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)

FEBRUARY/MARCH/*FEBRUARIE/MAART* 2016

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 16 pages.
Hierdie memorandum bestaan uit 16 bladsye.

QUESTION 1/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 D ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 A ✓✓ (2)

1.6 C✓✓ (2)

1.7 B✓✓ (2)

1.8 B ✓✓ (2)

1.9 C ✓✓ (2)

1.10 A ✓✓ (2)

[20]

QUESTION 2/*VRAAG 2*

2.1 **For the 5 kg mass/*Vir die 5 kg massa***:

2.1.1 $T - f = ma$
$T - \mu_k(mg) = ma$✓
$T - (0,4)(5)(9,8)$✓ $= 5a$✓……..(1)

NOTE/*LET WEL*:
1 mark for any of the 2 formulae
1 punt vir enige van die 2 formules

For the 20 kg mass/*Vir die 20 kg massa*
$mg - T = ma$
$\underline{20(9,8) - T = 20a}$✓…….(2)

$176,4 = 25a$ (1) + (2)
$\therefore a = 7,06\ (7,056)\ m\cdot s^{-2}$✓ (5)

ACCEPT/*AANVAAR* (4 marks/*4 punte*)
$F_{net} = ma$
$Mg - f = (M + m)\ a$✓
$[20(9,8) - (0,4)(5)(9,8)]$✓ $= 25a$✓
$\therefore a = 7,06\ m\cdot s^{-2}$✓ (4)

2.1.2 **POSITIVE MARKING FROM QUESTION 2.1.1**
POSITIEWE NASIEN VANAF VRAAG 2.1.1
OPTION 1/*OPSIE 1*
$v_f^{\ 2} = v_i^{\ 2} + 2a\Delta y$✓
$= 0$✓ $+ (2)(7,056)(6)$✓
$v_f = 9,20\ m\cdot s^{-1}$✓

POSITIVE MARKING FROM QUESTION 2.1.1
POSITIEWE NASIEN VANAF VRAAG 2.1.1
OPTION 2/*OPSIE 2*
The 5 kg mass travels as fast as the 20 kg mass
Die 5 kg massa beweeg net so vinnig soos die 20 kg massa
$W_{net} = \Delta K$✓
$\underline{(5)(7,056)(6\cos 0^{o})}$✓ $= \underline{\frac{1}{2}(5)(v_f^{\ 2} - 0)}$✓
$v_f = 9,20\ m\cdot s^{-1}$✓

OPTION 3/*OPSIE 3*
For the 20 kg mass/*Vir die 20 kg massa*
$W_{net} = \Delta K$✓
$Mg - T = Ma$
$(20)(9,8) - T = (20)(7,056)$✓
$T = 54,88\ N$

$W_{net} = \Delta K$
$W_T + W_g = \frac{1}{2}m(v_f^{\ 2} - v_i^{\ 2})$
$\underline{(54,88)(6)(\cos 180) + 20(9,8)(6)(\cos 0) = \frac{1}{2}(20)\ (v_f^{\ 2} - 0)}$✓
$v_f = 9,202\ m\cdot s^{-1}$✓

OPTION 4/*OPSIE 4*

$W_{nc} = \Delta K + \Delta U$✓

$W_{nc} = f_k \Delta x \cos\theta = \mu_k N \Delta x \cos\theta = \Delta U + \Delta K$

$(0,4)(5)(9,8)(6)\cos 180^{o}$✓ $= (20)(9,8)(0 - 6) + ½ (25)(v_f^{\ 2} - 0)$ ✓

$-117,6 = (20)(9,8)(-6) + ½(25)(v_f^{\ 2} - 0)$

$v_f = 9,202\ m \cdot s^{-1}$✓ (4)

2.1.3 6 m✓ (1)

2.2

2.2.1 Each body in the universe attracts every other body with a force that is directly proportional to the product of their masses ✓and inversely proportional to the square of the distance between their centres. ✓

Elke liggaam in die heelal trek elke ander liggaam aan met 'n krag wat direk eweredig is aan die produk van hul massas ✓ *en omgekeerd eweredig is aan die kwadraat van die afstand tussen hul middelpunte.* ✓ (2)

2.2.2 $F = \frac{Gm_1m_2}{r^2}$ ✓

On the mountain/*Op die berg*

$F_g = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(65)}{(6,38 \times 10^{6} + 6 \times 10^{3})^2}$ ✓ ✓

$= 627,2$ N

On the ground/*Op die grond*

$F_g = W = mg$

$= (65 \times 9,8)$✓

$= 637$ N

$F_g = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(65)}{(6,38 \times 10^{6})^2}$

$= 636,94$ N

Difference/*Verskil* = (637 – 627,2)✓

= 9,8 N✓ (6)

[18]

QUESTION 3/*VRAAG 3*

3.1

3.1.1

OPTION 1/*OPSIE 1*

Upwards positive/*Opwaarts positief*:

$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$v_f^2 = (-2)^2 + 2(-9,8)(-45)$ ✓
$v_f = 29,76\ m\cdot s^{-1}$ ✓

Downwards positive/*Afwaarts positief:*

$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$v_f^2 = (2)^2 + 2(9,8)(45)$ ✓
$v_f = 29,76\ m\cdot s^{-1}$ ✓ $(29,77\ m\cdot s^{-1})$

OPTION 2/*OPSIE 2*

Upwards positive/*Opwaarts positief*:

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
for either equation/*vir beide vergelykings*
$-45 = -2\Delta t + \frac{1}{2}(-9,8)\Delta t^2$
$-4,9\ \Delta t^2 - 2\Delta t + 45 = 0$
$4,9\ \Delta t^2 + 2\Delta t - 45 = 0$ ✓
$\Delta t = 2,83$

$v_f = v_i + a\ \Delta t$
$v_f = 0 + (-9,8)(2,83)$
$v_f = -29,73\ m\ s^{-1}$ ✓

Downwards positive/*Afwaarts positief:*

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
for either equation/*vir beide vergelykings*
$45 = 2\Delta t + \frac{1}{2}(9,8)\Delta t^2$
$4,9\ \Delta t^2 + 2\Delta t - 45 = 0$ ✓
$\Delta t = 2,83$
$v_f = v_i + a\ \Delta t$
$v_f = 0 + (9,8)(2,83)$
$v_f = 29,73\ m\ s^{-1}$ ✓

OPTION 3/*OPSIE 3*

Downwards positive/*Afwaarts positief:*

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
for either equation/*vir beide vergelykings*
$45 = 2\Delta t + \frac{1}{2}(9,8)\Delta t^2$
$4,9\ \Delta t^2 + 2\Delta t - 45 = 0$ ✓
$\Delta t = 2,83$

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

$$45 = \frac{2 + v_f}{2}\ 2,83$$

$v_f = 29,80 m\ s^{-1}$ ✓

Upwards positive/*Opwaarts positief*:

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
for either equation/*vir beide vergelykings*
$-45 = -2\Delta t + \frac{1}{2}(-9,8)\Delta t^2$
$-4,9\ \Delta t^2 - 2\Delta t + 45 = 0$
$4,9\ \Delta t^2 + 2\Delta t - 45 = 0$ ✓
$\Delta t = 2,83$

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

$$-45 = \frac{-2 + v_f}{2}\ 2,83$$ ✓

$v_f = -29,80 m\ s^{-1}$ ✓

OPTION 4/*OPSIE 4*

$E_{mech\ at\ top} = E_{mech\ at\ surface\ of\ water}$
$\frac{1}{2} mv_i^2 + mgh_i = \frac{1}{2} mv_f^2 + mgh_f$ ✓
$\frac{1}{2}(2)^2 + 9{,}8(45) = \frac{1}{2} v_f^2 + 0$ ✓
$v_f = 29{,}76\ m{\cdot}s^{-1}$ ✓

OPTION 5/OPSIE 5

$W_{net} =$ ***:*** ΔK ✓
$F_g \Delta h \cos\theta = \frac{1}{2} m (v_f^2 - v_i^2)$
$mg \Delta h \cos\theta = \frac{1}{2} m (v_f^2 - v_i^2)$
$9{,}8(45)\cos 0 = \frac{1}{2}(v_f^2 - 2^2)$ ✓
$v_f = 29{,}76\ m{\cdot}s^{-1}$ ✓ (3)

3.1.2

POSITIVE MARKING FROM 3.1
POSITIEWE NASIEN VANAF 3.1

OPTION 1/*OPSIE 1*

Upwards positive/*Opwaarts positief*:
The balls hit the water at the same instant./*Die balle tref die water gelyktydig*
$v_f = v_i + a\Delta t$ ✓
Ball/*Bal* **A**
$-29{,}76 = -2 + (-9{,}8)\ \Delta t$`
$\Delta t = 2{,}83$ s ✓
∴ for ball/*vir bal* **B**
$\Delta t_B = 2{,}83 - 1 = 1{,}83$ s
∴ for ball/*vir bal* **B**
$\Delta t_B = 2{,}83 - 1 = 1{,}83$ s ✓

POSITIVE MARKING FROM 3.1
POSITIEWE NASIEN VANAF 3.1

OPTION1/*OPSIE 1*

Downwards positive/*Afwaarts positief*
The balls hit the water at the same instant./*Die balle tref die water gelyktydig*
$v_f = v_i + a\Delta t$ ✓
Ball/*Bal* **A**
$29{,}76 = 2 + (9{,}8)\ \Delta t$`
$\Delta t = 2{,}83$ s ✓
∴ for ball/*vir bal* **B**
$\Delta t_B = 2{,}83 - 1 = 1{,}83$ s
∴ for ball/*vir bal* **B**
$\Delta t_B = 2{,}83 - 1 = 1{,}83$ s ✓

OPTION 2

Upwards positive/*Opwaarts positief*:
Ball/*Bal* A
$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓
$-45 = -2\Delta t + \frac{1}{2}(-9{,}8)\Delta t^2$
$-4{,}9\ \Delta t^2 - 2\Delta t + 45 = 0$
$4{,}9\ \Delta t^2 + 2\Delta t - 45 = 0$
$\Delta t = 2{,}83$ ✓
∴ for ball/*vir bal* **B**
$\Delta t_B = 2{,}83 - 1 = 1{,}83$ s ✓

Downwards positive/*Afwaarts positief:*
$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓
$45 = 2\Delta t + \frac{1}{2}(9{,}8)\Delta t^2$
$4{,}9\ \Delta t^2 + 2\Delta t - 45 = 0$
$\Delta t = 2{,}83$ ✓
∴ for ball/*vir bal* **B**
$\Delta t_B = 2{,}83 - 1 = 1{,}83$ s ✓

OPTION 3 **Downwards positive/*Afwaarts positief:*** Ball/*Bal* A $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $45 = \frac{2 + 29,76}{2}\ \Delta t$ $\Delta t = 2,83$ ✓ ∴ for ball/*vir bal* **B** $\Delta t_B = 2,83 - 1 = 1,83$ s ✓	**Upwards positive/*Opwaarts positief*:** Ball/*Bal* A $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $-45 = \frac{-2 - 29,76}{2}\ \Delta t$ $\Delta t = 2,83$ ✓ ∴ for ball/*vir bal* **B** $\Delta t_B = 2,83 - 1 = 1,83$ s ✓

(3)

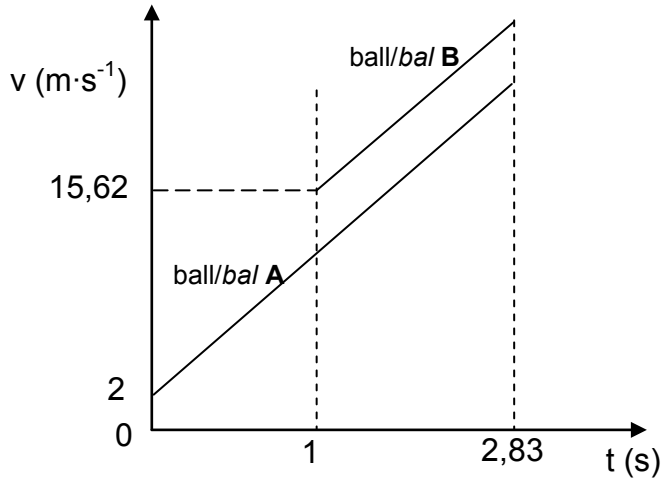
3.1.3

POSITIVE MARKING FROM 3.2/*POSITIEWE NASIEN VANAF 3.2* **Upwards positive/*Opwaarts positief*:** $\Delta t_B = 1.83$s ✓ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ -45 ✓ $= v_i\ (1,83) + \frac{1}{2}\ (-9.8)(1,83)^2$ ✓ $v_i = -15,62\ m{\cdot}s^{-1}$ ✓	**Downwards positive/*Afwaarts positief:*** $\Delta t_B = 1.83$s ✓ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ 45 ✓ $= v_i\ (1,83) + \frac{1}{2}\ (9.8)(1,83)^2$ ✓ $v_i = 15,62\ m{\cdot}s^{-1}$ ✓

(5)

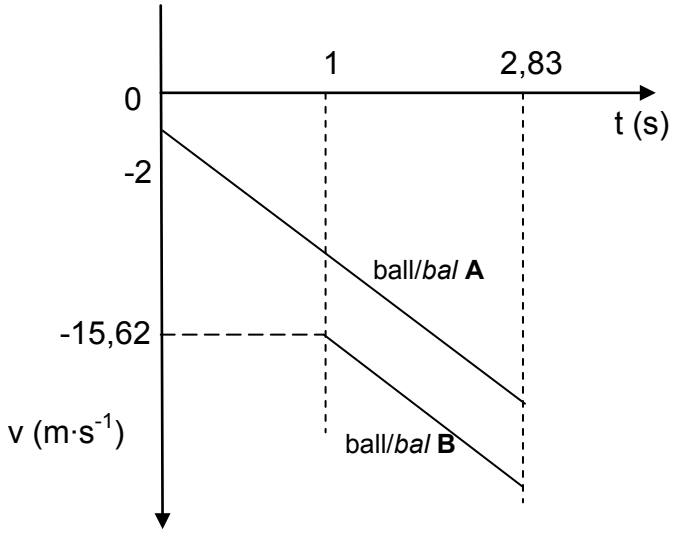
3.2

POSITIVE MARKING FROM 3.1.2; 3.1.3/*POSITIEWE NASIEN VANAF 3.1.2; 3.1.3*
CONSIDER MOTION DOWNWARD AS POSITIVE/*BESKOU BEWEGING AFWAARTS AS POSITIEF*



CRITERIA FOR MARKING/*KRITERIA VIR NASIEN*	
1 mark for each initial velocity shown/*1 punt vir elke beginsnelheid aangedui* (For/*Vir* A 2 $m{\cdot}s^{-1}$ for/*vir* B 15,62 $m{\cdot}s^{-1}$)	✓✓
Time of release of ball/*Tyd van vrystelling van bal* **B** t= 1s	✓
Time of flight for both balls must be indicated as same on time axis/*Vlugtyd van beide balle moet op dieselfde tydas aangetoon word* (2,83 s)	✓
Shape: Lines must be parallel or nearly so/*Vorm: Lyne moet parallel of amper parallel wees*	✓

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



CRITERIA FOR MARKING/*KRITERIA VIR NASIEN*	
1 mark for each initial velocity shown/*1 punt vir elke beginsnelheid aangedui* (For/*Vir* A -2 m·s^{-1} for/*vir* B -15,62 m·s^{-1})	✓✓
Time of release of ball/*Tyd van vrystelling van bal* **B** t= 1s	✓
Time of flight for both balls must be indicated as same on time axis/*Vlugtyd van beide balle moet op dieselfde tydas aangetoon word* (2,83 s)	✓
Shape: Lines must be parallel or nearly so/*Vorm: Lyne moet parallel of amper parallel wees*	✓

(5)
[16]

QUESTION 4/*VRAAG 4*

4.1 The total linear momentum in a closed system✓ remains constant./is conserved ✓/*Die totale lineêre momentum in 'n geslote stelsel✓ bly konstant/bly behoue.* ✓

OR/*OF*

In a closed/isolated system, the total momentum before a collision is equal to the total momentum after the collision./*In 'n geslote/geïsoleerde stelsel is die totale momentum voor 'n botsing gelyk aan die totale momentum na die botsing.* (2)

4.2

4.2.1 $\sum p_i = \sum p_f$✓

$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$

$(m_1 + m_2)v_i = m_1v_{1f} + m_2v_{2f}$

0✓ $= (0,4)v_{1f} + 0,6\,(4)$✓

$v_{1f} = -6\ m\cdot s^{-1}$

$= 6\ m\cdot s^{-1}$ to the left/*na links*✓

NOTE: Mark for final answer to be forfeited if direction is not given/ ***LET WEL:*** *Punt vir finale antwoord word verbeur indien rigting nie gegee word nie.*

(4)

4.2.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\Delta p = F_{net}\Delta t$✓ $[(0,6)(4) - 0]$✓ $= F_{net}\,(0,3)$✓ $F_{net} = 8$ N✓ **OR/*OF*** $m(v_f - v_i) = F_{net}\Delta t$✓ $0,6(4 - 0)$✓$= F_{net}(0,3)$✓ $F_{net} = 8$ N✓	$v_f = v_i + a\,\Delta t$ $4 = 0 + a(0,3)$ $a = 13,33\ m\cdot s^{-2}$ $F_{net} = ma$ $= 0,6(13,33)$ $F_{net} = 8$ N✓
OPTION 3/*OPSIE 3*	**OPTION 4/*OPSIE 4***
$\Delta p = F_{net}\Delta t$✓ $[(0,4)(6) - 0]$✓ $= F_{net}\,(0,3)$✓ $F_{net} = 8$ N✓ **OR/*OF*** $m(v_f - v_i) = F_{net}\Delta t$✓ $0,4(6 - 0)$✓$= F_{net}(0,3)$✓ $F_{net} = 8$ N✓	$v_f = v_i + a\,\Delta t$ $6 = 0 + a(0,3)$ $a = 20\ m\cdot s^{-2}$ $F_{net} = ma$ $= 0,4(20)$ $F_{net} = 8$ N✓

(4)

4.3 No/*Nee*✓ (1)

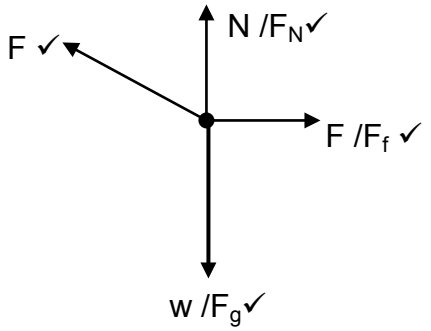
[11]

QUESTION 5/*VRAAG 5*

5.1 It is a ratio of two forces ✓ (hence units cancel out)./*Dit is 'n verhouding van twee kragte ✓ (dus word eenhede uitgekanseleer)* (1)

5.2 The net work done on an object is equal ✓to the change in kinetic energy of the object✓/*Die netto arbeid wat op 'n voorwerp verrig word, is gelyk ✓ aan die verandering in kinetiese energie van die voorwerp*✓ (2)

5.3



(4)

5.4 $F\sin 20^o + N = mg$✓
$N = mg - F\sin 20^o$

$W_{fk} = fk\Delta x \cos\theta = \mu_k N\Delta x \cos\theta$✓
$= \mu_k(mg - F\sin 20)(3)\cos\theta$
$= (0{,}2)[200(9{,}8) - F \sin 20](3)\cos 180^o$✓
$= (-1176 + 0{,}205\ F)$ J✓ (4)

5.5 $W_{tot} = [W_g] + W_f + W_F$ ✓
0 ✓ = [0] +[(-1176 + 0,205 F)] + [F (cos 20) (3) (cos 0)]✓
F = 388,88 N✓
NOTE: Do not penalise if value of W_g is not indicated/
LET WEL: *Moenie penaliseer indien die waarde van* W_g *nie aangedui word nie.* (4)
[15]

QUESTION 6/*VRAAG 6*

6.1 $v = f\lambda$ ✓
$= (222 \times 10^3)(1,5 \times 10^{-3})$✓
$= 333 \text{ m.s}^{-1}$ ✓ (3)

6.2
6.2.1 Towards the bat/*Na die vlermuis toe* ✓ (1)

6.2.2 **POSITIVE MARKING FROM QUESTION 6.1/*POSITIEWE NASIEN VANAF VRAAG 6.1***

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

$230,3 = \frac{333}{333 - v_s}(222)$✓✓✓

$76689,9 - 230,3\ v_s = 73\ 926$

$v = 12 \text{ m.s}^{-1}$ ✓ (towards bat/*na die vlermuis toe*)

Notes/*Notas*:
- Any other Doppler formula, e.g./*Enige ander Doppler-formule, bv.:*
  $f_L = \frac{v - v_L}{v - v_s}$ - Max./*Maks.* $\frac{3}{4}$
- Marking rule 1.5: No penalisation if zero substitutions are omitted./*Nasienreël 1.5: Geen penalisering indien nulvervangings uitgelaat is nie.*

(6)
[10]

QUESTION 7/*VRAAG 7*

7.1 The magnitude of the charges are equal✓/ The balls repel each other with the same/identical force or force of equal magnitude✓/*Die grootte van die ladings is gelyk*✓/*Die balle stoot mekaar af met dieselfde/identiese kragte of krag van dieselfde grootte.* ✓ (1)

7.2 The electrostatic force of attraction between two point charges is directly proportional to the product of the charges ✓and inversely proportional to the square of the distance between them. ✓/*Die elektrostatiese aantrekkingskrag tussen twee puntladings is direk eweredig aan die produk van die ladings*✓ *en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.*✓ (2)

7.3
7.3.1 $T\cos 20^o = w$✓
$= mg$
$= (0,1)(9,8)$✓ $= 0,98$ N
$\therefore T = 1,04$ N✓ (3)

7.3.2 **POSITIVE MARKING FROM 7.3/*POSITIEWE NASIEN VANAF 7.3***

$F_{electrostatic/elektrostaties} = T\sin 20^o$✓

$\frac{kQ_1Q_2}{r^2}$ ✓$= (1,04)\sin 20^o$

$\frac{kQ_1Q_2}{r^2} = 0,356$

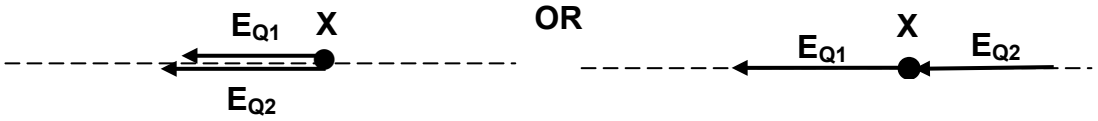
$\frac{(9\times10^9)(250\times10^{-9})(250\times10^{-9})}{r^2}$ ✓$= 0,356$✓

$\therefore r = 0,0397$ m ✓ (5)

[11]

QUESTION 8/*VRAAG 8*

8.1



Vectors E_{Q1} and E_{Q2} in the same direction✓✓/*Vektore E_{Q1} en E_{Q2} in dieselfde rigting*✓✓

Correct drawing of vectors E_{Q1} and E_{Q2}✓✓/*Korrekte tekening van vektore E_{Q1} en E_{Q2}*✓✓/

The fields due to the two charges add up because <u>they come from the same direction.</u> Hence the field cannot be zero./*Die velde as gevolg van die twee ladings word bymekaar getel omdat <u>hulle uit dieselfde rigting inwerk</u>. Die veld kan dus nie nul wees nie.* (4)

8.2 $E = k\frac{Q}{r^2}$ ✓

$E_{-2,5\mu C} = k\frac{Q}{r^2} = \frac{(9\times10^9)(2,5\times10^{-6})}{(0,3)^2}$✓$= 250\ 000$ N.C^{-1} to the left/*na links*

$E_{6\,\mu C} = k\frac{Q}{r^2} = \frac{(9\times10^9)(6\times10^{-6})}{(1,3)^2}$✓$=31\ 952,66$ N.C^{-1} to the left/*na links*

$E_P = E_{6\mu C} + E_{-2,5\mu C}$ ✓

$= 31\ 952,66 + 250\ 000$

$= 281\ 952,66$ N.C^{-1} ✓to the left/*na links* ✓ (6)

[10]

QUESTION 9/*VRAAG 9*

9.1

9.1.1 $V = IR$✓
$= (0,2)(4+8)$✓
$= 2,4\ V$✓ (3)

9.1.2 **POSITIVE MARKING FROM QUESTION 9.1.1/*POSITIEWE NASIEN VANAF VRAAG 9.1.1***

$V = IR$	OR
$2,4 = I_2(2)$ ✓	$I_2 = 6 \times 0,2$ ✓
$I_{2\Omega} = 1,2\ A$✓	$I_2 = 1,2\ A$✓
$I_T = I_2 + 0,2\ A$✓	$I_T = I_2 + 0,2$ ✓
$= 1,4\ A$✓	$= 1,4\ A$✓

(4)

9.1.3 **POSITIVE MARKING FROM QUESTION 9.1.2/*POSITIEWE NASIEN VANAF VRAAG 9.1.2***

OPTION 2/*OPSIE* 2	**OR/*OF***
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓	$R_P = \frac{R_1 R_2}{R_1 + R_2}$ ✓
$\frac{1}{R_p} = \frac{1}{12} + \frac{1}{2}$	$R_P = \frac{(12)(2)}{12+2}$
$R_P = 1,72\ \Omega$✓	$= 1,71\ \Omega$✓
$\varepsilon = I(R+r)$ ✓	$\varepsilon = I(R+r)$ ✓
$= 1,4(1,72+0,5)$ ✓	$= 1,4(1,71+0,5)$ ✓
$= 3,11\ V$✓	$= 3,09\ V$✓

OPTION 2/*OPSIE* 2
$V_{int} = Ir$✓
$=(1,4)(0,5)$
$= 0,7\ V$✓
$\varepsilon = V_{ext/eks} + V_{int}$✓
$= 2,4 + 0,7$✓
$= 3,1\ V$✓

(5)

9.2 Removing the 2 Ω resistor increases the total resistance of the circuit. ✓ Thus the <u>total current decreases, decreasing the V_{int} (V_{lost}).</u> ✓ Therefore the voltmeter reading increases. V✓/*Wanneer die 2 Ω-resistor verwyder word, verhoog dit die totale weerstand van die kring.* ✓ *Dus <u>verklein die totale stroom, wat die V_{int} ($V_{verloor}$) verlaag.</u>* ✓ *Dus verhoog die voltmeterlesing V.* ✓ (3)

[15]

QUESTION 10/*VRAAG 10*

10.1

10.1.1 North pole/*Noordpool*✓ (1)

10.1.2 Q to P✓ (1)

10.2

10.2.1

OPTION 1/*OPSIE 1*

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

$I_{rms} = \frac{8}{\sqrt{2}}$ ✓

= 5,66 A

$V_{rms} = I_{rms} R$✓

220 = (5,66)R✓

R = 38,87 Ω✓

(5)

OPTION 2/*OPSIE 2*

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

$220 = \frac{V_{max}}{\sqrt{2}}$ ✓

V_{max} = 311,12 V

$V_{max} = I_{max} R$✓

311,12 = (8)R✓

R = 38,89 Ω✓

10.2.2 **POSITIVE MARKING FROM QUESTION 10.4.1/*POSITIEWE NASIEN VANAF VRAAG 10.4.1***

OPTION 1/*OPSIE 1*

$P_{average} = V_{rms} I_{rms}$✓

= (220)(5,66)✓

= 1 245,2 W

$P = \frac{W}{\Delta t}$ ✓

$1245,2 = \frac{W}{7200}$ ✓

W = 8 965 440 J ✓

$P_{average} = I_{rms}^2 R$

$= (5,66)^2(38,89)$

= 1245,86

E = Pt

= (1245,86)(7200)

= 8970192J

(5)

OPTION 2/*OPSIE 2*

$P_{average} = I_{rms}^2 R$ ✓

$= (5,66)^2(38,87)$ ✓

$= 1\ 245,22$ W ✓

$1245,22 = \frac{W}{7200}$ ✓

W = 8 965 584 J ✓

OPTION 3/*OPSIE 3*

$P_{average} = \frac{V_{rms}^2}{R}$ ✓

$P_{average} = \frac{220^2}{38,87}$ ✓

= 1245,18 W

$P = \frac{W}{\Delta t}$ ✓ ✓

$1245,18 = \frac{W}{7200}$ ✓

W = 8 965 296 J ✓

$P_{average} = \frac{V_{rms}^2}{R}$

$P_{average} = \frac{220^2}{38,89}$

= 1244,54 W

E = Pt
= (1244,54)(7200)
= 8960688 J

OPTION 3/*OPSIE 3*

$W = I_{rms}^2 R\Delta t$

$= \left(\frac{I_{max}}{\sqrt{2}}\right)^2 R\Delta t$

$= \left(\frac{8}{\sqrt{2}}\right)^2 (38,87)(7200)$

W = 8 965 296 J ✓ (5)

[12]

QUESTION 11/*VRAAG 11*

11.1 It is the minimum energy that an electron in the metal needs to be emitted from the metal surface. ✓/*Dit is die minimum energie wat 'n elektron in die metaal benodig om elektrone uit die metaaloppervlak vry te stel.* ✓ (2)

11.2 Frequency/Intensity ✓/*Frekwensie/Intensiteit* (1)

11.3 The minimum frequency required to remove an electron from the surface of the metal✓/*Die minimum frekwensie benodig om 'n elektron vanaf die oppervlak van die metaal te verwyder*✓ (2)

11.4 **POSITIVE MARKING FROM QUESTION 11.4/**
POSITIEWE NASIEN VANAF VRAAG 11.4

$E = W_0 + E_k$
$hf = hf_0 + E_k$
✓ Any one/*Enige een*

$(6,63 \times 10^{-34})(6,50 \times 10^{14})$✓$=(6,63 \times 10^{-34})(5,001 \times 10^{14})$ ✓$+ ½(9,11 \times 10^{-31})v^2$✓
$\therefore\ v= 4,67 \times 10^5\ m\cdot s^{-1}$✓

OR/*OF*

$E_K = E_{light} - W_o$
$= hf_{light} - hf_o$
✓ Any one/*Enige een*

$= (6,63 \times 10^{-34})(6,50 \times 10^{14} - 5,001 \times 10^{14})$ ✓
$= 9,94 \times 10^{-20}$ J

$E_K = ½ mv^2$ ✓

$$v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{(2)(9,94 \times 10^{-20})}{9,11 \times 10^{-31}}}$$ ✓

$v = 4,67 \times 10^5\ m\cdot s^{-1}$ ✓ (5)

11.5 The photocurrent is directly proportional to the intensity of the incident light.✓✓/*Die fotostroom is direk eweredig aan die intensiteit van die invallende lig.* ✓✓ (2)

[12]

TOTAL/*TOTAAL*: 150