 Car driver ✓
(Car - driver system) have greater acceleration. ✓
(Car - driver system) have greater change in velocity /greater Δv . ✓

Motorbestuurder ✓

(Motor -bestuurder sisteem) het groter versnelling. ✓

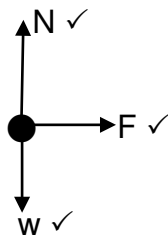
(Motor -bestuurder sisteem) het groter verandering in snelheid / groter Δv . ✓

(3)

[17]

QUESTION 5/VRAAG 5

5.1



(3)

5.2

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). ✓

(2)

5.3

5.3.1 $W_{\text{net}} = \Delta E_k / \Delta K$ ✓ **OR/OF** $F_{\text{net}} \Delta x \cos \theta = \frac{1}{2} m (v_f^2 - v_i^2)$

$F_{\text{net}} (1,02) \cos 180^\circ = \frac{1}{2} (1\,200) (0 - 20^2)$ ✓

$F_{\text{net}} = 235\,294,12 \text{ N}$ ✓ $(2,35 \times 10^5 \text{ N})$

(4)

5.3.2

OPTION 1 / OPSIE 1

$F_{\text{net}} \Delta t = m \Delta v$ ✓

$\therefore (-235\,294,12) \Delta t = (1\,200) (0 - 20)$ ✓

$\therefore \Delta t = 0,1 \text{ s}$ ✓ $(0,102 \text{ s})$

OPTION 2 / OPSIE 2

$\Delta x = \left(\frac{v_i + v_f}{2} \right) \Delta t$ ✓

$1,02 = \left(\frac{20 + 0}{2} \right) \Delta t$ ✓

$\Delta t = 0,1 \text{ s}$ ✓

(4)

[13]

QUESTION 6/VRAAG 6

6.1

Frequency/*Frekwensie* ✓

(1)

6.2

There is relative motion between the bird and the bird watcher. ✓

Daar is relatiewe beweging tussen die voël en die voëlkyker nie. ✓

(1)

6.3

0,2 m ✓

(1)

6.4

6.4.1

$v = f \lambda$ ✓

$340 = f(0,2)$ ✓

$\therefore f = 1\,700 \text{ Hz}$ ✓

(3)

6.4.2

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

$\therefore 1\,700 = \frac{340}{340 - v_s} (1\,650)$ ✓

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

(5)

[11]

QUESTION 7/VRAAG 7

7.1 Double slit/Dubbelspleet ✓ (1)

7.2 (Alternate) dark and bright/blue bands. ✓
Bright / blue bands of equal broadness (width). ✓
 (Afwissellende) donker en helder/blou bande. ✓
Helder / blou bande van gelyke breedte. ✓ (2)

7.3

7.3.1 $\tan \theta = \frac{\frac{1}{2} \text{central band}}{\text{screen distance}} / \frac{\frac{1}{2} \text{sentraleband}}{\text{skermafstand}}$
 $\therefore \tan \theta = \frac{\frac{1}{2}(0,22)}{1,4}$ ✓
 $\therefore \theta = 4,49^\circ$ ✓ (3)

7.3.2

OPTION 1/OPSIE 1:	OPTION 2/OPSIE 2:
$\sin \theta = \frac{m\lambda}{a}$ ✓	$\sin \theta = \frac{m\lambda}{a}$ ✓
$\sin 4,49^\circ = \frac{(1)(470 \times 10^{-9})}{a}$ ✓	$\sin (-4,49^\circ) = \frac{(-1)(470 \times 10^{-9})}{a}$ ✓
$\therefore a = 6 \times 10^{-6} \text{ m } \checkmark (6\,003,67 \text{ nm})$	$\therefore a = 6 \times 10^{-6} \text{ m } \checkmark (6\,003,67 \text{ nm})$

(5)

7.4 $\lambda_{\text{red light}} > \lambda_{\text{blue light}}$ ✓
 (Degree of) diffraction/ $\sin \theta / \theta \propto \text{wavelength } (\lambda)$ ✓
 $\lambda_{\text{rooilig}} > \lambda_{\text{bloulig}}$ ✓
 Diffraksie $\propto$ golflengte (λ) ✓ (2)

[13]

QUESTION 8/VRAAG 8

8.1 $R = \frac{V}{I} \checkmark$
 $1\,000 = \frac{12}{I} \checkmark$
 $\therefore I = 0,01\text{ A} \checkmark$ (3)

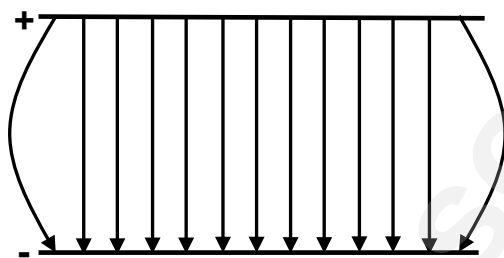
8.2 $12\text{ V} \checkmark$ (1)

8.3 $C = \frac{Q}{V} \checkmark$
 $120 \times 10^{-6} = \frac{Q}{12} \checkmark$
 $\therefore Q = 1,44 \times 10^{-3}\text{ C} \checkmark$ (3)

8.4
 8.4.1 Decreases/*Verminder* $\checkmark$ (1)

8.4.2 Increases/*Vermeerder* $\checkmark$ (1)

8.5
 8.5.1



Criteria for sketch:/ <i>Kriteria vir skets:</i>	Marks/ <i>Punte</i>
Parallel lines equally spaced. <i>Parallele lyne eweredig gespaseer.</i>	$\checkmark$
Direction from positive plate towards negative plate. (Polarity of plates must be indicated) <i>Rigting vanaf positiewe plaat na negatiewe plaat. (Polariteit van plate moet aangedui word)</i>	$\checkmark$
Field curved at the ends of the plates. <i>Veld gekrom aan einde van die plate.</i>	$\checkmark$

(3)

8.5.2
 $E = \frac{V}{d} \checkmark$
 $= \frac{12}{12 \times 10^{-3}} \checkmark$
 $\therefore E = 1\,000\text{ V}\cdot\text{m}^{-1} \checkmark$ (3)

[15]

QUESTION 9/VRAAG 9

9.1

9.1.1

$$\begin{aligned}\frac{1}{R_p} &= \frac{1}{R_1} + \frac{1}{R_2} \checkmark \\ &= \frac{1}{60} + \frac{1}{60} \checkmark \\ \therefore R_p &= 30 \, \Omega \checkmark\end{aligned}$$

(3)

9.1.2

OPTION 1 / OPSIE 1

$$\begin{aligned}R_{\text{ext}} &= 30 + 25 = 55 \, \Omega \checkmark \\ \text{Emf/emk} &= I(R + r) \checkmark \\ \therefore 12 \checkmark &= I(55 + 1,5) \checkmark \\ \therefore I &= 0,21 \, \text{A} \checkmark\end{aligned}$$

OPTION 2 / OPSIE 2:

$$\begin{aligned}R_{\text{tot}} &= (30 + 25) \checkmark + 1,5 = 56,5 \, \Omega \\ V &= IR \checkmark \\ 12 \checkmark &= I(56,5) \checkmark \\ \therefore I &= 0,21 \, \text{A} \checkmark\end{aligned}$$

(5)

9.1.3

OPTION 1/OPSIE 1

$$\begin{aligned}V &= IR \checkmark \\ &= (0,21)(30) \checkmark \\ &= 6,3 \, \text{V} \checkmark\end{aligned}$$

OPTION 2/OPSIE 2

$$\begin{aligned}V &= IR \checkmark \\ &= (0,105)(60) \checkmark \\ &= 6,3 \, \text{V} \checkmark\end{aligned}$$

(3)

9.2

9.2.1

$$1,5 \, \text{V} \checkmark$$

(1)

9.2.2

$$\begin{aligned}\text{gradient/m} &= \frac{\Delta V}{\Delta I} \\ &= \frac{0,65 - 1,5 \checkmark}{1,0 - 0 \checkmark} \\ &= -0,85 \, \Omega \checkmark\end{aligned}$$

(3)

9.2.3

Internal resistance ✓✓
Interne weerstand

(2)

9.2.4

Decreases/*Verminder* ✓

When I increases/*Wanneer I toeneem*:

“Lost volts”/ Ir increases./“Verlore volts”/Ir neem toe. ✓

$$V_{\text{ext}} = \text{emf} - Ir \text{ decreases.} \checkmark / V_{\text{ext}} = \text{emk} - Ir \text{ neem af.}$$

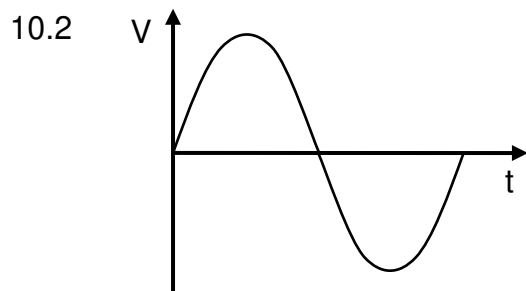
(3)

[20]

QUESTION 10/VRAAG 10

10.1 AC / WS ✓

(1)



Criteria for graph/ <i>Kriteria vir grafiek:</i>	Marks Punte
Correct shape as shown; accept more than one cycle. <i>Korrekte vorm soos aangetoon; aanvaar meer as een siklus.</i>	✓✓
If no/wrong labels: minus 1 mark <i>Indien geen/verkeerde byskifte: minus 1 punt</i>	

(2)

10.3

OPTION 1/OPSIE 1	OPTION 2 / OPSIE 2
$V_{rms/wgk} = \frac{V_{max/maks}}{\sqrt{2}} \checkmark$ $= \frac{30 \times 10^3}{\sqrt{2}} \checkmark$ $= 2,12 \times 10^4 \text{ V}$ $P_{ave} = V_{rms} I_{rms} / P_{gem.} = V_{wgk} I_{wgk} \checkmark$ $4,45 \times 10^9 \checkmark = (2,12 \times 10^4) I_{rms/wgk}$ $\therefore I_{rms/wgk} = 2,10 \times 10^5 \text{ A} \checkmark$	$P_{ave} = V_{rms} I_{rms} / P_{gem.} = V_{wgk} I_{wgk}$ $P_{ave/gem.} = \frac{V_{max} I_{rms}}{\sqrt{2}} / \frac{V_{maks} I_{wgk}}{\sqrt{2}} \checkmark \checkmark$ $4,45 \times 10^9 \checkmark = \frac{(30 \times 10^3) I_{rms/wgk}}{\sqrt{2}} \checkmark$ $\therefore I_{rms/wgk} = 2,10 \times 10^5 \text{ A} \checkmark$

(5)

10.4 Less loss in (electrical) energy (as heat). ✓

Minder verlies aan (elektriese) energie (as hitte). ✓

(1)

[9]

QUESTION 11/VRAAG 11

- 11.1
- 11.1.1 Kinetic energy / *Kinetiese energie* (E_k) ✓ (1)
- 11.1.2 Frequency / *Frekwensie* (f) ✓ (1)
- 11.1.3 (Type of) metal ✓
 (Soort) metaal ✓ (1)
- 11.2 The minimum frequency needed to emit electrons ✓
 from (the surface of) a metal. ✓
Die minimum frekwensie benodig om elektrone vry te stel
vanaf (die oppervlak van) 'n metaal. (2)
- 11.3 9×10^{14} Hz ✓ (1)
- 11.4
- $E = W_0 + E_k$ } ✓ Any one / *Enige een*
 $hf = hf_0 + E_k$ }
- $(6,63 \times 10^{-34})(14 \times 10^{14}) \checkmark = (6,63 \times 10^{-34})(9 \times 10^{14}) \checkmark + E_k$
 $\therefore E_k = 3,32 \times 10^{-19} \text{ J } \checkmark (3,31 \times 10^{-19} \text{ J})$ (4)
- 11.5 Remains the same / *Bly dieselfde* ✓ (1)

[11]

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