GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2015

MEMORANDUM

SUBJECT: PHYSICAL SCIENCES: PHYSICS P1 (10841)

FISIESE WETENSKAPPE: FISIKA V1 (10841)

GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION – 2015

PHYSICAL SCIENCES: PHYSICS/
FISIESE WETENSKAPPE: FISIKA
(First Paper/*Eerste Vraestel*)

MEMORANDUM

QUESTION 1/*VRAAG 1*

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

[20]

QUESTION 2/*VRAAG 2*

2.1 The net force acting on an object is equal to the rate of change in the momentum of the object. ✓✓
Die netto krag wat op 'n voorwerp inwerk is gelyk aan die tempo van verandering in momentum vir die voorwerp. ✓✓
OR/*OF*
When a <u>resultant/net force</u> acts on an object, the object will accelerate in the direction of the force at an <u>acceleration directly proportional to the force</u> ✓ and <u>inversely proportional to the mass</u> of the object. / ✓
Wanneer 'n <u>resultante/netto krag</u> op 'n voorwerp inwerk sal die voorwerp in die rigting van die krag versnel met 'n <u>versnelling direk eweredig aan die krag</u> ✓ *en <u>omgekeerd eweredig aan die massa</u>.*✓ (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*
N	F_N/normal *F_N/normaal*
f	Friction/F_f *Wrywing/F_f*
T	Tension/Force in string/F_T *Spanning/Trekkrag (van die tou)/ F_T*
F	F_{app}/15 N *F_{toeg}/15 N*
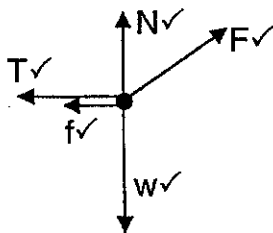
Note/*Nota*
One mark for correct arrow **and** label.
If **any** other forces shown max. ⅘

*Een punt vir die korrekte pyl **en** benaming*
*Indien **enige** ander krag getoon word maks.* ⅘ (5)

2.3

$f_k = \mu_k N$ ✓

$f_k = (0{,}35)(49 - 15\sin 30°)$ ✓

$f_k = 14{,}53\,N$ ✓

$(0{,}35)(49 - 7{,}5)$

$(0{,}35(41{,}5)$ (3)

2.4   **OPTION 1/OPSIE 1**

Right positive:
Regs positief:
For/Vir 5 kg

$$F_{net} = ma \checkmark$$
$$\text{---} F\cos\theta + T - f = m(2,2)$$
$$\text{---} 15\cos 30° + T - 14,53 \checkmark = 5(2,2) \checkmark$$
$$T = 14,53 + 15\cos 30° + 11$$
$$T = 38,52 \text{ N}$$

Upward positive:
Opwaarts positief:
For/Vir B

$$F_{net} = ma$$
$$-38,52 + F_G = m(2,2)$$
$$-38,52 + 9,8m \checkmark = m(2,2)$$
$$38,52 = 7,6m$$
$$m = 5,07 \text{kg} \checkmark$$

OPTION 2/OPSIE 2

Upward positive:
Opwaarts positief:
For/Vir B

$$F_{net} = ma \checkmark$$
$$\text{---} T + F_G = m(2,2) \checkmark$$
$$\text{---} T + 9,8m \checkmark = m(2,2)$$
$$T = 7,6m \quad (A)$$

Parallel down positive:
Ewewydig af positief:
For/Vir 5 kg

$$F_{net} = ma$$
$$-F\cos\theta + T - f = m(2,2)$$
$$-15\cos 30° + T - 14,53 \checkmark = 5(2,2)$$
$$T = 14,85 + 15\cos 30° + 11$$
$$T = 38,5 \text{ N} \quad (B)$$

Set/stel (A) = (B)

$$7,6m = 38,5$$
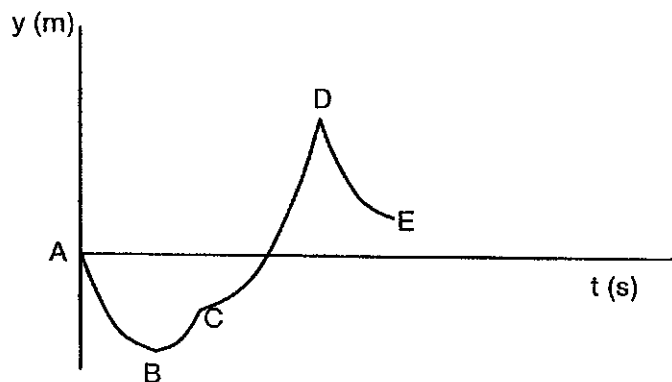$$m = 5,07 \text{kg} \checkmark$$

(5)
[15]

3.5

Upward positive/*Opwaarts positief*

Downward positive/*Afwaarts positief*
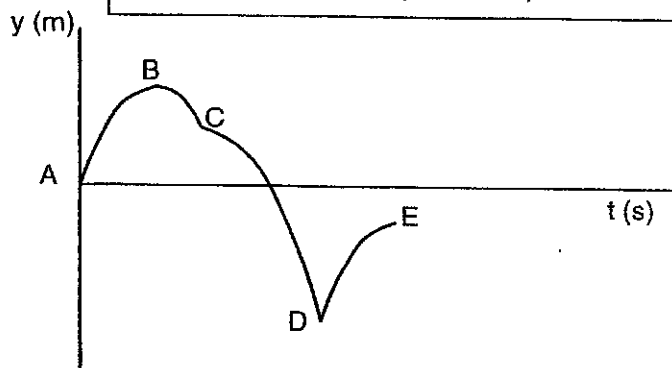
Criteria for graph/*Kriteria vir grafiek:*	Marks/ *Punte*
Parabolic shape from A to C *Paraboliese vorm van A tot C*	✓
Shape from C to D *Vorm van C tot D*	✓
Shape from D to E *Vorm van D tot E*	✓
Combination of negative parabola *Kombinasie van negatiewe parabole*	✓
A starts at zero *A begin vanaf nul*	✓

Note/*Nota*

if no/incorrect labels on axis: max. $\frac{4}{5}$

as geen/verkeerde benamings vir asse dan: maks. $\frac{4}{5}$

(5)
[13]

QUESTION 3/*VRAAG 3*

3.1 $9,8 \text{ m·s}^{-2}$ ✓ downward/to the centre of the earth ✓
       $9,8 \text{ m·s}^{-2}$ ✓ afwaarts / na die middelpunt van die aarde ✓   (2)

3.2   Once/one time ✓
       Een keer ✓   (1)

3.3   Upward ✓
       Opwaarts ✓   (1)

3.4   **OPTION 1/ *OPSIE 1***
       Upward positive:
       Opwaarts positief:

$$v_f^2 = v_i^2 + 2a\Delta y \;✓$$
$$-3,2^2 ✓ = 6^2 + 2(-9,8)\Delta y \;✓$$
$$\Delta y = 1{,}31 \text{ m} \;✓$$

OPTION 2 / *OPSIE 2*
Upward positive:
Opwaarts positief:
From t_1 to t_2 / *Vanaf t_1 na t_2*

$$v_f = v_i + a\Delta t$$
$$\underline{-3,2 = 6 + (-9,8)\Delta t} \quad ✓$$
$$\Delta t = 0{,}94 \text{ s}$$

$$\Delta y = v_i\Delta t + \tfrac{1}{2}a\Delta t^2 ✓$$
$$\Delta y = (6)(0,94) + \tfrac{1}{2}(-9,8)(0,94)^2 \;✓$$
$$\Delta y = 1{,}31 \text{ m} \;✓$$

OPTION 3 / *OPSIE 3*
Upward positive:
Opwaarts positief:

$$v_f = v_i + a\Delta t$$
$$\underline{-3,2 = 6 + (-9,8)\Delta t} \quad ✓$$
$$\Delta t = 0{,}94 \text{ s}$$

$$\Delta y = \frac{v_f + v_i}{2}\Delta t \;✓$$
$$\Delta y = \frac{-3.2 + 6}{2}(0,94) \quad ✓$$
$$\Delta y = 1{,}31 \text{ m} \;✓$$

OPTION 4 / *OPSIE 4*
Upward negative:
Opwaarts negatief:

All the options 1 to 3 with all the applicable signs changed. Maximum ¾

Al die opsies 1 tot 3 met die toepaslike tekens omgekeerd. Maksimum ¾

(4)

QUESTION 4/*VRAAG 4*

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

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

4.2

$$F_G = \frac{Gm_1m_2}{d^2} \checkmark$$

$$5,71 \times 10^{15} \stackrel{\checkmark}{=} \frac{(6,67 \times 10^{-11})(6,39 \times 10^{23}\checkmark)(1,08 \times 10^{18}\checkmark)}{d^2}$$

$$d^2 = 8,06 \times 10^{13}$$

$$d = 8,98 \times 10^6 \text{ m} \checkmark$$

$$\therefore h = 8,98 \times 10^6 - 3390 \times 10^3$$

$$h = 5,59 \times 10^6 \text{ m} \checkmark$$

(6)
[8]

QUESTION 5/*VRAAG 5*

5.1 The total linear momentum of 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 collision is equal to the total momentum after collison. ✓✓
In 'n geslote/geïsoleerde sisteem is die totale momentum voor 'n botsing gelyk aan die totale momentum na 'n botsing. ✓✓ (2)

5.2 **OPTION 1/ *OPSIE 1***
East positive:
Oos *positief*:

$$\Sigma p_i = \Sigma p_f \quad \checkmark$$

$$m_{1+2}v_i = m_1v_{1f} + m_2v_{2f}$$

$$(54 + 1,5)(0,08) \stackrel{\checkmark}{=} 54v_{1f} + 1,5(10,2) \checkmark$$

$$v_{1f} = -0,2 \text{ m} \cdot \text{s}^{-1}$$

$$v_{1f} = 0,2 \text{ m} \cdot \text{s}^{-1} \text{ west/wes} \checkmark$$

OPTION 2/ *OPSIE 2*
West positive:
***Wes positief*:**

$$\Sigma p_i = \Sigma p_f \quad \checkmark$$

$$m_{1+2}v_i = m_1v_{1f} + m_2v_{2f}$$

$$(54 + 1,5)(-0,08) \stackrel{\checkmark}{=} 54v_{1f} + 1,5(-10,2) \checkmark$$

$$v_{1f} = 0,2 \text{ m} \cdot \text{s}^{-1} \text{ west/wes} \checkmark$$

(4)

5.3 **OPTION 1 / OPSIE 1**
East positive:
Oos positief:

$F_{net}\Delta t = mv_f - mv_i$ ✓

$F_{net}(1,2) = (1,5)(10,2) - (1,5)(0,08)$ ✓

$F_{net} = 12,65 \, N \, east / oos$ ✓

OPTION 2 / OPSIE 2
West positive:
Wes positief:

$F_{net}\Delta t = mv_f - mv_i$ ✓

$F_{net}(1,2) = (1,5)(-10,2) - (1,5)(-0,08)$ ✓

$F_{net} = -12,65 \, N$

$\therefore F_{net} = 12,65 \, N \, east / oos$ ✓

OPTION 3 / OPSIE 3
East positive:
Oos positief:

$v_f = v_i + a\Delta t$

$10,2 = 0,08 + a(1,2)$

$a = 8,43 \, m \cdot s^{-2}$

$F_{net} = ma$ ✓

$F_{net} = 1,5(8,43)$ ✓

$F_{net} = 12,65 \, N \, east / oos$ ✓

OPTION 3 / OPSIE 3
West positive:
Wes positief:

$v_f = v_i + a\Delta t$

$-10,2 = -0,08 + a(1,2)$

$a = -8,43 \, m \cdot s^{-2}$

$F_{net} = ma$ ✓

$F_{net} = 1,5(-8,43)$ ✓

$F_{net} = -12,65 \, N$

$F_{net} = 12,65 \, N \, east / oos$ ✓

(3)
[9]

QUESTION 6/*VRAAG 6*

6.1 A force for which the net work done in any closed path is dependent on the path the object travelled. ✓✓
OR/*OF*
'n Krag waarvoor die netto arbeid verrig langs enige geslote pad·: afhanklik is van die roete geneem ✓✓
OR/*OF*
The net work done by the non-conservative force / frictional force depends on the path the object travelled ✓✓ /
Die netto arbeid verrig deur 'n nie-konserwatiewe krag / wrywingskrag is afhanklik van die roete geneem ✓✓
OR/*OF*
The mechanical energy is not constant ✓✓ for a non-conservative force /
Die meganiese energie is nie konstant ✓✓ *vir 'n nie-konserwatiewe krag nie* (2)

6.2 $\left.\begin{array}{l} f_k = \mu_k N \\ f_k = \mu_k F_{g\perp} \end{array}\right\}$ Any one/*enige een* ✓

$f_k = 0,22 \times (86 \times 9,8) \times \cos 25°$ ✓

$f_k = \underline{168,04\ N}$ (2)

6.3 <u>The net/total work done</u> ✓ on an object is <u>equal to the change in the object's kinetic energy.</u> ✓ OR The work done on an object by a resultant/net force is equal to the change in the object's kinetic energy.

Die netto/totale arbeid ✓ *wat op 'n voorwerp verrig word, is gelyk aan die verandering in die kinetiese energie van die voorwerp.* ✓ *OF Die arbeid verrig op 'n voorwerp deur 'n resultante/netto krag is gelyk aan die verandering in die kinetiese energie van die voorwerp.* (2)

6.4 **Accepted Labels/*Aanvaarde benoemings***

w	F_g/F_w/force of Earth on block/weight/842,8 N/mg/gravitational force *F_g/F_w/krag van Aarde op blok/gewig/842,8 N/mg/gravitasiekrag*
N	F_N/normal *F_N/normaal*
f	Friction/F_f *Wrywing/F_f*
F	F_{app}/15 N *F_{toe}/15 N*
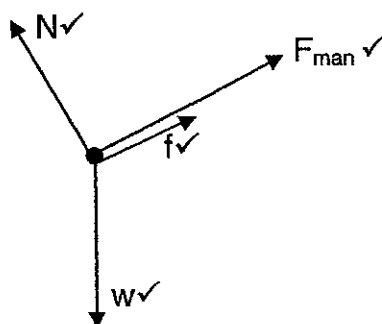
(4)

6.5 **OPTION 1 /** *OPSIE 1*
Parallel to the plane down is positive
Ewewydig aan die vlak af is positief

$$v_f^2 = v_i^2 + 2a\Delta x$$
$$v_f^2 - v_i^2 = 2(1,54)(0,9) \checkmark$$
$$v_f^2 - v_i^2 = 2,772$$

$$W_{net} = \Delta E_K \checkmark$$
$$W_{man} + W_{grav} + W_f = \tfrac{1}{2}m(v_f^2 - v_i^2)$$
$$W_{man} + (86 \times 9,8)\sin25°(0,9)\cos0° + 168,04(0,9)\cos180° \checkmark = \tfrac{1}{2}(86)(2,772) \checkmark$$
$$W_{man} + 320,56 - 151,236 = 119,196$$
$$W_{man} = -50,13 \, J \checkmark$$

OPTION 2 / *OPSIE 2*
Parallel to the plane up is positive
Ewewydig aan die vlak op is positief

$$v_f^2 = v_i^2 + 2a\Delta x$$
$$v_f^2 - v_i^2 = 2(-1,54)(-0,9) \checkmark$$
$$v_f^2 - v_i^2 = 2,772$$

$$W_{net} = \Delta E_K \checkmark$$
$$W_{man} + W_{grav} + W_f = \tfrac{1}{2}m(v_f^2 - v_i^2)$$
$$W_{man} + (86 \times 9,8)\sin25°(0,9)\cos0° + 168,04(0,9)\cos180° \checkmark = \tfrac{1}{2}(86)(2,772) \checkmark$$
$$W_{man} + 320,56 - 151,236 = 119,196$$
$$W_{man} = -50,13 \, J \checkmark$$

OPTION 3 / *OPSIE 3*
Parallel to the plane up is positive
Ewewydig aan die vlak op is positief

$$F_{net} = ma$$
$$F_{man} - F_G\sin\theta + f = ma$$
$$F_{man} - (86 \times 9,8)\sin25° + 168,04 = 86(-1,54) \checkmark$$
$$F_{man} = 356,18 - 168,04 - 132,44$$
$$F_{man} = 55,7 \, N$$

$$W_{man} = F_{man}\Delta x\cos\theta \checkmark$$
$$W_{man} = (55,7) \checkmark (0,9)\cos180° \checkmark$$
$$W_{man} = -50,13 \, J \checkmark$$

OPTION 4 / *OPSIE 4*
Parallel to the plane down is positive
Ewewydig aan die vlak af is positief

$$F_{net} = ma$$

$$-F_{man} + F_G \sin\theta + f = ma$$

$$-F_{man} + (86 \times 9,8)\sin 25° - 168,04 = 86(1,54) \quad \checkmark$$

$$F_{man} = -356,18 + 168,04 + 132,44$$

$$F_{man} = -55,7 \text{ N}$$

$$W_{man} = F_{man}\Delta x \cos\theta \checkmark$$

$$W_{man} = (55,7) \checkmark (0,9)\cos 180° \quad \checkmark$$

$$W_{man} = -50,13 \text{ J} \quad \checkmark$$

(5)
[15]

QUESTION 7/VRAAG 7

7.1 The 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.✓ ✓

Die verandering in die frekwensie(of toonhoogte) van die klank waargeneem deur 'n luisteraar omdat die klankbron en die luisteraar verskillende snelhede het relatief tot die medium van voortplanting. ✓ ✓ (2)

7.2 **OPTION 1 / OPSIE 1**

$$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark \quad \text{OR/OF} \quad f_L = \frac{v}{v - v_s} f_s$$

$$f_L = \left(\frac{335}{335 - 25}\right) \checkmark 430 \checkmark$$

$$f_L = 464{,}68 \, Hz$$

$$\lambda = \frac{v}{f} \checkmark$$

$$\lambda = \frac{335}{464{,}68} \checkmark$$

$$\lambda = 0{,}72 \, m \checkmark$$

OPTION 2 / OPSIE 2

$$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark \quad \text{OR/OF} \quad f_L = \frac{v}{v - v_s} f_s$$

$$\frac{v}{\lambda_L} \checkmark = \left(\frac{335}{335 - 25}\right) \checkmark 430 \checkmark$$

$$\frac{335 \checkmark}{\lambda_L} = \left(\frac{335}{335 - 25}\right) 430$$

$$\lambda = 0{,}72 \, m \checkmark \tag{6}$$

7.3 THE SAME; ✓ The relative velocity of the train driver and the train is zero✓. There will therefore not be an observed change ✓ in the frequency heard by the driver.

DIESELFDE ✓ *Die relatiewe snelheid van die treindrywer ten opsigte van die trein is nul.* ✓ *Daar sal dus nie 'n verandering in die waargenome frekwensie* ✓ *soos gehoor deur die treindrywer wees nie.* (3) **[11]**

QUESTION 8/*VRAAG 8*

8.1 Negative OR – ✓ The direction of E_1 on the diagram is to the left ✓which is opposite to that of E_2 which indicates the field for a positive charge. ✓

Negatief of – ✓ Die rigting van E_1 in die diagram is na links ✓ wat in die teenoorgestelde rigting is as E_2 wat die veld vir 'n positiewe lading is. ✓ (3)

8.2 **POSITIVE MARKING FROM QUESTION 8.1**
POSITIEWE NASIEN VANAF VRAAG 8.1
<u>Option 1/*Opsie 1*</u>

$$E_{net} = E_2 - E_1$$
$$\therefore E_1 = E_2 - E_{net}$$ } Any one/*enige een* ✓

$$\left(\frac{kQ_1}{r^2}\right)✓ = \frac{kQ_2}{r^2} - E_{net}$$

$$\frac{(9\times10^9)Q_1✓}{(0,6)^2} = \frac{(9\times10^9)(12\times10^{-9})✓}{(0,3)^2 ✓} - 600✓$$

$$2,5\times10^{10}Q_1 = 1200 - 600$$

$$Q_1 = 2,4\times10^{-8}C ✓$$

<u>Option 2/*Opsie 2*</u>

$$E_2 = \frac{kQ_2}{r^2} ✓$$

$$E_2 = \frac{(9\times10^9)(12\times10^{-9})✓}{(0,3)^2 ✓}$$

$$E_2 = 1200 \text{ N}\cdot\text{C}^{-1} \text{ to the right / } na \text{ regs}$$

$$E_{net} = E_2 - E_1$$
$$\therefore E_1 = E_2 - E_{net}$$ } Any one/*enige een*✓

$$E_1 = 1200 - 600✓$$

$$E_1 = 600 \text{ N}\cdot\text{C}^{-1} \text{ to the left/na links}$$

$$E_1 = \frac{kQ_1}{r^2}$$

$$600 = \frac{(9\times10^9)Q_1✓}{(0,6)^2}$$

$$Q_1 = 2,4\times10^{-8}C$$ (7)

8.3 $E = \dfrac{F}{Q}$ ✓

$F = (1{,}6 \times 10^{-19})$ ✓ (1600) ✓

$F = \underline{2{,}56 \times 10^{-16}}$ N to the right / na regs ✓
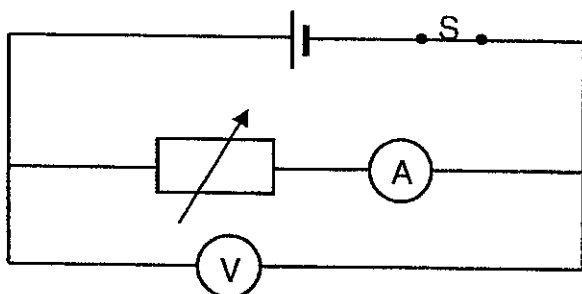
(4)
[15]

14

QUESTION 9 / VRAAG 9

9.1   **Independent variable/*Onafhanklike veranderlike:*
Total current** in the circuit ✓
Totale stroom(sterkte) in die stroombaan✓   (1)

9.2

Cell; switch rheostat correctly drawn and placed in series *Sel, skakelaar en reostaat korrek geteken en in serie met mekaar.*	✓
Ammeter in series with rheostat. *Ammeter in serie met die reostaat.*	✓
Voltmeter in parallel with the rheostat and ammeter or cell. *Voltmeter in parallel met die reostaat en die ammeter of sel.*	✓

(3)

9.3
$$\text{gradient} = \frac{\Delta y}{\Delta x}$$
$$\text{gradient} = \frac{10-8}{0-1} \checkmark \checkmark$$
$$\text{gradient} = -2$$
$$\therefore r = 2\,\Omega \quad \checkmark$$

Accept any legitimate coordinates taken from the graph
Aanvaar antwoorde enige geldige koördinate afgelees vanaf die grafiek

(3)

9.4   GREATER THAN; ✓
GROTER AS ✓   (1)
[8]

QUESTION 10/VRAAG 10

10.1.1 $R_T = R_1 + R_2$ ✓

$R_T = 3,7 + 3,4$

$R_T = 7,1 \ \Omega$ ✓ (2)

10.1.2 $\varepsilon = IR + Ir$ ✓

$20 = I(7,1 + 1)$ ✓

$I = 2,47 \ A$ ✓ (3)

10.2 INCREASES; ✓ When the <u>total resistance decreases</u> ✓; the total current increases when <u>emf and internal resistance stay the same.</u> ✓
NEEM TOE; ✓*Wanneer die <u>totale weerstand afneem</u>,* ✓ *sal die totale stroom toeneem as die <u>EMK en die interne weerstand dieselfde bly</u>.* ✓ (3)

10.3 **Option 1/*Opsie 1:***   **Option 2/*Opsie 2:***

$\varepsilon = IR + Ir$

$20 = (2,31)R_4 + (2,31)(1)$ ✓

$R_4 = 7,66 \ \Omega$

$V = IR$

$V = (2,31)(7,66)$

$V = 17,69 \ V$

$P = \dfrac{V^2}{R}$ ✓

$P = \dfrac{17,69^2}{7,66}$ ✓

$P = 40,86 \ W$ ✓

$\varepsilon = IR + Ir$

$20 = (2,31)R_4 + (2,31)(1)$ ✓

$R_4 = 7,66 \ \Omega$

$P = I^2R$ ✓

$P = 2,31^2 (7,66)$ ✓

$P = 40,87 \ W$ ✓

Accept answers between
Aanvaar antwoorde tussen
40,86 W en 40,88 W

(4)
[12]

QUESTION 11/VRAAG 11

11.1 AC; ✓ The magnetic field changes continuously ✓ which causes the current through the globe to alternate direction.✓
WS; ✓ Die magneetveld word kontinu omgekeer ✓ wat veroorsaak dat die stroom deur die gloeilamp van rigting verander. ✓ (3)

11.2 The globe will light up/glow/burn. ✓
Die gloeilamp sal brand/ gloei. ✓ (1)

11.3 The strength of the magnetic field/magnetic flux linking with the copper coil changes continuously. ✓ This causes an induced emf in the copper coil. ✓ A current is able to flow through the globe because the coil is part of that circuit.✓
Die sterkte van die magneetveld/magnetiese fluks wat met die koperspoel skakel verander voortdurend. ✓ Dit veroorsaak 'n geïnduseerde EMK in die koperspoel. ✓ 'n Stroom kan deur die gloeilamp vloei omdat die spoel deel vorm van daardie stroombaan. ✓ (3)

11.4
- Increase the speed/tempo at which the wheel/crank is turned.
- Increase the number or turns on the coil
- Use a stronger magnet ✓✓ [any two]

- *Verhoog die tempo waarteen die wiel/kruk gedraai word.*
- *Vermeerder die aantal windings op die spoel*
- *Gebruik 'n sterker magneet* ✓✓ [enige twee] (2)

11.5 **Option 1/Opsie 1:**

$P_{ave} = V_{rms}I_{rms}$ ✓
$6 = (12)I_{rms}$ ✓
$I_{rms} = 0,5\ A$

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

$0,5 = \dfrac{I_{max}}{\sqrt{2}}$

$I_{max} = 0,707\ A$ ✓

Option 2/Opsie 2:

$P_{ave} = \dfrac{V_{rms}^2}{R}$ ✓

$6 = \dfrac{(12)^2}{R}$ ✓

$R = 24\ \Omega$

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

$12 = \dfrac{V_{max}}{\sqrt{2}}$

$V_{max} = 16,97\ V$

$I_{max} = \dfrac{V_{max}}{R}$

$I_{max} = \dfrac{16,97}{24}$

$I_{max} = 0,707\ A$ ✓ (4)

[13]

QUESTION 12/*VRAAG 12*

12.1 Workfunction is the <u>minimum energy of a photon</u> ✓needed to <u>set an electron free</u> from the surface of a metal✓ /
Werksfunksie is die <u>minimum energie wat 'n foton</u> ✓moet hê om 'n <u>elektron vry te stel</u> uit die oppervlak van 'n metaal.✓ (2)

12.2 The <u>wavelength is then inversely proportional to the maximum kinetic energy</u> ✓ $(\lambda\alpha\dfrac{1}{E_{k\,max}})$.

<u>Wavelength is inversely proportional to the frequency</u> $(\lambda\alpha\dfrac{1}{f})$ of the radiation. ✓

The <u>frequency is directly proportional to the maximum kinetic energy</u>($f\alpha E_{k\,max}$). ✓
<u>if the cathode remains the same.</u> ✓

Die <u>golflengte is omgekeerd eweredig aan die maksimum kinetiese energie</u>✓ $(\lambda\alpha\dfrac{1}{E_{k\,max}})$

Die <u>golflengte is omgekeerd eweredig aan die frekwensie</u>✓ $(\lambda\alpha\dfrac{1}{f})$van die straling.

Die <u>frekwensie is direk eweredig aan die maksimum kinetiese energie</u>✓ ($f\alpha E_{k\,max}$)
<u>mits die katode dieselfde bly.</u> ✓ (4)

12.3 STAYS THE SAME
BLY DIESELFDE (1)

12.4 **Option 1/Opsie 1:**

$$E = W_0 + E_K$$
$$\frac{hc}{\lambda} = \frac{hc}{\lambda_0} + \tfrac{1}{2}mv_{max}^2 \left.\right\} \checkmark \text{ Any one/Enige een}$$

$$\frac{(6,63\times10^{-34})(3\times10^8)}{160\times10^{-9}} \checkmark = \frac{(6,63\times10^{-34})(3\times10^8)}{255\times10^{-9}} \checkmark + \tfrac{1}{2}(9,11\times10^{-31}) \checkmark v_{max}^2$$

$$1,24\times10^{-18} = 7,8\times10^{-19} + 4,555\times10^{-31}v_{max}^2$$

$$v_{max}^2 = 1.009\times10^{12}$$

$$v_{max} = 1,01\times10^6 \text{ m}\cdot\text{s}^{-1} \checkmark$$

Option 2/Opsie 2:

$$E = \frac{hc}{\lambda}$$

$$E = \frac{(6,63\times10^{-34})(3\times10^8)}{160\times10^{-9}} \checkmark$$

$$E = 1,24\times10^{-18} \text{ J}$$

$$W_0 = hf_0$$

$$W_0 = \frac{(6,63\times10^{-34})(3\times10^8)}{255\times10^{-9}} \checkmark$$

$$W_0 = 7,8\times10^{-19} \text{ J}$$

$$E_K = \tfrac{1}{2}mv^2$$

$$E - W_0 \checkmark = \tfrac{1}{2}(9,11\times10^{-31})v_{max}^2 \checkmark$$

$$1,24\times10^{-18} - 7,8\times10^{-19} = \tfrac{1}{2}(9,11\times10^{-31})v_{max}^2$$

$$v_{max}^2 = 1.009\times10^{12}$$

$$v_{max} = 1,01\times10^6 \text{ m}\cdot\text{s}^{-1} \checkmark$$

(5)
[12]

GRAND TOTAL/GROOTTOTAAL: 150