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# 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  $\text{N} \cdot \text{C}^{-1} / \text{V} \cdot \text{m}^{-1}$  / 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]

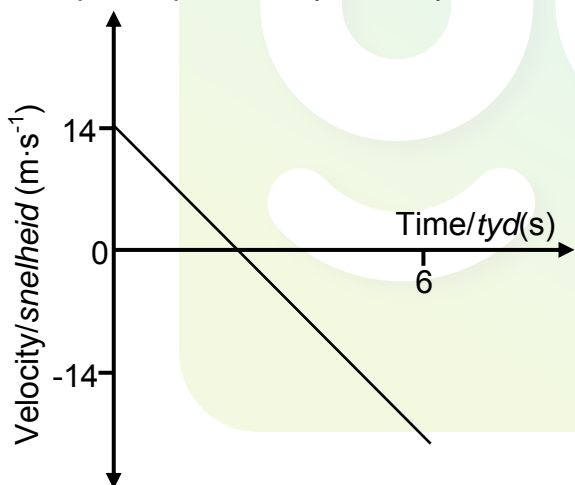
**TOTAL SECTION A / TOTAAL AFDELING A: 25**

**SECTION B / AFDELING B****QUESTION 3 / VRAAG 3**

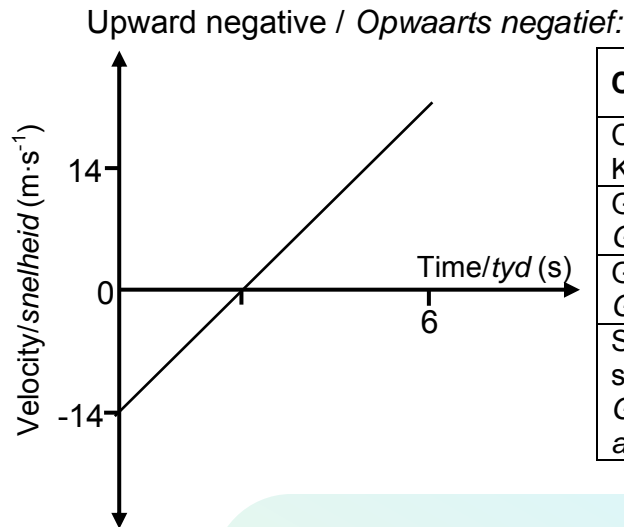
- 3.1 The initial velocity / speed of the camera is the same ✓  
(as that of the balloon).  
*Die beginsnelheid / spoed van die kamera is dieselfde* ✓ (as dié van die ballon). (1)

- 3.2 **Downward positive:**  
**Afwaarts positief:**  
 $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$  ✓  
 $\therefore 92,4 \checkmark = v_i(6) + \frac{1}{2}(9,8)(6)^2$  ✓  
 $\therefore v_i = -14 \text{ m}\cdot\text{s}^{-1}$  ✓  
 $\therefore v_i = 14 \text{ m}\cdot\text{s}^{-1}$  ✓
- Downward negative:**  
**Afwaarts negatief:**  
 $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$  ✓  
 $\therefore -92,4 \checkmark = v_i(6) + \frac{1}{2}(-9,8)(6)^2$  ✓  
 $\therefore v_i = 14 \text{ m}\cdot\text{s}^{-1}$  ✓ (4)

- 3.3 Upward positive/Opwaarts positief:



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



Criteria for graph/Kriteria vir grafiek:	Marks/Punte
Correct shape as shown. Korrekte vorm soos getoon.	✓
Graph starts at $v / v_i = -14 \text{ m} \cdot \text{s}^{-1}$ at $t = 0 \text{ s}$ . Grafiek begin by $v/v_i = -14 \text{ m} \cdot \text{s}^{-1}$ by $t = 0 \text{ s}$ .	✓
Graph extends above $t$ axis until $t = 6 \text{ s}$ . Grafiek verleng bokant $t$ -as tot $t = 6 \text{ s}$ .	✓
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:**

$$\Delta x = v \Delta t \checkmark$$

$$\therefore 10 \checkmark = (2) \Delta t \checkmark$$

$$\therefore \Delta t = 5 \text{ s} \checkmark$$

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:**

$$\Delta x = v \Delta t \checkmark$$

$$= (2) \checkmark (6) \checkmark$$

$$= 12 \text{ m} \checkmark$$

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:**

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

$$\therefore 10 \checkmark = (2) \Delta t \checkmark + \frac{1}{2} (0) \Delta t$$

$$\therefore \Delta t = 5 \text{ s} \checkmark$$

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:**

$$\Delta x = \left( \frac{v_i + v_f}{2} \right) \Delta t \checkmark \therefore 10 \checkmark = \left( \frac{2+2}{2} \right) \Delta t \checkmark \therefore \Delta t = 5 \text{ s} \checkmark$$

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:**

$$\Delta x = \left( \frac{v_i + v_f}{2} \right) \Delta t \checkmark = \left( \frac{2+2}{2} \right) \checkmark 6 \checkmark = 12 \text{ m} \checkmark$$

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  $30 \text{ m}\cdot\text{s}^{-1}$  ✓ east / oos ✓**Notes / Aantekeninge:**

$$V_{TP} = V_{TG} - V_{PG} = 40 - 10 = 30$$

$$\therefore V_{TP} = 30 \text{ m}\cdot\text{s}^{-1} \text{ east/oos}$$

**OR/OF**

$$V_{TP} = V_{TG} + V_{GP} = 40 + (-10) = 30$$

$$\therefore V_{TP} = 30 \text{ m}\cdot\text{s}^{-1} \text{ east/oos}$$

(2)

4.2  $70 \text{ m}\cdot\text{s}^{-1}$  ✓ east / oos ✓**Notes / Aantekeninge:****Solution 1 / Oplossing 1:**

$$V_{BT} = V_{BP} - V_{TP}$$

$$= 100 - 30 = 70$$

$$\therefore V_{BT} = 70 \text{ m}\cdot\text{s}^{-1} \text{ east / oos}$$

**Solution 2 / Oplossing 2**

$$V_{BT} = V_{BP} + V_{PT}$$

$$= 100 + (-30) = 70$$

$$\therefore V_{BT} = 70 \text{ m}\cdot\text{s}^{-1} \text{ east/oos}$$

**OR / OF**

$$V_{BT} = V_{BP} + V_{PG} + V_{GT}$$

$$= 100 + 10 + (-40)$$

$$= 70$$

$$\therefore V_{BT} = 70 \text{ m}\cdot\text{s}^{-1} \text{ east / oos}$$

**Solution 3 / Oplossing 3**

$$V_{BT} = V_{BP} + V_{PG} + V_{GT}$$

$$= 100 + 10 + (-40)$$

$$= 70$$

$$\therefore V_{BT} = 70 \text{ m}\cdot\text{s}^{-1} \text{ east / oos}$$

**Solution 4 / Oplossing 4**

$$V_{BG} = V_{BP} + V_{PG}$$

$$= 100 + 10 = 110$$

$$\therefore V_{BG} = 110 \text{ m}\cdot\text{s}^{-1}$$

$$V_{BT} = V_{BG} + V_{GT}$$

$$= 110 + (-40) = 70$$

$$\therefore V_{BT} = 70 \text{ m}\cdot\text{s}^{-1} \text{ east / oos}$$

(2)

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

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

(2)

4.4

**Option 1 / Opsie 1:**

To the right as positive / Na regs as positief:

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

$$(1\,000)(40) \checkmark + (5\,000)(-20) \checkmark = (1\,000 + 5\,000)v_f \checkmark$$

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

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

**Option 2 / Opsie 2:**

To the right as positive / Na regs as positief:

$$\Delta p_{\text{car}} = -\Delta p_{\text{truck}} \checkmark$$

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

$$(1\,000)(v_f - (40)) \checkmark = -(5\,000)(v_f \checkmark - (-20)) \checkmark$$

$$6\,000v_f = -60\,000$$

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

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

(6)

4.5

**Option 1 / Opsie 1:**

Force on car / Krag op motor:

To the right as positive / Na regs as positief:

$$F_{\text{net}}\Delta t = \Delta p \checkmark = mv_f - mv_i$$

$$F_{\text{net}}(0,5) \checkmark = 1\,000(-10 - 40) \checkmark$$

$$\therefore F_{\text{net}} = -1 \times 10^5 \text{ N } \checkmark \text{ OR/OF}$$

$$\therefore F_{\text{net}} = 1 \times 10^5 \text{ N } (100\,000 \text{ N})$$

$$\therefore F_{\text{net}} > 85\,000 \text{ N}$$

Yes, collision is fatal. / Ja, botsing is fataal.  $\checkmark$ 

Force on car / Krag op motor:

To the left as positive / Na links as positief:

$$F_{\text{net}}\Delta t = \Delta p \checkmark = mv_f - mv_i$$

$$F_{\text{net}}(0,5) \checkmark = 1\,000(10 - (-40)) \checkmark$$

$$\therefore F_{\text{net}} = 1 \times 10^5 \text{ N } \checkmark (100\,000 \text{ N})$$

$$\therefore F_{\text{net}} > 85\,000 \text{ N}$$

Yes, collision is fatal. / Ja, botsing is fataal.  $\checkmark$ **Option 2 / Opsie 2:**

Force on truck / Krag op vragmotor:

To the right as positive / Na regs as positief:

$$F_{\text{net}}\Delta t = \Delta p \checkmark = mv_f - mv_i$$

$$F_{\text{net}}(0,5) \checkmark = 5\,000(-10 - (-20)) \checkmark$$

$$\therefore F_{\text{net}} = 1 \times 10^5 \text{ N } \checkmark (100\,000 \text{ N})$$

$$\therefore F_{\text{net}} > 85\,000 \text{ N}$$

Yes, collision is fatal. / Ja, botsing is fataal.  $\checkmark$ 

Force on truck / Krag op vragmotor:

To the left as positive / Na links as positief:

$$F_{\text{net}}\Delta t = \Delta p \checkmark = mv_f - mv_i$$

$$F_{\text{net}}(0,5) \checkmark = 5\,000(10 - 20) \checkmark$$

$$\therefore F_{\text{net}} = -1 \times 10^5 \text{ N } \checkmark$$

$$\therefore F_{\text{net}} = 1 \times 10^5 \text{ N } (100\,000 \text{ N})$$

$$\therefore F_{\text{net}} > 85\,000 \text{ N}$$

Yes, collision is fatal / Ja, botsing is fataal.  $\checkmark$ **Option 3 / Opsie 3:**

Force on car / Krag op motor:

To the right as positive / Na regs as positief:

$$v_f = v_i + a \Delta t$$

$$\therefore -10 = 40 + a(0,5) \checkmark$$

$$\therefore a = -100$$

$$F_{\text{net}} = ma = (1\,000)(-100) \checkmark$$

$$\therefore F_{\text{net}} = -1 \times 10^5 \text{ N } \checkmark (-100\,000 \text{ N})$$

$$\therefore F_{\text{net}} = 1 \times 10^5 \text{ N } (100\,000 \text{ N})$$

$$\therefore F_{\text{net}} > 85\,000 \text{ N}$$

Yes, collision is fatal. / Ja, botsing is fataal.  $\checkmark$ 

$\checkmark$  Both  
formulae/  
Beide  
formules

Force on car / Krag op motor:

To the left as positive / Na links as positief:

$$v_f = v_i + a \Delta t$$

$$\therefore 10 = -40 + a(0,5) \checkmark$$

$$\therefore a = 100$$

$$F_{\text{net}} = ma = (1\,000)(100) \checkmark$$

$$\therefore F_{\text{net}} = 1 \times 10^5 \text{ N } \checkmark (100\,000 \text{ N})$$

$$\therefore F_{\text{net}} > 85\,000 \text{ N}$$

Yes, collision is fatal. / Ja, botsing is fataal.  $\checkmark$ 

$\checkmark$  Both  
formulae/  
Beide  
formules



<p><b>Option 4 / Opsie 4:</b> Force on truck / <i>Krag op vrugmotor:</i> To the right as positive / <i>Na regs as positief:</i></p> <p><math>v_f = v_i + a \Delta t</math>  <math>\therefore -10 = -20 + a(0,5) \checkmark</math>  <math>\therefore a = 20</math>  <math>F_{\text{net}} = ma = (5\,000)(20) \checkmark</math>  <math>\therefore F_{\text{net}} = 1 \times 10^5 \text{ N} \checkmark (100\,000 \text{ N})</math>  <math>\therefore F_{\text{net}} &gt; 85\,000 \text{ N}</math>          Yes, collision is fatal. / <i>Ja, botsing is fataal.</i> <math>\checkmark</math></p>	<p>Force on truck / <i>Krag op vrugmotor:</i> To the left as positive / <i>Na links as positief:</i></p> <p><math>v_f = v_i + a \Delta t</math>  <math>\therefore 10 = 20 + a(0,5) \checkmark</math>  <math>\therefore a = -20</math>  <math>F_{\text{net}} = ma = (5\,000)(-20) \checkmark</math>  <math>\therefore F_{\text{net}} = -1 \times 10^5 \text{ N} \checkmark (-100\,000 \text{ N})</math>  <math>\therefore F_{\text{net}} = 1 \times 10^5 \text{ N} (100\,000 \text{ N})</math>  <math>\therefore F_{\text{net}} &gt; 85\,000 \text{ N}</math>          Yes, collision is fatal. / <i>Ja, botsing is fataal.</i> <math>\checkmark</math></p>
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(5)  
[17]

## QUESTION 5 / VRAAG 5

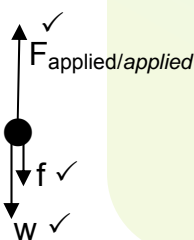
- 5.1 The net (total) work (done on an object)  $\checkmark$   
 is equal to the change in kinetic energy (of the object.)  $\checkmark$   
*Die netto (totale) arbeid (verrig op 'n voorwerp)  $\checkmark$*   
*is gelyk aan die verandering in kinetiese energie (van die voorwerp)  $\checkmark$*

### OR / OF

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

(2)

5.2



(3)

- 5.3 Gravitational force/weight (of soldier)  $\checkmark$   
*Gravitasiekrag/gewig (van soldaat)*

(1)

- 5.4  $W_{\text{net}} = \Delta K \checkmark$

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

$$(960)(20) \cos 0^\circ \checkmark + (80)(9,8)(20) \cos 180^\circ \checkmark + W_f = 0 \checkmark$$

$$19\,200 - 15\,680 + W_f = 0$$

$$W_f = -3\,520 \text{ J} \checkmark$$

(5)  
[11]



## QUESTION 6 / VRAAG 6

6.1 Doppler effect / Doppler-effek ✓ (1)

6.2  $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$  ✓  
 $\therefore f_L = \frac{340 \pm 0}{340 - 20} \checkmark (458) \checkmark$   
 $\therefore f_L = 486,63 \text{ Hz} \checkmark$  (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: <i>Kriteria vir ondersoekende vraag:</i>	Mark/ Punt
The <u>dependent</u> and <u>independent</u> variables are stated. <i>Die afhanklike en onafhanklike veranderlikes is genoem.</i>	✓
Asks a question about the relationship between <u>dependent</u> and <u>independent</u> variables. <i>Vra 'n vraag oor die verwantskap tussen die afhanklike en onafhanklike veranderlikes.</i>	✓

**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) / Frekwensie (van lig) / 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:**

$$\sin \theta = \frac{m\lambda}{a} \checkmark$$

$$\sin \theta = \frac{(2)(4 \times 10^{-7})}{2,2 \times 10^{-6}} \checkmark$$

$$\therefore \theta = 21,32^\circ \checkmark$$

**Option 2 / Opsie 2:**

$$\sin \theta = \frac{m\lambda}{a} \checkmark$$

$$\sin \theta = \frac{(-2)(4 \times 10^{-7})}{2,2 \times 10^{-6}} \checkmark$$

$$\therefore \theta = -21,32^\circ \checkmark$$

(5)

[13]

## QUESTION 8 / VRAAG 8

- 8.1 T to/na P ✓

(1)

8.2  $Q = \frac{3 \times 10^{-9} + (-6 \times 10^{-9})}{2} \checkmark = -1,5 \times 10^{-9} \text{ C}$

$$\begin{aligned} \Delta Q_P &= Q_P(\text{final}) - Q_P(\text{initial}) \\ &= -1,5 \times 10^{-9} - 3 \times 10^{-9} \checkmark \\ &= -4,5 \times 10^{-9} \text{ C} \checkmark \end{aligned}$$

**OR / OF**

$$\begin{aligned} \Delta Q_T &= Q_T(\text{final}) - Q_T(\text{initial}) \\ &= -1,5 \times 10^{-9} - (-6 \times 10^{-9}) \checkmark \\ &= 4,5 \times 10^{-9} \text{ C} \checkmark \end{aligned}$$

(3)

8.3 Number of electrons / *Getal elektrone* =  $\frac{-4,5 \times 10^{-9}}{-1,6 \times 10^{-19}} \checkmark$   
 $= 2,81 \times 10^{10} \checkmark$

(2)

8.4

**Option 1 / Opsie 1**

$$F_{TR} = \frac{kQ_1Q_2}{r^2} \checkmark$$

$$= \frac{(9 \times 10^9)(1,5 \times 10^{-9})(3 \times 10^{-9})}{1^2} \checkmark$$

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

*na links/na P toe*

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

$$= \frac{(9 \times 10^9)(1,5 \times 10^{-9})(3 \times 10^{-9})}{0,5^2} \checkmark$$

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

*na regs/na T toe*

To the right / towards T as positive: / Na regs / na T toe as positief

$$F_{\text{net}} = 1,62 \times 10^{-7} - 4,05 \times 10^{-8}$$

$$= 1,22 \times 10^{-7} \text{ N } (1,215 \times 10^{-7} \text{ N})$$

$$= 1,22 \times 10^{-7} \text{ N } \checkmark \text{ to the right / towards T / na regs / na T toe } \checkmark$$

✓ Any one  
Enige een

(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 =  $\frac{\Delta y}{\Delta x} = \frac{0,64 - 0}{4 - 0} \checkmark = 0,16$

$R = \frac{1}{0,16} = 6,25 \Omega \checkmark \checkmark$  (4)  
[9]

## QUESTION 10 / VRAAG 10

10.1 12 V ✓ (1)

<p><b>Option 1 / Opsie 1:</b></p> $I = \frac{V}{R} \checkmark = \frac{9,6}{2,4} \checkmark = 4 \text{ A}$	<p><b>Option 2 / Opsie 2:</b></p> $\text{emf} = IR + Ir \checkmark$ $12 = I(2,4) + 2,4 \checkmark \therefore I = 4 \text{ A} \checkmark$
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(3)

10.2.2	<p><b>Option 1 / Opsie 1:</b>  <math>\text{emf}/\text{emk} = IR + Ir \checkmark</math>  <math>12 = 9,6 + 4r \checkmark</math>  <math>\therefore r = 0,6 \Omega \checkmark</math></p>	<p><b>Option 2 / Opsie 2:</b>  <math>V_{\text{lost/verlore}} = Ir \checkmark</math>  <math>2,4 = 4r \checkmark</math>  <math>\therefore r = 0,6 \Omega \checkmark</math></p>
	<p><b>Option 3 / Opsie 3:</b>  <math>\text{emf}/\text{emk} = I(R + r) \checkmark</math>  <math>12 = 4(2,4 + r) \checkmark \therefore r = 0,6 \Omega \checkmark</math></p>	

(3)

10.3

<p><b>Option 1 / Opsie 1:</b>  <math>\text{emf}/\text{emk} = I(R + r) \checkmark</math>  <math>12 = 6(R + 0,6) \checkmark</math>  <math>R_{\text{ext/eks}} = 1,4 \Omega</math>  <math>\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \checkmark</math>  <math>\frac{1}{1,4} = \frac{1}{2,4} + \frac{1}{R} \checkmark</math>  <math>\therefore R = 3,36 \Omega</math>          Each tail lamp/Elke agterlig:  <math>\therefore R = 1,68 \Omega \checkmark</math></p>	<p><b>Option 2 / Opsie 2:</b>  <math>\text{Emf} = V_{\text{terminal}} + Ir \checkmark</math>  <math>12 = V_{\text{terminal}} + 6(0,6) \checkmark</math>  <math>\therefore V_{\text{terminal}} = 8,4 \text{ V}</math>  <math>I_{2,4 \Omega} = \frac{V}{R} = \frac{8,4}{2,4} = 3,5 \text{ A}</math>  <math>I_{\text{tail lamps/agterligte}} = 6 - 3,5 = 2,5 \text{ A}</math>  <math>R_{\text{tail lamps/agterligte}} = \frac{V}{I} \checkmark = \frac{8,4}{2,5} \checkmark = 3,36 \Omega</math>  <math>R_{\text{tail lamp/agterlig}} = 1,68 \Omega \checkmark</math></p>
<p><b>Option 3 / Opsie 3:</b>  <math>V = IR \checkmark</math>  <math>12 = (6)R \checkmark</math>  <math>R_{\text{ext}} = 2 \Omega</math>  <math>\therefore R_{\text{parallel}} = 2 - 0,6 = 1,4 \Omega</math>  <math>\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \checkmark</math>  <math>\frac{1}{1,4} = \frac{1}{2,4} + \frac{1}{R} \checkmark</math>  <math>\therefore R = 3,36 \Omega</math>          Each tail lamp/Elke agterlig: <math>R = 1,68 \Omega \checkmark</math></p>	<p><b>Option 4 / Opsie 4:</b>          For parallel combination: <math>I_1 + I_2 = 6 \text{ A}</math>          Vir parallelle kombinasie: <math>I_1 + I_2 = 6 \text{ A}</math>  <math>\therefore \frac{V}{2,4} + \frac{V}{R_{\text{taillamps}}} \checkmark = 6 \checkmark</math>  <math>8,4 \checkmark \left( \frac{1}{2,4} + \frac{1}{R_{\text{taillamps}}} \right) \checkmark = 6</math>  <math>\therefore R_{\text{tail lamps/agterligte}} = 3,36</math>  <math>R_{\text{tail lamp/agterligte}} = 1,68 \Omega \checkmark</math></p>

(5)

- 10.4 Increases / Vermeerder  $\checkmark$   
Resistance increases, current decreases  $\checkmark$   
Ir (lost volts) decreases  $\checkmark$   
 Vermeerder  $\checkmark$   
Weerstand verhoog, stroom verlaag  $\checkmark$   
Ir (verlore volts) verminder / neem af.  $\checkmark$

(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:

$$\begin{aligned} P_{\text{ave}} &= V_{\text{rms}} I_{\text{rms}} \checkmark \\ &= \frac{V_{\text{max}}}{\sqrt{2}} \checkmark \cdot \frac{I_{\text{max}}}{\sqrt{2}} \checkmark \\ &= \frac{(311)(21)}{2} \checkmark \checkmark \\ &= 3\,265,5 \text{ W} \checkmark \end{aligned}$$

### OR / OF

$$\begin{aligned} P_{\text{max}} &= V_{\text{max}} I_{\text{max}} \checkmark \\ &= (311) \checkmark (21) \checkmark \\ &= 6531 \text{ W} \\ \therefore P_{\text{ave}} &= \frac{P_{\text{max}}}{2} \checkmark \checkmark = \frac{6531}{2} \\ &= 3\,265,5 \text{ W} \checkmark \end{aligned}$$

### Option 2 / Opsie 2:

$$\begin{aligned} V_{\text{rms}} &= \frac{V_{\text{max}}}{\sqrt{2}} \checkmark \\ &= \frac{311}{\sqrt{2}} \checkmark \\ &= 219,91 \text{ V} \\ I_{\text{rms}} &= \frac{I_{\text{max}}}{\sqrt{2}} \checkmark \\ &= \frac{21}{\sqrt{2}} \checkmark \\ &= 14,85 \text{ A} \\ P_{\text{ave}} &= V_{\text{rms}} I_{\text{rms}} \checkmark \\ &= (219,91)(14,85) \\ &= 3\,265,66 \text{ W} \checkmark \end{aligned}$$

### Option 3 / Opsie 3

$$\begin{aligned} R &= \frac{V}{I} \checkmark = \frac{311}{21} \checkmark = 14,81 \, \Omega \\ I_{\text{rms}} &= \frac{I_{\text{max}}}{\sqrt{2}} \checkmark \\ &= \frac{21}{\sqrt{2}} \checkmark \\ &= 14,85 \text{ A} \\ P_{\text{ave}} &= I_{\text{rms}}^2 R \checkmark \\ &= (14,85)^2 (14,81) \\ &= 3\,265,83 \text{ W} \checkmark \end{aligned}$$

### Option 4 / Opsie 4

$$\begin{aligned} R &= \frac{V}{I} \checkmark = \frac{311}{21} \checkmark = 14,81 \, \Omega \\ V_{\text{rms}} &= \frac{V_{\text{max}}}{\sqrt{2}} \checkmark \\ &= \frac{311}{\sqrt{2}} \checkmark \\ &= 219,91 \text{ V} \\ P_{\text{ave}} &= \frac{V_{\text{rms}}^2}{R} \checkmark \\ &= \frac{219,91^2}{14,81} \\ &= 3\,265,83 \text{ W} \checkmark \end{aligned}$$

(6)

[12]

## QUESTION 12 / VRAAG 12

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

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

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

**OR/OF**

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

$$E = hf$$

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

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

✓ for both equations  
vir beide vergelykings

(4)

12.4

### **Option 1 / Opsie 1:**

$$\left. \begin{aligned} E &= W_o + K \\ \frac{hc}{\lambda} &= W_o + K \end{aligned} \right\} \checkmark \text{ Any one / Enige een}$$

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

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

### **Option 2 / Opsie 2:**

$$\left. \begin{aligned} E &= W_o + K \\ hf &= W_o + K \end{aligned} \right\} \checkmark \text{ Any one / Enige een}$$

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

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

(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**