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/*MEI/JUNIE* 2024

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 21 pages.
Hierdie nasienriglyne bestaan uit 21 bladsye.

QUESTION 1/*VRAAG 1*

1.1   B ✓✓   (2)

1.2   B ✓✓   (2)

1.3   C ✓✓   (2)

1.4   A ✓✓   (2)

1.5   D ✓✓   (2)

1.6   A ✓✓   (2)

1.7   A ✓✓   (2)

1.8   C ✓✓   (2)

1.9   A ✓✓   (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 sleutel woorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

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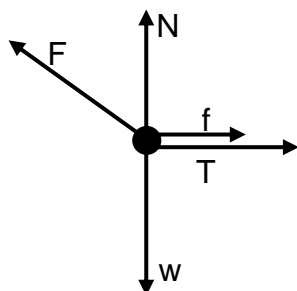
OR/*OF*
The <u>resultant/net force</u> acting on an object is <u>equal to the rate of change of momentum of the object in the direction of the resultant/net force</u>.
Die <u>resulterende/netto krag</u> wat op 'n voorwerp inwerk is <u>gelyk aan die tempo van verandering van momentum in die rigting van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

2.2

Accepted labels/*Aanvaarde benoemings:*	
w	F_g/F_w/40,18 N/mg/weight/gravitational force/*gewig*/*gravitasiekrag*
T	F_T/tension/*spanning*/F_{string}/F_{tou}
f	(kinetic) friction/F_f/f_k/f_r/*(kinetiese) wrywing*/f_w
N	F_N /Normal/F_{normal} /*$F_{normaal}$*/*Normaal*
F	F_{app}/*F_{toeg}*/49 N/F_a/F_A

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* $^4/_5$
- If everything is correct, but no arrows./*Indien alles korrek, maar geen pyltjies nie*: Max/*Maks* $^4/_5$
- If force(s) do not make contact with the dot./*Indien krag(te) nie met die kolletjie kontak maak nie*: Max/*Maks* $^4/_5$
- If forces are superimposed/*Indien kragte bo-oor mekaar geteken* Max/*Maks* $^4/_5$

(5)

2.3.1

$f_k = \mu_k F_N$
$f_k = \mu_k(F_g - F_y)$ ✓ Any one/ *Enige een*
$f_k = \mu_k(mg - Fsinθ)$
$= \underline{(0,35)[(4,1)(9,8) - 49sin50°]}$ ✓
$= 0,93$ N ✓   Range/*Gebied*: (0,92 – 0,93 N)

(3)

2.3.2   **POSITIVE MARKING FROM QUESTION 2.3.1./**
POSITIEWE NASIEN VANAF VRAAG 2.3.1.

For A/*Vir A***:**
LEFT AS POSITIVE/
LINKS AS POSITIEF

$$F_{net} = ma$$
$$F_x - T - f = ma$$
$$F\cos\theta - T - \mu_k F_N = ma$$

✓ Any one/ *Enige een*

$$\underline{49\cos 50° - T - 0,93} \checkmark = \underline{(4,1)a}$$
$$T = 30,57 - 4,1a \text{ ... equation 1}$$

For B/*Vir B***:**
UPWARDS AS POSITIVE/
OPWAARTDS AS POSITIEF

$$F_{net} = ma$$
$$T - F_g = ma$$
$$\underline{T - (2,3)(9,8)} \checkmark = \underline{(2,3)a}$$
$$T = 2,3a + 22,54 \text{ ... equation 2}$$

✓ Both/*Beide*

$$30,57 - 4,1a = 2,3a + 22,54$$
$$a = 1,25 \text{ m·s}^{-2} \checkmark \qquad \text{Range/}Gebied: (1,25 - 1,26 \text{ m·s}^{-2})$$

For A/*Vir A***:**
RIGHT AS POSITIVE/
REGS AS POSITIEF

$$F_{net} = ma$$
$$-F_x + T + f = ma$$
$$-F\cos\theta + T + \mu_k F_N = ma$$

✓ Any one/ *Enige een*

$$\underline{-49\cos 50° + T + 0,93} \checkmark = \underline{(4,1)a}$$
$$T = 30,57 + 4,1a \text{ ... equation 1}$$

For B/*Vir B***:**
DOWNWARDS AS POSITIVE/
AFWAARTDS AS POSITIEF

✓ Both/*Beide*

$$F_{net} = ma$$
$$F_g - T = ma$$
$$\underline{(2,3)(9,8) - T} \checkmark = \underline{(2,3)a}$$
$$T = 22,54 - 2,3a \text{ ... equation 2}$$

$$30,57 + 4,1a = 22,54 - 2,3a$$
$$a = -1,25 \text{ m·s}^{-2}$$
$$a = 1,25 \text{ m·s}^{-2} \checkmark \qquad \text{Range/}Gebied: (1,25 - 1,26 \text{ m·s}^{-2})$$

(5)

NOTE/NOTA: systems approach $^2/_5$ marks for formula and correct answer
Sisteem benadering $^2/_5$ punte vir formule en korrekte antwoord

[15]

QUESTION 3/*VRAAG 3*

3.1   <u>Motion</u> during which the <u>only force</u> acting is <u>gravitational force</u>. (**2 or 0**)
Beweging waar die <u>enigste krag</u> wat inwerk, <u>gravitasiekrag/swaartekrag</u> is.
OR/*OF*
<u>Motion</u> under the influence of <u>gravitational force only</u>. ✓✓ (**2 or 0**)
<u>Beweging</u> slegs onder die invloed van <u>gravitasiekrag/swaartekrag</u>.   (2)

NOTE: if projectile is defined 0/2
NOTA: indien projektiel gedefinieer is 0/2

3.2.   NO/*NEE* ✓   (1)

3.3.1

Marking criteria/*Nasienkriteria:*
- Formula with Δt./*Formule met Δt* ✓
- Correct substitution into formula./*Korrekte vervanging in formule.* ✓
- Final answer/*Finale antwoord*: 1,44 s ✓

OPTION 1/*OPSIE 1*

DOWNWARDS AS POSITIVE/ ***AFWAARTS AS POSITIEF***	**UPWARDS AS POSITIVE/** ***OPWAARTS AS POSITIEF***
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$\underline{15 = 3,4\Delta t + \frac{1}{2}(9,8)\Delta t^2}$ ✓	$\underline{-15 = -3,4\Delta t + \frac{1}{2}(-9,8)\Delta t^2}$ ✓
$\Delta t = 1,44$ s ✓	$\Delta t = 1,44$ s ✓

OPTION 2/*OPSIE 2*

DOWNWARDS AS POSITIVE/ ***AFWAARTS AS POSITIEF***	**UPWARDS AS POSITIVE/** ***OPWAARTS AS POSITIEF***
$v_f^2 = v_i^2 + 2a\Delta y$	$v_f^2 = v_i^2 + 2a\Delta y$
$v_f^2 = (3,4)^2 + 2(9,8)(15)$	$v_f^2 = (-3,4)^2 + 2(-9,8)(-15)$
$v_f = 17,48$ m·s⁻¹	$v_f = -17,48$ m·s⁻¹
$v_f = v_i + a\Delta t$ ✓	$v_f = v_i + a\Delta t$ ✓
$\underline{17,48 = 3,4 + (9,8)\Delta t}$ ✓	$\underline{-17,48 = -3,4 + (-9,8)\Delta t}$ ✓
$\Delta t = 1,44$ s ✓	$\Delta t = 1,44$ s ✓

OPTION 3/*OPSIE 3*

DOWNWARDS AS POSITIVE/ ***AFWAARTS AS POSITIEF***	**UPWARDS AS POSITIVE/** ***OPWAARTS AS POSITIEF***
$v_f^2 = v_i^2 + 2a\Delta y$	$v_f^2 = v_i^2 + 2a\Delta y$
$v_f^2 = (3,4)^2 + 2(9,8)(15)$	$v_f^2 = (-3,4)^2 + 2(-9,8)(-15)$
$v_f = 17,48$ m·s⁻¹	$v_f = -17,48$ m·s⁻¹
$\Delta y = \left(\dfrac{v_i + v_f}{2}\right)\Delta t$ ✓	$\Delta y = \left(\dfrac{v_i + v_f}{2}\right)\Delta t$ ✓
$15 = \left(\dfrac{3,4 + 17,48}{2}\right)\Delta t$ ✓	$-15 = \left(\dfrac{-3,4 - 17,48}{2}\right)\Delta t$ ✓
$\Delta t = 1,44$ s ✓	$\Delta t = 1,44$ s ✓

(3)

3.3.2 **POSITIVE MARKING FROM QUESTION 3.3.1.**
POSITIEWE NASIEN VANAF VRAAG 3.3.1.

<table>
<tr><td colspan="2">

Marking criteria/Nasienkriteria:
- Correct formula to calculate Δy./Korrekte *formule om Δy te bereken.*✓
- Correct substitution into formula./*Korrekte vervanging in formule.* ✓
- Subtraction of displacement from initial height./*Aftrekking van verplasing van oorspronklike hoogte.* ✓
- Final answer/*Finale antwoord*: Range/Gebied: (10,1 - 10,12 m) ✓

</td></tr>
<tr><td colspan="2">

OPTION 1/OPSIE 1

</td></tr>
<tr><td>

UPWARDS AS POSITIVE/
OPWAARTS AS POSITIEF
$\Delta y = v_i \Delta t + \frac{1}{2}a\Delta t^2$ ✓
$\Delta y = \underline{-3,4(1,44) + \frac{1}{2}(0)(1,44)^2}$ ✓
$\Delta y = -4,896$ m

Height = $\underline{15 - 4,896}$✓ = 10,1 m ✓

</td><td>

DOWNWARDS AS POSITIVE/
AFWAARTS AS POSITIEF
$\Delta y = v_i \Delta t + \frac{1}{2}a\Delta t^2$ ✓
$\Delta y = \underline{3,4(1,44) + \frac{1}{2}(0)(1,44)^2}$ ✓
$\Delta y = 4,896$ m

Height = $\underline{15 - 4,896}$✓ = 10,1 m ✓

</td></tr>
<tr><td colspan="2">

OPTION 2/OPSIE 2

</td></tr>
<tr><td>

UPWARDS AS POSITIVE/
OPWAARTS AS POSITIEF
$\Delta y = \left(\dfrac{v_i + v_f}{2}\right)\Delta t$ ✓

$\Delta y = \boxed{\left(\dfrac{-3,4 - 3,4}{2}\right)(1,44)}$ ✓

$\Delta y = -4,896$ m

Height = $\underline{15 - 4,896}$ ✓ = 10,1 m ✓

</td><td>

DOWNWARDS AS POSITIVE/
AFWAARTS AS POSITIEF
$\Delta y = \left(\dfrac{v_i + v_f}{2}\right)\Delta t$ ✓

$\Delta y = \boxed{\left(\dfrac{3,4 + 3,4}{2}\right)(1,44)}$ ✓

$\Delta y = 4,896$ m

Height = $\underline{15 - 4,896}$ ✓ = 10,1 m ✓

</td></tr>
<tr><td colspan="2">

OPTION 3/OPSIE 3

</td></tr>
<tr><td>

UPWARDS AS POSITIVE/
OPWAARTS AS POSITIEF
$v = \dfrac{\Delta y}{\Delta t}$ ✓

$\boxed{-3,4 = \dfrac{\Delta y}{1,44}}$ ✓

$\Delta y = -4,896$ m
Height = $\underline{15 - 4,896}$ ✓ = 10,1 m ✓

Accept $s = \dfrac{d}{\Delta t}$ **OR**
Speed = $\dfrac{\text{distance}}{\text{time}}$

</td><td>

DOWNWARDS AS POSITIVE/
AFWAARTS AS POSITIEF
$v = \dfrac{\Delta y}{\Delta t}$ ✓

$\boxed{3,4 = \dfrac{\Delta y}{1,44}}$ ✓

$\Delta y = 4,896$ m
Height = $\underline{15 - 4,896}$ ✓ = 10,1 m ✓

Aanvaar $s = \dfrac{d}{\Delta t}$ **OF**
Spoed = $\dfrac{\text{afstand}}{\text{tyd}}$

</td></tr>
</table>

(4)

3.4   **POSITIVE MARKING FROM Q 3.3.1./*POSITIEWE NASIEN VANAF VR 3.3.1.***

Marking citeria/*Nasienkriteria:*	
• Correct formula to calculate Δt./*Korrekte formule om Δt te bereken.* ✓	
• Correct substitution into formula./*Korrekte vervanging in formule.* ✓	
• Addition of three time values./*Bymekaartel van drie tydwaardes.* ✓	
• Final answer/*Finale antwoord*: Range/*Gebied*: (2,37 – 2,38 s) ✓	

OPTION 1/*OPSIE 1*

	Note/*Aantekening*:
UPWARDS AS +/*OPWAARTS AS +*	Accept for all options if v_i and v_f are swapped./*Aanvaar vir alle opsies indien v_i en v_f omgeruil is.*
$v_f = v_i + a\Delta t$ ✓	
$0 = 7,2 + (−9,8)\Delta t$ ✓	
$\Delta t = 0,73$ s	
DOWNWARDS AS +/*AFWAARTS AS +*	
$v_f = v_i + a\Delta t$ ✓	
$0 = −7,2 + (9,8)\Delta t$ ✓ →	
$\Delta t = 0,73$ s	

OPTION 2/*OPSIE 2*
UPWARDS AS +/*OPWAARTS AS +*
$v_f = v_i + a\Delta t$ ✓
$-7,2 = 7,2 + (−9,8)\Delta t$ ✓
$\Delta t = 1,47$ s
Time to max height/*Tyd tot maks hoogte* $\Delta t = 0,73$ s

DOWNWARDS AS +/*AFWAARTS AS +* →
$v_f = v_i + a\Delta t$ ✓
$7,2 = −7,2 + (9,8)\Delta t$ ✓
$\Delta t = 1,47$ s
Time to max height/*Tyd tot maks hoogte* $\Delta t = 0,73$ s

OPTION 3/*OPSIE 3* →
UPWARDS AS +/*OPWAARTS AS +*

$v_f^2 = v_i^2 + 2a\Delta y$
$0 = (7,2)^2 + 2(−9,8)\Delta y$
$\Delta y = 2,64$ m

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

$2,64 = \left(\dfrac{7,2 + 0}{2}\right)\Delta t$ ✓

$\Delta t = 0,73$ s

OR/*OF*

$\Delta y = v_i\Delta t + ½a\Delta t^2$ ✓
$2,64 = 7,2\Delta t + ½(−9,8)\Delta t^2$ ✓
$\Delta t = 0,73$ s

$t_3 = 1,44 + 0,2 + 0,73$ ✓
$= 2,37$ s ✓ (2,38)

DOWNWARDS AS +/*AFWAARTS AS +*

$v_f^2 = v_i^2 + 2a\Delta y$
$0 = (−7,2)^2 + 2(9,8)\Delta y$
$\Delta y = −2,64$ m

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

$−2,64 = \left(\dfrac{−7,2 + 0}{2}\right)\Delta t$ ✓

$\Delta t = 0,73$ s

OR/*OF*

$\Delta y = v_i\Delta t + ½a\Delta t^2$ ✓
$−2,64 = −7,2\Delta t + ½(9,8)\Delta t^2$ ✓
$\Delta t = 0,73$ s

(4)

[14]

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.*

In an <u>isolated system</u> the <u>total</u> (linear) <u>momentum is conserved/remains constant</u>. ✓✓   (Accept closed system for this exam)
In 'n <u>geïsoleerde sisteem</u> bly die <u>totale</u> (lineêre) <u>momentum behoue/konstant.</u> (Aanvaar geslote sisteem vir hierdie eksamen)
OR/OF
Accept for 1 mark: In an isolated system the total momentum before the collision is equal to the total momentum after the collision.
Aanvaar vir 1 punt: In 'n geïsoleerde sisteem is die totale momentum voor 'n botsing gelyk aan die totale momentum na die botsing. (2)

4.2

> **Marking citeria/*Nasienkriteria:***
> - Correct momentum formula/*Korrekte momentumformule.* ✓
> - Correct substitution into momentum formula./*Korrekte vervanging in momentum formule.* ✓✓
> - Correct substitution into equation of motion/*Korrekte vervanging in bewegingsvergelyking.* ✓
> - Final correct answer/*Finale korrekte antwoord*: 0,64 m ✓

OPTION 1/*OPSIE 1*
RIGHT AS POSITIVE/*REGS AS POSITIEF*

$$\sum p_i = \sum p_f$$
$$m_A v_{iA} + m_B v_{iB} = m_A v_{fA} + m_B v_{fB}$$ ✓ Any one/*Enige een*
$$0 ✓ = \underline{(3,2)(-0,4) + (2,6)v_f} ✓$$
$$\therefore v_f = 0,49 \ m \cdot s^{-1}$$

LEFT AS POSITIVE/*LINKS AS POSITIEF*

$$\sum p_i = \sum p_f$$
$$m_A v_{iA} + m_B v_{iB} = m_A v_{fA} + m_B v_{fB}$$ ✓ Any one/*Enige een*
$$0 ✓ = \underline{(3,2)(0,4) + (2,6)v_f} ✓$$
$$\therefore v_f = -0,49 \ m \cdot s^{-1}$$

OPTION 2/*OPSIE 2*
RIGHT AS POSITIVE/*REGS AS POSITIEF*

$$\Delta p_A = - \Delta p_B$$
$$m(v_{Af} - v_{Ai}) = - m(v_{Bf} - v_{Bi})$$ ✓ Any one/*Enige een*
$$\underline{3,2(-0,4 - 0)} ✓ = \underline{-2,6(v_{Bf} - 0)} ✓$$
$$\therefore v = 0,49 \ m \cdot s^{-1}$$

LEFT AS POSITIVE/*LINKS AS POSITIEF*

$$\Delta p_A = - \Delta p_B$$
$$m(v_{Af} - v_{Ai}) = - m(v_{Bf} - v_{Bi})$$ ✓ Any one/*Enige een*
$$\underline{3,2(0,4 - 0)} ✓ = \underline{-2,6(v_{Bf} - 0)} ✓$$
$$\therefore v = - 0,49 \ m \cdot s^{-1}$$

RIGHT AS POSITIVE/*REGS AS POSITIEF*

$$v = \frac{\Delta x}{\Delta t}$$
$$0,49 = \frac{\Delta x}{1,3}$$ ✓
$$\Delta x_B = 0,64 \ m$$ ✓
OR/*OF*
$$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$$
$$= \left(\frac{0,49 + 0,49}{2}\right)1,3$$ ✓
$$\Delta x_B = 0,64 \ m$$ ✓

LEFT AS POSITIVE/*LINKS AS POSITIEF*

$$v = \frac{\Delta x}{\Delta t}$$
$$-0,49 = \frac{\Delta x}{1,3}$$ ✓
$$\Delta x = - 0,64 \ m \ ie \ \Delta x_B = 0,64 \ m$$ ✓
OR/*OF*
$$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$$
$$= \left(\frac{-0,49 - 0,49}{2}\right)1,3$$ ✓
$$\Delta x = - 0,64 \ m \ ie \ \Delta x_B = 0,64 \ m$$ ✓ (5)

4.3 **POSITIVE MARKING FROM QUESTION 4.2.**
POSITIEWE NASIEN VANAF VRAAG 4.2.

OPTION 1/*OPSIE 1* **RIGHT AS POSITIVE/** *REGS AS POSITIEF:* **For A/*Vir A:*** $F_{net}\Delta t = \Delta p$ $F_{net}\Delta t = m(v_f - v_i)$ ⎫ ✓Any one/ ⎭ *Enige een* $\underline{(-4,2)\Delta t = 3,2(-0,4 - 0)}$ ✓ $\Delta t = 0,3$ s ✓	**LEFT AS POSITIVE/** *LINKS AS POSITIEF:* **For A/*Vir A:*** $F_{net}\Delta t = \Delta p$ $F_{net}\Delta t = m(v_f - v_i)$ ⎫ ✓Any one/ ⎭ *Enige een* $\underline{(4,2)\Delta t = 3,2(0,4 - 0)}$ ✓ $\Delta t = 0,3$ s ✓
OPTION 2/*OPSIE 2* **RIGHT AS POSITIVE/** *REGS AS POSITIEF:* **For B/*Vir B:*** $F_{net}\Delta t = \Delta p$ $F_{net}\Delta t = m(v_f - v_i)$ ⎫ ✓Any one/ ⎭ *Enige een* $\underline{(4,2)\Delta t = 2,6(0,49 - 0)}$ ✓ $\Delta t = 0,3$ s ✓	**LEFT AS POSITIVE/** *LINKS AS POSITIEF:* **For B/*Vir B:*** $F_{net}\Delta t = \Delta p$ $F_{net}\Delta t = m(v_f - v_i)$ ⎫ ✓Any one/ ⎭ *Enige een* $\underline{(-4,2)\Delta t = 2,6(-0,49 - 0)}$ ✓ $\Delta t = 0,3$ s ✓
OPTION 3/*OPSIE 3* $F_{net} = ma$ $\underline{4,2 = 3,2a}$ $a = 1,31$ m·s^{-2} $v_f = v_i + a\Delta t$ ✓ $\underline{0,4 = 0 + (1,31)\Delta t}$ ✓ $\Delta t = 0,3$ s ✓	**OPTION 4/*OPSIE 4*** $F_{net} = ma$ $\underline{4,2 = 2,6a}$ $a = 1,62$ m·s^{-2} $v_f = v_i + a\Delta t$ ✓ $\underline{0,49 = 0 + (1,62)\Delta t}$ ✓ $\Delta t = 0,3$ s ✓

(3)

4.4 LESS THAN ✓
Final momentum/change in momentum/impulse remains constant. ✓
If mass/inertia increases, velocity decreases/velocity inversely proportional to mass ✓
OR
From $F_{net}\Delta t = m\Delta v$ if $F_{net}\Delta t$ remains constant ✓ and m increase then Δv decreases and v_C decreases ✓
OR
From $F_{net} = ma$ if F_{net} remains constant ✓ and a is inversely proportional to m then m increases and a decreases and therefore v_C decreases. ✓

KLEINER AS
Finale momentum/verandering in momentum/impuls bly konstant.
Indien massa/traagheid toeneem, sal snelheid afneem/snelheid omgekeerd eweredig aan massa.
OF
Van $F_{net}\Delta t = m\Delta v$ indien $F_{net}\Delta t$ konstant bly en m neem toe dan sal Δv afneem en v_C afneem
OF
Van $F_{net} = ma$ indien F_{net} konstant bly en a is omgekeerd eweredig aan m dan as m toeneem dan sal a afneem en v_C afneem

(3)
[13]

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.*

The underlined total mechanical energy/sum of the gravitational potential energy and kinetic energy/sum of E_p and E_k in an isolated system is conserved/remains constant. ✓✓   (Accept closed system for this exam)
OR
If the sum of the non-conservative forces is zero, then total mechanical energy/sum of the gravitational potential energy and kinetic energy/sum of E_p and E_k is conserved/remains constant.

Die totale meganiese energie/som van die gravitasie potensiële energie en kinetiese energie/som van E_p en E_k in 'n geïsoleerde sisteem bly behoue/konstant. (Aanvaar geslote sisteem vir hierdie eksamen)
OF
Indien die som van die nie-konserwatiewe kragte nul is, sal die totale meganiese energie/som van die gravitasie potensiële energie en kinetiese energie/som van E_p en E_k behoue/konstant bly.   (2)

5.2

OPTION 1/*OPSIE 1*

$(E_{mech})_{A/Top/Bo/i} = (E_{mech})_{B/Bottom/Onder/f}$
$(E_P + E_K)_{A/Top/Bo/i} = (E_P + E_K)_{B/Bottom/Onder/f}$ ✓ Any one/*Enige een*
$(mgh + \frac{1}{2}mv^2)_{A/Top/Bo/i} = (mgh + \frac{1}{2}mv^2)_{B/Bottom/Onder/f}$
$(18)(9,8)(3) + 0 = 0 + (\frac{1}{2})(18)v^2$ ✓
$v = 7,67 \text{ m·s}^{-1}$ ✓

OPTION 2/*OPSIE 2*

$W_{nc} = \Delta K + \Delta U$
$W_{nc} = \frac{1}{2}m(v_f^2 - v_i^2) + mg(h_f - h_i)$
$W_{nc} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mgh_f - mgh_i$ ✓ Any one/*Enige een*
$mgh_{bottom} - mgh_{top} = -(\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2)$
$\Delta E_k = -\Delta E_p$
$0 = \frac{1}{2}(18)(v_f^2 - 0^2) + (18)(9,8)(0 - 3)$ ✓ **OR** $\frac{1}{2}(18)(v_f^2 - 0^2) = -[(18)(9,8)(0 - 3)]$
$v = 7,67 \text{ m·s}^{-1}$ ✓

OPTION 3/*OPSIE 3*

$W_{net} = \Delta E_k$
$mg\Delta y\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ ✓ Any one/*Enige een*
$(18)(9,8)(3)\cos 0° = \frac{1}{2}(18)v_f^2 - 0$ ✓
$v = 7,67 \text{ m·s}^{-1}$ ✓   (3)

5.3

> **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>net/total work done</u> (on an object) is <u>equal</u> to the <u>change</u> in the object's <u>kinetic energy</u>. ✓✓
Die <u>netto/totale arbeid</u> wat (op 'n voorwerp) verrig is, is <u>gelyk</u> aan die <u>verandering</u> in die voorwerp se <u>kinetiese energie</u>.

OR/*OF*
The <u>work done</u> on an object by a <u>resultant/net force</u> is <u>equal</u> to the <u>change</u> in the object's <u>kinetic energy</u>. ✓✓
Die <u>arbeid verrig</u> op 'n voorwerp deur 'n <u>resultante/netto krag</u> is <u>gelyk</u> aan die <u>verandering</u> in die voorwerp se <u>kinetiese energie</u>. (2)

5.4

> **POSITIVE MARKING FROM QUESTION 5.2.**
> ***POSITIEWE NASIEN VANAF VRAAG 5.2.***
>
> **OPTION 1/*OPSIE 1***
>
> $W_{net} = \Delta E_k$ / $E_{kf} - E_{ki}$ / $\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
> $W_f = \Delta E_k$ / $E_{kf} - E_{ki}$ / $\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ ✓ Any one/*Enige een*
> $f\Delta x\cos180° = \Delta E_k$ / $E_{kf} - E_{ki}$ / $\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
> <u>(40,6)Δx(−1)</u> ✓ $= \frac{1}{2}(18)[(0)^2 - (7,67)^2]$ ✓
> $\Delta x = 13,04$ m ✓   Range/*Gebied*: (13,03 – 13,04 m)
>
> **OPTION 2/*OPSIE 2***
>
> $W_{nc} = \Delta E_p + \Delta E_k$
> $W_{nc} = mg(h_C - h_B) + \frac{1}{2}m(v_f^2 - v_i^2)$ ✓ Any one/*Enige een*
> $W_f = \Delta E_p + \Delta E_k$
> $f\Delta x\cos180° = mg\Delta h + \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
> <u>(40,6)Δx(−1)</u> ✓ $= \underline{0 + \frac{1}{2}(18)[(0)^2 - (7,67)^2]}$ ✓
> $\Delta x = 13,04$ m ✓   Range/*Gebied*: (13,03 – 13,04 m)

(4)

5.5 Smaller than/*Kleiner as* ✓
- Total mechanical/Gravitational potential energy (at A) is less ✓
  Totale meganiese/Gravitasie potensiële energie (by A) is minder
- Velocity(speed) <u>at B</u> is less/Kinetic energy <u>at B</u>/ΔE_k will be less <u>from B to C/rest</u> ✓
  Snelheid(spoed) <u>by B</u> is minder/Kinetiese energie <u>by B</u>/ΔE_k sal minder wees <u>vanaf B tot C/rus</u> (3)

[14]

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 sleutel woorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

It is the (apparent) <u>change in frequency/pitch</u> of the sound (detected by a listener) because the <u>sound source and the listener have different velocities relative to the medium of sound propagation</u>. ✓✓
Dit is die (skynbare) <u>verandering in frekwensie/toonhoogte</u> van die klank (waargeneem deur 'n luisteraar) omdat die <u>klankbron en die luisteraar verskillende snelhede relatief tot die medium van klankvoortplanting het</u>.

OR/*OF*
An (apparent) <u>change in</u> (observed/detected) <u>frequency/pitch</u> as a result of the <u>relative motion between a source and an observer</u> (listener) ✓✓.
'n (Skynbare) <u>verandering in</u> (waargenome) <u>frekwensie/toonhoogte</u> as gevolg van die <u>relatiewe beweging tussen die bron en 'n waarnemer</u> (luisteraar). (2)

6.2

> **MOVING TOWARDS OBSERVER/**
> ***BEWEGING NA LUISTERAAR:***
>
> $f_L = \dfrac{v \pm v_L}{v \pm v_s} f_S$ **OR/*OF*** $f_L = \dfrac{v}{v - v_s} f_S$ **OR/OF** $f_L = \dfrac{v + v_L}{v - v_s} f_S$
>
> $\boxed{615 = \left(\dfrac{v}{v-26}\right) f_s}$ ✓
>
> $f_s = \dfrac{615(v-26)}{v}$ equation 1/*vergelyking 1*
>
> **MOVING AWAY FROM OBSERVER/**
> ***BEWEGING WEG VAN LUISTERAAR:***
>
> $f_L = \dfrac{v \pm v_L}{v \pm v_s} f_S$ **OR/*OF*** $f_L = \dfrac{v}{v + v_s} f_S$ **OR/OF** $f_L = \dfrac{v - v_L}{v + v_s} f_S$
>
> $\boxed{526 = \left(\dfrac{v}{v+26}\right) f_s}$ ✓
>
> $f_s = \dfrac{526(v+26)}{v}$ equation 2/*vergelyking 2*
>
> $\dfrac{615(v-26)}{v} \overset{✓}{=} \dfrac{526(v+26)}{v}$ (equating to solve for v)
>
> $v = 333{,}33 \text{ m·s}^{-1}$ ✓ Range/*Gebied*: (331,88 – 333,33 m·s⁻¹)

✓ Any one/*Enige een*

(5)

6.3

POSITIVE MARKING FROM QUESTION 6.2./*POSITIEWE NASIEN VANAF VRAAG 6.2.*	
Substitution into equation 1/ *Vervanging in vergelyking 1*	**Substitution into equation 2/** *Vervanging in vergelyking 2*

$f_s = \dfrac{615(333,33 - 26)}{333,33}$ ✓   **OR/*OF*** $f_s = \dfrac{526(333,33 + 26)}{333,33}$ ✓

$f_s = 567,03$ Hz $f_s = 567,03$ Hz

$v = f\lambda$ ✓

$333,33 = 567,03\lambda$ ✓

$\lambda = 0,59$ m ✓   Range/Gebied: (0,585 – 0,59 m)   (4)

6.4
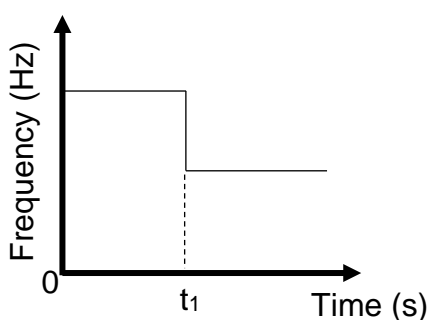
OR/*OF*
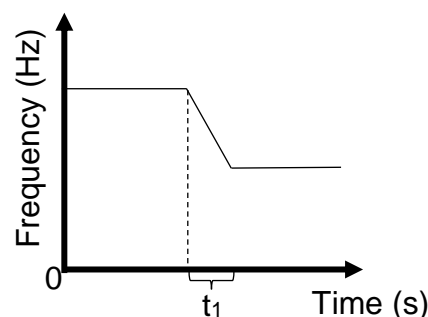
Criteria for graph/*Kriteria vir grafiek:*	
The lines before and after t_1 are horizontal./*Die lyne voor en na t_1 is horisontaal.* (If this criteria is not met/*Indien nie aan hierdie kriteria voldoen nie:* $^0/_3$)	✓
The frequency after t_1 is less than before t_1./*Die frekwensie na t_1 is kleiner as voor t_1.*	✓
Time t_1 correctly indicated where the frequency changes if everything else is correct./*Tyd t_1 word korrek aangedui wanneer frekwensie verander indien alles anders korrek is.*	✓

(3)

[14]

QUESTION 7/VRAAG 7

7.1.1
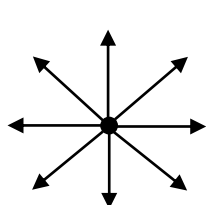
OR/*OF*
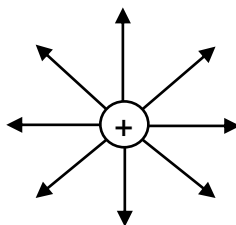
NOTE/*NOTA*: more than one charge or combined field drawn/*meer as een lading of gekombineerde veld geteken* $^0/_2$

Criteria for sketch/*Kriteria vir skets:*	
Correct shape./*Korrekte vorm.*	✓
Correct direction away from the charge./*Korrekte rigting weg van die lading.*	✓
Note/*Nota:* If electric field lines cross or touch/*Indien elektriese veldlyne kruis of raak*: Max/*Maks* $^1/_2$	

(2)

7.1.2　　$E = \dfrac{kQ}{r^2}$ ✓

$= \left[\dfrac{(9 \times 10^9)(4 \times 10^{-9})}{(0,025)^2}\right]$ ✓

$= 5,76 \times 10^4 \text{ N·C}^{-1}$ ✓　(57 600 N·C^{-1})

(3)

7.2.1

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.*

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

(2)

NOTE/*NOTA*: If mass is mentioned/*Indien massa genoem* $^0/_2$

7.2.2

Marking citeria/*Nasienkriteria:*
• Correct substitution of mg with angle 9° or 81°/*Korrekte vervanging van mg met hoek 9° of 81°* ✓
• Correct trig-expression equated to F_E /*Korrekte trig-uitdrukking gelykstel aan F_E* ✓
• Correct Coulombs' formula/*Korrekte Coulomb-formule* ✓
• Correct substitution into F_E/Coulombs' formula/*Korrekte vervanging in F_E/Coulomb-formule* ✓
• Calculating 2Q/*Berekening van 2Q* ✓
• Final correct answer/*Finale korrekte antwoord*: Range/Gebied (2,88 × 10^{-7} – 2,98 × 10^{-7} C) ✓

OPTION 1/*OPSIE 1*

$F_E = w(\tan\theta)$

$F_E = mg(\tan\theta)$

$F_E = \dfrac{w}{\tan(90° - \theta)}$ ✓

$F_E = \underline{(0,012)(9,8)(\tan 9°)}$ ✓

$\quad = 0,0186 \text{ N}$

$F_E = \dfrac{kQ_AQ_B}{r^2}$ ✓

$0,0186 = \dfrac{\left(9 \times 10^9\right)\left(Q^2\right)}{0,1^2}$ ✓

$Q = 1,44 \times 10^{-7} \text{ C}$

$Q_B = 2(1,44 \times 10^{-7})$ ✓

$\quad = 2,88 \times 10^{-7} \text{ C}$ ✓
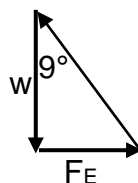
OPTION 2/*OPSIE 2*

$w = mg$
$\quad = (0,012)(9,8)$
$\quad = 0,1176 \text{ N}$

$T_y = w$
$\boxed{T\sin 81° = 0,1176}$ ✓ **OR** $T\cos 9° = 0,1176$
$T = 0,1191 \text{ N}$

$\checkmark \quad F_E = T_x$
$\dfrac{kQ_AQ_B}{r^2} = T\cos 81°$ ✓ **OR** $T\sin 9°$

$\boxed{\dfrac{\left(9 \times 10^9\right)\left(Q^2\right)}{0,1^2} = (0,1191)\cos 81°}$ ✓ **OR** $= (01191)\sin 9°$

$Q = 1,4388 \times 10^{-7} \text{ C}$
$Q_B = 2(1,44 \times 10^{-7})$ ✓
$\quad = 2,88 \times 10^{-7} \text{ C}$ ✓
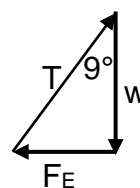
(6)

[13]

QUESTION 8/*VRAAG 8*

8.1 The resistor/R_Z is short circuited./*Die resistor/R_z word gekortsluit.* ✓
OR/*OF*
Current follows the path of least resistance./*Stroom volg die pad van minste weerstand.*
OR/*OF*
Branch with switch has no resistance./*Tak met skakelaar het geen weerstand nie.* (1)

8.2

Marking citeria/*Nasienkriteria:*
• Correct emf or V_{int} formula/*Korrekte emk of V_{int}-formule.* ✓
• Correct substitution into emf or V_{int} formula./*Korrekte vervanging in emk of V_{int}-formule.* ✓
• Correct R_p formula ($R_X = R$)/*Korrekte R_p-formule ($R_X = R$)* ✓
• Correct substitution into R_p formula./*Korrekte vervanging in R_p-formule*
• Final correct answer/*Finale korrekte antwoord*: Range/*Gebied*: (5,92 Ω – 5,96 Ω) ✓

OPTION 1/*OPSIE 1*

$\dfrac{1}{R_p} = \dfrac{1}{R_X} + \dfrac{1}{R_Y}$ ✓ **OR/*OF*** $R_p = \dfrac{R_XR_Y}{R_X + R_Y}$ ✓

$\dfrac{1}{R_p} = \boxed{\dfrac{1}{R} + \dfrac{1}{2R}}$ ✓ $R_p = \boxed{\dfrac{(R)(2R)}{R + 2R}}$ ✓

$R_p = 0,67R$ $R_p = 0,67R$

$\varepsilon = I(R + r)$ ✓
$\underline{12 = 5,5(0,67R + 0,2)}$ ✓
$R = 2,97 \text{ Ω}$ (Range/*gebied* 2,96 – 2,97 Ω)
$R_Y = 2(2,97)$
$\quad = 5,95 \text{ Ω}$ ✓

OPTION 2/*OPSIE 2*

$$\varepsilon = I(R + r) \checkmark$$
$$12 = 5,5(R + 0,2) \checkmark$$
$$R = 1,98 \ \Omega$$

OR/*OF*

$$\frac{1}{R_p} = \frac{1}{R_X} + \frac{1}{R_Y} \checkmark$$

$$\frac{1}{1,98} = \boxed{\frac{1}{R} + \frac{1}{2R}} \checkmark \quad (R_X = R)$$

$$R = 2,97 \ \Omega$$
$$R_Y = 2(2,97)$$
$$= 5,95 \ \Omega \checkmark$$

$$R_p = \frac{R_X R_Y}{R_X + R_Y} \checkmark$$

$$1,98 = \boxed{\frac{(R)(2R)}{R + 2R}} \checkmark \quad (R_X = R)$$

$$R = 2,97 \ \Omega$$
$$R_Y = 2(2,97)$$
$$= 5,95 \ \Omega \checkmark$$

OPTION 3/*OPSIE 3*

$$\left.\begin{array}{l}\varepsilon = I(R + r) \\ \varepsilon = V_{ext} + Ir\end{array}\right] \checkmark \text{Any one/} \\ \textit{Enige een}$$

$$\underline{V_{ext} + 5,5(0,2)} \checkmark$$
$$V_{ext} = 10,9 \ V$$

OR
OF

$$V_{int} = Ir \checkmark$$
$$= (5,5)(0,2) \checkmark$$
$$= 1,1 \ V$$
$$V_p = 12 - 1,1 = 10,9 \ V$$

$$\frac{1}{R_p} = \frac{1}{R_X} + \frac{1}{R_Y} \checkmark$$

OR/*OF*

$$\frac{1}{R_p} = \boxed{\frac{1}{R} + \frac{1}{2R}} \checkmark$$

$$R_p = 0,67R$$

$$R_p = \frac{V_p}{I_T}$$

$$0,67R = \frac{10,9}{5,5}$$

$$R = 2,97 \ \Omega$$
$$R_Y = 2(2,97)$$
$$= 5,95 \ \Omega \checkmark$$

$$R_p = \frac{V_p}{I_T}$$
$$= \frac{10,9}{5,5}$$
$$= 1,98 \ \Omega$$

$$\frac{1}{R_p} = \frac{1}{R_X} + \frac{1}{R_Y} \checkmark$$

$$\frac{1}{1,98} = \boxed{\frac{1}{R} + \frac{1}{2R}} \checkmark$$

$$R = 2,97 \ \Omega$$
$$R_Y = 2(2,97)$$
$$= 5,95 \ \Omega \checkmark$$

Marking criteria for branch only:
- Correct ratio for R_p
- Correct substitution for final answer
- Final correct answer

Nasienriglyne vir slegs tak:
- Korrekte verhouding vir R_p
- Korrekte vervanging vir finale antwoord
- Korrekte finale antwoord

$$\frac{1}{3}(5,5) = 1,83 \ A \checkmark$$

$$V = IR$$
$$10,9 = 1,83R \checkmark$$
$$R_y = 5,95 \ \Omega \checkmark$$

OPTION 4/*OPSIE 4*

$$\varepsilon = IR + Ir \checkmark$$

$$\varepsilon = I(\frac{R_1 R_2}{R_1 + R_2})^{\checkmark} + Ir$$

$$\boxed{12 = 5,5 (\frac{(R)(2R)}{R + 2R}) \checkmark +(5,5)(0,2)} \checkmark$$

$$R_X = 2,97 \ \Omega$$

$$R_Y = 2R_X$$

$$= 2(2,97)$$

$$= 5,95 \ \Omega \checkmark$$

(5)

8.3 **POSITIVE MARKING FROM QUESTION 8.2. (Take the values of range into account)**
POSITIEWE NASIEN VANAF VRAAG 8.2. (Neem waardes van gebied in ag)

$V_p = I_T R_p$ $= \underline{(5,5)(1,98)}$ ✓ $= 10,89$ V **OR/*OF*** $\varepsilon = I (R + r)$ $\varepsilon = V_{ext} + Ir$ $\underline{12 = V_{ext} + 5,5(0,2)}$ ✓ $V_{ext} = 10,9$ V $V_p = 10,9$ V	$I_x = \frac{2}{3}(5,5)$ ✓ $= 3,67$ A **OR/*OF*** $I_x = \frac{R_{//}}{R_X} I_{total}$ $= \frac{1,98}{2,97}(5,5)$ ✓ $= 3,67$ A	**OR/*OF*** $I_x = \frac{V_p}{R_X}$ $= \boxed{\frac{10,9}{2,97}}$ ✓ $= 3,67$ A **OR/*OF*** $I_x = 5,5 - 1,83$ ✓ $= 3,67$ A
OPTION 1/*OPSIE 1* $P = I^2R$ ✓ $= \underline{(3,67)^2(2,97)}$ ✓ $= 40$ W ✓	**OPTION 2/*OPSIE 2*** $P = \frac{V^2}{R}$ ✓ $= \boxed{\frac{10,9^2}{2,97}}$ ✓ $= 40$ W ✓	**OPTION 3/*OPSIE 3*** $P = VI$ ✓ $= \underline{(10,9)(3,67)}$ ✓ $= 40$ W ✓
	If 10,9 V already calculated in 8.2 award 4 marks	
Range/*Gebied*: (39,84 – 40 W)		

(4)

8.4 **POSITIVE MARKING FROM QUESTION 8.2. (Take the values of range into account)**
POSITIEWE NASIEN VANAF VRAAG 8.2. (Neem waardes van gebied in ag)

$V = IR$ ✓

$= 1,3(5,95)$ ✓

$= 7,72$ V ✓   Range/*Gebied*: (7,7 – 7,75 V)

(3)

8.5   **POSITIVE MARKING FROM QUESTION 8.2 and 8.4. (Take the values of range into account)**
POSITIEWE NASIEN VANAF VRAAG 8.2 en 8.4. (Neem waardes van gebied in ag)

Marking citeria/*Nasienkriteria*:
Calculation of R_Z/*Berekening van R_Z*:
•   Correct formula $\varepsilon = I(R + r)$./*Korrekte formule* $\varepsilon = I(R + r)$. ✓
•   Correct substitution into formula./*Korrekte vervanging in formule*. ✓
•   Correct substitution to calculate R_Z./*Korrekte vervanging om R_Z te bereken*. ✓
Calculation of I/*Berekening van I*:
•   Addition of R_p and R_Z./*Bymekaartel van R_p en R_Z*.
•   Correct substitution to calculate I./*Korrekte vervanging om I te bereken*.
•   Correct final answer/*Korrekte finale antwoord*: Range/*Gebied*: (2,26 A – 2,29 A)

S₁ AND S₂ OPEN/*S₁ EN S₂ OOP*:	**OR/*OF***
$\varepsilon = I(R + r)$ ✓ <u>$12 = 1,3(R_T + 0,2)$</u> ✓ $R_T = 9,03\ \Omega$ $R_T = R_Y + R_z$ <u>$9,03 = 5,95 + R_z$</u> ✓ $R_z = 3,08\ \Omega$	$\varepsilon = I(R + r)$ ✓ $IR = 12 - (1,3 \times 0,2)$ $IR = 11,74\ V$ $V_{ex} = V_{Ry} + V_{Rz}$ $11,74 = 7,75 + V_{Rz}$ ✓ $V_{Rz} = 3,99\ V$ $V = IR$ $3,99 = 1,3R_z$ ✓ $R_z = 3,07\ \Omega$

S₁ OPEN AND S₂ CLOSED/*S₁ OOP EN S₂ GESLUIT*:			
$R_p = 0,67R$ $= (0,67)(2,97)$ $= 1,98\ \Omega$	$\varepsilon = I(R + r)$ $12 = 5,5(R + 0,2)$ $R_p = 1,98\ \Omega$	$\dfrac{1}{R_p} = \dfrac{1}{R_X} + \dfrac{1}{R_Y}$ $\dfrac{1}{R_p} = \dfrac{1}{2,97} + \dfrac{1}{5,94}$ $R_p = 1,98\ \Omega$	$R_p = \dfrac{R_X R_Y}{R_X + R_Y}$ $R_p = \dfrac{(2,97)(5,94)}{2,97 + 5,94}$ $R_p = 1,98\ \Omega$

Possibly already calculated in/*Moontlik reeds bereken in* Q8.2

$R_{ex} = \underline{3,08 + 1,98}$ ✓ $R_{ex} = 5,06\ \Omega$

$\varepsilon = I(R + r)$ <u>$12 = I(5,06 + 0,2)$</u> ✓ $I = 2,28\ A$ ✓	$R_T = \dfrac{V}{I}$ $5,26 = \dfrac{12}{I}$ ✓ $I = 2,28\ A$ ✓

(6)

[19]

QUESTION 9/*VRAAG 9*

9.1   Y to/*na X* ✓✓   (2)

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

9.3
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 rms potential difference is the <u>alternating current potential difference</u> which dissipates/produces <u>the same amount of energy/heating effect</u> as an <u>equivalent DC potential difference</u>.✓✓

Die wgk-potensiaalverskil is die <u>wisselstroom potensiaalverskil</u> wat <u>dieselfde hoeveelheid energie/verhittingseffek</u> verbruik/vervaardig as die <u>ekwivalente GS-potensiaalverskil</u>.   (2)

9.4
$$V_{rms} = \frac{V_{max}}{\sqrt{2}} \checkmark$$
$$= \frac{125}{\sqrt{2}} \checkmark$$
$$= 88{,}39 \text{ V} \checkmark$$ (3)

9.5
OPTION 1/*OPSIE 1*

$$I_{max} = \frac{V_{max}}{R} \checkmark$$
$$= \frac{125}{42{,}4} \checkmark$$
$$= 2{,}95 \text{ A} \checkmark$$

OPTION 2/*OPSIE 2*

$$I_{rms} = \frac{V_{rms}}{R}$$
$$= \frac{88{,}39}{42{,}4}$$
$$= 2{,}08 \text{ A}$$

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

$$\boxed{2{,}08 = \frac{I_{max}}{\sqrt{2}}} \checkmark$$

$$I_{max} = 2{,}94 \text{ A} \checkmark$$

Range/*Gebied*: (2,94 - 2,95 A)

OR/*OF*

$$P_{ave} = \frac{V_{rms}^2}{R}$$
$$P_{ave} = \frac{88{,}39^2}{42{,}4}$$
$$P_{ave} = 184{,}26 \text{ W}$$
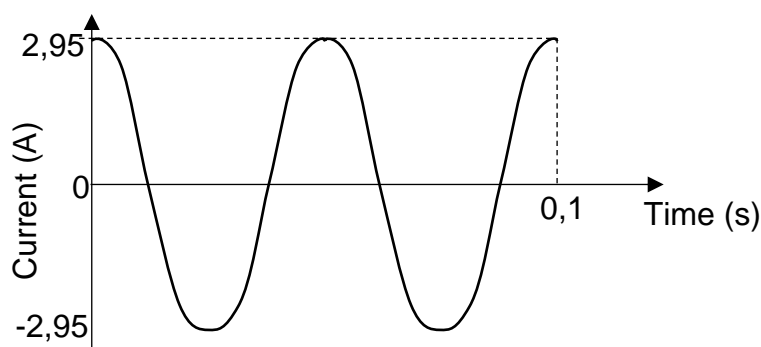
$$P_{ave} = I_{rms}^2 R$$
$$184{,}26 = I_{rms}^2 (42{,}4)$$
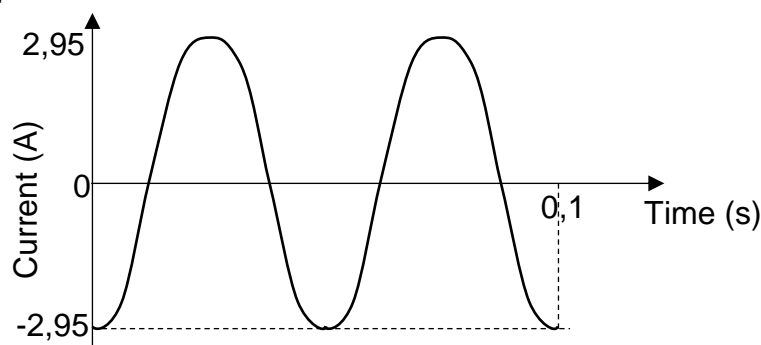$$I_{rms} = 2{,}08 \text{ A}$$

Notes/*Aantekeninge:*
Do not deduct a mark if subscripts are omitted from V = IR formula./ *Moenie penaliseer indien onderskrifte uitgelaat is uit die formule V = IR nie.*
                                                                                                              (3)

9.6   **POSITIVE MARKING FROM 9.5/*POSITIEWE NASIEN VANAF 9.5***

OR/*OF*

Criteria for graph/*Kriteria vir grafiek*	
Two complete cycles indicated./*Twee volledige siklusse aangedui.*	✓
Graph stops at 0,1 s **OR** one cycle in 0,05 s./ *Grafiek stop by 0,1 s **OF** een siklus in 0,05 s*	✓
Maximum current (2,94/2,95 A) as a positive or negative value correctly indicated./ *Maksimum stroom (2,94/2,95 A) as 'n positiewe of negatiewe waarde korrek aangedui.*	✓
Correct shape (cosine graph)./*Korrekte vorm (cosinus grafiek)*	✓

(4)

[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 process whereby <u>electrons are ejected from a</u> (metal) <u>surface</u> when <u>light</u> of suitable frequency <u>is incident on that surface.</u> ✓✓ *Die proses waartydens <u>elektrone vrygestel word vanaf 'n</u> (metaal) <u>oppervlak</u> wanneer <u>lig</u> van geskikte frekwensie <u>invallend is op die oppervlak.</u>*

(2)

10.2

OPTION 1/*OPSIE 1*

$$E = W_0 + K_{max}$$

$$\frac{hc}{\lambda} = hf_0 + \frac{1}{2}mv_{max}^2$$

✓ Any one/ Enige een

$$\frac{(6{,}63 \times 10^{-34})(3 \times 10^8)}{4{,}7 \times 10^{-7}} ✓ = (6{,}63 \times 10^{-34})(4{,}37 \times 10^{14})✓ + \frac{1}{2}(9{,}11 \times 10^{-31})v_{max}^2 ✓$$

$$v_{max} = 5{,}41 \times 10^5 \text{ m·s}^{-1} ✓ \quad (541\ 292{,}69 \text{ m·s}^{-1})$$

Range/*Gebied*: (541 289,67 m·s^{-1} - 541 292,69 m·s^{-1})

OPTION 2/*OPSIE 2*

$$c = f\lambda$$
$$3 \times 10^8 = f (4{,}7 \times 10^{-7})$$
$$f = 6{,}38 \times 10^{14} \text{ Hz}$$

$$E = W_0 + K_{max}$$

$$hf = hf_0 + \frac{1}{2}mv_{max}^2$$

✓ Any one/ Enige een

$$(6{,}63 \times 10^{-34})(6{,}38 \times 10^{14})✓ = (6{,}63 \times 10^{-34})(4{,}37 \times 10^{14})✓ + \frac{1}{2}(9{,}11 \times 10^{-31})v_{max}^2 ✓$$

$$v_{max} = 5{,}41 \times 10^5 \text{ m·s}^{-1}✓ \quad (541\ 292{,}69 \text{ m·s}^{-1})$$

Range/*Gebied*: (541 289,67 m·s^{-1} - 541 292,69 m·s^{-1})

(5)

10.3.1   Higher than/*Hoër as* ✓   (1)

10.3.2
- (Photons of UV light) eject electrons (from the disc/Zn). ✓
- The negative charge on the electroscope decreases/becomes zero. ✓
- The electrostatic/repulsive force on the foil decreases/becomes zero. ✓
- *(Fotone van UV lig) stel elektrone vry (vanaf die skyf/Zn).*
- *Die negatiewe lading op die elektroskoop verlaag/word nul.*
- *Die elektrostatiese/afstotende krag op die foelie verlaag/word nul.*

(3)

10.3.3   No/*Nee* ✓

(Increasing the intensity increases the number of photons) does not increase the energy of the photon(s) **OR** photons will still have the same energy **OR** frequency stays the same/does not increase ✓
*(Verhoging van intensiteit verhoog die aantal fotone) en nie die energie van die foton(e) nie **OF** fotone sal nog steeds dieselfde enegie besit **OF** frekwensie bly dieselfde/sal nie toeneem nie.*

(2)

[13]

TOTAL/*TOTAAL*:   **150**