basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

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

NOVEMBER 2014

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 28 pages.
Hierdie memorandum bestaan uit 28 bladsye.

QUESTION 1/*VRAAG 1*

1.1 A ✓✓ (2)

1.2 A ✓✓ (2)

1.3 D ✓✓ (2)

1.4 C ✓✓ (2)

1.5 B ✓✓ (2)

1.6 C ✓✓ (Accept/ *Aanvaar* R) (2)

1.7 A ✓✓ (2)

1.8 D ✓✓ (2)

1.9 A ✓✓ (2)

1.10 C ✓✓ (2)
[20]

QUESTION 2/*VRAAG 2*

2.1 When a resultant (net) force acts on an object, the object will accelerate in the direction of the force. This acceleration is directly proportional to the force✓ and inversely proportional to the mass of the object.✓

Wanneer 'n resulterende (netto) krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel. Hierdie versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

OR/*OF*

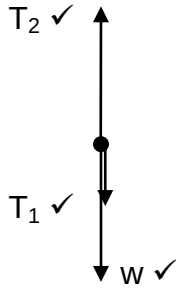
The net force acting on an object is equal to the rate of change of momentum ✓✓ of the object (in the direction of the force). (2 or 0)

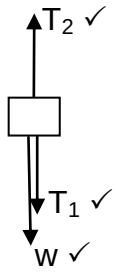
Die netto krag wat op 'n voorwerp inwerk is gelyk aan die tempo van verandering in momentum van die voorwerp (in die rigting van die krag).(2 of 0) (2)

2.2

Accepted Labels/*Aanvaarde benoemings*	
w	F_g/F_w/force of Earth on block / weight/49 N / mg / gravitational force *F_g/F_w/krag van Aarde op blok/gewig/49 N / mg / gravitasiekrag*
T_2	Tension 2 / F_Q/ 250 N / F_{T2} /F_{app} *Spanning 2*/ F_Q/ 250 N / F_{T2} / $F_{toegepas}$
T_1	Tension 1 / F_{T1} /F_P *Spanning 1* / F_{T1} / F_P

Accept/*Aanvaar*: Force diagram/*kragtediagram*





(3)

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* $\frac{2}{3}$
- If force(s) do not make contact with body / *Indien krag(te) nie met die voorwerp kontak maak nie:* Max/*Maks:* $\frac{2}{3}$

2.3

OPTION 1/*OPSIE 1*

$F_{net} = ma$ ✓

For 5 kg block/*Vir 5 kg-blok*

$T_2 + (-mg) + (-T_1) = ma$

$250 - (5)(9,8) - T_1$ ✓ $= 5\ a$

$201 - T_1 = 5\ a$

$T_1 = 201 - 5a$.....(1)

✓for either/ *vir of* / 5a or/*of* 20a

For 20 kg block/*Vir 20 kg-blok*

$T_1 + (-mg) = ma$.....(2)

$T_1 + [-20(9,8)]$ ✓ $= 20a$

$5 = 25\ a$

$a = 0,2$ ~~m·s^{-2}~~ upwards/*opwaarts*

$\therefore T_1 = 201 - 5(0,2)$ ✓

$= 200$ N ✓

OR/*OF* $T_1 = 20(9,8) + 20(0,2)$ ✓

$= 200$ N ✓

(6)

OPTION 2 /*OPSIE 2*

$F_{net} = ma$✓

For 5 kg block/*Vir 5 kg-blok*

$T_2 + (-mg) + (-T_1) = ma$

$250 - (5)(9,8) - T_1$✓$= 5a$

$201 - T_1 = 5a$

$T_1 = 201 - 5a$.....(1)

For 20 kg block/*Vir 20 kg-blok* ,

$T_1 + (-mg) = ma$.....(2)

$T_1 + [-20(9,8)]$ ✓ $= 20a$

✓for either/ *vir of* / 5a or/*of* 20a

(1) x 4 : $4T_1 = 804 - 20a$

$\therefore T_1 - 196 = 804 - 4T_1$ ✓

$\therefore 5T_1 = 1\,000$

$\therefore T_1 = 200$ N ✓

(6)

OPTION 3/*OPSIE 3*

$F_{net} = ma$✓

For 5 kg block/*Vir 5 kg-blok*

$T_2 + (-mg) + (-T_1) = ma$

$250 - (5)(9,8) - T_1$✓$= 5a$

$201 - T_1 = 5a$

$T_1 = 201 - 5a$.....(1)

$\therefore a = \frac{201 - T_1}{5}$

✓for either/ *vir of* / 5a or/*of* 20a

For 20 kg block/*Vir 20 kg-blok* ,

$T_1 + (-mg) = ma$.....(2)

$T_1 + [-(20)(9,8)]$ ✓ $= 20a$

$\therefore T_1 - 196 = 20(\frac{201 - T_1}{5})$✓

$\therefore T_1 = 200$ N✓

(6)

Notes/*Aantekeninge*
Learners need not show how (1) and (2) were combined.
Leerders hoef nie aan te toon hoe (1) en (2) gekombineer is nie.

2.4 **Q** ✓ (1)

[12]

QUESTION 3/*VRAAG 3*

3.1 An object moving / Motion <u>under the influence of gravity / weight / gravitational force only</u> (and there are no other forces such as friction).✓✓ (2 or/*of* 0)
('n Voorwerp wat / Beweging <u>slegs onder die invloed van swaartekrag / gewig / gravitasiekrag</u> (en daar is geen ander kragte soos wrywing nie). (2)

Notes/Aantekeninge An object falling at 9,8 $m \cdot s^{-2}$ / *'n Voorwerp wat teen 9,8 $m \cdot s^{-2}$ val* Max/*Maks* $\frac{1}{2}$

3.2

<u>OPTION 1/*OPSIE 1*</u>	
Upwards positive/*Opwaarts positief:*	**Downwards positive/*Afwaarts positief:***
$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$✓ 0 ✓= <u>15 $\Delta t + \frac{1}{2}$ (-9,8) Δt^2</u>✓ Δt = 3,06 s It takes/*Dit neem* 3,06 s✓	$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$✓ 0✓ = <u>-15 $\Delta t + \frac{1}{2}$ (9,8) Δt^2</u>✓ Δt = 3,06 s It takes/*Dit neem* 3,06 s✓

(4)

<u>Notes/*Aantekeninge*</u>
Accept/*Aanvaar*
g or/*of* a
$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$✓
$s = ut + \frac{1}{2} at^2$
Ball A: Can work from top down: $v_i = 0\ m \cdot s^{-1}$, $v_f = 15\ m \cdot s^{-1}$
Bal A: Kan vanaf topunt afwaarts werk $v_i = 0\ m \cdot s^{-1}$, $v_f = 15\ m \cdot s^{-1}$

<u>OPTION 2/*OPSIE 2*</u>	
Upwards positive/*Opwaarts positief:*	**Downwards positive/*Afwaarts positief:***
$v_f = v_i + a \Delta t$✓ 0✓ = <u>15 +(-9,8)Δt</u>✓ Δt = 1,53 s It takes (2)(1,53) = 3,06 s✓	$v_f = v_i + a \Delta t$✓ 0✓ = <u>-15 +(9,8)Δt</u>✓ Δt = 1,53 s It takes/*Dit neem* 3,06 s✓

(4)

<u>Notes/*Aantekeninge*</u>
At maximum height $v_f = 0$: *By maksimum hoogte: $v_f = 0$:*
Accept/*Aanvaar*
g or/*of* a
v = u + at

<u>OPTION 3 / *OPSIE 3*</u>	
Upwards positive/*Opwaarts positief:*	**Downwards positive/*Afwaarts positief:***
$v_f = v_i + a \Delta t$✓ -15 ✓= <u>15 + (-9,8)Δt</u>✓ Δt = 3,06 s✓	$v_f = v_i + a \Delta t$✓ 15 ✓= <u>-15 + (9,8)Δt</u>✓ Δt = 3,06 s✓

(4)

Notes/*Aantekeninge*
When it returns to same level its speed is 15 $m \cdot s^{-1}$.
Wanneer dit na dieselfde vlak terugkeer is sy spoed 15 $m \cdot s^{-1}$.

Accept/*Aanvaar*
g or/*of* a
v = u + at

OPTION 4/*OPSIE 4*	
Upwards positive/*Opwaarts positief:*	**Downwards positive /*Afwaarts positief:***
$F_{net}\,\Delta t = \Delta p$✓	$F_{net}\,\Delta t = \Delta p$✓
$mg\,\Delta t = m\,(v_f - v_i)$	$mg\,\Delta t = m\,(v_f - v_i)$
$\Delta t = \frac{(0-15)}{-9,8}$ ✓✓	$\Delta t = \frac{0-(-15)}{9,8}$ ✓✓
Δt = 1,53 s	Δt = 1,53 s
It takes/*Dit neem* (2)(1,53s) = 3,06 s✓	It takes/*Dit neem* (2)(1,53s) = 3,06 s✓

(4)

Notes/*Aantekeninge*
At maximum height v_f = 0: / *By maksimum hoogte: v_f = 0:*

Accept/*Aanvaar*
g or/*of* a

mat = m (v – u)
Any one of the two formulae./ *Enigeen van die twee formules.*

OPTION 5/*OPSIE 5*	
Upwards positive/*Opwaarts positief:*	**Downwards positive/*Afwaarts positief:***
$F_{net}\,\Delta t = \Delta p$✓	$F_{net}\,\Delta t = \Delta p$✓
$mg\,\Delta t = m\,(v_f - v_i)$	$mg\,\Delta t = m\,(v_f - v_i)$
$\Delta t = \frac{-15-(15)}{-9,8}$ ✓✓	$\Delta t = \frac{15-(-15)}{9,8}$ ✓✓
= 3,06 s✓	Δt = 3,06 s✓

(4)

Notes/*Aantekeninge*
When it returns to same level its speed is 15 $m \cdot s^{-1}$ /*Wanneer dit na dieselfde vlak terugkeer is sy spoed 15 $m \cdot s^{-1}$.*

Accept/*Aanvaar*
g or/*of* a

OPTION 6/*OPSIE 6*

ALL OPTIONS FROM QUESTION 3.3 TO CALCULATE Δy = 11,48 m
ALLE OPSIES VANAF VRAAG 3.3 OM Δy = 11,48 m TE BEREKEN

Upwards positive/*Opwaarts positief:*	**Downwards positive/*Afwaarts positief:***
$v_f^2 = v_i^2 + 2a\Delta y$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓
For ball A/*Vir bal A*	For ball A/*Vir bal A*
$0 = (15)^2 + 2(-9,8)\Delta y$✓	$0 = (-15)^2 + 2(9,8)\Delta y$✓
$\Delta y_A = 11,48$ m	$\Delta y_A = -11,48$ m
$\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$	$\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$
$11,48 = \left(\frac{15+0}{2}\right)\Delta t$ ✓	$-11,48 = \left(\frac{-15+0}{2}\right)\Delta t$ ✓
$\Delta t = 1,53$ s	$\Delta t = 1,53$ s
It takes/*Dit neem* (2)(1,53s) = 3,06 s✓	It takes/*Dit neem* (2)(1,53s) = 3,06 s✓

(4)

Notes/*Aantekeninge*
Ball A: Can work from top down: $v_i = 0$ m·s^{-1} , $v_f = 15$ m·s^{-1}
Bal A: Kan vanaf topunt afwaarts werk $v_i = 0$ m·s^{-1} , $v_f = 15$ m·s^{-1}

3.3 **POSITIVE MARKING FROM QUESTION 3.2**
POSITIEWE NASIEN VANAF VRAAG 3.2

OPTION 1/*OPSIE 1*

Upwards positive/*Opwaarts positief:*	**Downwards positive/*Afwaarts positief:***
$v_f^2 = v_i^2 + 2a\Delta y$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓
For ball A/*Vir bal A*	For ball A/*Vir bal A*
$0 = (15)^2$✓ $+ 2(-9,8)\Delta y$✓	$0 = (-15)^2$✓ $+ 2(9,8)\Delta y$✓
$\Delta y_A = 11,48$ m	$\Delta y_A = -11,48$ m
<u>When A is at highest point</u>	<u>When A is at highest point</u>
<u>*Wanneer A op hoogste punt is*</u>	<u>*Wanneer A op hoogste punt is*</u>
$\Delta y_B = v_i\Delta t + ½ a\Delta t^2$	$\Delta y_B = v_i\Delta t + ½ a\Delta t^2$
$= 0 + \underline{½(-9,8)(1,53)^2}$✓✓	$= 0 + \underline{½(9,8)(1,53)^2}$✓✓
$\Delta y_B = -11,47$ m	$\Delta y_B = 11,47$ m
$\Delta y_B = 11,47$ m downward/*afwaarts*	$\Delta y_B = 11,47$ m downward/*afwaarts*
Distance/*Afstand* = $y_A + y_B$	Distance/*Afstand* = $y_A + y_B$
= 11,47 + 11,48 ✓	= 11,48 + 11,47 ✓
= 22,95 m✓	= 22,95 m✓

(7)

Notes/*Aantekeninge*
Accept/*Aanvaar*
g or/*of* a
$\Delta x = v_i\Delta t + ½ a\Delta t^2$✓
$s = ut + ½ at^2$

OPTION 2/*OPSIE 2*	
Upwards positive/*Opwaarts positief:*	**Downwards positive/*Afwaarts positief:***
At maximum height $v_f = 0$: *By maksimum hoogte $v_f = 0$:* Ball/*Bal* A $\Delta y_A = v_i\Delta t + \frac{1}{2} a\Delta t^2$✓ $= 15\ (1,53)$ ✓ $+ \frac{1}{2}\ (-9,8)\ (1,53)^2$✓ $= 11,48$ m When A is at highest/point *Wanneer A op hoogste punt is* $\Delta y_B = v_i\Delta t + \frac{1}{2} a\Delta t^2$ $= 0 + \frac{1}{2}\ (-9,8)\ (1,53)^2$✓✓ $\Delta y_B = -11,47$ m $\Delta y_B = 11,47$ m downward/*afwaarts* Distance/*Afstand* $= y_A + y_B$ $= 11,48 + 11,47$✓ $= 22,95$ m✓	At maximum height $v_f = 0$: *By maksimum hoogte $v_f = 0$:* Ball/*Bal* A $\Delta y_A = v_i\Delta t + \frac{1}{2} a\Delta t^2$✓ $= (-15)\ (1,53)$ ✓$+ \frac{1}{2}\ (9,8)\ (1,53)^2$✓ $= -11,48$ m When A is at highest point *Wanneer A by hoogste punt is* $\Delta y_B = v_i\Delta t + \frac{1}{2} a\Delta t^2$ $= 0 + \frac{1}{2}\ (-9,8)\ (1,53)^2$✓✓ $\Delta y_B = -11,47$ m $\Delta y_B = 11,47$ m downward/*afwaarts* Distance/*Afstand* $= (y_A + y_B)$ $= 11,48 + 11,47$ ✓ $= 22,95$ m✓

(7)

Notes/*Aantekeninge*
Accept/*Aanvaar*
g or/*of* a
v = u + at

OPTION 3/*OPSIE 3*	
Upwards positive/*Opwaarts positief:*	**Downwards positive/*Afwaarts positief:***
Ball A/*Bal A* $\Delta y_A = v_i\Delta t + \frac{1}{2} a\Delta t^2$✓ $\Delta y_A = 15(1,53)$ ✓$+ \frac{1}{2}\ (-9,8)\ (1,53)^2$✓ $= 11,48$ m For ball B/*Vir bal B* $v_f = v_i + a\Delta t$ $v_f = 0 + (-9,8)(1,53)$ $v_f = 14,99\ m\cdot s^{-1}$ $v_f^2 = v_i^2 + 2a\Delta x$ $14,99^2$✓ $= 0 + 2(-9,8)\ \Delta y_B$✓ $\Delta y_B = -11,47$ (m) $= 11,47$ m downward/*afwaarts* Distance/*Afstand* $= (y_A + y_B)$ $= 11,48 + 11,47$✓ $= 22,95$ m✓	Ball A/*Bal A* $y_A = v_i\Delta t + \frac{1}{2} a\Delta t^2$✓ $\Delta y_A = -15\ (1,53)$ ✓ $+ \frac{1}{2}\ (9,8)\ (1,53)^2$✓ $= -11,48$ (m) $= 11,48$ m upward/*opwaarts* For ball B/*Vir bal B* $v_f = v_i + a\Delta t$ $v_f = 0 + (9,8)(1,53)$ $v_f = 14,99\ m\cdot s^{-1}$ $v_f^2 = v_i^2 + 2a\Delta x$ $14,99^2$ ✓$= 0 + 2(9,8)\ \Delta y_B$✓ $\Delta y_B = 11,47$ (m) Distance/*Afstand* $= (y_A + y_B)$ $= 11,48 + 11,47$✓ $= 22,95$ m✓

(7)

Notes/*Aantekeninge*
When it returns to same level its speed is 15 m·s^{-1} / *Wanneer dit na dieselfde vlak terugkeer is sy spoed 15 m·s^{-1}.*

Accept/*Aanvaar*
g or/*of* a
v = u + at

OPTION 4/*OPSIE 4*

Upwards positive/*Opwaarts positief:*

Ball A/*Bal A*

$\Delta y_A = \frac{v_i + v_f}{2}\Delta t$ ✓ $= \frac{(15 + 0)}{2}(1{,}53)$ ✓ (✓)
$= 11{,}48$ m

For ball B/*Vir bal B*

$v_f = v_i + a\Delta t$
$= 0 + (-9{,}8)(1{,}53)$
$= -15$ m·s^{-1}

$\Delta y = \frac{v_i + v_f}{2}\Delta t = \frac{(0 - 15) \times 1{,}53}{2}$ ✓ (✓)
$= -11{,}47$ m
$= 11{,}47$ m downward/*afwaarts*

Distance/*Afstand* = $(y_A + y_B)$
$= 11{,}48 + 11{,}47$ ✓
$= 22{,}95$ m ✓

Downwards positive/*Afwaarts positief:*

Ball A/*Bal A*

$\Delta y_A = \frac{v_i + v_f}{2}\Delta t$ ✓ $= \frac{(-15 + 0)}{2}(1{,}53)$ ✓ (✓)
$= -11{,}48$ (m)
$= 11{,}48$ m upwards/*opwaarts*

$v_f = v_i\Delta t + a\Delta t$
$= 0 + (9{,}8)(1{,}53)$
$= 15$ m·s^{-1}

$\Delta y = \frac{v_i + v_f}{2}\Delta t = \frac{(0 + 15) \times 1{,}53}{2}$ ✓ (✓)
$= 11{,}47$m

Distance/*Afstand* = $y_A + y_B$
$= 11{,}48 + 11{,}47$ ✓
$= 22{,}95$ m ✓ (7)

Notes/*Aantekeninge*
Accept/*Aanvaar*
g or/*of* a
v = u + at
$s = \frac{u + v}{2}t$

OPTION 5/*OPSIE 5*	
Upwards positive/*Opwaarts positief:*	**Downwards positive/*Afwaarts positief:***
Ball A/*Bal A* $W_{net} = \Delta K$✓	Ball A/*Bal A* $W_{net} = \Delta K$✓
OR/*OF* ½ m($v_f^2 - v_i^2$) = mg($h_f - h_i$)cosθ ½ m(0 -15^2) ✓= m(9,8)$h_f$cos180^o ✓ h = 11,48 m	**OR/*OF*** ½ m($v_f^2 - v_i^2$) = mg($h_f - h_i$)cosθ ½ m(0 -15^2) ✓= m(9,8)$h_f$cos180^o ✓ h = 11,48 m
OR/*OF* For Ball B when A is at highest point./ *Vir Bal B wanneer A by sy hoogste punt is.*	**OR/*OF*** For Ball B when A is at highest point./ *Vir Bal B wanneer A by sy hoogste punt is.*
$v_f = v_i + a\Delta t$ = 0 +(-9,8) (1,53) = -15 m·s^{-1} ✓ $\Delta y = \frac{v_i + v_f}{2}\Delta t = \frac{(0 - 15)\times 1{,}53}{2}$ ✓ =-11,48 m = 11,48 m downward/*afwaarts*	$v_f = v_i + a\Delta t$ = 0 +(9,8) (1,53) = 15 m·s^{-1} ✓ $\Delta y = \frac{v_i + v_f}{2}\Delta t = \frac{(0 + 15)(1{,}53)}{2}$ ✓ = 11,48 m downward/*afwaarts*
Distance/*Afstand* = $y_A + y_B$ = 11,48 + 11,48✓ = 22,96 m✓	Distance/*Afstand* = $y_A + y_B$ = 11,48 + 11,48✓ = 22,96 m✓

(7)

Notes/*Aantekeninge*
Accept all the other options for calculating the height of ball B when this option is used to determine the maximum height of A.
Aanvaar al die ander opsies vir die berekening van die hoogte van bal B wanneer hierdie opsie gebruik word om die maksimum hoogte van A te bepaal.

OPTION 6/*OPSIE 6*
Any of the above calculations for calculating the maximum height ball A reaches. (2 marks)
Enige van die bogenoemde berekeninge vir die berekening van maksimum hoogte wat bal A bereik. (2 punte)

- Ball B takes same time as Ball A✓/*bal B neem dieselfde tyd as bal A*
- Since acceleration is constant ✓/ *Aangesien versnelling constant is*
- Δy for ball A is the same as that for B✓ / *Δy vir bal A is dieselfde as dié vir bal B*
- Ball A travels 11,48 m in this time ∴ B also travels 11,48 m ✓/ *Ball A beweeg 11,48 m in hierdie tyd ∴ B beweeg ook 11,48 m*
- Distance between A and B = 22, 96 m /*Afstand tussen A en B = 22,96m*

(7)

OPTION 7/*OPSIE 7*

Upwards positive/*Opwaarts positief:*

Ball A

$\frac{1}{2} m v_i^2 + mgh_i = \frac{1}{2} m v_f^2 + mgh_f$ ✓

$\frac{1}{2} m(15^2)$ ✓ $+0 = \frac{1}{2} m(0) + m(9,8)h$ ✓

$h = 11,48$ m

OR/*OF*

For Ball B when A is at highest point.

Vir Bal B wanneer A by sy hoogste punt is.

$v_f = v_i + a\Delta t$

$= 0 + (-9,8)(1,53)$

$= -15 \text{ m·s}^{-1}$

$\Delta y = \frac{v_i + v_f}{2} \Delta t$ ✓

$= \frac{(0 - 15)(1,53)}{2}$ ✓

$= -11,48$ m

$= 11,48$ m downward/*afwaarts*

Distance/*Afstand* $= y_A + y_B$

$= 11,48 + 11,48$ ✓

$= 22,96$ m ✓

Downwards positive/*Afwaarts positief:*

Ball A

$\frac{1}{2} m v_i^2 + mgh_i = \frac{1}{2} m v_f^2 + mgh_f$ ✓

$\frac{1}{2} m(15^2)$ ✓ $+0 = \frac{1}{2} m(0) + m(9,8)h$ ✓

$h = 11,48$ m

OR/*OF*

For Ball B when A is at highest point.

Vir Bal B wanneer A by sy hoogste punt is.

$v_f = v_i + a\Delta t$

$= 0 + (9,8)(1,53)$

$= 15 \text{ m·s}^{-1}$

$\Delta y = \frac{v_i + v_f}{2} \Delta t$ ✓

$= \frac{(0 + 15)(1,53)}{2}$ ✓

$= 11,48$ m downward/*afwaarts*

Distance/*Afstand* $= y_A + y_B$

$= 11,48 + 11,48$ ✓

$= 22,96$ m ✓

(7)

Notes/*Aantekeninge*

Accept/*Aanvaar*

$\Delta K + \Delta U = 0$ (when/as $W_{nc} = 0$)

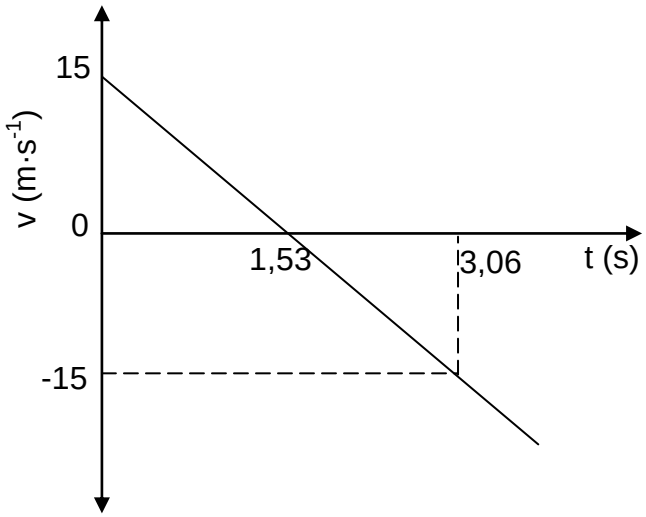
$\frac{1}{2} m(v_f^2 - v_i^2) + mg(h_f - h_i) = 0$

Accept all other options for calculating the height of ball B when this option is used to determine maximum height of A

Aanvaar aal die ander opsies vir die berekening van die hoogte van bal B wanneer hierdie opsie gebruik word om die maksimum hoogte van bal B wanneer hierdie opsie gebruik word om die maksimum hoogte van A te bepaal.

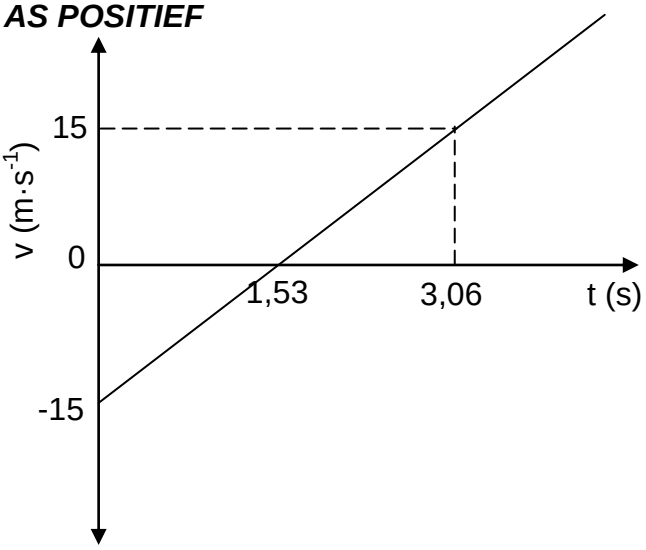
3.4 **POSITIVE MARKING FROM QUESTION 3.2/*POSITIEWE NASIEN VANAF VRAAG 3.2.***

CONSIDER MOTION UPWARD AS POSITIVE/*BESKOU BEWEGING OPWAARTS AS POSITIEF*



(4)
[17]

CONSIDER MOTION DOWNWARD AS POSITIVE/*BESKOU BEWEGING AFWAARTS AS POSITIEF*



Criteria/*Kriteria*	**Marks/*Punte***
Graph starts at correct Initial velocity shown./*Grafiek begin by korrekte beginsnelheid aangetoon.*	✓
Time for maximum height shown (1,53 s)./*Tyd vir maksimum hoogte aangetoon.(1,53 s)*	✓
Time for return shown (3,06 s) /*Tyd om terug te keer (3,06) aangetoon.*	✓
Shape/*Vorm*: Straight line extending beyond 3,06 s/ *Reguitlyn wat verby 3,06 s strek.*	✓

(4)
[17]

QUESTION 4/*VRAAG 4*

4.1 $p = mv$✓
$= 50(5)$✓
$= 250\ kg{\cdot}m{\cdot}s^{-1}$✓ (downward/*afwaarts)*

OR/*OF*
$p = mv$✓
$= 50(-5)$✓
$= -250\ kg{\cdot}m{\cdot}s^{-1}$
$= 250\ kg{\cdot}m{\cdot}s^{-1}$✓ (downward/*afwaarts)* (3)

4.2 The product of the (net) force and the time interval (during which the force acts)✓✓ (2 or 0)
Die produk van die (netto) krag en die tydinterval (waartydens die krag inwerk) (2 of 0). (2)

4.3

OPTION 1/*OPSIE 1*		
$\Delta p = F_{net}\Delta t$✓ 0 - 250 ✓$= F_{net}(0,2)$ $F_{net} = -1\ 250$ N $= 1\ 250$ N ✓	$\Delta p = F_{net}\Delta t$✓ 250 - 0 ✓$= F_{net}(0,2)$ $F_{net} = 1\ 250$ N ✓	$\Delta p = F_{net}\Delta t$✓ 50(0 – (-5))✓$= F_{net}(0,2)$ $F_{net} = 1\ 250$ N ✓

(3)

OPTION 2/*OPSIE 2*	
$m(v_f - v_i) = F_{net}\Delta t$✓ 50 (0 - 5) ✓$= F_{net}$ (0,2) $F_{net} = -1\ 250$ N $= 1\ 250$ N ✓	$m(v_f - v_i) = F_{net}\Delta t$✓ 50 (5 - 0) ✓$= F_{net}$ (0,2) $F_{net} = 1\ 250$ N ✓

(3)

Notes/*Aantekeninge*
Accept/*Aanvaar* $m(v - u) = F_{net}\ \Delta t$

OPTION 3 /*OPSIE 3*	
$v_f = v_i + a\Delta t$ 0 = 5 + a(0,2) ✓ $a = -25\ m{\cdot}s^{-2}$ $F_{net} = ma$✓ $= 50\ (-25)$ $= -1\ 250$ N $= 1\ 250$ N✓	$v_f = v_i + a\Delta t$ 5 = 0 + a(0,2) ✓ $a = 25\ m{\cdot}s^{-2}$ $F_{net} = ma$✓ $= 50\ (25)$ $= 1\ 250$ N✓

(3)

Notes/*Aantekeninge*
Accept/*Aanvaar* $v = u + at$

4.4 Greater than/*Groter as*✓ (1)

4.5 For the same momentum change, ✓
the stopping time (contact time) ✓will be smaller (less) ✓
∴ the (upward) force exerted (on her) is greater.
Vir dieselfde verandering in momentum,
sal die stilhoutyd (kontaktyd) kleiner wees
∴ *die (opwaartse)krag wat (op haar) uitgeoefen word, sal groter wees.* (3)
[12]

Notes/*Aantekeninge*
Accept/*Aanvaar*
Since $F_{net} = \frac{\Delta p}{\Delta t}$ the force is great when the stopping time✓ is smaller (less) ✓
Since change in momentum is the same for both jumps✓ F_{net} increases.
Aangesien $F_{net} = \frac{\Delta p}{\Delta t}$ *, is die krag groot indien die stilhoutyd klein is. Aangesien die verandering in momentum dieselfde is vir beide spronge sal* F_{net} *toeneem*

QUESTION 5/*VRAAG 5*

5.1.1 In an isolated/closed system, ✓ the total mechanical energy is conserved / remains constant ✓
In 'n geïsoleerde/geslote sisteem bly die totale meganiese energie behoue / bly konstant.

OR/*OF*
The total mechanical energy of a system is conserved/ remains constant ✓ in the absence of friction.✓
Die totale meganiese energie van 'n sisteem bly behoue/bly konstant in die afwesigheid van wrywing.

OR/*OF*
The total mechanical energy of a system remains constant ✓provided the net work done by external non conservative forces is zero.✓
Die totale meganiese energie van 'n sisteem bly konstant, mits die arbeid verrig deur eksterne nie-konserwatiewe kragte, nul is.

OR/*OF*
In the absence of a non-conservative force, the total mechanical energy is conserved/remains constant
In die afwesigheid van 'n nie-konserwatiewe krag, bly die totale meganiese energie behoue / konstant

OR/*OF*
In an isolated/closed system, ✓ the sum of kinetic and gravitational potential energy is conserved / remains constant ✓
In 'n geïsoleerde/geslote sisteem bly som van kinetiese en gravitasionele potensiële energie behoue / bly konstant.

Notes/Aantekeninge:
Allocate mark for "isolated/closed system" only in conjunction with energy.
Ken punt toe vir "geïsoleerde/geslote sisteem" slegs indien saam met energie gebruik.

(2)

5.1.2 No/*Nee*✓ (1)

5.1.3

OPTION 1/*OPSIE 1*

Along **AB**/*Langs* **AB**	Along **AB**/*Langs* **AB**
$E_{mechanical\ at\ A} = E_{mechanical\ at\ B}$ $(E_p + E_k)_A = (E_p + E_k)_B$ ✓ $(mgh + ½ mv^2)_A = (mgh + ½ mv^2)_B$ $(10)(9,8)(4) + 0 = 0 + ½ (10) v_f^2$✓ $v_f = 8,85\ m\cdot s^{-1}$	$W_{net} = \Delta E_k$ ✓ $F_g \Delta h \cos\theta = ½ m(v_f^2 - v_i^2)$ $(10)(9,8)(4)\cos 0^o = ½ (10)(v_f^2 - 0)$ ✓ $v_f = 8,85\ m\cdot s^{-1}$

Along **AB**/*Langs* **AB**

$W_{nc} = \Delta K + \Delta U$ ✓
$0 = ½ (10)(v_f^2 - 0) + 10(9,8)(4 - 0)$ ✓
$v_f = 8,85\ m\cdot s^{-1}$

Substitute 8,85 $m\cdot s^{-1}$ in one of the following options
Vervang 8,85 $m\cdot s^{-1}$ in een van die volgende opsies

Along **BC**/*Langs* **BC**	Along **BC**/*Langs* **BC**
$W_{net} = \Delta K$✓ $f\Delta x \cos\theta = \Delta K$ $\underline{f(8)\cos 180^o}$ ✓= $\underline{½ (10)(0 - 8,85^2)}$ ✓ $f = 48,95$ N✓	$W_{nc} = \Delta K + \Delta U$ ✓ $f\ \Delta x \cos\theta = \Delta K + \Delta U$ $\underline{f(8)\cos 180}$ ✓= $\underline{½ (10)(0 - 8,85^2) + 0}$✓ $f = 48,95$ N✓ (Accept/ *Aanvaar* 49 N)

(6)

Notes/*Aantekeninge*
1 mark for having all underlined substitutions correct./ *1 punt vir al die onderstreepte wat korrek vervanging is.*

OPTION 2/*OPSIE 2*
Along **AC/***Langs* **AC**

$W_{nc} = \Delta K + \Delta U$✓
$f\Delta x \cos\theta = \Delta K + \Delta U$
$(f)(8)$✓$(\cos 180^o)$✓ $= (0 - 0)$ ✓ $+ 10\ (9,8)(0 - 4)$ ✓
$f = 49$ N ✓

(6)

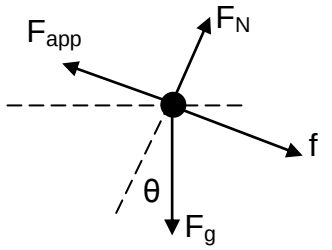
5.2.1 $f_k = \mu_k N$✓
$= \mu_k mg\cos\theta$
$= \underline{(0,19)(300)(9,8)\cos 25^o}$✓
$= 506,26$ N✓

(3)

Notes/*Aantekeninge*
If subscripts not shown award mark formula / *Indien voetskrifte nie aangedui is nie, ken punte toe.*

5.2.2 **POSITIVE MARKING FROM QUESTION 5.2.1**
POSITIEWE NASIEN VAN VRAAG 5.2.1

OPTION 1/*OPSIE 1*



$F_{net} = 0$ ✓
$F_{app} + (-F_g \sin\theta) + (-f) = 0$
$F_{app} - (300)(9,8)\sin 25^o$✓ - 506,26✓ = 0
$F_{app} = 1\ 748,76$ N

$P_{ave} = Fv_{ave}$ ✓
= 1748,76 x 0,5✓
= 874,38 W ✓ (6)

Notes/*Aantekeninge*
Do not penalise if free body diagram is not shown / *Moenie penaliseer indien die vrye kragtediagram nie getoon is nie.*
Do not penalise if $F_{app} – (F_g \sin\theta + f) = 0$ is not given / *Moenie penaliseer indien*
If $F_{app} = (300)(9,8)\sin 25^o + 506,26$ (3 marks / *punte*)

OPTION 2/*OPSIE 2*
$W_f + W_{app} + W_N + W_g = 0$ ✓
$F\Delta x\cos\theta + F_{app}\Delta x\cos\theta + 0 + F_g\Delta x\cos\theta = 0$
$(506,26\Delta x \cos 180^o)$✓ + $(F_{app}\Delta x \cos 0) + 300(9,8)\Delta x\cos 115^o$✓= 0

$F_{app} = 1748,76$ N
$P_{ave} = Fv_{ave}$✓
= (1748,76) (0,5)✓
= 874,38 W✓ (6)

Notes/*Aantekeninge*
Do not penalise if free body diagram is not shown / *Moenie penaliseer indien die vrye kragtediagram nie getoon is nie.*
Do not penalise/ *Moenie penaliseer* if/*indien* $F_{app} – (F_g \sin\theta + f) = 0$ is not given /*nie gegee is nie* (3 marks / *punte*)
Do not penalise/ *Moenie penaliseer* if/*indien* $W_f + W_{app} + W_N + W_g = 0$ is not given /*nie gegee is nie* (3 marks / *punte*)

ACCEPT/*AANVAAR*

$P_{ave} = \frac{W}{\Delta t} = \frac{F\Delta x\cos\theta}{\Delta t}$ ✓

$= \frac{(1748{,}76)(0{,}5)(1)}{1}$ ✓

$= 874{,}38$ W ✓

OPTION 3/*OPSIE 3*

$W_f + W_{app} + W_N + W_g = 0$ ✓

$F\Delta x\cos\theta + F_{app}\Delta x\cos\theta + 0 + F_g\sin\theta\Delta x\cos\theta = 0$

$(506{,}26\Delta x\cos 0)$ ✓ + $(F_{ap}\Delta x\cos 0) + 300\,(9{,}8)\sin 25^{o}\,\Delta x\cos 180)$ ✓ $= 0$

$F_{app} = 1\,748{,}76$ N

$P_{ave} = Fv_{ave}$ ✓

$= (1\,748{,}76)(0{,}5)$ ✓ (6)

$= 874{,}38$ W ✓ **[18]**

ACCEPT/*AANVAAR*

$P_{ave} = \frac{W}{\Delta t} = \frac{F\Delta x\cos\theta}{\Delta t}$ ✓

$= \frac{(1748{,}76)(0{,}5)(1)}{1}$ ✓

$= 874{,}38$ W ✓

QUESTION 6/*VRAAG 6*

6.1.1 An (apparent) change in observed/detected frequency (pitch), (wavelength) ✓as a 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)

6.1.2 Towards/*Na*✓

Observed/detected frequency is greater than the actual frequency.✓
Waargenome frekwensie is groter as die werklike frekwensie. (2)

6.1.3 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ **OR/*OF*** $f_L = \frac{v}{v - v_s} f_s$ ✓

$(1200) = \frac{343}{343 - v_s} 1130$ ✓ ✓ ✓

$v_s = 20{,}01\ m\cdot s^{-1}$ ✓

Accept/*Aanvaar:* $(19{,}42 – 20{,}01\ m\cdot s^{-1})$ (5)

6.2 The star is approaching the earth. ✓
Die ster nader die aarde.
OR/*OF*
The earth and the star are approaching (moving towards) each other.✓
Die aarde en die ster nader mekaar.

The spectral lines in diagram 2 are shifted towards the blue end/blue shifted.✓ (2)
Die spektrumlyne in diagram 2 het verskuif na die blou ent/blou verskuiwing **[11]**

Notes/*Aantekeninge*
Accept/*Aanvaar*
Shifted toward the left /the wavelengths of the corresponding spectral lines in diagram 2 are shorter (shifted).✓
Verskuif na links/die golflengtes van die ooreenstemmende spektrumlyne in diagram 2 is korter (verskuif).

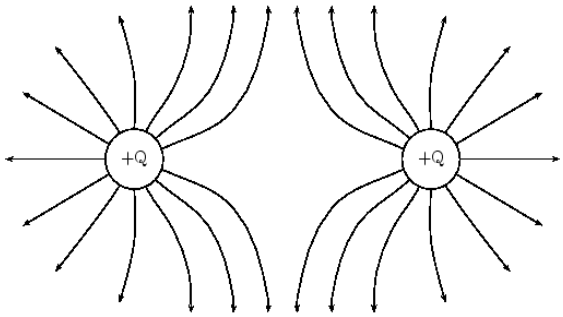
QUESTION 7/*VRAAG 7*

7.1 To ensure that charge does not leak to the ground/insulated. ✓
Om te verseker dat die lading nie na die grond toe lek nie/isoleer. (1)

Notes/*Aantekeninge*
Accept/*Aanvaar*
In order retain original charge✓/To insulate the charges./ *Om oorspronklike lading te behou/ Om lading te isoleer.*

7.2 Net charge/*Netto lading* = $\frac{Q_R + Q_S}{2} = \frac{+8+(-4)}{2}$ ✓= 2 µC✓ (2)

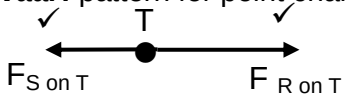
7.3 **POSITIVE MARKING FROM QUESTION 7.2**
POSITIEWE NASIEN VANAF VRAAG 7.2



Criteria for sketch:/*Kriteria vir skets:*	Marks/ *Punte*
Correct direction of field lines *Korrekte rigting van veldlyne*	✓
Shape of the electric field *Vorm van elektrieseveld*	✓
No field line crossing each other / No field lines inside the spheres/ *Geen veldlyne wat maekaar kruis nie / Geen veldlyne binne sfeer nie*	✓

Accept / *Aanvaar*: pattern for point charges /*patroon vir puntladings* (3)

7.4



(2)

Notes/*Aantekeninge*
1 mark for forces correctly drawn with arrows**.** *1 punt vir kragte korrek aangedui met pyltjies*
No labels/ *Geen byskrifte 1 / 2*

7.5 **POSITIVE MARKING FROM QUESTION 7.2**
POSITIEWE NASIEN VANAF VRAAG 7.2

OPTION 1/*OPSIE 1*

$F = k\frac{Q_1Q_2}{r^2}$ ✓

$F_{ST} = (9\times10^9)\frac{(1\times10^{-6})(2\times10^{-6})}{(0,2)^2}$ ✓ ✓ = 0,45 N / 4,5 x 10^{-1} N left/*links*

OR/*OF*

$F_{TS} = \frac{1}{4}F_{RT} = \frac{1}{4}(1,8) = 0,45$ N

$F_{RT} = 9\times10^9 \times \frac{(2\times10^{-6})(1\times10^{-6})}{(0,1)^2}$ ✓ = 1,8 N right/*regs*

OR/*OF*

$F_{RT} = 4F_{ST} = 4(0,45) = 1,8$ N right /*regs*

$F_{net} = F_{ST} + F_{RT} = \underline{1,8 + (-0,45)}$ ✓

= 1,35 N or towards sphere S / *na sfeer* or/*of* right/*regs* S✓ (6)

Notes/*Aantekeninge*
If original charge of R and S is used / *Indien oorspronklike lading van R en S gebruik is* Max/Maks $\frac{2}{6}$

Notes/*Aantekeninge*
For calculation of first force i.e. F_{ST} or F_{RT} award 2 marks / *Vir berekening van eerste krag d.i. F_{ST} of F_{RT} keen 2 punte toe*

1 mark correct conversion and substitution of denominator./ *1 punt vir korrekte omskakeling en vervanging in deler.*

ACCEPT/*AANVAAR*
$F_{left/links}$ and/*en* $F_{right/regs}$
Final mark for both magnitude and direction /*Finale punt vir beide grootte en rigting*

OPTION 2/*OPSIE 2*

$E_R = \frac{kQ}{r^2} = \frac{(9\times10^9)(2\times10^{-6})}{(0,1)^2}$ ✓= 1,8 x 10^6 N.C^{-1} right/*regs*

$E_s = \frac{kQ}{r^2} = \frac{(9\times10^9)(2\times10^{-6})}{(0,2)^2}$ ✓= 4,5 x 10^5 N.C^{-1} left/*links*

E_{net} = 1,8 x 10^6 - 4,5 x 10^5 ✓= 1,35 x 10^6 N.C^{-1}right/*regs*

F = EQ ✓= (1,35 x 10^6)(1 x 10^{-6}) ✓

= 1,35 N towards sphere S / na sfeer S right/*regs* ✓ (6)

7.6 Force experienced ✓per unit positive charge ✓placed at that point.
Krag ondervind per eenheid positiewe lading by daardie punt. (2)

ACCEPT/*AANVAAR*
Force ✓per unit positive charge ✓/*Krag*✓*per eenheid positiewe lading* ✓.

7.7 **POSITIVE MARKING FROM QUESTION 7.5**
POSITIEWE NASIEN VANAF VRAAG 7.5

OPTION 1/*OPSIE 1*

$E = \frac{F}{q}$ ✓ $= \frac{1{,}35}{1\times10^{-6}}$ ✓ $= 1{,}35 \times 10^{6}$ N·C^{-1} ✓ (3)

OPTION 2/*OPSIE 2*

$E_R = \frac{kQ}{r^2}$ ✓ $= \frac{(9\times10^{9})(2\times10^{-6})}{(0{,}1)^2}$ ✓ $= 1{,}8 \times 10^{6}$ N·C^{-1} right/*regs*

$E_s = \frac{kQ}{r^2} = \frac{(9\times10^{9})(2\times10^{-6})}{(0{,}2)^2} = 4{,}5 \times 10^{5}$ N·C^{-1} left/*links*

$E_{net} = 1{,}8 \times 10^{6} - 4{,}5 \times 10^{5} = 1{,}35 \times 10^{6}$ N·C^{-1} ✓ (3)

OPTION 3/*OPSIE 3*

$E = \frac{F}{q}$ ✓ $= \frac{1{,}8}{1\times10^{-6}}$ ✓ $= 1{,}8 \times 10^{6}$ N·C^{-1}

$E = \frac{F}{q} = \frac{0{,}45}{1\times10^{-6}} = 4{,}5 \times 10^{5}$ N·C^{-1}

$E_{net} = 1{,}8 \times 10^{6} - 4{,}5 \times 10^{5} = 1{,}35 \times 10^{6}$ N·C^{-1} ✓ (3)

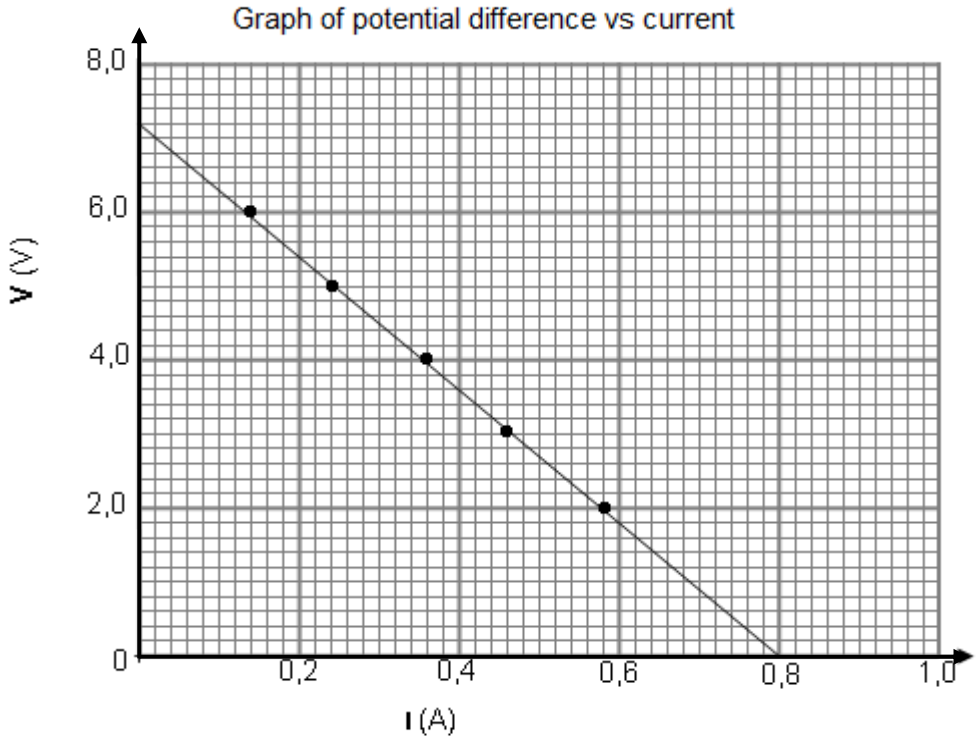
[19]

QUESTION 8/*VRAAG 8*

8.1.1 Keep the temperature (of battery) constant.
Hou die temperatuur (van battery) konstant (1)

8.1.2

Grafiek van potensiaalverskil teenoor stroom



Criteria for drawing line of best fit:/*Kriteria vir teken van lyn van beste pas:*	Marks/ *Punte*
ALL points correctly plotted (at least 4 points) *ALLE punte korrek gestip (ten minste 4 punte)*	✓✓
Correct line of best fit if all plotted points are used (at least 3 point) *Korrekte lyn van beste pas indien alle punte gebruik word (ten minste 3 punte)*	✓

Notes/*Aantekeninge*

If only 3 points are plotted correctly / *Indien 3 punte korrek gestip is* $\frac{1}{2}$

If the points are incorrectly plotted and the line of best fit is drawn

Indien die punte verkeerd gestip is en lyn van beste pas ie geteken Max /*Maks* $\frac{1}{3}$

(3)

8.1.3 7,2 V✓
(Accept any readings between 7,0 V and 7,4 V or the value of the y-intercept
/*Aanvaar enige lesing tussen 7,0 V en 7,4 V of die waarde van die y-afsnit* (1)

8.1.4 **POSITIVE MARKING FROM QUESTION 8.1.3**
POSITIEWE NASIEN VAN VRAAG 8.1.3

Slope/*Helling* $= \frac{\Delta V}{\Delta I}$

$= \frac{0 - 7,2}{0,8 - 0}$ ✓✓ $= - 9$

$r = 9\ \Omega$✓ (3)

Notes/*Aantekeninge*
The final answer must be written for the last mark (must be positive)/ *Die finale antwoord moet geskryf word vir die laaste punt.*

Either the numerator must be negative (i.e. smaller value – larger value) or the denominator must be negative.
Of die teller moet negatief wees (d.i. kleiner waarde – groter waarde) of die noemer moet negatef wees.

Accept/*Aanvaar*:
Values between 8,3 Ω and10,0 Ω / *Waardes tussen 8,3 Ω en10,0* Ω

8.2.1

OPTION 1/*OPSIE 1*
$P = VI$ ✓
$100 = 20(I)$✓
$I = 5$ A ✓ (3)

OPTION 2/*OPSIE 2*

$P = \frac{V^2}{R}$

$100 = \frac{(20)^2}{R}$

$R = 4\ \Omega$

✓Both formulae/*Beide formule*

$V = IR$

$20 = I(4)$ ✓

$I = 5$ A ✓

(3)

OPTION 3/*OPSIE 3*

$P = \frac{V^2}{R}$

$100 = \frac{(20)^2}{R}$

$R = 4\ \Omega$

✓Both formulae/*Beide formule*

$P = I^2R$

$100 = I^2(4)$ ✓

$I = 5$ A ✓

8.2.2

OPTION 1/*OPSIE 1*

$P = \frac{V^2}{R}$ ✓

$R = \frac{(20)^2}{150}$ ✓

$= 2{,}67\ \Omega$ ✓

(3)

OPTION 2/OPSIE 2

$P = VI$

$150 = (20)I$

$I = 7{,}5$ A

✓Both formulae/*Beide formule*

$V = IR$

$20 = (7{,}5)R$ ✓

$R = 2{,}67\ \Omega$ ✓

OR/*OF*

$P = I^2R$

$150 = (7{,}5)^2R$✓

$R = 2{,}67\ \Omega$ ✓

(3)

OPTION 3/*OPSIE 3*

$I_X : I_Y$

$5 : 7{,}5$

$1 : 1{,}5$

$R_X : R_Y$

$1{,}5 : 1$✓

4 ✓: $2{,}67\ \Omega$✓

(3)

8.2.3 **POSITIVE MARKING FROM QUESTION 8.2.2.**
POSITIEWE NASIEN VAN VRAAG 8.2.2.

OPTION 1/*OPSIE 1*

$P = VI$ **OR/*OF*** $P = I^2R$

$I_{150W} = \frac{150}{20}$ ✓ = 7,5 A $I_{150W} = \sqrt{\frac{150}{2,67}}$ ✓ = 7,5 A

$I_{tot} = (5 + 7,5)$ ✓

$\varepsilon = I(R + r)$ ✓

$24 = 12,5(R + r)$

$24 = V_{ext} + V_{ir}$

$24 = 20 + 12,5(r)$ ✓

$r = 0,32\ \Omega$ ✓ (5)

Notes/*Aantekeninge*

1 mark for one of the following /*1 punt vir een van die volgende*

$24 = 12,5(R + r)$

OR/*OF*

$24 = V_{ext} + V_{int}$

OR/*OF*

$24 = 20 + 12,5(r)$ (5)

OPTION 2/*OPSIE 2*

$V = Ir$✓

$I_{tot} = (5 + 7,5)$ ✓

$(24 - 20)$ ✓$= 12,5\ r$✓

$\therefore r = \frac{4}{12,5}$

$r = 0,32\ \Omega$✓ (5)

8.2.3 **POSITIVE MARKING FROM QUESTION 8.2.2**
POSITIEWE NASIEN VAN VRAAG 8.2.2.

OPTION 3/*OPSIE 3*

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

$\frac{1}{R_{//}} = \frac{1}{4} + \frac{1}{2,67}$ ✓ OR/*OF* $R_{//} = \frac{(4)(2,67)}{4 + 2,67}$

$\therefore R_{||} = 1,6\ \Omega$

Note mark allocated for value of resistor X / *Let wel: punt toegeken vir waarde van resistor X*

$I_{tot} = \frac{20}{1,6} = 12,5\ A$ ✓

$\mathcal{E} = I(R + r)$ ✓

$24 = 12,5(R + r)$

$24 = V_{ext} + V_{ir}$

$24 = 20 + 12,5(r)$ ✓

$r = 0,32\ \Omega$ ✓ (5)

Notes/*Aantekeninge*

$R_1 = R_X = \frac{400}{100}$

$R_1 = R_X = \frac{20}{5}$

Accept/*Aanvaar:*

$R_{//} = \frac{R_1 R_2}{R_1 + R_2}$

$\frac{1}{R} = \frac{1}{R_X} + \frac{1}{R_Y}$

1 mark for either of:/*1 punt vir of*

$24 = 12,49(R + r)$

$24 = V_{ext} + V_{ir}$

OR/*OF*

$24 = 20 + 12,49(r)$

OPTION 4/*OPSIE 4*

$P = VI$ ✓

$250 = (20)I$ ✓

$I = 12,5\ A$

$V = Ir$ ✓

$4 = (12,5)r$ ✓

$r = 0,32\ \Omega$ ✓ (5)

8.2.4 Device Z is a voltmeter ✓.
Toestel Z is 'n voltmeter (1)

-

Notes/*Aantekeninge*
Accept/*Aanvaar:*
Very high resistance device / *Baie hoë weerstand toestel*

8.2.5 Device **Z** should be a voltmeter (or a device with very high resistance) because it has a very high resistance✓ and will draw very little current. ✓
The current through **X** and **Y** will remain the same hence the device can operate as rated.
*Toestel **Z** moet 'n voltmeter wees (of 'n toestel met 'n baie hoë weerstand) omdat dit 'n baie hoë weerstand het en baie min sal stroom trek*
*Die stroom deur **X** en **Y** sal dieselfde bly, gevolglik kan die toestel werk soos ontwerp.* (2)
[22]

QUESTION 9/*VRAAG 9*

9.1 Electromagnetic induction / *Elektromagnetiese induksie*✓ (1)

9.2 Rotate the coil faster/Increase the number of coils/ Increase the strength of the magnetic field.
Roteer die spoel vinniger/Verhoog die aantal spoele / Verhoog die sterkte van die magneetveld. (1)

9.3 Slip rings/*Sleepringe*✓ (1)

9.4.1 It is the value of the voltage in a DC circuit✓ that will have the same heating effect as an AC circuit. ✓
Dit is die waarde van die potensiaalverskil in 'n GS-stroombaan✓ wat dieselfde verhittingseffek het as 'n WS-stroombaan✓ (2)

9.4.2 $V_{rms} = \frac{V_{max}}{\sqrt{2}}$ ✓

$= \frac{339{,}45}{\sqrt{2}}$ ✓

V_{rms} = 240,03 V ✓ Accept/*Aanvaar* (240,03 – 240,74) (3)
[8]

QUESTION 10/*VRAAG 10*

10.1 The minimum frequency (of a photon/light) needed to emit electrons ✓ from (the surface of) a metal. (substance) ✓
Die minimum frekwensie (van 'n foton/lig) benodig om elektrone vanaf die (oppervlakte van)'n metaal (stof) vry te stel. (2)

10.2 **OPTION 1/*OPSIE 1***

$E = W_o + E_{k(max)}$
$E = W_o + \frac{1}{2}mv^2_{max}$
$h\frac{c}{\lambda} = hf_0 + \frac{1}{2}mv^2_{max}$
✓Any one / *Enige een*

$\frac{(6{,}63\times10^{-34})(3\times10^{8})}{\lambda}$ ✓$= (6{,}63\times10^{-34})(5{,}548\times10^{14})$ ✓$+ \frac{1}{2}(9{,}11\times10^{-31})(5{,}33\times10^{5})^2$ ✓

$\lambda = 4 \times 10^{-7}$ m✓ (5)

OPTION 2/*OPSIE 2*

$E = W_o + E_{k(max)}$
$E = W_o + \frac{1}{2}mv^2_{max}$
$hf = hf_0 + \frac{1}{2}mv^2_{max}$
✓Any one / *Enige een*

$(6{,}63 \times 10^{-34})f = (6{,}63\times10^{-34})(5{,}548\times10^{14})$ ✓$+ \frac{1}{2}(9{,}11\times10^{-31})(5{,}33\times10^{5})^2$ ✓

$f = 7{,}5 \times 10^{14}$ Hz

$c = f\lambda$
$3 \times 10^{8} = (7{,}5 \times 10^{14})\lambda$✓
$\lambda = 4 \times 10^{-7}$ m ✓ (5)

10.3 Smaller (less) than ✓
Kleiner (minder) as (1)

10.4 The wavelength/frequency/energy of the incident light (photon/hf) is constant✓.
Die golflengte/frekwensie/energie van die invallende lig (foton/hf) is konstant

Since the speed is larger, the kinetic energy is larger ✓ the work function/W_0/threshold frequency smaller. ✓

Aangesien die spoed vergroot, is die kinetiese energie groter, is die arbeidsfunksie / W_0 / drumpel frekwensie kleiner (3)
[11]

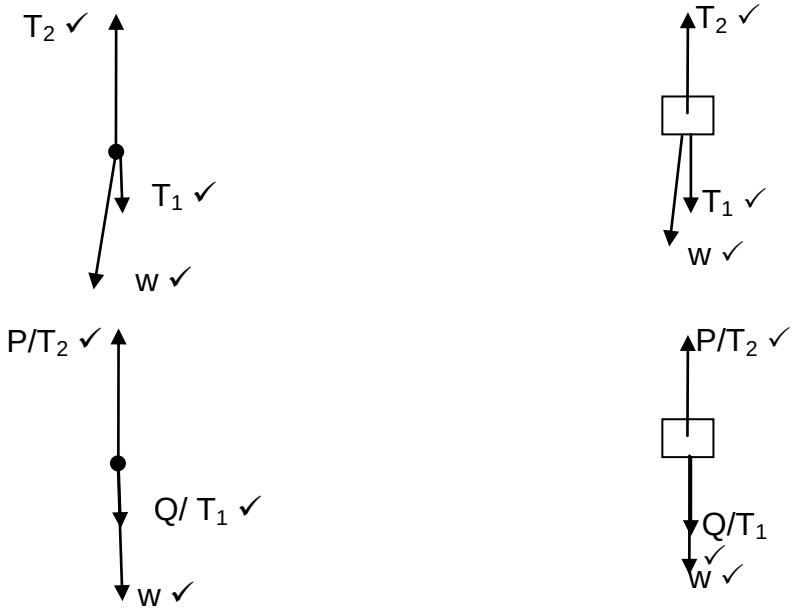
GRAND TOTAL/*GROOTTOTAAL*: 150

ANNEXURE/*AANHANGSEL*

QUESTION 2 / *VRAAG* 2

2.1 Accept "unbalanced force" in the context of Newton's Second Law
Aanvaar "omgebalanseerde krag" in die konteks van Newton se Tweede wet

2.2 **Accept/*Aanvaar***



(3)

2.3

ACCEPT/*AANVAAR*

$F_{net} = ma$✓
$T_2 - (M + m)g = (M + m)a$
$\underline{250 - (25)(9,8)}$✓$= 25$✓a✓ (one mark for /*een punt vir* 25 kg)
$a = 0,2\ m{\cdot}s^{-2}$
<u>For 20 kg block/*Vir 20 kg blok*</u>
$T_1 + (-mg) = ma$.....(2)
$T_1 = \underline{20(9,8) + 20(0,2)}$✓
$T_1 = 200$ N ✓

(6)

ACCEPT/*AANVAAR*
$F_{net} = ma$✓
$T_2 - (M + m)g = (M + m)a$
$\underline{250 - (25)(9,8)}$✓$= 25$✓a✓ (one mark for/ *een punt vir* 25 kg)
$a = 0,2\ m{\cdot}s^{-2}$
<u>For 5 kg block/ *Vir 5 kg blok*</u>
$F_{net} = ma$
$T_2 + F_g + T_1 = ma$
$250 - (5)(9,8) + T_1 = 5(0,2)$ ✓
$T_1 = -200$ N
$T_1 = 200$ N✓

(6)

QUESTION 3 / *VRAAG 3*

3.3 The distance between A and B can also be determined by using the graph in QUESTION 3.4 / *Die afstand tussen A en B kan ook bepaal word deur die grafiek in VRAAG 3.4 te gebruik*
First part of graph is for ball A✓ and the second part is for ball B✓ / *Eerste deel van grafiek is vir bal A en die tweede deel is vir bal B*
Distance = area between the graph and the x-axis ✓/ *Afstand = area tussen grafiek en die x-as*
= ½ bh + ½ bh✓
= ½ (1,53)(15)✓ + ½ (1,53)(15)✓
= 11,48 + 11,48
= 22,96 m ✓ (7)

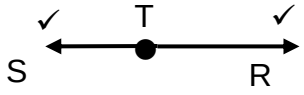
QUESTION 4 / *VRAAG 4*

4.2 Accept: Impulse is the change in momentum (2 or 0)
Aanvaar: Impuls is die verandering in momentum (2 of 0) (2)

QUESTION 7 / *VRAAG 7*

7.3 If electric field pattern for two equal opposite charges are drawn
I*ndien elektrieseveldpatroon vir twee gelyke teenoorgestelde ladings geteken is:* Max/*Maks* $1/3$
If electric pattern for two unequal opposite charges are drawn
Indien elektrieseveldpatroon vir twee ongelyke teenoorgestelde ladings geteken is: Max/*Maks* $2/3$

7.4 Accept / *Aanvaar*



(2)

QUESTION 8 / *VRAAG 8*

8.2.4 Accept: rheostat / Open switch
Aanvaar: reostaat / oop skakelar

QUESTION 9 / *VRAAG 9*

9.4.1 Accept/*Aanvaar*

$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ where V_{max} is the maximum (peak) voltage of the AC✓✓

$V_{wgk} = \frac{V_{maks}}{\sqrt{2}}$ *where V_{maks} is the maksimum (piek) spanning van die WS*