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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

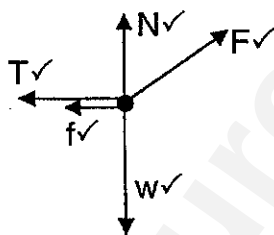
When a resultant/net force acts on an object, the object will accelerate in the direction of the force at an acceleration directly proportional to the force ✓ and inversely proportional to the mass of the object. / ✓

Wanneer 'n resultante/netto krag op 'n voorwerp inwerk sal die voorwerp in die rigting van die krag versnel met 'n versnelling direk eweredig aan die krag ✓ en omgekeerd eweredig aan die massa. ✓

(2)

2.2 Accepted Labels/Aanvaarde benoemings

w	F_g/F_w /force of Earth on block/weight/49 N/mg/gravitational force <i>F_g/F_w/krag van Aarde op blok/gewig/49 N/mg/gravitasiekrag</i>
N	F_N /normal <i>F_N/normaal</i>
f	Friction/ F_f <i>Wrywing/F_f</i>
T	Tension/Force in string/ F_T <i>Spanning/Trekkrag (van die tou)/ F_T</i>
F	F_{app} /15 N <i>F_{toeg}/15 N</i>



Note/Nota

One mark for correct arrow and label.

If any other forces shown max. $\frac{4}{5}$

Een punt vir die korrekte pyl en benaming

Indien enige ander krag getoon word maks. $\frac{4}{5}$

(5)

2.3

$$f_k = \mu_k N \quad \checkmark$$

$$f_k = (0,35)(49 - 15 \sin 30^\circ) \quad \checkmark$$

$$f_k = 14,53 \text{ N} \quad \checkmark$$

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

$$(0,35)(41,5)$$

(3)

2.4

OPTION 1/OPSIE 1**Right positive:****Regs positief:****For/Vir 5 kg**

$$F_{\text{net}} = ma \quad \checkmark$$

$$-F \cos \theta + T - f = m(2,2)$$

$$-15 \cos 30^\circ + T - 14,53 = 5(2,2) \quad \checkmark$$

$$T = 14,53 + 15 \cos 30^\circ + 11$$

$$T = 38,52 \text{ N}$$

Upward positive:**Opwaarts positief:****For/Vir B**

$$F_{\text{net}} = ma$$

$$-38,52 + F_G = m(2,2)$$

$$-38,52 + 9,8m = m(2,2) \quad \checkmark$$

$$38,52 = 7,6m$$

$$m = 5,07 \text{ kg} \quad \checkmark$$

OPTION 2/OPSIE 2**Upward positive:****Opwaarts positief:****For/Vir B**

$$F_{\text{net}} = ma \quad \checkmark$$

$$-T + F_G = m(2,2) \quad \checkmark$$

$$-T + 9,8m = m(2,2) \quad \checkmark$$

$$T = 7,6m \quad (\text{A})$$

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

$$F_{\text{net}} = ma$$

$$-F \cos \theta + T - f = m(2,2)$$

$$-15 \cos 30^\circ + T - 14,53 = 5(2,2) \quad \checkmark$$

$$T = 14,85 + 15 \cos 30^\circ + 11$$

$$T = 38,5 \text{ N} \quad (\text{B})$$

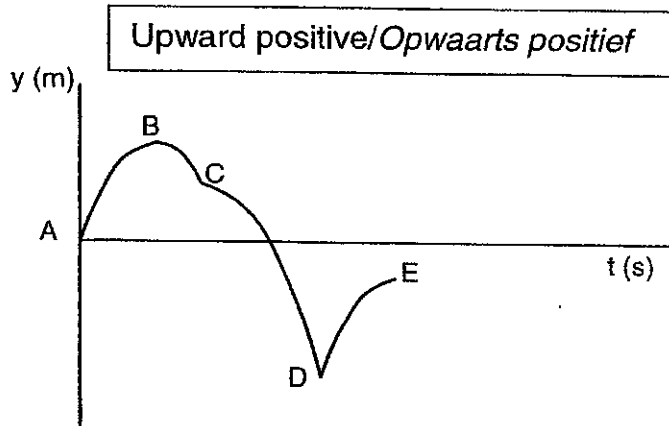
Set/stel (A) = (B)

$$7,6m = 38,5$$

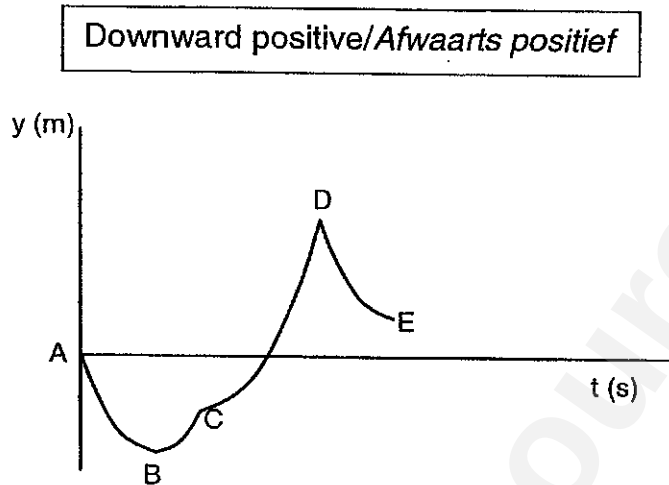
$$m = 5,07 \text{ kg} \quad \checkmark$$

(5)
[15]

3.5



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

**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 $9,8 \text{ m}\cdot\text{s}^{-2}$ ✓ downward/to the centre of the earth ✓
 $9,8 \text{ m}\cdot\text{s}^{-2}$ ✓ 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:

$$v_f^2 = v_i^2 + 2a\Delta y \quad \checkmark$$

$$-3,2^2 = 6^2 + 2(-9,8)\Delta y \quad \checkmark$$

$$\Delta y = 1,31 \text{ m} \quad \checkmark$$

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

$$v_f = v_i + a\Delta t$$

$$-3,2 = 6 + (-9,8)\Delta t \quad \checkmark$$

$$\Delta t = 0,94 \text{ s}$$

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \quad \checkmark$$

$$\Delta y = (6)(0,94) + \frac{1}{2}(-9,8)(0,94)^2 \quad \checkmark$$

$$\Delta y = 1,31 \text{ m} \quad \checkmark$$

OPTION 3 / OPSIE 3
 Upward positive:
 Opwaarts positief:

$$v_f = v_i + a\Delta t$$

$$-3,2 = 6 + (-9,8)\Delta t \quad \checkmark$$

$$\Delta t = 0,94 \text{ s}$$

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

$$\Delta y = \frac{-3,2 + 6}{2} (0,94) \quad \checkmark$$

$$\Delta y = 1,31 \text{ m} \quad \checkmark$$

OPTION 4 / OPSIE 4
 Upward negative:
 Opwaarts negatief:

All the options 1 to 3 with all the applicable signs changed. Maximum $\frac{3}{4}$

Al die opsies 1 tot 3 met die toepaslike tekens omgekeerd.
 Maksimum $\frac{3}{4}$

(4)

QUESTION 4/VRAAG 4

- 4.1 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 voorwerp in die heelal trek elke ander voorwerp 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)

4.2
$$F_G = \frac{Gm_1m_2}{d^2} \quad \checkmark$$

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

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

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

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

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

(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 collision. ✓✓
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:**

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

$$m_{1+2} v_i = m_1 v_{1f} + m_2 v_{2f}$$

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

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

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

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

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

$$m_{1+2} v_i = m_1 v_{1f} + m_2 v_{2f}$$

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

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

(4)

5.3 OPTION 1 / OPSIE 1

East positive:

Oos positief:

$$F_{\text{net}}\Delta t = mv_f - mv_i \quad \checkmark$$

$$F_{\text{net}}(1,2) = (1,5)(10,2) - (1,5)(0,08) \quad \checkmark$$

$$F_{\text{net}} = 12,65 \text{ N east / oos} \quad \checkmark$$

OPTION 2 / OPSIE 2

West positive:

Wes positief:

$$F_{\text{net}}\Delta t = mv_f - mv_i \quad \checkmark$$

$$F_{\text{net}}(1,2) = (1,5)(-10,2) - (1,5)(-0,08) \quad \checkmark$$

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

$$\therefore F_{\text{net}} = 12,65 \text{ N east / oos} \quad \checkmark$$

OPTION 3 / OPSIE 3

East positive:

Oos positief:

$$v_f = v_i + a\Delta t$$

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

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

$$F_{\text{net}} = ma \quad \checkmark$$

$$F_{\text{net}} = 1,5(8,43) \quad \checkmark$$

$$F_{\text{net}} = 12,65 \text{ N east / oos} \quad \checkmark$$

OPTION 3 / OPSIE 3

West positive:

Wes positief:

$$v_f = v_i + a\Delta t$$

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

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

$$F_{\text{net}} = ma \quad \checkmark$$

$$F_{\text{net}} = 1,5(-8,43) \quad \checkmark$$

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

$$F_{\text{net}} = 12,65 \text{ N east / oos} \quad \checkmark$$

(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
$$\left. \begin{aligned} f_k &= \mu_k N \\ f_k &= \mu_k F_{g\perp} \end{aligned} \right\} \text{Any one/enige een } \checkmark$$

$$f_k = 0,22 \times (86 \times 9,8) \times \cos 25^\circ \checkmark$$

$$f_k = \underline{168,04 \text{ N}}$$

(2)

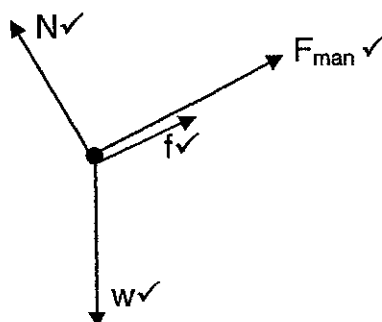
- 6.3 The net/total work done ✓ on an object is equal to the change in the object's kinetic energy. ✓ OR The work done on an object by a resultant/net force is equal to the change in the object's kinetic energy.

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_{toeg} /15 N



(4)

6.5 OPTION 1 / OPSIE 1

Parallel to the plane down is positive

Ewewydig aan die vlak af is positief

$$v_f^2 = v_i^2 + 2a\Delta x$$

$$v_f^2 - v_i^2 = 2(1,54)(0,9) \quad \checkmark$$

$$v_f^2 - v_i^2 = 2,772$$

$$W_{\text{net}} = \Delta E_K \quad \checkmark$$

$$W_{\text{man}} + W_{\text{grav}} + W_f = \frac{1}{2}m(v_f^2 - v_i^2)$$

$$W_{\text{man}} + (86 \times 9,8) \sin 25^\circ (0,9) \cos 0^\circ + 168,04(0,9) \cos 180^\circ = \frac{1}{2}(86)(2,772) \quad \checkmark$$

$$W_{\text{man}} + 320,56 - 151,236 = 119,196$$

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

OPTION 2 / OPSIE 2

Parallel to the plane up is positive

Ewewydig aan die vlak op is positief

$$v_f^2 = v_i^2 + 2a\Delta x$$

$$v_f^2 - v_i^2 = 2(-1,54)(-0,9) \quad \checkmark$$

$$v_f^2 - v_i^2 = 2,772$$

$$W_{\text{net}} = \Delta E_K \quad \checkmark$$

$$W_{\text{man}} + W_{\text{grav}} + W_f = \frac{1}{2}m(v_f^2 - v_i^2)$$

$$W_{\text{man}} + (86 \times 9,8) \sin 25^\circ (0,9) \cos 0^\circ + 168,04(0,9) \cos 180^\circ = \frac{1}{2}(86)(2,772) \quad \checkmark$$

$$W_{\text{man}} + 320,56 - 151,236 = 119,196$$

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

OPTION 3 / OPSIE 3

Parallel to the plane up is positive

Ewewydig aan die vlak op is positief

$$F_{\text{net}} = ma$$

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

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

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

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

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

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

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

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

$$F_{\text{net}} = ma$$

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

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

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

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

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

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

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

(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

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

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

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

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

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

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

OPTION 2 / OPSIE 2

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

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

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

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

(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

Option 1/Opsie 1

$$\begin{aligned}
 E_{\text{net}} &= E_2 - E_1 \\
 \therefore E_1 &= E_2 - E_{\text{net}} \quad \left. \vphantom{\begin{aligned} E_{\text{net}} &= E_2 - E_1 \\ \therefore E_1 &= E_2 - E_{\text{net}} \end{aligned}} \right\} \text{Any one/enige een } \checkmark \\
 \frac{kQ_1}{r^2} &= \frac{kQ_2}{r^2} - E_{\text{net}} \\
 \frac{(9 \times 10^9) Q_1}{(0,6)^2} &= \frac{(9 \times 10^9)(12 \times 10^{-9})}{(0,3)^2} - 600 \quad \checkmark \\
 2,5 \times 10^{10} Q_1 &= 1200 - 600 \\
 Q_1 &= 2,4 \times 10^{-8} \text{ C } \checkmark
 \end{aligned}$$

Option 2/Opsie 2

$$E_2 = \frac{kQ_2}{r^2} \quad \checkmark$$

$$E_2 = \frac{(9 \times 10^9)(12 \times 10^{-9})}{(0,3)^2} \quad \checkmark$$

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

$$E_{\text{net}} = E_2 - E_1$$

$$\therefore E_1 = E_2 - E_{\text{net}}$$

$$E_1 = 1200 - 600 \quad \checkmark$$

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

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

$$600 = \frac{(9 \times 10^9) Q_1}{(0,6)^2} \quad \checkmark$$

$$Q_1 = 2,4 \times 10^{-8} \text{ C}$$

(7)

8.3

$$E = \frac{F}{Q} \checkmark$$

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

$$F = \underline{2,56 \times 10^{-16} \text{ N to the right / na regs}} \checkmark$$

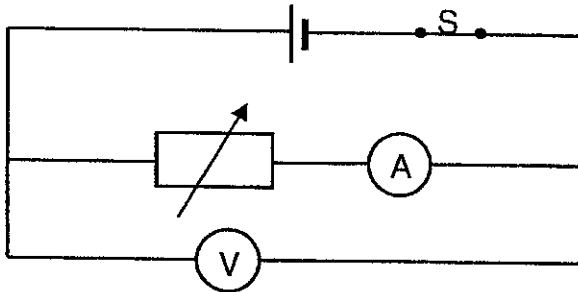
(4)
[15]

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

$$\text{gradient} = \frac{\Delta y}{\Delta x}$$

$$\text{gradient} = \frac{10-8}{0-1} \checkmark$$

$$\text{gradient} = -2$$

$$\therefore r = 2\Omega \checkmark$$

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

$$10.1.1 \quad R_T = R_1 + R_2 \checkmark$$

$$R_T = 3,7 + 3,4$$

$$R_T = 7,1 \, \Omega \checkmark$$

(2)

$$10.1.2 \quad \varepsilon = IR + Ir \checkmark$$

$$20 = I(7,1 + 1) \checkmark$$

$$I = 2,47 \, A \checkmark$$

(3)

10.2 INCREASES; $\checkmark$ When the total resistance decreases $\checkmark$; the total current increases when emf and internal resistance stay the same. $\checkmark$

NEEM TOE; $\checkmark$ Wanneer die totale weerstand afneem, $\checkmark$ sal die totale stroom toeneem as die EMK en die interne weerstand dieselfde bly. $\checkmark$

(3)

10.3 **Option 1/Opsie 1:**

Option 2/Opsie 2:

$$\varepsilon = IR + Ir$$

$$20 = (2,31)R_4 + (2,31)(1) \checkmark$$

$$R_4 = 7,66 \, \Omega$$

$$\varepsilon = IR + Ir$$

$$20 = (2,31)R_4 + (2,31)(1) \checkmark$$

$$R_4 = 7,66 \, \Omega$$

$$V = IR$$

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

$$V = 17,69 \, V$$

$$P = I^2 R \checkmark$$

$$P = 2,31^2 (7,66) \checkmark$$

$$P = 40,87 \, W \checkmark$$

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

$$P = \frac{17,69^2}{7,66} \checkmark$$

$$P = 40,86 \, W \checkmark$$

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:**

$$P_{ave} = V_{rms} I_{rms} \quad \checkmark$$

$$6 = (12) I_{rms} \quad \checkmark$$

$$I_{rms} = 0,5 \text{ A}$$

$$I_{rms} = \frac{I_{max}}{\sqrt{2}} \quad \checkmark$$

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

$$I_{max} = 0,707 \text{ A} \quad \checkmark$$

Option 2/Opsie 2:

$$P_{ave} = \frac{V_{rms}^2}{R} \quad \checkmark$$

$$6 = \frac{(12)^2}{R} \quad \checkmark$$

$$R = 24 \Omega$$

$$V_{rms} = \frac{V_{max}}{\sqrt{2}} \quad \checkmark$$

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

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

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

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

$$I_{max} = 0,707 \text{ A} \quad \checkmark$$

(4)

[13]

QUESTION 12/VRAAG 12

- 12.1 Workfunction is the minimum energy of a photon ✓ needed to set an electron free ✓ from the surface of a metal ✓ /

Werksfunksie is die minimum energie wat 'n foton ✓ moet hê om 'n elektron vry te stel uit die oppervlak van 'n metaal. ✓

(2)

- 12.2 The wavelength is then inversely proportional to the maximum kinetic energy ✓
 $(\lambda \propto \frac{1}{E_{k \max}})$

Wavelength is inversely proportional to the frequency $(\lambda \propto \frac{1}{f})$ of the radiation. ✓

The frequency is directly proportional to the maximum kinetic energy $(f \propto E_{k \max})$. ✓
if the cathode remains the same. ✓

Die golflengte is omgekeerd eweredig aan die maksimum kinetiese energie ✓

$$(\lambda \propto \frac{1}{E_{k \max}})$$

Die golflengte is omgekeerd eweredig aan die frekwensie ✓ $(\lambda \propto \frac{1}{f})$ van die straling.

Die frekwensie is direk eweredig aan die maksimum kinetiese energie ✓ $(f \propto E_{k \max})$ mits die katode dieselfde bly. ✓

(4)

- 12.3 STAYS THE SAME
 BLY DIESELFDE

(1)

12.4 Option 1/Opsie 1:

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

$$\frac{(6,63 \times 10^{-34})(3 \times 10^8)}{160 \times 10^{-9}} \checkmark = \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{255 \times 10^{-9}} \checkmark + \frac{1}{2}(9,11 \times 10^{-31})v_{\max}^2 \checkmark$$

$$1,24 \times 10^{-18} = 7,8 \times 10^{-19} + 4,555 \times 10^{-31} v_{\max}^2$$

$$v_{\max}^2 = 1,009 \times 10^{12}$$

$$v_{\max} = 1,01 \times 10^6 \text{ m} \cdot \text{s}^{-1} \checkmark$$

Option 2/Opsie 2:

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

$$E = \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{160 \times 10^{-9}} \checkmark$$

$$E = 1,24 \times 10^{-18} \text{ J}$$

$$W_0 = hf_0$$

$$W_0 = \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{255 \times 10^{-9}} \checkmark$$

$$W_0 = 7,8 \times 10^{-19} \text{ J}$$

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

$$E - W_0 = \frac{1}{2}(9,11 \times 10^{-31})v_{\max}^2 \checkmark$$

$$1,24 \times 10^{-18} - 7,8 \times 10^{-19} = \frac{1}{2}(9,11 \times 10^{-31})v_{\max}^2$$

$$v_{\max}^2 = 1,009 \times 10^{12}$$

$$v_{\max} = 1,01 \times 10^6 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(5)
[12]

GRAND TOTAL/GROOTTOTAAL: 150