education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE 12/*GRAAD 12*

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

SEPTEMBER 2025

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 15 pages.
Hierdie nasienriglyne bestaan uit 15 bladsye.

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QUESTION/*VRAAG 1*

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

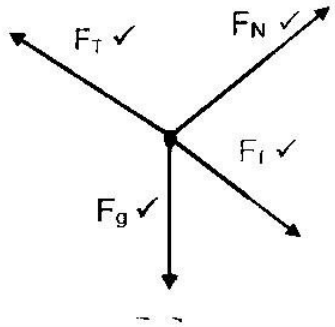
[20]

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QUESTION/*VRAAG 2*

2.1 The force that opposes the motion of a moving object relative to the surface.✓✓/*Die krag wat die beweging van 'n bewegende voorwerp relatief tot 'n oppervlak teenwerk.* **(2 or/*of* 0)** (2)

2.2



Accepted labels/Aanvaarde benoemings	
F_N	N/Normal force/*Normaalkrag*
F_T	T/Tension force/*Spanningskrag*
F_g	Fw/w/gravitational force/weight/*gravitasiekrag/gewig*
F_f	f/f_k/(kinetic) friction/*(kinetiese) wrywing*

***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* 3/4
- If everything correct, but no arrows/*Indien alles korrek, maar geen pyltjies*: Max/*Maks* 3/4
- If force(s) do not make contact with the dot /*Indien krag(te) nie met die kolletjie kontak maak nie*: Max/*Maks* 3/4
- If components drawn for F_g/*Indien komponente van F_g geteken*: Max/*Maks* 3/4

(4)

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2.3.1
Fnet = ma
$T - f_f - F_{g//} = ma$ } Any one✓/*Enige een*
$\underline{T - 4,3 - (3 \times 9,8 \sin 30°)}$ ✓= $\underline{3 \times 2}$✓
T = 25 N ✓ (4)

POSITIVE MARKING FROM 2.3.1/*POSITIEWE NASIEN VANAF 2.3.1*

2.3.2
Fnet = ma
$F - T - f_f = ma$ } Any one✓/*Enige een*
$F - 25 - 7,2 = 6 \times 2$ ✓
F = 44,2 N ✓ (3)

2.4 Increase✓/*Toeneem* (1)
[14]

QUESTION/*VRAAG 3*

3.1
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 gravity/gravitation **without** force is used 1/2
*Indien gravitasie sonder **krag** gebruik word 1/2*

An object which has been given an initial velocity✓ and then moves under the influence of the gravitational force only.✓/*'n Voorwerp waaraan 'n beginsnelheid gegee word, wat daarna slegs onder die invloed van gravitasiekrag beweeg.* (2)

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3.2.1 **Upwards as positive (note: v_f and v_i can be switched except for OPTION 1)/*Opwaarts as positief (nota: v_f en v_i kan omgeruil word behalwe vir OPSIE 1)***

OPTION/*OPSIE 1*	**OPTION/*OPSIE 2***	**OPTION/*OPSIE 3***
$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓ $= \underline{0 + \frac{1}{2}(-9,8)(1,5)^2}$ ✓ $= 11,025$ m $h = 11,025 \underline{+ 100}$ ✓ $h = 111,03$ m ✓	$v_f = v_i + a\Delta t$ $\underline{0 = v_i + (-9,8)(1,5)}$ $v_i = 14,7\ m\cdot s^{-2}$ $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0 = 14,7^2 + (-9,8)\Delta y$ ✓ $\Delta y = 11,025$ $h = 11,025 \underline{+ 100}$ ✓ $h = 111,03$ m ✓	$v_f = v_i + a\Delta t$ $\underline{0 = v_i + (-9,8)(1,5)}$ $v_i = 14,7\ m\cdot s^{-2}$ $\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓ $=14,7(1,5)+ \frac{1}{2}(9,8)(1,5)^2$ ✓ $\Delta y = 11,025$ m $h = 11,025 \underline{+ 100}$ ✓ $h = 111,03$ m ✓
OPTION/*OPSIE 4*		
$v_f = v_i + a\Delta t$ $\underline{0 = v_i + (-9,8)(1,5)}$ $v_i = 14,7\ m\cdot s^{-2}$ $\Delta y = \frac{v_i + v_f}{2}\Delta t$ ✓ $\Delta y = \frac{0 + 14,7}{2}\ 1,5$ ✓ $\Delta y = 11,025$ $h = 11,025 \underline{+ 100}$ ✓ $h = 111,03$ m ✓		

Downwards as positive (note: v_f and v_i can be switched except for OPTION 5)/Af*waarts as positief (nota: v_f en v_i kan omgeruil word behalwe vir OPSIE 5)*

OPTION/*OPSIE 5*	**OPTION/*OPSIE 6***	**OPTION/*OPSIE 7***
$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓ $= \underline{0 + \frac{1}{2}(9,8)(1,5)^2}$ ✓ $= 11,025$ m $h = 11,025 \underline{+ 100}$ ✓ $h = 111,03$ m ✓	$v_f = v_i + a\Delta t$ $\underline{0 = v_i + (9,8)(1,5)}$ $v_i = -14,7\ m\cdot s^{-2}$ $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0 = -14,7^2 + (9,8)\Delta y$ ✓ $\Delta y = -11,025$ $h = 11,025 \underline{+ 100}$ ✓ $h = 111,03$ m ✓	$v_f = v_i + a\Delta t$ $\underline{0 = v_i + (9,8)(1,5)}$ $v_i = -14,7\ m\cdot s^{-2}$ $\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓ $= -14,7(1,5)+\frac{1}{2}(9,8)(1,5)^2$ ✓ $\Delta y = 11,025$ m $h = 11,025 \underline{+ 100}$ ✓ $h = 111,03$ m ✓
OPTION/*OPSIE 8*		
$v_f = v_i + a\Delta t$ $\underline{0 = v_i + (-9,8)(1,5)}$ $v_i = 14,7\ m\cdot s^{-2}$ $\Delta y = \frac{v_i + v_f}{2}\Delta t$ ✓ $\Delta y = \frac{0 + 14,7}{2}\ 1,5$ ✓ $\Delta y = 11,025$ $h = 11,025 \underline{+ 100}$ ✓ $h = 111,03$ m ✓		

(4)

3.2.2 **Upwards as positive/*Opwaarts as positief***

OPTION/*OPSIE 1*	**OPTION/*OPSIE 2***
$v_f = v_i + a\Delta t$ $0 = v_i + (-9,8)(1,5)$ $v_i = 14,7\ m\cdot s^{-1}$ $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $= 14,7^2 + 2(-9,8)(-100)$ ✓ $v_f = 46,65\ m\cdot s^{-1}$ ✓downwards✓/ *afwaarts*	**POSITIVE MARKING FROM 3.2.1/** ***POSITIEWE NASIEN VANAF 3.2.1*** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = 0^2 + 2(-9,8)(-111,03)$ ✓ $v_f = 46,65\ m\cdot s^{-1}$ ✓ downwards✓/ *afwaarts*

Downwards as positive/Af*waarts as positief*

OPTION/*OPSIE* 3	**OPTION/*OPSIE* 4**
$v_f = v_i + a\Delta t$ $0 = v_i + (9,8)(1,5)$ $v_i = -14,7\ m\cdot s^{-1}$ $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $= -14,7^2 + 2(9,8)(100)$ ✓ $v_f = 46,65\ m\cdot s^{-1}$ ✓ downwards✓/ *afwaarts*	**POSITIVE MARKING FROM 3.2.1** ***POSITIEWE NASIEN VANAF 3.2.1*** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = 0^2 + 2(9,8)(111,03)$ ✓ $v_f = 46,65\ m\cdot s^{-1}$ ✓ downwards✓/ *afwaarts*

(4)

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3.2.3 **Positive marking from/*Positiewe nasien vanaf* 3.2.1 and/*en* 3.2.2**
Upwards as positive/*Opwaarts as positief*

OPTION/*OPSIE 1*	**OPTION/*OPSIE 2***
$v_f = v_i + a\Delta t$ $0 = v_i + (-9,8)(1,5)$ $v_i = 14,7\ m\cdot s^{-1}$ $\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓ $-100 = 14,7\Delta t + \frac{1}{2}(-9,8)(\Delta t)^2$ ✓ $\Delta t = 6,26\ s$ ✓	$v_f = v_i + a\Delta t$ $0 = v_i + (-9,8)(1,5)$ $v_i = 14,7\ m\cdot s^{-1}$ $v_f = v_i + a\Delta t$ ✓ $46,65 = 14,7 + (-9,8)\Delta t$ ✓ $\Delta t = 6,26\ s$ ✓
OPTION/*OPSIE 3*	
$v_f^2 = v_i^2 + 2a\Delta y$ $v_f^2 = 14,7^2 + 2(-9,8)(-100)$ $v_f = 46,65\ m\cdot s^{-1}$ $v_f = v_i + a\Delta t$ ✓ $-46,65 = 14,7 + (-9,8)\Delta t$ ✓ $\Delta t = 6,26\ s$ ✓	

Downwards as positive/*Afwaarts as positief*

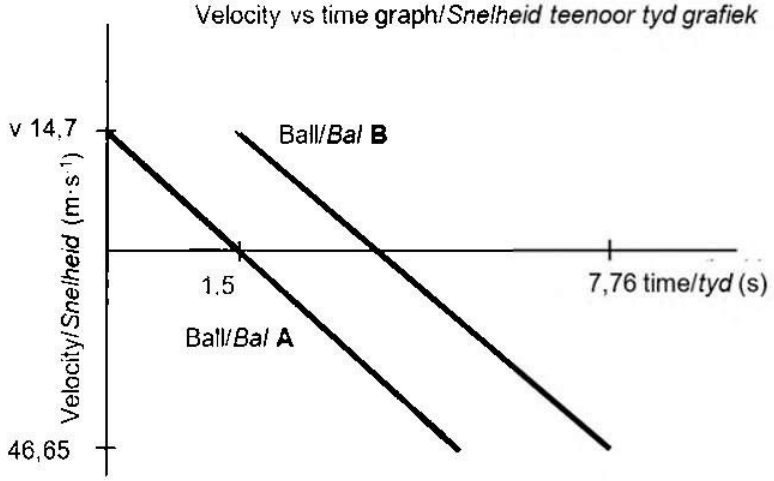
OPTION/*OPSIE 4*	**OPTION/*OPSIE 5***
$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓ $100 = -14,7\Delta t + \frac{1}{2}(9,8)(\Delta t)^2$ ✓ $\Delta t = 6,26\ s$ ✓	$v_f = v_i + a\Delta t$ $0 = v_i + (9,8)(1,5)$ $v_i = 14,7\ m\cdot s^{-1}$ $v_f = v_i + a\Delta t$ ✓ $46,65 = -14,7 + 9,8\Delta t$ ✓ $\Delta t = 6,26\ s$ ✓
OPTION/*OPSIE 6*	
$v_f^2 = v_i^2 + 2a\Delta y$ $v_f^2 = -14,7^2 + 2(9,8)(100)$ $v_f = 46,65\ m\cdot s^{-1}$ $v_f = v_i + a\Delta t$ ✓ $46,65 = -14,7 + (9,8)\Delta t$ ✓ $\Delta t = 6,26\ s$ ✓	

(3)

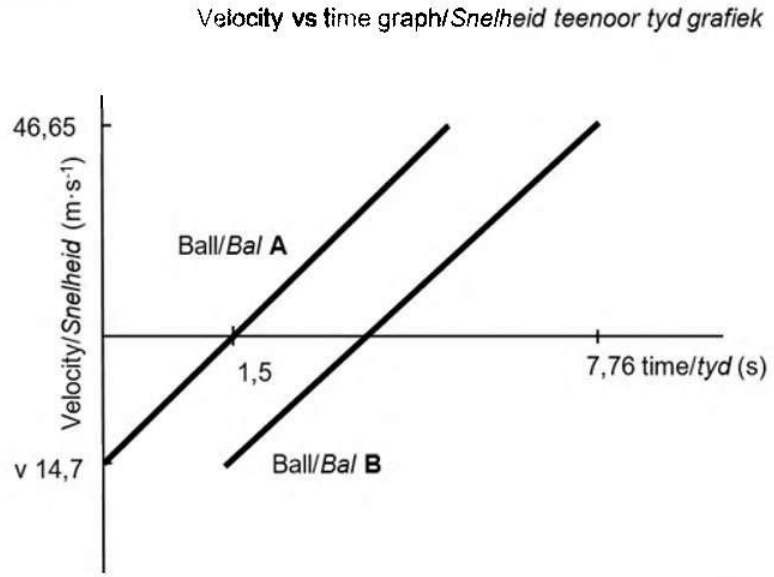
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3.3 **POSITIVE MARKING FROM QUESTION 3.2.1 AND QUESTION 3.2.3/** ***POSITIEWE NASIEN VANAF VRAE 3.2.1 EN 3.2.3***

OPTION 1: UPWARDS AS POSITIVE/*OPSIE 1: OPWAARTS AS POSITIEF*



OPTION 2: DOWNWARDS AS POSITIVE/*OPSIE 2: AFWAARTS AS POSITIEF*



Criteria/*Kriteria*:

- Same initial velocity for both ball A and B.✓/*Dieselfde aanvanklike snelheid vir beide bal A en bal B.*
- Graph of ball B starts at 1,5 s.✓/*Grafiek van bal B begin by 1,5 s.*
- Both graphs end with the same final velocity.✓/*Beide grafieke eindig met dieselfde eindsnelheid.*
- Graph of ball B stops at 7,76 s.✓/*Grafiek van bal B eindig by 7,76 s.*
- Correct shape and equal sizes for both graphs.✓/*Korrekte vorm en gelyke groottes vir beide grafieke.*

(5)
[18]

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QUESTION/*VRAAG 4*

4.1

$mv_A + mv_B = mv_A + mv_B$ ✓
$(m \times 12) + (3m \times 0)$ ✓ $= mv_A + (3m \times 4,68)$ ✓
$v = - 0,86\ m \cdot s^{-1}$
$v = 0,86\ m \cdot s^{-1}$ left✓/*links* (4)

4.2

$E_k = ½\ mv^2$ ✓
Before collision/*Voor botsing*
$E_k = ½(m)(12)^2 + ½(3m)(0)^2$ ✓
$E_k = 72m$ J

After collision/*Na botsing*
$E_k = ½(m)(0,86)^2 + ½(3m)(4,68)^2$ ✓
$E_k = 14,83m$ J
$E_{k\ before}$ is not equal to $E_{k\ after}$ ✓/$E_{k\ voor}$ *is nie gelyk aan* $E_{k\ na}$
Thus, an inelastic collision./*Dus 'n onelastiese botsing.* (4)

4.3

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 product of the resultant/net force acting on an object ✓and the time the net force acts on the object.✓/*Die produk van die resulterende/netto krag wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk.* (2)

4.4

OPTION/*OPSIE 1*	**OPTION/*OPSIE 2***
$F_{net}\Delta t = m(v_f - v_i)$ } Any one✓/Enige een	$F_{net}\Delta t = m(v_f - v_i)$
$F_{net}\Delta t = \Delta p$ }	$F_{net}\Delta t = \Delta p$
$F_{net} \times 0,03 = 0,05\ (-0,86 - 12)$ ✓	$F_{net} \times 0,03 = 0,15(4,68 - 0)$ ✓
$F_{net} = 21,43$ N ✓	$F_{net} = 23,4$ N ✓

(3)
[13]

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QUESTION/*VRAAG 5*

5.1 (Kinetic) frictional force.✓/*(Kinetiese) wrywingskrag* (1)

5.2.1
$mhg_f + ½ mv_f^2 = mhg_i + ½ mv_i^2$ ✓
$0 + ½ 4(v_f^2) = (4 \times 9,8 \times 15) + ½ 4(3^2)$ ✓
$v_f = 17,41 \text{ m·s}^{-1}$ ✓ (3)

5.2.2
$F_{net}\Delta x = ½ mv_f^2 - ½ mv_i^2$ ✓
$f_k \times 18\cos 180° = 0 - ½ 4(17,41^2)$ ✓ ✓
$f_k = 33,68 \text{ N}$ ✓ (4)

5.3 **POSITIVE MARKING FROM 5.2.1/*POSITIEWE NASIEN VANAF 5.2.1***
$f_k = \mu_k mg$ ✓
$33,68 = \mu_k \times 4 \times 9,8$ ✓
$\mu_k = 0,86$ ✓ (3)
[11]

QUESTION/*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.*

The change in frequency (or pitch) of the sound detected by the listener✓, because the sound source and the listener have different velocities relative to the medium of sound propagation.✓/*Die verandering in frekwensie (of 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

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

6.2.1
$v = \lambda f$ ✓
$343 = 350 \times 10^{-3} f$ ✓
$f = 980 \text{ Hz}$ ✓ (3)

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6.2.2 **POSITVE MARKING FROM 6.2.1/*POSITIEWE NASIEN VANAF 6.2.1***

$$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \quad ✓$$

$$980 ✓ = \frac{343}{343-30} f_s ✓$$

$$f_s = 894{,}29 \text{ Hz}$$

$$v = \lambda f$$

$$343 = \lambda \times 894{,}29 ✓$$

$$\lambda = 0{,}39 \text{ m} ✓$$

(5)

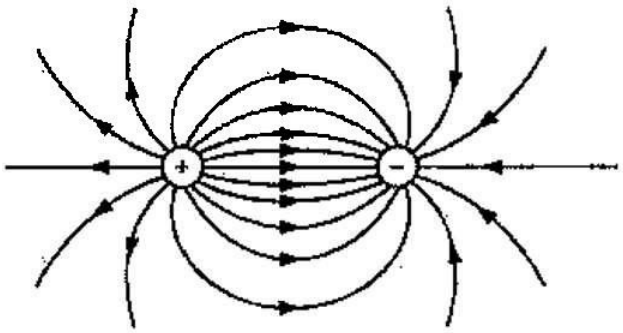
6.3.1 TOWARDS✓/*NA* (1)

6.3.2 The curve shows a blue shift✓/*Die kurwe toon 'n blou verskuiwing* , the star moves towards the side of a higher frequency/lower wavelength.✓/*die ster beweeg na die kant met 'n hoër frekwensie/korter golflengte*. (2)

[13]

QUESTION/*VRAAG 7*

7.1



Criteria for sketch/*Kriteria vir skets*	Marks/ *Punte*
Correct direction of field lines./*Korrekte rigting van veldlyne.*	✓
Correct shape of te electric field lines between the charges and on the outside of the charges./*Korrekte vorm van elektriese veldlyne tussen ladings en aan die buitekant van die ladings.*	✓
No field lines crossing each other. Field lines must touch the charge, but not go inside the charge./*Geen veldlyne wat mekaar kruis nie. Veldlyne moet die lading raak, maar nie die lading binnegaan nie.*	✓
Note: If learner draws field pattern of two like charges: 0/3 If only one charge is drawn: 0/3 *Nota: Indien leerder elektriese veld van twee gelyke ladings teken:* 0/3 *Indien slegs een lading geteken is:* 0/3	

(3)

7.2

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 mass is used/*Indien massa gebruik is:* 0/2
If force is ommited/*Indien krag weggelaat is:* 0/2

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

7.3

$F = \frac{KQq}{r^2}$ ✓

$F = \frac{9 \times 10^9 \times 1,6 \times 10^{-19} \times 1,6 \times 10^{-19}}{(3 \times 10^{-12})^2}$ ✓

$F = 2,56 \times 10^{-5}$ N ✓ (3)

7.4.1

$r^2 = x^2 + y^2$ ✓ (or any suitable equation/*of enige geskikte formule*)
$r^2 = (2,56 \times 10^{-5})^2 + (2,56 \times 10^{-5})^2$ ✓
$F_{net} = 3,62 \times 10^{-5}$ N ✓

45º north west/west of north/north of west✓/*noordwes/wes van noord/noord van wes* **OR/OF** 315º (4)

7.4.2

OPTION/*OPSIE 1* **POSITIVE MARKING FROM 7.4.1/ *POSITIEWE NASIEN VANAF 7.4.1***	**ACCEPT/*AANVAAR:***
$E = \frac{F}{q_e}$ ✓	$E = \frac{KQ}{r^2}$ ✓
$= \frac{3,62 \times 10^{-5}}{1,6 \times 10^{-19}}$ ✓	$E = \frac{9 \times 10^9 \times 1,6 \times 10^{-19}}{(3 \times 10^{-12})^2}$
$= 2,26 \times 10^{14}$ N·C^{-1} ✓	$E = 1,6 \times 10^{14}$ N·C^{-1}
	$E_{net}^2 = (1,6 \times 10^{14})^2 + (1,6 \times 10^{14})^2$ ✓
	$E_{net} = 2,26 \times 10^{14}$ N·C^{-1} ✓

(3)
[15]

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QUESTION/*VRAAG 8*

8.1 To measure the total current of the circuit.✓/ *Om die totale stroomsterkte in die stroombaan te meet.*
(If only current: 0/1/*Indien slegs stroomsterkte: 0/1*) (1)

8.2.1 $5 \checkmark \times \frac{2}{3} \checkmark = 3{,}33\ A \checkmark$ (3)

8.2.2

Emf/*Emk* = I(R + r) ✓
26 = 5(R + 0,6) ✓
$R_E = 4{,}6\ \Omega$

$$\frac{1}{R_E} = \frac{1}{2R} + \frac{1}{R}$$

$$\frac{1}{4{,}6} \checkmark = \frac{1}{2R} + \frac{1}{R} \checkmark$$

$R = 6{,}9\ \Omega$ ✓ (5)

8.2.3

OPTION/*OPSIE 1*	**OPTION/*OPSIE 2***
POSITIVE MARKING FROM 8.2.2/*POSITIEWE NASIEN VANAF 8.2.2*	V = Ir = 5 x 0,6 = 3 V
V = IR ✓ = 5 x 4,6✓ = 23 V ✓	Emf = V_{ext} + V_{Int}/*Emk* = $V_{ekstern}$ + V_{intern} ✓ 26 = V + 3 ✓ V = 23 V ✓

(3)

8.2.4 **POSITIVE MARKING FROM 8.2.1; 8.2.2 AND 8.2.3/**
POSITIEWE NASIEN VANAF 8.2.1; 8.2.2 EN 8.2.3

OPTION/*OPSIE 1*	**OPTION/*OPSIE 2***	**OPTION/*OPSIE 3***
$W = I^2R\Delta t$ ✓ $= 3{,}33^2 \times 6{,}9 \times 120$ ✓ = 9181,61 J ✓	$W = V^2/R\Delta t$ ✓ $= 23^2/6{,}9 \times 120$ ✓ = 9200 J ✓	$W = VI\Delta t$ ✓ $= 23 \times 3{,}33 \times 120$ ✓ = 9190,8 J ✓

(3)

8.3.1 DECREASE✓/AF*NEEM* (1)

8.3.2 Total external resistance increase, current decreases. ✓
V_{int} decreases as current decreases/V_{int} is directly proportional to current ✓
Emf remains constant ✓, thus V_{lost} decreases.
Totale eksterne weerstand vermeerder, stroom verminder.
V_{int} verminder soos stroom verminder/V_{int} is direk eweredig aan die stroom
Emk bly konstant, dus neem $V_{verlore}$ af. (3)
[19]

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QUESTION/*VRAAG 9*

9.1 Mechanical to electrical energy✓✓/*Meganiese na elektriese energie.* (2)

9.2 B to A✓✓/B *na A* (2)

9.3
- Use stronger magnets./*Gebruik sterkter magnete.* ✓
- Increase frequency of the rotation✓/*Verhoog die frekwensie van die rotasie*
- Increase the number of coils/surface area/*Meer windings/vergroot oppervlak*

(any two/*enige twee*) (2)

9.4 **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 AC current which dissipates/produces the same amount of energy/heat✓ as an equivalent direct current (DC).✓*Die wgk-stroom is die wisselstroom wat dieselfde hoeveelheid energie verbruik/oordra as 'n ekwivalente gelykstroom (GS).* (2)

9.5.1
$I_{rms} = \frac{I_{max}}{\sqrt{2}}$ ✓ / $I_{wgk} = \frac{I_{maks}}{\sqrt{2}}$

$= \frac{23}{\sqrt{2}}$ ✓

= 16,26 A ✓ (3)

9.5.2

OPTION/*OPSIE 1*

V = IR ✓

= 23 x 13 ✓

= 299 V ✓

OPTION/*OPSIE 2*

POSITIVE MARKING FROM 9.5.1/
POSITIEWE NASIEN VANAF 9.5.1

V = IR

= 16,26 x 13

$V_{rms/wgk}$ = 211,38 V ✓

$V_{rms} = \frac{V_{max}}{\sqrt{2}} / V_{wgk} = \frac{V_{maks}}{\sqrt{2}}$

$211,38 = \frac{V_{max/maks}}{\sqrt{2}}$ ✓

$V_{max/maks}$ = 298,94 V ✓ (3)

[14]

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QUESTION 10/*VRAAG 10*

10.1 Photon✓/*Foton* (1)

10.2 **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 frequency required✓ to eject an electron from a metal surface.✓/*Die minimum frekwensie benodig om 'n elektron uit 'n metaaloppervlak vry te stel.* (2)

10.3

OPTION/*OPSIE 1*	**OPTION/*OPSIE 2***
NO✓/*NEE*	NO✓/*NEE*
$W_0 = hf_0$ ✓	$E = hf$ ✓
$= 6,63 \times 10^{-34} \times 8,1 \times 10^{14}$ ✓	$4,8 \times 10^{-19} = 6,63 \times 10^{-34} f$ ✓
$= 5,37 \times 10^{-19}$ J ✓	$f = 7,24 \times 10^{14}$ Hz ✓
$W_0 > E$	$f_0 > f$

(4)

10.4 **POSITIVE MARKING FROM 10.3/*POSITIEWE NASIEN VANAF 10.3***

$E = W_0 + \frac{1}{2} mv_{max/maks}^2$ ✓

$7,68 \times 10^{-19} = 5,37 \times 10^{-19}$ ✓ $+ \frac{1}{2} 9,11 \times 10^{-31} v_{max/maks}^2$ ✓

$v_{max/maks} = 712\,134,13 \text{ m·s}^{-1}$ ✓ (4)

10.5 REMAIN THE SAME✓/*BLY DIESELFDE* (1)

10.6
- Intensity does not affect the maximum speed.✓
- Only a change in frequency affects the maximum speed.
- *Intensiteit het geen effek op die maksimum spoed nie.*
- *Slegs 'n verandering in die frekwensie sal die maksimum spoed beïnvloed.*

(any one/*enige een*) (1)

[13]

TOTAL/*TOTAAL*: 150

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