

**POSSIBLE ANSWERS**  
**OCT / NOV 2006**

PHYSICAL SCIENCE PAPER 1  
NATUUR- EN SKEIKUNDE VRAESTEL 1

HIGHER GRADE  
HOËR GRAAD

NOVEMBER 2006  
NOVEMBER 2006

**QUESTION 1 / VRAAG 1**

1.1	A	1.2	B	1.3	D	1.4	B	1.5	C
1.6	D	1.7	B	1.8	C	1.9	D	1.10	A
1.11	D	1.12	C	1.13	B	1.14	C	1.15	C

[15 x 4 = 60]

**QUESTION 2 / VRAAG 2**

2.1

$v_R = \frac{s}{\Delta t} = \frac{1300}{4} = 325 \text{ km.h}^{-1}$ $v_R = \frac{s}{t} = \frac{1300}{4} = 325 \text{ km.h}^{-1}$	$\frac{1300}{4} = 325 \text{ km.h}^{-1}$ $v_R = \frac{1300}{4} = 325 \text{ km.h}^{-1}$	(4)
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$\frac{\Delta s}{\Delta t}$  will also be accepted, sal ook aanvaar word

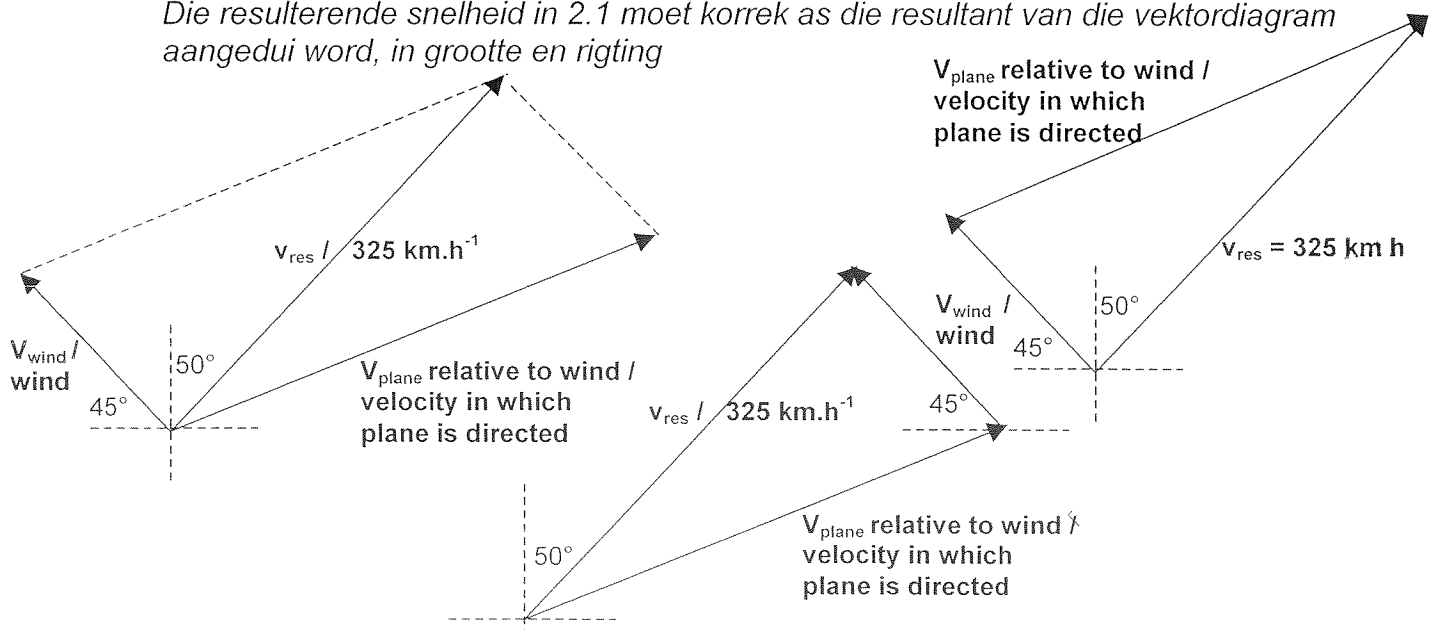
2.2 Positive marking from 2.1 to 2.2 and 2.3 / Positiewe nasien van 2.1 na 2.2 en 2.3  
Because of candidates incorrectly labelling and indicating directions of vectors, the following very important guidelines need to be followed for consistent marking  
Aangesien kandidate byskrifte en rigtings van vektore verkeerd aandui, moet die volgende belangrike riglyne gevolg word vir konsekwente punttoekenning

**Diagram conceptually correct / Diagram korrek met begrip korrek**

Explanation / Verduideliking:

The resultant velocity in 2.1 needs to be correctly indicated as the resultant of the vector diagram, in magnitude and direction

Die resulterende snelheid in 2.1 moet korrek as die resultant van die vektordiagram aangedui word, in grootte en rigting

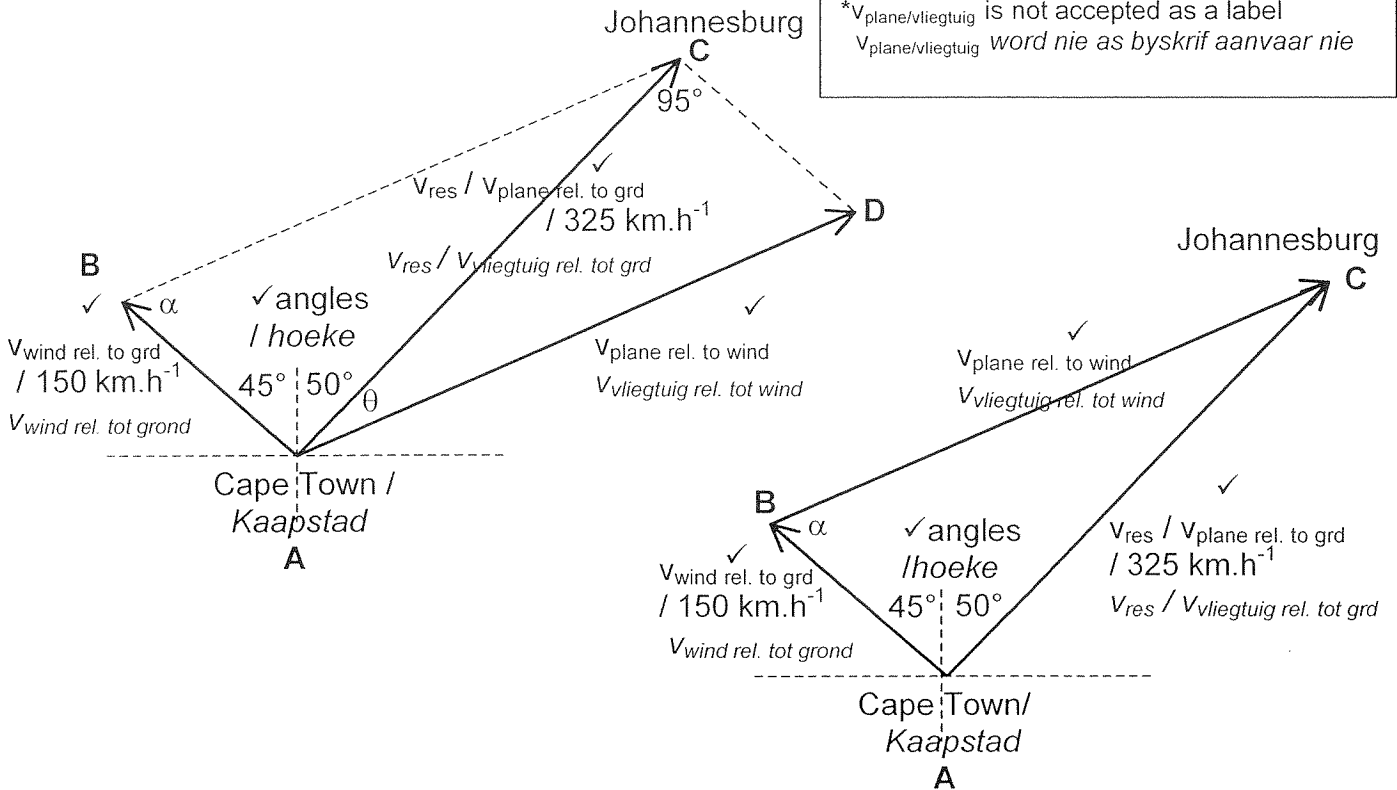


**Continue marking / Gaan voort met merk**

1. Diagram / diagram (4)
2. Magnitude / grootte (4)
3. Direction / rigting (3)

\* All vectors must have labels & arrows else  
 Alle vektore moet byskrifte & pylpunte hê anders 1/4

\*  $V_{\text{plane/vliegtuig}}$  is not accepted as a label  
 $V_{\text{plane/vliegtuig}}$  word nie as byskrif aanvaar nie



In triangle ACD / In driehoek ACD

**MAGNITUDE / GROOTTE**

$$v_p^2 = 325^2 + 150^2 - (2 \cdot 325 \cdot 150 \cdot \cos 95^\circ)$$

$$v_p = 369,62 \text{ km.h}^{-1}$$

**DIRECTION / RIGTING**

$$\frac{\sin \theta}{150} = \frac{\sin 95^\circ}{369,62}$$

$$\sin \theta = 0,4042$$

$$\theta = 23,84^\circ$$

$\therefore$  bearing  $73,84^\circ$  ✓  
 rigting  $73,84^\circ$

If angle of  $95^\circ$  incorrect in diagram  $\rightarrow$   
 As hoek van  $95^\circ$  verkeerd in diag. Max 8/11

In triangle ABC / In driehoek ABC

**MAGNITUDE / GROOTTE**

$$v_p^2 = 325^2 + 150^2 - (2 \cdot 325 \cdot 150 \cdot \cos 95^\circ)$$

$$v_p = 369,62 \text{ km.h}^{-1}$$

**DIRECTION / RIGTING**

$$\frac{\sin \alpha}{325} = \frac{\sin 95^\circ}{369,62}$$

$$\sin \alpha = 0,8759$$

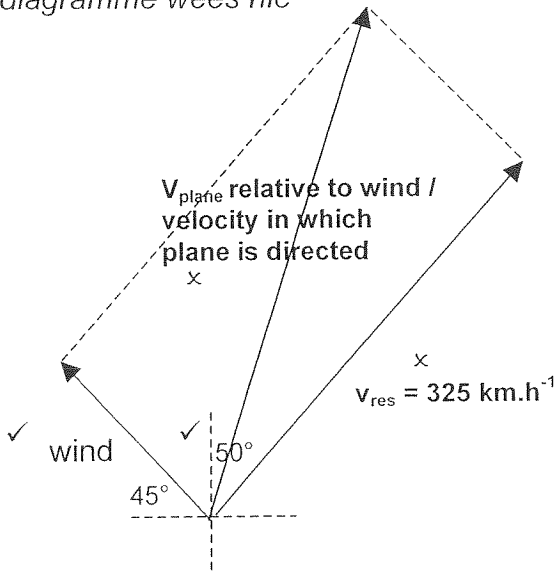
$$\alpha = 61,16^\circ$$

$\therefore$  direction =  $(180^\circ - 61,16^\circ - 45^\circ)$   
 $\therefore$  bearing  $73,84^\circ$  ✓

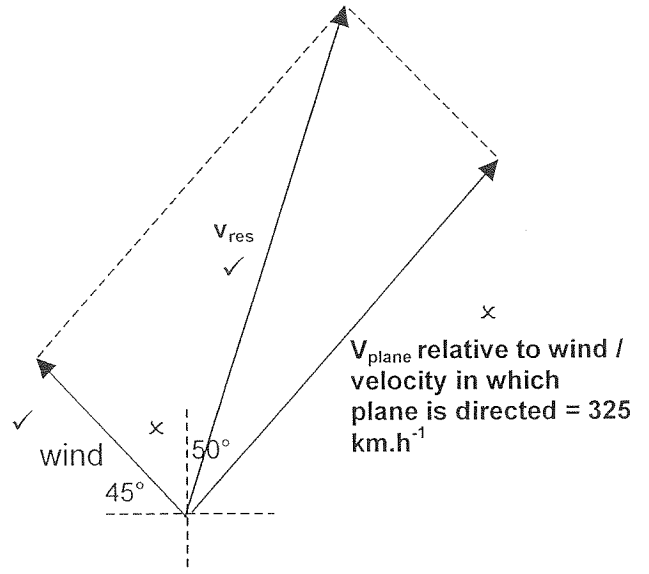
If angle of  $95^\circ$  incorrect in diagram  $\rightarrow$   
 As hoek van  $95^\circ$  verkeerd in diag. Max 8/11

**Diagram conceptually INCORRECT / Diagram a.g.v begrip NIE korrek nie**

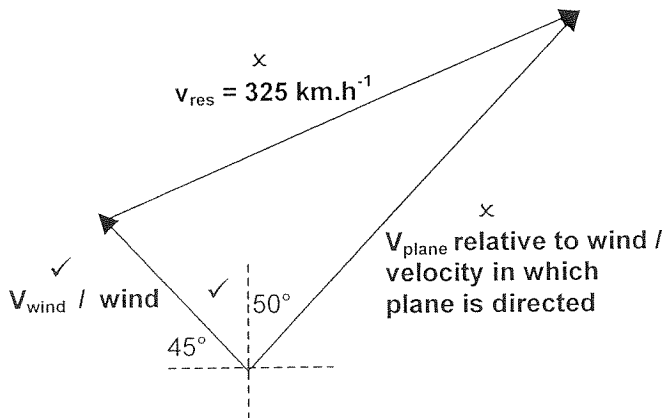
$v_{res}$  cannot be the resultant in these diagrams /  $v_{res}$  kan nie die resultant in hierdie diagramme wees nie



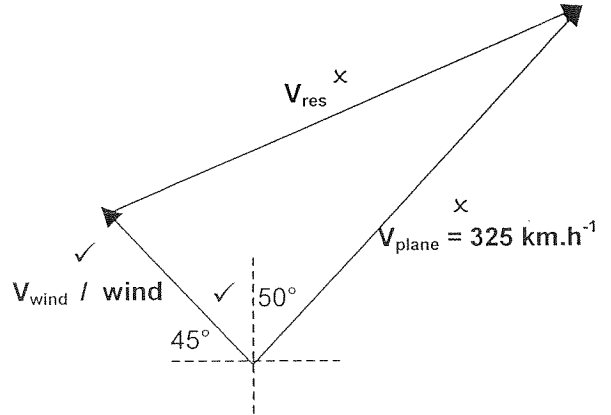
Correct angle but wrong resultant



Correct resultant but wrong angle



$v_{res}$  is not the resultant in the diagram



$v_{res}$  is not the resultant in the diagram

**NB!!** In the last 4 diagrams there are conceptual errors resulting in a maximum mark of:  
*In die laaste 4 diagramme is daar begripsfoute wat 'n maksimum tot gevolg het:*

$\frac{2}{11}$

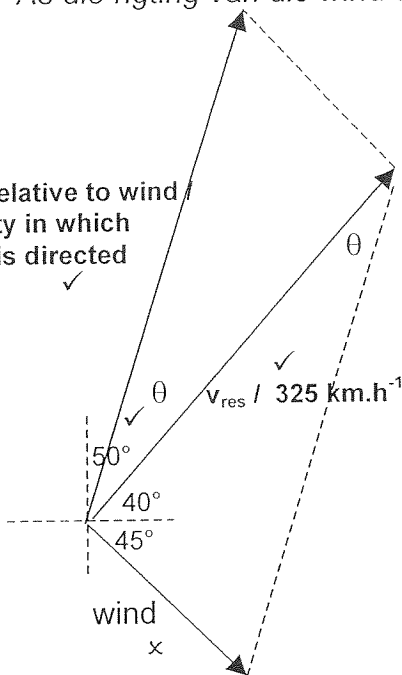
**Do not continue marking / Moenie verder nasien nie**

OR / OF

If the direction of the wind is wrong as follows, then a maximum of:  
 As die rigting van die wind as volg verkeerd is, dan 'n maksimum van:

$\frac{8}{11}$

$V_{\text{plane}}$  relative to wind /  
 velocity in which  
 plane is directed



**MAGNITUDE / GROOTTE**

$$V_{\text{plane}}^2 = 325^2 + 150^2 - (2 \cdot 325 \cdot 150 \cdot \cos 85^\circ)$$

$$V_{\text{plane}} = 345,87 \text{ km.h}^{-1} \times$$

**Direction / Rigting**

$$\frac{\sin \theta}{150} = \frac{\sin 85^\circ}{345,87}$$

$$\sin \theta = 0,4320$$

$$\theta = 25,60^\circ$$

$$\therefore \text{bearing of / rigting van} \\ (50^\circ - 25,60^\circ) \\ = 24,40^\circ \times$$

From 2.1 / From 2.1

2.3

2.3.1

**Distance / Afstand**

Distance travelled from Cape Town after 2,5 hrs /  
 Afstand afgelê vanaf Kaapstad na 2,5 uur

$$s = vt = (325)(2,5) = 812,5 \text{ km.}$$

$$\therefore \text{distance of plane from Jhb} = 1\,300 - 812,5 = 487,5 \text{ km} \checkmark$$

$$\therefore \text{vliegtuig se afstand vanaf Jhb} = 1\,300 - 812,5 = 487,5 \text{ km}$$

**OR / of**

$$\text{distance / afstand} = \frac{1,5}{4} \times 1\,300 = 487,5 \text{ km} \checkmark$$

**OR / of**

$$\text{distance / afstand} = 1\,300 - \left( \frac{2,5}{4} \times 1\,300 \right) = 487,5 \text{ km}$$

$$\text{OR / of: distance / afstand} = 325 \times 1,5 = 487,5 \text{ km} \checkmark$$

(3)

2.3.2

**Direction from Jhb** =  $(180^\circ + 50^\circ) = 230^\circ$  / S  $50^\circ$  W /  $50^\circ$  W of S / W  $40^\circ$  S

**Rigting vanaf Jhb** =  $(180^\circ + 50^\circ) = 230^\circ$  / S  $50^\circ$  W /  $50^\circ$  W van S / W  $40^\circ$  S

(2)

[20]

**OTHER POSSIBILITIES FOR QUESTION 2 (2.2) WITH EXPLANATIONS**  
**ANDER MOONTLIKHEDE VIR VRAAG 2 (2.2) MET VERDUIDELIKINGS**

1. To calculate the magnitude one can get the following / Om die grootte te bepaal kan die volgende verkry word:

This is purely as a result of mathematical manipulation:  
 Hierdie is slegs 'n gevolg van wiskundige manipulasie:

$$\cos 95^\circ = -\cos 85^\circ$$

**MAGNITUDE / GROOTTE**

$$V_{\text{plane}}^2 = 325^2 + 150^2 - (2 \cdot 325 \cdot 150 \cdot \cos 95^\circ)$$

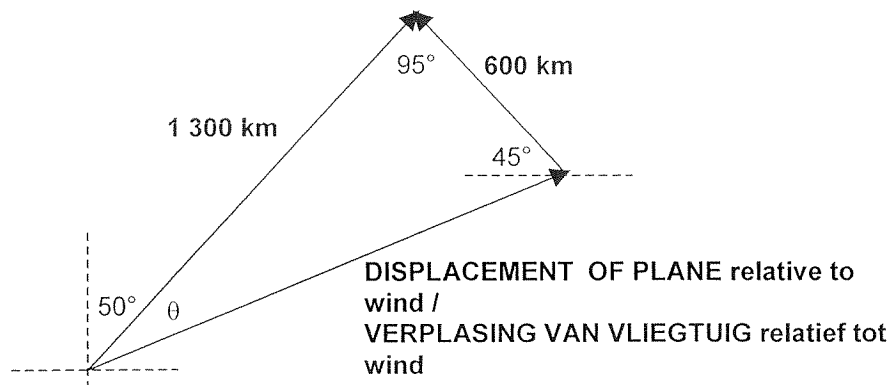
$$V_{\text{plane}} = 369,62 \text{ km} \cdot \text{h}^{-1}$$

**MAGNITUDE / GROOTTE**

$$V_{\text{plane}}^2 = 325^2 + 150^2 + (2 \cdot 325 \cdot 150 \cdot \cos 85^\circ)$$

$$V_{\text{plane}} = 369,62 \text{ km} \cdot \text{h}^{-1}$$

2. **DISPLACEMENT VECTORS / VERPLASINGSVEKTORE**



**MAGNITUDE / GROOTTE**

$$D^2 = 1300^2 + 600^2 - (2 \cdot 1300 \cdot 600 \cdot \cos 95^\circ)$$

$$D = 1478,5 \text{ km}$$

$$v = \frac{s}{t} = \frac{1478,5}{4} = 369,63 \text{ km} \cdot \text{h}^{-1}$$

**DIRECTION / RIGTING**

$$\frac{\sin \theta}{600} = \frac{\sin 95^\circ}{1478,5} \quad \theta = 23,85^\circ$$

$$\text{Bearing/rigting} = 23,85^\circ + 50^\circ = 73,85^\circ$$

OR / OF

$$600^2 = 1300^2 + 1478,5^2 - (2 \cdot 1300 \cdot 1478,5 \cdot \cos \theta)$$

$$\cos \theta = \frac{1300^2 + 1478,5^2 - 600^2}{(2 \cdot 1300 \cdot 1478,5)}$$

$$\theta = 23,84^\circ$$

$$\text{Direction / bearing / Rigting: } 23,84^\circ + 50^\circ = 73,84^\circ$$

## QUESTION 3/ VRAAG 3

3.1

$$v = u + at \quad \checkmark$$

$$0 = 18 + a(6) \quad \checkmark \quad \checkmark \quad \checkmark$$

$$a = -3 \text{ m.s}^{-2} \quad \checkmark$$

$$= 3 \text{ m.s}^{-2}, \text{ opposite direction to motion / left}$$

$$= 3 \text{ m.s}^{-2}, \text{ teenoorgestelde rigting van beweging / links}$$

(6)

If  $s = 54 \text{ m}$  calculated first using middle option in 3.2 then:

As  $s = 54 \text{ m}$  eers bereken word met middelste opsie in 3.2 dan:

$$v^2 = u^2 + 2as \quad \checkmark$$

$$0 = 18^2 + 2(a)54 \quad \checkmark \quad \checkmark \quad \checkmark$$

$$a = -3 \text{ m.s}^{-2} \quad \checkmark$$

$$= 3 \text{ m.s}^{-2} \text{ opp to dir of motion / teenoorgesteld aan bew rig}$$

If  $s \neq 54 \text{ m}$ , do not mark further

As  $s \neq 54 \text{ m}$ , moenie verder nasien nie

3.2

$$s = ut + \frac{1}{2}at^2 \quad \checkmark$$

$$= (18)(6) + \frac{1}{2}(-3)(6)^2 \quad \checkmark \quad \checkmark \quad \checkmark \quad \checkmark$$

$$= 54 \text{ m} \quad \checkmark$$

$$s = \left( \frac{u+v}{2} \right) t \quad \checkmark$$

$$= \left( \frac{18+0}{2} \right) (6) \quad \checkmark \quad \checkmark \quad \checkmark$$

$$= 54 \text{ m} \quad \checkmark$$

$$v^2 = u^2 + 2as \quad \checkmark$$

$$(0)^2 = (18)^2 + 2(-3)s \quad \checkmark \quad \checkmark \quad \checkmark$$

$$s = 54 \text{ m} \quad \checkmark$$

3.3

**Inertia** is the ability / property of a body to resist (oppose) any changes in its state of motion.

**Traagheid** is daardie eienskap van 'n liggaam wat dit instaat stel om enige verandering in sy toestand van beweging teen werk.

(4)

3.4

$$v^2 = u^2 + 2as \quad \checkmark$$

$$0^2 = (6)^2 + 2a(1,6) \quad \checkmark \quad \checkmark \quad \checkmark$$

$$a = -11,25 \text{ m.s}^{-2}$$

$$F_f = F_{\text{res}} = ma \quad \checkmark$$

$$= (450)(-11,25)$$

$$= -5\,062,5 \text{ N} \quad \checkmark$$

$$= 5\,062,5 \text{ N, opposite to direction to motion / left}$$

$$= 5\,062,5 \text{ N, teenoorgestelde rigting van beweging / links}$$

$$W = \Delta E_k$$

$$F_s = \frac{1}{2}m \Delta v^2 \quad \checkmark \quad \checkmark \quad \checkmark$$

$$F(1,6) = \frac{1}{2}(450)(0^2 - 6^2) \quad \checkmark \quad \checkmark \quad \checkmark \quad \checkmark$$

$$F = -5\,062,5 \text{ N} \quad \checkmark$$

$$= 5\,062,5 \text{ N, opposite to direction of motion / left}$$

$$= 5\,062,5 \text{ N, teenoorgestelde rigting van beweging / links}$$

$\Delta$  not shown  
 $\Delta$  nie gewys nie  
Max / Maks

 $\left( \frac{5}{8} \right)$ 

(8)

[23]

## ADDENDUM

u and v swapped

3.1

$$v = u + at \quad \checkmark$$

$$x \quad x \quad \checkmark$$

$$18 = 0 + a(6)$$

$$a = 3 \text{ m.s}^{-2}, \text{ opposite direction to motion}$$

u and v swapped; max  $\left(\frac{2}{6}\right)$   
 u en v omgeruil: maks

3.2 ONLY for candidates who swapped in 3.1

$$s = ut + \frac{1}{2}at^2 \quad \checkmark$$

$$= (0)(6) + \frac{1}{2}(3)(6)^2 \quad \checkmark \checkmark \checkmark$$

$$= 54 \text{ m} \quad \checkmark \quad \left(\frac{5}{5}\right)$$

$$s = \left(\frac{u+v}{2}\right)t \quad \checkmark$$

$$= \left(\frac{18+0}{2}\right)(6) \quad \checkmark$$

$$= 54 \text{ m} \quad \left(\frac{2}{5}\right)$$

$$v^2 = u^2 + 2as \quad \checkmark$$

$$(18)^2 = (0)^2 + 2(3)s \quad \checkmark \checkmark \checkmark$$

$$s = 54 \text{ m} \quad \checkmark \quad \left(\frac{5}{5}\right)$$

OR

OR

OR

$$s = ut + \frac{1}{2}at^2 \quad \checkmark$$

$$= (18)(6) + \frac{1}{2}(3)(6)^2 \quad \checkmark \checkmark \checkmark$$

$$= 162 \text{ m} \quad \left(\frac{3}{5}\right)$$

$$s = \left(\frac{u+v}{2}\right)t \quad \checkmark$$

$$= \left(\frac{0+18}{2}\right)(6) \quad \checkmark$$

$$= 54 \text{ m} \quad \checkmark \quad \left(\frac{5}{5}\right)$$

$$v^2 = u^2 + 2as \quad \checkmark$$

$$(0)^2 = (18)^2 + 2(3)s \quad \checkmark$$

$$s = -54 \text{ m} \quad \checkmark \quad \left(\frac{2}{5}\right)$$

3.3

→ Newton I and statement / *Newton I en stelling* : $\left(\frac{0}{4}\right)$ 

→ Inertia as answer and then Newton I as statement:

*Traagheid as antwoord en dan Newton I as stelling of verduideliking:* $\left(\frac{1}{4}\right)$ 

3.4

$$v_x^2 = u_x^2 + 2as \quad \checkmark$$

$$(6)^2 = 0^2 + 2a(1,6) \quad \checkmark$$

$$a = 11,25 \text{ m.s}^{-2}$$

$$F_f = F_{\text{res}} = ma \quad \checkmark$$

$$= (450)(11,25) \quad \checkmark$$

$$= 5062,5 \text{ N}, \quad \checkmark$$

opposite to direction of motion / left  
*teenoorgestelde rigting van beweging / links*

 $\left(\frac{6}{8}\right)$ 

$$W = \Delta E_k \quad \checkmark$$

$$Fs = \frac{1}{2}m\Delta v^2$$

Δ not shown  
 Δ nie gewys  
 Max / Maks

 $\left(\frac{5}{8}\right)$ 

$$F_{\text{FRICTION/RES}}(1,6) = \frac{1}{2}(450)(6^2 - 0^2) \quad \checkmark \checkmark \checkmark$$

$$= 5062,5 \text{ N} \quad \checkmark$$

opposite direction to motion /  
*teenoorgestelde rigting van beweging / links*

 $\left(\frac{6}{8}\right)$

QUESTION 4/ VRAAG 4

4.1.1

OP – [increase in speed, constant acceleration] OR [constant increase in speed]  
 OP – [toename in spoed, konstante versnelling] of [konstante toename in spoed]

(2)

4.1.2

PQ – [decrease in speed, constant acceleration] OR [constant decrease in speed]  
 PQ – [afname in spoed, konstante versnelling] of [konstante afname in spoed]

(2)

4.2

$$a = \text{gradient / gradiënt of PQ} = \frac{\Delta v}{\Delta t}$$

$$= \frac{1 - 7,2}{6,8 - 1,8}$$

$$= -1,24 \text{ m.s}^{-2}$$

$\therefore$  mag. of  $a = 1,24 \text{ m.s}^{-2}$   
 $\therefore$  grootte van  $a = 1,24 \text{ m.s}^{-2}$

$$v = u + at$$

$$1 = (7,2) + a(5)$$

$$a = -1,24 \text{ m.s}^{-2}$$

$\therefore$  mag. of  $a = 1,24 \text{ m.s}^{-2}$   
 $\therefore$  grootte van  $a = 1,24 \text{ m.s}^{-2}$

ACCEPT:  $a = \frac{\Delta y}{\Delta x}$  OR  $a = \frac{\Delta v}{\Delta t}$

If /as:  $a = \frac{v^x}{t}$  then/dan  $\left(\frac{3}{4}\right)$

$$a = \text{gradient/gradiënt} = \frac{-6,2}{5}$$

$$= -1,24 \text{ m.s}^{-2}$$

mag. of  $a$  / grootte van  $a = 1,24 \text{ m.s}^{-2}$

(4)

$$a = \frac{v^x}{t} = \frac{1 - 7,2}{6,8 - 1,8}$$

$$= -1,24 \text{ m.s}^{-2}$$

mag/grootte:  $a = 1,24 \text{ m.s}^{-2}$

$$a = \frac{1 - 7,2}{6,8 - 1,8} = -1,24 \text{ m.s}^{-2}$$

$$a = m = \frac{1 - 7,2}{6,8 - 1,8} = -1,24 \text{ m.s}^{-2}$$



4.3 acceleration over OP is **bigger in magnitude** AND  
 versnelling oor OP is **groter in grootte** ✓ EN

1. acceleration for OP is in the direction of motion while acceleration for PQ is in opposite direction to motion. ✓  
 versnelling vir OP is in die rigting van beweging terwyl die versnelling vir PQ in die teenoorgestelde rigting van beweging is.

OR / OF

2. OP speeding up and PQ slowing down ✓  
 OP snelheid neem toe en PQ neem snelheid af

OR / OF

3. acceleration over OP positive and over PQ negative ✓  
 versnelling oor OP positief en oor PQ negatief

OR / OF

4. acceleration in OP opposite in direction to acceleration in PQ ✓  
 versnelling in OP in teenoorgestelde rigting as versnelling in PQ

4 is wrong because the motion is along different inclines and therefore the component of gravitational acceleration is directed along the inclines, BUT will be accepted

4 is verkeerd aangesien die beweging langs verskillende hellings is en die komponente van gravitasieversnelling langs die hellings gerig is, MAAR sal aanvaar word

(2)

4.4 Slopes constant / hellings konstant ✓  
 OP downhill / OP afdraend ✓  
 PQ uphill / PQ opdraend ✓  
 OP steeper than PQ / OP steiler helling as PQ ✓  
 BUT up or down / MAAR op en af x

(4)

4.5

$$\begin{aligned} \text{distance} &= \text{area of triangle} = \frac{1}{2} b \perp h \\ \text{afstand} &= \text{oppervlakte van driehoek} = \frac{1}{2} b \perp h \\ &= \frac{1}{2} (1,8)(7,2) = 6,48 \text{ m} \end{aligned}$$

s and d accepted for distance (only here)  
 s en d aanvaarbaar vir afstand (slegs hier)

(4)

4.6

$F_{QR} = 0 \text{ N} / F_{res} = 0 \text{ N} / F_{res}$  is zero ✓ (N as unit compulsory)  
 (Uniform/constant velocity/zero acceleration/ $a = 0 \text{ m}\cdot\text{s}^{-2}$  ✓✓ ( $a = 0$  ✓)  
 $F_{QR} = 0 \text{ N} / F_{res} = 0 \text{ N} / F_{res}$  is zero ✓  
 (Uniforme/ konstante snelheid/zero versnelling/ $a = 0 \text{ m}\cdot\text{s}^{-2}$  ✓✓ ( $a = 0$  ✓)

(3)  
 [21]

**QUESTION 5/ VRAAG 5**

5.1

Every particle in the universe exerts a (gravitational) force (of attraction) on every other particle which is **directly proportional to the product of their masses** and **inversely proportional to the square of the distance between them**.

[If "object/mass/body" used, then "between their centres" must be stated.]

Elke deeltjie in die heelal oefen 'n (gravitasie-aantrekkings-) krag op elke ander deeltjie uit wat **direk eweredig is aan die produk van hulle massas** en **omgekeerd eweredig is aan die kwadraat van die afstand tussen hulle**.

[As "voorwerp/massa/licgaam" gebruik word, moet "tussen hulle middelpunte" gebruik word]

(4)

5.2

On the surface of earth / Op die oppervlak van die aarde

$F_{\text{gravity / gravitasie}} = F_{\text{Newton's Gravitational law / Newton se Universele Gravitasielaw}}$

$$mg = \frac{GmM_E}{R_E^2}$$

$$g = \frac{GM_E}{R_E^2} \quad (\text{m cancels / m kanselleer uit})$$

(4)

A clear distinction must be made between the different masses – if the difference cannot be determined – lose one mark.

'n Duidelike verskil moet tussen die massas gemaak word – indien die verskil nie vasgestel kan word nie – verloor een punt.

$$mg = \frac{Gmm}{R_E^2}$$

$$g = \frac{Gm}{R_E^2}$$

Only answer / Slegs die antwoord:

$$g = \frac{GM_E}{R^2} \quad \left( \frac{1}{4} \right)$$

5.3

$$g_{\text{Mercury / Mercurius}} = \frac{GM_M}{R_M^2}$$

$$= \frac{(6,7 \times 10^{-11})(2,99 \times 10^{23})}{(2,42 \times 10^6)^2}$$

$$= 3,42 \text{ m.s}^{-2}$$

(4)

[12]

## QUESTION 6/ VRAAG 6

6.1  $(E_p + E_k)_{\text{top of table / bokant van tafel}} = (E_p + E_k)_{\text{bottom of table / onderkant van tafel}}$  ✓  
 $(mgh + \frac{1}{2}mu^2)_{\text{top / bokant}} = (E_p + \frac{1}{2}mv^2)_{\text{bottom of table / onderkant van tafel}}$  ✓  
 $(1,575)(10)(1,2) + \frac{1}{2}(1,575)u^2 = 0 + \frac{1}{2}(1,575)(8)^2$  ✓  
 $18,9 + 0,79 u^2 = 50,4$  ✓  
 $u = 6,32 \text{ m.s}^{-1}$  ✓

Allocate mark for 1,575 kg once only  
 Gee punt vir 1,575 kg slegs een-keer

If equation of motion is used like:  $v^2 = u^2 + 2as$

As bewegingsvergelyking gebruik word soos:  $v^2 = u^2 + 2as$

$\frac{0}{7}$

(7)

6.2  $p_{\text{before / voor}} = p_{\text{after / na}}$  ✓  
 $m_1u_1 + m_2u_2 = (m_1 + m_2)v$  ✓  
 $(0,075)u_1 + 0 = (1,575)(6,32)$  ✓  
 $u_1 = 132,72 \text{ m.s}^{-1}$  ✓

If  $(m_1 + m_2) = 1,58 \text{ kg}$   
 then  $u_1 = 133,14 \text{ m.s}^{-1}$

(7)

6.3

Impulse/ Impuls =  $F\Delta t = \Delta p = mv - mu$  ✓  
 $= (0,075)(6,32 - 132,72)$  ✓  
 $= -9,48 \text{ N.s}$  ✓

left to right : positive  
 links na regs: positief

Magnitude of the impulse / grootte van impuls: 9,48 N.s

Also accept/aanvaar ook:  $\text{kg.m.s}^{-1}$

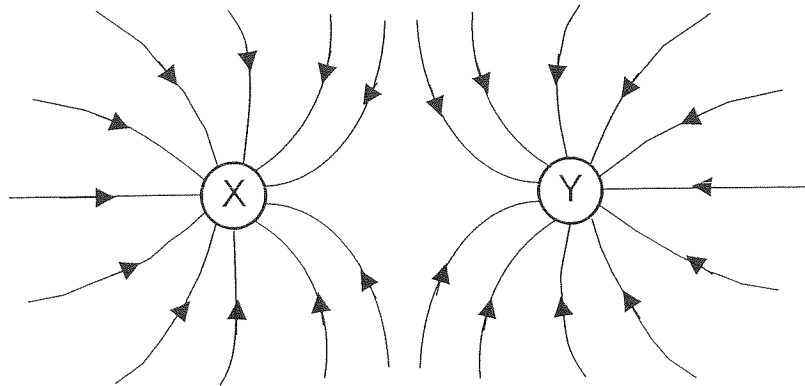
(5)

v and u swapped / v en u omgeruil  
 Max / Maks

$\frac{2}{5}$

**QUESTION 7/ VRAAG 7**

7.1



Curves impt. here  
Kurwes NB hier

- ✓ field lines between charges / veldlyne tussen die ladings
- ✓ field lines outside the charges / veldlyne buite die ladings
- ✓ direction: towards X and Y / rigting: na X en Y toe
- ✓ field lines not inside spheres, touching surface and even distribution without touching each other / veldlyne nie binne sferie nie, raak oppervlak en eweredige verspreiding sonder om aan mekaar te raak

(4)

7.2

$$F = \frac{kq_X q_Y}{r^2}$$

$$= \frac{(9 \times 10^9)(3 \times 10^{-12})(3 \times 10^{-12})}{(0,05)^2}$$

$$= 3,24 \times 10^{-11} \text{ N}$$

Mark direction independently  
Merk rigting onafhanklik

$$F = \frac{kq^2}{r} \left( \frac{1}{6} \right)$$

; repulsion / right / away from X  
afstotend / regs / weg van X af

(6)

r	F	mark
0,05 ✓	$3,24 \times 10^{-11} \text{ N}$ ✓	6 marks
5 cm ✓	$3,24 \times 10^{-11} \text{ N}$ ✓	6 marks
5 ✗	$3,24 \times 10^{-11} \text{ N}$ ✗	max 4 marks
5 ✗	$3,24 \times 10^{-15} \text{ N}$ ✓	max 5 marks

7.3

**Acceleration decreases.** ✓

As distance increases / the electric field strength gets weaker → resultant force decreases (since distance is inversely proportional to the force)

⇒ acceleration decreases (since  $F_{res} \propto a$ )

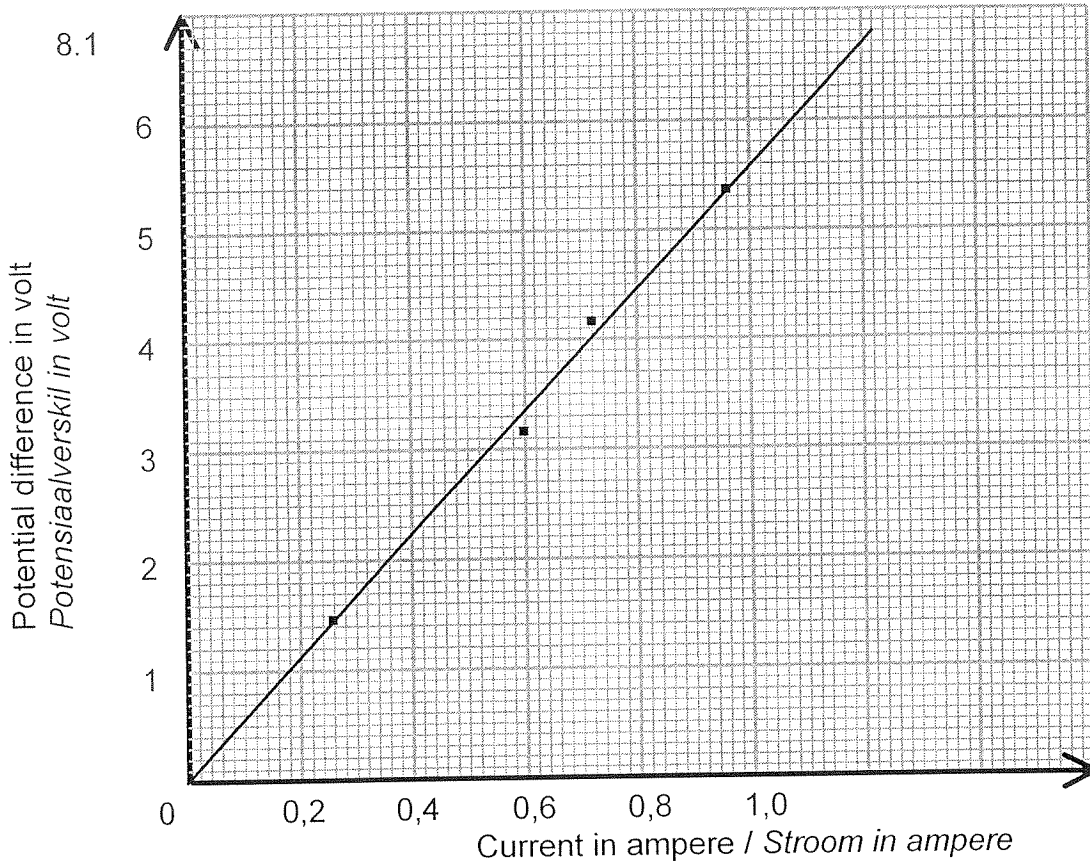
**Versnelling verminder/ word kleiner/ neem af.** ✓

Soos die afstand groter word / word die elektriese veldsterkte swakker → resulterende krag kleiner (aangesien afstand omgekeerd eweredig is aan die krag)

⇒ versnelling neem af (aangesien  $F_{res} \propto a$ )

(3)  
[13]

## QUESTION 8 / VRAAG 8



## Labels

X	Y
I	V
stroom	potensiaal verskil
current	potential difference

Not acceptable: Emf  
Nie aanvaarbaar: Emk

## Unit

X	Y
ampere	volt
A	V

## CRITERIA / KRITERIA

- ✓ { horizontal axis: label and unit / horinsontale as: byskrif en eenheid  
vertical axis: label and unit / vertikale as: byskrif en eenheid
- ✓ **suitable scale** on horizontal axis / **geskikte skaal** op horisontale as
- ✓ **suitable scale** on vertical axis / **geskikte skaal** op vertikale as

✓✓ points correctly plotted / punte korrek gestip

- 1 mark for any 3 points plotted correctly / 2 marks for 5 points plotted correctly  
1 punt vir enige 3 punte korrek gestip / 2 punte vir 5 punte korrek gestip  
(Consider origin point as plotted if graph goes through origin)  
(Beskou oorprongpunt as gestip indien grafiek deur oorsprong gaan)

(6)

✓ best fit / best straight line / beste passing / beste reguit lyn

→ If plotted points too big (blobs > 2 x 2 small blocks):

-1 for best fit & -1 for uncertainty in plotting

As gestipte punte te groot is (kolle > 2 x 2 klein blokkies):

-1 vir passing & -1 vir onsekerheid vir stip

Max/Maks  $\left(\frac{4}{6}\right)$

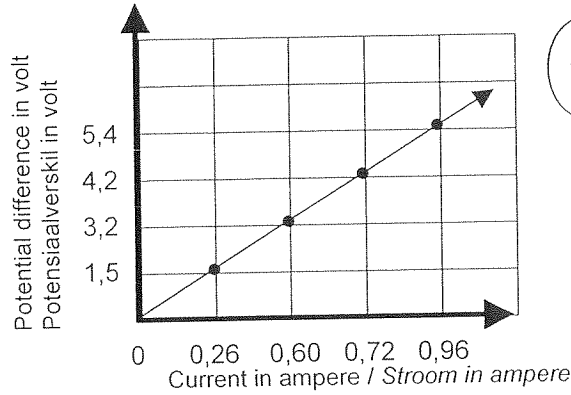
**Suitable:** Evenly spread out so that all points can be plotted accurately

**Geskikte:** Eweredig verspreid sodat alle punte met akkuraatheid gestip kan word

If scale (one or both) unsuitable - lose both marks for plotting

As skaal (een of beide) nie geskik is nie - verloor beide punte vir stip

→ If points used from table / As punte vanaf tabel gebruik is:



$\frac{1}{6}$

For labels / Vir byskrifte

8.2  $V \propto I$  OR  $I \propto V$  OR in words ✓✓  
 $V \propto I$  OF  $I \propto V$  OF in woorde ✓✓

(2)

8.3

gradient / gradiënt =  $\frac{\Delta V}{\Delta I}$  ✓  
 Any set from graph, e.g. =  $\frac{2,2}{0,4}$  ✓  
 Enige stel van grafiek, bv. =  $5,5 \Omega$  ✓

Any answer from  $5,5 \Omega$  to  $5,8 \Omega$  will be acceptable.  
 Answers outside the range of  $5,5 \Omega$  to  $5,8 \Omega$  → max. 2 marks.  
 1 mark for the formula  
 1 mark for the substitution of a value

Learners need to use the values from the graph plotted and not the values in the given table.

→ If values/points used from the table; max  $\left(\frac{2}{4}\right)$

(4)

$\Omega$  is important for the answer and the mark  
 $\Omega$  is belangrik vir die antwoord en die punt

$\frac{V}{A}$  not acceptable / nie aanvaarbaar nie

Enige antwoord van  $5,5 \Omega$  tot  $5,8 \Omega$  sal aanvaar word;  
 Antwoorde buite die gebied van  $5,5 \Omega$  tot  $5,8 \Omega$  → maks 2 punte.  
 1 punt vir die formule  
 1 punt vir 'n substitusie van 'n waarde

Leerders moet die waardes vanaf die grafiek gebruik en nie die waardes in die tabel nie  
 → As waardes vanaf tabel gebruik; maks  $\left(\frac{2}{4}\right)$

8.4

Resistance / R / Weerstand ✓✓

(2)

8.5

Ohm's Law / Ohm se wet ✓✓

(2)

[16]

8.1

If V and I swapped on graph, THEN lose 1 mark for axis, can get: 5

As V en I omgeruil word op die grafiek, DAN verloor 1 punt vir as, kan kry: 5

8.3

$$\text{Gradient} = \frac{\Delta I}{\Delta V} = \frac{0,4}{2,2} = 0,18 \Omega^{-1}$$

Range / gebied: 0,17 to 0,19

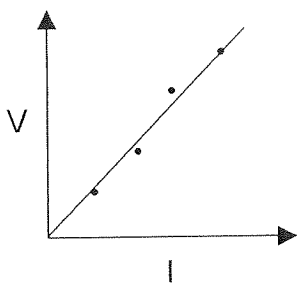
8.4

$\frac{1}{\text{resistance}}$  or inverse of resistance or conductance or  $\frac{1}{R}$  or  $R^{-1}$  ✓✓  
 $\frac{1}{\text{weerstand}}$  of die omgekeerde van weerstand of konduktansie of  $\frac{1}{R}$  of  $R^{-1}$  ✓✓

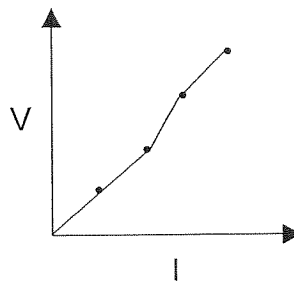
8.3

The following possibilities could be found in 8.1:

Die volgende moontlikhede kan in 8.1 gevind word:



OR / OF



straight line / reguit lyn

not straight line / nie reguit lyn nie

If straight line in 8.1 then:  
 Indien reguit lyn in 8.1, dan:

$$\text{gradient / gradiënt} = \frac{\Delta V}{\Delta I}$$

Any set from graph, e.g.  $\left(\frac{4}{4}\right) = \frac{2,2}{0,4} = 5,5 \Omega$  ✓

Enige stel van grafiek, bv.  $\left(\frac{4}{4}\right) = \frac{2,2}{0,4} = 5,5 \Omega$  ✓

If not straight line in 8.1 then any set of TABLE values MUST be used, e.g. Indien nie reguit lyn in 8.1 nie, dan MOET enige stel TABELwaardes gebruik word, bv.

$$\text{gradient / gradiënt} = \frac{\Delta V}{\Delta I}$$

**Max / Maks**  $\left(\frac{2}{4}\right) = \frac{1,5}{0,26} = 5,8 \Omega$  ✓

Even with V and I swapped / Selfs vir V en I omgeruil

## QUESTION 9 / VRAAG 9

9.1

$$\begin{aligned} \text{emf/emk} &= V_{\text{ext. cir}} + V_{\text{lost}} \\ 45 &= 43,5 + Ir \\ I(0,5) &= 1,5 \\ I &= 3 \text{ A} \end{aligned}$$

$$\begin{aligned} V_{\text{lost}} &= Ir \\ 1,5 &= I(0,5) \\ I &= 3 \text{ A} \end{aligned}$$

**Accept / Aanvaar**  
E for emf / E vir Emk  
V = IR

If small v / as klein v  
-1 for formula  
-1 vir formule

(5)

9.2

$$\begin{aligned} R &= \frac{V}{I} \\ 12 &= \frac{V}{3} \\ V &= 36 \text{ V} \end{aligned}$$

(3)

9.3

$$\begin{aligned} I_2 &= \frac{V_p}{R_{10\Omega}} \\ &= \frac{43,5 - 36}{10} \\ &= 0,75 \text{ A} \end{aligned}$$

$$\begin{aligned} I_2 &= \frac{V_p}{R_{10\Omega}} \\ &= \frac{7,5}{10} \\ &= 0,75 \text{ A} \end{aligned}$$

(4)

9.4

$$\begin{aligned} R_1 &= \frac{V_p}{I_{R_1}} \\ &= \frac{7,5}{3 - 0,75} \\ &= 3,33 \Omega \end{aligned}$$

Answer 9.1 – answer 9.3 to get current in  $R_1$   
Antwoord 9.1 – antwoord 9.3 om stroom in  $R_1$  te kry

$$R_1 = \frac{0,75}{2,25} \times 10 = \frac{10}{3} \Omega = 3,33 \Omega$$

$$\begin{aligned} \text{Emf/Emk} &= I(R_{\text{ext}} + R_i) \\ 45 &= 3(R_{\text{ext}} + 0,5) \\ R_{\text{ext}} &= 14,5 \Omega \\ R_{\text{ext}} &= 12 \Omega + R_p \\ 14,5 &= 12 \Omega + R_p \\ R_p &= 2,5 \Omega \\ \frac{1}{R_p} &= \frac{1}{10 \Omega} + \frac{1}{R_1} \\ \frac{1}{2,5} &= \frac{1}{10} + \frac{1}{R_1} \\ R_1 &= 3,3 \Omega \end{aligned}$$

Note: Use subscripts like  $V_{R_1}$  and other descriptive subscripts for more clarity  
Nota: Gebruik onderskrifte soos  $V_{R_1}$  en ander vir meer duidelikheid

(4)

**[16]**

Question 1/ Vraag 1 : 60  
Question 2 – 9 / Vraag 2 - 9 : 140  
Grand Total / Groototaal : 200