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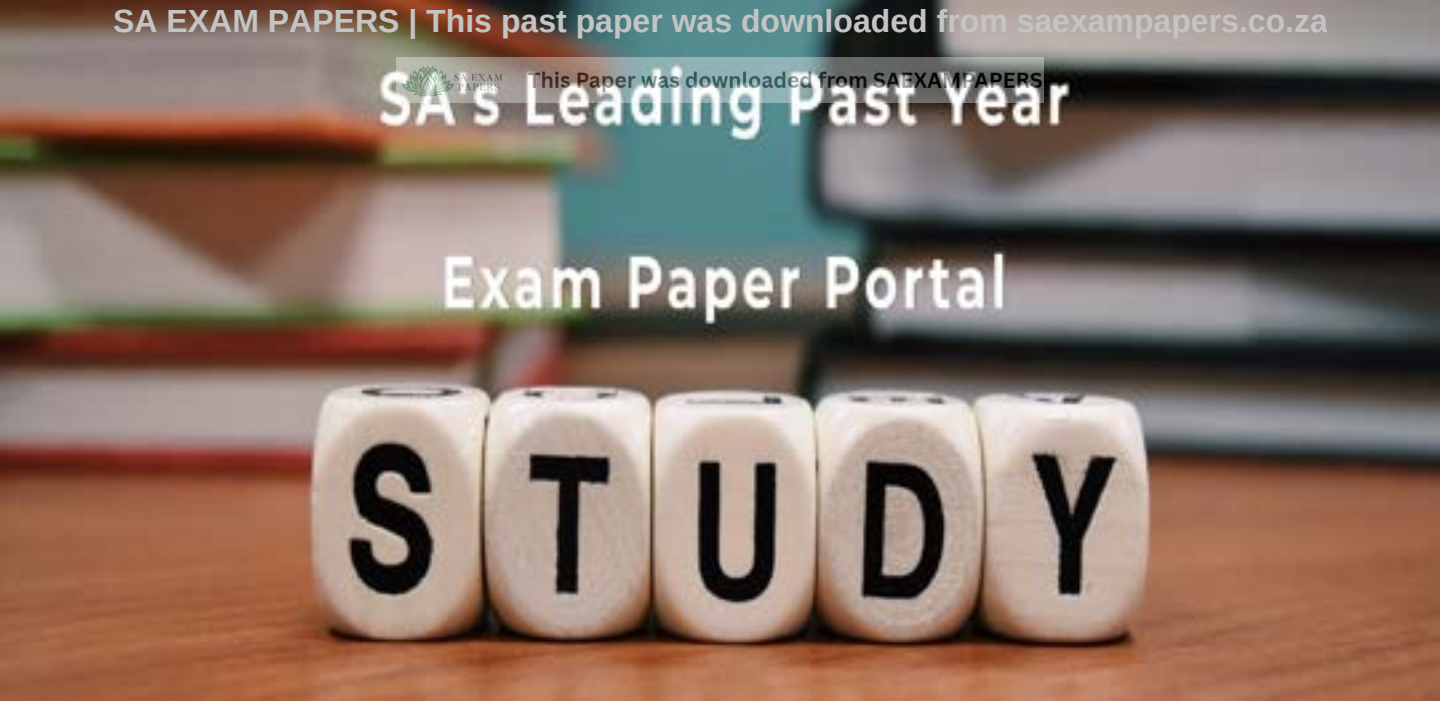

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basic education

Department:
Basic Education
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SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS/ *SENIORSERTIFIKAAT-EKSAMEN/ NASIONALE SENIORSERTIFIKAAT-EKSAMEN*

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

MAY/JUNE 2025/*MEI/JUNIE 2025*

MARKING GUIDELINES/*NASIENRIGLYNE*

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MARKS/*PUNTE*: 150

These marking guidelines consist of 20 pages.
Hierdie nasienriglyne bestaan uit 20 bladsye.

DBE IM 29/05/2025

29-05-2025

External Moderator 29/05/2025

UMALUSI: EXTERNAL MODERATOR 29 May 2025

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QUESTION 1/*VRAAG 1*

1.1	D ✓✓	(2)
1.2	A ✓✓	(2)
1.3	B ✓✓ Accept Q / *Aanvaar Q*	(2)
1.4	D ✓✓	(2)
1.5	D ✓✓	(2)
1.6	C✓✓	(2)
1.7	A ✓✓	(2)
1.8	C ✓✓	(2)
1.9	C ✓✓	(2)
1.10	C ✓✓	(2)

[20]

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QUESTION 2/*VRAAG 2*

2.1

Marking criteria/*Nasienkriteria*
If any 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 force acts on it. ✓✓
'n Liggaam sal in sy toestand van rus of beweging teen konstante snelheid volhard, tensy 'n nie-nul resulterende/netto krag daarop inwerk. (2)

2.2

ACCEPT/*AANVAAR*

	Accepted labels/*Aanvaarde benoemings*
N	F_N/Normal force/F_{normal}/ 212,18 N / *$F_{normaal}$/Normaalkrag*
f_k	(kinetic) friction/F_f/ f / 40 N / *(kinetiese) wrywing*/F_w
F	Applied force/ $F_{applied}$ /F_a / Toegepaste krag/$F_{toegepas}$
w	F_g/F_w/mg/245 N/weight/gravitational force/*gewig*/*gravitasiekrag*

Notes/*Aantekeninge*
- Mark is awarded for label and arrow/*Punt word toegeken vir byskrif en pyltjie.*
- Do not penalise for length of arrows/*Moenie vir die lengte van die pyltjies penaliseer nie.*
- If arrows do not touch the dot/*Indien pyle nie die kolletjie raak nie*: Max/*Maks* $^3/_4$
- Any other additional force(s)/*Enige ander addisionele krag(te)*: Max/*Maks* $^3/_4$
- If everything correct, but no arrows/*Indien alles korrek, maar geen pyltjies*: Max/*Maks* $^3/_4$
- If components are drawn/*Indien komponente geteken*: max/*maks* $^3/_4$

(4)

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2.3

OPTION 1/*OPSIE 1*

DOWNWARDS AS POSITIVE/
AFWAARTS AS POSITIEF

$F_{net} = 0$
$F_{net} = ma$
$F_{g//} - F - f_k = ma$
$mg\sin\theta - F - f_k = ma$
✓Any one/ *Enige een*

$25(9,8)\sin30° - F - 40 = 25(0)$ ✓
$F = 82,5$ N ✓

UPWARDS AS POSITIVE/
OPWAARTS AS POSITIEF

$F_{net} = 0$
$F_{net} = ma$
$-F_{g//} + F + f_k = ma$
$-mg\sin\theta + F + f_k = ma$
✓Any one/ *Enige een*

$-25(9,8)\sin30° + F + 40 = 25(0)$ ✓
$F = 82,5$ N✓

OPTION 2/*OPSIE 2*

$W_{net} = \Delta E_k$
$W_F + W_f + W_{Fg} = 0$
$F\Delta x\cos\theta + f\Delta x\cos\theta + mg\sin\Phi\Delta x\cos\theta = 0$
✓Any one/ *Enige een*

$F\cos180° + 40\cos180° + (25)(9,8)\sin30°\cos0° = 0$ ✓
$F = 82,5$ N ✓

(3)

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2.4

$F_{net} = 0$
$F_{g//} = f$ ✓Any one/*Enige een*
$F_{g//} - f = F_{net} = 0$

NOTE: mark only awarded with correct substitution of $F_{g//}$
NOTA:*punt toegeken slegs indien korrekte vervanging van* $F_{g//}$

OR/*OF* $f = \mu_k N$ ✓

$mg\sin\theta$ ✓$= \mu_k mg\cos\theta$ ✓ **OR/*OF*** $\mu_k = \frac{mg\sin\theta}{mg\cos\theta}$ ✓

$\mu_k = \frac{\sin\theta}{\cos\theta}$

(3)

2.5

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\tan\theta = 0,19$	$\tan\theta = 0,19$
$\theta = 10,76°$✓	$\theta = 10,76°$✓
$f_k = \mu_k mg\cos\theta$	$f_k = F_{g//} = mg\sin\theta$
$= (0,19)(25)(9,8)\cos 10,76°$✓	$= (25)(9,8)\sin 10,76°$ ✓
$= 45,73$ N ✓	$= 45,73$ N ✓
(Range/*Gebied*: 45,73 – 45,74 N)	(Range/*Gebied*: 45,73 – 45,74 N)

(3)
[15]

QUESTION 3/*VRAAG 3*

3.1 Motion under the influence of gravitational force only. ✓✓
Accept weight for gravitational force.
Beweging slegs onder die invloed van gravitasiekrag.
Aanvaar swaartekrag/gewig vir gravitasiekrag.
(2 or/*of* 0)
OR/*OF*
Motion in which the only force acting is gravitational force. ✓✓
Accept weight for gravitational force.
Beweging waar die enigste krag wat inwerk, gravitasiekrag is.
Aanvaar swaartekrag/gewig vir gravitasiekrag.
(2 or/of 0)

NOTE: If projectile is defined: $^0/_2$
LET WEL: Indien projektiel gedefinieer is: $^0/_2$

(2)

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3.2

Marking criteria /*Nasienkriteria*

- Correct formula for $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ / *Korrekte formule vir* $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
- Correct substitution into formula for **A-B**./*Korrekte vervanging in formule vir* ***A-B***. ✓
- Correct substitution into formula for **B-C** or **A-C**./ *Korrekte vervanging in formule vir* ***B-C*** *of* ***A-C***. ✓
- Equating v_f at B and v_i at B / *Gelykstelling van* v_f *by B en* v_i *by B* ✓

DOWNWARDS AS POSITIVE/AFWAARTS AS POSITIEF

A
h Δt
B
8 h 2 s
C

OPTION 1/*OPSIE 1*

A-B

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

$h = \underline{(0) + \frac{1}{2}(9,8)(t)^2}$ ✓

$h = 4,9\ t^2$

A-C

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

$\underline{9h = (0)(t + 2) + \frac{1}{2}(9,8)(t + 2)^2}$ ✓

$9h = (4,9)(t + 2)^2$

$9t^2 = (t + 2)^2$ ✓

$3t = (t + 2)$

$t = 1\ s$

NOTE/*NOTA*:

If candidate uses t = 3 s or t = 1 s

Indien kandidaat t = 3 s of t = 1 s gebruik

max/*maks* $^1/_4$

OPTION 2/*OPSIE 2*

A-B

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

$h = \underline{(0)\ t + \frac{1}{2}(9,8)\ t^2}$ ✓

$h = 4,9\ t^2$

B-C

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

$\underline{8h = v_i(2) + \frac{1}{2}(9,8)(2)^2}$ ✓

$= 2v_i + 19,6$

$v_i = \dfrac{(8h - 19,6)}{2}$

A-B & B-C

$v_f = v_i + a\Delta t$

$v_f = 0 + (9,8)\ t$

$v_{i(B-C)} = v_{f(A-B)}$ → ✓Any one / *Enige een*

$\dfrac{(8h - 19,6)}{2} = (9,8)\ t$

$8(4,9t^2) = (19,6)\ t + 19,6$

$2t^2 - t - 1 = 0$

$t = 1\ s$

OPTION 3/*OPSIE 3*

A-B

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$= \underline{(0) + 2(9,8)(h)}$

$v_B = \sqrt{19,6h}$ → ✓✓Both /*Beide*

B-C

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

$\underline{8h = v_B(2) + \frac{1}{2}(9,8)(2)^2}$

$8h = 2(\sqrt{19,6h}) + 19,6$

$8h - 2\sqrt{19,6h} = 19,6$

$h = 4,9\ m$

A-B

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

$\underline{4,9 = (0) + \frac{1}{2}(9,8)(t)^2}$ ✓

$t = 1\ s$

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OPTION 4/*OPSIE 4*

A-B $F_{net}\Delta t = m(v_f - v_i)$
$mg\Delta t = m(v_f - v_i)$
$v_f = 9{,}8t$ ...(1)

B-C
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$8h = 9{,}8t(2) + \frac{1}{2}(9{,}8)(2)^2$ ✓
$8h = 19{,}6t + 19{,}6$ ...(2)

A-B
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$h = 0t + \frac{1}{2}(9{,}8)t^2$ ✓
$h = 4{,}9t^2$ ...(3)

$8(4{,}9t^2) = 19{,}6t + 19{,}6$ ✓ (3) into (2)
$39{,}2t^2 - 19{,}6t + 19{,}6 = 0$
$t = 1$ s

OPTION 5/*OPSIE 5*

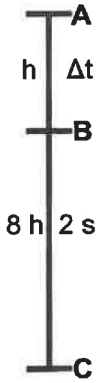
B-C $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$8h = v_i(2) + \frac{1}{2}(9{,}8)(2)^2$ ✓
$v_i = 4h - 9{,}8$ .....(1)

A-B $v_f = v_i + a\Delta t$
$4h - 9{,}8 = 0 + 9{,}8t$
$t = \frac{4h}{9{,}8} - 1$ .....(2)

A-B $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$h = 0 + \frac{1}{2}(9{,}8)t^2$ ✓
$= 4{,}9t^2$ .....(3)

(3) into (2): $t = \frac{4(4{,}9t^2)}{9{,}8} - 1$ ✓
$2t^2 - t - 1 = 0$
$t = 1$ s

UPWARDS AS POSITIVE/*OPWAARTS AS POSITIEF*



OPTION 1/*OPSIE 1*

A-B $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$-h = (0) + \frac{1}{2}(-9{,}8)(t)^2$ ✓
$h = 4{,}9\,t^2$

A-C
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$-9h = (0)(t + 2) + \frac{1}{2}(-9{,}8)(t + 2)^2$ ✓
$9h = (4{,}9)(t + 2)^2$
$9t^2 = (t + 2)^2$ ✓
$3t = (t + 2)$
$t = 1$ s

NOTE/*NOTA*:
If candidate uses t = 3 s or t = 1 s
Indien kandidaat t = 3 s of t = 1 s gebruik
max/*maks* $^1/_4$

OPTION 2/*OPSIE 2*

A-B $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$-h = (0)t + \frac{1}{2}(-9{,}8)\,t^2$ ✓
$-h = -4{,}9\,t^2$

B-C $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$-8h = v_i(2) + \frac{1}{2}(-9{,}8)(2)^2$ ✓
$-8h = 2v_i - 19{,}6$
$v_i = \frac{(-8h + 19{,}6)}{2}$

A-B & B-C
$v_f = v_i + a\Delta t$
$v_f = 0 + (-9{,}8)\,t$
$v_{i(B-C)} = v_{f(A-B)}$ ✓Any one / *Enige een*
$\frac{(-8h + 19{,}6)}{2} = (-9{,}8)\,t$
$-8(4{,}9\Delta t^2) = (-19{,}6)\Delta t - 19{,}6$
$2t^2 - t - 1 = 0$
$t = 1$ s

OPTION 3/*OPSIE 3*

A-B
$v_f^2 = v_i^2 + 2a\Delta y$
$= (0) + 2(-9{,}8)(h)$ ✓
$v_B = -\sqrt{19{,}6h}$

B-C
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$-8h = v_B(2) + \frac{1}{2}(-9{,}8)(2)^2$ ✓
$-8h = 2(-\sqrt{19{,}6h}) - 19{,}6$
$8h + 2\sqrt{19{,}6h} = 19{,}6$
$h = 4{,}9$

A-B
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$-4{,}9 = (0) + \frac{1}{2}(-9{,}8)(t)^2$ ✓
$t = 1$ s

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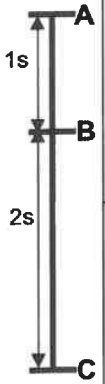
OPTION 4/*OPSIE 4*	**OPTION 5/*OPSIE 5***
A-B $F_{net}\Delta t = m(v_f - v_i)$ $mg\Delta t = m(v_f - v_i)$ $v_f = 9{,}8t$ ...(1) **B-C** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $-8h = -9{,}8t(2) + \frac{1}{2}(-9{,}8)(2)^2$ ✓ $8h = 19{,}6t + 19{,}6$ ...(2) **A-B** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $-h = 0t + \frac{1}{2}(-9{,}8)t^2$ ✓ $h = 4{,}9t^2$ ...(3) $8(4{,}9t^2) = 19{,}6t + 19{,}6$ ✓ (3) into (2) $t = 1$ s	**B-C:** $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $-8h = v_i(2) + \frac{1}{2}(-9{,}8)(2)^2$ ✓ $v_i = -4h + 9{,}8$ ...(1) **A-B:** $v_f = v_i + a\Delta t$ $-4h + 9{,}8 = 0 + (-9{,}8)t$ $t = \frac{4h}{9{,}8} - 1$ ...(2) **A-B:** $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $-h = 0 + \frac{1}{2}(-9{,}8)t^2$ ✓ $h = 4{,}9t^2$ ...(3) (3) into (2) $t = \frac{4(4{,}9t^2)}{9{,}8} - 1$ ✓ $t = 1$ s

(4)

3.3

Marking criteria/*Nasienkriteria*
- Formula to calculate v_f/*Formule om v_f te bereken* ✓
- Correct substitution/*Korrekte vervanging* ✓
- Correct final answer/*Korrekte finale antwoord*: 29,4 m·s^{-1} ✓

DOWNWARDS AS POSITIVE/*AFWAARTS AS POSITIEF*



OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
A-C $v_f = v_i + a\Delta t$ ✓ $= 0 + (9{,}8)(3)$ ✓ $v_f = 29{,}4$ m·s^{-1} ✓	**A-B** $v_f = v_i + a\Delta t$ $= 0 + (9{,}8)(1)$ $v_f = 9{,}8$ m·s^{-1} **B-C** $v_f = v_i + a\Delta t$ ✓ $v_f = 9{,}8 + (9{,}8)(2)$ ✓ $v_f = 29{,}4$ m·s^{-1} ✓
A-C $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $= (0)(3) + \frac{1}{2}(9{,}8)(3)^2$ $\Delta y = 44{,}1$ m	**OPTION 3/*OPSIE 3*** **A-C** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = (0)^2 + (2)(9{,}8)(44{,}1)$ ✓ $v_f = 29{,}4$ m·s^{-1} ✓
	OPTION 4/*OPSIE 4* **A-C** $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $44{,}1 = \left(\frac{0 + v_f}{2}\right)(3)$ ✓ $v_f = 29{,}4$ m·s^{-1} ✓

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A-B

$v_f = v_i + a\Delta t$

$= 0 + (9,8)(1)$

$v_f = 9,8\ m\cdot s^{-1}$

B-C

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

$= (9,8)(2) + \frac{1}{2}(9,8)(2)^2$

$\Delta y = 39,2\ m$

OPTION 5/*OPSIE 5*

B-C

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$v_f^2 = \underline{(9,8)^2 + (2)(9,8)(39,2)}$ ✓

$v_f = 29,4\ m\cdot s^{-1}$ ✓

OPTION 6/*OPSIE 6*

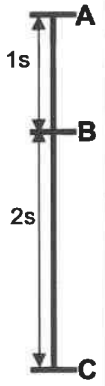
B-C

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

$39,2 = \left(\frac{9,8 + v_f}{2}\right)(2)$ ✓

$v_f = 29,4\ m\cdot s^{-1}$ ✓

UPWARDS AS POSITIVE/ OPWAARTS AS POSITIEF



OPTION 1/*OPSIE 1*

A-C

$v_f = v_i + a\Delta t$ ✓

$= \underline{0 + (-9,8)(3)}$ ✓

$v_f = -29,4$

$v_f = 29,4\ m\cdot s^{-1}$ ✓

OPTION 2/*OPSIE 2*

A-B

$v_f = v_i + a\Delta t$

$= 0 + (-9,8)(1)$

$v_f = -9,8\ m\cdot s^{-1}$

B-C

$v_f = v_i + a\Delta t$ ✓

$v_f = \underline{-9,8 + (-9,8)(2)}$ ✓

$v_f = -29,4$

$v_f = 29,4\ m\cdot s^{-1}$ ✓

A-C

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

$= (0)(3) + \frac{1}{2}(-9,8)(3)^2$

$\Delta y = -44,1\ m$

OPTION 3/*OPSIE 3*

A-C

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$v_f^2 = \underline{(0)^2 + (2)(-9,8)(-44,1)}$ ✓

$v_f = -29,4$

$v_f = 29,4\ m\cdot s^{-1}$ ✓

OPTION 4/*OPSIE 4*

A-C

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

$-44,1 = \left(\frac{0 + v_f}{2}\right)(3)$ ✓

$v_f = -29,4$

$v_f = 29,4\ m\cdot s^{-1}$ ✓

A-B

$v_f = v_i + a\Delta t$

$= 0 + (-9,8)(1)$

$v_f = -9,8\ m\cdot s^{-1}$

B-C

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

$= (-9,8)(2) + \frac{1}{2}(-9,8)(2)^2$

$\Delta y = -39,2\ m$

OPTION 5/*OPSIE 5*

B-C

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$v_f^2 = \underline{(-9,8)^2 + (2)(-9,8)(-39,2)}$ ✓

$v_f = -29,4$

$v_f = 29,4\ m\cdot s^{-1}$ ✓

OPTION 6/*OPSIE 6*

B-C

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

$-39,2 = \left(\frac{-9,8 + v_f}{2}\right)(2)$ ✓

$v_f = -29,4$

$v_f = 29,4\ m\cdot s^{-1}$ ✓

(3)

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3.4.1

POSITIVE MARKING FROM QUESTION 3.2 and 3.3
POSITIEWE NASIEN VANAF VRAAG 3.2 en 3.3

Note/Let wel: If 9h = 44,1 m already calculated in 3.2 or 3.3, award 2 marks for answer./*Indien h = 44,1 m alreeds in 3.2 of 3.3 bereken, ken 2 punte toe vir antwoord.*

DOWNWARDS AS POSITIVE/*AFWAARTS AS POSITIEF*

OPTION 1/*OPSIE 1*

$h = 4,9$ **OR/OF** $h = (4,9)(1)^2$ **OR/OF** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$h = \underline{(0) + \frac{1}{2}(9,8)(1)^2}$

$9h = 9(4,9)$ ✓
$= 44,1$ m✓

OPTION 2/*OPSIE 2*

$\Delta y = 4,9 + 39,2$ ✓
$= 44,1$ m✓

OPTION 3/*OPSIE 3*

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= \underline{(0)(3) + \frac{1}{2}(9,8)(3)^2}$ ✓
$\Delta y = 44,1$ m ✓

OPTION 4/*OPSIE 4*

$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$
$= \left(\frac{0 + 29,4}{2}\right)(3)$ ✓
$\Delta y = 44,1$ m ✓

OPTION 5/*OPSIE 5*

$v_f^2 = v_i^2 + 2a\Delta y$
$\underline{(29,4)^2 = (0)^2 + (2)(9,8)\Delta y}$ ✓
$\Delta y = 44,1$ m✓

OPTION 6/*OPSIE 6*

$(E_{mech})_i = (E_{mech})_f$
$\underline{0 + m(9,8)h = \frac{1}{2}m(29,4)^2 + 0}$ ✓
$h = 44,1$ m ✓

DOWNWARDS AS NEGATIVE/*AFWAARTS AS NEGATIEF*

OPTION 1/*OPSIE 1*

$h = 4,9$ **OR/OF** $h = (4,9)(1)^2$ **OR/OF** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$h = \underline{(0) + \frac{1}{2}(-9,8)(1)^2}$

$9h = 9(4,9)$ ✓
$= 44,1$ m✓

OPTION 2/*OPSIE 2*

$\Delta y = 4,9 + 39,2$ ✓
$= 44,1$ m✓

OPTION 3/*OPSIE 3*

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= \underline{(0)(3) + \frac{1}{2}(-9,8)(3)^2}$ ✓
$\Delta y = -44,1$
$\Delta y = 44,1$ m ✓

OPTION 4/*OPSIE 4*

$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$
$= \left(\frac{0 + (-29,4)}{2}\right)(3)$ ✓
$\Delta y = -44,1$
$\Delta y = 44,1$ m ✓

OPTION 5/*OPSIE 5*

$v_f^2 = v_i^2 + 2a\Delta y$
$\underline{(-29,4)^2 = (0)^2 + (2)(-9,8)\Delta y}$ ✓
$\Delta y = -44,1$
$\Delta y = 44,1$ m✓

OPTION 6/*OPSIE 6*

$(E_{mech})_i = (E_{mech})_f$
$\underline{0 + m(9,8)h = \frac{1}{2}m(-29,4)^2 + 0}$ ✓
$h = 44,1$ m ✓

(2)

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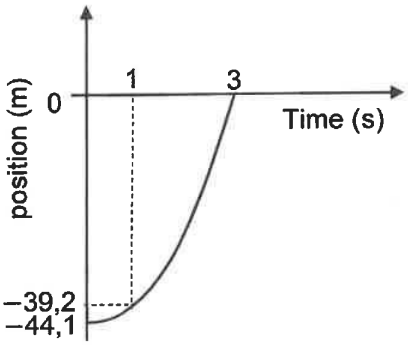
3.4.2 $\Delta y_{BC} = 39,2\ m$✓ (1)

3.5 **POSITIVE MARKING FROM QUESTIONS 3.3 and 3.4**
POSITIEWE NASIEN VANAF VRAAG 3.3 en 3.4

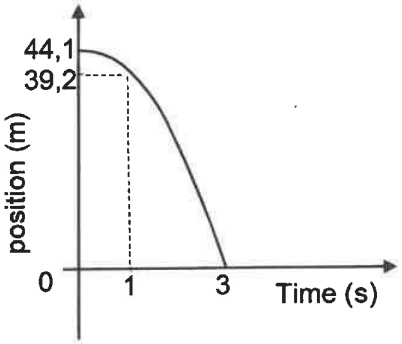
DOWNWARDS AS POSITIVE/*AFWAARTS AS POSITIEF*



Marking criteria:
- Initial position -44,1 m AND ball strikes the ground at 3 s ✓
- Position at 1s is -39,2 m✓
- Correct shape ✓✓
- If ground is not used as zero max $^3/_4$
- If axis incorrectly/not labelled max $^3/_4$

Nasienkriteria:
- *Aanvanklike posisie -44,1 m EN bal tref die grond by 3 s* ✓
- *Posisie na 1s is -39,2 m*✓
- *Korrekte vorm* ✓✓
- *Indien grond nie as nul gebruik is nie maks* $^3/_4$
- *Indien asse verkeerd/nie benoem maks* $^3/_4$

UPWARDS AS POSITIVE/*OPWAARTS AS POSITIEF*



Marking criteria:
- Initial position 44,1 m AND ball strikes the ground at 3 s ✓
- Position at 1s is 39,2 m✓
- Correct shape ✓✓
- If ground is not used as zero max $^3/_4$
- If axis incorrectly/not labelled max $^3/_4$

Nasienkriteria:
- *Aanvanklike posisie 44,1 m EN bal tref die grond by 3 s* ✓
- *Posisie na 1s is 39,2 m*✓
- *Korrekte vorm* ✓✓
- *Indien grond nie as nul gebruik is nie maks* $^3/_4$
- *Indien asse verkeerd/nie benoem maks* $^3/_4$

(4)
[16]

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QUESTION 4/*VRAAG 4*

4.1

Marking criteria/*Nasienkriteria*
If any 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.*
IF: closed system -1 mark
INDIEN: geslote sisteem – 1 punt

The total (linear) momentum in an isolated system is conserved/remains constant. ✓✓
Die totale (lineêre) momentum in 'n geïsoleerde sisteem bly behoue/konstant.

Accept for 1 mark/*Aanvaar vir 1 punt*
In a isolated system the total momentum before a collision is equal to the total momentum after a collision. ✓
In 'n geïsoleerde sisteem is die totale momentum voor 'n botsing gelyk aan die totale momentum na 'n botsing.

(2)

4.2

$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$0,8 = v_i(2)$ ✓
$v_i = 0,4\ m\cdot s^{-1}$

RIGHT AS +/*REGS AS +*	LEFT AS +/*LINKS AS +*
OPTION 1/*OPSIE 1*	
$\sum p_i = \sum p_f$ $m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$ $m_1v_{1i} + m_2v_{2i} = (m_1 + m_2)v_f$ $(2)v_{1i} + 0$ ✓ $= (2 + 1,5)(0,4)$✓ $v_{i1} = 0,7\ m\cdot s^{-1}$ ✓ ✓Any one/ *Enige een*	$\sum p_i = \sum p_f$ $m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$ $m_1v_{1i} + m_2v_{2i} = (m_1 + m_2)v_f$ $(2)(-v_{1i}) + 0$ ✓$= (2 + 1,5)(-0,4)$✓ $v_{1i} = 0,7\ m\cdot s^{-1}$ ✓ ✓Any one/ *Enige een*
OPTION 2 /*OPSIE 2*	
$\Delta p_1 = -\Delta p_2$ $m(v_{1f} - v_{1i}) = -m(v_{2f} - v_{2i})$ $2(0,4 - v_{1i})$ ✓$= -1,5(0,4 - 0)$ ✓ $v_{1i} = 0,7\ m\cdot s^{-1}$ ✓ ✓Any one/ *Enige een*	$-\Delta p_1 = \Delta p_2$ $-m(v_{1f} - v_{1i}) = m(v_{2f} - v_{2i})$ $-2(0,4 - v_{1i})$ ✓$= 1,5(-0,4 - 0)$ ✓ $v_{1i} = 0,7\ m\cdot s^{-1}$ ✓ ✓Any one/ *Enige een*

(5)

4.3 Inelastic / *Onelasties*✓ (1)

4.4 DECREASES/*NEEM AF* ✓
$F_{net}\Delta t = \Delta p$ **OR/*OF*** $F_{net} = \frac{\Delta p}{\Delta t}$ **OR/*OF*** $F_{net}\Delta t = m\Delta v$ **OR/*OF*** $F_{net} \propto \frac{1}{\Delta t}$ ✓ (2)

[10]

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QUESTION 5/*VRAAG 5*

5.1

Marking criteria/*Nasienkriteria*
If any 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.*
IF: The word 'work' is omitted: 0 marks.
INDIEN: *Die woord 'arbeid' uitgelaat is: 0 punte.*

A *non-conservative force* is a force for which the work done (in moving an object between two points) is dependent on the path taken. ✓✓
'n Nie-konserwatiewe krag is 'n krag waarvoor die arbeid wat verrig is (om 'n voorwerp tussen twee punte te beweeg) afhanklik is van die pad wat gevat word.

(2)

5.2

ACCEPT/*AANVAAR*

	Accepted labels/*Aanvaarde benoemings*
F_{pump}	F/F_P/$F_{electric\ pump}$/F/1 960 N/$F_{applied}$/F_{up}/F_p/$F_{elektriese\ pomp}$/$F_{toegepas}$/F_{op}
w	F_g/F_w/weight/mg/gravitational force/1 960 N/*gewig*/*gravitasiekrag*

Notes/*Aantekeninge*
- Mark is awarded for label and arrow./*Punt word toegeken vir byskrif en pyltjie.*
- Do not penalise for length of arrows./*Geen penalisasie vir die lengte van pyltjies*
- If arrows do not touch the dot/*Indien pyle nie die kolletjie raak nie*: Max/*Maks* $^1/_2$
- Any other additional force(s)/*Enige ander addisionele krag(te): Max/Maks* $^1/_2$
- If everything correct, but no arrows/*Indien alles korrek, maar geen pyltjies*: Max/*Maks* $^1/_2$

(2)

5.3.1

OPTION 1/*OPSIE 1*
$W_{nc} = \Delta E_p + \Delta E_k$ } ✓Any one/*Enige een*
$W_{pump} = mg\Delta h$ / mgh }
$= 200(9,8)(12,5)$ ✓
$= 24\ 500$ J✓

OPTION 2/*OPSIE 2*
$F_{pump} = w = 1960$ N
$W_{pump} = F_{pump}\Delta x\cos\theta$ ✓
$= (1960)(12,5)(1)$ ✓
$= 24\ 500$ J✓

OPTION 3/*OPSIE 3*
$W_{net} = \Delta E_k$ } ✓Any one/*Enige een*
$W_{pump} + W_{Fg} = 0$ }
$W_{pump} + 200(9,8)(12,5)\cos 180° = 0$ ✓
$W_{pump} = 24\ 500$ J ✓

(3)

5.3.2

NOTE: Q5.3.3 can be done first for Q5.3.2. Credit the candidate
NOTA: *Q5.3.3 kan eerste gedoen word vir V5.3.2. Ken punte toe*

OPTION 1/*OPSIE 1*
$\Delta t = \frac{200}{2,5}$ ✓ = 80 s
$v = \frac{\Delta x}{\Delta t}$
$= \frac{12,5}{80}$ ✓
$= 0,16\ m{\cdot}s^{-1}$ $(0,156\ m{\cdot}s^{-1})$✓

OPTION 2/*OPSIE 2*
$\Delta t = \frac{200}{2,5}$ ✓ = 80 s
$\Delta x = \frac{(v_i + v_f)}{2}\Delta t$
$12,5 = \frac{2v}{2}(80)$ ✓
$v = 0,16\ m{\cdot}s^{-1}$ $(0,156\ m{\cdot}s^{-1})$✓

(3)

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5.3.3

POSITIVE MARKING FROM Q5.3.1 and Q5.3.2 /
POSITIEWE NASIEN VANAF V5.3.1 en V5.3.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$P = \frac{W}{\Delta t}$ ✓ $= \frac{24500}{80}$ ✓ = 306,25 W ✓	$P_{ave} = FV_{ave}$ ✓ = (200)(9,8)(0,16) ✓ = 313,60 W ✓ (Range/*Gebied*: 305,76 W - 313,60 W)

(3)
[13]

QUESTION 6/*VRAAG 6*

6.1

Marking criteria/*Nasienkriteria*
If any 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.*

Doppler effect/ Doppler effek✓

The change in frequency (pitch) 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 in frekwensie (toonhoogte) van die klank waargeneem deur 'n luisteraar omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium waarin die klank voortgeplant word, het.
OR/*OF*
A change in observed/detected frequency (pitch), as a result of the relative motion between a source and an observer (listener).
'n Verandering in waargenome frekwensie (toonhoogte), as gevolg van die relatiewe beweging tussen die bron en 'n waarnemer (luisteraar). (3)

6.2

$v = f_L \lambda$
$340 = f_L \times 0,016$ ✓
$f_L = 21\ 250$ Hz

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

$21\ 250$✓ $= \left(\frac{340 + 0}{340 - v_B}\right) f_S$ ✓
$f_S = 21\ 250 - 62,5v_B$

(4)

6.3

POSITIVE MARKING FROM Q6.2 for 21 250 Hz for f_s
POSITIEWE NASIEN VANAF Q6.2 vir 21 250 Hz vir f_s

$f_L' = 21\ 250 - 62,5v_B + 850$
$= 22\ 100 - 62,5v_B$
✓Any one/*Enige een*

$f_L' = \frac{v \pm v_L}{v \pm v_s} f_S$ **OR/*OF*** $f_L' = \frac{v + v_L}{v} f_S$

$[22\ 100 - 62,5v_B]$ ✓ $= \frac{340 + v_B}{340 - 0}$ ✓ $(21\ 250)$ ✓
$v_B = 6,8\ m \cdot s^{-1}$ ✓

NOTE/*NOTA*:
f_L' is the frequency detected by the bat after reflection off the cliff.
f_L' is die frekwensie waargeneem deur die vlermuis na weerkaatsing vanaf die krans

(5)
[12]

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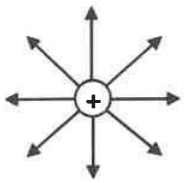
QUESTION 7/*VRAAG 7*

7.1



Criteria for sketch/*Kriteria vir skets:*	
Correct shape (straight field lines)./*Korrekte vorm (reguit veldlyne).*	✓
Correct direction away from the charge./*Korrekte rigting weg van die lading.*	✓✓

Notes/*Aantekeninge:*
- Sphere with field lines inside OR If electric field lines cross or touch/ *Sfeer met veldlyne binne-in OF Indien elektriese veldlyne kruis of raak*: Max/*Maks* $^{2}/_{3}$
- If negative sign shown/*Indien negatiewe teken getoon:* Max/*Maks* $^{2}/_{3}$
- If more than one charge or combined field drawn/*Indien meer as een lading of gekombineerde veld geteken is:* $^{0}/_{3}$

(3)

7.2.1

Marking criteria/*Nasienkriteria:*
If any of the underlined key words/phrases in the correct context are omitted:
- 1 mark per word/phrase.
Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word:
- 1 punt per word/frase.

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 ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle.
OR/*OF*
The magnitude of the electrostatic force exerted by one charge (Q_1) on another 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 their centres. ✓
Die grootte van die elektrostatiese krag wat een lading (Q_1) op 'n ander lading (Q_2) uitoefen, is direk eweredig aan die produk van die ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle middelpunte.

NOTE: If masses are mentioned instead of charges: $^{0}/_{2}$
LET WEL: Indien massas in pleks van ladings genoem word: $^{0}/_{2}$

(2)

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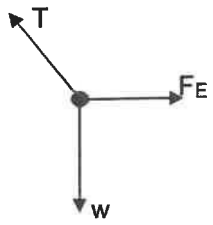
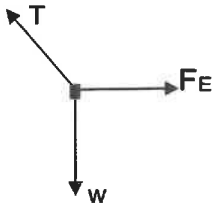
7.2.2 **Accept/*Aanvaar***





Accepted labels/*Aanvaarde byskrifte*	
w ✓	F_w/F_g/mg/1,47 x 10^{-3} N/gravitational force/*gravitasiekrag*/weight/*gewig*
F_E ✓	F/Electrostatic force/Coulomb force/$F_{E\ Field}/F_{R\ on\ S}$ / $F_{Eveld}/F_{R\ op\ S}$ / F_R *Elektrostatiese krag/Coulomb-krag*
T ✓	F_T/F_{string}/tension/*spanning*/F_{tou}

Notes/*Aantekeninge:*

- Mark awarded for label and arrow./*Punt toegeken vir benoeming en pyltjie.*
- Do not penalise for length of arrows since drawing is not to scale./*Moenie vir die lengte van die pyltjies penaliseer nie aangesien die tekening nie volgens skaal is nie.*
- Any other additional force(s)/*Enige ander addisionele krag(te):* *Max/Maks* $^2/_3$
- If everything is correct, but no arrows/*Indien alles korrek is, maar geen pyltjies*: Max/*Maks* $^2/_3$
- If force(s) do not make contact with the dot /Indien krag(te) nie met die kolletjie kontak maak nie: Max/Maks $^2/_3$

(3)

7.2.3

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

$$= \frac{(9 \times 10^9)(6 \times 10^{-9})(3 \times 10^{-9})}{0{,}03^2} \checkmark$$

$$= 1{,}8 \times 10^{-4}\ N$$

$$w = mg$$

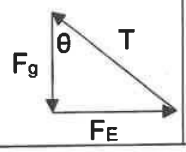
$$= (1{,}5 \times 10^{-4})(9{,}8) \checkmark$$

$$= 1{,}47 \times 10^{-3}\ N$$

$$\tan\theta = \frac{F_E}{mg}$$

$$= \frac{1{,}8 \times 10^{-4}}{1{,}47 \times 10^{-3}} \checkmark$$

$$\theta = 6{,}98° \checkmark$$



OR/OF

$$T^2 = (F_E)^2 + (F_g)^2$$

$$= (1{,}47 \times 10^{-3})^2 + (1{,}8 \times 10^{-4})^2$$

$$T = 1{,}481 \times 10^{-3}\ N$$

$$\cos\theta = \frac{1{,}47 \times 10^{-3}}{1{,}481 \times 10^{-3}} \checkmark \textbf{ OR/OF } \sin\theta = \frac{1{,}8 \times 10^{-4}}{1{,}481 \times 10^{-3}}$$

$$\theta = 6{,}98° \checkmark$$

(5)
[13]

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QUESTION 8/*VRAAG 8*

8.1

Marking criteria/*Nasienkriteria*
If any 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.*

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The potential difference (voltage) across a conductor is directly proportional to the current in the conductor at constant temperature. ✓✓
Die potensiaalverskil (spanning) oor 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur.
OR/*OF*
The current in a conductor is directly proportional to the potential difference (voltage) across the conductor if the temperature is constant. ✓✓
Die stroom in 'n geleier is direk eweredig aan die potensiaalverskil (spanning) oor die geleier indien die temperatuur konstant is.
OR/*OF*
The ratio of potential difference to current for a conductor is constant provided the temperature is constant. ✓✓
Die verhouding van potensiaalverskil tot stroom vir 'n geleier is konstant indien die temperatuur konstant bly. (2)

8.2.1

OPTION 1/*OPSIE 1*

$V = IR$
$V = 0,8(13)$ ✓
$= 10,4$ V

$V = IR$
$10,4 = I_L(9,5)$ ✓
$I_L = 1,09$ A ✓

OPTION 2/*OPSIE 2*

$V_{13} = V_L$
$0,8(13)$ ✓$= I_L(9,5)$ ✓
$I_L = 1,09$ A ✓

OPTION 3/*OPSIE 3*

$I_{R_L} = I_{R_{13}}\left(\frac{R_{13}}{R_L}\right)$

$I_{R_L} = (0,8)\left(\frac{13}{9,5}\right)$ ✓✓

$= 1,09$ A ✓

OPTION 4/*OPSIE 4*

$\frac{I_{R13}}{22,5}(9,5) = 0,8$ ✓
$I_{R13} = 1,89$ A

$I_L = 1,89 - 0,8$ ✓
$= 1,09$ A ✓

(3)

8.2.2 **POSITIVE MARKING FROM QUESTION 8.2.1 / *POSITIEWE NASIEN VANAF VRAAG 8.2.1***

OPTION /*OPSIE 1*

$V_p = V_{9\Omega}$
$10,4$✓$= I_{9\Omega}(9)$ ✓
$I_{9\Omega} = 1,16$ A

OR/*OF*

$V_p = V_{9\Omega}$
$I_1 R_{13} = I_{9\Omega}R_{9\Omega}$
$(0,8)(13)$ ✓$= I_{9\Omega}(9)$ ✓
$I_{9\Omega} = 1,16$ A

OPTION 2/*OPSIE 2*

$I_{R_{9\Omega}} = I_{R_{13}}\left(\frac{R_{13}}{R_9}\right)$ ✓

$I_{R_{9\Omega}} = (0,8)\left(\frac{13}{9}\right)$ ✓

$= 1,16$ A

$I_{total} = I_{13\Omega} + I_L + I_{9\Omega}$
$= 0,8 + 1,09 + 1,16$ ✓
$= 3,05$ A ✓

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OPTION 3/*OPSIE 3*

$V = IR$

$V = 0,8(13)$ ✓

$= 10,4$ V

$V_p = V_9$

$10,4 = I(9)$ ✓

$I = 1,156$ A

$R_{p1} = \left(\frac{R_1R_2}{R_1+R_2}\right) = \frac{13(9,5)}{13 + 9,5}$

$R_{p1} = 5,49\ \Omega$

$V = IR$

$10,4 = I(5,49)$

$I = 1,89$ A

$I_{total} = 1,156 + 1,89$ ✓ $= 3,05$ A ✓ (4)

8.2.3 **POSITIVE MARKING FROM Q 8.2.2. / *POSITIEWE NASIEN VANAF V 8.2.2.***

OPTION 1/*OPSIE 1*

$\varepsilon = I(R + r)$
$\varepsilon = V_{ext} + V_{int}$
$\varepsilon = V_{ext} + Ir$
$V = IR$
✓ Any one/ enige een

$24 = V_{ext} + 3,05(0,3)$ ✓

$V_{ext} = 23,09$ V

$V_{ext} = V_p + V_R$

$23,09 = 10,40 + V_R$ ✓

$V_R = 12,69$ V

$V = IR$

$12,69 = (3,05)R$ ✓

$R = 4,16\ \Omega$ ✓

(Range: 4,157 Ω – 4,161 Ω)

OPTION 2/*OPSIE 2*

$\varepsilon = I(R + r)$ ✓ **OR/OF** $V = IR$

$24 = 3,05(R_{ext} + 0,3)$ ✓

$R_{ext} = 7,57\ \Omega$

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$\frac{1}{R_p} = \frac{1}{13} + \frac{1}{9,5} + \frac{1}{9}$ ✓

$R_p = 3,41\ \Omega$

OR/OF $R_{p1} = \left(\frac{R_1R_2}{R_1+R_2}\right)$

$= \frac{13(9,5)}{13 + 9,5}$

$R_{p1} = 5,49\ \Omega$

$R_{p2} = \frac{5,49(9)}{5,49 + 9}$ ✓

$R_{p1} = 3,41\ \Omega$

$R_{ext} = R_p + R$

$7,57 = 3,41 + R$ ✓

$R = 4,16\ \Omega$ ✓ (5)

8.3 Decreases/*Neem af* ✓
The total/external resistance increases ✓/*Totale/eksterne weerstand neem toe* (2)

8.4 Increases ✓
- V_R / IR decreases ✓ thus
- V_{Lost} / Ir decreases AND V_L increases ✓ (and emf stays constant)
- R_L constant AND $P \alpha V^2$ / $P = \frac{V^2}{R}$ ✓ therefore L is brighter

OR
- R_L constant AND I_L increases AND $P \alpha I^2$ / $P = I^2R$ therefore L is brighter

Neem toe
- *V_R / IR neem af, daarom*
- *$V_{verlore}$ / Ir neem af EN V_L neem toe (terwyl emk konstant bly)*
- *R_L konstant EN $P \alpha V^2$ / $P = \frac{V^2}{R}$ daarom is L helderder*

OF
- *R_L konstant EN I_L neem toe EN $P \alpha I^2$ / $P = I^2R$ daarom is L helderder*

Accept for this exam ONLY: calculation of P/
***Aanvaar SLEGS vir hierdie eksamen**: berekening van P* (4)

8.5 C✓, D✓ and/*en* F✓ **OR/*OF*** A_1, A_2 and $V_{9\Omega}$
Mark first three answers /*Merk eerste drie antwoorde* (3)
[23]

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QUESTION 9/*VRAAG 9*

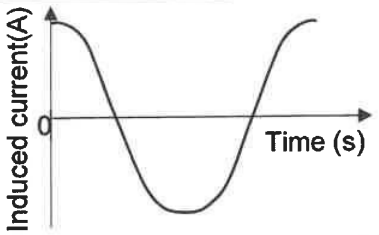
9.1.1 North/*Noord* ✓✓ (2)

9.1.2 **ANY ONE** of the following/***ENIGE EEN*** *van die volgende*
- Increase speed of the rotation✓/*Verhoog spoed van rotasie*

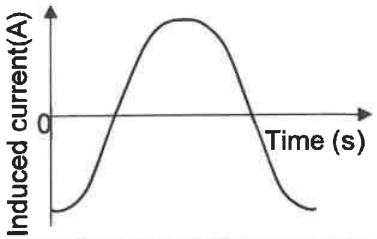
ACCEPT/*AANVAAR*
- Increase number of coils (turns)/*Meer windings*
- Use magnet with stronger field/stronger magnet/increase magnetic flux/electromagnets/ insert soft iron core/*Gebruik magneet met sterker veld/sterker magneet/verhoog magnetiese vloedkoppeling/ elektromagneet/voeg sagte ysterkern by* (1)

9.1.3

OPTION 1/*OPSIE 1*



OPTION 2/*OPSIE 2*



Criteria for graph/*Kriteria vir grafiek*	
AC-graph starts with maximum current/ *WS-grafiek begin met maksimum stroom.*	✓
Graph drawn for one cycle/one complete wavelength./ *Grafiek geteken vir een siklus/een volledige golflengte.*	✓
Correct shape (cosine graph)./Korrekte vorm (cosinus grafiek)	✓
If one cycle of a sin-graph drawn/*Indien sin-grafiek geteken*: max/*maks* $^1/_3$	

(3)

9.2.1

Marking criteria/*Nasienkriteria*
If any 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.*

Root-mean-square current is the alternating current (AC) that dissipates the same amount of energy/heating effect as an equivalent direct current (DC) ✓✓
Die wortelgemiddeldekwadraat-stroom is die wisselstroom (WS) wat dieselfde hoeveelheid energie verbruik/verhittingseffek het as 'n ekwivalente gelykstroom (GS) het.

NOTE: If learner writes DC first / If energy or heating effect is omitted / If learner defines potential difference: $^0/_2$
***LET WEL**: Indien leerder GS eerste skryf / energie of verhittingseffek uitgelaat is / Indien leerder potensiaalverskil definieer : $^0/_2$*

(2)

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9.2.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***	**OPTION 3/*OPSIE 3***
$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ $= \left(\frac{340}{\sqrt{2}}\right)$ ✓ $= 240,42$ V $P_{ave} = V_{rms}I_{rms}$ ✓ $1200 = (240,42)\, I_{rms}$ ✓ $I_{rms} = 4,99$ A ✓	$P_{ave} = \frac{I_{max/maks} \times V_{max/maks}}{2}$ $1200 = \frac{I_{max/maks} \times 340}{2}$ ✓ $I_{max/maks} = 7,06$ A $I_{rms} = \frac{I_{max}}{\sqrt{2}}$ ✓ $= \left(\frac{7,06}{\sqrt{2}}\right)$ ✓ $= 4,99$ A ✓	$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ $= \left(\frac{340}{\sqrt{2}}\right)$ ✓ $= 240,42$ V $P_{ave} = \frac{V_{rms}^2}{R}$ $1200 = \frac{240,42^2}{R}$ $R = 48,17\ \Omega$ $V = IR$ ✓ $240,42 = I(48,17)$ ✓ $I = 4,99$ A ✓

NOTE: Penalise for subscripts not shown/
LET WEL: *Penaliseer indien voetskrifte nie getoon nie*

(4)

9.2.3 **POSITIVE MARKING FROM QUESTION 9.2.2 /**
POSITIEWE NASIEN VANAF VRAAG 9.2.2.

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***	**NOTE:** Options 1 and 2 subscripts not necessary ***NOTA:*** *Opsies 1 en 2 voetskrifte nie nodig nie*
$R = \frac{V_{rms}}{I_{rms}}$ ✓ $= \left(\frac{240,42}{4,99}\right)$ ✓ $R = 48,18\ \Omega$ ✓	$R = \frac{V_{max}}{I_{max}}$ ✓ $= \left(\frac{340}{7,06}\right)$ ✓ $R = 48,18\ \Omega$ ✓	
OPTION 3/*OPSIE 3*	**OPTION 4/*OPSIE 4***	**NOTE:** If R calculated in Q9.2.2 (option 3) give credit. ***NOTA:*** *Indien R reeds bereken in V9.2.2 (opsie 3) gee krediet*
$P_{ave} = \frac{V_{rms}^2}{R}$ ✓ $1200 = \frac{240,42^2}{R}$ ✓ $R = 48,17\ \Omega$ ✓	$P_{ave} = I_{rms}^2 R$ ✓ $1200 = (4,99)^2 R$ ✓ $R = 48,19\ \Omega$ ✓	

(3)
[15]

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QUESTION 10/*VRAAG 10*

10.1

Marking criteria/*Nasienkriteria*
If any 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 incident photons) that can eject electrons from a metal/surface. ✓✓
Die minimum energie (van invallende fotone) wat elektrone kan vrystel vanuit 'n metaal/oppervlak.

NOTE: If reference to frequency: $^0/_2$
LET WEL: Indien na frekwensie verwys word: $^0/_2$ (2)

10.2 1 ✓✓ (2)

10.3.1

$$E_{k(max)} = \frac{1}{2}mv^2_{max} \checkmark$$
$$2,99 \times 10^{-19} = \tfrac{1}{2}(9,11 \times 10^{-31})v^2_{max} \checkmark$$
$$v_{max} = 8,10 \times 10^5 \text{ m·s}^{-1} \checkmark$$ (3)

10.3.2

OPTION 1/*OPSIE 1*
$E = W_0 + E_{k(max)}$
$hf = W_0 + E_{k(max)}$ ✓ Any one/*Enige een*
$= 3,68 \times 10^{-19}$✓ $+ 2,99 \times 10^{-19}$ ✓
$E = 6,67 \times 10^{-19}$ (J) ✓

POSITIVE MARKING FROM Q10.2
POSITIEWE NASIEN VANAF Q10.2
OPTION 2/*OPSIE 2*
gradient = $\frac{\Delta E_{k(max)}}{\Delta E}$ ✓

$$1 = \frac{2,99 \times 10^{-19} - 0}{Y - 3,68 \times 10^{-19}} \checkmark \checkmark$$
$$Y = 6,67 \times 10^{-19} \checkmark$$ (4)

10.4 Remains the same/*Bly dieselfde* ✓
The energy of the incident photons is not changing./*Die energie van die invallende fotone verander nie* ✓
OR/*OF*
(Kinetic energy is affected by/depends on the frequency of the photons and) the frequency remains the same✓/(*Kinetiese energie word beïnvloed deur/hang af van die frekwensie van die fotone en) die frekwensie bly dieselfde* (2)
[13]

TOTAL/*TOTAAL*: 150

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5. MARKING GUIDELINES: PAPER 1

5.1 Calculations

5.1.1 **Marks will be awarded for:** correct formula, correct substitution, correct answer with unit.
5.1.2 **No marks** will be awarded if an **incorrect or inappropriate formula is used**, even though there may be relevant symbols and applicable substitutions.
5.1.3 When an error is made during **substitution into a correct formula**, a mark will be awarded for the correct formula and for the correct substitutions, but **no further marks** will be given.
5.1.4 If **no formula** is given, but **all substitutions are correct**, the candidate will **forfeit one mark**.
5.1.5 **No penalisation if zero substitutions are omitted** in calculations where **correct formula/principle is given correctly**.
5.1.6 Mathematical manipulations and change of subject of appropriate formulae carry no marks, but if a candidate starts off with the correct formula and then changes the subject of the formula incorrectly, marks will be awarded for the formula and the correct substitutions. The mark for the incorrect numerical answer is forfeited.
5.1.7 Marks are only awarded for a formula if a **calculation has been attempted**, i.e. substitutions have been made or a numerical answer given.
5.1.8 Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.
5.1.9 All calculations, when not specified in the question, must be rounded off to a minimum of TWO decimal places.
5.1.10 If a final answer to a calculation is correct, full marks will not automatically be awarded. Markers will always ensure that the correct/appropriate formula is used and that workings, including substitutions, are correct.
5.1.11 Questions where a series of calculations do not necessarily always have to follow the same order (as in circuit calculations) full marks will be awarded provided that it is a valid solution to the problem.
5.1.12 Any calculation that will not bring the candidate closer to the answer than the original solution, will not count any marks.

5.2 Units

5.2.1 Candidates will only be penalised once for the repeated use of an incorrect unit **within a question.**
5.2.2 Units are only required in the final answer to a calculation.
5.2.3 Marks are only awarded for an answer, and not for a unit per se. Candidates will therefore forfeit the mark allocated for the answer in each of the following situations:
- Correct answer + wrong unit
- Wrong answer + correct unit
- Correct answer + no unit

5.2.4 SI units must be used, except in certain cases, e.g. $V \cdot m^{-1}$ instead of $N \cdot C^{-1}$, and $cm \cdot s^{-1}$ or $km \cdot h^{-1}$ instead of $m \cdot s^{-1}$ where the question warrants this.

5.3 General

5.3.1 If one answer or calculation is required, but two are given by the candidate, only the first one will be marked, irrespective of which one is correct. If two answers are required, only the first two will be marked, etc.
5.3.2 For marking purposes, alternative symbols (s, u, t, etc.) will also be accepted.
5.3.3 Separate compound units with a multiplication dot, not a full stop, e.g. $m \cdot s^{-1}$. For marking purposes, $m.s^{-1}$ and m/s will also be accepted.

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5.4 Positive marking

Positive marking regarding calculations will be followed in the following cases:

5.4.1 **Subquestion to subquestion:** When a certain variable is incorrectly calculated in one subquestion (e.g. 3.1) and needs to be substituted into another subquestion (3.2 or 3.3), **full marks** are to be awarded for the subsequent subquestions.

5.4.2 **A multistep question in a subquestion:** If the candidate has to calculate, for example, current in the first step and gets it wrong due to a substitution error, the mark for the substitution and the final answer will be forfeited.

5.5 Negative marking

Normally an incorrect answer cannot be correctly motivated if based on a conceptual mistake. If the candidate is therefore required to motivate in QUESTION 3.2 the answer given to QUESTION 3.1, and QUESTION 3.1 is incorrect, no marks can be awarded for QUESTION 3.2. However, if the answer for, for example, QUESTION 3.1 is based on a calculation, the motivation for the incorrect answer in QUESTION 3.2 should be considered.

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