basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS
SENIORSERTIFIKAAT-EKSAMEN

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

2018

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE: 150*

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

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QUESTION 1/*VRAAG 1*

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

[20]

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QUESTION 2/*VRAAG 2*

2.1 The rate of change of velocity. ✓✓
Die tempo van verandering van snelheid.

Accept/*Aanvaar*
Change in velocity per unit time
Verandering in snelheid per eenheidstyd (2)

NOTE:/*LET WEL*
If any one of the underlined key words in the **correct context** is omitted deduct 1 mark.
*Indien enige van die onderstreepte woorde in die **korrekte konteks** uitgelaat is trek 1 punt af.*

2.2

OPTION 1/*OPSIE 1*
$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓
$0,5 = (0)(3) + \frac{1}{2}(a)(3^2)$ ✓
$a = 0,11\ m\cdot s^{-2}$ ✓ (3)

OPTION 2/*OPSIE 2*
$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓
$0,5 = \left(\frac{0 + v_f}{2}\right)(3)$
$v_f = 0,333\ m\cdot s^{-1}$

1 mark for either of the two/
1 punt vir enige van die twee

$v_f = v_i + a\Delta t$
$0,33 = 0 + a(3)$ ✓
$a = 0,11\ m\cdot s^{-2}$ ✓ (3)

OPTION 3/*OPSIE 3*
$v_f = v_i + a\Delta t$
$= 0 + 3a$
$v_f = 3a$……..(i)

$v_f^2 = v_i^2 + 2a\Delta y$
$= 0^2 + 2a(0,5)$
$v_f = \sqrt{a}$ ……(ii)

1 mark for either of the two/
1 punt vir enige van die twee

$9a^2 = a$ ✓
$\therefore a = 0,11\ m\cdot s^{-2}$ ✓ (3)

2.3 **POSITIVE MARKING FROM 2.2 / *POSITIEWE NASIEN VANAF 2.2***
OPTION 1/*OPSIE 1*
For the 3 kg mass/*vir die 3 kg massa*:
$F_{net} = ma$
$(mg - T)/(mg + T) = ma$ } ✓
$(3)(9,8) - T = (3)(0,11)$ ✓
$T = 29,07$ N ✓ (3)

OPTION 2/*OPSIE 2*

For the 3 kg mass/*vir die 3 kg massa*:

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

$$0,5 = \left(\frac{0 + v_f}{2}\right)(3)$$

$v_f = 0,333\ m\cdot s^{-1}$

OR/*OF*

POSITIVE MARKING FROM 2.2/*POSITIEWE NASIEN VANAF 2.2*

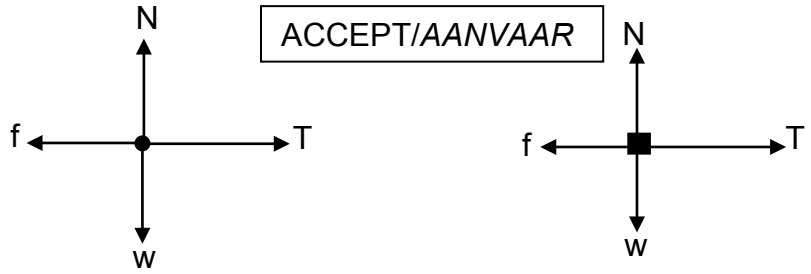
$v_f = v_i + a\Delta t$
$= 0 + (0,11)(3)$
$= 0,33\ m\cdot s^{-1}$

$W_{net} = \Delta E_K$ ✓
$W_w + W_T = ½\ mv_f^2 - ½\ mv_i^2$
$mg\Delta x\cos\theta + T\Delta x\cos\theta = ½\ mv_f^2 - ½\ mv_i^2$
$(3)(9,8)(0,5)\cos0^o + T(0,5)\cos180^o = ½\ (3)(0,33^2 - 0^2)$ ✓
$14,7 - 0,5T = -0,16$
$T = 29,72\ N$ ✓ (3)

OPTION 3/*OPSIE 3*

$W_{nc} = \Delta E_k + \Delta E_p$ ✓
$T\Delta x\cos180^0 = ½\ mv_f^2 - ½\ mv_i^2 + mgh_f - mgh_i$
$T(0,5)\cos180^o = ½\ (3)(0)^2 - ½\ (3)(0,33)^2 + (3)(9,8)(0) - (3)(9,8)(0,5)$ ✓
$T = 29,72\ N$ ✓ (3)

2.4



Accepted labels/*Aanvaarde benoemings*		
w	F_g / F_w / weight / mg / gravitational force *F_g / F_w / gewig / mg / gravitasiekrag*	✓
f	Friction/ F_f / f_k / 27 N/ *wrywing* / *F_w*	✓
N	Normal (force) / F_{normaL} / F_N / $F_{normaal}$ /$F_{reaction}$ / F_{reasie}	✓
T	F_T/tension/spanning	✓

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 force(s) do not make contact with body / *Indien krag(te) nie met die voorwerp kontak maak nie:* Max/*Maks:* $^3/_4$

(4)

2.5

POSITIVE MARKING FROM 2.2 AND 2.3/*POSITIEWE NASIEN VANAF 2.2 EN 2.3*	
For/ *Vir* P F_{net} = ma T- f = ma } ✓ 29,07 - 27 = m(0,11) ✓ m = 18,82 kg ✓ (Range: 18,60 – 18,82)	**OR/*OF*** For/ *Vir* P F_{net} = ma T- f = ma } ✓ 29,72 - 27 = m(0,11) ✓ m = 24,73 kg ✓

(3)

[15]

QUESTION 3/*VRAAG 3*

3.1 Motion under the influence of gravity/weight/gravitational force only. ✓✓
Beweging slegs onder die invloed van gravitasie/gewig/gravitasiekrag.

OR/*OF*
Motion in which the only force considered is gravitational. ✓✓
Beweging waar die enigste krag wat in ag geneem word, gravitasie is. (2)

NOTE:/*LET WEL*
If ONLY is omitted minus 1 mark.
Indien SLEGS uitgelaat is, trek 1 punt af.

3.2

OPTION 1/*OPSIE 1*

UPWARDS AS POSITIVE/*OPWAARTS AS POSITIEF*

$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓
$= \frac{(0)(1) + \frac{1}{2}(-9,8)(1^2)}{}$ ✓
$= -4,9$ m
Height/*hoogte* = $2\Delta y$
$= (2)(4,9)$
$= 9,8$ m ✓

DOWNWARDS AS POSITIVE/*AFWAARTS AS POSITIEF*

$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓
$= \frac{(0)(1) + \frac{1}{2}(9,8)(1^2)}{}$ ✓
$= 4,9$ m
Height/*hoogte* = $2\Delta y$
$= (2)(4,9)$
$= 9,8$ m ✓

OPTION 2/*OPSIE 2*

UPWARD POSITIVE/*OPWAARTS POSITIEF*	**DOWNWARD POSITIVE/*AFWAARTS POSITIEF***
$v_f = v_i + a\Delta t$ $= 0 + (-9,8)(1)$ $= -9,8\ m\cdot s^{-1}$	$v_f = v_i + a\Delta t$ $= 0 + (9,8)(1)$ $= 9,8\ m\cdot s^{-1}$
$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $= \left(\frac{0 + (-9,8)}{2}\right)(1)$ ✓ $= -4,9$ m	$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $= \left(\frac{0 + (9,8)}{2}\right)(1)$ ✓ $= 4,9$ m
Height/*hoogte* = $(2)(4,9)$ $= 9,8$ m ✓	Height/*hoogte* = $(2)(4,9)$ $= 9,8$ m ✓

OPTION 3/*OPSIE 3*

UPWARD POSITIVE/*OPWAARTS POSITIEF*	**DOWNWARD POSITIVE/*AFWAARTS POSITIEF***
$v_f = v_i + a\Delta t$ $= 0 + (-9,8)(1)$ $= -9,8\ m\cdot s^{-1}$ $v_f^2 = v_i^2 + 2a\Delta y$✓ $(-9,8)^2 = 0 + (2)(-9,8)\Delta y$ ✓ $\Delta y = -4,9\ m$ Height/*hoogte* $= 2\Delta y$ $= (2)(4,9)$ Height/*hoogte* $= 9,8\ m$✓	$v_f = v_i + a\Delta t$ $= 0 + (9,8)(1)$ $= 9,8\ m\cdot s^{-1}$ $v_f^2 = v_i^2 + 2a\Delta y$✓ $(9,8)^2 = 0 + (2)(9,8)\Delta y$ ✓ $\Delta y = 4,9\ m$ Height/*hoogte* $= 2\Delta y$ $= (2)(4,9)$ Height/*hoogte* $= 9,8\ m$✓

OPTION 4/*OPSIE 4*

UPWARD POSITIVE/*OPWAARTS POSITIEF*	**DOWNWARD POSITIVE/*AFWAARTS POSITIEF***
$v_f = v_i + a\Delta t$ $= 0 + -9,8(1)$ $v_f = -9,8\ m\cdot s^{-1}$	$v_f = v_i + a\Delta t$ $= 0 + 9,8(1)$ $= 9,8\ m\cdot s^{-1}$

$E_{(mech/meg)Top/Bo} = E_{(mech/meg\ at/by\ B)}$ ✓
$(E_p + E_k)_{Top} = (E_p + E_k)_{at\ B}$
$(mgh + ½ mv^2)_{Top/Bo} = (mgh + ½ mv^2)_{at/by\ B}$
$(9,8)(h) + 0 = (9,8)\ ½\ (h) + (½)(9,8^2)$ ✓
$h = 9,8\ m$ ✓

OPTION 5/*OPSIE 5*

UPWARD POSITIVE/*OPWAARTS POSITIEF*	**DOWNWARD POSITIVE/*AFWAARTS POSITIEF***
$v_f = v_i + a\Delta t$ $= 0 + -9,8(1)$ $v_f = -9,8\ m\cdot s^{-1}$	$v_f = v_i + a\Delta t$ $= 0 + 9,8(1)$ $= 9,8\ m\cdot s^{-1}$

$W_{net} = \Delta K$✓
$mg\Delta x\cos\theta = ½ mv_f^2 - ½ mv_i^2$
$(9,8)\ ½h\ \cos 0^o = ½\ (9,8^2 - 0)$ ✓
$h = 9,8\ m$✓

OPTION 6/*OPSIE 6*

UPWARD POSITIVE/*OPWAARTS POSITIEF*	**DOWNWARD POSITIVE/*AFWAARTS POSITIEF***
$v_f = v_i + a\Delta t$ $= 0 + -9,8(1)$ $v_f = -9,8\ m\cdot s^{-1}$	$v_f = v_i + a\Delta t$ $= 0 + 9,8(1)$ $v_f = 9,8\ m\cdot s^{-1}$

$W_{nc} = \Delta K + \Delta U$✓
$0 = (½mv_f^2 - ½ mv_i^2) + (mg½h - mgh)$
$(9,8)(½h) = (½)(9,8^2 - 0)$ ✓
$h = 9,8\ m$✓ (3)

3.3

OPTION 1/*OPSIE 1*

UPWARDS AS POSITIVE/*OPWAARTS AS POSITIEF*

$v_f^2 = v_i^2 + 2a\Delta y$✓
$= 0 + (2)(-9,8)(-9,8)$ ✓
$v_f = 13,86\ m\cdot s^{-1}$ ✓

DOWNWARDS AS POSITIVE/*AFWAARTS AS POSITIEF*

$v_f^2 = v_i^2 + 2a\Delta y$✓
$= 0 + (2)(9,8)(9,8)$ ✓
$v_f = 13,86\ m\cdot s^{-1}$ ✓

OR/*OF*

FROM POINT B/ *VANAF PUNT B*

UPWARDS AS POSITIVE/*OPWAARTS AS POSITIEF*

$v_f^2 = v_i^2 + 2a\Delta y$✓
$= (-9,8)^2 + (2)(-9,8)(-4,9)$ ✓
$v_f = -13,86\ m\cdot s^{-1}$
Magnitude $= 13,86 m\cdot s^{-1}$✓

DOWNWARDS AS POSITIVE/*AFWAARTS AS POSITIEF*

$v_f^2 = v_i^2 + 2a\Delta y$✓
$= (9,8)^2 + (2)(9,8)(4,9)$ ✓
$v_f = 13,86\ m\cdot s^{-1}$ ✓ (3)

OPTION 2/*OPSIE 2*

$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$
$-9,8 = 0 + \frac{1}{2}(-9,8)\Delta t^2$
$\Delta t = 1,41$ s

1 mark for either of the two/
1 punt vir enige van die twee

$v_f = v_i + a\Delta t$
$= 0 + (-9,8)(1,41)$ ✓
$= -13,82\ m\cdot s^{-1}$
Magnitude $= 13,82\ m\cdot s^{-1}$ ✓ (3)

3.4

OPTION 1/*OPSIE 1*

POSITIVE MARKING FROM 3.3/*POSITIEWE NASIEN VANAF 3.3*

UPWARDS AS POSITIVE/*OPWAARTS AS POSITIEF*

$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0 = v_i^2 + (2)(-9,8)(4,9)$ ✓
$v_i = 9,8\ m\cdot s^{-1}$

$F_{net}\Delta t = m\Delta v$
$F_{net}\Delta t = m(v_f - v_i)$ ✓

1 mark for any
1 punt vir enige een

$F_{net}(0,2)$ ✓ $= 0,4[9,8 - (-13,86)]$ ✓
$F_{net} = 47,32$ N✓

UPWARDS AS POSITIVE/*OPWAARTS AS POSITIEF*

$v_f^2 = v_i^2 + 2a\Delta y$✓
$0 = v_i^2 + (2)(9,8)(-4,9)$ ✓
$v_i = -9,8\ m\cdot s^{-1}$

$F_{net}\Delta t = m\Delta v$
$F_{net}\Delta t = m(v_f - v_i)$ ✓

1 mark for any
1 punt vir enige een

$F_{net}(0,2)$ ✓$= 0,4[-9,8 - (13,86)]$✓
$F_{net} = -47,32$ N
$F_{net} = 47,32$ N✓

If calculation of $9,8\ m\cdot s^{-1}$ is not shown and it is substituted **correctly** award 1 mark/*Indien berekening van 9,8 $m\cdot s^{-1}$ nie getoon is nie en dit is **korrek** vervang ken 1 punt toe*

OPTION 2/*OPSIE 2*
POSITIVE MARKING FROM 3.3/ *POSITIEWE NASIEN VANAF 3.3*

$E_{mech\ top/bo} = E_{(mech\ ground/meg\ grond)}$
$(E_p + E_k)_{top} = (E_p + E_k)_{bottom/onder}$
$(mgh + ½\ mv^2)_{top/bo} = (mgh + ½\ mv^2)_{bottom/onder}$ ✓

1 mark for any
1 punt vir enige een

$(0,4)(9,8)(4,9) + 0 = ½(0,4)v_f^2$ ✓
$v_i = 9,8\ m\cdot s^{-1}$

$F_{net}\Delta t = m\Delta v$
$F_{net}\Delta t = m(v_f - v_i)$ ✓

1 mark for any
1 punt vir enige een

$F_{net}(0,2)$ ✓ $= 0,4[9,8 - (-13,86)]$✓
$F_{net} = 47,32$ N✓

If calculation of $9,8\ m\cdot s^{-1}$ is not shown and it is substituted **correctly** award 1 mark/*Indien berekening van 9,8 $m\cdot s^{-1}$ nie getoon is nie en dit is **korrek** vervang ken 1 punt toe*

(6)

OPTION 3/*OPSIE 3*
POSITIVE MARKING FROM 3.3/ *POSITIEWE NASIEN VANAF 3.3*

$v_f = v_i + a\Delta t$ ✓
$9,8 = -13,86$ ✓$+ a(0,2)$ ✓
$a = 118,3\ m\cdot s^{-2}$

$F_{net} = ma$ ✓
$= (0,4)(118,3)$ ✓
$= 47,32$ N ✓

(6)
[14]

QUESTION 4/*VRAAG 4*

4.1

$E_{(\text{mech top/}meg\ bo)} = E_{(\text{mech bottom/}meg\ onder)}$
$(E_p + E_k)_{top/bo} = (E_p + E_k)_{bottom/onder}$
$(mgh + ½ mv^2)_{top/bo} = (mgh + ½ mv^2)_{bottom/onder}$
$\underline{(1,5)(9,8)(2) + 0}$ ✓ $= \underline{0 + ½ (1,5)v^2}$ ✓
$v = 6,26\ m\cdot s^{-1}$ ✓

1 mark for any
1 punt vir enigeen

(4)

4.2 In a/an closed/isolated✓ system, the total✓ linear momentum is conserved.
/*In 'n geïsoleerde/geslote sisteem bly die totale liniêre momentum behoue.* (2)

4.3 **POSITIVE MARKING FROM 4.1/*POSITIEWE NASIEN VANAF 4.1***

$\Sigma p_i = \Sigma p_f$
$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$
$m_1v_{1i} + m_2v_{2i} = (m_1 + m_2)v$
$\underline{(1,5)(6,26) + 0}$ ✓ $= \underline{(1,5 + 2)v_f}$ ✓
$v_f = 2,68\ m\cdot s^{-1}$ ✓

1 mark for any
1 punt vir enige een

(4)

4.4 **POSITIVE MARKING FROM 4.3/*POSITIEWE* NASIEN VANAF 4.3**

OPTION 1/*OPSIE 1*
$\Delta x = v\Delta t$ ✓
$= (2,68)(3)$ ✓
$= 8,04\ m$ ✓

OPTION 2/OPSIE 2
$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓
$= \left(\frac{(2,68 + 2,68)}{2}\right)(3)$ ✓
$= 8,04\ m$

OPTION 3/*OPSIE 3*
$\Delta x = v_i\Delta t + ½ a\Delta t^2$ ✓
$= (2,68)(3) + ½ (0)(3)^2$ ✓
$= 8,04\ m$ ✓ (Range 8,04 – 8,05) (2)

[13]

QUESTION 5/*VRAAG 5*

5.1

Accepted labels/*Aanvaarde benoemings*	
w	F_g/F_w/weight/mg/gravitational force/N/19,6 N *F_g/F_w/gewig/mg/gravitasiekrag/19,6* N
T	Tension/F_T/ F_A/ *Spanning*

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* $\frac{1}{2}$
- If force(s) do not make contact with body/*Indien krag(te) nie met die voorwerp kontak maak nie*: Max/*Maks*: $\frac{1}{2}$

(2)

5.2 Tension✓/*Spanning*

Accept/*Aanvaar*
$F_{applied}$ /$F_{toegepas}$ (1)

5.3

$W = F\Delta x\cos\theta$
$W_w = mg\Delta x\cos\theta$ ✓

1 mark for any of these/*1 punt vir enige van hierdie*

$= \underline{75(9,8)\ (12)\cos 180^{o}}$✓
$= -\ 8\ 820$ J✓

OR/*OF*
$W_w = -\Delta E_p$ ✓
$= -(mgh - 0)$
$= -(75)(9,8)(12)$ ✓
$= -8\ 820$ J✓

(3)

5.4 The work done on an object by a net force is equal to the change in the object's kinetic energy. ✓✓
Die arbeid verrig op 'n voorwerp deur 'n netto krag is gelyk aan die verandering in die voorwerp se kinetiese energie.

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

NOTE:/*LET WEL*
If any one of the underlined key words in the **correct context** is omitted deduct 1 mark.
*Indien enige van die onderstreepte woorde in die **korrekte konteks** uitgelaat is trek 1 punt af.*

5.5 **POSITIVE MARKING FROM 5.3/*POSITIEWE NASIEN VANAF 5.3***

OPTION 1/*OPSIE 1*

$W_{net} = \Delta K$
$F_{net}\Delta x\cos\theta = (½ mv_f^2 - ½ mv_i^2)$ ✓

1 mark for any of these
1 punt vir enige van hierdie

$(75)(0,65)(12)$ ✓$\cos 0^o$✓ = ½(75)(v_f^2 - 0) ✓
v_f = 3,95 m·s^{-1} (3,949 m·s^{-1}) ✓

POSITIVE MARKING FROM 5.2/ *POSITIEWE NASIEN VANAF 5.2*
OPTION 2/OPSIE 2

$W_{net} = \Delta K$
$W_{nc/nk} = \Delta K + \Delta U$ ✓
$W_T + W_g = \Delta K$

1 mark for any of these/*1 punt vir enige van hierdie*

$W_{nc/nk} = (½ mv_f^2 - ½ mv_i^2) + (mgh_f - mgh_i)$
9405 ✓= (½ (75)v_f^2 -0) ✓+ (75)(9,8)(12 -0)✓
v_f = 3,95 m·s^{-1}✓

T – mg = ma
T – 75(9,8) = 75(0,65)✓
T = 783,75 N
W_T = 783,75 (12) $\cos 0^o$✓
= 9405 J
9405 – (8820) = ½ (75)(v_f^2 – 0)✓
v_f = 3,95 m·s^{-1} (3,949 m·s^{-1})✓

(5)
[13]

QUESTION 6/*VRAAG 6*

6.1 It is the (apparent) change in frequency (or pitch) of the sound (detected by a listener) ✓because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓
Dit is 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 van klankvoortplanting het.
OR/OF
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)

NOTE:/*LET WEL*
If any one of the underlined key words in the **correct context** is omitted deduct 1 mark.
*Indien enige van die onderstreepte woorde in die **korrekte konteks** uitgelaat is trek 1 punt af.*

6.2

OPTION1/*OPSIE1*

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

$(5100) = \frac{340}{340 - 240} f_s$ ✓✓✓

f_s = 1 500 Hz

$v = f\lambda$ ✓

$340 = (1\,500)\lambda$ ✓

λ = 0,23 m ✓ (7)

OPTION 2/*OPSIE 2*

$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓ **OR/*OF*** $f_L = \frac{v}{v - v_s}\left(\frac{v}{\lambda_s}\right)$

$(5100) = \left(\frac{340}{340 - 240}\right)\left(\frac{340}{\lambda_s}\right)$ ✓✓✓✓

λ= 0,23 m ✓ (7)

6.3 Greater than ✓/*Groter as* (1)
[10]

QUESTION 7/*VRAAG 7*

7.1 The two forces must be equal in magnitude ✓ but in opposite directions ✓/*Die twee kragte moet gelyke groottes hê maar in teenoorgestelde rigtings werk*.

OR/*OF*
The force experienced by Q due to P, must be equal in magnitude ✓but opposite in direction to the force experienced by Q due to V.✓/*Die krag wat Q agv P ondervind moet gelyk in grootte maar teenoorgesteld in rigting wees met die krag wat Q agv V ondervind* (2)

7.2 The magnitude of the electrostatic force exerted by one point charge on another point charge <u>is directly proportional to the product of the (magnitudes of the) charges</u>✓ and <u>inversely proportional to the square of the distance (r) between them.</u> ✓
Die grootte van die elektrostatiese krag uitgeoefen deur een puntlading op 'n ander puntlading is direk eweredig aan die produk van die (groottes van die) ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle.
OR/*OF*
The force of attraction or repulsion between two point charges is <u>directly proportional to the product of the charges</u> ✓ and <u>inversely proportional to the square of the distance between them</u>. ✓
Die aantrekkings- of afstotingskrag tussen twee puntladings is direk eweredig aan die produk van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle (2)

NOTE:/*LET WEL*
If mass is mentioned instead of charges. $^{0}/_{2}$
Indien massa in plaas van ladings genoem word. $^{0}/_{2}$

NOTE:/*LET WEL*
If any one of the underlined key words in the **correct context** is omitted deduct 1 mark.
*Indien enige van die onderstreepte woorde in die **korrekte konteks** uitgelaat is trek 1 punt af.*

7.3

OPTION 1/OPSIE 1

$F = k\frac{Q_1Q_2}{r^2}$ ✓

$F_{PQ} = \frac{(9\times10^9)(Q)(5\times10^{-6})}{(x)^2}$ ✓

$= \frac{45\times10^3Q}{x^2}$

$F_{VQ} = \frac{(9\times10^9)(Q)(7\times10^{-6})}{(1-x)^2}$ ✓

$= \frac{63\times10^3Q}{(1-x)^2}$

($F_{net} = F_{PQ} - F_{VQ} = 0$)

$\frac{45\times10^3Q}{x^2} = \frac{63\times10^3Q}{(1-x)^2}$ ✓ (equating two equations)

$6{,}708(1 - x) = 7{,}937x$

$x = 0{,}458$ m

x is 0,46 m✓ (away from P/*weg van P)* (5)

OPTION 2/*OPSIE 2*

$E = \frac{kQ_p}{r^2}$ ✓

$E_{net} = \frac{kQ_p}{r^2} - \frac{kQ_v}{r^2}$

($E_{net} = E_p – E_v = 0$)

$0 = \frac{(9\times10^9)(5\times10^{-6})}{x^2}$ ✓ $- \frac{(9\times10^9)(7\times10^{-6})}{(1-x)^2}$ ✓

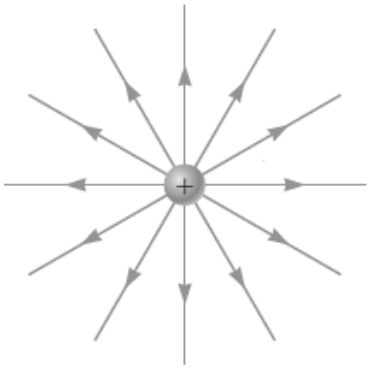
$\frac{(9\times10^9)(5\times10^{-6})}{x^2} = \frac{(9\times10^9)(7\times10^{-6})}{(1-x)^2}$ ✓ (equating two equations)

$\therefore x = 0{,}46$ m ✓(away from P/*weg van P)* (5)

[9]

QUESTION 8/*VRAAG 8*

8.1 (2)



Criteria for sketch/*Kriteria vir skets*	Marks/ *Punte*
Lines are directed away from the charge / *Lyne is weg vanaf die lading*	✓
Lines are radial, start on sphere and do not cross./*Lyne is radiaal, begin op die sfeer en kruis nie*	✓

8.2

$Q = ne$ ✓
$= (8 \times 10^{13})(-1,6 \times 10^{-19})$ ✓ or/*of* $(8 \times 10^{13})(1,6 \times 10^{-19})$
$= -12,8 \times 10^{-6}$
Net charge on the sphere $= (+ 6 \times 10^{-6}) + (-12,8 \times 10^{-6})$ ✓
$Q_{net} = - 6,8 \times 10^{-6}$ C
$E = \frac{kQ}{r^2}$ ✓
$E = \frac{(9 \times 10^{9})(6,8 \times 10^{-6})}{(0,5)^2}$ ✓
$= 2,45 \times 10^{5}$ N·C^{-1} ✓ towards sphere ✓/*na die sfeer* (7)

[9]

QUESTION 9/*VRAAG 9*

9.1.1 The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature.
Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier by konstate temperatuur.

OR/*OF*
The ratio of potential difference across a conductor to the current in the conductor is constant, provided the temperature remains constant.
Die verhouding van potensiaalverskil oor die geleier tot stroom in die geleier is konstant indien die temperatuur konstant bly. (2)

NOTE:/LET WEL
If any one of the underlined key words in the **correct context** is omitted deduct 1 mark.
*Indien enige van die onderstreepte woorde in die **korrekte konteks** uitgelaat is trek 1 punt af.*

9.1.2 $V_1 = IR$ ✓
$= (0,6)(4)$ ✓
$= 2,4$ V ✓ (3)

9.1.3

POSITIVE MARKING FROM 9.1.2/ *POSITIEWE NASIEN VANAF 9.1.2*	**OR/*OF***	**OR/*OF***
$I_{6\Omega} = \frac{V}{R}$ $= \frac{2,4}{6}$ ✓ $= 0,4$ A✓	$\frac{6}{10}(I) = 0,6$ ✓ $I = 1$ A $I_{6\Omega} = 0,4$ A✓	$V_{4\Omega} = V_{6\Omega}$ $I_{4\Omega}R_1 = I_{6\Omega}R_2$ $\underline{(0,6)(4) = I_{6\Omega}(6)}$ ✓ $I_{6\Omega} = 0,4$ A ✓

(2)

9.1.4

POSITIVE MARKING FROM 9.1.3 /*POSITIEWE NASIEN VANAF 9.1.3*

$V_2 = IR$
$= (0,4 + 0,6)(5,8)$ ✓
$= 5,8$ V ✓

(2)

9.1.5

POSITIVE MARKING FROM 9.1.4 AND 9.1.2/*POSITIEWE NASIEN VANAF 9.1.4 EN 9.1.2*

<u>OPTION 1/ *OPSIE 1*</u>

$V_{ext} = (5,8 + 2,4)$ ✓
$= 8,2$ V
$V_{int} = Ir$
$= (1)(0,8)$ ✓
$= 0,8$ V
Emf $= 0,8 + 8,2 = 9$ V✓

<u>OPTION 2/*OPSIE 2*</u>

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$
$= \frac{1}{6} + \frac{1}{4}$
$= \frac{5}{12}$
$R_p = 2,4\ \Omega$
$R_{ext} = (2,4 + 5,8)$ ✓
$= 8,2\ \Omega$
Emf $= I(R + r)$
$= 1\ (8,2 + 0,8)$ ✓
$= 9$ V ✓

$R_{//} = \frac{R_1R_2}{R_1+R_2}$
$= \frac{(6)(4)}{(6+4)}$
$= 2,4\ \Omega$

(3)

9.1.6

POSITIVE MARKING FROM 9.1.5 AND 9.1.3/ *POSITIEWE NASIEN VANAF 9.1.5 EN 9.1.3*

$W = V I \Delta t$ ✓ $= (0,8)(1)\ (15)$ ✓ $= 12$ J ✓	$W = I^2R \Delta t$ ✓ $= (1)^2\ (0,8)(15)$ ✓ $= 12$ J✓	$W = \frac{V^2 \Delta t}{R}$ ✓ $= \frac{0,8^2\,(15)}{0,8}$ ✓ $= 12$ J ✓

(3)

9.2.1
$$R = \frac{V}{I}$$
$$= \frac{2,8}{0,7} \checkmark$$
$$= 4\ \Omega \checkmark$$ (2)

9.2.2 Increases ✓/*Neem toe*
Total resistance decreases, ✓ current/power increases✓, motor turns faster/
Totale weerstand neem af, stroom/drywing neem toe, motor draai vinniger (3)
[20]

QUESTION 10/*VRAAG 10*

10.1
10.1.1 Split ring / commutator ✓/*Spleetring/ kommutator* (1)

10.1.2 Anticlockwise ✓✓/*Antikloksgewys* (2)

10.1.3 Electrical energy ✓to mechanical(kinetic) energy ✓
Elektriese energie na meganiese (kinetiese) energie (2)

10.2
10.2.1 DC generator: split ring/commutator and AC generator has slip rings✓
GS-generator spleetringe/kommutator en WS-generator sleepringe

OR/*OF*
AC generator: slip ring and DC generator has split rings✓
WS-generator sleepringe en GS-generator spleetringe (1)

10.2.2
$$V_{rms} = \frac{V_{max}}{\sqrt{2}} \checkmark$$
$$= \frac{320}{\sqrt{2}} \checkmark$$
$$= 226,27\ V \checkmark$$ (3)

10.2.3
<u>OPTION 2/*OPSIE 12*</u>
$$I_{max} = \frac{V_{max}}{R}$$
$$= \frac{320}{35} \checkmark$$
$$= 9,14\ A$$
$$I_{rms} = \frac{I_{max}}{\sqrt{2}} \checkmark$$
$$= \frac{9,14}{\sqrt{2}} \checkmark$$
$$= 6,46\ A \checkmark$$

POSITIVE MARKING FROM 10.2.2/ *POSITIEWE NASIEN VANAF 10.2.2.2.*

OPTION 2/*OPSIE 2*

$$P_{average} = \frac{V_{rms}^2}{R}$$
$$= \frac{226,27^2}{35} \checkmark$$
$$= 1462,80 \text{ W}$$

$P_{average} = V_{rms}I_{rms}$ ✓ $1\,462,80 = (226,27)\, I_{rms}$ ✓ $I_{rms} = 6,46$ A ✓	$P_{average} = I^2_{rms}R$ ✓ $1\,462,80 = I^2_{rms}(35)$ ✓ $I_{rms} = 6,46$ A ✓

(4)

POSITIVE MARKING FROM 10.2.2/ *POSITIEWE NASIEN VANAF 10.2.2.2*

OPTION 1/*OPSIE 1*

$$I_{rms} = \frac{V_{rms}}{R} \checkmark = \frac{226,27}{35} \checkmark = 6,46 \text{ A} \checkmark$$

(4)

[13]

QUESTION 11/*VRAAG 11*

11.1 Work function (of a metal) is the <u>minimum</u> energy needed to eject an electron from the metal/surface
Werksfunksie (van 'n metaal) is die <u>minimum</u> energie benodig om 'n elektron vanaf die metaal/oppervlak vry te stel. (2)

NOTE:/LET WEL
If any one of the underlined key words in the **correct context** is omitted deduct 1 mark.
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11.2 (Maximum) kinetic energy of the ejected electrons✓
(*<u>Maksimum)</u> kinetiese energie van die vrygestelde elektrone.* (1)

11.3 Wavelength/Frequency (of light) ✓
Golflengte/frekwensie (van lig) (1)

11.4 Silver✓/*Silwer*

- According to Photoelectric equation, $hf = W_o + ½ mv^2$
<u>(For a given constant frequency), as the work function increases the kinetic energy decreases.</u> ✓ <u>Silver has the smallest kinetic energy</u>✓ and hence the highest work function./
Volgens die fotoelektriese vergelyking $hf = W_o + ½ mv^2$:
(Vir 'n gegewe konstante frekwensie) as die werksfunksie verhoog, verlaag die kinetiese energie. Silwer het die kleinste kinetiese energie en dus die hoogste werksfunksie. (3)

11.5

$hf = W_o + \frac{1}{2}mv^2_{max/maks}$
$h\frac{c}{\lambda} = W_o + E_{k(max/maks)}$ ✓

$\frac{(6{,}63\times10^{-34})(3\times10^{8})}{2\times10^{-8}}$ ✓ $= W_o + 9{,}58\times10^{-18}$ ✓

$9{,}945\ x10^{-18} = W_o + 9{,}58\ x\ 10^{-18}$

$W_o = 3{,}65\ x\ 10^{-19}$ J ✓ (4)

11.6 REMAINS THE SAME✓/*BLY DIESELFDE*

Increasing intensity increases number of photons(per unit time) but frequency stays constant✓
the energy of the photon is the same ✓therefore the kinetic energy does not change.
Verhoging van die intensiteit verhoog die aantal fotone(per eenheidstyd) maar die frekwensie bly konstant
Foton se energie is dieselfde, daarom verander die kinetiese energie nie. (3)
[14]

TOTAL/*TOTAAL*: 150

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