

NATIONAL DEPARTMENT OF EDUCATION

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

QUESTION 1 / VRAAG 1

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

[15 x 4 = 60]

QUESTION 2 / VRAAG 2

2.1

If three forces acting at a point are in equilibrium, they can be represented in magnitude and direction by the three sides of a triangle taken in order. OR
 If the three forces acting at a point are placed head-to-tail, (one after the other), they will form a closed triangle (triangle where the resultant is zero).
 As drie kragte in ewewig is kan hulle voorgestel word in grootte en rigting as die drie sye van 'n geslote driehoek, in orde geplaas kop-aan-stert.
 As die drie kragte wat op 'n punt inwerk kop-aan-stert geplaas word, sal hulle 'n geslote driehoek vorm.

2.2

$$\frac{\sin 115^\circ}{600 \text{ N}} = \frac{\sin 40^\circ}{F_{\text{rope}}}$$

$$F_{\text{rope}} = \frac{600 \times \sin 40^\circ}{\sin 115^\circ}$$

$$F_{\text{rope}} = 425,5 \text{ N}$$

closed Δ / geslote Δ

(3)

BY CONSTRUCTION / BY SKAALTEKENING

orientation ✓ / oriëntasie

$F_{\text{rope/tou}} = 8,5 \text{ cm} = 425 \text{ N}$
 (±2 mm = 415 – 435 N)

(6)

2.3

In Fig. 1 the rod exerts an upward component of force on her -

$$\therefore (F_{\text{rod}} + F_{\text{rope}})_{\text{up}} = 600 \text{ N. } \checkmark$$

In Fig 2 the rod exerts a downward component of force on her -

$$\therefore (F_{\text{rod}})_{\text{down}} + (F_{\text{rope}})_{\text{up}} = 600 \text{ N } \checkmark$$

$\Rightarrow F_{\text{rope}}$ is more than before. \checkmark **OR**

Increase \checkmark bigger force opposite to bigger angle \checkmark (2 marks) **OR**

Increase \checkmark θ is smaller \checkmark (2 marks)

In Fig 1 oefen die staaf 'n opwaartse komponent van 'n krag uit op haar - $\therefore (F_{\text{staaf}} + F_{\text{tou}})_{\text{op}} = 600 \text{ N. } \checkmark$

In Fig 2 oefen die staaf 'n afwaartse komponent van 'n krag uit op haar

$$\therefore (F_{\text{staaf}})_{\text{af}} + (F_{\text{tou}})_{\text{op}} = 600 \text{ N } \checkmark$$

$\Rightarrow F_{\text{rope}}$ is meer as voorheen. \checkmark **OF**

Toeneem \checkmark groter krag teenoor groter hoek \checkmark (2 punte) **OF**

Toeneem \checkmark θ is kleiner \checkmark (2 punte)

(3)

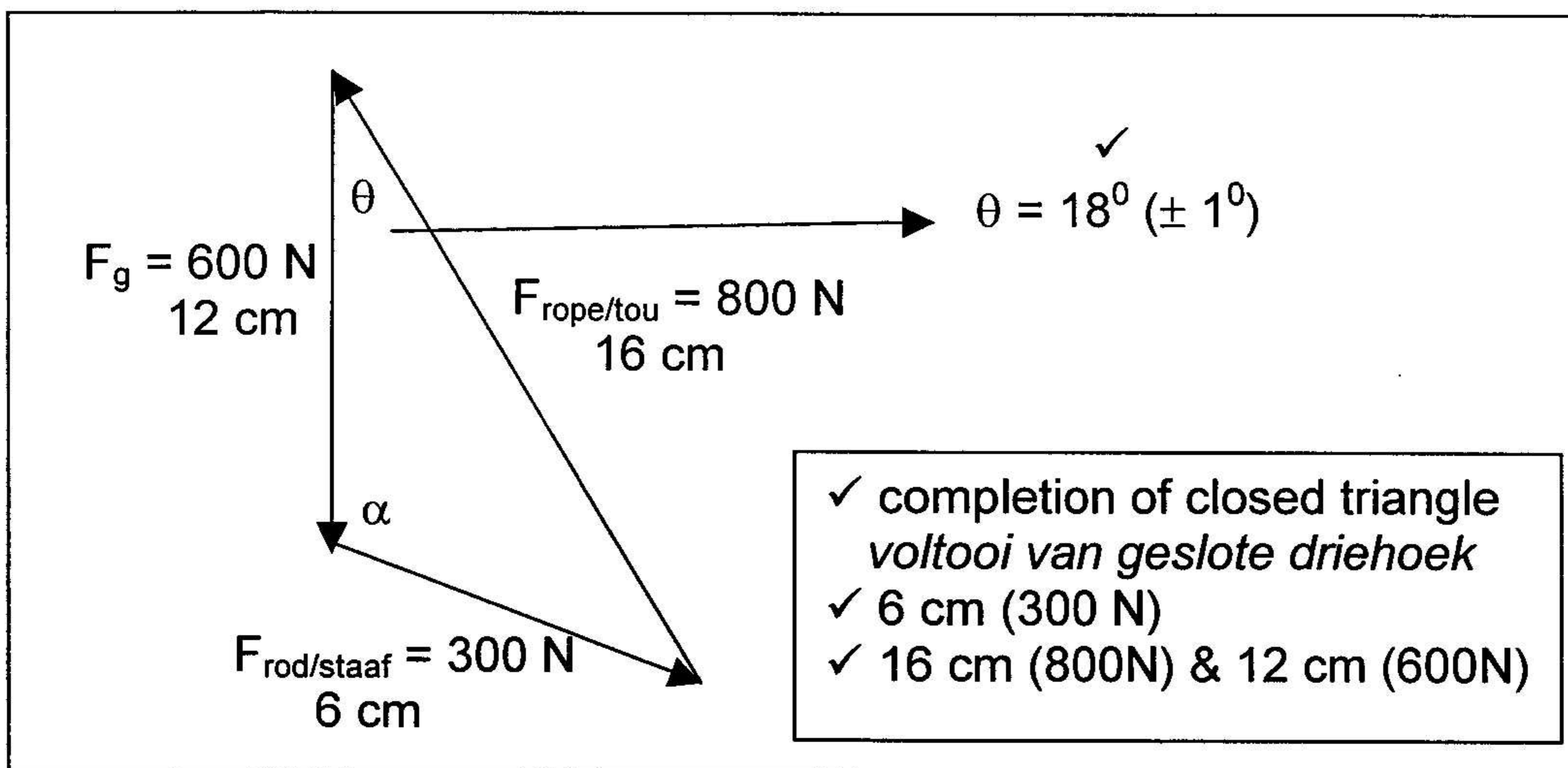
2.4 **CALCULATION / BEREKENING**

$$300^2 = 600^2 + 800^2 - (2 \times 600 \times 800 \times \cos \theta)$$

$$\cos \theta = 0,948$$

$$\theta = 18,56^\circ \checkmark$$

BY CONSTRUCTION / MET SKAALTEKENING



(4)

[16]

QUESTION 3 / VRAAG 3

3.1

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

$$16 = 0 + \frac{1}{2}(10)t^2$$

$$t^2 = \frac{16 \times 2}{10}$$

$$t = 1,79 \text{ s}$$

(5)

3.2

time for A to reach ground / Tyd vir A om grond te bereik

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

$$57,5 = 0 + \frac{1}{2}(10)t^2$$

$$t = 3,39 \text{ s}$$

∴ time from Q to ground / Tyd vir Q om grond te bereik
= 3,39 – 1,79 = 1,6 s

∴ initial velocity of B / aanvangsnelheid van B :

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

$$57,5 = u(1,6) + \frac{1}{2}(10)(1,6)^2$$

$$u = 27,94 \text{ m.s}^{-1}$$

(8)

[13]

QUESTION 4 / VRAAG 4

4.1 Acceleration can be defined as the rate of change of velocity **OR** the rate at which velocity is changing. ✓✓
Versnelling kan gedefinieer word as die tempo van verandering in snelheid OF die tempo waarteen die snleheid verander. ✓✓

(2)

4.2.1 MN > QR because it has a bigger gradient. Both in the same direction.
MN > QR aangesien dit 'n groter gradient het – beide selfde rigting

(3)

4.2.2 They are the same (equal) in magnitude and direction
Hulle is dieselfde (gelyk) in grootte en rigting

(2)

4.3 It slows down to a stop and then speed up in the opposite direction
Dit beweeg stadiger en stop, beweeg dan weer vinniger in teenoorgestelde rigting.

(4)

4.3 Distance travelled will be equal to sum of all areas underneath v-t graph. ✓
Afstand afgelê is gelyk aan die som van alle oppervlakte onder v-t grafiek. ✓

$$S_{total} = s(0 - 10s) + s(10 - 20s) + (20 - 32s)$$

$$= (5 \cdot 10 + \frac{1}{2} \cdot 10 \cdot 10) + (15 \cdot 10) + (\frac{1}{2} \cdot 12 \cdot 15)$$

$$= 480 \text{ m } \checkmark$$

OR / OF

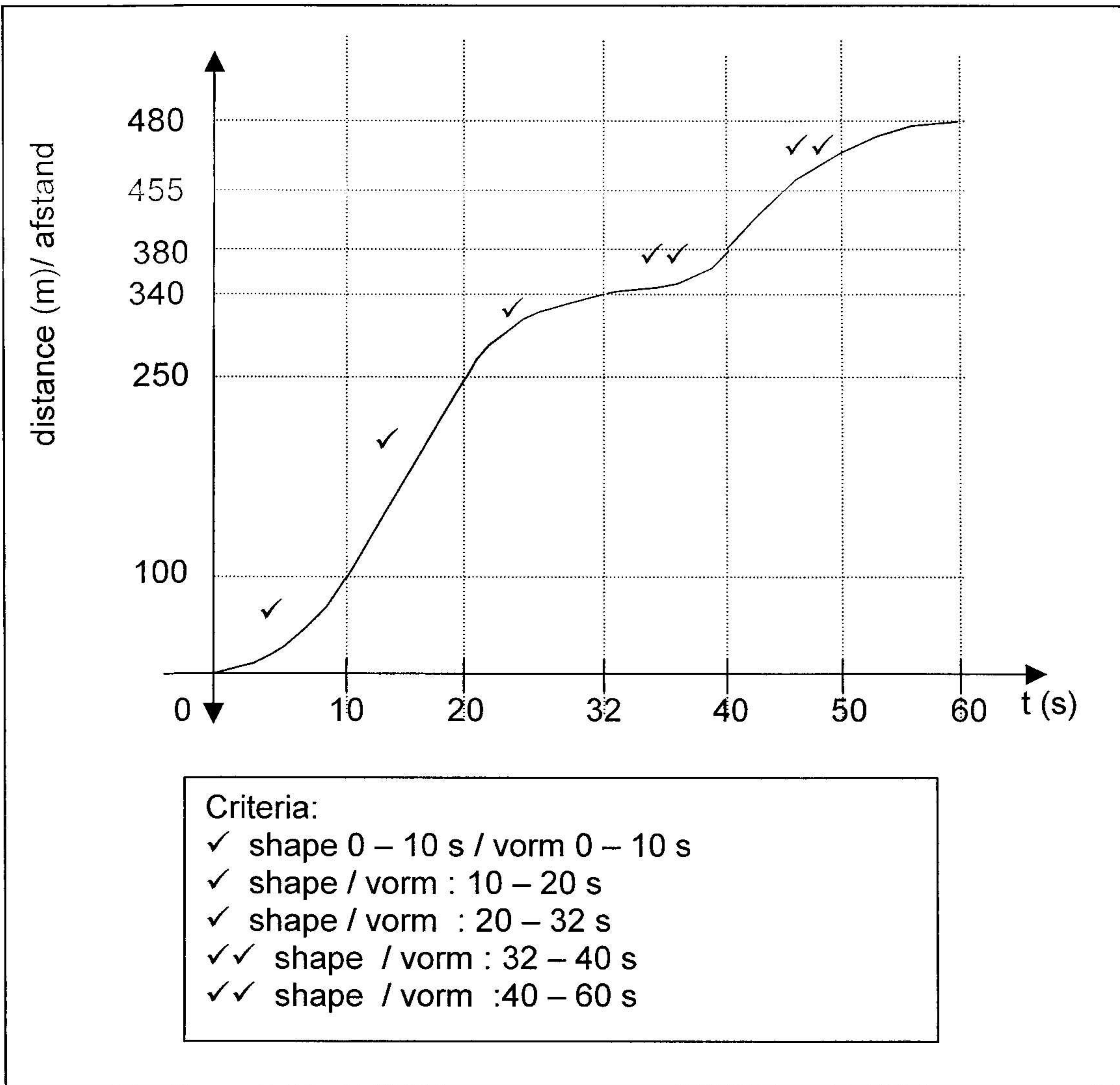
$$S_{total} = s(0 - 10s) + s(10 - 32s) + s(32 - 60s) \checkmark$$

$$= [\frac{1}{2} (15+5) \times 10] + [\frac{1}{2} (22+10) \times 15] + [\frac{1}{2} \times 28 \times 10]$$

$$= 480 \text{ m } \checkmark$$

(5)

4.4



(7)

[23]

QUESTION 5 / VRAAG 5

✓

5.1

It moves forward at velocity of car/ continues forward.
Dit beweeg vorentoe teen snelheid van motor / vorentoe

(1)

5.2

Newton 1 ✓ (NOT inertia) ✓
 A body will remain at rest or continue at constant velocity (speed in a straight line) unless acted on by an external non-zero resultant force. ✓
 Newton 1 ✓ (Nie traagheid)
 'n Liggaam sal in sy toestand van rus ✓ bly of teen 'n konstante snelheid in 'n reguit lyn bly beweeg ✓ tensy 'n nie-zero resulterende krag ✓ daarop inwerk.

(4)

5.3

Resultant force is directly proportional to change in momentum. **OR**

$$F_{\text{res}} \propto \Delta p \quad \checkmark \checkmark$$

NOT: F_{res} is directly proportional to rate of change in momentum

Resultante krag is direk eweredig aan verandering in momentum

$$F_{\text{res}} \propto \Delta p$$

(2)

5.4

$$F_{\text{res}} \Delta t = mv - mu \quad \checkmark$$

$$F_{\text{res}} (0,25) = 60(0 - 14) \quad \checkmark$$

$$F_{\text{res}} = 3360 \text{ N} \quad \checkmark \text{ opposite to direction of motion of car / left}$$

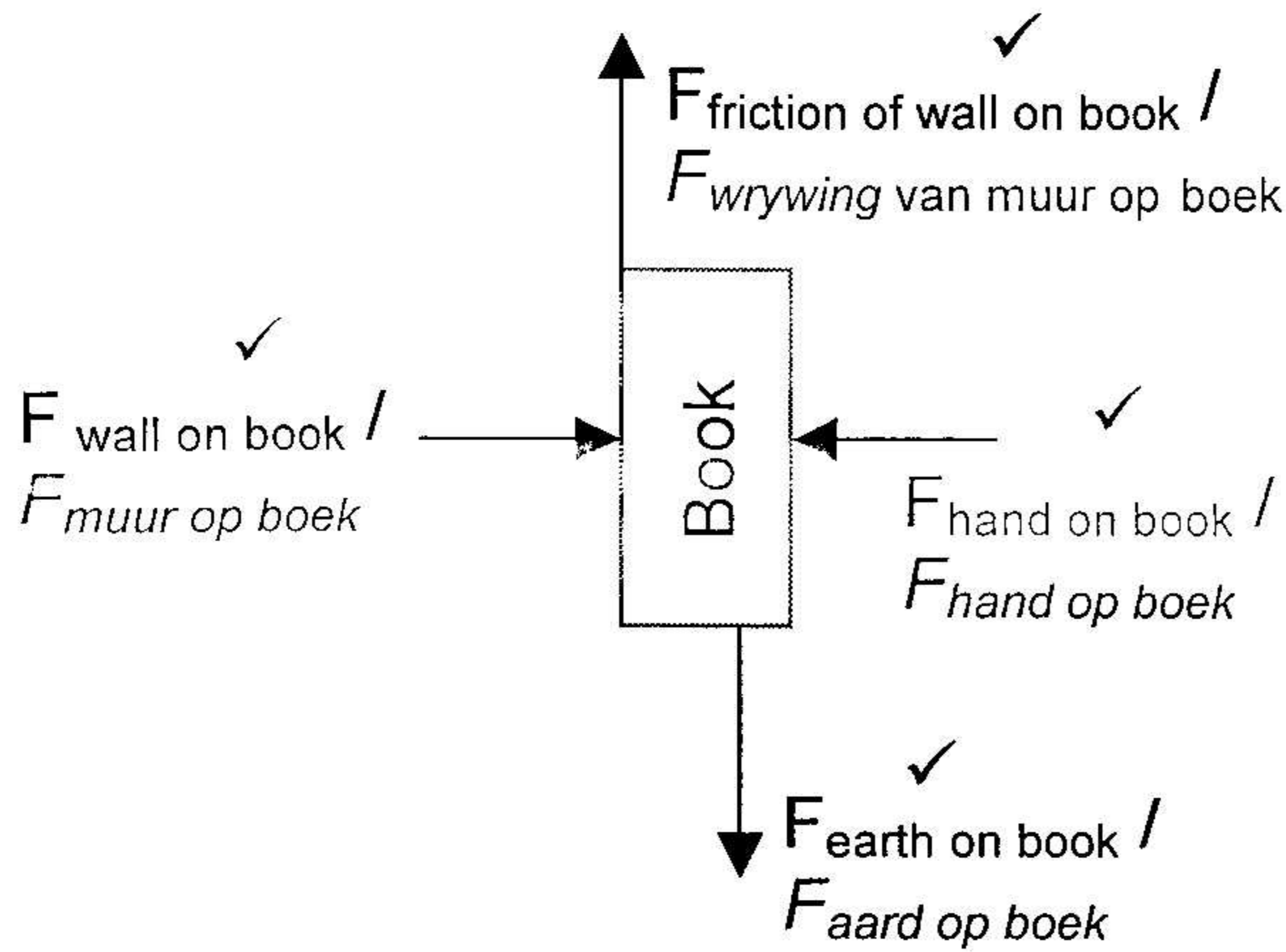
teenorgestelde rigting van motor / links

(6)

[13]

QUESTION 6/ VRAAG 6

6.1



arrows missing (-2 max)
pyle ontbreek (-2 max)

(4)

6.2

If body A exerts a force on body B then body B exerts a force of equal magnitude on body A, but in the opposite direction.
As liggaam A 'n krag op liggaam B uitoefen sal liggaam B 'n krag van dieselfde grootte maar in die teenoorgestelde rigting op liggaam A uitoefen.

(3)

6.3

(wall on book) and (book on wall) ✓✓
 (hand on book) and (book on hand) ✓✓
 [no gravitational forces considered here] [0, 2 or 4]
muur oop boek en boek op muur ✓✓
hand op boek en boek op hand ✓✓
(geen gravitasiekragte in ag geneem)

(4)

[11]

QUESTION 7 / VRAAG 7

7.1

The sum of the gravitational potential energy (E_p) and the kinetic energy (E_k) of a body in the absence of air friction / moving freely in a vertical plain remains constant.

Die som van die gravitasie-potensiële energie (E_p) en die kinetiese energie (E_k) van 'n liggaam in die afwesigheid van wrywing in die vertikale vlak bly konstant.

(3)

7.2

$y = 1,5 \times \cos 30^\circ$
 $= 1,3 \text{ m}$

\therefore height above reference point, Q
 $= 1,5 - 1,3 = 0,2 \text{ m}$

$\therefore E_p = mgh = (1)(10)(0,2) = 2 \text{ J}$

(7)

7.3

$$(E_p + E_k)_{\text{top}} = (E_p + E_k)_{\text{bottom}}$$

$$2 + 0 = 0 + \left(\frac{1}{2} \times 1 \times v^2\right)$$

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

zero if equations of motion are used
nul as bewegingsvergelings gebruik

(5)

7.4

2 m.s^{-1}

(2)

7.5

In an isolated system (no external forces are acting) the total linear momentum remains constant (conserved) in magnitude and direction **OR**

The total momentum before a collision is equal to the total momentum after a collision if there are no external forces acting

Die totale liniêre momentum in 'n geïsoleerde sisteem bly behoue in grootte en rigting **OF**

Die totale momentum voor 'n botsing is gelyk aan die totale momentum na die botsing indien daar geen eksterne kragte daarop inwerk nie.

(3)

QUESTION 8 / VRAAG 8

8.1

One charged particle exerts an electrostatic force of attraction or repulsion on another charged particle. The force is directly proportional to the product of their charges and inversely proportional to the square of the distance between their centres. ✓✓

Een gelaaiide deeltjie oefen 'n krag ✓ op 'n ander gelaaiide deeltjie uit. Die krag is direk eweredig ✓ aan die produk van hulle ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. ✓✓

(4)

8.2

$$\frac{2 \times 10^{-3}}{1,25 \times 10^{-4}} = 16$$

new force is $\frac{1}{16}$ times the old force
 nuwe krag is 1/16 keer die ou krag

(2)

8.3

$$F_{\text{new}} = \frac{1}{16} F_{\text{old}}$$

$$\frac{kq^2}{(x+10)^2} = \frac{1}{16} \cdot \frac{kq^2}{x^2}$$

$$16x^2 = x^2 + 20x + 100$$

(4)

8.4

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

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

$$q^2 = 2,42 \times 10^{-18}$$

$$q = 1,56 \times 10^{-9} \text{ C}$$

(5)

[15]

QUESTION 9 / VRAAG 9

9.1

emf is the rate of supply of energy per unit current. OR
 the rate of work done in moving 1 ampere of current OR
 the work done / maximum energy required to move 1 coulomb of charge through
 the whole circuit
emk is die tempo van energievoorsiening per eenheidstroom OF
die tempo van arbeid verrig om 1 ampere stroom te beweeg OF
die arbeid verrig / maksimum energie om 1 coulomb lading deur die hele
stroombaan te beweeg

(3)

9.2

$$P_L = I^2 R$$

$$18 = (1,5)^2 R_L$$

$$R_L = 8 \Omega$$

(4)

9.3

$$emf = I(R_{ext} + r_{int})$$

$$24 = 1,5[(8+6) + r]$$

$$r = 2 \Omega$$

$$V_L = IR_L = (1,5)(8) = 12V$$

$$V_{6\Omega} = (1,5)(6) = 9V$$

$$\therefore V_{ext\ cir} = 12 + 9 = 21V$$

$$emf = V_{ext} + V_{lost}$$

$$24 = 21 + 1,5r$$

$$r = \frac{3}{1,5} = 2 \Omega$$

(6)

9.4

$$emf = IR_{ext} + Ir_{int}$$

$$24 = V_{ext} + (2)(2)$$

$$V_{ext\ cir} = 20V$$

(4)

9.5

$$\begin{aligned} \text{emf} &= IR_{\text{ext}} + Ir_{\text{int}} \\ 24 &= (2)R_{\text{ext}} + (2)(2) \\ R_{\text{ext cir}} &= 10\Omega \\ \therefore R_p &= 10 - 8 = 2\Omega \\ \therefore \frac{1}{R_p} &= \frac{1}{X} + \frac{1}{6} \\ \frac{1}{X} &= \frac{1}{2} - \frac{1}{6} = \frac{1}{3} \\ \therefore X &= 3\Omega \end{aligned}$$

$$\begin{aligned} V_L &= IR_L = (2)(8) = 16\text{V} \\ V_p &= 20 - 16 = 4\text{V} \\ \therefore R_p &= \frac{V_p}{I_{\text{cir}}} = \frac{4}{2} = 2\Omega \\ \therefore \frac{1}{R_p} &= \frac{1}{X} + \frac{1}{6} \\ \frac{1}{X} &= \frac{1}{2} - \frac{1}{6} = \frac{1}{3} \\ \therefore X &= 3\Omega \end{aligned}$$

$$\begin{aligned} V_L &= IR_L = (2)(8) = 16\text{V} \\ \therefore V_p &= 20 - 16 = 4\text{V} \\ V_{6\Omega} &= I_{6\Omega} R_{6\Omega} \\ 4 &= I_{6\Omega} (6) \\ I_{6\Omega} &= \frac{4}{6} = 0,67\text{A} \\ \therefore I_x &= 2 - 0,67 = 1,33\text{A} \\ \therefore V_p &= I_x R_x \\ 4 &= (1,33)R_x \\ R_x &= 3\Omega \end{aligned}$$

(8)

9.6

$$\begin{aligned} W &= I^2 R t \\ &= (2)^2 (8) (120) \\ &= 3840\text{ J} \end{aligned}$$

$$\begin{aligned} W &= \frac{V^2 t}{R} \\ &= \frac{(16)^2 (120)}{8} \\ &= 3840\text{ J} \end{aligned}$$

$$\begin{aligned} W &= V I t \\ &= (16)(2)(120) \\ &= 3840\text{ J} \end{aligned}$$

(4)

[29]

Question 1 = 60
 Question 2 – 9 = 140
 Grand Total = 200