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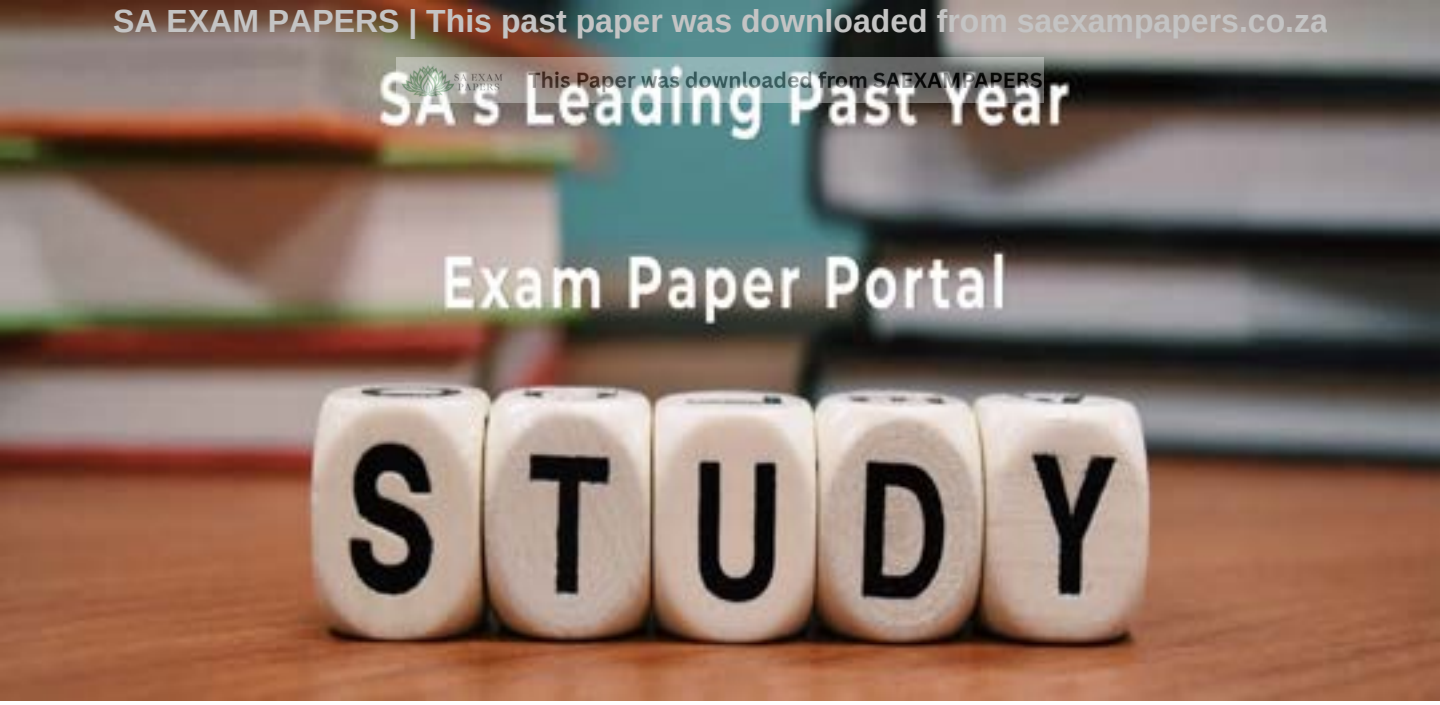

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NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 12

SEPTEMBER 2025

PHYSICAL SCIENCES P1 MARKING GUIDELINE/ *FISIESE WETENSKAPPE V1 NASIENRIGLYN*

MARKS/*PUNTE*: 150

This marking guideline consists of 15 pages./
Hierdie nasienriglyn bestaan uit 15 bladsye.

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QUESTION/*VRAAG* 1

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

[20]

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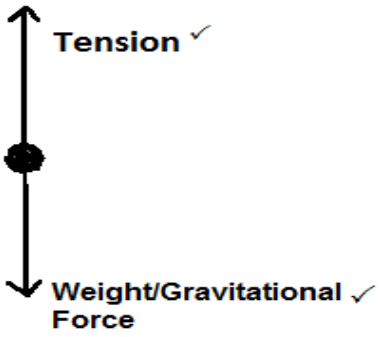
QUESTION/*VRAAG* 2

2.1 A body will remain at rest or motion at constant velocity unless a non-zero net/resultant force acts on it. ✓✓
'n Liggaam sal in rus bly of aanhou beweeg teen konstante snelheid tensy 'n netto/resultante krag op die liggaam inwerk. (2)

2.2



Accepted labels/*Aanvaarde benoeming*

w	F_g/F_w/weight/gravitational force/ *gewig/gravitasiekrag*	✓
T	F_T/Tension/Force in string/ *Spanning/ Krag in die tou*	✓

(2)

2.3 Gravitational force > Tension force ✓
Gravitasiekrag > Spanningskrag (1)

2.4.1 $F_{net} = ma$
$F_{net} = T - f$
$F_{net} = F_g - T$
Any one/*Enige een* ✓

3 kg block / *3 kg blok*
$3 \times 9,8 - T$ ✓ $= 3 \times 2$ ∴ **T = 23,4 N**
N

5 kg block / *5 kg blok*
$T - f_k = 5 \times 2$
$f_k = 23,4 - 10$ ✓
∴ $f_k = 13,4$ ✓

Any one/*Enige een* (3 x 2 or/*of* 5 x 2)✓

(5)

2.4.2 $f_k = \mu_k N$✓
$= \mu_k F_g = \mu_k mg$
$13,4 = \mu_k (5)(9,8)$✓

∴ $\mu_k = 0,27$✓ (3)

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2.5 The force that the rope exerts on the box and the force that the box exerts on the rope. ✓✓
Die krag wat die tou op die houer uitoefen en die krag wat die houer op die tou uitoefen.

OR/*OF*

The force that the Earth exerts on the box and the force that the box exerts on the Earth. ✓✓
Die krag wat die Aarde op die houer uitoefen en die krag wat die houer op die Aarde uitoefen. (2)
[15]

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QUESTION/*VRAAG* 3

3.1 The motion of an object where the only force acting on the object is the gravitational force. ✓✓
Die beweging van 'n voorwerp waar die enigste krag wat op die voorwerp inwerk die gravitasiekrag is. (2)

3.2.1 **Upwards as positive/*Opwaarts as positief***
Ball/*Bal A*:
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$-\Delta y = (-2,5)\ \Delta t + \frac{1}{2}(-9,8)\ \Delta t^2$ ✓

Ball/*Bal B*:
$-(\Delta y - 5,2) = 0 + \frac{1}{2}(-9,8)\ \Delta t^2$ ✓
$-\Delta y = -5,2 + \frac{1}{2}(-9,8)\ \Delta t^2$
$(-2,5)\ \Delta t + \frac{1}{2}(-9,8)\ \Delta t^2 = -5,2 + \frac{1}{2}(-9,8)\ \Delta t^2$ ✓ (equating/*gelykstelling* Δy_A to/na Δy_B)
$\Delta t = 2,08$ s ✓
Upwards as negative/*Opwaarts as negatief*

Ball/*Bal A*:
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$\Delta y = (2,5)\ \Delta t + \frac{1}{2}(9,8)\ \Delta t^2$ ✓

Ball/*Bal B*:
$(\Delta y - 5,2) = 0 + \frac{1}{2}(9,8)\ \Delta t^2$ ✓
$\Delta y = 5.2 + \frac{1}{2}(9,8)\ \Delta t^2$
$(2,5)\ \Delta t + \frac{1}{2}(9,8)\ \Delta t^2 = 5,2 + \frac{1}{2}(9,8)\ \Delta t^2$ ✓ (equating/*gelykstelling* Δy_A to Δy_B)
$\Delta t = 2,08$ s ✓ (5)

3.2.2 **POSITIVE MARKING FROM 3.2.1/*POSITIEWE NASIEN VANAF VRAAG 3.2.1***

Upwards as positive/*Opwaarts as positief*	**Upwards as negative/*Opwaarts as negatief***
$v_f = v_i + a\Delta t$ ✓	$v_f = v_i + a\Delta t$ ✓
$V_f = -2,5 + (-9,8)(2,08)$ ✓	$v_f = 2,5 + (9,8)(2,08)$ ✓
$v_f = -22,884$	$v_f = 22,884$ m·s^{-1}, downwards/*afwaarts* ✓
$v_f = 22,884$ m·s^{-1}, downwards/*afwaarts* ✓	

(3)

3.2.3 **POSITIVE MARKING FROM 3.2.2/ *POSITIEWE NASIEN VANAF VRAAG 3.2.2***
OPTION/*OPSIE 1*

Upwards as positive/*Opwaarts as positief*	**Upwards as negative/*Opwaarts as negatief***
Ball/*Bal A*:	**Ball/*Bal A***:
$V_f^2 = V_i^2 + 2a\Delta y$ ✓	$V_f^2 = V_i^2 + 2a\Delta y$ ✓
$-22,884^2 = -2,5^2 + 2(-9,8)(\Delta y)$ ✓	$22,884^2 = 2,5^2 + 2(9,8)(\Delta y)$ ✓
$\Delta y = -26,40$ m	$\Delta y = 26,40$ m
Height/*Hoogte* **Y** = –26,40 + 5,2	Height/*Hoogte* **Y** = 26,40 – 5,2
Height/*Hoogte* **Y** = 21,20 m ✓	Height/*Hoogte* **Y** = 21,20 m ✓

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POSITIVE MARKING FROM 3.2.1/ *POSITIEWE NASIEN VANAF VRAAG 3.2.1*

OPTION/*OPSIE 2*

Upwards is positive/*Opwaarts as positief*	**Upwards is negative/*Opwaarts as negatief***
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$\Delta y = \underline{(-2,5) \times 2,08 + \frac{1}{2}(-9,8)\ 2,08^2}$ ✓	$\Delta y = \underline{(2,5)\ 2,08 + \frac{1}{2}(9,8)\ 0,208^2}$ ✓
$\Delta y = -26,40$	$\Delta y = 26,40$
Height/*Hoogte* **Y** = –26,40 + 5,2	Height/*Hoogte* **Y** = 26,40 – 5,2
Height/*Hoogte* **Y** = 21,20 m ✓	Height/*Hoogte* **Y** = 21,20 m ✓

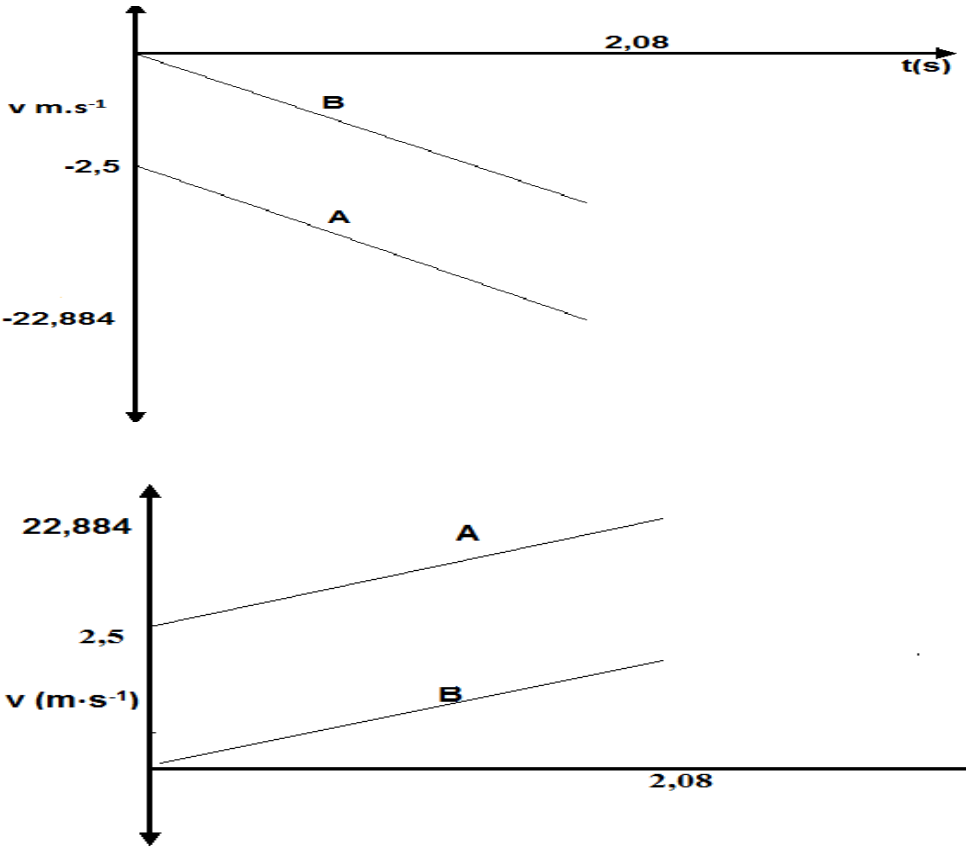
OPTION/*OPSIE 3*

Ball/*Bal B*

POSITIVE MARKING FROM 3.2.1/ *POSITIEWE NASIEN VANAF VRAAG 3.2.1*

Upwards is positive / *Opwaarts as positief*	**Upwards is negative/ *Opwaarts as negatief***
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$\Delta y = 0 \times 2,08 + \underline{\frac{1}{2}(-9,8)\ 2,08^2}$ ✓	$\Delta y = 0\ 2,08\ \underline{+ \frac{1}{2}(9,8)\ 0,208^2}$ ✓
Height/*Hoogte* **Y** = 21,20 m ✓	Height/*Hoogte* **Y** = 21,20 m ✓ (3)

3.3



Criteria for graph/*Kriteria vir grafiek*	**Marks/ *Punte***
Shape parallel lines/*Beide lyne parallel.*	✓✓
B starts on (0,0) and A from 2,5/ ***B** begin by (0,0) en vanaf 2,5*	✓
2,08 s and /*en* 22,884 m·s^{-1} indicated / *aangedui* (2,08, 22,884)	✓

(4)

[17]

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QUESTION/*VRAAG* 4

4.1 The <u>total linear momentum</u> ✓ of an <u>isolated system</u> ✓ remains constant/is conserved.
Die <u>totale lineêre momentum</u> van 'n <u>geïsoleerde sisteem</u> bly konstant/behoue. (2)

4.2 **Right as positive/*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* ✓
$(mv_i)_1 + (mv_i)_2 = (m_1 + m_2)\, v_f$
$(4\,000 \times 32{,}17) + (2\,000 \times 25)$ ✓ $= (6\,000)\, v_f$ ✓
$v_f = 29{,}78\ m.s^{-1}$ in the original direction/*in die oorspronklike rigting* ✓ (4)

4.3 Inelastic/*Onelasties* ✓ (1)

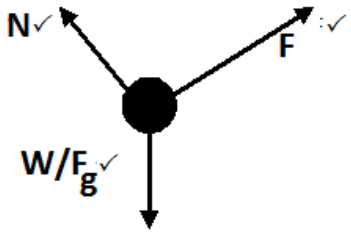
4.4.1 equal to F/*gelyk aan F* ✓ (1)

4.4.2 Newton's Third Law of motion/*Newton se derde Bewegingswet.* ✓

When object A exerts a force on object B, object B simultaneously exerts an oppositely directed force of equal magnitude on object A. ✓✓
Newton se derde Bewegingswet
Wanneer voorwerp A 'n krag op voorwerp B uitoefen, oefen voorwerp B gelyktydig 'n krag van gelyke grootte en in die teenoorgestelde rigting op voorwerp A uit. (3)
[11]

QUESTION/*VRAAG* 5

5.1



Accepted labels/*Aanvaarde benoeming*

w	F_g/F_w/weight/gravitational force *gewig/gravitasiekrag*	✓
F	F_A/Applied Force/ *Toegepastekrag*	✓
N	F_N/N/Normal force/ *Normaalkrag*	✓

(3)

5.2 No ✓, it is not an isolated system ✓
Nee, dit is nie op geïsoleerde stelsel/sisteem nie

OR/*OF*

No ✓, there is an external force (applied force) acting on the object ✓
Nee, daar is 'n eksterne krag (toegepastekrag) wat op die voorwerp inwerk. (2)

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5.3 Gravitational force/weight/*Gravitasiekrag/gewig* ✓ (1)

5.4 The force is perpendicular to the displacement. ✓
Die krag is loodreg aan die verplasing.

OR/*OF*

Therefore, cos θ = 90°/*daarom is cos θ = 90°* ✓ (1)

5.5 From **B** to **A** ✓ (1)
*Van **B** tot **A***

5.6 **OPTION/*OPSIE 1***
$W_{net} = \Delta K$
$W_{net} = \Delta E_k$
$W_{//} + W_F = \Delta K$
$F_{g//} \cdot \Delta x \cdot \cos\theta + F \cdot \Delta x \cdot \cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
Any one/*Enige een* ✓

$(20 \times 9,8 \times \sin 30°)(4,2)\cos 180° \checkmark + F(4,2)\cos 0° \checkmark = \frac{1}{2}(20)(12,2)^2 - \frac{1}{2}(20)(13,5)^2 \checkmark$

$411,6)(-1) + F(4,2)(1) = 1488,4 - 1822,5$

$F = 18,45$ N ✓

OPTION/*OPSIE 2*
$W_{nc} = \Delta E_k + \Delta E_p$
$F \cdot \Delta x \cdot \cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mgh_f - mgh_i$
Any one/*Enige een* ✓

$F(4,2)\cos 0° \checkmark = [\frac{1}{2}(20)(12,2)^2 - \frac{1}{2}(20)(13,5)^2] \checkmark + [(20)(9,8)(4,2 \sin 30°) \checkmark - 0]$

$F(4,2)(1) = 1488,4 - 1822,5 + (196)(4,2)(0,5)$

$F = 18,45$ N ✓ (5)

[13]

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QUESTION/*VRAAG* 6

6.1 $v = f\lambda$ ✓
330 = (440) λ ✓
λ = 0,75 m ✓ (3)

6.2 440 Hz ✓ (1)

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

Die (skynbare) verandering in frekwensie/toonhoogte van die klank wat deur 'n luisteraar waargeneem word want die luisteraar en die klankbron het verskillende snelhede relatief aan die medium van klank voortplanting. (2)

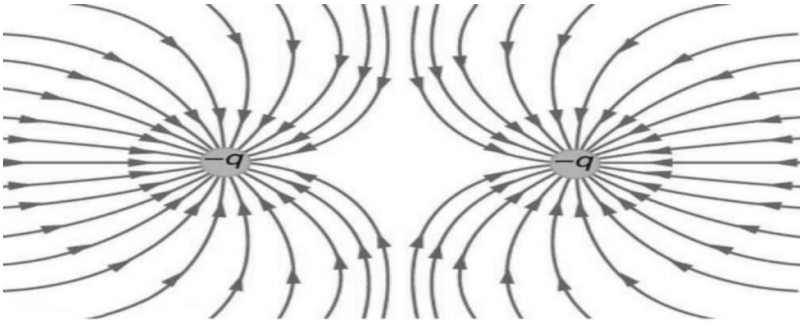
6.4 330 m·s^{-1} ✓ (1)

6.5 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓
$= \frac{330\ ✓}{330-8\ ✓}$ 440 ✓
f_L = 450,93 Hz ✓ (5)
[12]

QUESTION/*VRAAG* 7

7.1 It is the <u>electrostatic force</u> experienced <u>per unit positive magnitude of the charge</u> placed at that point. ✓✓
Dit is die <u>elektrostatiese krag</u> wat deur 'n <u>eenheidpositiewe-lading</u> wat by daardie punt geplaas is, ondervind word. (2)

7.2



Marking Criteria/*Nasienkriteria*
Correct Shape/*Korrektevorm* ✓
Arrows pointing towards P and Q/*Pyltjies wys na P en* Q ✓
Field lines don't touch/cross and perpendicular on charge/*Veldlyne raak nie/kruis en loodreg op lading* ✓

(3)

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7.3 $E = \frac{kQ}{r_1^2}$ ✓

$5,22 \times 10^5 = \frac{(9 \times 10^9)(5 \times 10^{-9})}{r^2}$ ✓

r = 9,285 x 10^{-3}

∴d = 9,285 x 10^{-3} – 8 x 10^{-3} m ✓

= 1,29 x 10^{-3} m ✓(or 1,29 mm) (4)

7.4 The magnitude of the electrostatic force exerted by one point charge on another point charge is directly proportional to the product of the charges ✓ and inversely proportional to the square of the distance between them. ✓
Die grootte van die elektrostatiese krag wat deur een puntlading op 'n ander puntlading uitgeoefen word, is direk eweredig aan die produk van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. (2)

7.5 $\mathbf{F = \frac{kQ_1Q_2}{r^2}}$ ✓

$\mathbf{F_1 = \frac{(9 \times 10^9)(5 \times 10^{-9})(5 \times 10^{-9})}{(0,008)^2}}$ ✓ ✓

F_1 = 3,52×10^{-3} N (west/*wes* OR/*OF* left/*links*)

$\mathbf{F_2 = \frac{(9 \times 10^9)(5 \times 10^{-9})(6 \times 10^{-9})}{(0,012)^2}}$ ✓

F_2 = 1,88 × 10^{-3} N (south/*suid* OR/*OF* down/*af*)

F_{net}^2 = (3,52×10^{-3})^2 + (1,88 × 10^{-3})^2 ✓

∴F_{net} = 3,98 X 10^{-3} N ✓

Range (3,98×10^{-3} N – 3,99×10^{-3} N)

(6)
[17]

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QUESTION/*VRAAG* 8

8.1 emf (ε) = IR_{ext} + Ir ✓/ emf (ε) = V + Vint
When the current increases, Ir (lost volts) increases ✓
IV_{ext} (terminal voltage/pd)(voltage of the load) decreases ✓
Since emf (ε) is the same/constant ✓
Wanneer die stroom toeneem, neem Ir (verlore volts) toe
IR_{ekst} (terminaal spanning/ spanning van die las) neem af
emk (ε) is dieselfde/konstant (4)

8.2 Group/*Groep* 2 ✓ [Accept/*Aanvaar* r_2] (1)

8.3
$$\text{gradient} = \frac{\Delta y}{\Delta x} \checkmark$$
$$= \frac{4-8}{4-2} \checkmark$$
$$\text{gradient} = -2\ \Omega$$
$$r = 2\ \Omega \checkmark$$
Use any coordinate values
Gebruik enige koördinaatwaardes
(3)

8.4 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

OR/*OF*

The ratio of potential difference across a conductor to current through the conductor is constant at constant temperature.
Die verhouding van potensiaalverskil oor 'n geleier tot stroom deur die geleier is konstant by konstante temperatuur. (2)

8.5 **OPTION/*OPSIE 1***
$R_{ext} = R_x + R_{parallel}$ **OR/*OF*** $R_{ext} = R_x + \left(\frac{R_1 R_2}{R_2 + R_1}\right)$ **OR/*OF*** $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓
Any one/*Enige een*
$\frac{1}{R_{//}} = \frac{1}{4} + \frac{1}{8} \checkmark$ $\therefore R_p = 2{,}67\Omega$
$R_{ext} = \frac{V}{I} \checkmark$
$R_{ext} = \frac{10}{1{,}5} \checkmark$
= 6,67Ω
6,67 = R_x + 2,67 ✓
R_x = 6,67 – 2,67
= 4 Ω ✓

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OPTION/*OPSIE 2*

$R_{ext} = R_x + R_{parallel}$ **OR/*OF*** $R_{ext} = R_x + \left(\frac{R_1R_2}{R_2+R_1}\right)$ **OR/*OF*** $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

Any one/*Enige een*

$\frac{1}{R_{//}} = \frac{1}{4} + \frac{1}{8}$ ✓ ∴ R= 2,67Ω

$V_p = IR_p$ ✓

= (1,5)(2,67) ✓

= 4,00 V **OR/*OF*** 4,01 V

V_{Rx} = 10 – 4 **OR/*OF*** 10 – 4,01

= 6 V **OR/*OF*** 5,99 V

$V_{Rx} = IR_x$

6 = (1,5)R_X ✓ **OR/*OF*** 5,99 = (1,5)R_X ✓

∴R_X = 4 Ω ✓ **OR/*OF*** 3,99 Ω ✓

(6)

8.6 **OPTION/*OPSIE 1***

POSITIVE MARKING FROM 8.5/ *POSITIEWE NASIEN VANAF VRAAG 8.5*

Emf/emk = I(R + r) ✓

12 = (1,5)(2,67+ 4 + r) ✓ **OR/*OF*** (1,5)(2,67 + 3,99 + r)

∴r = 1,33 Ω (1,33 Ω – 1,34 Ω) ✓

OPTION/*OPSIE 2*

$V_{lost/\ verlore}$ = Ir ✓

2= (1,5) r ✓ ∴r = 1,33 Ω ✓

(3)

OR/*OF*

8.7 W =VI Δt ✓

For the same potential different and time, internal $I_{4\Omega}$ is greater than $I_{8\Omega}$ ✓

W α I ✓

Vir dieselfde potensiaal verskil en tyd, is $I_{4\Omega}$ *groter as* $I_{8\Omega}$

Energy: $W = \frac{V^2}{R}\Delta t$ ✓ For the same potential difference and time ✓ $W \propto \frac{1}{R}$ is greater for the smaller resistance than for the larger resistance. ✓

Energie: $W = \frac{V^2}{R}\Delta t$ *Vir dieselfde potensiaalverskil en tyd* $W \propto \frac{1}{R}$ *is groter vir die kleiner weerstand as vir die groter weerstand*

(3)

[22]

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QUESTION/*VRAAG* 9

9.1 The rms voltage of AC is the AC potential difference which dissipates produces the same amount of energy as an equivalent DC potential difference ✓✓
Die wgk spanning van WS is die WS-potensiaalverskil wat dieselfde hoeveelheid energie verbruik/oordra as 'n ekwivalente GS-potensiaalverskil. (2)

9.2 Mechanical energy to electrical energy. ✓
Meganiese energie na elektriese energie (1)

9.3 It can be stepped up or stepped down/is easier to transmit ✓ with less energy lost
AC can be converted to DC but DC cannot be converted to AC
Dit kan verhoog of verlaag word/is makliker om oor te dra met minder energie wat verlore raak WS kan na GS omgeskakel word maar kan nie na WS herlei word nie (1)

9.4 **OPTION/*OPSIE* 1**

$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ ✓ Any one/*Enige een* $I_{rms} = \frac{I_{max}}{\sqrt{2}}$

$V_{rms} = \frac{311}{\sqrt{2}}$ ✓ $I_{rms} = \frac{21}{\sqrt{2}}$ ✓

= 219,91 V = 14,85 A

$P_{ave} = V_{rms}I_{rms}$ ✓

= (219,91)(14,85) ✓

= 3265,66 W ✓

OPTION/*OPSIE* 2

$P_{ave} = \frac{V_{max} I_{max}}{2}$ ✓✓

$P_{ave} = \frac{311 \times 21}{2}$ ✓✓✓

P_{ave} = 3265,5 W ✓

OPTION/*OPSIE* 3

$R = \frac{V}{I}$

$R = \frac{311}{21}$ ✓

R = 14,81Ω

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$ ✓

$= \frac{21}{\sqrt{2}}$ ✓

= 14,85 A

$P_{ave} = I^2_{rms}R$ ✓

$= (14,85)^2 (14,81)$ ✓

P_{ave} = 3265,94✓

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OPTION/*OPSIE* 4

$R = \frac{V}{I}$

$R = \frac{311}{21}$ ✓

R = 14,81Ω

$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ ✓

$V_{rms} = \frac{311}{\sqrt{2}}$ ✓

V_{rms} = 219,91 V

Range [3 265,39 V – 3 265,94]

$P_{ave} = \frac{V^2_{rms}}{R}$ ✓

$= \frac{219,91^2}{14,81}$ ✓

P_{ave} = 3 265,39 W ✓

(6)
[10]

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QUESTION/*VRAAG* 10

10.1 The energy of the photons of red light is greater than the work function of the metal in the photocell. ✓ Photo electrons are ejected (from the metal surface) ✓
Die energie van die fotone van rooi lig is groter as die arbeidsfunksie van die metaal in die fotosel. Foto-elektrone word vrygestel (vanaf die metaal oppervlak)

OR/*OF*

The frequency of the red light is higher than the threshold/cut-off frequency of the metal in the photocell. ✓ Photo electrons are ejected (from the metal surface) ✓

Die frekwensie van die rooi lig is hoër as die drumpel/afsnyfrekwensie van die metaal in die fotosel. Foto-elektrone word vrygestel (vanaf die metaal oppervlak) (2)

10.2 Increase/*Toeneem* ✓ (1)

10.3 Stays the same ✓
The change in colour/frequency only affected the kinetic energy of the photo electrons. ✓
Only the intensity of the light affected the number of photo electrons emitted per time unit. ✓
The intensity of the light stays the same and therefore the number of photo electrons emitted per unit time /current stays the same. ✓
Bly dieselfde
Die verandering in kleur/frekwensie het slegs 'n invloed op die kinetiese energie van die foto-elektrone.
Slegs die intensiteit van die lig het 'n invloed op die aantal foto-elektrone wat per tydseenheid vrygestel word
Die intensiteit van die lig bly dieselfde en daarom bly die aantal foto-elektrone wat per eenheid tyd/stroom vrygestel word dieselfde (4)

10.5 $E = W_o + E_{k(max)}$

$h\frac{c}{\lambda} = hf_o + \frac{1}{2}mv_{max}^2$ ✓Any one/*Enige een*

$\frac{6,63 \times 10^{-34} \times 3 \times 10^8}{4,5 \times 10^{-7}}$ ✓ ✓ $6,63 \times 10^{-34}(f_o)$ ✓ $+ \frac{1}{2}(9,11 \times 10^{-31})(4,78 \times 10^5)^2$ ✓

$f_o = 5,10 \times 10^{14}$ Hz ✓ (6)
[13]

TOTAL/*TOTAAL*: 150

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