



education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

**NATIONAL
SENIOR CERTIFICATE
*NASIONALE
SENIOR SERTIFIKAAT***

GRADE/GRAAD 12

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

SEPTEMBER 2022

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/PUNTE: 150

These marking guidelines consists of 15 pages

Hierdie nasienriglyne bestaan uit 15 bladsye

QUESTION 1 / VRAAG 1

- | | | |
|------|------|-------------|
| 1.1 | D ✓✓ | (2) |
| 1.2 | B ✓✓ | (2) |
| 1.3 | B ✓✓ | (2) |
| 1.4 | D ✓✓ | (2) |
| 1.5 | A ✓✓ | (2) |
| 1.6 | B ✓✓ | (2) |
| 1.7 | C ✓✓ | (2) |
| 1.8 | C ✓✓ | (2) |
| 1.9 | A ✓✓ | (2) |
| 1.10 | B ✓✓ | (2) |
| | | [20] |

QUESTION 2 / VRAAG 2

2.1

Marking criteria/Nasienkriteria

If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. /Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

A body will remain in its state of rest or motion at constant velocity unless a non-zero resultant/net/unbalanced force acts on it. ✓✓

'n Liggaam sal in 'n toestand van rus of beweging teen 'n konstante snelheid volhard, tensy 'n nie-nul resulterende/netto/ongebalanseerde krag daarop inwerk.

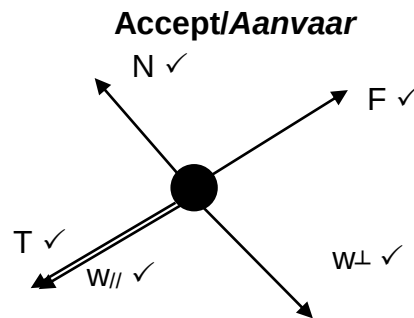
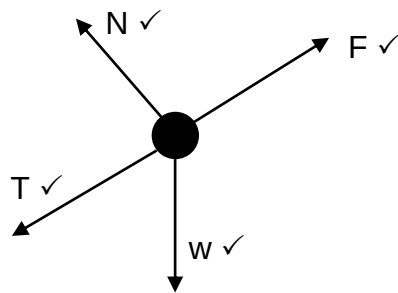
OR/OF

A body will remain in its state of rest or uniform motion in a straight line unless a non-zero resultant/net/unbalanced force acts on it. ✓

'n Liggaam sal in 'n toestand van rus of uniforme beweging in 'n reguit lyn volhard, tensy 'n nie-nul resulterende/netto/ongebalanseerde krag daarop inwerk.

(2)

2.2



(4)

Accepted labels / Aanvaarde benoemings	
w	F_g / F_w / force of earth on block / weight / mg / gravitational force / 29,4 N
F	F_{applied} / F_A / Applied force
T	Tension in rope / F_T
N	Normal force / F_N / 25,46 N

Notes/Aantekeninge:

- Any additional forces: deduct 1 mark: max $\frac{3}{4}$
- No labels: deduct 1 mark: max $\frac{3}{4}$
- No arrows: $\frac{0}{4}$
- Force(s) not touching object: deduct 1 mark: max $\frac{3}{4}$
- Ignore relative sizes of the vectors

2.3 $F = (F_{g//})_{5\text{kg}} + (F_{g//})_{3\text{kg}} - f_s$
 $= 5(9,8)\sin 30^\circ + 3(9,8)\sin 30^\circ - 16,97 = 22,23 \text{ N}$ (3)

2.4 **Marking criteria/Nasienkriteria:**

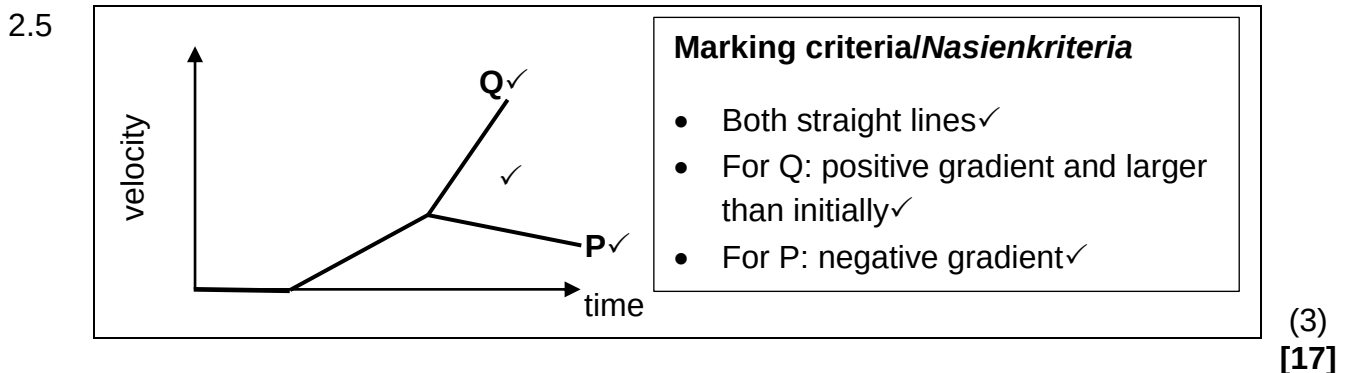
- Formula for block P or block Q ✓
- Substitution of F_{net} for block P ✓
- Substitution of F_{net} for block Q ✓
- $5a$ OR $3a$ ✓
- Answer: $a = 5,16 \text{ m}\cdot\text{s}^{-2}$ ✓

For Block P: $F_{\text{net}} = ma$
 $T + (-F_{g//}) + (-f) = ma$
 $T - (5 \times 9,8)\sin 30^\circ - 4,5 = 5a$
 $T = 5a + 29$

Any one ✓

For Block Q: $F_{\text{net}} = ma$
 $F + (-F_{g//}) + (-T) = ma$
 $85 - (3 \times 9,8)\sin 30^\circ - T = 3a$
 $T = 70,3 - 3a$

$\therefore 5a + 29 = 70,3 - 3a$
 $8a = 41,3$
 $a = 5,16 \text{ m}\cdot\text{s}^{-2}$ ✓ (5)



QUESTION 3 / VRAAG 3

3.1 $9,8 \text{ m}\cdot\text{s}^{-2}$ ✓ downwards / afwaarts ✓ (2)

3.2.1 **Note:** do not penalize for the omission of zero(s).

OPTION 1	
Upwards positive: $\Delta y = -50 - (-1,5) = -48,5 \text{ m}$ ✓ $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $= 0 + 2(-9,8)(-48,5)$ ✓ $v_f = 30,83 \text{ m}\cdot\text{s}^{-1}$ ✓	Downwards positive: $\Delta y = 50 - 1,5 = 48,5 \text{ m}$ ✓ $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $= 0 + 2(9,8)(48,5)$ ✓ $v_f = 30,83 \text{ m}\cdot\text{s}^{-1}$ ✓

OPTION 2	
$(mgh + \frac{1}{2}mv^2)_{\text{top}} = (mgh + \frac{1}{2}mv^2)_P$ ✓ $m(9,8)(50) + 0 = m(9,8)(1,5) + \frac{1}{2}(m)v^2$ ✓	$(mgh + \frac{1}{2}mv^2)_{\text{top}} = (mgh + \frac{1}{2}mv^2)_P$ ✓ $m(9,8)(48,5) + 0 = 0 + \frac{1}{2}(m)v^2$ ✓

(4)

	$v = 30,83 \text{ m}\cdot\text{s}^{-1} \checkmark$	$v = 30,83 \text{ m}\cdot\text{s}^{-1} \checkmark$
3.2.2	OPTION 1 Upwards Positive $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $-48,5 = 0 + \frac{1}{2} (-9,8) \Delta t^2 \checkmark$ $\Delta t = 3,15 \text{ s} \checkmark$	Downwards Positive $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $48,5 = 0 + \frac{1}{2} (9,8) \Delta t^2 \checkmark$ $\Delta t = 3,15 \text{ s} \checkmark$
	OPTION 2 POSITIVE MARKING FROM Q3.2.1 Upwards Positive $v_f = v_i + a \Delta t \checkmark$ $-30,83 = 0 + (-9,8) \Delta t \checkmark$ $\Delta t = 3,15 \text{ s} \checkmark$	Downwards Positive $v_f = v_i + a \Delta t \checkmark$ $30,83 = 0 + (9,8) \Delta t \checkmark$ $\Delta t = 3,15 \text{ s} \checkmark$
	OPTION 3 Upwards Positive $F_{\text{net}} \Delta t = m v_f - m v_i \checkmark$ $m(-9,8) \Delta t = m(-30,83) - 0 \checkmark$ $\Delta t = 3,15 \text{ s} \checkmark$	Downwards Positive $F_{\text{net}} \Delta t = m v_f - m v_i \checkmark$ $(m \times 9,8) \Delta t = m(30,83) - 0 \checkmark$ $\Delta t = 3,15 \text{ s} \checkmark$

(3)

3.3	Marking criteria/Nasienkriteria: • Formula for motion at constant velocity • Substitution for motion at constant velocity • Formula to calculate v_i for vertical motion • Substitution to calculate v_i • Final answer: $13,28 \text{ m}\cdot\text{s}^{-1}$			
	Motion at constant velocity: $\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $11 = 2,3 \Delta t \checkmark$ $\Delta t = 4,78 \text{ s}$	OR/ OF $\Delta x = \frac{(v_f + v_i)}{2} \Delta t \checkmark$ $11 = \frac{(2,3 + 2,3)}{2} \Delta t \checkmark$ $\Delta t = 4,78 \text{ s}$	OR/ OF Distance = speed $\times$ time $\checkmark$ $11 = 2,3 \Delta t \checkmark$ $\Delta t = 4,78 \text{ s}$	
	Vertical motion: Upwards positive $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $-48,5 = v_i(4,78) + \frac{1}{2}(-9,8)(4,78)^2 \checkmark$ $v_i = 13,28 \text{ m}\cdot\text{s}^{-1} \checkmark$	Downwards positive $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $48,5 = v_i(4,78) + \frac{1}{2}(9,8)(4,78)^2 \checkmark$ $v_i = -13,28 \text{ m}\cdot\text{s}^{-1}$ $v_i = 13,28 \text{ m}\cdot\text{s}^{-1} \checkmark$		

(5)
[14]

QUESTION 4 / VRAAG 4**Marking criteria/Nasienkriteria**

If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. /Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

- 4.1 A system on which the resultant/net external force is zero
'n Sisteem waarin die resulterende/netto eksterne krag nul is. (2)

- 4.2.1 $p = mv$ ✓
 $8,4 = m(560)$ ✓
 $m = 0,015 \text{ kg}$ ✓ (3)

- 4.2.2 **POSITIVE MARKING FROM 4.2.1**
- $$\left. \begin{aligned} \Sigma p_i &= \Sigma p_f \\ (mv_i)_1 + (mv_i)_2 &= (mv_f)_1 + (mv_f)_2 \end{aligned} \right\} \text{✓ Any one}$$
- $(0,015)(560) + (3)(-2,5) \text{ ✓} = (0,015)(80) + (3)(v) \text{ ✓}$
 $v = -0,1$
 $v = 0,1 \text{ m} \cdot \text{s}^{-1} \text{ ✓}$ (4)

- 4.2.3 **POSITIVE MARKING FROM QUESTION 4.2.1**
OPTION 1
 $F_{\text{net}} \Delta t = mv_f - mv_i \text{ ✓}$
 $F_{\text{net}}(0,02) = 0,015(80-560) \text{ ✓}$
 $F_{\text{net}} = -360$
 $F_{\text{net}} = 360 \text{ N ✓ East/Oos ✓}$ **Accept: Right/Regs**
- POSITIVE MARKING FROM QUESTION 4.2.2**
OPTION 2
 $F_{\text{net}} \Delta t = mv_f - mv_i \text{ ✓}$
 $F_{\text{net}}(0,02) = 3(0,1 - 2,5) \text{ ✓}$
 $(F_{\text{net}})_{\text{block}} = -360$
 $(F_{\text{net}})_{\text{bullet}} = 360 \text{ N ✓ East/Oos ✓}$ **Accept: Right/Regs** (4)

[13]

QUESTION 5 / VRAAG 5

5.1

OPTION 1

$$\left. \begin{aligned} (E_m)_A &= (E_m)_B \\ (mgh + \frac{1}{2}mv^2)_A &= (mgh + \frac{1}{2}mv^2)_B \end{aligned} \right\} \text{Any one } \checkmark$$

$$\underline{m(9,8)(0,7) + \frac{1}{2}m(2)^2 = 0 + \frac{1}{2}mv^2} \checkmark$$

$$\underline{v = 4,21 \text{ m}\cdot\text{s}^{-1}} \checkmark$$

OPTION 2

$$\left. \begin{aligned} W_{nc} &= \Delta E_k + \Delta E_p \\ 0 &= [\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2] + [mgh_f - mgh_i] \end{aligned} \right\} \text{Any one } \checkmark$$

$$\underline{0 = [\frac{1}{2}mv^2 - \frac{1}{2}m(2)^2] + [0 - m(9,8)(0,7)]} \checkmark$$

$$\underline{v = 4,21 \text{ m}\cdot\text{s}^{-1}} \checkmark$$

(3)

5.2

Marking criteria/Nasien kriteria

- Formula for $E_k = 11,17$
- Substitution of $mv=5,79$
- Final answer: $v = 3,86 \text{ m}\cdot\text{s}^{-1}$

OPTION 1

$$\begin{aligned} p &= mv = 5,79 \\ E_k &= \frac{1}{2}mv^2 = 11,17 \end{aligned} \quad \begin{aligned} \frac{1}{2}mv \cdot v &= 11,17 \checkmark \\ \frac{1}{2}(5,79)v &= 11,17 \checkmark \\ v &= 3,86 \text{ m}\cdot\text{s}^{-1} \checkmark \end{aligned}$$

OPTION 2

$$\begin{aligned} p &= mv = 5,79 \\ m &= \frac{5,79}{v} \end{aligned} \quad \longrightarrow \quad \begin{aligned} E_k &= \frac{1}{2}mv^2 = 11,17 \checkmark \\ \frac{1}{2}\left(\frac{5,79}{v}\right)v^2 &= 11,17 \checkmark \\ v &= 3,86 \text{ m}\cdot\text{s}^{-1} \checkmark \end{aligned}$$

(3)

5.3

Marking criteria/Nasien kriteria

If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. /Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

The net work done on an object is equal to the change in kinetic energy of the object. $\checkmark\checkmark$

Die netto arbeid op 'n voorwerp verrig is gelyk aan die verandering in die kinetiese energie van die voorwerp.

(2)

5.4

POSITIVE MARKING FROM Q5.2**OPTION 1**

$$\begin{aligned} mv &= 5,79 \\ \underline{m(3,86) = 5,79} \checkmark \\ m &= 1,5 \text{ kg} \end{aligned}$$

OR/OF

$$\begin{aligned} \frac{1}{2}mv^2 &= 11,17 \\ \underline{\frac{1}{2}m(3,86)^2 = 11,17} \checkmark \\ m &= 1,5 \text{ kg} \end{aligned}$$

$$\left. \begin{aligned} W_{net} &= \Delta E_k \\ f\Delta x \cos\Theta &= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 \end{aligned} \right\} \text{Any one } \checkmark$$

$$\underline{(3)(X)\cos 180^\circ = 0 - \frac{1}{2}(1,5)(3,86)^2} \checkmark$$

$$\underline{X = 3,72 \text{ m}} \checkmark$$

OPTION 2

$$mv = 5,79$$

$$m(3,86) = 5,79 \checkmark$$

$$m = 1,5 \text{ kg}$$

$$\frac{1}{2}mv^2 = 11,17$$

$$\frac{1}{2}m(3,86)^2 = 11,17 \checkmark$$

$$m = 1,5 \text{ kg}$$

$$W_{nc} = \Delta E_k + \Delta E_p$$

$$f\Delta x \cos\theta = [\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2] + [mgh_f - mgh_i]$$

$$(3)(X)\cos 180^\circ \checkmark = [0 - \frac{1}{2}(1,5)(3,86)^2] + 0 \checkmark$$

$$X = 3,72 \text{ m} \checkmark$$

} Any one ✓

(5)
[13]

QUESTION 6 / VRAAG 6

6.1

Marking criteria/Nasienkriteria

If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. /Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

The change in frequency/pitch/wavelength of the sound detected by a listener because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓✓

Die verandering van frekwensie/toonhoogte/golflengte van die klank waargeneem deur 'n luisteraar omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium van klankvoorplanting het.

OR/OF

An (apparent) change in observed frequency/pitch/wavelength as the result of the relative motion between a source and an observer/listener. ✓✓

'n (Skynbare) verandering in waargenome frekwensie/toonhoogte/golflengte as gevolg van die relatiewe beweging tussen die bron en 'n waarnemer/luisteraar. (2)

6.2

Waves in front of source are more compact/wavelength decreases ✓

More waves per second reaches the detector/listener ✓

Golwe voor die bron kompakteer / golflengte neem af ✓

Meer golwe per sekonde bereik die detector ✓

(2)

6.3.1

<u>Moving towards</u>	<u>Moving away</u>
$f_L = \frac{v \pm v_L}{v \pm v_S} f_S$ ✓ OR $f_L = \frac{v}{v - v_S} f_S$	$f_L = \frac{v \pm v_L}{v \pm v_S} f_S$ OR $f_L = \frac{v}{v + v_S} f_S$
$950 \checkmark = \frac{330}{330 - v_s} f_s \checkmark$	$750 \checkmark = \frac{330}{330 + v_s} f_s \checkmark$
$f_s = \frac{950(330 - v_s)}{330}$	$f_s = \frac{750(330 + v_s)}{330}$
$\therefore 950(330 - v_s) = 750(330 + v_s)$	
$200(330) = 1700v_s$	
$v_s = 38,82 \text{ m} \cdot \text{s}^{-1} \checkmark$	

(6)

6.3.2 POSITIVE MARKING FROM Q6.3.1

<u>OPTION 1</u>	<u>OPTION 2</u>	<u>OPTION 3</u>
$\Delta t = \underline{12,5-8} \checkmark = 4,5 \text{ s}$ $\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $= (38,82)(4,5) \checkmark$ $= 174,69 \text{ m} \checkmark$	$\Delta t = \underline{12,5-8} \checkmark = 4,5 \text{ s}$ $\Delta x = \frac{(v_f + v_i)}{2} \Delta t \checkmark$ $= \frac{(38,82 + 38,82)}{2} (4,5) \checkmark$ $= 174,69 \text{ m} \checkmark$	$\Delta t = \underline{12,5-8} \checkmark = 4,5 \text{ s}$ Distance = speed × time ✓ $= (38,82)(4,5) \checkmark$ $= 174,69 \text{ m} \checkmark$

(4)

[14]

QUESTION 7 / VRAAG 7**7.1.1 Marking criteria/Nasienkriteria**

If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. /Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

Note: If **masses** used ($0/2$)

The magnitude of the electrostatic force exerted by one point charge (Q_1) on another point charge (Q_2) is directly proportional to the product of the magnitudes of the charges ✓ and inversely proportional to the square of the distance (r) between them ✓

Die grootte van die elektrostatiese krag wat een puntlading (Q_1) op 'n ander puntlading (Q_2) uitoefen, is direk eweredig aan die produk van die groottes van die ladings ✓ en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle. ✓

(2)

7.1.2 Negative/Negatief ✓

(1)

7.1.3

$$F = \frac{kQ_1Q_2}{r^2} \checkmark$$

$$57,6 = \frac{(9 \times 10^9)Q^2}{(0,1)^2} \checkmark$$

$$Q = 8 \times 10^{-6} \text{ C} \checkmark \quad \text{Accept: } Q = -8 \times 10^{-6} \text{ C}$$

(3)

7.2.1 Marking criteria/Nasienriglyne:

-1 mark for each of the 5 key words omitted in the correct context.

-1 punt vir elk van die 5 sleutelwoorde weggelaat in die korrekte konteks.

The electric field at a point is the (electrostatic) force experienced per unit positive charge placed at that point.

Die elektriese veld by 'n punt is die (elektrostatiese) krag wat per positiewe eenheids-lading wat by daardie punt geplaas is, ondervind word.

(2)

7.2.2

$$E = \frac{kQ}{r^2} \checkmark$$

$$= \frac{(9 \times 10^9)(8 \times 10^{-9})}{(0,2)^2} \checkmark$$

$$= 1\,800 \text{ N} \cdot \text{C}^{-1} \checkmark \text{ to the left} \checkmark$$

(4)

7.2.3 $E_{\text{net}} = E_x - E_y$

$$120 = \frac{(9 \times 10^9)Q}{0,2^2} - \frac{(9 \times 10^9)(4 \times 10^{-9})}{0,08^2} \checkmark$$

$$Q = 2,55 \times 10^{-8} \text{ C}$$

↓

$$n = \frac{Q}{e} \checkmark$$

$$= \frac{(2,55 \times 10^{-8} - 8 \times 10^{-9})}{1,6 \times 10^{-19}} \checkmark$$

$$= 1,1 \times 10^{11} \checkmark$$

OR/OF

$$\frac{-2,55 \times 10^{-8} - (-8 \times 10^{-9})}{-1,6 \times 10^{-19}}$$

(5)
[17]

QUESTION 8 / VRAAG 8

8.1 7,2 (V) ✓ (1)

NOTE: Penalize once in Q8.2 for incorrect use of $\times 10^{-2}$

8.2.1 Gradient = $-r = \frac{V_2 - V_1}{I_2 - I_1}$

$$= \frac{7,2 - 0}{0 - 150 \times 10^{-2}} \checkmark$$

$$r = 4,8 \, \Omega \checkmark$$

NOTE: Can use any coordinates on the line, eg
(100 $\times 10^{-2}$; 2,4)
(67,5 $\times 10^{-2}$; 4,0)
(17,5 $\times 10^{-2}$; 6,4)

(2)

8.2.2 **POSITIVE MARKING FROM Q8.1 AND Q8.2.1****OPTION 1**

$$\varepsilon = I(R+r) \checkmark$$

$$7,2 = (117,5 \times 10^{-2})[R+4,8] \checkmark$$

$$R = 1,33 \, \Omega \checkmark$$

OPTION 2

$$V = IR \checkmark$$

$$1,6 = (117,5 \times 10^{-2})R \checkmark$$

$$R = 1,36 \, \Omega \checkmark$$

(3)
[6]

QUESTION 9 / VRAAG 9

- 9.1 The potential difference across a conductor is directly proportional to the current in the conductor ✓ at constant temperature. ✓

Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur.

(2)

9.2.1

OPTION 1

$$V_{6\Omega} = IR$$

$$= 0,5(6) \checkmark$$

$$= 3 \text{ V}$$

$$I_{12\Omega} = \frac{V}{R} = \frac{3}{12} = 0,25 \text{ A} \checkmark$$

$$I_1 = 0,5 + 0,25 = 0,75 \text{ A} \checkmark$$

OPTION 2

$$R_{6\Omega} : R_{12\Omega}$$

$$6 : 12$$

$$I_{6\Omega} : I_{12\Omega}$$

$$12 : 6$$

$$0,5 : 0,25 \checkmark$$

$$I_1 = 0,5 + 0,25 = 0,75 \text{ A} \checkmark$$

(3)

9.2.2

POSITIVE MARKING FROM Q9.2.1

$$V_{20\Omega} = IR$$

$$= 0,75(20)$$

$$= 15 \text{ V}$$

$$P = VI \checkmark$$

$$16 = (15 + 3)I \checkmark$$

$$I_2 = 0,89 \text{ A} \checkmark$$

(3)

9.2.3

POSITIVE MARKING FROM Q9.2.1 & Q9.2.2**OPTION 1**

$$I_T = 0,75 + 0,89 = 1,64 \text{ A} \checkmark$$

$$\epsilon = I(R+r) \checkmark$$

$$= (1,64)(10,98+1) \checkmark$$

$$= 19,65 \text{ V} \checkmark$$

OPTION 2

$$I_T = 0,75 + 0,89 = 1,64 \text{ A} \checkmark$$

$$\epsilon = V_e + Ir \checkmark$$

$$= 18 + (1,64)(1) \checkmark$$

$$= 19,64 \text{ V} \checkmark$$

(4)

[12]

QUESTION 10/VRAAG 10

10.1.1 Split ring/Split ring commutator/commutator✓
Splitring/splitring kommutator/kommutator (1)

10.1.2 Anticlockwise/Antikloksgewys✓✓ (2)

10.1.3 Electrical (energy) TO mechanical/kinetic (energy)✓
Elektriese (energie) NA meganiese/kinetiese (energie) (1)

10.2.1 **Marking criteria/Nasienkriteria**

If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. /Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

The AC current which dissipates the same amount of energy as an equivalent DC current. ✓✓

Die WS-stroomsterkte wat dieselfde hoeveelheid energie verbruik as die ekwivalente GS-stroomsterkte.

ACCEPT/AANVAAR

The DC current which dissipates the same amount of energy as an equivalent AC current.

Die GS-stroomsterkte wat dieselfde hoeveelheid energie verbruik as die ekwivalente WS-stroomsterkte.

(2)

10.2.2 **OPTION 1**

$$I_{\text{rms}} = \frac{I_{\text{max}}}{\sqrt{2}} \checkmark$$

$$= \frac{8}{\sqrt{2}} \checkmark$$

$$= 5,66 \text{ A}$$

$$P_{\text{ave}} = I_{\text{rms}}^2 R \checkmark$$

$$= (5,66)^2 (40) \checkmark$$

$$= 1280 \text{ W} \checkmark$$

OPTION 2

$$I_{\text{rms}} = \frac{I_{\text{max}}}{\sqrt{2}} \checkmark$$

$$= \frac{8}{\sqrt{2}} \checkmark$$

$$= 5,66 \text{ A}$$

$$V_{\text{rms}} = I_{\text{rms}} R$$

$$= (5,66)(40)$$

$$= 226,4 \text{ V}$$

$$P_{\text{avg}} = V_{\text{rms}} I_{\text{rms}} \checkmark$$

$$= (226,4)(5,66) \checkmark$$

$$= 1281,42 \text{ W} \checkmark$$

OR/OF

$$P_{\text{ave}} = \frac{V_{\text{rms}}^2}{R} \checkmark$$

$$= \frac{(226,4)^2}{40} \checkmark$$

$$= 1281,42 \text{ W} \checkmark$$

(5)

[11]

QUESTION 11 / VRAAG 11

11.1

Marking criteria/Nasienkriteria

If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. /Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

The minimum energy of light needed to eject electrons from a metal/surface.
✓✓

Die minimum energie benodig om 'n elektron uit die oppervlak van 'n metaal vry te stel.

Note: If referred to frequency: $0/2$

(2)

11.2

Zinc✓

Photons that have shorter wavelengths will have higher frequencies and thus a higher energy. ✓✓

OR/OF

photons that have longer wavelengths will have lower frequencies, and thus a lower energy ✓✓

OR/OF

$$W_0 \propto \frac{1}{\lambda_0} \checkmark, h \& c \text{ constant} \checkmark$$

OR/OF

$$f_0 \propto \frac{1}{\lambda_0} \checkmark, c = \text{constant} \checkmark$$

$$W_0 \propto f_0 \checkmark, h = \text{constant} \checkmark$$

OR/OF

W_0 is inversely proportional to λ_0 ✓ (with h and c staying constant✓).

(3)

11.3

Frequency of photon is less than✓ the threshold frequency of the metal✓

Die frekwensie van die foton is minder as die drumpelfrekwensie van die metaal.

OR/OF

Energy of the photon is less✓ than the work function of the metal. ✓

Die energie van die foton is minder as die arbeidsfunksie/werksfunksie van die metaal.

(2)

11.4

OPTION 1

$$\left. \begin{aligned} E &= W_0 + E_{k(\max)} \\ hf &= hf_0 + \frac{1}{2}mv_{\max}^2 \\ hf &= \frac{hc}{\lambda_0} + E_{k(\max)} \end{aligned} \right\} \text{Any one } \checkmark$$

$$(6,63 \times 10^{-34})(5 \times 10^{14}) \checkmark = \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{10 \times 10^{-7}} \checkmark + E_{k(\max)}$$

$$E_{k(\max)} = 1,33 \times 10^{-19} \text{ J } \checkmark$$

OPTION 2

$$c = f_0 \lambda_0$$

$$3 \times 10^8 = f_0(10 \times 10^{-7})$$

$$f_0 = 3 \times 10^{14} \text{ Hz}$$

$$hf = hf_0 + E_{k(\max)} \checkmark$$

$$(6,63 \times 10^{-34})(5 \times 10^{14}) \checkmark = (6,63 \times 10^{-34})(3 \times 10^{14}) \checkmark + E_{k(\max)}$$

$$E_{k(\max)} = 1,33 \times 10^{-19} \text{ J } \checkmark$$

(4)

11.5.1 Remains the same/*Bly dieselfde* ✓

(1)

11.5.2 Increases/*Toeneem* ✓

(1)

[13]**TOTAL/TOTAAL: 150**