Possible Answers
Oct/Nov 2005

NATIONAL DEPARTMENT OF EDUCATION

PHYSICAL SCIENCE (SG) – PAPER 1 / *NATUUR- en SKEIKUNDE (SG) – VRAESTEL 1*

QUESTION 1 / *VRAAG 1*

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

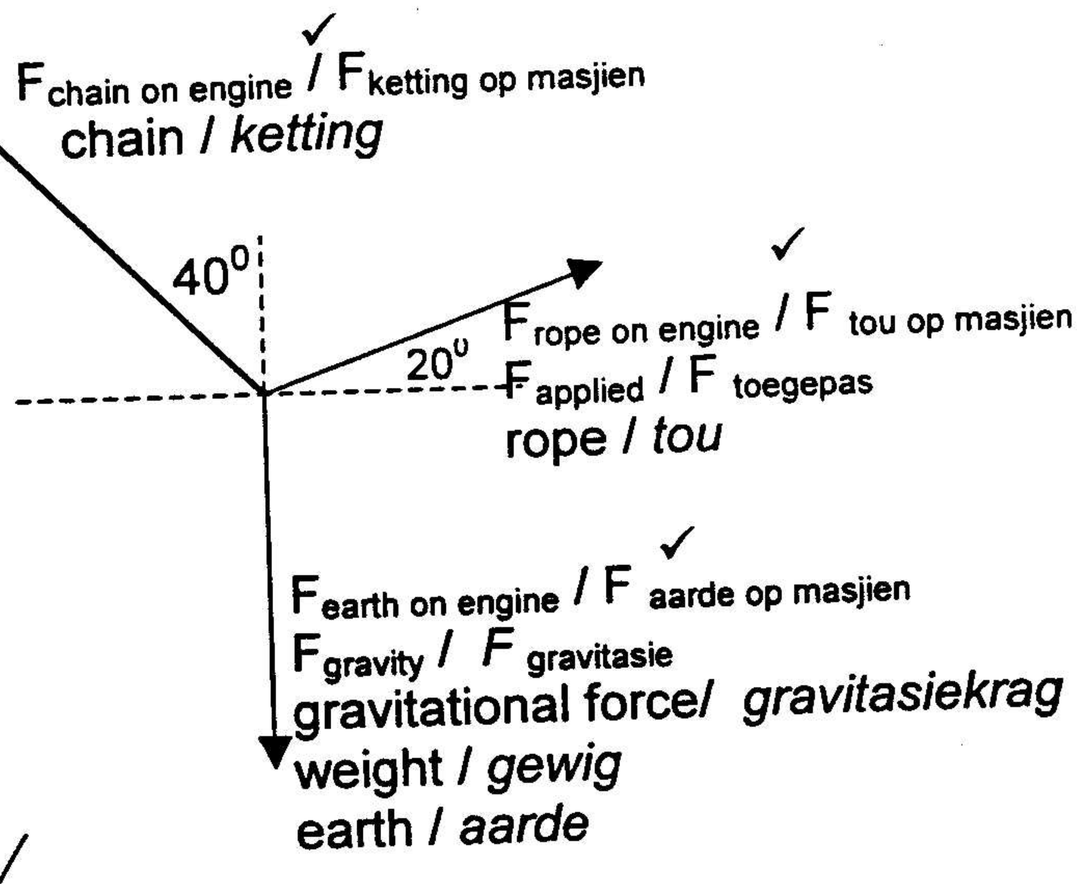
[15 x 3 = 45]

QUESTION 2 / *VRAAG 2*

2.1 F_{res} = 0 N ✓✓ (zero) (2)

Only 0 = 1 mark

2.2



✓ for each labelled force
✓ any two correct angles
if arrows missing max –1 mark

✓ *vir elke byskrif krag*
✓ *enige twee korekte hoeke*
as pyle ontbreek maks –1 punt

NOT Acceptable / *nie aanvaarbaar nie*
4 000 N , F_g , W , F_{grav}

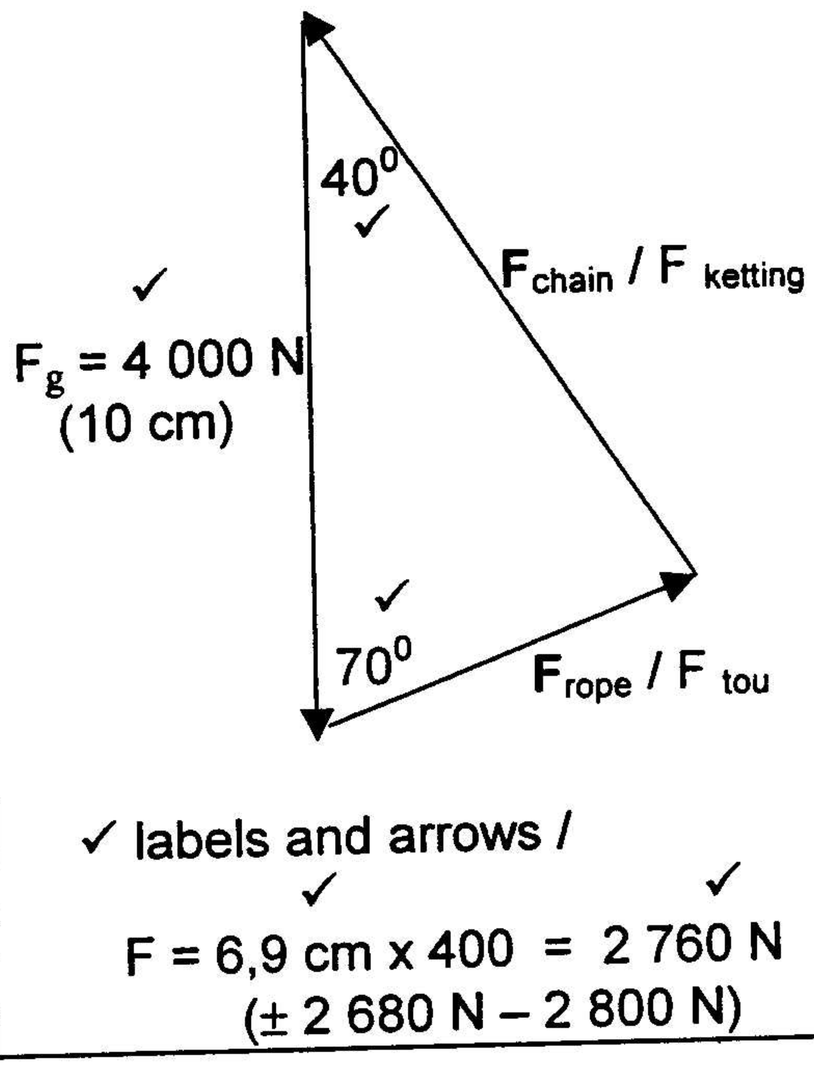
NOTE / *LET WEL*
If diagram of 2.3 given also continue to mark

Positive marking from 2.2 to 2.3

(4)

2.3 SCALE DRAWING / *SKAALTEKENING*

Must use template. If angles not indicated – use template to verify.



✓ labels and arrows /

✓ ✓

F = 6,9 cm x 400 = 2 760 N

(± 2 680 N – 2 800 N)

Check if 40^0 opp F_{rope} and continue to mark as follows

✓ measure 10 cm (4 000 N)
✓ measure 40^0 angle
✓ measure 70^0 angle
✓ arrows and labels opposite appropriate angles

✓ (length F_{rope} x 400)
✓ correct answer

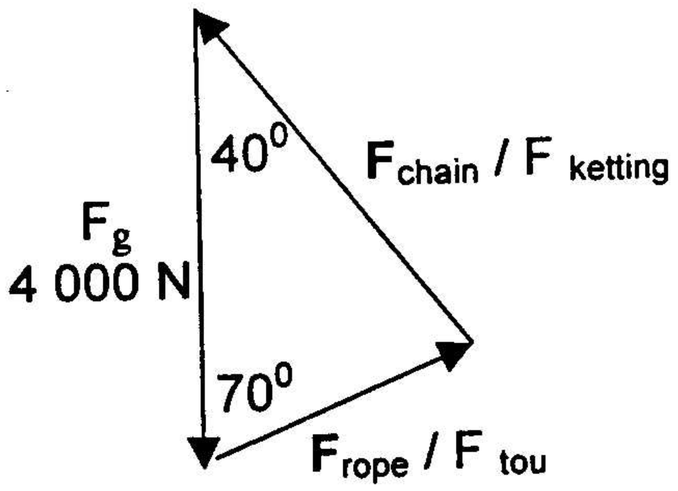
No arrows – 1 max

F_{rope} opposite 40^0 – max $\frac{6}{6}$

F_{rope} not opposite 40^0 – max $\frac{3}{6}$

4 000N opposite 40^0 – max $\frac{2}{6}$

CALCULATION / *BEREKENING*



✓ angles /
✓ arrows and labels

$$\frac{F}{\sin 40^0 \checkmark} = \frac{4000 \checkmark}{\sin 70^0 \checkmark}$$

$$F = 2736\,N \checkmark$$

No positive marking

(6)

[12]

QUESTION 3 / *VRAAG 3*

3.1

acceleration is the rate of change of velocity **OR** it is the change in velocity per unit time
versnelling is die tempo van verandering in snelheid OF verandering in snelheid per eenheidstyd

[2 or 0] / [2 of 0] (2)

3.2

$v^2 = u^2 + 2as$ ✓

✓ ✓ ✓

$0^2 = (20)^2 + 2(-2,5)s$

$s = 80\,m$ ✓

Look out for / kyk na:
u and a: opposite signs
u en a: teenoorgestelde tekens

If u and v swapped / As u en v omgeruil:
Max: 2/ maks: 2

$v^2 = u^2 + 2as$ ✓

$\frac{2}{5}$

x x ✓

$20^2 = (0)^2 + 2(-2,5)s$

$s = 80\,m$ x

$v = u + at$

$0 = 20 + (-2,5)t$

$t = 8\,s$

NOTE / LET WEL
If $t \neq 8$ s do not mark further.
As $t \neq 8$ s merk dan nie verder.

$\frac{0}{5}$

$s = ut + \frac{1}{2}at^2$ ✓

$= 20.8 + \frac{1}{2}(-2,5)(8)^2$ ✓ ✓ ✓

$= 80\,m$ ✓

$s = \left(\frac{u+v}{2}\right)t$ ✓

$= \left(\frac{20+0}{2}\right)(8)$ ✓ ✓ ✓

$= 80\,m$ ✓

3.3

"s" in reaction time / *"s" in reaksietyd*

$= 120 - (80 + 2) = 38\,m$ ✓ ✓

38 m ✓✓ (2)

3.4

$v = \frac{\Delta s}{\Delta t}$ ✓

✓ ✓

$20 = \frac{38}{\Delta t}$

$\Delta t = 1,9\,s$ ✓

$v = \frac{s}{t}$ ✓

✓ ✓

$20 = \frac{38}{t}$

$t = 1,9\,s$ ✓

$s = ut + \frac{1}{2}at^2$ ✓

✓ ✓ ✓

$38 = 20t + 0$

$t = 1,9\,s$ ✓

1,9 s only: 1 mark

$s = \left(\frac{u+v}{2}\right)t$ ✓

✓ ✓

$38 = \left(\frac{20+20}{2}\right)t$

$t = 1,9\,s$ ✓

Since truck moves at constant velocity ✓
20 m covered in 1 s
∴ 38 m covered in 1,9 s ✓✓✓

(4)
[13]

QUESTION 4 / *VRAAG 4*

4.1 Every particle in this universe attracts every other particle in this universe with a force which is directly proportional to the product of their masses and is inversely proportional to the square of the distance between them.

Elke deeltjie in die heelal oefen 'n aantrekkingskrag uit op elke ander deeltjie in die heelal en die krag is direk eweredig aan die produk van hulle massas en omgekeerd eweredig aan die kwadraat van die afstand tussen die deeltjies.

If "**object**" is used instead of "particle" then "**between their centres**" must be stated
*As **voorwerp** i.p.v. deeltjie gebruik word moet **"tussen hulle middelpunte"** gestel word*

(4)

4.2

$$F = \frac{Gm_1m_2}{r^2}$$

$$4{,}2 \times 10^{-10} = \frac{G(0{,}5)(1{,}2)}{(0{,}3)^2}$$

$$G = 6{,}3 \times 10^{-11}\ N.m^2.kg^{-2}$$

$$G = \frac{Fr^2}{m_1 m_2}$$

$$G = \frac{(4{,}2 \times 10^{-10})(0{,}3)^2}{0{,}5 \times 1{,}2}$$

$$G = 6{,}3 \times 10^{-11}\ N.m^2.kg^{-2}$$

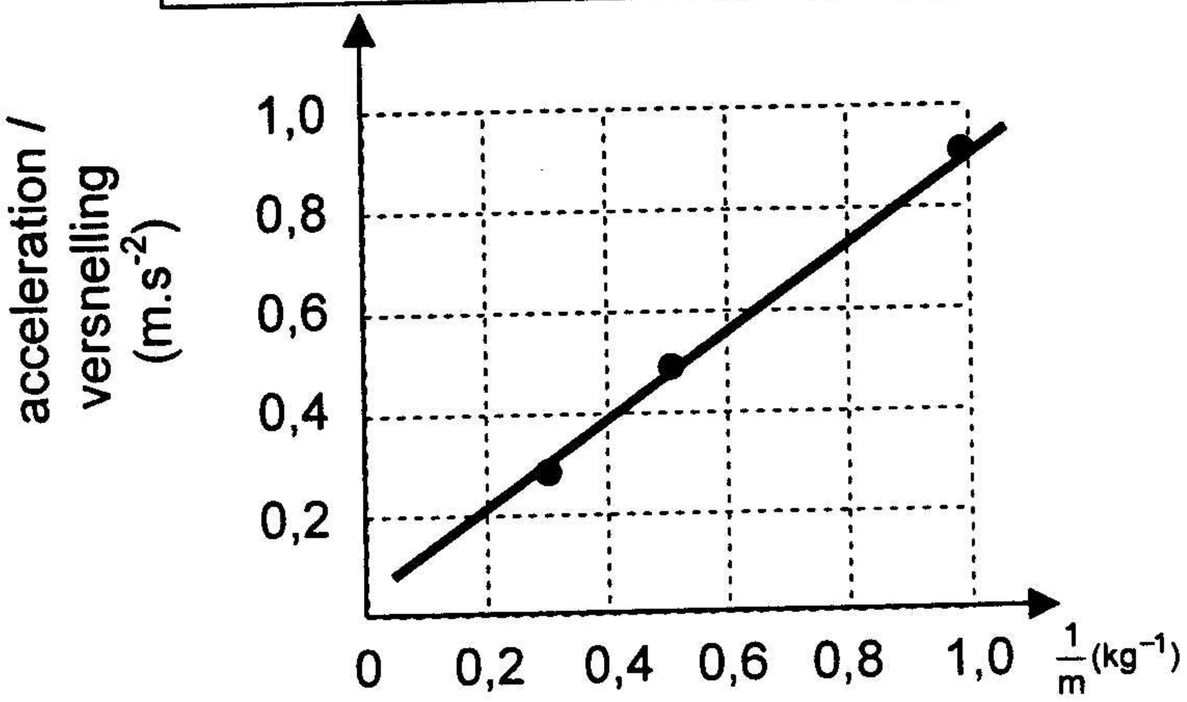
(5)

[9]

QUESTION 5 / *VRAAG 5*

5.1

$\frac{1}{m}$	Acceleration/ Versnelling ($m.s^{-2}$)
1	0,96
0,5	0,49
0,33	0,31



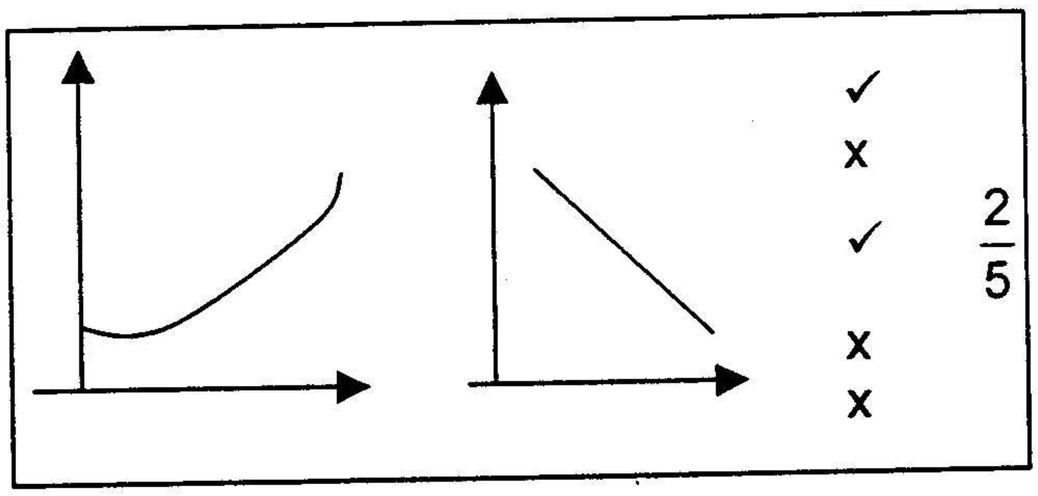
Or some calculation shown
Or you can determine from the plotting
Or co-ordinate form

✓1/m calculations */berekeninge*

✓ x-axis: labels + values + units
(range 0 → 1)
x-as: byskrifte+waardes+ eenhede
(gebied 0 → 1)

✓ y-axis: labels + values + units
(range 0 → 1)
x-as: byskrifte+waardes + eenhede
(gebied 0 → 1)

✓ plotting of points approximately
stip van punte by benadering
✓ straight line more or less through origin
reguitlyn min of meer deur oorsprong



(5)

5.2 acceleration inversely proportional to mass / mass inversely proportional to acceleration / $a \propto \frac{1}{m}$ / $m \propto \frac{1}{a}$ / $ma = k$ ✓✓

versnelling omgekeerd eweredig aan massa / massa omgekeerde eweredig aan versnelling

(2)

5.3

$$\text{grad} = \frac{\Delta y}{\Delta x} \checkmark = \frac{\Delta a}{\Delta \frac{1}{m}} = \frac{0,96-0,31}{1-0,33} \checkmark = 0,97\,\text{N} \checkmark$$

$$= \frac{0,96-0,49}{1-0,5} = 0,94\,\text{N}$$

$$= \frac{0,49-0,31}{0,5-0,33} = 1,06\,\text{N}$$

$$\text{grad} \checkmark = \frac{\Delta y}{\Delta x} \checkmark = \frac{0,96}{1} \checkmark = 0,96\,\text{N} \checkmark$$

$$\text{grad} \checkmark = \frac{0,96 - 0,31}{1-0,33} \checkmark = 0,97\,\text{N} \checkmark$$

$$\overset{x}{\text{grad}} = \frac{0,96}{1} \overset{x}{=} 0,96\,\text{N}$$

0/3

$$\text{grad} = \frac{\Delta y}{\Delta x} \checkmark = ma \checkmark = (1)(0,96) \checkmark = 0,96\ \text{N}$$

OR any of the given value of m and a

F= ma 0/3

Consider any answer between 0,96 N – 1,06 N
Oorweeg enige antwoord tussen 0,96 N – 1,06 N

5.4 ✓✓

resultant force / *resulterende of resultante krag*
force of elastic band /
applied force

Only: force 0/2
Net: krag

NOT - Elastic force
Nie – Elastiese krag

(2)

5.5

An object which experience a (non-zero) resultant force will accelerate in the direction of the (resultant) force. The acceleration is directly proportional to the (resultant) force and is inversely proportional to the mass of the object.

'n Voorwerp waarop 'n (nie-zero) resulterende krag inwerk sal versnel In die rigting van die resulterende krag. Die versnelling is direk eweredig aan die (resulterende) krag en omgekeerd eweredig aan die massa van die voorwerp.

The resultant force on an object is directly proportional to the rate of change of momentum and the rate of change of momentum is in the direction of the resultant force.

Die resulterende krag op 'n voorwerp is direk eweredig aan die tempo van verandering van momentum van die voorwerp en die tempo van verandering in die momentum is in die rigting van die resulterende krag

DEPT. VAN ONDERWYS

(3)
[15]

QUESTION 6 / *VRAAG 6*

6.1

In an isolated system the total linear momentum remains constant (conserved in magnitude and direction) **OR**
In an isolated system (if there are no external forces acting) the total momentum before a collision is equal to the total momentum after a collision

In 'n geisoleerde sisteem is die totale liniêre momentum konstant (bly behoue) (in grootte en rigting) ***OF***
In 'n geisoleerde sisteem (indien daar geen eksterne kragte daarop inwerk nie)is die totale momentum voor 'n botsing gelyk aan die totale momentum na die botsing.

(3)

6.2

Right positive

$$p_{before} = p_{after}$$
$$(m_1 + m_2)u = m_1v_1 + m_2v_2$$
$$(2+1)3 = (1)v_1 + (2 \times 4{,}7)$$
$$v_1 = -0{,}4\ m.s^{-1}$$

$= 0{,}4\ m.s^{-1}$; to the left/ *na links*
opposite to direction of original motion /
teenoorgestelde rigting van oorspronklike beweging

Direction /*Rigting*
NOT: West
Nie wes nie

Right positive

$$p_{before} = p_{after}$$
$$m_1u + m_2u = m_1v_1 + m_2v_2$$
$$(2 \times 3) + (1 \times 3) = (1)v_1 + (2 \times 4{,}7)$$
$$v_1 = -0{,}4\ m.s^{-1}$$

$= 0{,}4\ m.s^{-1}$; to the left/ *na links*
opposite to direction of original motion /
teenoorgestelde rigting van oorspronklike beweging

(7)

[10]

QUESTION 7 / *VRAAG 7*

7.1 (2)

Scalar ✓✓ / *skalaar*

7.2 (4)

$W = F \times s$ ✓

$= (1\,500 \times 10) \times 8$ ✓ ✓

$= 120\,000\ J\ (1{,}2 \times 10^5\ J)$ ✓

$W = \Delta E_p = (E_p)_{gain}$ ✓

$= mgh$ ✓ ✓

$= 1500 \times 10 \times 8$ ✓

$= 120\,000\ J$

$W = E_p$ x

$= mgh$ ✓ ✓

$= 1500 \times 10 \times 8$

$= 120\,000\ J$ ✓ (3/4)

7.3 applied force / *toegepaste krag* ✓✓ **(2 or 0)** (2)

7.4

$(E_k)_{initial} = \frac{1}{2} m u^2 = \frac{1}{2} 0{,}2 \times 2^2 = 0{,}4\ J$ ✓ ✓

$(E_k)_{final} = \frac{1}{2} m v^2 = \frac{1}{2} 0{,}2 \times 0{,}5^2 = 0{,}025\ J$ ✓

$\therefore W = \Delta E_K = (E_K)_{final} - (E_K)_{initial}$

$W = \Delta E_K = 0{,}025 - 0{,}4 = -0{,}375\ J$ ✓

$W = \Delta E_K = (E_K)_{final} - (E_K)_{initial}$ ✓

$= \frac{1}{2} mv^2 - \frac{1}{2} mu^2$

$= \frac{1}{2}(0{,}2)(0{,}5)^2 - \frac{1}{2}(0{,}2)(2)^2$ ✓ ✓

$= -0.375\ J$ ✓

Unit only important in final answer
Eenheid slegs belangrik in finale antwoord

But also accept the following / *Aanvaar ook die volgende as korrek*

$(E_k)_{initial} = \frac{1}{2} m u^2 = \frac{1}{2} 0{,}2 \times 2^2 = 0{,}4\ J$ ✓ ✓

$(E_k)_{final} = \frac{1}{2} m v^2 = \frac{1}{2} 0{,}2 \times 0{,}5^2 = 0{,}025\ J$ ✓

$\therefore W = \Delta E_K = (E_K)_{initial} - (E_K)_{final}$

$W = \Delta E_K = 0{,}4 - 0{,}025 = 0{,}375\ J$ ✓

$W = \Delta E_K = (E_K)_{final} - (E_K)_{initial}$ ✓

$= \frac{1}{2} mv^2 - \frac{1}{2} mu^2$

$= \frac{1}{2}(0{,}2)(2)^2 - \frac{1}{2}(0{,}2)(0{,}5)^2$ ✓ ✓

$= 0.375\ J$ ✓

$s = \frac{v^2 - u^2}{2a} = \frac{0{,}5^2 - 2^2}{2a}$

$W = mas = (0{,}2)a\left(\frac{0{,}5^2 - 2^2}{2a}\right)$ ✓ ✓

$= (0{,}1)(0{,}5)^2 - (0{,}1)(2)^2$ ✓ ✓

$= -0{,}375\ J$ ✓

$\Delta E_k = \frac{1}{2} m (v-u)^2$ (0/5)

(5)

7.5

The applied force by the carpet ✓ is the frictional force. This is the only horizontal force ✓ acting on the car. ∴ the applied force is the resultant force.
Die toegepaste krag deur die mat is die wrywingskrag. Dit is die enigste horisontale krag wat op die motor inwerk. ∴ Die toegepaste krag is die resulterende krag.

The ✓ frictional force is the ✓ only horizontal force /

The applied force is the ✓✓ only horizontal force /

It is the only horizontal force ✓✓

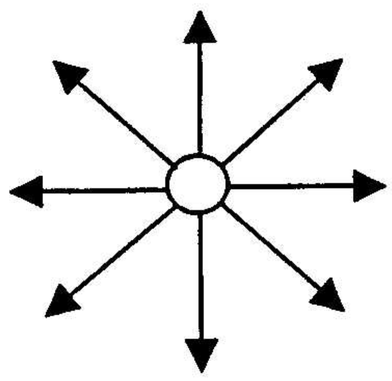
$F_{res} = F_{applied}$ $\frac{0}{2}$

(2)

[15]

QUESTION 8 / *VRAAG 8*

8.1



Direction ✓
Str. line starting on surface ✓
Uniform distribution at right angle to surface ✓

Rigting
Reguit lyne wat op die oppervlak begin
Uniform verspreiding teen regte hoeke met oppervlak

(3)

8.2

$$E = \frac{kQ}{r^2} \quad \checkmark$$

$$= \frac{(9x10^9)(5x10^{-9})}{0,2^2} \quad \checkmark \checkmark$$

$$= 1125 \ NC^{-1} \text{ away from S / right} \quad \checkmark \checkmark$$

Mark direction independently
Merk rigting onafhanklik

NOT Accepted : repelling, towards S, east, away from P, towards P
***NIE aanvaarbaar**: afstotend, na S, oos, weg van P, na P*

(5)

8.3

$$F = Eq \quad \checkmark$$

$$3,375x10^{-5} = 1125 \times q \quad \checkmark \checkmark$$

$$q = 3 \times 10^{-8} \ C \quad \checkmark \text{ polarity positive} \quad \checkmark$$

Mark polarity independently
Merk polariteit onafhanklik

$$F = \frac{kq_1 q_2}{r^2} \quad \checkmark$$

$$3,375x10^{-5} = \frac{(9x10^9)(5x10^{-9})\ q}{(0,2)^2} \quad \checkmark \checkmark \checkmark$$

$$q = 3 \times 10^{-8} \ C \quad \text{polarity positive} \quad \checkmark$$

(5)

[13]

QUESTION 9 / *VRAAG 9*

9.1

$$R = \frac{V}{I} \checkmark$$

$$4 = \frac{V}{1{,}25} \checkmark \checkmark$$

$$V = 5\,V \checkmark$$

$$V = IR \quad \checkmark$$

$$= (1{,}25)(4) \quad \checkmark \checkmark$$

$$= 5\ V$$

(3)

9.2

$$R = \frac{V}{I}$$

$$10 = \frac{5}{I} \checkmark \checkmark$$

$$I = 0{,}5\,A \checkmark$$

$$I = \frac{V}{R}$$

$$= \frac{5}{10} \checkmark \checkmark$$

$$= 0{,}5\ A$$

$$I = \frac{4}{10}(1{,}25) = 0{,}5\,A$$

(3)

9.3

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \checkmark$$

$$= \frac{1}{4} \checkmark + \frac{1}{10} \checkmark + \frac{1}{20} \checkmark$$

$$= \frac{8}{20} = \frac{2}{5}$$

$$R_p = 2{,}5\,\Omega \checkmark$$

$$\frac{1}{R_p} = \frac{1}{4} \checkmark + \frac{1}{10} \checkmark + \frac{1}{20} \checkmark$$

$$= \frac{8}{20} = \frac{2}{5}$$

$$R_p = 2{,}5\,\Omega \checkmark$$

4 marks

$$R_p = \frac{1}{4} + \frac{1}{10} + \frac{1}{20}$$

$$= \frac{2}{5}$$

$$R_p = 2{,}5\,\Omega$$

zero marks

$R_p = 2{,}5\ \Omega$
1 mark

$$R = \frac{\text{product}}{\text{sum}} = \frac{4 \times 10}{4 + 10} = 2{,}857\,\Omega$$

$$R_p = \frac{2{,}857 \times 20}{2{,}857 + 20} = 2{,}5\,\Omega$$

9.5

(5)

9.4

$$R_{20\Omega} = \frac{V_p}{I_{20\Omega}}$$

$$20 = \frac{5}{I_{20\Omega}}$$

$$I_{20\Omega} = \frac{5}{20} = 0{,}25\,A \checkmark$$

$$\therefore I_{A3} = (0{,}25 + (1{,}25 + 0{,}5)) = 2\,A \checkmark$$

$$I_{20\Omega} = \frac{1}{2} I_{10\Omega} = \frac{1}{2}(0{,}5) = 0{,}25\,A \checkmark$$

$$\therefore I_3 = (0{,}25 + (1{,}25 + 0{,}5)) = 2\,A \checkmark$$

$$I_{20\Omega} = \frac{1}{5} I_{4\Omega} = \frac{1}{2}(1{,}25) = 0{,}25\,A \checkmark$$

$$\therefore I_3 = (0{,}25 + (1{,}25 + 0{,}5)) = 2\,A \checkmark$$

$$I_{20\Omega} = \frac{V_p}{R_{20\Omega}} = \frac{5}{20} = 0{,}25A \checkmark$$

$$I_{A3} = (1{,}25 + 0{,}5 + 0{,}25) = 2\,A \checkmark$$

$$I_{A3} = I_{cir} = \frac{V_p}{R_p} = \frac{5}{2{,}5} \checkmark = 2A \checkmark$$

$$I_{A3} = I_{cir} = \frac{V_P}{R_P} = \frac{5}{6} = 0{,}833\,A$$

1 mark

9.5

DEPT. VAN ONDERWYS

9.3 + 3,5 Ω

9.4

9.5

Emf = V_{cir} = I x R ✓

✓ ✓

= 2 x (2,5 + 3,5)

= 12 V ✓

emf = V_{cir} = V_P + $V_{3,5\Omega}$

✓ ✓ ✓

= 5 + (2 x 3,5)

= 5 + 7

= 12 V ✓

If in 9.4 : I_{A_3} = 0,83 A ✓ ✓ ✓

then in 9.5: V_{cir} = IR = (0,83)(2,5 + 3,5) = 4,98 V

(4)

[18]

TOTAL QUESTION 1 : 45
TOTAL QUESTIONS 2-9 : 105
GRAND TOTAL : 150