education

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE NASIONALE SENIOR SERTIFIKAAT

GRADE/GRAAD 12

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

SEPTEMBER 2026

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/*PUNTE*: 150

These marking guidelines consists of 14 pages
Hierdie nasienriglyne bestaan uit 14 bladsye

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QUESTION 1 / *VRAAG 1*

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

[20]

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QUESTION 2 / *VRAAG 2*

2.1

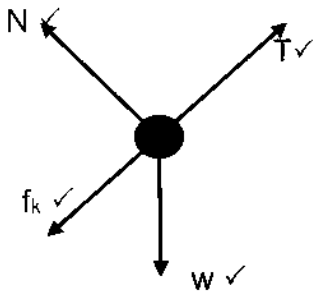
Marking criteria/*Nasienkriteria*
If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. */Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

The force that opposes the motion of a moving object relative to a surface. ✓✓

Die krag wat die beweging van 'n bewegende voorwerp relatief tot 'n oppervlak teenwerk.

(2)

2.3



(4)

Accepted labels / Aanvaarde benoemings	
w	F_g / F_w / force of earth on block / weight / mg / gravitational force / VALUE / gravitasiekrag
T	Tension in rope / F_T /F/$F_{applied}$ / spankrag
f_k	f/$F_{friction}$ / F_f / frictional force / wrywing
N	Normal force / F_N / Normaalkrag

Notes/Aantekeninge:
- Mark awarded for label and arrow/ *Punt toegeken vir benoeming en pyltjie..*
- Any additional forces/Enige addisionele kragte: deduct 1 mark/trek 1 punt af: max/maks $^3/_4$
- No labels/*Nie benoem nie*: deduct 1 mark/*trek 1 punt af*: max/maks $^3/_4$
- If everything correct, but no arrows *Indien alles korrek is, maar geen pyltjies* /: deduct 1 mark/trek 1 punt af: max/maks $^3/_4$
- Force(s) not touching object/*Krag(te) nie die voorwerp raak nie: deduct 1 mark/trek 1 punt af*: max/maks $^3/_4$
- Ignore relative sizes of the vectors/Ignoreer die relatiewe groottes van die vektore.

2.3.1

$F_{\parallel} = mg\sin\theta$ ✓
$F_{\parallel} = (70)(9,8)\sin 60^{o}$ ✓
$F_{\parallel} = 594,09$ N ✓

(3)

2.3.2

$F_{net} = ma$
$T + (-f) + (-Fg_{\parallel}) = ma$ } Any one ✓
$T - 15$ ✓ $- 594,09$ ✓ $= (70)(0,5)$ ✓
$T = 644,09$ N ✓

(5)

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2.4.1 REMAINS THE SAME / BLY DIESELFDE ✓ (1)

2.4.2 DECREASES / NEEM AF ✓
Fgll decreases/neem af ✓ (2)
[17]

QUESTION 3 / VRAAG 3

3.1 An object (which has been given an initial velocity and) then it moves under the influence of the gravitational force only. ✓✓ **(2 or 0)**

'n Voorwerp (waaraan 'n beginsnelheid gegee is en) wat dan slegs onder die invloed van die gravitasiekrag beweeg. (2)

3.2.1

Upwards positive/Opwaarts positief	**Downwards positive/Afwaarts positief**
$\Delta y=48 + 8 = 56$ m $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = v_i^2 + 2(-9,8)(56)$ ✓ $v_i = 33,13\ m\cdot s^{-1}$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = v_i^2 + 2(9,8)(-56)$ ✓ $v_i = 33,13\ m\cdot s^{-1}$ ✓

(3)

3.2.2 **POSITIVE MARKING FROM/POSITIEWE MERK VANAF 3.2.1**

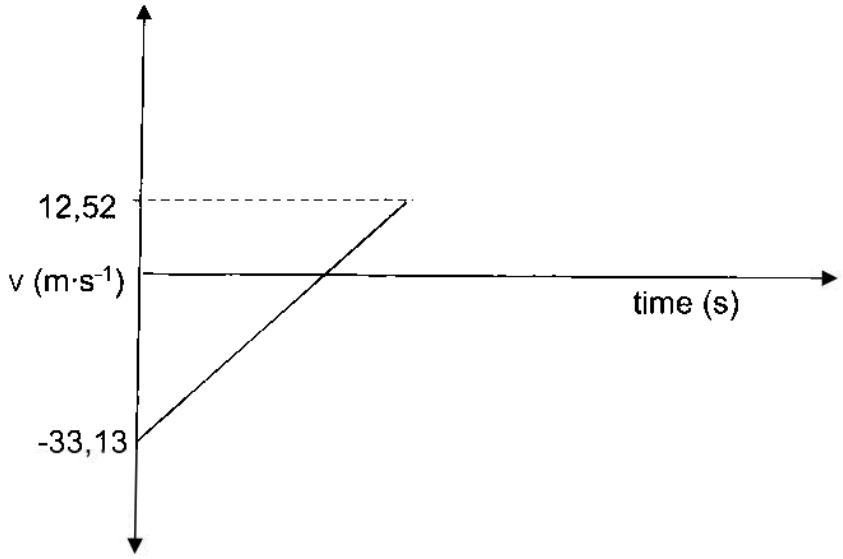
OPTION/OPSIE 1 **Upwards positive/Opwaarts positief**	**OPTION/OPSIE 1** **Downwards positive/Afwaarts positief**
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = (33,13)^2 + 2(-9,8)(48)$ ✓ $v_i = 12,52\ m\cdot s^{-1}$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = (-33,13)^2 + 2(9,8)(-48)$ ✓ $v_i = 12,52\ m\cdot s^{-1}$ ✓
OPTION/OPSIE 2 **Upwards positive/Opwaarts positief**	**OPTION/OPSIE 2** **Downwards positive/Afwaarts positief**
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = (0)^2 + 2(-9,8)(-8)$ ✓ $v_i = 12,52\ m\cdot s^{-1}$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = (0)^2 + 2(9,8)(8)$ ✓ $v_i = 12,52\ m\cdot s^{-1}$ ✓

(3)

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3.3 **POSITIVE MARKING FROM/POSITIEWE MERK VANAF 3.2.1 & 3.2.2**
UPWARDS POSITIVE/OPWAARTS POSITIEF

Criteria/Kriteria	**Marks/Punte**
Correct shape – straight line cutting through x-axis / Korrekte vorm – reguitlyn wat die x-as kruis	✓
Initial velocity / aanvanklike snelheid (3.2.1)	✓
Velocity it hits the roof with / snelheid waarmee dit die dak tref (3.2.2)	✓



(3)
[11]

QUESTION 4 / VRAAG 4

4.1. The net (or resultant) force acting on an object is equal to the rate of change of momentum of the object in the direction of the net force.✓✓ **(2 or 0)**

Die netto (of resulterende) krag wat op 'n voorwerp inwerk, is gelyk aan die tempo van verandering van momentum van die voorwerp in die rigting van die netto krag. (2)

4.2
$F_{net} \cdot \Delta t = \Delta p$ ✓
F_{net} (0,2) ✓ = (1 500)(-2,22) – (1 500)(27,78) ✓
F_{net} = -225 000 N
F_{net} = 225 000 N east/oos✓
(4)

4.3 DECREASES/ AFNEEM ✓ (1)

4.4 INELASTIC✓, kinetic energy is not conserved/velocity changed.✓

ONELASTIES, kinetiese energie bly nie behoue nie /snelheid het verander. (2)

4.5.1 GRAPH/GRAFIEK **B** ✓

4.5.2 An airbag extends the contact time ✓ during the collision and therefore he driver experiences a smaller net force for the same change in momentum/$F_{net} \propto \frac{1}{\Delta t}$. ✓

'n Lugsak verleng die kontaktyd tydens die botsing en ervaar die bestuurder dus 'n kleiner netto krag vir dieselfde verandering in momentum.
(2)
[11]

QUESTION 5 / VRAAG 5

5.1 The total linear momentum in an isolated system remains constant. ✓✓ **(2 or 0)**

Die totale liniêre momentum in 'n geisoleerde sisteem bly konstant. (2)

5.2.1
$E_p = mgh$ ✓
$E_p = (5)(9,8)(0,3)$ ✓
$E_p = 14,7$ J ✓
(3)

5.2.2
$E_{ki} + E_{pi} = E_{kf} + E_{pf}$✓
0 + 14,7 ✓ = ½(5)v^2 + 0 ✓
v = 2,42 m·s^{-1} ✓right/regs✓
(5)

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5.2.3

POSITIVE MARKING FROM/POSITIEWE MERK VANAF 5.2.2

TAKE TO THE RIGHT AS POSITIVE/NEEM REGS AS POSITIEF

$\Sigma p_i = \Sigma p_f$

$(mv_i)_A + (mv_i)_B = (mv_f)_1 + (mv_f)_2$ } ✓ Any one/enige een

$\underline{(0,15)(v_{iA})}$ ✓ $+ 4,85(0) = \underline{(5)(2,42)}$ ✓

$v_{iA} = \underline{80,67\ m\cdot s^{-1}}$ ✓right/regs✓

(5)

[15]

QUESTION 6 / VRAAG 6

6.1

Marking criteria/*Nasienkriteria*

If any one 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/pitch/wavelength 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 van frekwensie/toonhoogte/golflengte van die klank waargeneem deur 'n luisteraar omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium van klankvoorplanting het.

OR/*OF*

An (apparent) change in observed frequency/pitch/wavelength as the result of the relative motion between a source and an observer/listener. ✓✓

'n (Skynbare) verandering in waargenome frekwensie/toonhoogte/golflengte as gevolg van die relatiewe beweging tussen die bron en 'n waarnemer/luisteraar.

(2)

6.2

$v_f = v_i + a\Delta t$ ✓

$= 0 + 2\ (5)$ ✓

$= 10\ m\cdot s^{-1}$

$f_L = \frac{v \pm v_L}{v \pm v_S} f_S$ ✓ OR $f_L = \frac{v - v_L}{v} f_S$

$f_L = \frac{340 - 10}{340}$ ✓ 600 ✓

$f_L = 582,35\ Hz$ ✓

(6)

6.3 Pitch keeps DECREASING ✓ over time

Frequency decreases./ Pitch and frequency are directly proportional. ✓

Toonhoogte bly AFNEEM oor tyd. Frekwensie neem af. / Toonhoogte en frekwensie is direk eweredig.

(2)

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6.4 Wavelength INCREASES. ✓
The source is MOVING AWAY from the observer. ✓

Golflengte NEEM TOE.
Die bron BEWEEG WEG van die waarnemer. (2)

[12]

QUESTION 7 / VRAAG 7

7.1

Marking criteria/Nasienkriteria

If any one 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.*

Note/Nota: If **masses** used ($^{0}/_{2}$)

As massagebruik is

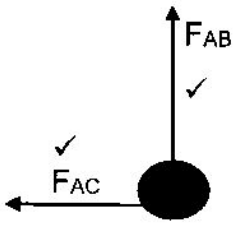
The magnitude of the electrostatic force exerted by one point charge (Q1) on another point charge (Q2) is directly proportional to the product of the magnitudes of the charges ✓ and inversely proportional to the square of the distance (r) between them ✓

Die grootte van die elektrostatiese krag wat een puntlading (Q1) op 'n ander puntlading (Q2) uitoefen, is direk eweredig aan die produk van die groottes van die ladings ✓ en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle. ✓

(2)

7.2 Negative/negatief ✓ (1)

7.3



(2)

Accepted labels / Aanvaarde benoemings	
F_{AB}	Electrostatic force on charge **A** due to charge **B** Elektrostatiese krag op lading **A** as gevolg van lading **B**
F_{AC}	Electrostatic force on charge **A** due to charge **C** Elektrostatiese krag op lading **A** as gevolg van lading **C**

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Notes/Aantekeninge:

- Any additional forces/enige addisionele kragte: deduct 1 mark/trek 1 punt af: max/maks $^1/_2$
- No labels/geen benoemings: deduct 1 mark/trek 1 punt af: max/maks $^1/_2$
- No arrows/geen pyltjies: $0/2$
- Force(s) not touching object/krag(te) raak nie die voorwerp nie: deduct 1 mark/trek 1 punt af: max/maks $^1/_2$
- **Ignore relative sizes of the vectors/Ignoreer relatiewe groottes van die vektore**

7.4

$$F_{AB} = \frac{kQ_1Q_2}{r^2} \checkmark = \frac{(9\times10^{9})(2\times10^{-6})\ (6\ \times10^{-6})}{(r)^2} \checkmark$$

$$F_{AC} = \frac{(9\times10^{9})(2\times10^{-6})\ (6\ \times10^{-6})}{(r)^2} \checkmark$$

$(F_{net})^2 = (F_{AB})^2 + (F_{AC})^2$ ✓ (Pythagoras)

$$(0,12)^2 \checkmark = \left(\frac{0,108}{r^2}\right)^2 + \left(\frac{0,108}{r^2}\right)^2$$

$r = 1,128$ m ✓

(6)

[11]

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QUESTION 8 /VRAAG 8

8.1.1

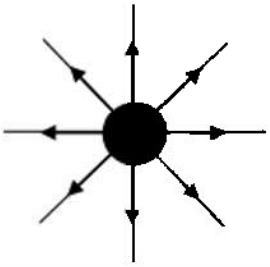
Marking criteria/Nasienriglyne:
-1 mark for each of the 5 key words omitted in the correct context.
-1 punt vir elk van die 5 sleutelwoorde weggelaat in die korrekte konteks.

The electric field at a point is the electrostatic **force** experienced by a **positive unit charge.** ✓ ✓

Die elektriese veld by 'n punt is die elektrostatiese **krag** wat deur 'n **positiewe eenheidslading** ervaar word.

(2)

8.1.2



Criteria for sketch/Kriteria vir skets	Marks/Punte
Correct shape as shown.Field lines start on sphere. *Korrekte vorm soos getoon.Veldlyne begin op sfeer.*	✓
Direction away from charge. *Rigting weg van lading.*	✓

(2)

8.1.3

$n = \frac{Q}{q_e}$ ✓

$n = \frac{6 \times 10^{-6}}{1{,}60 \times 10^{-19}}$ ✓

$n = 3{,}75 \times 10^{13}$ electrons/elektrone ✓

(3)

8.2

At/by E = 100 N. C^{-1} $E = \frac{kQ}{r^2}$ ✓

$100 ✓ = \frac{(9 \times 10^9)Q}{(0{,}6)^2}$ ✓

$Q = 4 \times 10^{-9}$ C

At/by E = 50 N.C^{-1} $E = \frac{kQ}{r^2}$

$50 = \frac{(9 \times 10^9)(4 \times 10^{-9})}{r^2}$ ✓

r = 0,85 m (0,845m) ✓

(5)

[12]

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QUESTION 9 / VRAAG 9

9.1 To measure potential difference ✓

Om potensiaalverskil te meet (1)

9.2 SMALLER THAN/*KLEINER AS* ✓

A_1 is in a parallel connection, A_2 is the total current ✓

A_1 is in 'n parallelle verbinding, A_2 is die totale stroom (2)

9.3.1

$P = I^2R$ ✓
$65 = 2{,}5^2 R$ ✓
$R = 10{,}4\ \Omega$ ✓ (3)

9.3.2 **POSITIVE MARKING FROM/POSITIEWE MERK VANAF 9.3.1**

$V = I \times R$ ✓
$= 2{,}5 \times (4 + 10{,}4)$ ✓
$= 36$ V

$I_{12\Omega} = V / R$
$= 36 / 12$ ✓
$= 3$ A

Total current/*Totale stroom* = 2,5 + 3 = 5,5 A ✓ (4)

9.3.3 **POSITIVE MARKING FROM/POSITIEWE MERK VANAF 9.3.1 & 9.3.2**

$V_{3,5\Omega} = I \times R$
$= 5{,}5 \times 3{,}5$ ✓
$= 19{,}25$ V

$V_1 = 19{,}25 + 36$ ✓
$= 55{,}25$ V ✓ (3)

9.4 THE SAME AS ✓ No current in both, the readings will be 0 A ✓

BLY DIESELFDE Geen stroom in beide nie, die lesings sal 0 A wees (2)
[15]

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QUESTION 10 / VRAAG 10

10.1.1 Maximum voltage / peak voltage ✓

Maksimum spanning / Piekspanning (1)

10.1.2 Replace slip rings by split ring/commutator ✓ (1)

Vervang die glyringe deur splitring/kommutator

10.1.3

$P_{ave} = V_{rms} \cdot I_{rms}$ ✓ $V_{rms} = \frac{V_{max}}{\sqrt{2}}$ $I_{rms} = 66,68 \text{ X } 0,05$ ✓

$= 66,68 \text{ X } 3,33$ $= \frac{94,3}{\sqrt{2}}$ ✓ $= 3,33 \text{ A}$

$= 222,04 \text{ W}$ ✓ $= 66,68 \text{ V}$

(4)

10.2.1

$P_{ave} = \frac{V_{rms}^2}{R}$ ✓

$56 = \frac{90^2}{R}$ ✓

$R = 144,64 \ \Omega$ ✓

(3)

10.2.2 LESS BRIGHT, ✓ Current less ✓

MINDER HELDER Die stroom is minder (2)

[11]

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QUESTION 11 / VRAAG 11

11.1.1

Marking criteria/*Nasienkriteria*
If any one 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 electrons are emitted from a (metal) surface when light of suitable frequency is incident on that surface. ✓✓
Die proses waardeur elektrone uit 'n (metaal)oppervlak vrygestel word wanneer lig van 'n geskikte frekwensie daarop inval/skyn.

(2)

11.1.2 Only ultraviolet light releases (photo) electrons (from the surface of the zinc). ✓✓ OR
Red light does not release (photo) electrons (from the surface of the zinc)

ACCEPT/AANVAAR
$f(UV) \geq f_o$/ $f(Red) < f_o$

Slegs ultravioletlig /straling sal (foto)elektrone vrystel (vanuit die oppervlak van sink). OF
Rooi lig stel geen (foto)elektrone (uit die oppervlak van sink) vry nie. (2)

11.1.3 Light energy ✓ to kinetic / electrical energy ✓ (2)

Ligenergie na kinetiese/ elektriese energie

11.2.1

E of red light $= h\frac{c}{\lambda}$ ✓
$= (6{,}63 \times 10^{-34}) \left(\frac{3 \times 10^{8}}{6{,}99 \times 10^{-7}}\right)$ ✓
$= 2{,}845 \times 10^{-19}$ J ✓

$E < W_o$ ✓ - no electrons released / geen elektrone vrygestel nie. (4)

11.2.2

$E = W_o + E_{k(max)}$ ✓

$h\frac{c}{\lambda} = (6{,}63 \times 10^{-34}) \left(\frac{3 \times 10^{8}}{2{,}7 \times 10^{-7}}\right)$ ✓ $= \underline{6{,}88 \times 10^{-19} + \frac{1}{2} mv^2}$ ✓

$v = 3{,}27 \times 10^{5}$ $m \cdot s^{-1}$

$p = mv$ ✓

$= 9{,}11 \times 10^{-31} \times 3{,}27 \times 10^{5}$ $m \cdot s^{-1}$

$= 2{,}978 \times 10^{-25}$ kg $m \cdot s^{-1}$ ✓

(5)

[15]

TOTAL/*TOTAAL*: 150

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