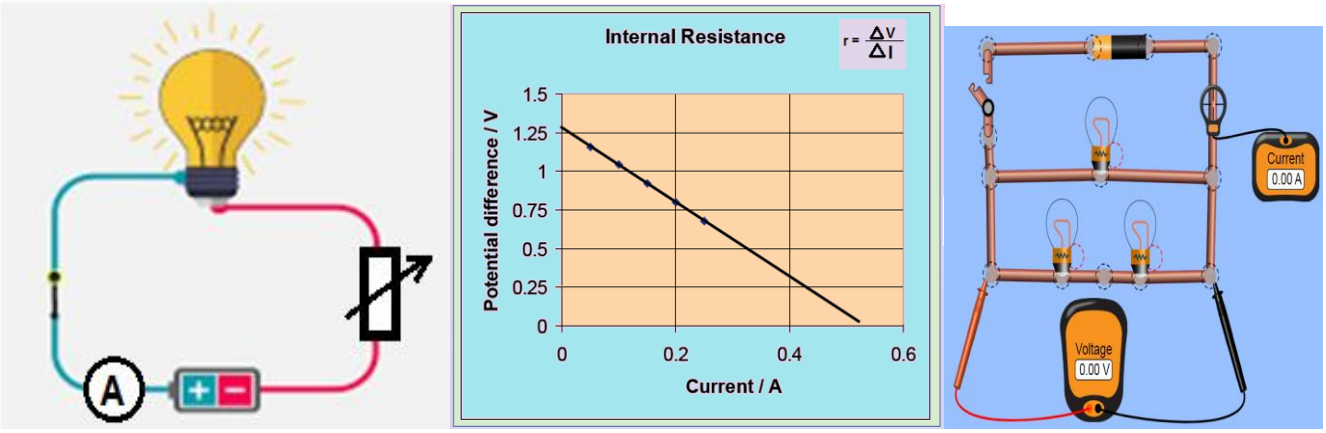
NORTHERN CAPE DEPARTMENT OF EDUCATION

NOORD- KAAP DEPARTEMENT VAN ONDERWYS

PHYSICAL SCIENCES/ *FISIESE WETENSKAPPE*

PHYSICS/*FISIKA*

GRADE 12 /GRAAD 12



CONSOLIDATION/ *KONSOLIDASIE*

TERM 3/*KWARTAAL 3*

ELECTRIC CIRCUITS /*ELEKTRIESE STROOMBANE*

MEMORANDUM

COMPILED BY/SAAMGESTEL DEUR:

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2020

SOLUTIONS/*OPLOSSINGS:*

QUESTION 1/*VRAAG 1* (2)

1.1 B ✓✓ (2)

1.2 C ✓✓ (2)

1.3 A ✓✓ (2)

1.4 B✓✓ (2)

1.5 B ✓✓ (2)

1.6 D ✓✓ (2)

1.7 A ✓✓ (2)

1.8 B ✓✓ (2)

1.9 D ✓✓ (2)

1.10 B✓✓ (2)

[20]

QUESTION 2/*VRAAG 2*

2.1 10 V✓ (1)

2.2.1

$R_{ext/eks} = R_x + R_{parallel}$ ✓ **OR/*OF*** $R_{ext/eks} = R_x + \left(\frac{R_1 R_2}{R_2 + R_1}\right)$ $R_{ext/eks} = \frac{V}{I}$ ✓

$\frac{1}{R_{parallel}} = \frac{1}{R_1} + \frac{1}{R_2}$ $R_{ext/eks} = \frac{8}{1}$ ✓

$\frac{1}{R} = \frac{1}{2} + \frac{1}{4}$ ✓ $R_{ext/eks}$= 8 Ω

$R_{parallel}$=1,33 Ω

✓8 = R_x+ 1,33✓

R_x= 8 - 1,33= 6,67 Ω✓ (7)

2.2.2 V_{int}= Ir✓
10- 8 = 1 r✓
r= 2 Ω✓
OR/*OF*
Emf/*emk* = $V_{ext/eks}$ + I r✓
10 = 8 + 1r✓
r = 2 Ω✓
OR/*OF*
V_{int} = I r✓
2= 1x r✓
r = 2 Ω✓ (3)

2.3 INCREASES✓
Total resistance increases.✓
Current in the circuit decreases ✓
Lost volts (Ir) decreases and according to the equation (V_{ext} = ε- Ir) the voltage increases✓.
TOENEEM✓
Totale weerstand neem toe. ✓
Stroomsterkte in die baan neem af. ✓
Verlore volts (Ir) neem af en volgens die vergelykig (V_{eks} = ε- Ir) sal die voltmeterlesing toeneem. ✓
(4)

[15]

QUESTION 3/*VRAAG 3*

3.1 The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature. (provided temperature and all other physical conditions are constant) ✓✓

Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur (mits temperatuur en alle fisiese toestande konstant bly)

OR/*OF*

.The current in a conductor is directly proportional to the potential difference across the conductor, provided temperature and all other physical conditions are constant ✓✓

Die stroom in 'n geleier is direk eweredig aan die potensiaalverskil oor 'n geleier by konstante temperatuur mits temperatuur en alle fisiese toestande konstant bly (2)

3.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$V = IR$✓	$V = IR$✓
$V_8 = (0,5)(8)$✓ $= 4$ V	$V_8 = (0,5)(8)$ ✓ $= 4$ V
$V_8 = V_{16}$	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$
$\therefore V_{16} = 4$ V	$= \frac{1}{8} + \frac{1}{16}$✓
$I_{16} = \frac{V}{R} = \frac{4}{16} = 0,25$ A	$R = 5,33\ \Omega$
$I_{tot//} = A_1 = (0,5 + 0,25)$ ✓ $= 0,75$ A✓	$I_{tot//} = \frac{4}{5,33}$
	$A_1 = 0,75$ A✓

(4)

OPTION 3/*OPSIE 3*	**OPTION 4/*OPSIE 4***
$I_1R_1 = I_2R_2$✓	$2R_{8\Omega} = R_{16\Omega}$✓
$(0,5)(8) = I_{16}(16)$ ✓	$\therefore I_{R16} = ½ I_{R8}$ ✓
	$\therefore I_{R16} = ½ (0,5) = 0,25$ A
$I_{16} = \frac{(8)(0,5)}{16} = 0,25$ A	$A_1 = (0,5 + 0,25)$ ✓ $= 0,75$ A✓
$I_{tot//} = A_1 = (0,5 + 0,25)$ ✓$= 0,75$ A✓	(4)

3.3

OPTION 1/*OPSIE 1*

$V = IR$

$V_{20\Omega} = (0,75)(20)$ ✓ $= 15$ V

$V_{//tot} = (15 + 4)$ ✓ $= 19$ V

$V_R = 19$ V

$P = VI$✓

$12 = (19)I$ ✓

$I_R = A_2 = 0,63$ A✓ (5)

OPTION 2/*OPSIE 2*

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{8} + \frac{1}{16}$ ✓

$R_{//} = 5,33\ \Omega$

$R_{//} + R_{20} = (5,33 + 20)$ ✓ $= 25,33\Omega$

$V_{//tot} = I(R_{//} + R_{20})$

$= (0,75)(25,33)$

$= 19$ V

OR/*OF*

$R = \frac{R_1R_2}{R_1 + R_2} = \frac{8 \times 16}{8 + 16}$ ✓ $= 5,33\ \Omega$

(5)

$P = VI$

$12\checkmark = I(19)\ \checkmark$

$I_R = A_2 = 0{,}63\ A\checkmark$

OPTION 3/*OPSIE 3*

$V = IR$

$V_{20\Omega} = (0{,}75)\ (20)\ \checkmark = 15\ V$

$V_{//tot} = (15 + 4)\ \checkmark = 19\ V$

$V_R = 19\ V$

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

$$12 = \frac{(19)^2}{R}$$

$R = 30{,}08\ \Omega$

$P = I^2R\checkmark$

$12 = I^2(30{,}08)\checkmark$

$I = 0{,}63\ A\checkmark$ (5)

QUESTION 4/*VRAAG 4*

4.1

4.1.1 $V = IR$✓

$= (0,2)(\underline{4+8})$✓

$= 2,4\ V$✓ (3)

4.1.2 **POSITIVE MARKING FROM QUESTION 4.1.1/*POSITIEWE NASIEN VANAF VRAAG 4.1.1***

$V = IR$	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)

4.1.3 **POSITIVE MARKING FROM QUESTION 4.1.2/*POSITIEWE NASIEN VANAF VRAAG 4.1.2***

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)

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

[15]

3.4

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$(\varepsilon) = I(R + r)$ ✓	$V_{int} = Ir$
$= V_{terminal} + V_{int}$	$= (0,75 + 0,63)(1)$✓
$= 19 + (0,75 + 0,63)(1)$ ✓	$= 1,38$ V
$= 20,38$ V✓	$\varepsilon = V_{terminal} + V_{int}$ ✓
	$= 19 + 1,38$
	$= 20,38$ V ✓ (3)

OPTION 3/OPSIE 3

$R = \frac{V}{I} = \frac{19}{0,63} = 30,16\ \Omega$

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{30,16} + \frac{1}{25,33}$ $\therefore R_p = 13,77\ \Omega$

$I_{tot} = 0,63 + 0,75 = 1,38$ A
$\varepsilon = I(R + r)$ ✓
$= (1,38)(13,77 + 1)$✓
$= 20,38$ V✓

[14]

QUESTION 5/ VRAAG 5

5.1 When current flows through a voltage source (battery/generator) a resistance to current flow arises✓ due to the resistance of the materials (chemicals/conductors) from which the source is made.✓

Wanneer stroom deur 'n volt-kragbron (battery/generator) vloei, ontstaan 'n weerstand teen stroomvloei as gevolg van die weerstand van die materiaal (chemikaleë/ geleiers) waarvan die bron gemaak is.

OR/*OF*

Internal resistance is the resistance offered to the electron flow✓ by the electrolyte/medium of the cell/generator. ✓

Interne weerstand is die weerstand gebied teen die vloei van elektrone deur die elektroliet/ medium van die sel/ generator. (2)

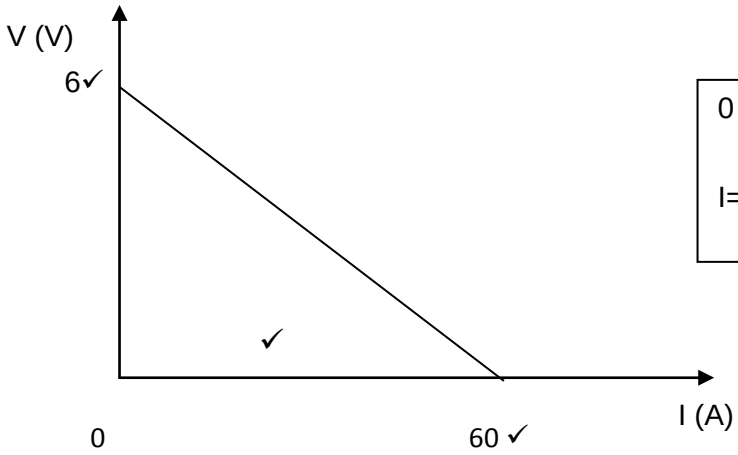
5. 2

$\varepsilon = V_{ext} + Ir$✓

$6 = V_{ext} + I(0,10)$

$V_{ext} = 6 - (0,10)I$✓ (2)

5.3



$0 = 6 - (0,10)I$

$I = \frac{6}{0,1} = 60$ A (3)

5.4

5.4.1 **OPTION 1/ *OPSIE 1***

$W_4 = I^2R\Delta t$ ✓= 40

$I^2(4)\Delta t = 40$✓

$W_R = (\frac{10}{\Delta t})R\Delta t = 60$ ✓

R = 6 Ω✓

OPTION 2/ *OPSIE 2*

$W = I^2R\Delta t$✓

$\frac{W_4}{W_R} = \frac{I^2R_4\Delta t}{I^2R\ \Delta t^2}$

$\frac{40}{60}$ ✓ $= \frac{I^2(4)\Delta t}{I^2R\ \Delta t}$ ✓

R = 6 Ω✓

(4)

5.4.2 **POSITIVE MARKING FROM QUESTION 5.4.1**
POSITIEWE NASIEN VANAF VRAAG 5.4.1

OPTION 1/ *OPSIE 1*

ε = I(R+r) ✓

6 = I(4+6)+ 0,10)✓

I = 0,59 A✓

OPTION 2/ *OPSIE 2*

ε = I(R+r) ✓

6 = I(10)+ 0,10)✓

I = 0,59 A✓

(3)

5.4.3 **POSITIVE MARKING FROM QUESTION 5.4.1 and 5.4.2**

POSITIEWE NASIEN VANAF VRAAG 5.4.1 en 5.4.2

OPTION 1/ *OPSIE 1*	**OPTION 2 /*OPSIE 2***
$\varepsilon = V_{ext} + Ir$✓	$V = IR_{ext}$✓
$6 = V_{ext} + (0,59)(0,10)$ ✓	$= (0,59)(10)$ ✓
$V_{ext} = 5,94$ V✓	$=5,9$ V✓

(3)

5.5 DECREASE✓

Total resistance of the circuit decreases ✓

Current increases✓

$V_{internal\ resistance}$ increases✓

V_{ext} (voltmeter reading) decreases ($V_{ext} = \varepsilon - V_{int}$)

AFNEEM

Totale weerstand van die stroombaan neem af

Stroom neem toe

$V_{interne\ weerstand}$ neem toe

V_{eks}(voltmeterlesing) neem af ($V_{eks} = \varepsilon - V_{int}$) (4)

[21]

QUESTION 6 / VRAAG 6

6.1
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 konstante temperatuur✓.

(2)

6.2
$R = \frac{V}{I}$ ✓

$R = \frac{12.9}{1.5}$ ✓
$R = 8.6\,\Omega$ ✓ (3)

6.3 **POSITIVE MARKING FROM QUESTION6.2**
POSITIEWE NASIEN VAN VRAAG 6.2
$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_s}$ ✓
$\frac{1}{R_T} = \frac{1}{8.6} + \frac{1}{(4+5)}$ ✓
$\frac{1}{R_T} = \frac{88}{387}$
$R_T = 4.4\,\Omega$ ✓ (3)

6.4 **POSITIVE MARKING FROM QUESTION 6.3**
POSITIEWE NASIEN VAN VRAAG 6.3

OPTION 1/OPSIE1	***OPTION 2/OPSIE 2***
$R = \frac{V}{I}$ ✓	$R = \frac{V}{I}$ ✓
$4.4 = \frac{12.9}{I}$ ✓	$4.4 = \frac{12.9}{I}$ ✓
$I = 2{,}93\ A$	$I = 2{,}93\ A$
$r = \frac{V}{I}$	$\varepsilon = I\,(R + r\,)$
$r = \frac{15-12.9}{2.93}$ ✓	$15 = 2.93\,(4.4 + r)$ ✓
$r = 0{,}72\ \Omega$ ✓	$r = 0{,}72\ \Omega$ ✓

OPTION 3/OPSIE 3	*OPTION 4/OPSIE 4*
$R = \frac{V}{I}$ ✓ $9 = \frac{12.9}{I}$ ✓ $I = 1.43\ A$ $I = 1.5 + 1.43$ $I = 2.93\ A$ $r = \frac{V}{I}$ $r = \frac{15-12.9}{2.93}$ ✓ $r = 0{,}72\ \Omega$ ✓	$R = \frac{V}{I}$ ✓ $9 = \frac{12.9}{I}$ ✓ $I = 1.43\ A$ $I = 1.5 + 1.43$ $I = 2.93\ A$ $\varepsilon = I\ (R + r\ )$ $15 = 2.93\ (4.4 + r)$ ✓ $r = 0{,}72\ \Omega$ ✓

(4)
[12]

QUESTION 7 / VRAAG 7

7.1 **Any TWO✓✓**

Electromotive force

1. Electromotive force transmits current both inside and outside the cell.
2. Electromotive force emf is the cause.
3. Electromotive force is always greater than potential difference.
4. Electromotive force creates potential difference in the entire circuit.
5. Electromotive force does not depend on the resistance of the circuit.
6. Electromotive force remains constant.
7. The part of the circuit where electrical energy is created from any other energy then that part contains the source of Electromotive force.

Potential difference

1. Potential difference current transfers between any two points in the circuit.
2. Potential difference is the result.
3. Potential difference is always less than electromotive force.
4. Potential difference takes place between any two points in the circuit.
5. Potential difference of two points depends on the resistance of those points.
6. It does not remain constant.
7. Potential difference exists in the part of the circuit where electrical potential energy is transformed into another form of energy

ENIGE TWEE

Elektromotoriese krag

1. Elektromotoriese krag stuur stroom binne en buite die sel.

2. Elektromotoriese krag emk is die oorsaak.

3. Elektromotoriese krag is altyd groter as potensiaalverskil.

4. Elektromotoriese krag skep potensiaalverskil die hele kring.

5.Elektromotoriese krag is nie afhanklik van die weerstand van die stroombaan nie.

6. Elektromotoriese krag bly konstant.

7. Die deel van die stroombaan waar elektriese energie geskep word van enige ander energie, daardie deel is die bron van elektromotoriese krag.

Moontlike verskil

1. Potensiaalverskil stroom word tussen enige twee punte in die kring.

2. Potensiaalverskil is die resultaat. (2)

3. Potensiaalverskil is altyd minder as elektromotoriese krag.

4. Potensiaalverskil vind plaas tussen enige twee punte in die kring oogedra.

5. Potensiaalverskil van twee punte hang af van die weerstand van die punte.
6. Dit bly nie konstant nie.
7. Potensiaalverskil bestaan in die deel van die stroombaan waar elektriese potensiële energie omskep word in 'n ander vorm van energie

7.2 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 konstante temperatuur.

OR/*OF*

The current in a conductor is directly proportional to the potential difference across the conductor at constant temperature. ✓✓

Die stroom in 'n geleier is direk eweredig aan die potensiaalverskil oor die geleier by konstante temperatuur.

(2)

7.3 **OPSION 1/*OPSIE 1***

$I_2 = \frac{V_2}{R_2}$✓

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$✓ OR/OF $R_{eq} = \frac{R}{3}$

$V_1 = V_2 = V_1$=V

$V_2 = IR_{eq} = I\frac{R}{3}$

$I_2 = \frac{I\frac{R}{3}}{R} = \frac{I}{3}$✓

$I_2 = \frac{3}{3} = 1\ A$✓

OPSION 2/*OPSIE 2*

OR/*OF*

Since resistors are in parallel and are equal✓, the main current will divide equally.✓

Aangesien resistors parallel en gelyk is, sal die hoofstroom eweredig verdeel

$I_2 = \frac{1}{3} I_{main/hoof}$

$I_2 = \frac{1}{3} \times 3$ ✓

$I_2 = 1\ A$ ✓

(4)

7.4 $V_{ext} = \varepsilon - V_i$ ✓

$V_{ext} = 12$ ✓ $- (3 \times 0{,}4)$ ✓

$V_{ext} = 10{,}8\ V$ ✓

(4)

7.5.1 Decreases/*Afneem* ✓ (1)

7.5.2 Increases/Neem toe ✓

The resistor is now connected in series then total resistance increases✓, emf is constant then current decreases✓, drop of potential in the battery decreases✓ and according to $V_{ext} = \varepsilon - V_i$ terminal potential increases.

Die resistor word nou in serie verbind, dan word die totale weerstand verhoog, emk is konstant as huidige afname, daling van potensiaal in die battery neem af en volgens $V_{ext} = \varepsilon - V_i$terminale potensiaal toeneem.

(4)

[17]

QUESTION 8/*VRAAG 8*

8.1 The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature.✓✓ (2 or 0)

Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur. (2 of 0)

OR/*OF*

The current in a conductor is directly proportional to the potential difference across the conductor at constant temperature. ✓✓ (2 or 0)

Die stroom in 'n geleier is direk eweredig aan die potensiaalverskil oor die geleier by konstante temperatuur. (2 of 0)

(2)

8.2.1 **OPTION 1/*OPSIE 1***

$R_{234}=R_2+\left(\frac{R_3R_4}{R_3+R_4}\right)$✓$= 10+\left(\frac{10\times10}{10+10}\right)$✓$=15\ \Omega$

R_1 and/en R_{234} are/is in parallel

$R_{1234}=\frac{R_1\times R_{234}}{R_1+R_{234}}$ **OR/*OF*** $\frac{1}{R_P}=\frac{1}{R_1}+\frac{1}{R_{p2}}$

$R_{1234}=\frac{15\times15}{15+15}$✓ **OR/*OF*** $\frac{1}{R_{eq}}=\frac{1}{15}+\frac{1}{15}$

$R_{1234}=7,5\ \Omega$

$I=\frac{\varepsilon}{R+r}$✓ **OR/*OF*** (emf/*emk*) $\varepsilon=I(R+r)$

$I=\frac{12}{7,5+0,5}$✓ **OR/*OF*** $12=I(7,5+0,5)$✓

$I=1,5\ A$✓

OPTION 2/*OPSIE 2*

R_3 and/en R_4 are/is in parallel

$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$

$\frac{1}{R_{34}} = \frac{1}{10} + \frac{1}{10}$

Any one✓/*Enige een*

$R_{34} = 5\ \Omega$

R_2 and R_{34} are in series/*R_2 en R_{34} is in serie*

$R_{234} = R_2 + R_{34}$

$R_{234} = 10 + 5$

Any one✓/*Enige een*

$R_{234} = 15\ \Omega$

R_1 and/en R_{234} are/is in parallel

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_{p2}}$$

$\frac{1}{R_{eq}} = \frac{1}{15} + \frac{1}{15}$✓

R_{1234}=7,5 Ω

$I = \frac{\varepsilon}{R+r}$✓ **OR/*OF*** (emf/*emk*) $\varepsilon = I(R+r)$

$I = \frac{12}{7,5+0,5}$✓ **OR/*OF*** $12 = I(7,5+0,5)$✓

I=1,5 A✓

OPTION 3/*OPSIE 3*

R_3 and/en R_4 are/is in parallel

$R_{34}=\frac{R_3\times R_4}{R_3+R_4}$] Any one✓/*Enige een*

$R_{34}=\frac{10\times 10}{10+10}$

$R_{34}= 5\ \Omega$

R_2 and R_{34} are in series/*R_2 en R_{34} is in serie*

$R_{234}= R_2 + R_{34}$] Any one✓/*Enige een*

$R_{234}= 10 + 5$

$R_{234}= 15\ \Omega$

R_1 and/en R_{234} are/is in parallel

$R_{1234}=\frac{R_1\times R_{234}}{R_1+R_{234}}$

$R_{1234}=\frac{15\times 15}{15+15}$✓

$R_{1234}=7,5\ \Omega$

$I=\frac{\varepsilon}{R+r}$✓ **OR/*OF*** (emf/*emk*) $\varepsilon=I(R+r)$

$I=\frac{12}{7,5+0,5}$✓ **OR/*OF*** $12=I(7,5+0,5)$✓

$I=1,5$ A✓

OPTION 4/*OPSIE 4*

$\frac{1}{R_P}=\frac{1}{R_1}+\frac{1}{R_{p2}}$✓

$R_T=R_p=\left(\frac{1}{15}\checkmark+\frac{1}{10+\left(\frac{1}{10}+\frac{1}{10}\right)^{-1}}\checkmark\right)^{-1}=7,5\ \Omega$

$I=\frac{\varepsilon}{R+r}$✓ **OR/*OF*** (emf/*emk*) $\varepsilon=I(R+r)$

$I=\frac{12}{7,5+0,5}$✓ **OR/*OF*** $12=I(7,5+0,5)$✓

$I=1,5$ A✓

(6)

8.2.2 **POSITIVE MARKING FROM 8.2.1/*POSITIEWE NASIEN VANAF 8.2.1.***

OPTION 1/*OPSIE 1*

$I_T=I_1+I_2$

$I_1=I_2$

$I_T=2I$

$1,5=2I$✓

$I=0,75$ A

$P=I^2R$✓

$P=(0,75)^2 15$✓

$P = 8,44$ W✓

OPTION 2/*OPSIE 2*

$I_T=I_1+I_2$

$I_1=I_2$

$I_T=2I$

$1,5=2I$✓

$I=0,75$ A

$V=IR$

$V=(0,75)(15)$

$V=11,25$ V

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

$P=\frac{(11,25)^2}{R15}$✓

$P=8,44$ W✓

✓ Both/*Beide*

OPTION 3/*OPSIE 3*

$I_T=I_1+I_2$
$I_1=I_2$
$I_T=2I$
1,5=2I✓
I=0,75 A
V=IR
V=(0,75)(15)
V=11,25 V
P=VI
P=11,25×0,75✓
P=8,44 W✓

✓ Both/*Beide*

(4)

8.2.3 **POSITIVE MARKING FROM 8.2.1/*POSITIEWE NASIEN VANAF 8.2.1.***

OPTION 1/*OPSIE 1*

$I_2=I_3+I_4$

$I_3=I_4$

$I_2=2I_3$

0,75=2I

I=0,375 A

V=IR✓

V=(0,375)(10)✓

V=3,75 V✓

OPTION 2/*OPSIE 2*

$I_T=I_1+I_2$

$I_1=I_2$

$I_T=2I$

1,5=2I✓

$I_2=I_{34}$=0,75 A

V=IR✓

V=(0,75)(5)✓

V=3,75 V✓

(3)

8.3.1 DECREASES/*AFNEEM* ✓

Emf is constant therefore current is inversely proportional to total resistance. ✓ External resistance increases therefore total resistance increases✓, hence current decreases.

Emk is konstant, daarom is die stroom omgekeerd eweredig aan totale weerstand. Eksterne weerstand neem toe dus neem totale weerstand toe, en stroom neem af.

(3)

8.3.2 INCREASES/*TOENEEM* ✓

Total current decreases✓ then less drop in potential (voltage drop) in the internal resistance and emf is constant✓therefore according do $V = \varepsilon - Ir$ terminal potential increases.

Totale stroom neem af, dus minder afname in potensiaal oor die interne weerstand en emk is konstante, en volgens V = ε - Ir sal die terminale potensiaal verhoog.

(3)

[21]

QUESTION 9/*VRAAG 9*

9.1 0✓✓ (2)

9.2 $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ OR/*OF* $R_p = \frac{R_1 R_2}{R_1 + R_2}$ ✓

$\frac{1}{3} + \frac{1}{6}$ ✓ $= \frac{3x6}{6+3}$ ✓ = 2Ω✓

$R_P = 2\Omega$ ✓

R_T = 2+1 ✓

=3 Ω ✓ (5)

9.3 I= $\frac{V}{R}$ ✓= $\frac{9}{3}$ ✓= 3A✓

Emf / *emk* = I(R+r) ✓ OR/OF V_{lost} = Ir ✓

12 = 3(3+r) ✓ 3 = 3 x r ✓

r=1 Ω ✓ r = 1Ω ✓ (6)

9.4 **OPTION 1/ *OPSIE 1***

P = I^2R✓

= 3^2 ✓ X 1 ✓ = 9 W ✓

OPTION 2/*OPSIE 2*

V= IR ✓ = 3 x 1 ✓ = 3 V

P = VI = 3 x 3 ✓ = 9 W✓

OPTION 3/*OPSIE 3*

(4)

$P = \frac{V^2}{R}$ ✓ = $\frac{3^2}{1}$ = 9 W ✓

9.5 **OPTION 1/*OPSIE 1***

W = $I^2R\Delta t$ ✓= 3^2 ✓x1✓ x 20 ✓= 180 J✓

OPTION 2/ OPSIE 2

W = $\frac{V^2\Delta t}{R}$ ✓

= $\frac{3^2 x20}{1}$✓ = 180 J ✓

OPTION 3/ *OPSIE 3*

W= VIΔt ✓ = 3 x 3 ✓ x 20 ✓= 180 J ✓

(4)

[21]

QUESTION 10/*VRAAG 10*

10.1 Zero/ nul. (1)

10.2 12 V (1)

10.3 $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$\frac{1}{R_{eq}} = \frac{1}{6} + \frac{1}{4}$ ✓

$\frac{1}{R_{eq}} = \frac{2+3}{12} = \frac{5}{12}$ (3)

Re= 2,4 Ω✓

10.4 V= I.R✓ (3)
V= 3 Ax2,4 Ω ✓
V= 7,2 V✓

10.5 V_{lost}= Ir✓ (3)
12-10 = 3r✓
r= 0,67 Ω✓
Or
emf = V_{ext} + I r✓
12 = 10 + 3r✓
r = 0,67 Ω✓

10.6 V_{ext} = I. R✓ (3)
10= 3 R_t✓
R_{ext}= 3,33 Ω✓

10.7 If the bulb of 6 Ω is burnt out the resistance of the circuit increases then the reading of the ammeter decreases✓ because the current strength decreases due to the increasing of the external resistance✓, but the reading of the voltmeter increases✓because the lost volts also decreases but the emf of the battery is constant according to V=ε-V_{lost} = ε-Ir.✓
As die gloeilamp van 6 Ω uitbrand, sal die weerstand in die stroombaan toeneem en die lesing op die ammeter afneem ✓ want die stroomsterkte neem af as gevolg van die toename van die eksterne weerstand✓, maar die voltmeterlesing sal toeneem✓ want die verlore volts neem ook af, maar die emk van die battery bly konstant volgens V=ε-$V_{verlore}$ = ε-Ir. ✓ (4)

[18]

QUESTION 11/*VRAAG 11*

11.1.1 (Maximum) energy provided (work done) by a battery per coulomb/unit charge passing through it ✓✓

Energie verskaf (arbeid verrig) deur 'n battery per coulomb/eenheid lading wat daardeur vloei. (2)

11.1.2 12 (V)✓ (1)

11.1.3 0 (V) / Zero/*nul* □ (1)

11.1.4 $\varepsilon = I(R + r)$ } ✓

$\varepsilon = V_{ext} + V_{int}$

$12 = 11,7 + Ir$

$\underline{0,3 = I_{tot}(0,2)}$ ✓

$I_{tot} = 1,5$ A ✓

OR/*OF*

$V = IR$ ✓ (Accept/Aanvaar: $V_{"lost"} = Ir$)

$\underline{0,3 = I_{tot}(0,2)}$ ✓

$I_{tot} = 1,5$ A✓ (3)

11.1.5

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\frac{1}{R_{//}} = \frac{1}{R_1} + \frac{1}{R_2}$ } ✓Any one $\frac{1}{R} = \frac{1}{10} + \frac{1}{15}$ $R = 6\ \Omega$ ✓	$R_{\|\|} = \frac{R_1 R_2}{R_1 + R_2}$ } ✓Any one $= \frac{(10)(15)}{10+15}$ $= 6\ \Omega$ ✓

(2)

11.1.6 **POSITIVE MARKING FROM QUESTIONS 11.1.4 AND11.1.5/*POSITIEWE NASIEN VANAF VRAE 11.1.4 EN 11.1.5***

OPTION 1/*OPSIE 1*

	OR/OF
$V = IR$ □	$V = IR$ □
$11,7$ □ $= \underline{1,5(6 + R)}$ □	$\underline{11,7 = 1,5R}$ □
$R = 1,8\ \Omega$ □	$R = 7,8\ \Omega$
	↘
	$R_R = 7,8 - 6$ □□
	$= 1,8\ \Omega$ □

OPTION 2/*OPSIE 2*

$\varepsilon = I(R + r)$ □

$\underline{12 = 1,5(R + 0,2)}$ □

$R = 7,8\ \Omega$

↘

$R_R = 7,8 - 6$ □□

$= 1,8\ \Omega$ □

OPTION 3/*OPSIE 3*

$V_{||} = IR_{||}$

$= (6)(1,5)$ ✓

$= 9$ V

$V_R = IR$ □

$\underline{(11,7 - 9) = (1,5)R}$ ✓

$R = 1,8\ \Omega$ ✓ (4)

11.2.1

$P_{ave/gemid} = Fv_{ave/gemid}$ ✓ $= mg(v_{ave/gemid})$

$= (0,35)(9,8)(0,4)$ ✓

$= 1,37$ W ✓

OR/*OF*

$$P = \frac{W_{nc}}{\Delta t} \square = \frac{\Delta E_k + \Delta E_p}{\Delta t} = \frac{0 + (0,35)(9,8)(0,4 - 0)}{1} \square = 1,37 \text{ W } \square$$

OR/*OF*

$$P = \frac{W}{\Delta t} \square = \frac{E_p}{\Delta t} = \frac{(0,35)(9,8)(0,4)}{1} \square = 1,37 \text{ W } \square$$

(3)

11.2.2

POSITIVE MARKING FROM QUESTION 11.2.1/*POSITIEWE NASIEN VANAF VRAAG 11.2.1*

OPTION 1/*OPSIE 1*

$P = VI$

$\underline{1,37 = (3)I}$ ✓

$I = 0,46$ A

✓Any one

$\varepsilon = V_{ext} + V_{int}$

$= V_T + V_X + V_{int}$

$\underline{12 = V_T + 3 + (0,2)(0,46)}$ ✓

$V_T = 8,91$ V

$V_T = IR_T$

$\underline{8,91 = (0,46)R_T}$ □

$R_T = 19,37\ \Omega$ ✓

OPTION 2/*OPSIE 2*

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

$\underline{1,37 = \frac{3^2}{R}}$ □

$R = 6,57\ \Omega$

✓Any one

$P = VI$

$\underline{1,37 = (3)I}$ ✓

$I = 0,46$ A

$\varepsilon = I(R + r)$

$\underline{12 = 0,46(6,57 + R_T + 0,2)}$ □

$R_T = 19,38\ \Omega$ □

OPTION 3/*OPSIE 3*

$P = VI$ □

$1,37 = (3)I$ ✓

$I = 0,46$ A

$P_{tot} = P_r + P_{motor} + P_T$

$(12)(0,46)$ □ $= (0,46)^2(0,2) + 1,37 + (0,46)^2R_T$ □

$R_T = 19,41\ \Omega$ □

OR/*OF*

$P = VI$ □

$1,37 = (3)I$ ✓

$I = 0,46$ A

$P_{tot} = P_r + P_{motor} + P_T$

$(12)(0,46) = (0,46)^2(0,2) + 1,37 + P_T$ □

$P_T = 4,07$ W

$P=I^2R$

$4,07 = (0,46)^2R_T$ □

$R_T = 19,49\ \Omega$ ✓

OPTION 4/*OPSIE 4*

P = VI

1,37 = (3)I □

I = 0,46 A

✓Any one

ε = I(R + r)

12 = (0,46)(R + 0,2) □

R = 25,87 Ω

V = IR 3 = (0,46)R□ R = 6,52 Ω R_T = 25,87 – 6,52 = 19,35 Ω □	P = I^2R 1,37 = $(0,46)^2$R□ R = 6,47 Ω R_T = 25,87 – 6,47 = 19,4 Ω □	$P_{motor} = \frac{V^2}{R}$ $1,37 = \frac{3^2}{R}$ □ R = 6,56 Ω R_T = 25,87 – 6,56 = 19,31 Ω □

(5)

[21]