basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

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*

MARKS/*PUNTE*: 150

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

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]

QUESTION 2/VRAAG 2
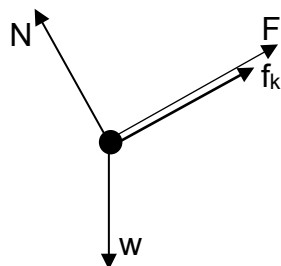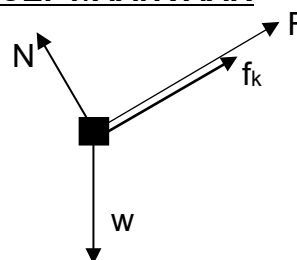
2.1

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)

2.3

OPTION 1/OPSIE 1

DOWNWARDS AS POSITIVE/ *AFWAARTS AS POSITIEF*	UPWARDS AS POSITIVE/ *OPWAARTS AS POSITIEF*
$F_{net} = 0$ $F_{net} = ma$ $F_{g\parallel} - F - f_k = ma$ $mg\sin\theta - F - f_k = ma$ ⎫ ✓ Any one/ *Enige een* $\underline{25(9,8)\sin30° - F - 40 = 25(0)}$ ✓ $F = 82,5$ N ✓	$F_{net} = 0$ $F_{net} = ma$ $- F_{g\parallel} + F + f_k = ma$ $-mg\sin\theta + F + f_k = ma$ ⎫ ✓ Any one/ *Enige een* $\underline{-25(9,8)\sin30° + F + 40 = 25(0)}$ ✓ $F = 82,5$ N ✓

OPTION 2/OPSIE 2

$W_{net} = \Delta E_k$ ⎫ ✓ Any one/ *Enige een*
$W_F + W_f + W_{Fg} = 0$
$F\Delta x\cos\theta + f\Delta x\cos\theta + mg\sin\Phi\Delta x\cos\theta = 0$
$\underline{F\cos180° + 40\cos180° + (25)(9,8)\sin30°\cos0° = 0}$ ✓
$F = 82,5$ N ✓   (3)

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* $f = \mu_k N$ ✓

mgsinθ ✓ = $\mu_k$mgcosθ ✓ **OR/*OF*** $\mu_k = \dfrac{mgsinθ}{mgcosθ}$ ✓ ✓

$$\mu_k = \dfrac{sinθ}{cosθ}$$

(3)

2.5

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
tanθ = 0,19	tanθ = 0,19
θ = 10,76°✓	θ = 10,76°✓
$f_k = \mu_k mgcos θ$	$f_k = F_{g//} = mgsin θ$
= (0,19)(25)(9,8) cos10,76°✓	= (25)(9,8) sin10,76° ✓
= 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)

3.2

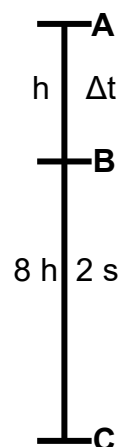| **Marking criteria /***Nasienkriteria*	
• Correct formula for $\Delta y = v_i \Delta t + \frac{1}{2}a\Delta t^2$ / *Korrekte formule vir* $\Delta y = v_i \Delta t + \frac{1}{2}a\Delta t^2$ ✓	
• Correct substitution into formula for **A-B**./*Korrekte vervanging in formule vir **A-B**.* ✓	
• Correct substitution into formula for **B-C** or **A-C**./ *Korrekte vervanging in formule vir **B-C** of **A-C**.* ✓	
• Equating v_f at B <u>and</u> v_i at B / *Gelykstelling van v_f by B <u>en</u> v_i by B* ✓	
DOWNWARDS AS POSITIVE/AFWAARTS AS POSITIEF	
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** $\Delta y = v_i \Delta t + \frac{1}{2}a\Delta t^2$ $\underline{9h = (0)(t+2) + \frac{1}{2}(9,8)(t+2)^2}$ ✓ $9h = (4,9)(t+2)^2$ $9t^2 = (t+2)^2$ ✓ $3t = (t+2)$ $t = 1\text{ s}$	**NOTE/***NOTA***:** If candidate uses t = 3 s or t = 1 s *Indien kandidaat t = 3 s of t = 1 s gebruik* max/*maks* $\frac{1}{4}$
OPTION 2/*OPSIE 2*	**OPTION 3/***OPSIE 3*
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** $v_f = v_i + a\Delta t$ $v_f = 0 + (9,8)\,t$ $V_{i(\textbf{B-C})} = V_{f(\textbf{A-B})}$ — ✓ Any one / *Enige een* $\dfrac{(8h - 19,6)}{2} = (9,8)\,t$ $8(4,9t^2) = (19,6)\,t + 19,6$ $2t^2 - t - 1 = 0$ $t = 1\text{ s}$	**A-B** $v_f^2 = v_i^2 + 2a\Delta y$ $= \underline{(0) + 2(9,8)(h)}$ ✓ $v_B = \sqrt{19,6h}$ **B-C** $\Delta y = v_i \Delta t + \frac{1}{2}a\Delta t^2$ ✓ $\underline{8h = v_B(2) + \frac{1}{2}(9,8)(2)^2}$ ✓ $8h = 2(\sqrt{19,6h}) + 19,6$ $8h - 2\sqrt{19,6h} = 19,6$ $h = 4,9\text{ m}$ **A-B** $\Delta y = v_i \Delta t + \frac{1}{2}a\Delta t^2$ $\underline{4,9 = (0) + \frac{1}{2}(9,8)(t)^2}$ ✓ $t = 1\text{ s}$

Diagram labels: A ; h , Δt ; B ; 8 h , 2 s ; C

OPTION 4/OPSIE 4	**OPTION 5/OPSIE 5**
A-B $F_{net}\Delta t = m(v_f - v_i)$ $\quad\quad mg\Delta t = m(v_f - v_i)$ $\quad\quad\quad\quad v_f = 9,8t$ …(1) **B-C** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $\underline{8h = 9,8t(2) + \frac{1}{2}(9,8)(2)^2}$ ✓ $8h = 19,6t + 19,6$ …(2) **A-B** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\underline{h = 0t + \frac{1}{2}(9,8)t^2}$ ✓ $h = 4,9t^2$ …(3) $8(4,9t^2) = 19,6t + 19,6$ ✓ (3) into (2) $39,2t^2 - 19,6t + 19,6 = 0$ $\quad\quad\quad\quad\quad\quad\quad t = 1\ s$	**B-C** $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $\quad\quad \underline{8h = v_i(2) + \frac{1}{2}(9,8)(2)^2}$ ✓ $\quad\quad v_i = 4h - 9,8$ ……..(1) **A-B** $\quad v_f = v_i + a\Delta t$ $\quad\quad 4h - 9,8 = 0 + 9,8t$ $\quad\quad\quad\quad t = \frac{4h}{9,8} - 1$ …..(2) **A-B** $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\quad\quad \underline{h = 0 + \frac{1}{2}(9,8)t^2}$ ✓ $\quad\quad = 4,9t^2$ ……..(3) (3) into (2): $t = \frac{4(4,9t^2)}{9,8} - 1$ ✓ $\quad 2t^2 - t - 1 = 0$ $\quad\quad\quad t = 1\ s$

UPWARDS AS POSITIVE/OPWAARTS AS POSITIEF	
OPTION 1/OPSIE 1	
A-B $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $\quad\quad -h = \underline{(0) + \frac{1}{2}(-9,8)(t)^2}$ ✓ $\quad\quad h = 4,9\ t^2$ **A-C** $\quad \Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\underline{-9h = (0)(t + 2) + \frac{1}{2}(-9,8)(t + 2)^2}$ ✓ $\quad 9h = (4,9)(t + 2)^2$ $9t^2 = (t + 2)^2$ ✓ $\quad 3t = (t + 2)$ $\quad\quad t = 1\ s$	**NOTE/NOTA**: If candidate uses t = 3 s or t = 1 s *Indien kandidaat t = 3 s of t = 1 s gebruik* max/*maks* $\frac{1}{4}$
OPTION 2/OPSIE 2	**OPTION 3/OPSIE 3**
A-B $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $\quad\quad -h = \underline{(0)t + \frac{1}{2}(-9,8)\ t^2}$ ✓ $\quad\quad -h = -4,9\ t^2$ **B-C** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\quad\quad \underline{-8h = v_i(2) + \frac{1}{2}(-9,8)(2)^2}$ ✓ $\quad\quad -8h = 2v_i - 19,6$ $\quad\quad\quad v_i = \frac{(-8h + 19,6)}{2}$ **A-B & B-C** $\quad\quad\quad v_f = v_i + a\Delta t$ $\quad\quad\quad v_f = \underline{0 + (-9,8)\ t}$ $\quad\quad V_{i(B-C)} = V_{f(A-B)}$ ✓Any one / $\quad\quad\quad\quad\quad\quad\quad\quad$ *Enige een* $\frac{(-8h + 19,6)}{2} = (-9,8)\ t$ $\quad -8(4,9\Delta t^2) = (-19,6)\Delta t - 19,6$ $2t^2 - t - 1 = 0$ $\quad\quad\quad t = 1\ s$	**A-B** $\quad v_f^2 = v_i^2 + 2a\Delta y$ $\quad\quad = \underline{(0) + 2(-9,8)(h)}$ ✓ $\quad v_B = -\sqrt{19,6h}$ **B-C** $\quad \Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\underline{-8h = v_B(2) + \frac{1}{2}(-9,8)(2)^2}$ ✓ $\quad -8h = 2(-\sqrt{19,6h}) - 19,6$ $8h + 2\sqrt{19,6h} = 19,6$ $\quad\quad\quad h = 4,9$ **A-B** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $\underline{-4,9 = (0) + \frac{1}{2}(-9,8)(t)^2}$ ✓ $\quad\quad t = 1\ s$

Diagram (left margin):
A
h | Δt
B
8 h | 2 s
C

OPTION 4/*OPSIE 4*	**OPTION 5/*OPSIE 5***
A-B	**B-C**: $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$F_{net}\Delta t = m(v_f - v_i)$	$\underline{-8h = v_i(2) + \frac{1}{2}(-9,8)(2)^2}$ ✓
$mg\Delta t = m(v_f - v_i)$	$v_i = -4h + 9,8$　　　…(1)
$v_f = 9,8t$ …(1)	**A-B**:　　$v_f = v_i + a\Delta t$
B-C	$-4h + 9,8 = 0 + (-9,8)t$
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓	$t = \frac{4h}{9,8} - 1$　　…(2)
$\underline{-8h = -9,8t(2) + \frac{1}{2}(-9,8)(2)^2}$ ✓	**A-B**:　$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$8h = 19,6t + 19,6$　　…(2)	$\underline{-h = 0 + \frac{1}{2}(-9,8)t^2}$ ✓
A-B	$h = 4,9t^2$　　…(3)
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$	
$\underline{-h = 0t + \frac{1}{2}(-9,8)t^2}$ ✓	(3) into (2) $t = \frac{4(4,9t^2)}{9,8} - 1$ ✓
$h = 4,9t^2$ …(3)	$t = 1$ s
$8(4,9t^2) = 19,6t + 19,6$ ✓ (3) into (2)	
$t = 1$ 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	**A-B**
$v_f = v_i + a\Delta t$ ✓	$v_f = v_i + a\Delta t$
$= \underline{0 + (9,8)(3)}$ ✓	$= 0 + (9,8)(1)$
$v_f = 29,4$ m·s^{-1} ✓	$v_f = 9,8$ m·s^{-1}
	B-C
	$v_f = v_i + a\Delta t$ ✓
	$v_f = \underline{9,8 + (9,8)(2)}$ ✓
	$v_f = 29,4$ m·s^{-1} ✓
A-C	**OPTION 3/*OPSIE 3***
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$	**A-C**
$= (0)(3) + \frac{1}{2}(9,8)(3)^2$	$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$\Delta y = 44,1$ m	$v_f^2 = \underline{(0)^2 + (2)(9,8)(44,1)}$ ✓
	$v_f = 29,4$ 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} ✓
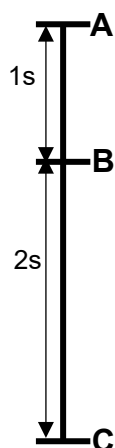
A-B $v_f = v_i + a\Delta t$ $\quad = 0 + (9,8)(1)$ $\quad v_f = 9,8 \text{ m·s}^{-1}$ **B-C** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\quad = (9,8)(2) + \frac{1}{2}(9,8)(2)^2$ $\Delta y = 39,2 \text{ m}$	**OPTION 5/*OPSIE 5*** **B-C** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = \underline{(9,8)^2 + (2)(9,8)(39,2)}$ ✓ $v_f = 29,4 \text{ m·s}^{-1}$✓ **OPTION 6/*OPSIE 6*** **B-C** $\Delta y = \left(\dfrac{v_i + v_f}{2}\right)\Delta t$ ✓ $\boxed{39,2 = \left(\dfrac{9,8 + v_f}{2}\right)(2)}$ ✓ $v_f = 29,4 \text{ m·s}^{-1}$✓

UPWARDS AS POSITIVE/ OPWAARTS AS POSITIEF

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
A-C $v_f = v_i + a\Delta t$ ✓ $\quad = \underline{0 + (-9,8)(3)}$ ✓ $v_f = -29,4$ $v_f = 29,4 \text{ m·s}^{-1}$✓	**A-B** $v_f = v_i + a\Delta t$ $\quad = 0 + (-9,8)(1)$ $\quad v_f = -9,8 \text{ m·s}^{-1}$ **B-C** $v_f = v_i + a\Delta t$ ✓ $v_f = \underline{-9,8 + (-9,8)(2)}$ ✓ $v_f = -29,4$ $v_f = 29,4 \text{ m·s}^{-1}$✓
A-C $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\quad = (0)(3) + \frac{1}{2}(-9,8)(3)^2$ $\Delta y = -44,1 \text{ m}$	**OPTION 3/*OPSIE 3*** **A-C** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = \underline{(0)^2 + (2)(-9,8)(-44,1)}$ ✓ $v_f = -29,4$ $v_f = 29,4 \text{ m·s}^{-1}$✓ **OPTION 4/*OPSIE 4*** **A-C** $\Delta y = \left(\dfrac{v_i + v_f}{2}\right)\Delta t$ ✓ $\boxed{-44,1 = \left(\dfrac{0 + v_f}{2}\right)(3)}$ ✓ $v_f = -29,4$ $v_f = 29,4 \text{ m·s}^{-1}$✓
A-B $v_f = v_i + a\Delta t$ $\quad = 0 + (-9,8)(1)$ $\quad v_f = -9,8 \text{ m·s}^{-1}$ **B-C** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\quad = (-9,8)(2) + \frac{1}{2}(-9,8)(2)^2$ $\Delta y = -39,2 \text{ m}$	**OPTION 5/*OPSIE 5*** **B-C** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = \underline{(-9,8)^2 + (2)(-9,8)(-39,2)}$ ✓ $v_f = -29,4$ $v_f = 29,4 \text{ m·s}^{-1}$✓ **OPTION 6/*OPSIE 6*** **B-C** $\Delta y = \left(\dfrac{v_i + v_f}{2}\right)\Delta t$ ✓ $\boxed{-39,2 = \left(\dfrac{-9,8 + v_f}{2}\right)(2)}$ ✓ $v_f = -29,4$ $v_f = 29,4 \text{ m·s}^{-1}$✓

(3)

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* Δy = 4,9 + 39,2 ✓ 　　= 44,1 m ✓	**OPTION 3/*OPSIE 3*** $\Delta y = v_i \Delta t + \frac{1}{2}a\Delta t^2$ 　　= $\underline{(0)(3) + \frac{1}{2}(9,8)(3)^2}$ ✓ Δy = 44,1 m ✓
OPTION 4/*OPSIE 4* $\Delta y = \left(\dfrac{v_i + v_f}{2}\right)\Delta t$ 　　= $\underline{\left(\dfrac{0 + 29,4}{2}\right)(3)}$ ✓ Δy = 44,1 m ✓	**OPTION 5/*OPSIE 5*** $v_f^2 = v_i^2 + 2a\Delta y$ $\underline{(29,4)^2 = (0)^2 + (2)(9,8)\Delta y}$ ✓ Δy = 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* Δy = 4,9 + 39,2 ✓ 　　= 44,1 m ✓	**OPTION 3/*OPSIE 3*** $\Delta y = v_i \Delta t + \frac{1}{2}a\Delta t^2$ 　　= $\underline{(0)(3) + \frac{1}{2}(-9,8)(3)^2}$ ✓ Δy = −44,1 Δy = 44,1 m ✓
OPTION 4/*OPSIE 4* $\Delta y = \left(\dfrac{v_i + v_f}{2}\right)\Delta t$ 　　= $\underline{\left(\dfrac{0 + (-29,4)}{2}\right)(3)}$ ✓ Δy = −44,1 Δy = 44,1 m ✓	**OPTION 5/*OPSIE 5*** $v_f^2 = v_i^2 + 2a\Delta y$ $\underline{(-29,4)^2 = (0)^2 + (2)(-9,8)\Delta y}$ ✓ Δy = −44,1 Δy = 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)

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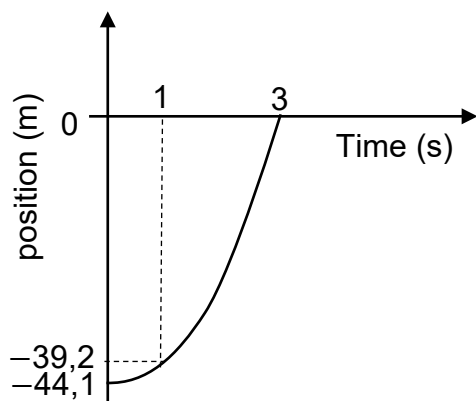
Marking criteria:
- Initial position -44,1 m AND ball strikes the ground at 3 s ✓
- Position at 1s is -39,2 m✓
- Correct shape ✓✓
- If ground is not used as zero max $^3/_4$
- If axis incorrectly/not labelled max $^3/_4$

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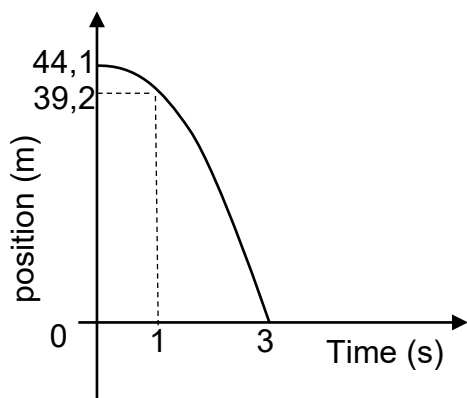
Marking criteria:
- Initial position 44,1 m AND ball strikes the ground at 3 s ✓
- Position at 1s is 39,2 m✓
- Correct shape ✓✓
- If ground is not used as zero max $^3/_4$
- If axis incorrectly/not labelled max $^3/_4$

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]

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 <u>total</u> (linear) <u>momentum</u> in an <u>isolated system is conserved/remains constant</u>. $\checkmark\checkmark$
Die <u>totale</u> (lineêre) <u>momentum in</u> 'n <u>geïsoleerde sisteem</u> bly <u>behoue/konstant.</u>

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

(2)

4.2

$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\underline{0,8 = v_i(2)}$ $\checkmark$ $v_i = 0,4$ m·s^{-1}	
RIGHT AS +/REGS AS +	**LEFT AS +/LINKS AS +**
OPTION 1/OPSIE 1 $\sum p_i = \sum p_f$ $m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$ $\left.\right\}$ $\checkmark$Any one/*Enige een* $m_1v_{1i} + m_2v_{2i} = (m_1 + m_2)v_f$ $\underline{(2)v_{1i} + 0}$ $\checkmark$ = $\underline{(2 + 1,5)(0,4)}\checkmark$ $v_{i1} = 0,7$ m·s^{-1} $\checkmark$	$\sum p_i = \sum p_f$ $m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$ $\left.\right\}$ $\checkmark$Any one/*Enige een* $m_1v_{1i} + m_2v_{2i} = (m_1 + m_2)v_f$ $\underline{(2)(v_{1i}) + 0}$ $\checkmark$= $\underline{(2 + 1,5)(-0,4)}\checkmark$ $V_{1i} = -0,7$ $v_{1i} = 0,7$ m·s^{-1} $\checkmark$
OPTION 2 /OPSIE 2 $\Delta p_1 = -\Delta p_2$ $\left.\right\}$ $\checkmark$Any one/*Enige een* $m(v_{1f} - v_{1i}) = -m(v_{2f} - v_{2i})$ $\underline{2(0,4 - v_{1i})}$ $\checkmark$= $\underline{-1,5(0,4 - 0)}$ $\checkmark$ $v_{1i} = 0,7$ m·s^{-1} $\checkmark$	$-\Delta p_1 = \Delta p_2$ $\left.\right\}$ $\checkmark$Any one/*Enige een* $-m(v_{1f} - v_{1i}) = m(v_{2f} - v_{2i})$ $\underline{-2(0,4 - v_{1i})}$ $\checkmark$= $\underline{1,5(-0,4 - 0)}$ $\checkmark$ $v_{1i} = 0,7$ m·s^{-1} $\checkmark$

(5)

4.3 Inelastic / *Onelasties*$\checkmark$

(1)

4.4

DECREASES/*NEEM AF* $\checkmark$ $F_{net}\Delta t = \Delta p$ **OR/OF** $F_{net} = \frac{\Delta p}{\Delta t}$ **OR/OF** $F_{net}\Delta t = m\Delta v$ **OR/OF** $F_{net}\ \alpha\ \frac{1}{\Delta t}$ $\checkmark$

(2)

[10]

QUESTION 5/*VRAAG 5*

5.1

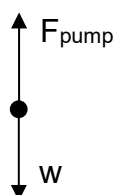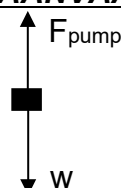| **Marking criteria/*Nasienkriteria*** |
|---|
| If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark./*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.* |
| **IF:** The word 'work' is omitted: 0 marks. |
| ***INDIEN:*** *Die woord 'arbeid' uitgelaat is: 0 punte.* |

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

(2)

5.2

ACCEPT/*AANVAAR*

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

Notes/*Aantekeninge*
- Mark is awarded for label <u>and</u> arrow./*Punt word toegeken vir byskrif <u>en</u> 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*	**OPTION 2/*OPSIE 2***
$W_{nc} = \Delta E_p + \Delta E_k$ ✓Any one/ $W_{pump} = mg\Delta h\ /\ mgh$ *Enige een* $\quad = 200(9,8)(12,5)$ ✓ $\quad = 24\ 500\ J$✓	$F_{pump} = w = 1960\ N$ $W_{pump} = F_{pump}\Delta x\cos\theta$ ✓ $\quad = (1960)(12,5)(1)$ ✓ $\quad = 24\ 500\ J$✓
OPTION 3/*OPSIE 3*	
$\quad\quad W_{net} = \Delta E_k$ ✓Any one/ $W_{pump} + W_{Fg} = 0$ *Enige een* $W_{pump} + 200(9,8)(12,5)\cos 180° = 0$ ✓ $\quad\quad W_{pump} = 24\ 500\ J$ ✓	

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

(3)

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*** $f_L = \frac{v \pm v_L}{v \pm v_B} f_S$

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

$f_S = 21\ 250 - 62{,}5 v_B$

(4)

6.3

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

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

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

$\boxed{[22\ 100 - 62{,}5 v_B]}$ ✓ $= \boxed{\frac{340 + v_B}{340 - 0}}$ ✓ $(21\ 250)$ ✓

$v_B = 6{,}8$ m·s⁻¹ ✓
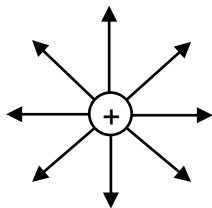
NOTE/*NOTA*:
f_L' is the frequency detected by the bat after reflection off the cliff.
f_L' is die frekwensie waargeneem deur die vlermuis na weerkaatsing vanaf die krans

(5)

[12]

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 <u>force</u> exerted by one point charge (Q_1) on another point charge (Q_2) is <u>directly proportional to the product of the (magnitudes) of the charges</u> ✓ and <u>inversely proportional to the square of the distance (r) between them.</u> ✓

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

OR/*OF*

The magnitude of the electrostatic <u>force</u> exerted by one charge (Q_1) on another charge (Q_2) is <u>directly proportional to the product of the (magnitudes) of the charges</u> ✓ and <u>inversely proportional to the square of the distance (r) between their centres.</u> ✓

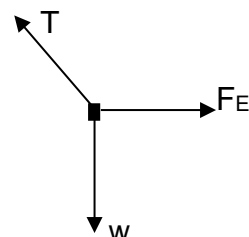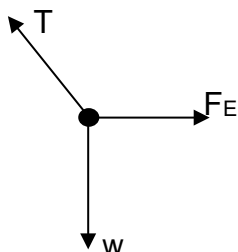*Die grootte van die elektrostatiese <u>krag</u> wat een lading (Q_1) op 'n ander lading (Q_2) uitoefen, is <u>direk eweredig aan die produk van die ladings</u> en <u>omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle middelpunte.</u>*

NOTE: If masses are mentioned instead of charges: $^0/_2$
LET WEL: Indien massas in pleks van ladings genoem word: $^0/_2$

(2)

7.2.2

Accept/*Aanvaar*

Accepted labels/*Aanvaarde byskrifte*	
w ✓	F_w/F_g/mg/$1{,}47 \times 10^{-3}$ 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 <u>and</u> arrow./*Punt toegeken vir benoeming <u>en</u> 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

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

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

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

$w = mg$
$= \underline{(1{,}5 \times 10^{-4})(9{,}8)}$ ✓
$= 1{,}47 \times 10^{-3}\ N$

	OR/*OF*	
$\tan\theta = \dfrac{F_E}{mg}$ $= \boxed{\dfrac{1{,}8 \times 10^{-4}}{1{,}47 \times 10^{-3}}}$ ✓ $\theta = 6{,}98°$ ✓		$T^2 = (F_E)^2 + (F_g)^2$ $= (1{,}47 \times 10^{-3})^2 + (1{,}8 \times 10^{-4})^2$ $T = 1{,}481 \times 10^{-3}\ N$ $\cos\theta = \dfrac{1{,}47 \times 10^{-3}}{1{,}481 \times 10^{-3}}$ ✓ **OR/*OF*** $\sin\theta = \dfrac{1{,}8 \times 10^{-4}}{1{,}481 \times 10^{-3}}$ $\theta = 6{,}98°$ ✓

(5)

[13]

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.*

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*	**OPTION 2/*OPSIE 2***
$V = IR$ $V = \underline{0,8(13)}$ ✓ $= 10,4 \text{ V}$ $V = IR$ $10,4 = \underline{I_L(9,5)}$ ✓ $I_L = 1,09 \text{ A}$ ✓	$V_{13} = V_L$ $\underline{0,8(13)}$ ✓ $= \underline{I_L(9,5)}$ ✓ $I_L = 1,09 \text{ A}$ ✓
OPTION 3/*OPSIE 3*	**OPTION 4/*OPSIE 4***
$I_{R_L} = I_{R_{13}}\left(\dfrac{R_{13}}{R_L}\right)$ $I_{R_L} = \boxed{(0,8)\left(\dfrac{13}{9,5}\right)}$ ✓✓ $= 1,09 \text{ A}$ ✓	$\dfrac{I_{R13}}{22,5}(9,5) = 0,8$ ✓ $I_{R13} = 1,89 \text{ A}$ $I_L = 1,89 - 0,8$ ✓ $= 1,09 \text{ A}$ ✓

(3)

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

OPTION /*OPSIE 1*	**OPTION 2/*OPSIE 2***
$V_p = V_{9\Omega}$ **OR/*OF*** $V_p = V_{9\Omega}$ $\underline{10,4}$✓ $= \underline{I_{9\Omega}(9)}$ ✓ $I_1 R_{13} = I_{9\Omega}R_{9\Omega}$ $I_{9\Omega} = 1,16 \text{ A}$ $\underline{(0,8)(13)}$ ✓ $= \underline{I_{9\Omega}(9)}$ ✓ $I_{9\Omega} = 1,16 \text{ A}$	$I_{R_{9\Omega}} = \boxed{I_{R_{13}}\left(\dfrac{R_{13}}{R_9}\right)}$ ✓ $I_{R_{9\Omega}} = \boxed{(0,8)\left(\dfrac{13}{9}\right)}$ ✓ $= 1,16 \text{ A}$

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

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

$R_{p1} = \left(\dfrac{R_1 R_2}{R_1 + R_2}\right) = \dfrac{13(9,5)}{13 + 9,5}$
$R_{p1} = 5,49$ Ω
$V = IR$
$10,4 = I(5,49)$
$I = 1,89$ 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*	**OPTION 2/*OPSIE 2***

OPTION 1/*OPSIE 1*

$\left.\begin{array}{l}\varepsilon = I(R + r) \\ \varepsilon = V_{ext} + V_{int} \\ \varepsilon = V_{ext} + Ir \\ V = IR\end{array}\right\}$ ✓ 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

$V = IR$
$12,69 = (3,05)R$ ✓
$R = 4,16$ Ω ✓

(Range: 4,157 Ω – 4,161 Ω)

OPTION 2/*OPSIE 2*

$\varepsilon = I(R + r)$ ✓ **OR/OF** $V = IR$
$24 = 3,05(R_{ext} + 0,3)$ ✓
$R_{ext} = 7,57$ Ω

$\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$ **OR/OF** $R_{p1} = \left(\dfrac{R_1 R_2}{R_1 + R_2}\right)$

$\dfrac{1}{R_p} = \boxed{\dfrac{1}{13} + \dfrac{1}{9,5} + \dfrac{1}{9}}$ ✓ $= \dfrac{13(9,5)}{13 + 9,5}$
$R_p = 3,41$ Ω

$R_{p1} = 5,49$ Ω

$R_{p2} = \boxed{\dfrac{5,49(9)}{5,49 + 9}}$ ✓

$R_{p1} = 3,41$ Ω

$R_{ext} = R_p + R$
$7,57 = 3,41 + R$ ✓
$R = 4,16$ Ω ✓

(5)

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

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

OR
- <u>R_L</u> constant AND <u>I_L</u> increases AND <u>P α I^2</u> / $P = I^2R$ 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)*
- *<u>R_L</u> konstant EN <u>P α V^2</u> / $P = \dfrac{V^2}{R}$ daarom is L helderder*

OF
- *<u>R_L</u> konstant EN <u>I_L</u> neem toe EN <u>P α I^2</u> / $P = I^2R$ 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 $V_{9Ω}$
Mark first three answers /*Merk eerste drie antwoorde*   (3)

[23]

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)
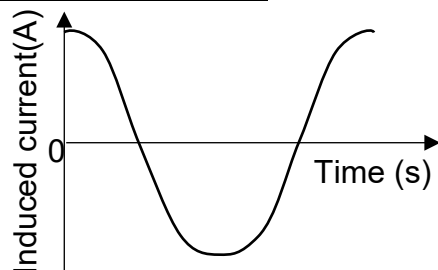
9.1.3   **OPTION 1/*OPSIE 1***   **OPTION 2/*OPSIE 2***
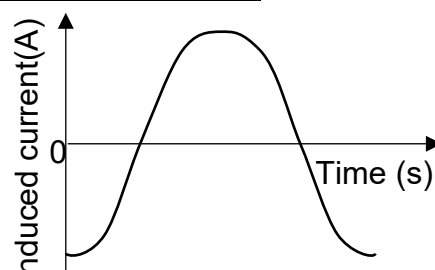
Criteria for graph/*Kriteria vir grafiek*	
AC-graph starts with maximum current/ *WS-grafiek begin met maksimum stroom.*	✓
Graph drawn for one cycle/one complete wavelength./ *Grafiek geteken vir een siklus/een volledige golflengte.*	✓
Correct shape (cosine graph)./*Korrekte vorm (cosinus grafiek)*	✓
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 underlined 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)

9.2.2

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*	OPTION 3/*OPSIE 3*
$V_{rms} = \dfrac{V_{max}}{\sqrt{2}}$ $= \boxed{\dfrac{340}{\sqrt{2}}}$ ✓ $= 240,42$ V $P_{ave} = V_{rms}I_{rms}$ ✓ $\underline{1200 = (240,42)\,I_{rms}}$ ✓ $I_{rms} = 4,99$ A ✓	$P_{ave} = \dfrac{I_{max/maks} \times V_{max/maks}}{2}$ $1200 = \dfrac{I_{max/maks} \times 340}{2}$ ✓ $I_{max/maks} = 7,06$ A $I_{rms} = \dfrac{I_{max}}{\sqrt{2}}$ ✓ $= \boxed{\dfrac{7,06}{\sqrt{2}}}$ ✓ $= 4,99$ A ✓	$V_{rms} = \dfrac{V_{max}}{\sqrt{2}}$ $= \boxed{\dfrac{340}{\sqrt{2}}}$ ✓ $= 240,42$ V $P_{ave} = \dfrac{V_{rms}^2}{R}$ $1200 = \dfrac{240,42^2}{R}$ $R = 48,17$ Ω $V = IR$ ✓ $240,42 = I(48,17)$ ✓ $I = 4,99$ 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:
$R = \dfrac{V_{rms}}{I_{rms}}$ ✓ $= \boxed{\dfrac{240,42}{4,99}}$ ✓ $R = 48,18$ Ω ✓	$R = \dfrac{V_{max}}{I_{max}}$ ✓ $= \boxed{\dfrac{340}{7,06}}$ ✓ $R = 48,18$ Ω ✓	Options 1 and 2 subscripts not necassary ***NOTA:*** *Opsies 1 en 2 voetskrifte nie nodig nie*
OPTION 3/*OPSIE 3*	OPTION 4/*OPSIE 4*	NOTE:
$P_{ave} = \dfrac{V_{rms}^2}{R}$ ✓ $\boxed{1200 = \dfrac{240,42^2}{R}}$ ✓ $R = 48,17$ Ω ✓	$P_{ave} = I_{rms}^2 R$ ✓ $\underline{1200 = (4,99)^2 R}$ ✓ $R = 48,19$ Ω ✓	If R calculated in Q9.2.2 (option 3) give credit. ***NOTA:*** *Indien R reeds bereken in V9.2.2 (opsie 3) gee krediet*

(3)
[15]

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 <u>minimum energy</u> (of incident photons) that can <u>eject electrons from a metal/surface</u>. ✓✓
> *Die <u>minimum energie</u> (van invallende fotone) wat <u>elektrone kan vrystel vanuit 'n metaal/oppervlak</u>.*

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

10.2   1 ✓✓   (2)

10.3.1

> $E_{k(max)} = \frac{1}{2}mv_{max}^2$ ✓
>
> $\underline{2,99 \times 10^{-19}} = \frac{1}{2}(9,11 \times 10^{-31})v_{max}^2$ ✓
> $v_{max} = 8,10 \times 10^5 \text{ m·s}^{-1}$ ✓   (3)

10.3.2

OPTION 1/*OPSIE 1*	**POSITIVE MARKING FROM Q10.2**
$E = W_0 + E_{k(max)}$ ⎫ ✓ Any one/*Enige een* $hf = W_0 + E_{k(max)}$ ⎭ $\quad = 3,68 \times 10^{-19}$ ✓ $+ 2,99 \times 10^{-19}$ ✓ $E = 6,67 \times 10^{-19}$ (J) ✓	***POSITIEWE NASIEN VANAF Q10.2*** **OPTION 2/*OPSIE 2*** gradient $= \frac{\Delta E_{k(max)}}{\Delta E}$ ✓ $1 = \dfrac{2,99 \times 10^{-19} - 0 \;\checkmark}{Y - 3,68 \times 10^{-19}}$ ✓ $Y = 6,67 \times 10^{-19}$ ✓

(4)

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

[13]

TOTAL/*TOTAAL*:   150