LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12
GRAAD 12

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

SEPTEMBER 2018

MARKING GUIDELINES / MEMORANDUM

MARKS/ TOTAAL: 150

TIME/TYD: 3 hours / ure

This Marking Guidelines consists of 20 pages / Hierdie memorandum bestaan uit 20 bladsye

QUESTION 1 / VRAAG 1

1.1 B ✓✓ (2)

1.2 A ✓✓ (2)

1.3 D ✓✓ (2)

1.4 C ✓✓ (2)

1.5 A ✓✓ (2)

1.6 B ✓✓ (2)

1.7 D ✓✓ (2)

1.8 A ✓✓ (2)

1.9 C ✓✓ (2)

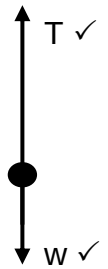
1.10 C ✓✓ (2)
[20]

QUESTION 2/ VRAAG 2

2.1

2.1.1 When an external non-zero net/resultant force acts on an object, the object accelerates in the direction of the net/resultant force with an acceleration whose magnitude is directly proportional to the magnitude of the net/resultant force✓ and inversely proportional to the mass of the object.✓
Wanneer 'n eksterne, nie-zero netto/resultante krag op 'n voorwerp inwerk, sal die voorwerp versnel in die rigting van die netto/resultante krag. Die versnelling se grootte is direk eweredig aan die grootte van die netto/resultante krag✓ en omgekeerd eweredig aan die massa van die voorwerp. ✓ (2)

2.1.2



Accepted Labels *laanvaar benoemings*:	
T	F_T / Tension / *spanning* / $F_{cord\ on\ m1}$ / $F_{tou\ op\ m1}$
w	weight / F_g / Gravitational force / $F_{earth\ on\ m1}$ /mg/force of Earth on block. *Gewig/ F_g / Gravitasiekrag* / $F_{aarde\ op\ m1}$ / *mg / krag van Aarde op blok*

Notes: Let us teach our learners to write full names for forces, not symbols. e.g Tension not **T**!! */ Leer leerders om die volle name uit te skryf en nie net die simbole nie.*
- Mark awarded for label and arrow/ *punt vir benoeming en pyl*
- Do not penalize for length of arrow since drawing is not to scale / *Moenie penaliseer vir lengte van pyl nie omdat skets nie volgens skaal is nie.*
- Any other additional force(s) / *Enige ander krag(te)*: Max.: 1/2
- If force(s) do not make contact with dot / *indien krag(te) nie kontak maak met kol*: Max: 1/2

(2)

2.1.3 **Take clockwise as positive/ *Neem kloksgewys as positief*:**

$$\Delta y = V_i \Delta t + \frac{1}{2} a (\Delta t)^2 \checkmark$$

$$\therefore \underline{0{,}245 = 0.\ \Delta t + \frac{1}{2} a (1)^2} \checkmark$$

$$\therefore (0{,}245)(2) = a$$

$$\therefore a = 0{,}49\ m \cdot s^{-2}$$

Consider m_1 / *Beskou m_1*:

$F_{net} = ma$ } Any one/ *enige een*✓

$\therefore\ T - m_1g = m_1a$ }

$\therefore\ T - (1,9)g = (1,9)\ (0,49)$ ✓

$\therefore\ T - (1,9)g = 0,931\ldots$ (1)

Consider m_2 /*Beskou m_2*:

$F_{net} = ma$

$\therefore\ m_2g - T = m_2a$

$\therefore\ (2,1)g - T = (1,9)\ (0,49)$ ✓

$\therefore\ T - (1,9)\ g = 0,931\ldots$ (2) ✓

(1) + (2):

$\therefore\ (2,1)g - (1,9)g = 1,96$

$\therefore\ (0,2)g = 1,96$

$\therefore\ g = 9,80\ m\cdot s^{-2}$ ✓ (6)

2.2.1 The gravitational force that one particle exerts on another particle is inversely proportional to the square of the distance between them. ✓
Die gravitasiekrag wat een deeltjie op 'n ander deeltjie uitoefen is omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.
OR/*OF*
The gravitational force that one body exerts on the other body is inversely proportional to the square of the distance between their centres.
Die gravitasiekrag wat een liggaam op 'n ander liggaam uitoefen is omgekeerd eweredig aan die kwadraat van die afstand tussen hulle middelpunte.
OR/*OF*
ACCEPT/ *AANVAAR*: (1)

$F_g \propto \frac{1}{r^2}$ or $F_g \propto \frac{1}{d^2}$

2.2.2 $F = G\frac{m_1 m_2}{r^2}$ ✓

$|F_{A\ on\ S}| = |F_{B\ on\ S}|$

$\therefore \frac{G\ M_A m}{(0{,}6r)^2}$ ✓ $= \frac{GM_B m}{(0{,}4r)^2}$ ✓

$\therefore \frac{M_A}{(0{,}6r)^2} = \frac{M_B}{(0{,}4r)^2}$

$\therefore \frac{M_A}{M_B} = \frac{0{,}36r^2}{0{,}16r^2}$

$\therefore$ M_A: M_B = 0,36: 0,16✓

$\therefore$ M_A: M_B = 9: 4 (4)

[15]

QUESTION 3 / VRAAG 3

3.1 An object upon which the only force acting is the gravitational force. ✓✓
'n Voorwerp waar die enigste krag wat daarop inwerk gravitasiekrag is. ✓✓

ACCEPT / *AANVAAR*:
An object that falls freely with an acceleration of g /9,8 m · s^{-2}. ✓✓
'*'n Voorwerp wat vryval met 'n versnelling van g /9,8 m · s^{-2}*. ✓✓ (2)

An object that is launched with an initial velocity under the influence of the gravitational force
'n Voorwerp wat gelanseer word met 'n aanvanklike snelheid onder die invloed van gravitasiekrag.

3.2

UPWARDS POSITIVE/ *OPWAART POSITIEF*:	**DOWNWARDS POSITIVE / *AFWAARTS POSITIEF*:**
$v_f^2 = v_i^2 + 2a\Delta y$	$v^2 = v_i^2 + 2a\Delta y$
$v_f^2 = \underline{(0)^2 + 1(2,20)\ (555)}$ ✓	$v_f^2 = \underline{(0)^2 + (2)\ (-2,\ 20)\ (-555)}$ ✓
$v_f^2 = 2442$	$v_f^2 = 2442$
∴ $v_f = 49,\ 4166\ m\cdot s^{-1}$	$v_f = -49,4166\ m\cdot s^{-1}$
$v_f = v_i + g\cdot\Delta t$	$v_f = v_i + g\cdot\Delta t$
$\underline{0 = 49,\ 4166 + (-9,8)}\ \Delta t$ ✓	$\underline{0 = -49,\ 4166 + (9,8)}\ \Delta t$ ✓
∴ $\Delta t = 5,042515$	∴ $\Delta t = 5,042515$ s
$\Delta y = v_i\Delta t + \frac{1}{2}\ a\ (\Delta t)^2$ ✓	$\Delta y = v_i\ \Delta t + \frac{1}{2}\ a\ (\Delta t)^2$ ✓
$= (49,4166)(5,04251) + \frac{1}{2}\ (-9,8)(5,04251)^2$ ✓	$= (-49,4166)(5,04251) + \frac{1}{2}\ (9,8)(5,04251)^2$ ✓
$= 249,\ 1837 – 124,5918$	$= -249 + 124,5918$
= 124, 5919 m ∴ height above launch pad/ *hoogte bo* lanseervlak	= -124, 5919 m ∴ Height above launch pad/ *hoogte bo* lanseervlak
= 555 + 124,5919 m✓ = 679, 592 m	= 555 + 124, 5919✓ = 679,592 m

(5)

3.3.1 **POSITIVE MARKING FROM 3.2. / *POSITIEWE NASIEN VANAF 3.2.***

UPWARDS POSITIVE/ *OPWAARTS POSITIEF*:	**DOWNWARDS POSITIVE /AFWAARTS POSITIEF:**
<u>OPTION/ *OPSIE* 1</u>	
$v_f = v_i + a\Delta t$ ✓	$v_f = v_i + a\Delta t$ ✓
$= \underline{0 + (-9,8)(11,7768)}$ ✓	$= \underline{0 + (9,8)(11,7768)}$ ✓
$= -115,41264\ m\cdot s^{-1}$	$=115,41264\ m\cdot s^{-1}$
Speed = 115,41264 $m\cdot s^{-1}$ ✓	Speed = 115,41264 $m\cdot s^{-1}$ ✓

(3)

3.3.2

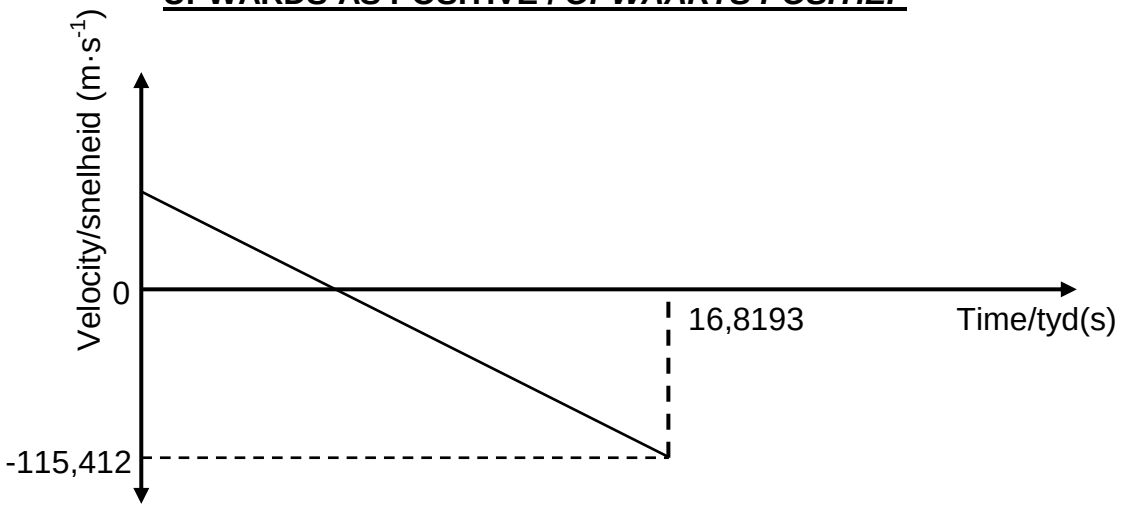
OPTION /*OPSIE* 2	
$\Delta y = (\frac{v_i + v_f}{2})\ \Delta t$ ✓	$\Delta y = (\frac{v_i + v_f}{2})\ \Delta t$ ✓
$-679,592 = (\frac{0 + v_f}{2})\ (11,7768)$ ✓	$679,592 = (\frac{0 + v_f}{2})\ (11,7768)$ ✓
$\therefore\ v_f = -115,411997\ m\cdot s^{-1}$	$\therefore\ v_f = 115,411997\ m\cdot s^{-1}$
Speed = 115, 411997 $m\cdot s^{-1}$ ✓	Speed = 115, 411997 $m\cdot s^{-1}$ ✓
OPTION/ *OPSIE* 3	
$v_f^2 = v_i^2 + 2a\Delta y$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$= (0)^2 + 2(-9,8)(-679,592)$ ✓	$= (0)^2 + 2(9,8)(679,592)$ ✓
$= 13\ 312,32$	$= 13\ 312,32$
$\therefore\ v_f = 115,37903\ m\cdot s^{-1}$	$\therefore\ v_f = 115,37903\ m\cdot s^{-1}$
Speed = 115,37903 $m\cdot s^{-1}$ ✓	Speed = 115,37903 $m\cdot s^{-1}$ ✓

POSITIVE MARKING FROM 3.3.1 and 3.3.2./ POSITIEWE NASIEN VANAF 3.3.1en 3.3.2

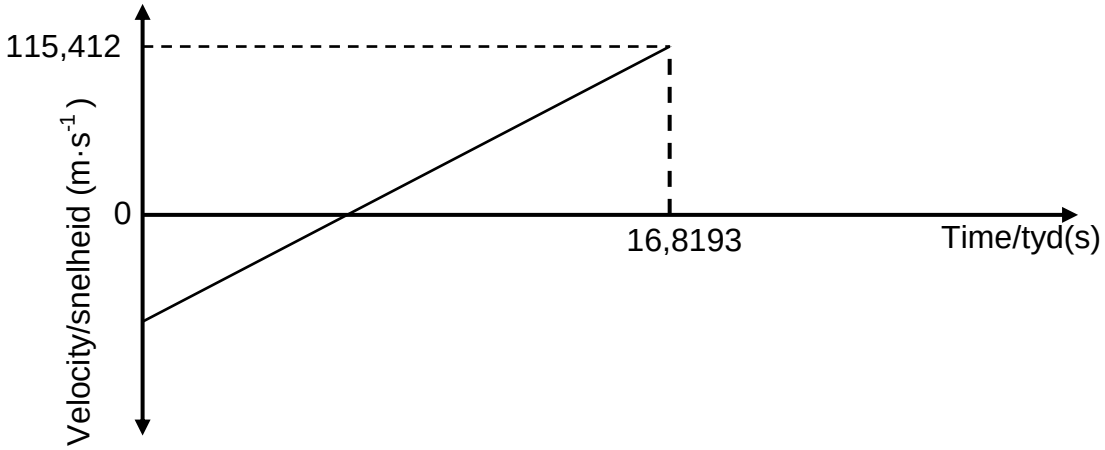
3.4

Velocity versus time sketch graph for the motion of the rocket.
Snelheid teen tyd sketsgrafiek vir beweging van die vuurpyl

UPWARDS AS POSITIVE / *OPWAARTS POSITIEF*



DOWNWARDS AS POSITIVE / AFWAARTS POSITIEF



Marking criteria for the graph / *Nasienriglyne vir die grafiek*	
Correct shape/Straight line not through the origin / *korrekte vorm/ reguit lyn, nie deur oorsprong nie*	✓
Speed, v = 115,412 m·s^{-1} correctly shown / *spoed,* v = 115,412 m·s^{-1} *korrek aangedui*	✓
Time, t = 16,8193 s correctly shown / *tyd,* t = 16,8193 s korrek aangetoon	✓

(3)

[16]

QUESTION 4 / VRAAG 4

4.1 The product of the net/resultant force acting on an object and the time the net/resultant force acts on the object.✓✓
Die produk van die netto/resultante krag wat op die voorwerp inwerk en die tyd wat die netto/resultante krag op die voorwerp inwerk.✓✓ (2 or/of 0) (2)

4.2

To the left as positive:	**To the right as positive:**
Impulse = Δp = $m\Delta v$ = $mv_f - mv_i$ = $m(v_f - v_i)$ ✓ Any one/*enige een* = (0,08)(-9) – (0,08)(+9) ✓ = -0,72 – 0,72 = -1,44 N·s Rightwards/Eastwards/ Away from the wall✓/ *regs/ooswaarts/weg van die muur*	Impulse = Δp = $m\Delta v$ = $mv_f - mv_i$ = $m(v_f - v_i)$ ✓ Any one/ *enige een* = (0,08)(+9) – (0,08)(-9) ✓ = 0,72 +0,72 = 1,44 N·s Rightwards/Eastwards/ Away from the wall✓/ *regs/ooswaarts/weg van die muur*

Notes/ Notas:

- Any one of the formulae / *enige een van die formules*
- Accept kg·m·s^{-1} as the unit / *aanvaar kg·m·s^{-1} as eenheid*
- If direction is not stated (-1 mark) / *rigting nie aangedui nie (-1 punt)*
- Accept **J** as the symbol for impulse / *aanvaar **J** as die simbool vir impuls*

(3)

4.3

$K_i = \frac{1}{2}mv_i^2$ ✓

= (0,5) (0,08) $(9)^2$

= 3,24 J

$K_f = \frac{1}{2}mv_f^2$

= (0,5) (0,08) $(9)^2$

= 3,24 J ✓

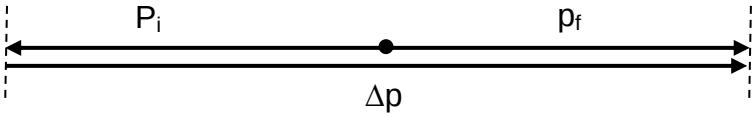
Marking kriteria / *Nasienriglyne*

- Formula ($K = \frac{1}{2}mv_i^2$)✓/ *formule*
- Both answers: 3,24 J ✓ / beide antwoorde
- Conclusion✓/ *gevolgtrekking*

The collision is elastic since K/E_k is conserved/$K_i = K_f$ / $E_{ki} = E_{kf}$ ✓
Die botsing is elasties want K/E_k bly behoue / $K_i = K_f$ / $E_{ki} = E_{kf}$ ✓

(3)

4.4



Marking criteria:
• p_i correctly drawn (Arrow pointing to the left)✓ *p_i is korrek geteken (pylpunt na links)* • p_f correctly drawn (Arrow pointing to the right) ✓ *p_f is korrek geteken (pylpunt na regs)* • Δp correctly drawn (Arrow starting from the head of p_i to the head of p_f) ✓ *Δp is korrek geteken (pylpunt begin by die kop van p_i tot by kop van p_f)*

(3) **[11]**

QUESTION 5 / VRAAG 5

5.1 A force for which the work done in moving an object between two points depends on the path taken. ✓ ✓
'n Krag waarvoor die arbeid verrig om 'n voorwerp tussen twee punte te beweeg afhang van die pad wat geneem word. ✓ ✓ (2 or/of 0) (2)

5.2 $W_{nc} = \Delta E_p + \Delta E_k$
$0 = E_{pf} - E_{pi} + E_{kf} - E_{ki}$ ✓
$0 = (E_p + E_k)_f - E_{pi} - E_{pi}$
$0 = (E_p + E_k)_f - (E_P + E_k)_i$ ✓
$0 = (E_{mechanical})_f - (E_{mechanical})_i$
$\therefore (E_{mechanical})_i = (E_{mechanical})_f$ ✓
Hence total mechanical energy is conserved./*Meganiese energie bly dus behoue.* (3)

5.3 $(E_p + E_k)_A = (E_p + E_K)_B$
$mgh_i + \frac{1}{2}mv_i^2 = mgh_f + \frac{1}{2}mv_i^2$ ✓ Any one / *enige een*

$\therefore (20)(9,8)(5,1) + (\frac{1}{2})(20)(0)^2 = (20)(9,8)(0) + \frac{1}{2}(20)\,v_f^2$ ✓
$\therefore 999,6 = 10v_f^2$
$\therefore v_f^2 = 99,96$
$\therefore v_f = 9,998\ m\cdot s^{-1}$
$\therefore$ speed $= 9,998\ m\cdot s^{-1}$ ✓ (3)

5.4 **POSITIVE MARKING FROM 5.3./ POSITIEWE NASIEN VANAF 5.3**

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

$W_{net} = \Delta E_k$
$= E_{kf} – E_{ki}/K_f - K_i$
$W_f + W_N + W_w = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
$(\mu_k \cdot mg)\Delta x\cos\theta + 0 + 0 = \frac{1}{2}mv_i^2 - \frac{1}{2}mv_i^2$

✓ Any one / *enige een*

$(0,2)\ (20)\ (9,8)\ (x)\ (\cos 180^o)$ ✓ $= (0,5)\ (20)\ (0)^2 – (0,5)\ (20)\ (9,998)^2$ ✓

$(-39,20)x = -999,60$

∴25,50 m ✓

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

$Wnc = \Delta E_k + \Delta E_p$

$f\Delta x\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mgh_f - mgh_i$

$(\mu_k \cdot mg)\Delta x\cos\theta = 0 - \frac{1}{2}mv_i^2 + 0 + - 0$

✓ Any one / *enige een*

$(0,2)\ (20)\ (9,8)\ (x)\ (\cos 180^o)$ ✓ $= - (0,5)\ (20)\ (9,998)^2$ ✓

(4)

∴ $-1,96x = -49,98$
∴ $x = 25,50$ m ✓

[12]

QUESTION 6 / VRAAG 6

6.1

6.1.1 Doppler effect/*effek* ✓ (1)

6.1.2 E to/*na* D ✓ (1)

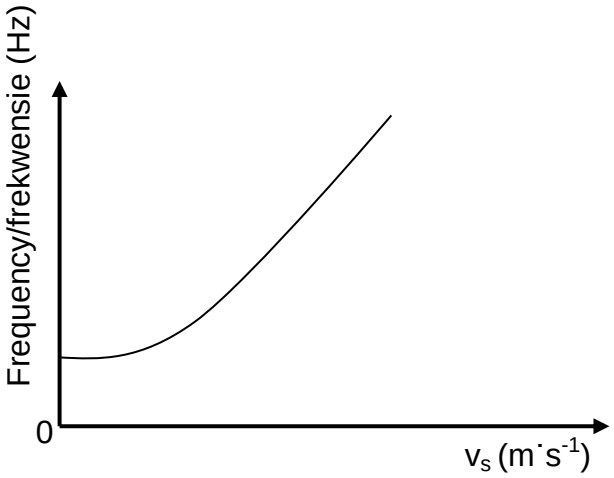
6.1.3 P ✓
The engine is traveling away from **Y**, so, the waves are spread out (λ increases)✓
For the same speed of sound ✓(speed of sound is constant), the observed pitch/frequency is lower/decreases ($f = \frac{V}{\lambda}$). ✓
*Die enjin beweeg weg van **Y**, dus, die golwe sprei uit (λ vergroot) ✓ Vir dieselfde spoed van klank (spoed van klank bly konstant) is die waargenome toonhoogte/frekwensie laer* ($f = \frac{V}{\lambda}$). ✓ (4)

6.1.4 $f_L = \left(\frac{V \pm V_L}{V \pm V_L}\right) f_s$ ✓

$= \left(\frac{330 + 0}{330 - 20}\right)(440)$ ✓

= 468, 39 Hz ✓ (3)

6.1.5



Marking kriteria/ *Nasienkriteria*:
• Frequency not at zero / *frekwensie nie by nul nie* ✓ • Shape/ *vorm* ✓

(2)

6.2.1 B ✓
Light with a lower frequency/light with longer wavelength. ✓/ *Lig met 'n laer frekwensie/ lig met 'n langer golflengte.* (2)

6.2.2 Towards the Earth ✓/*Na die aarde* (1)
[14]

QUESTION 7 / VRAAG 7

7.1 A region of space in which an electric charge experiences a force. ✓✓
'n Gebied in die ruimte waar 'n elektriese lading 'n krag ondervind. ✓✓ (2 or 0) (2)

7.2 $E = \frac{kQ}{r^2}$ ✓

$E_{BQ1} = \frac{kQ_1}{r^2} = \frac{(9 \times 10^9)(6{,}25 \times 10^{-9})}{(0{,}10)^2}$ ✓= 5 625 N·C^{-1} (East/*Oos*)

$E_{BQ2} = \frac{kQ_2}{r^2} = \frac{(9 \times 10^9)(2{,}5 \times 10^{-9})}{(0{,}35)^2}$ ✓= 918, 36735 N·C^{-1} (East/*Oos*)

$E_{net} = E_{BQ1} + E_{BQ2}$
= 5625 + 918, 36735✓
= 5 543,367 N·C^{-1} ✓ (5)

7.3 The magnitude of the electrostatic force exerted by one-point charge on another point charge is directly proportional to the product of the magnitudes of the charges ✓ and inversely proportional to the square of the distance between them. ✓
Die grootte van die elektrostatiese krag uitgeoefen deur 'n 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 tussen hulle. ✓ (2)
OR/OF
The force of attraction or repulsion that two point charges exert on each other is directly proportional to the product of the charges ✓and inversely proportional to the square of the distance between them. ✓
Die aantrekkings- of afstotingskrag wat twee puntladings op mekaar uitoefen is direk eweredig aan die produk van die ladings✓en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. ✓ (2)

7.4 **OPTION 1/*OPSIE* 1:**

$F = \frac{kQ_1Q_2}{r^2}$ ✓

$F_{Q1 \text{ on } q} = \frac{KQ1q_e}{r^2} = \frac{(9 \times 10^9)(6{,}25 \times 10^{-9})(1{,}6 \times 10^{-19})}{(0{,}15)^2}$ ✓

= 4 x 10^{-16} N (West/*Wes*)

$F_{Q2 \text{ on } q} = \frac{(9 \times 10^9)(12{,}5 \times 10^{-9})(1{,}6 \times 10^{-19})}{(0{,}10)^2}$ ✓ = 1,8 x 10^{-15} N (East/*Oos*)

Take East as positive/ *Neem oos as positief*:

$F_{net} = F_{qeQ2} + F_{qeQ1}$
$= 1,80 \times 10^{-15} + (-4 \times 10^{-16})$ ✓
$= 1,40 \times 10^{-15}$ N (East) ✓

OPTION 2/OPSIE 2:

$E_{AQ1} = \frac{kQ_1}{r^2} = \frac{(9 \times 10^9)(6,25 \times 10^{-9})}{(0,15)^2}$ ✓= 2 500 N·C^{-1} (West/*Wes*)

$E_{AQ2} = \frac{kQ_2}{r^2} = \frac{(9 \times 10^9)(12,5 \times 10^{-9})}{(0,10)^2}$ ✓= 11 250 N·C^{-1} (East/*Oos*)

$E_{A,net}$ = 11 250 +(-2 500) = 97 50 N·C^{-1} (East*/Oos*)

$F_{net} = q \cdot E_{net}$ ✓ = (1,6 x 10^{-19}) (9 750) ✓= 1,4 x 10^{-15} N (East*Oos*) ✓

(5)

7.5 **OPTION 1/*OPSIE* 1:**

$Q_{new\ on\ each} = \frac{Q_2+Q_2}{2} = \frac{(-6,25 \times 10^{-9})+(-12,5 \times 10^{-9})}{2}$ ✓= -9,375 x 10^{-9} **C**

$n = \frac{Q}{e}$ ✓ $= \frac{-9,375 \times 10^{-9} - (-6,25 \times 10^{-9})}{-1,6 \times 10^{-9}}$ ✓

$n = \frac{-3,125 \times 10^{-9}}{-1,6 \times 10^{-9}}$ = 1,953125 x 10^{10} electrons/*elektrone* ✓

OPTION 2/*OPSIE* 2:

$Q_{new\ on\ each} = \frac{Q_1+Q_2}{2} = \frac{(-6,25 \times 10^{-9})+(-12,5 \times 10^{-9})}{2}$ ✓= -9,375 x 10^{-9} **C**

$n = \frac{Q}{e}$ ✓= $\frac{-9,375 \times 10^{-9} - (-12,5 \times 10^{-9})}{-1,6 \times 10^{-9}}$ ✓= $\frac{3,125 \times 10^{-9}}{1,6 \times 10^{-19}}$

∴ n = 1,953 x 10^{10} electrons/*elektrone* ✓ (4)
[18]

Question 8 / VRAAG 8

8.1

8.1.1 Ohm 's Law/ *Ohm se wet* ✓ (1)

8.1.2 Temperature/*temperatuur* ✓ (1)

8.1.3 If the current in a resistor increases/decreases, the potential difference across the resistor will increase/decrease to the same proportion, provided that the temperature remains constant. ✓✓
As die stroom deur 'n resistor verhoog/verlaag, sal die potensiaalverskil oor die resistor verhoog/verlaag, mits die temperatuur konstant bly. ✓✓ (2)

8.1.4 Dependent variable / *afhanklike veranderlike* ✓ (1)

8.1.5 Rheostat / *reostaat* ✓
It enables the learner to change/alter/vary the current in the circuit.✓
Dit stel die leerder in staat om die stroom in die geleier te verander. ✓ (2)

Accept/*aanvaar*:

To increase/decrease the current./ *Om die stroom te verhoog/te verlaag.*

8.1.6 $\frac{V}{I} = \frac{3,2}{0,4} = 8\ V \cdot A^{-1}$ ✓

$\frac{V}{I} = \frac{7,2}{0,9} = 8\ V \cdot A^{-1}$ ✓

$\frac{V}{I} = \frac{9,6}{1,2} = 8\ V \cdot A^{-1}$ ✓

∴ The ratio V:I is constant at constant temperature.✓
∴ *Die verhouding V:I is konstant by 'n konstante temperatuur*✓

OR/OF:

V ∞ I (at constant temperature/*by 'n konstante temperatuur*) (4)

8.1.7 ∴ R = 8 Ω ✓ (1)

8.2.1 $\varepsilon = I(R_{ext} + r)$

$R_{total} = R_{ext} + r = \frac{6}{2,4} = 2,50\ \Omega$ ✓

$R_{ext} = R_p = R_{total} - r = 2,50 - 0,5 = 2,00\ \Omega$ ✓

$R_p = \frac{R_1 R_2}{R_1 + R_2}$ ✓ $= \frac{(3)\cdot R}{3+R} = 2$

$\therefore 3\cdot R = 6 + 2\cdot R$
$\therefore \quad R = 6\ \Omega$✓

(4)

8.2.2 **OPTION 1/*OPSIE* 1:**

$P = I^2R_p$ ✓$= (2,4)^2\,(2)$ ✓ $= 11,52$ W ✓

OPTION 2/*OPSIE* 2:

$V_p = IR_p = (2,4)\ (2)$ ✓ $= 4,80$ V

$P = VI$ ✓ $= (4,80)\ (2,4) = 11,52$ W ✓

OPTION 3/*OPSIE* 3:

$P = \frac{V^2}{R}$ ✓ $= \frac{(4,80)^2}{2}$ ✓ $= 11,52$ W ✓

(3)
[19]

QUESTION 9 / VRAAG 9

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

9.2 V_1 ✓ (1)

9.3 $V_1 = \frac{V_2}{\sqrt{2}}$ ✓ (1)

9.4 $V_1 = \frac{V_2}{\sqrt{2}}$ or $V_{rms} = \frac{V_{max}}{\sqrt{2}}$ ✓

$240 = \frac{V_2}{\sqrt{2}}$ ✓

$\therefore V_2 = \sqrt{2} \cdot 240$
$\therefore V_2 = 339{,}4113$ V✓ (3)

9.5 The rms value of the AC is the direct current which dissipates the same amount of energy as AC. ✓✓
Die wgk waarde van die WS is die gelykstroomwaarde wat dieselfde hoeveelheid energie as WS lewer. ✓✓
Accept/*aanvaar*:The root mean square value of an alternating current is the value of the direct current that would give the same heating effect as the alternating current in the same resistor.
Die wortel gemiddelde kwadraat waarde vir 'n wisselstroom is die waarde van die gelykstroom wat dieselfde verhittingseffek as die wisselstroom in dieselfde resistor sal hê. (2)

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

$P_{ave} = \frac{1}{2} V_{max} \cdot I_{max}$ ✓
$\therefore 1200 = \frac{1}{2}(339{,}4113) \cdot I_{max}$ ✓
$\therefore I_{max} = 7{,}0711$ A ✓

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

$P_{ave} = \frac{1}{2} V_{max} \cdot \frac{I_{max}}{\sqrt{2}}$ ✓

$(\sqrt{2})(1200) = (240) \cdot I_{max}$ ✓
$\therefore I_{max} = 7,\ 0711$ A ✓

OPTION 3/*OPSIE* 3:

$P_{ave} = V_{rms} \cdot I_{max}$

$\therefore 12000 = 240 \cdot I_{rms}$ ✓
$\therefore \quad I_{rms} = 5$ A
But $I_{max} = \sqrt{2} \cdot I_{rms}$ ✓
$= (\sqrt{2})(5)$
$= 7, 0711$ A ✓

OPTION 4/*OPSIE* 4:

$R = \frac{V_{rms}}{I_{rms}} = \frac{240}{5}$ ✓ $= 48\ \Omega$

$I_{max} = \frac{V_{max}}{R} = \frac{339,4113}{48}$ ✓ $= 7, 0711$ A ✓

OPTION 5/*OPSIE* 5:

$P_{ave} = \frac{(V_{rms})^2}{R}$

$\therefore R = \frac{(240)^2}{1200}$ ✓ $= 48\ \Omega$

$I_{max} = \frac{V_{max}}{R} = \frac{339,4113}{48}$ ✓ $= 7, 0711$ A ✓

(3)

9.7 **ANYONE / *ENIGE EEN***

- Easier to generate and transmit from place to place.✓
  Makliker om op te wek en te vervoer tussen plekke.
- Easier to convert from AC to DC than the reverse.✓
  Makliker om WS na GS om te skakel as omgekeerd.
- Voltage can be easily changed by stepping it up or down.✓
  Potensiaalverskil kan makliker verhoog of verlaag word.
- High frequency used in AC makes it more suitable for electric motors.✓
  Die hoë frekwensie wat gebruik word by WS maak dit meer geskik vir elektriese Motors.

(1)

[12]

QUESTION 10 / VRAAG 10

10.1 Do not look directly into UV light, because the eyes could suffer damage. ✓
Moenie direk in UV lig inkyk nie, dit kan die oë beskadig. (1)

10.2 **ANYONE/ *ENIGE EEN:***

- Frequency of the incident light./ *frekwensie van die invallende lig.* ✓
- Energy of the photons./ *energie van die fotone*. ✓
- Work function of the material surface./*werkfunksie van die material oppervlak* ✓ (1)

10.3.1

At $E_{k,max}$ = 0 J, $hf_o = W_o$

$W_o = hf_o$ ✓

$= (6,63 \times 10^{-34})(1,0 \times 10^{15})$ ✓

$= 6,63 \times 10^{-19}$ J ✓ (3)

10.3.2 Slope(Gradient) = $\frac{\Delta E_{k,max}}{\Delta f}$

$6,63 \times 10^{-34}$ ✓ = $\frac{(x-2,7) \times 10^{-19}}{(2,0-1,5) \times 10^{15}}$ ✓

∴ $3,315 \times 10^{-19} = (x-2,7) \times 10^{-19}$

∴ $3,315 = x-2,7$

∴ $x = 3,315 + 2,7$

∴ $x = 6,02$

∴ $E_{k,max} = 6,02 \times 10^{-19}$ J ✓ (3)

10.4 The minimum energy that an electron in the metal needs to be emitted from the metal surface. ✓✓
Die minimum energie wat 'n elektron in die metaal benodig om uit die metaaloppervlakte vrygestel te word. (2 or/of 0) (2)

10.5 **OPTION 1/*OPSIE* 1:**

$E = hf$ ✓
$= (6,63 \times 10^{-34})(5,5 \times 10^{14})$ ✓
$= 3,647 \times 10^{-19}$ J

∴ No photoelectric effect is observed since $hf(E_{photon}) < W_o$ ✓
∴*Geen fotoelektriese effek word waargeneem nie aangesien* $hf(E_{foton}) < W_o$ ✓

OPTION 2/*OPSIE* 2:

$W_o = hf_o$ ✓

∴ $4,0 \times 10^{-19} = (6,63 \times 10^{-34}) f_o$ ✓
∴ $f_o = 6,0332 \times 10^{14}$ (3)

No photoelectric effect is observed since $f < f_o$ ✓
Geen fotoelektriese effek word waargeneem nie aangesien $f < f_o$ ✓

[13]

TOTAL [150]