education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

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

SEPTEMBER 2023

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guideline consists of 14 pages

Hierdie nasienriglyne bestaan uit 14 bladsye

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QUESTION 1 / *VRAAG 1*

1.1	C ✓✓	(2)
1.2	C ✓✓	(2)
1.3	A ✓✓	(2)
1.4	B ✓✓	(2)
1.5	D ✓✓	(2)
1.6	A ✓✓	(2)
1.7	B ✓✓	(2)
1.8	C ✓✓	(2)
1.9	B ✓✓	(2)
1.10	D ✓✓	(2)

[20]





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QUESTION 2 / *VRAAG 2*

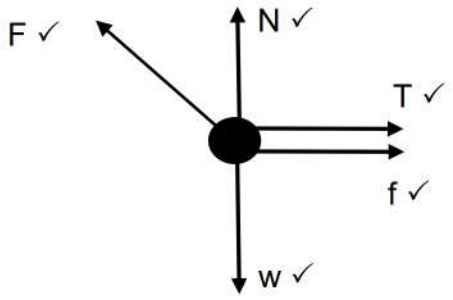
2.1

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.*

When a net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the resultant/net force and inversely proportional to the mass of the object. ✓✓
Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die krag teen 'n versnelling direk eweredig aan die resultante/netto krag en omgekeerd eweredig aan die massa van die voorwerp.
OR/*OF*
The resultant/net force acting on an object is equal to the rate of change of momentum of the object. **(2 or 0)**
Die resulterende/netto krag wat op 'n voorwerp inwerk is gelyk aan die tempo van verandering van momentum. ***(2 of 0)***

(2)

2.2



(5)

Accepted labels / Aanvaarde benoemings	
w	F_g / F_w / force of earth on block / weight / mg / gravitational force / VALUE
F	$F_{applied}$ / F_A / Applied force
T	Tension in rope / F_T
F	$F_{friction}$ / F_f / frictional force /
N	Normal force / F_N

Notes/Aantekeninge:
- Mark awarded for label and arrow.
- Any additional forces: deduct 1 mark: max $^4/_5$
- No labels: deduct 1 mark: max $^4/_5$
- If everything correct, but no arrows: deduct 1 mark: $^4/_5$
- Force(s) not touching object: deduct 1 mark: max $^4/_5$
- Ignore relative sizes of the vectors

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2.3.1

Marking criteria/*Nasienkriteria*:

- Formula for block A or block B ✓
- Substitution of Fnet for block A ✓
- Substitusion of Fnet for block B ✓
- 8a **OR** 4a ✓
- Answer ✓

For Block A:		For Block B:
$F_{net} = ma$ $F_x + (-T) + (-f) = ma$	Any one ✓	$F_{net} = ma$ $F_g + T + (-F) = ma$
$(75)\cos 25 - T - 11{,}76$ ✓ $= 4a$ ✓		$78{,}4 + T - 96$ ✓ $= 8a$
$56{,}21 - T = 4a$		$T - 17{,}6 = 8a$
$T = -4a + 56{,}21$		$T = 8a + 17{,}6$

$\therefore -4a + 56{,}21 = 8a + 17{,}6$

$12a = 38{,}61$

$a = 3{,}22\ m{\cdot}s^{-2}$ ✓

(5)

2.3.2

POSITIVE MARKING FROM QUESTION 2.3.1

Marking criteria/*Nasienkriteria*:

- Substitution to calculate T ✓
- Answer ✓

For Block A:	For Block B:
$T = -4a + 56{,}21$	$T = 8a + 17{,}6$
$= (-4)(3{,}22) + 56{,}21$ ✓	$= (8)(3{,}22) + 17{,}6$
$= 43{,}33$ N✓	$= 43{,}36$ N

(2)

[14]

QUESTION 3 / VRAAG 3

3.1 An object which has been given an initial velocity and then it moves under the influence of the gravitational force only. ✓ ✓ **(2 or 0)**

'n Voorwerp waaraan 'n beginsnelheid gegee is en wat dan slegs onder die invloed van die gravitasiekrag beweeg. **(2 or 0)**

(2)

3.2.1

Upwards positive/ **Opwaarts positief:**	**Downwards positive/** **Afwaarts positief:**
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
-48 ✓ $= v_i(2{,}8) + \frac{1}{2}(-9{,}8)(2{,}8)^2$ ✓	48 ✓ $= v_i(2{,}8) + \frac{1}{2}(9{,}8)(2{,}8)^2$ ✓
$v_i = -3{,}42$	$v_i = 3{,}42\ m{\cdot}s^{-1}$ ✓
$v_i = 3{,}42\ m{\cdot}s^{-1}$ ✓	

(4)

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3.2.2

POSITIVE MARKING FROM QUESTION 3.2.1
POSITIEWE NASIEN VANAF VRAAG 3.2.1

OPTION 1

Upwards Positive/ Opwaarts positief	**Downwards Positive/ Afwaarts positief**
$v_f = v_i + a\,\Delta t$ ✓	$v_f = v_i + a\,\Delta t$ ✓
$v_f = \underline{-3,42 + (-9,8)(2,8)}$ ✓	$v_f = \underline{3,42 + (9,8)(2,8)}$ ✓
$v_f = -30,86\ m\cdot s^{-1}$	
$v_f = 30,86\ m\cdot s^{-1}$ ✓	$v_f = 30,86\ m\cdot s^{-1}$ ✓

OPTION 2

Upwards Positive/ Opwaarts positief	**Downwards Positive/ Afwaarts positief**
$v_f^2 = v_i^2 + 2a\,\Delta y$ ✓	$v_f^2 = v_i^2 + 2a\,\Delta y$ ✓
$v_f^2 = \underline{(-3,42)^2 + 2(-9,8)(-48)}$ ✓	$v_f^2 = \underline{(3,42)^2 + 2(9,8)(48)}$ ✓
$v_f = 30,86\ m\cdot s^{-1}$ ✓	$v_f = 30,86\ m\cdot s^{-1}$ ✓

OPTION 3

Upwards Positive/ Opwaarts positief	**Downwards Positive/ Afwaarts positief**
$\Delta x = \frac{(v_f + v_i)}{2}\Delta t$ ✓	$\frac{(v_f + v_i)}{2}\Delta t$ ✓
$-48 = \frac{(v_f - 3,42)}{2}2,8$ ✓	$48 = \frac{(v_f + 3,42)}{2}2,8$ ✓
$v_f = -30,87\ m\cdot s^{-1}$	
$v_f = 30,87\ m\cdot s^{-1}$ ✓	$v_f = 30,87\ m\cdot s^{-1}$ ✓

OPTION 4

$(E_m)_A = (E_m)_B$
$(mgh + \frac{1}{2}mv^2)_A = (mgh + \frac{1}{2}mv^2)_B$ } Any one ✓ / Enige een

$\underline{m(9,8)(48) + \frac{1}{2}m(3,42)^2 = 0 + \frac{1}{2}mv^2}$ ✓
$v = 30.86\ m\cdot s^{-1}$ ✓

OPTION 5

$F_{net}\cdot\Delta t = \Delta p$
$F_{net}\cdot\Delta t = mv_f - mv_i$
$mg\Delta t = mv_f - mv_i$
$g\Delta t = v_f - v_i$
$\underline{(9,8)(2,9) = v_f - 3,42}$ ✓
$v = 30.86\ m\cdot s^{-1}$ ✓

Any one ✓ / Enige een

(3)

3.2.3

Upwards positive / Opwaarts positief	**Downwards positive/ Afwaarts positief**
$v_f^2 = v_i^2 + 2a\,\Delta y$ ✓	$v_f^2 = v_i^2 + 2a\,\Delta y$ ✓
$\underline{0 = v_i^2 + 2(-9,8)(8)}$ ✓	$\underline{0 = v_i^2 + 2(9,8)(-8)}$ ✓
$v_i = 12,52\ m\cdot s^{-1}$ ✓	$v_i = 12,52\ m\cdot s^{-1}$ ✓

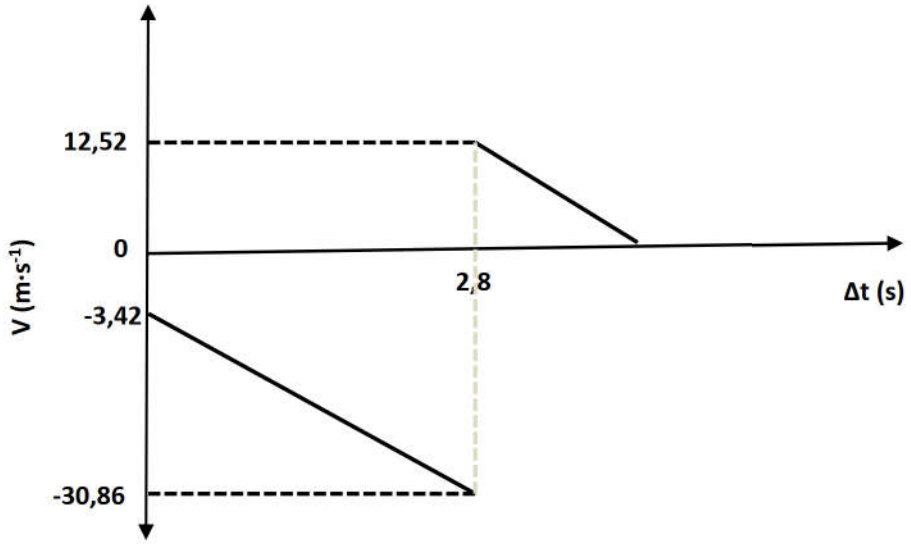
(3)

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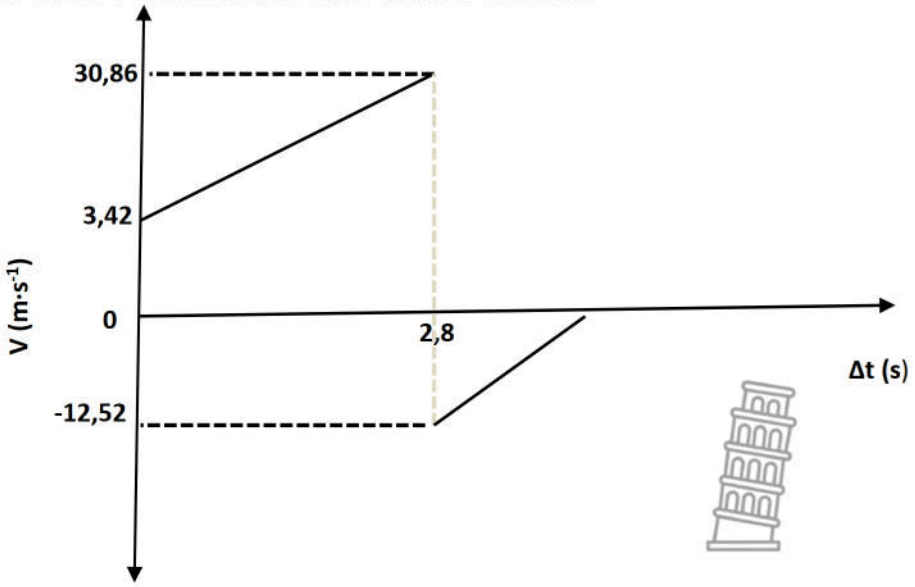
3.3 **Marking criteria/*Nasienkriteria*:**

- Initial velocity with which the ball was thrown (3.2.1) ✓
- Beginsnelheid waarmee bal gegooi is
- Final velocity with which the ball hit the ground (3.2.2) ✓
- Eindsnelheid waarmee die bal die grond tref
- Time taken to hit the ground (2,8 s)✓
- Tyd om die grond te tref (2,8 s)
- The velocity with which the ball bounces off the ground – line parallel to other line (3.2.3) ✓
- Die snelheid waarmee die bal van die grond as bons – lyn parallel met ander lyn

POSITIVE MARKING FROM/POSITIEWE MERK VANAF 3.2.1., 3.2.2 & 3.2.3
UPWARDS POSITIVE/OPWAARTS POSITIEF



DOWNWARDS POSITIVE/AFWAARTS POSITIEF



(4)
[16]

QUESTION 4 / VRAAG 4

4.1

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 total (linear) momentum of an isolated/closed system remains constant/is conserved. ✓✓

Die totale (lineêre) momentum in 'n geïsoleerde sisteem bly konstant/behoue.

(2)

4.2.1

TAKE TO THE LEFT AS POSITIVE/NEEM LINKS AS POSITIEF

$\Sigma p_i = \Sigma p_f$
$(mv_i)_1 + (mv_i)_2 = (mv_f)_1 + (mv_f)_2$ } ✓ Any one/enige een

$(0,015)(-45) + (8,45)(0)$ ✓ $= (0,015)(10,60) + (8,45)(v_f)$ ✓

$v = -0,10\ m\cdot s^{-1}$

$v = 0,10\ m\cdot s^{-1}$ ✓

TAKE TO THE RIGHT AS POSITIVE/NEEM REGS AS POSITIEF

$\Sigma p_i = \Sigma p_f$
$(mv_i)_1 + (mv_i)_2 = (mv_f)_1 + (mv_f)_2$ } ✓ Any one/enige een

$(0,015)(45) + (8,45)(0)$ ✓ $= (0,015)(-10,60) + (8,45)(v_f)$ ✓

$v = 0,10\ m\cdot s^{-1}$ ✓

(4)

4.2.2

POSITIVE MARKING FROM QUESTION 4.2.1
OPTION 1

$v_f^2 = v_i^2 + 2a\,\Delta y$

0^2 ✓$= (0.10)^2 + 2(a)(1,32)$✓

$a = -0,00378\ m\cdot s^{-2}$ $\quad (a = -3,79 \times 10^{-3}\ m\cdot s^{-2})$

$F_{net} = ma$✓

$f = (8,45)(-0,00378)$ ✓

$f = 0,03$ N ✓

POSITIVE MARKING FROM QUESTION 4.2.1
OPTION 2

$v_f^2 = v_i^2 + 2a\,\Delta y$

$0^2 = (0.10)^2 + 2(a)(1,32)$✓

$a = -0,00378\ m\cdot s^{-2}$ $\quad (a = -3,79 \times 10^{-3}\ m\cdot s^{-2})$

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

$0 = 0,10 + (-0,00378)\,\Delta t$

$\Delta t = 26,39$ s✓

$F_{net}\cdot\Delta t = mv_f - mv_i$ ✓

$f(26.39) = (8,45)(0) - (8,45)(0,10)$ ✓

$f = -0,03$ N

$f = 0,03$ N ✓

(5)

[11]

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QUESTION 5 / VRAAG 5

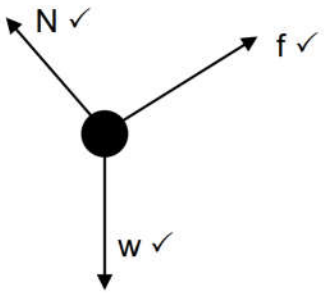
5.1

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 force for which the work done in moving an object between two points depends on the path taken✓✓

'n Krag waarvoor die arbeid verrig om 'n voorwerp tussen twee punte te beweeg, afhanklik is van die roete wat gevolg word. (2)

5.2



(3)

Accepted labels / Aanvaarde benoemings	
w	F_g / F_w / force of earth on block / weight / mg / gravitational force /
f	$F_{friction}$ / F_f / frictional force
N	Normal force / F_N

5.3

$f_k = \mu_k N$ ✓ $\quad N = F_{g\perp}$
$= (0,45)(449,81)$ ✓ $\quad = (53)(9,8)\cos 30°$
$= 202,42$ N ✓ $\quad = 449,81$ N

(3)

5.4

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.*

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

Die netto arbeid verrig op 'n voorwerp is gelyk aan die verandering in kinetiese energie van die voorwerp **OF** die arbeid verrig op die voorwerp deur 'n netto krag is gelyk aan die verandering in kinetiese energie van die voorwerp. (2)

5.5 **POSITIVE MARKING FROM Q5.3**

OPTION 1
$W_{net} = \Delta E_k$ } Any one ✓
$f\Delta x\cos\Theta + N\Delta x\cos\Theta + F_g\Delta x\cos\Theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
$(202,42)(35)\cos 180°$ ✓ $+ 0 + (53)(9,8)(35)\cos 60°$ ✓ $= \frac{1}{2}(53)v_f^2$ ✓ $- 0$
$v_f = 8,70\ m\cdot s^{-1}$ ✓

OPTION 2

$W_{nc} = \Delta Ek + \Delta Ep$
$f\Delta x \cos\Theta = [½mv_f^2 - ½mv_i^2] + [mgh_f - mgh_i]$ } Any one ✓
$(202,42)(35)\cos 180° ✓ = [½(53)\ v_f^2 ✓ - 0] + [(53)(9,8)(17,5) - (53)(9,8)(35)] ✓$
$v_f = 8,70\ m{\cdot}s^{-1}$ ✓ (5)

[15]

QUESTION 6 / VRAAG 6

6.1 Doppler effect / effek ✓ (1)

6.2
$v = f\lambda$
$340 = 780\lambda$ ✓
$\lambda = 0,44$ m ✓ (2)

6.3 Waves in front of source are more compact/ wavelength decreases ✓
More waves per second reaches the listener ✓

Golwe voor die bron is meer kompak/ golflengte neem af
Meer golwe per sekonde bereik die luisteraar (2)

6.4.1
$$f_L = \frac{v \pm v_L}{v \pm v_S} f_S \checkmark \quad \text{OR} \quad f_L = \frac{v}{v - v_S} f_S$$
$$850 \checkmark = \left(\frac{340 + v_L}{340 + 0} \checkmark\right) 780 \checkmark$$
$v_L = 30,51\ m{\cdot}s^{-1}$ ✓ (5)

6.4.2
$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$(30,51)^2 = 0^2 + 2a\ (83,11)$ ✓
$a = 5,60\ m{\cdot}s^{-2}$ ✓ (3)

[13]

QUESTION 7 / VRAAG 7

7.1

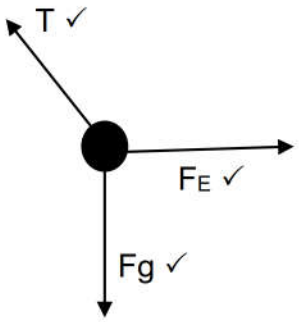
Marking criteria/*Nasienkriteria*
If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. */Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

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)

7.2



Accepted labels / Aanvaarde benoemings	
W	F_g / F_w / force of earth on block / weight / mg / gravitational force / 0,392 N
F_E	Electrostatic force
T	Tension in rope / F_T

(3)

Notes/Aantekeninge:
- Any additional forces: deduct 1 mark: max $^2/_3$
- No labels: deduct 1 mark: max $^2/_3$
- No arrows: $^0/_3$
- Force(s) not touching object: deduct 1 mark: max $^2/_3$
- Ignore relative sizes of the vectors

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7.3.1

$F = \frac{kQ_1Q_2}{r^2}$ ✓

$= \frac{(9\times10^9)\ (30 \times 10^{-6})(\ 20 \times 10^{-6})}{(0,8)^2}$ ✓

F = 8,44 N ✓ (8,4375 N)

(3)

7.3.2

$F_g = mg$
$= (0,09)(9,8)$
$= 0,882$ N ✓

$T^2 = F_e^2 + F_g^2$ ✓
$= (8,44)^2 + (0,88)^2$ ✓
T = 8,49 N ✓

(4)

[12]

QUESTION 8 / VRAAG 8

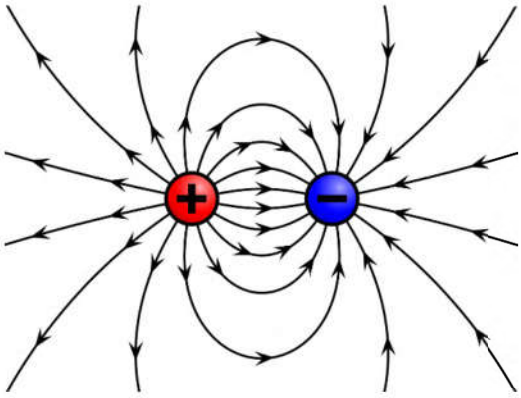
8.1

Marking criteria/Nasienriglyne:
-1 mark for each of the 3 key words omitted in the correct context.
-1 punt vir elk van die 3 sleutelwoorde weggelaat in die korrekte konteks.

The electric field is an area in space where an electric charge experiences a force. ✓✓
Die elektriese veld is 'n gebied in die ruimte waarin 'n elektriese lading 'n krag ondervind

(2)

8.2



Criteria for sketch/Kriteria vir skets	Marks/Punte
Correct shape as shown. Korrekte vorm soos getoon.	✓
Direction away from positive to negative. Rigting weg van positief na negatief.	✓
Field lines start on spheres and do not cross for correct diagram. Veldlyne begin op elke sfeer en kruis nie vir korrekte diagram.	✓

(3)

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8.3

$E_{nett} = E_1 + E_2$

$E_{net} = \frac{kQ}{r^2} - \frac{kQ}{r^2}$ ✓ (Mark for/Punt vir $\frac{kQ}{r^2}$)

✓ $4\,128 = \frac{(9x10^9)(5x10^{-9})}{r^2}$ ✓ − ✓ $\frac{(9x10^9)(4x10^{-9})}{(4r)^2}$ ✓

$4\,128 = \frac{45}{r^2} - \frac{36}{16r^2}$

$r = 0{,}10\ m$ ✓

(6)
[11]

QUESTION 9 / VRAAG 9

9.1 24 Joule✓ per unit coulomb charge work done. ✓

Arbeid van 24 Joule per eenheid coulomb lading (2)

9.2.1

$r_i = \frac{\text{lost V}}{I}$ ✓

$I = \frac{24 - 22{,}3}{0{,}5}$ ✓

=3,4 A✓

(3)

9.2.2 **POSITIVE MARKING FROM Q9.2.1**

$V_{3\Omega} = IR$

= 3,4(3) ✓

= 10,2 V

$V_{\parallel}$ = 22,3- 10,2 ✓

= 12,1V

$P_{18\Omega} = \frac{V^2}{R}$ ✓

$P_{18\Omega} = \frac{(12{,}1)^2}{18}$ ✓

= 8,314 W✓

(5)

9.2.3 **POSITIVE MARKING FROM Q9.2.1 & Q9.2.2**

$I_{6\Omega} = \frac{V}{R}$ ✓

$= \frac{12{,}1}{6}$ ✓

= 2,02 A

$I_R = I_{tot} - I_{6\Omega} - I_{18\Omega}$

= 3,4 – 2,02 -0,67

= 0,71 A ✓

$I_{18\Omega} = \frac{V}{R}$

$= \frac{12{,}1}{18}$ ✓

= 0,67 A

(4)

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9.3 Increase ✓
R (18Ω) remains constant, $V_{\parallel}$ increases ✓
Current in circuit decreases
$P = \frac{V^2}{R}$ ✓

(3)
[17]

QUESTION 10/*VRAAG 10*

10.1 Kinetic/mechanical energy TO electrical energy✓✓
Kinetiese/meganiese energie NA elektriese energie (2)

10.2 Slip rings (AC) and split rings (DC)✓
Sleepringe (WS) en splitringe (GS) (1)

10.3

OPTION 1	**OPTION 2**
$P_{ave} = I_{rms}^2 R$ ✓ $100 = I_{rms}^2(3)$✓ $I_{rms} = 5{,}77A$ $I_{rms} = \frac{I_{max}}{\sqrt{2}}$ ✓ $5{,}77 = \frac{I_{max}}{\sqrt{2}}$ ✓ $I_{max} = 8{,}16A$✓	$P_{ave} = I_{rms}^2 R$ ✓ 100 ✓$= \frac{I_{max}}{\sqrt{2}}$ ✓ (3)✓ $I_{max} = 8{,}16A$✓

(5)
[8]

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 that an electron in the metal needs to be emitted from the metal surface. ✓✓
Die minimum energie benodig om 'n elektron uit die oppervlak van 'n metaal vry te stel.. (2)

11.2 Light source A – higher frequency than f_o ✓
OR Light source B – lower frequency than f_o

Ligbron A – hoër frekwensie as f_o
OF Ligbron B – laer frekwensie as f_o

Wavelength ά $\frac{1}{f}$✓
Golflengte ά $\frac{1}{f}$ (2)

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11.3.1

$$W_o = \frac{hc}{\lambda_0} \checkmark$$

$$= \frac{(6,63\times10^{-34})(3\times10^{8})}{570\times10^{-9}} \checkmark$$

$$= 3,489 \times 10^{-19}\ J \checkmark$$

(3)

11.3.2 **POSITIVE MARKING FROM 11.3.1**

$$E = W_o + E_{k(max)} \checkmark$$

$$\frac{hc}{\lambda} = W_o + \tfrac{1}{2}mv^2$$

$$\frac{(6,63\times10^{-34})(3\times10^{8})}{480\times10^{-9}} \checkmark = (3,489\times10^{-19}) \checkmark + \tfrac{1}{2}(9,11\times10^{-31})v^2 \checkmark$$

$$v = 3,79 \times 10^{5}\ m\cdot s^{-1} \checkmark$$

(5)

11.4 Green/Groen✓ (1)

[13]

TOTAL/*TOTAAL*: 150

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education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

ERRATA PHYISCAL SCIENCES 2023 GRADE 12 TRIAL PAPER 1

Question	Correction
1.5	Answer is A
5.5	Q5.5 should not be marked; statement was in complete.

BASED ON Q5.5 ABOVE THE TOTAL OF THE PAPER IS NOW 145 MARKS