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KWV 01

QUESTION 2/VRAAG 2

- 2.1 When a resultant (net) force acts on an object, the object will accelerate in the direction of the force. This acceleration is directly proportional to the force ✓ and inversely proportional to the mass of the object. ✓

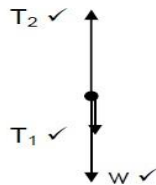
Wanneer 'n resulterende (netto) krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel. Hierdie versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

OR/OF

The net force acting on an object is equal to the rate of change of momentum ✓✓ of the object (in the direction of the force). (2 or 0)

Die netto krag wat op 'n voorwerp inwerk is gelyk aan die tempo van verandering in momentum van die voorwerp (in die rigting van die krag). (2 of 0) (2)

2.2



(3)

2.3

OPTION 1/OPSIE 1

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

For 5 kg block/Vir 5 kg-blok

$$T_2 + (-mg) + (-T_1) = ma$$

$$250 - (5)(9,8) - T_1 \checkmark = 5a \checkmark$$

$$201 - T_1 = 5a$$

$$T_1 = 201 - 5a \dots\dots(1)$$

For 20 kg block/Vir 20 kg-blok

$$T_1 + (-mg) = ma \dots\dots(2)$$

$$T_1 + [-20(9,8)] \checkmark = 20a$$

$$5 = 25a$$

$$a = 0,2 \text{ m} \cdot \text{s}^{-2} \text{ upwards/opwaarts}$$

$$\therefore T_1 = \underline{201 - 5(0,2)} \checkmark$$

$$= 200 \text{ N} \checkmark$$

$$\text{OR/OF } T_1 = \underline{20(9,8) + 20(0,2)} \checkmark$$

$$= 200 \text{ N} \checkmark$$

(6)

OPTION 2 /OPSIE 2

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

For 5 kg block/Vir 5 kg-blok

$$T_2 + (-mg) + (-T_1) = ma$$

$$250 - (5)(9,8) - T_1 \checkmark = 5a \checkmark$$

$$201 - T_1 = 5a$$

$$T_1 = 201 - 5a \dots\dots(1)$$

For 20 kg block/Vir 20 kg-blok ,

$$T_1 + (-mg) = ma \dots\dots(2)$$

$$T_1 + [-20(9,8)] \checkmark = 20a$$

$$(1) \times 4 : 4T_1 = 804 - 20a$$

$$\therefore T_1 - 196 = 804 - 4T_1 \checkmark$$

$$\therefore 5T_1 = 1000$$

$$\therefore T_1 = 200 \text{ N} \checkmark$$

(6)

2.4

Q ✓

KWV 02

QUESTION 2/VRAAG 2

- 2.1 When one body exerts a force on a second body, the second body exerts a force of equal magnitude in the opposite direction on the first body.
Wanneer een liggaam 'n krag op 'n tweede liggaam uitoefen, oefen die tweede liggaam 'n krag van gelyke grootte in die teenoorgestelde rigting op die eerste liggaam.

OR/OF:

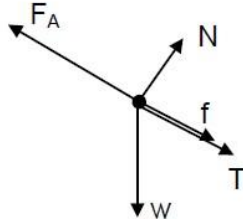
When body A exerts a force on body B, body B will exert a force of equal magnitude but opposite in direction on body A.
Indien liggaam A 'n krag uitoefen op liggaam B, sal B 'n krag van gelyke grootte maar teenoorgestel in rigting op liggaam A uitoefen.

ACCEPT/AANVAAR (for 1 mark only/vir slegs 1 punt)

Action and reaction are equal and opposite.
Aksie en reaksie is gelyk en teenoorgestel

(2)

2.2



Accept/Aanvaar Force diagram <i>Kragtediagram</i>	Notes/Aantekeninge Do not penalise for length of arrows <i>Moenie vir die lengte van die pyltjies penaliseer nie</i> If w is not shown but $F_{\parallel}$ and $F_{\perp}$ are shown give 1 mark for both. <i>Indien w nie aangetoon is nie maar $F_{\parallel}$ en $F_{\perp}$ is getoon, ken 1 punt toe vir beide.</i>
---	---

Accept the following symbols/Aanvaar die volgende simbole.	
N	F_N ; Normal;/Normaal ✓
F_A	40 N ✓
f	F_f, f_k ✓
w	F_G Weight/Gewig; Gravitational force/Gravitasiekrag ✓
T	Tension/Spinning; F_T ; ✓

(5)

2.3.1 **OPTION 1/OPSIE 1**

For the 1 kg block/Vir die 1 kg blok;

$$\begin{aligned} f_k &= \mu_k N \\ &= \mu_k mg \cos \theta \checkmark \\ &= 0,29 (1 \times 9,8 \cos 30^\circ) \checkmark \\ &= 2,46 \text{ N} \checkmark \end{aligned}$$

OPTION 2/OPSIE 2

BY PROPORTION:/DEUR EWEREDIGHEID

The smaller mass = $\frac{1}{4}$ of the larger mass $\checkmark$

Die kleiner massa = $\frac{1}{4}$ die groter massa

$$\begin{aligned} \therefore \text{frictional force/wrywingskrag} &= \frac{1}{4} (10) \checkmark \\ &= 2,5 \text{ N} \checkmark \end{aligned}$$

(3)

2.3.2 **POSITIVE MARKING FROM QUESTION 2.2
POSITIEWE NASIEN VANAF VRAAG 2.2**

OPTION 1/OPSIE 1

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

For 1 kg block/Vir 1 kg blok

$$\begin{aligned} F_A - \{(T + f_k) + mg \sin \theta\} &= ma \\ 40 - \{T + 2,46 + 1(9,8)(\sin 30^\circ)\} &= (1 \times) a \checkmark \\ 40 - T - 7,36 &= a \end{aligned}$$

$$32,64 - T = a \dots \dots (1)$$

For 4 kg block/Vir 4 kg blok

$$\begin{aligned} T - (mg \sin \theta + f_k) &= 4a \\ T - (4 \times 9,8 \sin 30^\circ + 10) &= 4a \checkmark \end{aligned}$$

$$T - 29,6 = 4a \dots \dots (2)$$

From (1) and (2)/Vanaf (1) en (2)

$$\begin{aligned} a &= 0,61 \text{ m} \cdot \text{s}^{-2} \\ T &= 29,6 + (4(0,61)) \checkmark \\ T &= 32,04 \text{ N} \checkmark \end{aligned}$$

OPTION 2/OPSIE 2

Consider the blocks as a single system.

Beskou die blokke as 'n enkele sisteem.

$$\begin{aligned} F_A - [(f_{\text{tot}}) + \{(4+1) g \sin 30^\circ\}] &= (4+1)a \\ 40 - (10 - 2,46) - (5(9,8) \sin 30^\circ) &= 5a \checkmark \\ \therefore a &= 0,61 \text{ m} \cdot \text{s}^{-2} \end{aligned}$$

For 1 kg block/Vir 1 kg blok

$$\begin{aligned} F_{\text{net}} &= ma \checkmark \\ F_A - \{(T + f_k) + mg \sin \theta\} &= ma \\ 40 - \{T + 2,46 + 1(9,8)(\sin 30^\circ)\} &= (1 \times) a \checkmark \\ 40 - T - 7,36 &= a \\ 32,64 - T &= 0,61 \checkmark \\ T &= 32,04 \text{ N} \checkmark \end{aligned}$$

Notes/Aantekeninge

Learners need not show how (1) and (2) were combined
Leerders hoef nie aan te toon hoe (1) en (2) gekombineer is nie.

The first correct substitution for equation (1) should carry 2 marks.

The second substitution must carry 1 mark.

Die eerste korrekte vervanging vir vergelyking (1) moet 2 punte tel.

Die tweede vervanging tel 1 punt.

KWV 03

QUESTION 2/VRAAG 2

- 2.1.1 When body A exerts a force on body B, body B exerts a force of equal magnitude in the opposite direction on body A. ✓✓

Wanneer liggaam A 'n krag uitoefen op liggaam B, oefen liggaam B 'n krag van gelyke grootte in die teenoorgestelde rigting op liggaam A uit.

OR/OF

If body A exerts a force on body B, then body B exerts an equal ✓ and opposite✓ force on body A

Indien liggaam A 'n krag uitoefen op liggaam B, dan sal liggaam B 'n gelyke maar teenoorgestelde krag op liggaam A uitoefen

(2)

- | | | |
|---|--|--|
| <p>2.1.2 For 2,5 kg block/Vir 2,5 kg blok</p> $T = mg✓$ $∴ T = (2,5)(9,8)✓$ $= 24,5 \text{ N}✓$ | <p>OR/OF</p> $F_{\text{net}} = ma$ $T - mg = (2,5)(0)✓$ $T - (2,5)(9,8)✓ = 0$ $T = 24,5 \text{ N}✓$ | <p>OR/OF</p> $F_{\text{net}} = ma$ $mg - T = (2,5)(0)✓$ $(2,5)(9,8) - T✓ = 0$ $T = 24,5 \text{ N}✓$ |
|---|--|--|

(3)

- | | |
|---|---|
| <p>2.1.3 POSITIVE MARKING FROM 2.1.2
POSITIEWE NASIEN VANAF 2.1.2</p> <p>For mass M/Vir mass M</p> $f_s = \mu_s N✓$ $∴ N = \frac{24,5}{0,2}✓ = 122,5 \text{ N}$ $N = Mg = 122,5 \text{ N}$ $\underline{M(9,8) = 122,5 \text{ N}✓}$ $M = 12,5 \text{ kg}✓$ | <p>OR/OF</p> $\mu_s N✓ = \mu_s Mg$ $24,5✓ = (0,2)✓ \underline{M(9,8)}✓$ $M = 12,5 \text{ kg}✓$ |
|---|---|

(5)

- | | |
|--|--|
| <p>2.1.4 For the 5 kg block/Vir die 5 kg blok:</p> $f_k = \mu_k N$ $f_k = (0,15)(5)(9,8)✓$ $= 7,35 \text{ N}$ $F_{\text{net}} = ma✓$ $T - f_k = ma✓$ $\underline{T - 7,35 = 5a✓}$ <p>For the 2,5 kg block/Vir die 2,5 kg blok</p> $w - T = ma$ $\underline{(2,5)(9,8) - T = 2,5 a}✓$ $17,15 = 7,5 a$ $a = 2,29 \text{ m} \cdot \text{s}^{-2}✓$ | |
|--|--|

(5)

2.2

$$F = G \frac{m_1 m_2}{r^2} \checkmark$$

$$F = \frac{(6,67 \times 10^{-11})(6,5 \times 10^{20})(90)}{(550 \times 10^3)^2} \checkmark$$

$$= 12,90 \text{ N} \checkmark (12,899 \text{ N})$$

(4)

OR/OF

$$g = \frac{Gm}{r^2} \checkmark$$

$$g = \frac{(6,67 \times 10^{-11})(6,5 \times 10^{20})}{(550 \times 10^3)^2} \checkmark$$

$$= 0,143 \dots \text{m} \cdot \text{s}^{-2}$$

$$w = mg$$

$$= (90)(0,143 \dots) \checkmark$$

$$= 12,89 \text{ N} \checkmark (\text{downwards/afwaarts})$$

(4)

[19]

KWV 04

QUESTION 2/VRAAG 2

2.1 For the 5 kg mass/Vir die 5 kg massa:

2.1.1 $T - f = ma$

$$T - \mu_k(mg) = ma \checkmark$$

$$T - (0,4)(5)(9,8) \checkmark = 5a \checkmark \dots\dots\dots(1)$$

NOTE/LET WEL:

1 mark for any of the 2 formulae

1 punt vir enige van die 2 formules

For the 20 kg mass/Vir die 20 kg massa

$$mg - T = ma$$

$$20(9,8) - T = 20a \checkmark \dots\dots\dots(2)$$

$$176,4 = 25a \quad (1) + (2)$$

$$\therefore a = 7,06 \text{ (7,056) m} \cdot \text{s}^{-2} \checkmark$$

ACCEPT/AANVAAR (4 marks/4 punte)

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

$$Mg - f = (M + m) a \checkmark$$

$$[20(9,8) - (0,4)(5)(9,8)] \checkmark = 25a \checkmark$$

$$\therefore a = 7,06 \text{ m} \cdot \text{s}^{-2} \checkmark$$

2.1.2 **POSITIVE MARKING FROM QUESTION 2.1.1**

POSITIEWE NASIEN VANAF VRAAG 2.1.1

OPTION 1/OPSIE 1

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

$$= 0 \checkmark + (2)(7,056)(6) \checkmark$$

$$v_f = 9,20 \text{ m} \cdot \text{s}^{-1} \checkmark$$

POSITIVE MARKING FROM QUESTION 2.1.1

POSITIEWE NASIEN VANAF VRAAG 2.1.1

OPTION 2/OPSIE 2

The 5 kg mass travels as fast as the 20 kg mass

Die 5 kg massa beweeg net so vinnig soos die 20 kg massa

$$W_{\text{net}} = \Delta K \checkmark$$

$$(5)(7,056)(6 \cos 0^\circ) \checkmark = \frac{1}{2}(5)(v_f^2 - 0) \checkmark$$

$$v_f = 9,20 \text{ m} \cdot \text{s}^{-1} \checkmark$$

OPTION 3/OPSIE 3

For the 20 kg mass/Vir die 20 kg massa

$$W_{\text{net}} = \Delta K \checkmark$$

$$Mg - T = Ma$$

$$(20)(9,8) - T = (20)(7,056) \checkmark$$

$$T = 54,88 \text{ N}$$

$$W_{\text{net}} = \Delta K$$

$$W_T + W_g = \frac{1}{2}m(v_f^2 - v_i^2)$$

$$(54,88)(6)(\cos 180) + 20(9,8)(6)(\cos 0) = \frac{1}{2}(20)(v_f^2 - 0) \checkmark$$

$$v_f = 9,202 \text{ m} \cdot \text{s}^{-1} \checkmark$$

OPTION 4/OPSIE 4

$$W_{nc} = \Delta K + \Delta U \checkmark$$

$$W_{nc} = f_k \Delta x \cos \theta = \mu_k N \Delta x \cos \theta = \Delta U + \Delta K$$

$$(0,4)(5)(9,8)(6) \cos 180^\circ \checkmark = (20)(9,8)(0 - 6) + \frac{1}{2}(25)(v_f^2 - 0) \checkmark$$

$$-117,6 = (20)(9,8)(-6) + \frac{1}{2}(25)(v_f^2 - 0)$$

$$v_f = 9,202 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(4)

2.1.3 $6 \text{ m} \checkmark$

(1)

2.2

2.2.1 Each body in the universe attracts every other body with a force that is directly proportional to the product of their masses $\checkmark$ and inversely proportional to the square of the distance between their centres. $\checkmark$

Elke liggaam in die heelal trek elke ander liggaam aan met 'n krag wat direk eweredig is aan die produk van hul massas $\checkmark$ en omgekeerd eweredig is aan die kwadraat van die afstand tussen hul middelpunte. $\checkmark$

(2)

2.2.2

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

On the mountain/Op die berg

$$F_g = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(65)}{(6,38 \times 10^6 + 6 \times 10^3)^2} \checkmark$$

$$= 627,2 \text{ N}$$

On the ground/Op die grond

$$F_g = W = mg$$

$$= (65 \times 9,8) \checkmark$$

$$= 637 \text{ N}$$

$$F_g = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(65)}{(6,38 \times 10^6)^2}$$

$$= 636,94 \text{ N}$$

$$\text{Difference/Verskil} = (637 - 627,2) \checkmark$$

$$= 9,8 \text{ N} \checkmark$$

(6)

[18]

KWV 05

QUESTION 2/VRAAG 2

- 2.1 When a resultant/net force acts on an object, the object will accelerate in the (direction of the net/resultant force). The acceleration is directly proportional to the net force ✓ and inversely proportional to the mass ✓ of the object.
Wanneer 'n netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die netto krag teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

OR/OF

The resultant/net force acting on the object is equal (is directly proportional to) to the rate of change of momentum of an object (in the direction of the force). ✓✓

Die resulterende/netto krag wat op 'n voorwerp inwerk, is gelyk aan (is direk eweredig aan) die tempo van verandering van momentum van die voorwerp (in die rigting van die netto krag).

(2)

2.2 $f_k = \mu_k N \checkmark = \mu_k mg$
 $= (0,15)(3)(9,8) \checkmark$
 $= 4,41 \text{ N} \checkmark$

(3)

2.3



Accepted Labels/Aanvaarde benoemings	
W	F_g/F_w /force of Earth on block/weight/14,7 N/mg/gravitational force F_g/F_w /krag van Aarde op blok/gewig/14,7 N/mg/gravitasiekrag
N	F_N/F_{normal} /normal force F_N/F_{normaal} /normalekrag
T	Tension/ F_T Spanning/ F_T
f_k	$f_{\text{kinetic friction/kinetiesewrywing}}/f_{t/w}/f_{t/w}$ kinetic friction/kinetiesewrywing
25 N	$F_{\text{applied}}/F_A/F$ $F_{\text{toegepas}}/F_A/F$

2.4.1

OPTION 1/OPSIE 1	OPTION 2/OPSIE 2	(3)
$f_k = \mu_k N = \mu_k (25 \sin 30^\circ + mg)$ $= 0,15[(25 \sin 30^\circ) + (1,5)(9,8)]$ $= 4,08 \text{ N}$	$f_k = \mu_k N = \mu_k (25 \cos 60^\circ + mg)$ $= 0,15[(25 \cos 60^\circ) + (1,5)(9,8)]$ $= 4,08 \text{ N}$	

2.4.2

POSITIVE MARKING FROM QUESTION 2.2 AND QUESTION 2.4.1 POSITIEWE NASIEN VANAF VRAAG 2.2 EN VRAAG 2.4.1 OPTION 1/OPSIE 1	
For the 1,5 kg block/Vir die 1,5 kg blok $F_{\text{net}} = ma$ $F_x + (-T) + (-f_k) = ma$ ✓ $25 \cos 30^\circ - T - f_k = 1,5a$ $(25 \cos 30^\circ - T) - 4,08 = 1,5a$ $17,571 - T = 1,5a \dots\dots\dots(1)$	✓ either one enigeen
For the 3 kg block Vir die 3 kg blok $T - f_k = 3a$ $T - 4,41 = 3a \dots\dots\dots(2)$ $13,161 = 4,5a$ $a = 2,925 \text{ m} \cdot \text{s}^{-2}$ $T = 13,19 \text{ N}$ ✓	(13,17 N – 13,19 N)

OPTION 2/OPSIE 2	OPTION 3/OPSIE 3	(5)
For the 1,5 kg block/Vir die 1,5 kg blok $F_{\text{net}} = ma$ $F_x + (-T) + (-f_k) = ma$ ✓ $25 \cos 30^\circ - T - f_k = 1,5a$ $(25 \cos 30^\circ - T) - 4,08 = 1,5a$ $17,571 - T = 1,5a \dots\dots\dots(1)$	For the 1,5 kg block/Vir die 1,5 kg blok $F_{\text{net}} = ma$ $F_x + (-T) + (-f_k) = ma$ ✓ $25 \cos 30^\circ - T - f_k = 1,5a$ $(25 \cos 30^\circ - T) - 4,08 = 1,5a$ $17,571 - T = 1,5a \dots\dots\dots(1)$ $a = \frac{17,571 - T}{1,5}$	
For the 3 kg block Vir die 3 kg blok $T - f_k = 3a$ $T - 4,41 = 3a \dots\dots\dots(2)$ $35,142 - 2T = T - 4,41$ $T = 13,18 \text{ N}$ ✓	For the 3 kg block Vir die 3 kg blok $T - f_k = 3a$ $T - 4,41 = 3a \dots\dots\dots(2)$ $a = \frac{T - 4,41}{3}$ $\frac{17,571 - T}{1,5} = \frac{T - 4,41}{3}$ $T = 13,18 \text{ N}$ ✓	[18]

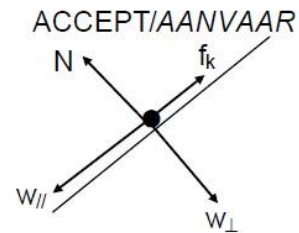
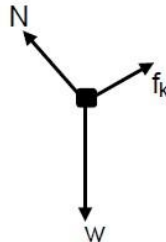
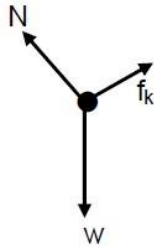
KWV 06

QUESTION 2/VRAAG 2

2.1 0 N/zero/nul ✓

(1)

2.2



Accepted labels/Aanvaarde benoemings	
W	F_g/F_w /weight/mg/gravitational force/N/19,6 N F_d/F_w /gewig/mg/gravitasiekrag/19,6 N
f	F_{friction}/F_f /friction/ f_k F_{wrywing}/F_w /wrywing/ f_k
N	F_N/F_{normal} /normal force F_N/F_{normaal} /normaalkrag
Deduct 1 mark for any additional force. Trek een punt af vir enige addisionel krag	
Mark is given for both arrow and label Punt word toegeken vir beide pyl/punt en benoeming	

1 mark if BOTH components of weight are shown.
All other rules in the table apply.
1 punt indien BEIDE komponent van die gewig getoon is
Al die ander reëls in die tabel gelte

(3)

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ f_k - mg \sin \theta = 0 \\ f_k = mg \sin \theta \end{array} \right\} \checkmark$$

1 mark for any of these/1 punt vir enige van hierdie

$$f_k = (2)(9,8) \sin 7^\circ \checkmark$$

$$f_k = 2,39 \text{ N} \checkmark \quad (2,389) \text{ N}$$

(3)

2.3.2 **POSITIVE MARKING FROM QUESTION 2.3.1/POSITIEWE NASIEN VANAF VRAAG 2.3.1**

$$\left. \begin{array}{l} f_k = \mu_k N \\ = \mu_k mg \cos 7^\circ \end{array} \right\} \checkmark$$

1 mark for any of these/1 punt vir enige van hierdie

$$2,389 = \mu_k (2)(9,8) \cos 7^\circ \checkmark$$

$$\mu_k = 0,12 \checkmark$$

(3)

2.3.3 **POSITIVE MARKING FROM QUESTION 2.3.2/POSITIEWE NASIEN VANAF VRAAG 2.3.2**
OPTION 1/OPSIE 1

$$\begin{aligned} F_{\text{net}} &= ma \\ -f_k &= ma \\ -\mu_k N &= ma \\ -\mu_k(mg) &= ma \end{aligned}$$

✓ 1 mark for any of these/1 punt vir enige van hierdie

$$\frac{-(0,12)(2)(9,8)}{a = -1,176 \text{ m.s}^{-2}} \checkmark = 2a \checkmark \quad (-1,18)$$

$$\begin{aligned} v_f^2 &= v_i^2 + 2a\Delta x \\ 0 &= (1,5)^2 + 2(-1,176)\Delta x \checkmark \\ \Delta x &= 0,96 \text{ m} \end{aligned}$$

Distance is/Afstand is 0,96 m ✓

OPTION 2/OPSIE 2

$$W_{\text{net}} = \Delta K$$

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

$$W_{\text{nc}} = \Delta K + \Delta U$$

$$W_{\text{nc}} = \Delta E_K + \Delta E_P$$

$$\mu_k N \Delta x \cos \theta = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

1 mark for any of these/ 1 punt vir enige van hierdie

NOTE: substituting into any of the above equations will lead to the following:

LET WEL: vervanging in enige van hierdie vergelyking sal lei to die volgende

$$(0,12)(2)(9,8) \checkmark \Delta x \cos 180^\circ \checkmark = 0 - \frac{1}{2}(2)(1,5)^2 \checkmark$$

$$\Delta x = 0,957 \text{ m} \checkmark$$

(5)
[15]

KWV 07

QUESTION 2 / VRAAG 2

2.1.1 An object continues in its state of rest or uniform motion (moving with constant velocity) unless it is acted upon by an unbalanced (resultant/net) force.✓✓

OR

A body will remain in its state of rest or motion at constant velocity unless a resultant/net force acts on it.✓✓

OR

A body will remain in its state of rest or of uniform motion in a straight line at constant velocity/speed unless a non-zero resultant/net force acts on it.✓✓

'n Liggaam sal in sy toestand van rus of uniforme beweging (teen konstante snelheid) volhard tensy 'n ongebalanseerde (resulterende/netto) krag daarop inwerk.

OF

'n Liggaam sal in sy toestand van rus of beweging teen konstante snelheid bly tensy 'n resulterende/netto krag daarop inwerk

OF

'n Liggaam sal in sy toestand van rus of uniforme beweging in 'n reguitlyn teen konstante snelheid/spoed volhard tensy 'n nie-nul resulterende/netto krag daarop inwerk.

(2)

2.1.3



Accepted Labels/Aanvaarde benoemings	
W	F_g / F_w /weight/mg /78,4 N/gravitational force F_g / F_w /gewig/mg/78,4 N/gravitasiekrag
F	F_{app} / F_A / applied force (Accept T / tension) $F_{toegepas}$ / F_T / toegepaste krag (Aanvaar T / spanning)
f_k	(kinetic) Friction/ F_f / f /(kineties) wrywing/ F_w
N	F_N /Normal (force)/Normaal(krag)/ 67,9 N

(4)

2.1.3

$F_{\text{net}} = ma \checkmark$ $F_{\text{net}} = 0$ $F + (-f_k) + (-F_{\text{gll}}) = ma$ $F - (f_k + F_{\text{gll}}) = ma$ $F - 20,37 \checkmark - (8)(9,8)\sin 30^\circ \checkmark = 0$ $F = 59,57 \text{ N} \checkmark$	(5)
---	-----

2.1.4

OPTION 1/OPSIE 1	OPTION 2/OPSIE 2
$F_{\text{net}} = ma$ $(F_{\text{gll}} - f_k) = ma \checkmark$ $(8)(9,8)\sin 30^\circ - 20,37 \checkmark = 8a \checkmark$ $\therefore \text{magnitude/grootte: } a = 2,35 \text{ m}\cdot\text{s}^{-2} \checkmark$	$F_{\text{net}} = ma$ $(f_k - F_{\text{gll}}) = ma \checkmark$ $20,37 + [-(8)(9,8)\sin 30^\circ] \checkmark = 8a \checkmark$ $\therefore a = -2,35 \text{ m}\cdot\text{s}^{-2}$ $\therefore \text{magnitude/grootte: } a = 2,35 \text{ m}\cdot\text{s}^{-2} \checkmark$

(4)

2.2.1

Each body in the universe attracts every other body with a force that is directly proportional to the product of their masses $\checkmark$ and inversely proportional to the square of the distance between their centres. $\checkmark$
Elke liggaam in die heelal trek elke ander liggaam 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.

OR/OF
 Every particle in the universe attracts every other particle with a force along a line joining them. The force is directly proportional to the product of the masses $\checkmark$ of the particles and inversely proportional to the square of the distance between them. $\checkmark$
Elke partikel in die heelal trek elke ander partikel 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 hulle.

(2)

2.2.2

OPTION 1/OPSIE 1	OPTION 2/OPSIE 2
$g = \frac{GM}{r^2} \checkmark$ $\checkmark 6 = \frac{(6,67 \times 10^{-11})M}{(700 \times 10^3)^2} \checkmark$ $M = 4,41 \times 10^{22} \text{ kg} \checkmark$	$F = G \frac{m_1 m_2}{r^2}$ $mg = \frac{GmM}{r^2} \checkmark$ $(200)(6) = \frac{(6,67 \times 10^{-11})(200)M}{(700 \times 10^3)^2} \checkmark$ $M = 4,41 \times 10^{22} \text{ kg} \checkmark$

(4)
[21]

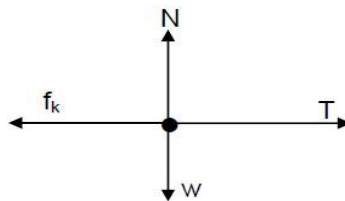
KWV 08

QUESTION 2/VRAAG 2

- 2.1. A body will remain in its state of rest or motion at constant velocity unless a non-zero resultant/net force acts on it. ✓✓
'n Liggaam sal in sy toestand van rus of beweging teen konstante snelheid in 'n reguitlyn volhard tensy 'n nie-nul resulterende/netto krag daarop inwerk. (2)

2.2

Accepted labels/Aanvaarde benoemings	
W	F_g / F_w /weight / mg / gravitation force F_g / F_w /gewicht / mg / gravitasiekrag
T	F_T /tension F_s /spanning
f_k	(Kinetic) Friction / F_f / 4 N / f / wrywing / F_w
N	F_{Normal} / Normal / F_N



(4)

Notes/Aantekeninge

- Mark awarded for label and arrow/Punt toegeken vir benoeming en pyltjie
- Do not penalise for length of arrows since drawing is not to scale./Moenie vir die lengte van die pyltjies penaliseer nie aangesien die tekening nie volgens skaal is nie
- Any other additional force(s)/Enige ander addisionele krag(te) Max/Maks $\frac{3}{4}$
- If force(s) do not make contact with body/Indien krag(te) nie met die voorwerp kontak maak nie: Max/Maks: $\frac{3}{4}$

2.3 Object Q/Voorwerp Q

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ F_{\text{net}} = 0 \\ T + (f_k) = ma \\ T - 3 = 0 \end{array} \right\} \checkmark$$

$T = 3 \text{ N}$

Object P/Voorwerp P

$$\begin{array}{l} F_{\text{net}} = ma \\ F_{\text{hor}} - (f_k + T) = ma \checkmark \\ (F \cos 30^\circ) - 5 - 3 = 0 \checkmark \\ F = 9,24 \text{ N} \checkmark (9,238 \text{ N}) \end{array}$$

(6)

2.4 3 s ✓

(1)

2.5 Y ✓

Graph Y represents the motion of Q after the string breaks.
 The graph Y shows a decreasing velocity ✓ with a negative acceleration. ✓
This is because the net force (friction) acting on Q is in the opposite direction to its motion. ✓ (accept: only frictional force acts on Q).

*Grafiek Y verteenwoordig die beweging van Q na die toujie breek
 Die versnelling is negatief vir grafiek Y en toon 'n afnemende snelheid
 Dit is omdat wrywing op Q inwerk*

(4)

[17]

KWV 09

QUESTION 2/VRAAG 2

2.1

When a (non-zero) resultant/net force acts on an object, the object will accelerate in the direction of the force with an acceleration that is directly proportional to the force and inversely proportional to the mass of the object.
✓✓

Wanneer 'n (nie-nul) resultante/netto krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel teen 'n versnelling wat direk eweredig is aan die (netto) krag en omgekeerd eweredig aan die massa van die voorwerp.

OR/OF

The (non-zero) resultant/net force acting on an object is equal to the rate of change of momentum of the object in the direction of the resultant/net force.

✓✓ (2 or 0)

Die (nie-nul) netto krag wat op 'n voorwerp inwerk is gelyk aan die tempo van verandering van momentum.

ACCEPT/AANVAAR

Acceleration is directly proportional to the net force and inversely proportional to the mass of the object.

Versnelling direk eweredig is aan die netto krag en omgekeerd eweredig aan die massa van die voorwerp.

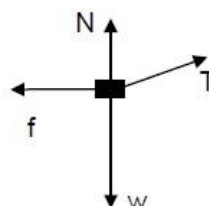
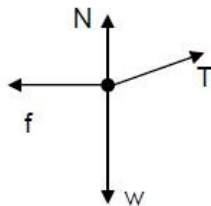
NOTE/LET WEL

If any of the underlined key words in the correct context is omitted deduct 1 mark.

Indien enige van die onderstreepte sleutel woorde in die **korrekte konteks** uitgelaat is, trek 1 punt af.

(2)

2.2



Notes/Aantekeninge

- Mark is awarded for label and arrow
Punt word toegeken vir byskrif en pyltjie
- Do not penalise for length of arrows
Moenie vir die lengte van die pyltjies penaliseer nie.
- If T is not shown but $T_{\parallel}$ and $T_{\perp}$ are shown, give 1 mark for both
Indien T nie aangetoon is nie maar $T_{\parallel}$ en $T_{\perp}$ is getoon. Ken 1 punt toe vir beide.
- If force(s) do not make contact with body/Indien krag(te) nie met die voorwerp kontak maak nie: Max/Maks: $\frac{3}{4}$
- Deduct 1 mark for any additional force /Trek 1 punt af vir enige addisionele krag

(4)

	Accept the following symbols /Aanvaar die volgende simbole.
N	F_N ; Normal; Normal force /Normaal; Normaalkrag ✓
f	F_f / f_k / frictional force/wrywingskrag/kinetic frictional force/ kinetiese wrywingskrag ✓
W	F_g ; mg; Weight; $F_{\text{Earth on block}}$; F_W / Gewig ;Gravitational force / Gravitasiekrag/ 78,4 N ✓
T	Tension/Spanning; F_T / F_A , F /16,96 N ✓

2.3.1 The 2/8 kg block /system is accelerating/Die 2/8 kg blok / sisteem is besig om te versnel ✓

OR/OF

The acceleration is not zero / $a \neq 0$ ($\text{m} \cdot \text{s}^{-2}$) / $a = 1,32 \text{ m} \cdot \text{s}^{-2}$ / Die versnelling is nie nul nie ✓

OR/OF

Velocity is /increasing/changing/not constant/Snelheid neem toe/ verander/is nie konstant nie ✓

OR/OF

F_{net} is not equal to zero / F_{net} is nie gelyk aan nul nie / $F_{\text{net}} \neq 0$ (N) ✓

OR/OF

The acceleration is changing / Die versnelling verander ✓

Accept/Aanvaar

An unbalanced force is acting on it / 'n Ongebalanseerde krag werk in op die liggaam ✓

(1)

2.3.2 **For 2 kg/Vir die 2 kg massa**

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ mg - T = ma \end{array} \right\} \checkmark \quad \begin{array}{l} \text{1 mark for any} \\ \text{1 punt vir} \end{array}$$

$$(2)(9,8) - T = 2(1,32) \checkmark$$

$$T = 16,96 \text{ N} \checkmark$$

$$\begin{array}{l} F_{\text{net}} = ma \\ mg + T = ma \\ (2)(-9,8) + T = 2(-1,32) \checkmark \\ T = 16,96 \text{ N} \checkmark \end{array}$$

(3)

2.3.3 **POSITIVE MARKING FROM 2.3.2/POSITIEWE NASIEN VANAF 2.3.2**

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ T \cos 15^\circ - f = ma \end{array} \right\} \checkmark$$

$$\begin{array}{l} T_x = T \cos 15^\circ \\ = 16,96 \cos 15^\circ \\ = 16,38 \text{ N} (16,382 \text{ N}) \end{array} \rightarrow$$

$$\begin{array}{l} 16,382 - f = (8)(1,32) \checkmark \\ f = 5,82 \text{ N (to the left/na links)} \checkmark \end{array}$$

OR/OF

$$\left. \begin{aligned} F_{\text{net}} &= ma \\ T \cos 15^\circ + f &= ma \end{aligned} \right\} \checkmark$$

$$\begin{aligned} T_x &= T \cos 15^\circ \\ &= 16,96 \cos 15^\circ \\ &= 16,38 \text{ N (16,382 N)} \end{aligned}$$

$$\begin{aligned} -16,382 + f &= (8)(-1,32) \checkmark \\ f &= 5,82 \text{ N (to the left/na links)} \checkmark \end{aligned}$$

(4)

2.4

ANY ONE/ENIGE EEN

Normal force changes/decreases $\checkmark$ / Normaalkrag verander/neem af

The angle (between string and horizontal) changes/increases. / Die hoek (tussen die toujie en die horisontaal) verander/neem toe

The vertical component of the tension changes/increases / Die vertikale komponent van die spanning verander / neem toe.

(1)

2.5 

Yes $\checkmark$ / Ja

The frictional force (coefficient of friction) depends on the nature of the surfaces in contact. $\checkmark$

Die wrywingskrag (wrywingskoëffisiënt) is afhanklik van die aard van die oppervlaktes in kontak met mekaar.

ACCEPT/AANVAAR

The nature of the surface changes / μ_k changes

Die aard van die oppervlakte verander / μ_k verander

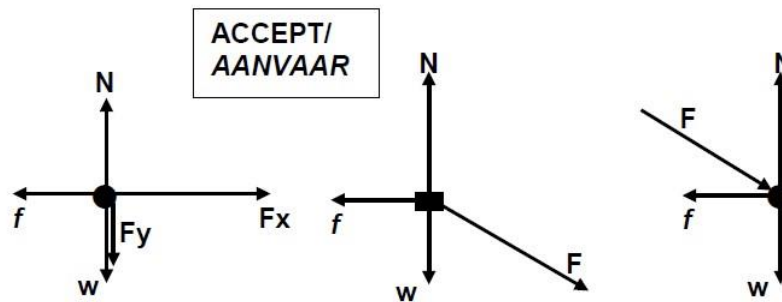
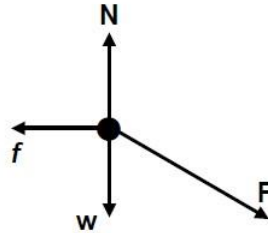
(2)

[17]

KWV 10

QUESTION 2/VRAAG 2

2.1.1



Accepted labels/Aanvaarde benoemings	
F	$F_A/90\text{ N}/F_{90}$
w	$F_g / F_w/\text{weight} / mg / \text{gravitational force}$ $F_g / F_w/\text{gewig} / mg / \text{gravitasiekrag}$
f	(Kinetic) Friction / $F_f / f_k / \text{wrywing} / F_w$
N	$F_{\text{Normal}} / \text{Normal}/\text{Normaal} / F_N$

Notes/Aantekeninge

- Mark awarded for label and arrow / Punt toegeken vir benoeming en pyltjie
- Do not penalise for length of arrows since drawing is not to scale. /Moenie vir die lengte van die pyltjies penaliseer nie aangesien die tekening nie volgens skaal is nie
- Any other additional force(s) / Enige ander addisionele krag(te) Max/Maks $\frac{3}{4}$
- If force(s) do not make contact with body / Indien krag(te) nie met die voorwerp kontak maak nie: Max/Maks: $\frac{3}{4}$
- Deduct 1 mark for an arrow/arrows omitted / trek 1 punt af indien pyl/pyle weggelaat

(4)

2.1.2 It is moving at constant speed in a straight line/, the acceleration is zero/ the net force (resultant) acting on it is zero/it is moving at constant velocity ✓
Dit beweeg teen konstante speed in 'n reguit lyn / versnelling is nul / netto krag (resultant) wat daarop inwerk is nul/ dit beweeg teen konstante snelheid

(1)

2.1.3

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ F_{\text{net}} = 0 \\ F_x = f \\ F_x - f = 0 \\ F \cos 40^\circ - f = 0 \end{array} \right\} \begin{array}{l} \checkmark \text{ any one} \\ \text{enige een} \end{array}$$

$$\underline{90 \cos 40^\circ - f = 0} \checkmark$$

$$f = 68,94 \text{ N} \checkmark$$

OR/OF

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ F_{\text{net}} = 0 \\ F_x = f \\ F_x - f = 0 \\ F \cos 320^\circ - f = 0 \end{array} \right\} \begin{array}{l} \checkmark \text{ any one} \\ \text{enige een} \end{array}$$

$$\underline{90 \cos 320^\circ - f = 0} \checkmark$$

$$f = 68,94 \text{ N} \checkmark$$

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ F_{\text{net}} = 0 \\ F_x = f \\ F_x - f = 0 \\ F \sin 50^\circ - f = 0 \end{array} \right\} \begin{array}{l} \checkmark \text{ any one} \\ \text{enige een} \end{array}$$

$$\underline{90 \sin 50^\circ - f = 0} \checkmark$$

$$f = 68,94 \text{ N} \checkmark$$

NOTE:

1 mark for formula/equation, 1 mark substitution with zero, 1 mark answer.
 LW: 1 punt vir formule/vergelyking, 1 punt substitusie, 1 punt antwoord.

2.1.4

POSITIVE MARKING FROM 2.1.3 / POSITIEWE NASIEN VANAF 2.1.3
OPTION 1/OPSIE 1

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

$$2 = 0 \checkmark + a(3) \checkmark$$

$$a = 0,67 \text{ m} \cdot \text{s}^{-2}$$

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

$$F \cos 320^\circ - f = 15(0,67)$$

$$\underline{F \cos 320^\circ \checkmark - 68,94 \checkmark = 15(0,67)}$$

$$F = 103,11 \text{ N} \checkmark$$

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

$$\underline{F \cos 40^\circ \checkmark - 68,94 \checkmark = 15(0,67)}$$

$$F = 103,11 \text{ N} \checkmark \quad (103,05 \text{ N} - 103,11 \text{ N})$$

POSITIVE MARKING FROM 2.1.3 / POSITIEWE NASIEN VANAF 2.1.3
OPTION 2/OPSIE 2

$$F_{\text{net}} \cdot \Delta t = \Delta p \checkmark$$

$$\underline{F \cos 40^\circ \checkmark - (68,94) \checkmark (3) \checkmark = 15(2 - 0) \checkmark}$$

$$F = 103,11 \text{ N} \checkmark$$

2.2

OPTION 1/OPSIE 1

$$F = G \frac{m_1 m_2}{r^2} \checkmark$$

$$20 \checkmark = (6,67 \times 10^{-11}) \frac{m_{\text{planet}} (10)}{(6 \times 10^5)^2} \checkmark$$

$$m_{\text{planet}} = 1,08 \times 10^{22} \text{ kg} \checkmark$$

OPTION 2/OPSIE 2

$$w = mg \checkmark$$

$$20 = (10)(g) \checkmark$$

$$g = 2 \text{ m} \cdot \text{s}^{-2} \checkmark$$

$$g = \frac{GM}{R^2}$$

$$2 = \frac{(6,67 \times 10^{-11}) M}{(6 \times 10^5)^2} \checkmark$$

$$M = 1,08 \times 10^{22} \text{ kg} \checkmark$$

$\checkmark$ Any one
 Enige een

(4)
 [18]

KWV 11

QUESTION 2/VRAAG 2

NOTE: -1 mark for each key word/phrase omitted in the correct context
LET WEL: -1 punt vir elke sleutel woord/frase in die korrekte konteks weggelaat

(2)

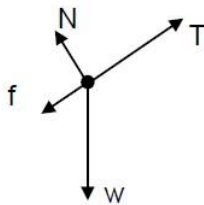
- 2.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force with an acceleration that is directly proportional to the force and inversely proportional to the mass of the object. ✓✓
Wanneer 'n resultante/netto krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel teen 'n versnelling wat direk eweredig is aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

OR/OF

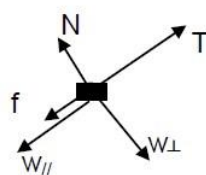
The resultant/net force acting on an object is equal to the rate of change of momentum of the object (in the direction of the resultant/net force.) ✓✓
Die netto krag wat op 'n voorwerp inwerk is gelyk aan die tempo van verandering van momentum van die voorwerp (in die rigting van die resulterende/netto krag.)

(2)

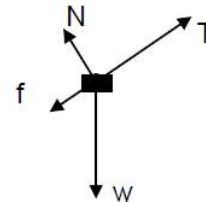
2.2



ACCEPT/AANVAAR



OR/OF



	Accept the following symbols/Aanvaar die volgende simbole.
N ✓	F_N /Normal/Normaál/Normal force/Normaalkrag /16,97 N
f ✓	F_f / f_k / f_r / frictional force/wrywingskrag/kinetic frictional force/kinetiese wrywingskrag
W ✓	F_g , mg/weight/ $F_{\text{Earth on block}}$ /19,6 N/gravitational force/gewig/ $F_{\text{aarde op blok}}$ /gravitasiekrag
T ✓	Tension/Spinning/ F_T / F_A / F / F_s

Notes/Aantekeninge

- Mark is awarded for label and arrow. /Punt word toegeken vir byskrif en pyltjie
- Do not penalise for length of arrows.
Moenie vir die lengte van die pyltjies penaliseer nie.
- Deduct 1 mark for any additional force. /Trek 1 punt af vir enige addisionele krag.
- If force(s) do not make contact with body/dot /Indien krag(te) nie met die voorwerp /kolletjie kontak maak nie: Max./Maks: $\frac{3}{4}$
- If arrows missing/Indien pyltjies uitgelaat is: Max./Maks: $\frac{3}{4}$

(4)

2.3

For the 2 kg (P) block/Vir die 2 kg (P) blok:

$$\left. \begin{aligned} F_{\text{net}} &= ma \\ T + (-w_{\parallel}) + (-f_k) &= ma \\ T - (w_{\parallel} + f_k) &= ma \end{aligned} \right\} \checkmark \text{ Any one/Enige een}$$

$$T - (2)(9,8)\sin 30^\circ - 2,5 = 2a \checkmark$$

$$T - 9,8 - 2,5 = 2a$$

$$T - 12,3 = 2a \dots\dots\dots(1)$$

For the 3 kg (Q) block/Vir die 3 kg (Q) blok:

$$\begin{aligned} F_x + (-T) + (-w_{\parallel}) &= ma \\ F_x - (T + w_{\parallel}) &= ma \\ [40 \cos 25^\circ - T - (3)(9,8)\sin 30^\circ] &= 3a \\ 36,25 - T - 14,7 &= 3a \\ 21,55 - T &= 3a \dots\dots\dots(2) \end{aligned}$$

$$9,25 = 5a$$

$$a = 1,85 \text{ m}\cdot\text{s}^{-2} \checkmark$$

Marking criteria/Nasienriglyne

- Formula/Formule $\checkmark$
- Substitution of /vervanging van $w_{\parallel}$ for/vir 2 kg: $(2)(9,8)\sin 30^\circ \checkmark$
- Substitution of -2,5 N /Vervanging van -2,5 N $\checkmark$
- 2a **OR/OF** 3a $\checkmark$
- Calculate/Bereken F_x :
 $40 \cos 25^\circ \checkmark$ ($40 \sin 65^\circ$)
- Substitution of /vervanging van $w_{\parallel}$ for/vir for 3 kg: $(3)(9,8)\sin 30^\circ \checkmark$
- Left hand side substitution for 3 kg/Linkerkant vervanging vir 3 kg $\checkmark$
- Final answer/Finale antwoord:
 $1,85 \text{ m}\cdot\text{s}^{-2} \checkmark$

(8)

Systems Approach (Massless String Approximation /
Sisteembenadering (Massalose Tou Benadering)
(Max 5/8 marks / Maks 5/8 punte)

$$\left. \begin{aligned} F_{\text{net}} &= ma \\ F_x + (-w_{\parallel}) + (-f_k) &= ma \\ F_x - (w_{\parallel} + f_k) &= ma \end{aligned} \right\} \checkmark \text{ Any one/Enige een}$$

$$40 \cos 25^\circ - (5)(9,8)\sin 30^\circ - 2,5 = 5a$$

$$a = 1,85 \text{ m}\cdot\text{s}^{-2} \checkmark$$

2.4

Greater than/groter as $\checkmark$ F_{net} increases. / F_{net} neem toe. $\checkmark$ **ACCEPT/AANVAAR**

There is no friction. / Daar is geen wrywing nie.

OR/OF

The surface is smooth / Die oppervlak is glad

(2)

[16]

KWV 12

QUESTION 2/VRAAG 2

2.1

Marking criteria/Nasienriglyne

If any of the underlined key words/phrases in the correct context are omitted:
- 1 mark per word/phrase.

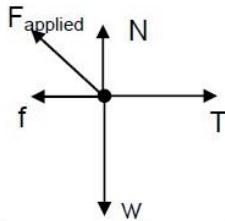
Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word:
- 1 punt per woord/frase

The perpendicular force exerted by a surface on an object in contact with the surface. ✓✓

Die loodregte krag deur 'n oppervlak uitgeoefen op 'n voorwerp wat daarmee in kontak is.

(2)

2.2



	Accepted symbols/Aanvaarde simbole
N ✓	F_N /Normal/Normal force/173,5N /Normaal/Normaalkrag
f ✓	F_f/f_k /frictional force/wrywingskrag/kinetic frictional force/kinetiese wrywingskrag/5 N
W ✓	F_g/mg /Weight/ $F_{\text{Earth on block}}$ /FW/Gewig/Gravitational force/Gravitasiekrag/196 N
T ✓	Tension/Spanning/ F_T
F_{applied} ✓ F_{toegepas}	F/Applied force/35 N/Toegepaste krag/ F_A

Notes/Aantekeninge

- Mark is awarded for label and arrow./Punt word toegeken vir byskrif en pyltjie.
- Do not penalise for length of arrows./Moenie vir die lengte van die pyltjies penaliseer nie.
- Deduct 1 mark for any additional force./Trek 1 punt af vir enige addisionele krag.
- If all forces are correctly drawn and labelled, but no arrows, deduct 1 mark. / Indien all kragte korrek geteken en benoem is, maar geen lyne nie, trek 1punt af.

(5)

2.3

For the/Vir die 20 kg:

$$\left. \begin{aligned} F_{\text{net}} &= ma \\ T - f - F_{Ax} &= ma \end{aligned} \right\} \checkmark$$

$$T - 5 - 35 \cos 40^\circ = 0 \checkmark$$

$$T = 31,81 \text{ N}$$

For/vir m:

$$\left. \begin{aligned} F_{\text{net}} &= ma \\ mg - T &= ma \end{aligned} \right\} \checkmark$$

$$m(9,8) - 31,81 = 0 \checkmark$$

$$m = 3,25 \text{ kg} \checkmark$$

Marking criteria/Nasienriglyne

- Formula for 20 kg or m kg/Formule vir 20 kg of m kg / $F_{\text{net}} = ma$ ✓
- Substitution of zero into either formula ✓
Vervanging van nul in een van die formules
- All substitutions into F_{net} for 20 kg as shown ✓
Alle vervanging in F_{net} for 20 kg soos getoon
- Substitution of value of T in eqn for m
/Substitusie van waarde vir T in vgl vir m ✓
- Final answer/finale antwoord: 3,25 kg ✓

(5)

2.4.1 Decreases/Neem af ✓

(1)

2.4.2 **POSITIVE MARKING FROM QUESTION 2.3**

POSITIEWE NASIEN VANAF VRAAG 2.3

Moving to the right/Beweeg na regs

Velocity decreases/*snellheid neem af* ✓

Accelerates/Net force to left /*Versnelling/netto krag na links* ✓✓

OR/OF

As the tension force decreases, the net force/acceleration acts in the opposite direction of motion /to the left. ✓✓

Soos die spanning afneem, is daar 'n netto krag/versnelling in die teenoorgestelde rigting / na links

Moving to the left/Beweeg na links

Velocity increases/*snellheid neem toe* ✓

Accelerates/Net force to left /*Versnelling/netto krag na links* ✓✓

(3)

[16]

KWV 13

QUESTION 2/VRAAG 2

2.1

NOTE/LET WEL

-1 mark for each key word/phrase omitted in the correct context.

-1 punt vir elke sleutel woord/frase in die korrekte konteks weggelaat.

The word "resultant/net force" has to be mentioned at least once

Die woord "resultante/netto krag" moet ten minste een keer genoem word

When a (non-zero) resultant/net force acts on an object, the object will accelerate in the direction of the force with an acceleration that is directly proportional to the force ✓ and inversely proportional to the mass of the object. ✓

Wanneer 'n (nie-nul) resultante/netto krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel teen 'n versnelling wat direk eweredig is aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

OR/OF

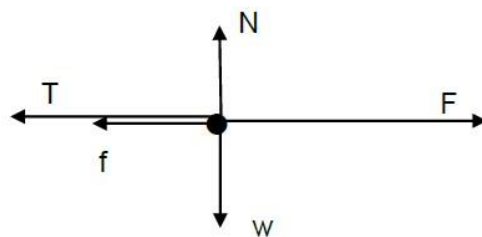
The (non-zero) resultant/net force acting on an object is equal to the rate of change of momentum of the object in the direction of the resultant/net force.

✓✓

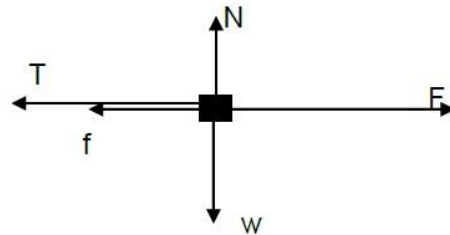
Die (nie-nul) resultante/netto krag wat op 'n voorwerp inwerk is gelyk aan die tempo van verandering van momentum van die voorwerp in die rigting van die resultante/netto krag.

(2)

2.2



ACCEPT/AANVAAR



Accept the following symbols./Aanvaar die volgende simbole:

N ✓	F_N / Normal / Normaal / Normal force / Normaalkrag / 78,4 N
f ✓	F_f / f_k / f_r / F_w / frictional force/wrywingskrag/kinetic frictional force / kinetiese wrywingskrag
W ✓	F_g / mg / weight / $F_{\text{Earth on block}}$ / 78,4 N / gravitational force / gewig / $F_{\text{aarde op blok}}$ / gravitasiekrag/ gravity / gravitasie
T ✓	Tension / Spanning / F_T / F_s
$F_{\text{applied/toegepas}}$ ✓	F / F_A / F_{app} / F_{toeg} / 29,6 N / Applied force / Toegepaste krag

Notes/Aantekeninge

- Mark is awarded for label and arrow. /Punt word toegeken vir byskrif en pyltjie
- Do not penalise for length of arrows.
Moenie vir die lengte van die pyltjies penaliseer nie.
- Deduct 1 mark for any additional force. /Trek 1 punt af vir enige addisionele krag.
- If force(s) do not make contact with body/dot /Indien krag(te) nie met die voorwerp / kolletjie kontak maak nie: Max./Maks: $\frac{4}{5}$
- If arrows missing/Indien pyltjies uitgelaat is: Max./Maks: $\frac{4}{5}$

(5)

2.3

OPTION 1/OPSIE 1 8 kg block/blok: $F_{\text{net}} = ma$ $F_{\text{net}} = 0$ $F - (f + T) = ma$ $29,6 - 10 - T = 0 \checkmark$ $T = 19,6 \text{ N} \checkmark$	OPTION 2/OPSIE 2 2 kg block/blok: $F_{\text{net}} = ma$ $F_{\text{net}} = 0$ $T - w = 0$ $T = w = mg = (2)(9,8) \checkmark$ $T = 19,6 \text{ N} \checkmark$
OPTION 3/OPSIE 3 $W_{\text{net}} = \Delta E_k \checkmark$ $W_w + W_N + W_F + W_f + W_T = 0$ $0 + 0 + F\Delta x \cos\theta + f\Delta x \cos\theta + T\Delta x \cos\theta = 0$ $(29,6)\cos 0^\circ + (10)\cos 180^\circ + T\cos 180^\circ = 0 \checkmark$ $29,6 - 10 - T = 0$ $T = 19,6 \text{ N} \checkmark$	
OPTION 4/OPSIE 4 $W_{\text{nc}} = \Delta E_p + \Delta E_k \checkmark$ $W_F + W_f + W_T = 0 + 0$ $F\Delta x \cos\theta + f\Delta x \cos\theta + T\Delta x \cos\theta = 0$ $(29,6)\cos 0^\circ + (10)\cos 180^\circ + T\cos 180^\circ = 0 \checkmark$ $29,6 - 10 - T = 0$ $T = 19,6 \text{ N} \checkmark$	

(3)

2.4.1

8 kg block/blok
 $F_{\text{net}} = ma$
 $F - (f + T) = ma$ } $\checkmark$ Any one/Enige een
 $50 - 10 - T = 8a \checkmark$
 $40 - T = 8a$

2 kg block/blok
 $F_{\text{net}} = ma$
 $T - mg = ma$
 $T - 2(9,8) = 2a \checkmark$

$40 - 19,6 = 10a$
 $20,4 = 10a$
 $a = 2,04 \text{ m}\cdot\text{s}^{-2} \checkmark$

Marking criteria/Nasienkriteria

- Appropriate formula /
Gesikte formule $\checkmark$
- Substitution for forces on 8 kg /
Vervanging van kragte op die 8 kg $\checkmark$
- 2a **OR/OF** 8a $\checkmark$
- Substitution of forces on 2 kg /
Vervanging van kragte op die 2 kg $\checkmark$
- Final answer/Finale antwoord
 $2,04 \text{ m}\cdot\text{s}^{-2} \checkmark$

(5)

2.4.2

POSITIVE MARKING FROM QUESTION 2.4.1
POSITIEWE NASIEN VANAF VRAAG 2.4.1

Substitute/Vervang a
 $T - 2(9,8) = 2a$
 $T - 19,6 = 2(2,04) \checkmark$
 $T = 23,68 \text{ N} \checkmark$

OR/OF

$40 - T = 8a$
 $T = 40 - 8(2,04) \checkmark$
 $T = 23,68 \text{ N} \checkmark$

Marking criteria/Nasienkriteria

- Substitution of a/Vervanging van a $\checkmark$
- Final answer/Finale antwoord:
 $23,68 \text{ N} \checkmark$

Notes/Aantekeninge

If substitution into incorrect equation for T / Indien vervanging in verkeerde vergelyking vir T: Max/Maks $\frac{1}{2}$

(2)
[17]

KWV 14

QUESTION 2/VRAAG 2

2.1

Marking criteria/Nasienkriteria

If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark. /Indien enige van die onderstreepte sleutel woorde/frases in die korrekte konteks uitgelaat is, trek 1 punt af.

A body will remain in its state of rest or motion at constant velocity unless a non-zero resultant/net force/unbalanced force acts on it. ✓✓

'n Liggaam sal in sy toestand van rus of beweging teen konstante snelheid volhard, tensy 'n (nie-nul) resulterende/netto krag/ongebalanseerde krag daarop inwerk.

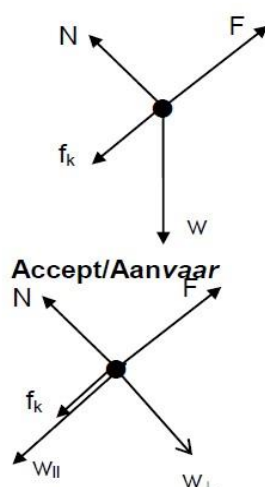
OR/OF

A body will remain in its state of rest or uniform motion in a straight line unless a (non-zero) resultant/net /unbalanced force acts on it. ✓✓

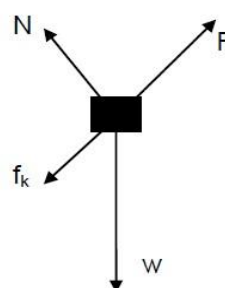
'n Liggaam sal in sy toestand rus of uniforme beweging in 'n reghoekige lyn volhard, tensy 'n (nie-nul) resulterende/netto/ongebalanseerde krag daarop inwerk.

(2)

2.2



Accept force diagram/
Aanvaar kragdiagram



Accepted labels/Aanvaarde benoemings	
W	F_g / F_w / weight / mg / 196 N / gravitational force F_g / F_w / gewig / mg / 196 N / gravitasiekrag
F	F_A / Applied force F_T / Toegepaste krag
f_k	(kinetic) Friction / (kineties)wrywing / F_f / f / 18 N / F_w / f_w
N	F_N / Normal / Normaal / 169,74 N

Notes/Aantekeninge:

- Mark awarded for label and arrow, but penalise only once if arrows are omitted/Punt toegeken vir benoeming en pyltjie, maar penaliseer slegs een keer indien pyle uitgelaat is.
- Do not penalise for length of arrows, drawing is not to scale. /Moenie vir die lengte van die pyltjies penaliseer nie, die tekening is nie volgens skaal nie.
- Any other additional force(s) deduct 1 mark. / Enige ander addisionele krag(te) trek 1 punt af.
- If force(s) do not make contact with body deduct 1 mark. /Indien krag(te) nie met die voorwerp kontak maak nie, trek 1 punt af.

(4)

2.3

OPTION 1/OPSIE 1**Positive up the incline/Positief opwaarts teen skuinsvlak**

$$\begin{aligned}
 F_{\text{net}} &= ma \\
 F + f_k + w_{\parallel} &= ma \\
 F + (-f_k) + (-w_{\parallel}) &= ma \\
 F - (f_k + w_{\parallel}) &= ma
 \end{aligned}
 \left. \vphantom{\begin{aligned} F + f_k + w_{\parallel} &= ma \\ F + (-f_k) + (-w_{\parallel}) &= ma \\ F - (f_k + w_{\parallel}) &= ma \end{aligned}} \right\} \checkmark \text{ Any one/Enige een}$$

NOTE/LET WEL

$$\begin{aligned}
 F_{\text{net}} &= 0 \checkmark \checkmark \\
 F &= f_k + w_{\parallel} \checkmark \checkmark
 \end{aligned}$$

OPTION 2/OPSIE 2**Positive up the incline/Positief opwaarts teen skuinsvlak**

$$\begin{aligned}
 W_{\text{net}} &= \Delta E_k \checkmark \\
 F\Delta x \cos 0^\circ + f\Delta x \cos 180^\circ + w\Delta x \cos 120^\circ &\checkmark = 0 \checkmark \\
 F\Delta x &= 18\Delta x + (20)(9,8)\Delta x(0,5) \\
 F &= 116 \text{ N} \checkmark
 \end{aligned}$$

NOTE/LET WEL

$$\begin{aligned}
 W_{\text{net}} &= 0 \checkmark \checkmark \\
 F\Delta x &= f\Delta x + w\Delta x(0,5) \checkmark \checkmark
 \end{aligned}$$

(4)

2.4

POSITIVE MARKING FROM QUESTION 2.3 /**POSITIEWE NASIEN VANAF VRAAG 2.3**

116 N / $f + w_{\parallel} \checkmark$ Down the incline/opposite to direction of motion / Teen die helling af / in teenoorgestelde rigting van beweging $\checkmark$

ACCEPT/AANVAAR:

Downwards/down/Afwaarts/af

(2)

2.5

POSITIVE MARKING FROM QUESTION 2.4 /**POSITIEWE NASIEN VANAF VRAAG 2.4****OPTION 1/OPSIE 1****Up the incline positive/Teen skuinsvlak op positief**

$$\begin{aligned}
 F_{\text{net}} &= ma \\
 -116 &= 20a \checkmark \\
 a &= -5,80 \text{ m} \cdot \text{s}^{-2}
 \end{aligned}$$

$$\begin{aligned}
 v_f^2 &= v_i^2 + 2a\Delta x \checkmark \\
 0 &= (2)^2 + (2)(-5,8)\Delta x \checkmark \\
 \Delta x &= 0,34 \text{ m} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 v_f &= v_i + \Delta t \\
 0 &= 2 + (-5,8)\Delta t \\
 \Delta t &= 0,34 \text{ s}
 \end{aligned}$$

OR/OF

$$\begin{aligned}
 F_{\text{net}}\Delta t &= m(v_f - v_i) \\
 (-116)\Delta t &= (20)(0 - 2) \\
 \Delta t &= 0,34 \text{ s}
 \end{aligned}$$

$$\begin{aligned}
 \Delta x &= v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark \\
 &= (2)(0,34) + \frac{1}{2}(-5,8)(0,34)^2 \checkmark \\
 &= 0,34 \text{ m} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 v_f &= v_i + \Delta t \\
 0 &= 2 + (-5,8)\Delta t \\
 \Delta t &= 0,34 \text{ s}
 \end{aligned}$$

OR/OF

$$\begin{aligned}
 F_{\text{net}}\Delta t &= m(v_f - v_i) \\
 (-116)\Delta t &= (20)(0 - 2) \\
 \Delta t &= 0,34 \text{ s}
 \end{aligned}$$

$$\begin{aligned}
 \Delta x &= \left(\frac{v_i + v_f}{2} \right) \Delta t \checkmark \\
 &= \left(\frac{2 + 0}{2} \right) 0,34 \checkmark \\
 &= 0,34 \text{ m} \checkmark
 \end{aligned}$$

OPTION 1/OPSIE 1**Down the incline positive / Teen skuinsvlak af positief**

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

$$116 = 20a \checkmark$$

$$a = 5,80 \text{ m}\cdot\text{s}^{-2}$$

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

$$0 = (-2)^2 + (2)(5,8)\Delta x \checkmark$$

$$\Delta x = -0,34 \text{ m}$$

Distance = 0,34 m $\checkmark$
 Afstand

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

$$0 = -2 + (5,8)\Delta t$$

$$\Delta t = 0,34 \text{ s}$$

OR/OF

$$F_{\text{net}}\Delta t = m(v_f - v_i)$$

$$(116)\Delta t = (20)(0 - (-2))$$

$$\Delta t = 0,34 \text{ s}$$

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

$$= (-2)(0,34) + \frac{1}{2}(5,8)(0,34)^2 \checkmark$$

$$= -0,34 \text{ m} \checkmark$$

Distance/Afstand = 0,34 m $\checkmark$

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

$$0 = -2 + (5,8)\Delta t$$

$$\Delta t = 0,34 \text{ s}$$

OR/OF

$$F_{\text{net}}\Delta t = m(v_f - v_i)$$

$$(116)\Delta t = (20)(0 - (-2))$$

$$\Delta t = 0,34 \text{ s}$$

$$\Delta x = \left(\frac{v_i + v_f}{2} \right) \Delta t \checkmark$$

$$= \left(\frac{-2 + 0}{2} \right) 0,34 \checkmark$$

= -0,34 m $\checkmark$
 Distance/Afstand
 = 0,34 m $\checkmark$

OPTION 2/OPSIE 2

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

$$F_{\text{net}}\Delta x \cos \theta = \frac{1}{2}m(v_f^2 - v_i^2) \checkmark \text{ Any one/Enige een}$$

$$(116)\Delta x \cos 180^\circ \checkmark = \frac{1}{2}(20)(0^2 - 2^2) \checkmark$$

$$\Delta x = 0,34 \text{ m} \checkmark$$

OPTION 3/OPSIE 3

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

$$W_f + W_{\text{w}} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$f\Delta x \cos \theta + (mg \sin 30^\circ)\Delta x \cos \theta = \frac{1}{2}m(v_f^2 - v_i^2) \checkmark \text{ Any one/Enige een}$$

$$(18)\Delta x \cos 180^\circ + (20)(9,8)\sin 30^\circ \Delta x \cos 180^\circ \checkmark = \frac{1}{2}(20)(0^2 - 2^2) \checkmark$$

$$\Delta x = 0,34 \text{ m} \checkmark$$

OPTION 4/OPSIE 4

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

$$W_f + W_w = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$f\Delta x \cos \theta + mg\Delta x \cos 120^\circ = \frac{1}{2}m(v_f^2 - v_i^2) \checkmark \text{ Any one/Enige een}$$

$$(18)\Delta x \cos 180^\circ + (20)(9,8)\Delta x \cos 120^\circ \checkmark = \frac{1}{2}(20)(0^2 - 2^2) \checkmark$$

$$\Delta x = 0,34 \text{ m} \checkmark$$

OPTION 5/OPSIE 5

$$W_{\text{nc}} = \Delta E_p + \Delta E_k$$

$$f\Delta x \cos \theta = mg(h_f - h_i) + \frac{1}{2}m(v_f^2 - v_i^2) \checkmark \text{ Any one/Enige een}$$

$$18\Delta x \cos 180^\circ \checkmark = 20(9,8)\Delta x + \frac{1}{2}(20)(0^2 - 2^2) \checkmark$$

$$-18\Delta x = 196\Delta x \sin 30^\circ - 40$$

$$\Delta x = 0,34 \text{ m} \checkmark$$

(4)
 [16]

KWV 15

QUESTION 2/VRAAG 2

2.1

Marking criteria/Nasienkriteria:

If any of the underlined key words/phrases in the correct context are omitted:
- 1 mark per word/phrase.

Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: -
1 punt per word/frase.

A body will remain in its state of rest or motion at constant velocity unless a (non-zero) resultant/net force/unbalanced force acts on it. ✓✓

'n Liggaam sal in sy toestand van rus of beweging teen konstante snelheid volhard, tensy 'n (nie-nul) resulterende/netto krag/ongebalanseerde krag daarop inwerk.

OR/OF

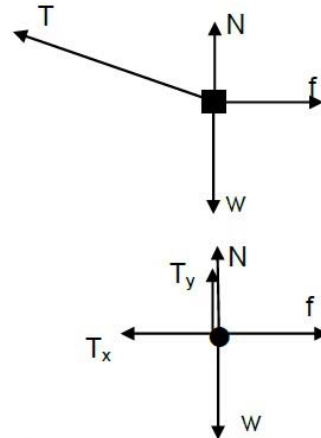
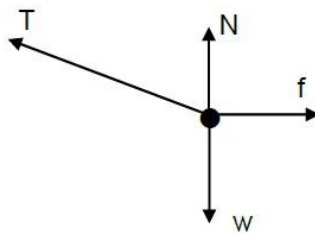
A body will remain in its state of rest or uniform motion in a straight line unless a (non-zero) resultant/net force acts on it. ✓✓

'n Liggaam sal in sy toestand rus of uniforme beweging in 'n reguit lyn volhard, tensy 'n (nie-nul) resulterende/netto krag daarop inwerk.

(2)

2.2

ACCEPT/AANVAAR



	Accepted symbols/Aanvaarde simbole
N ✓	F_N /Normal/Normal force/Normaal/Normaalkrag/ F_{buoyant}
f ✓	F_f/f_k /frictional force/wrywingskrag/kinetic frictional force/kinetiese wrywingskrag/300 N
W ✓	F_g/mg /Weight/Gewig/ $F_{\text{Earth on man}}$ $F_{\text{Aarde op man}}$ / F_w /Gravitational force/Gravitasiekrag/ 686 N
T ✓	Tension/Spinning/ F_{Tension} / F_{Spinning} / F_T/F_S / ACCEPT/ AANVAAR F/F_{applied} / F_{toegepas}

Notes/Aantekeninge

- Mark is awarded for label and arrow./Punt word toegeken vir byskrif en pyltjie.
- Do not penalise for length of arrows./Moenie vir die lengte van die pyltjies penaliseer nie.
- Deduct 1 mark for any additional force /Trek 1 punt af vir enige addisionele krag
- If T is not shown but T_y and T_x are shown give 1 mark for both.
Indien T nie aangetoon is nie maar T_y en T_x is getoon, ken 1 punt toe vir beide.

(4)

2.3

OPTION 1/OPSIE 1

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ T \cos 50^\circ - F_f = ma \end{array} \right\} \checkmark \text{Any one/Enige een}$$

$$T \cos 50^\circ - 300 \checkmark = 0 \checkmark \quad \text{OR/OF} \quad T \cos 50^\circ = 300 \checkmark \checkmark$$

$$T = 466,72 \text{ N} \checkmark (468,75 \text{ N})$$

OR/OF

$$F_{\text{net}} = 0 \checkmark \checkmark$$

$$T \cos 50^\circ = F_f \checkmark \checkmark$$

OPTION 2/OPSIE 2

$$W_{\text{net}} = \Delta E_k \checkmark$$

$$T \Delta x \cos 0^\circ + f \Delta x \cos 180^\circ = 0 \checkmark$$

$$T \cos 50^\circ - 300 \checkmark = 0$$

$$T = 466,72 \text{ N} \checkmark (468,75 \text{ N})$$

OR/OF

$$W_{\text{net}} = 0 \checkmark \checkmark$$

$$T \Delta x \cos 50^\circ = -f \Delta x \cos 180^\circ \checkmark \checkmark$$

NOTE/AANTEKENING

Can use $\sin 40^\circ$ instead of $\cos 50^\circ$.

Kan ook $\sin 40^\circ$ i.p.v. $\cos 50^\circ$ gebruik.

(4)

2.4 Increases/Neem toe $\checkmark$

$$F_{\text{net}} \text{ increases} / F_{\text{net}} \text{ is not zero} / T_x > f / T \cos 50^\circ > f \checkmark$$

$$F_{\text{net}} \text{ neem toe} / F_{\text{net}} \text{ is nie nul nie} / T_x > f / T \cos 50^\circ > f$$

(2)

2.5

Marking criteria Options 1 & 2/Nasienkriteria Opsies 1 & 2

- Substitution to calculate a /Vervanging om a te bereken $\checkmark$
- Formula to calculate $F_{\text{up/water}}$ /Formule om $F_{\text{op/water}}$ te bereken $\checkmark$
- Substitution to calculate $F_{\text{up/water}}$ /Vervanging om $F_{\text{op/water}}$ te bereken $\checkmark \checkmark$
- Final answer/Finale antwoord: 679,20 N $\checkmark$

OPTION 1/OPSIE 1

**DOWNWARDS AS POSITIVE/
AFWAARTS AS POSITIEF:**

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

$$\frac{0 = (16)^2 + 2a(0,8)}{a = -160 \text{ m}\cdot\text{s}^{-2}} \checkmark$$

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ F_g - F_{\text{up/op}} = ma \end{array} \right\} \checkmark \text{Any one/Enige een}$$

$$(4)(9,8) - F_{\text{up/op}} \checkmark = (4)(-160) \checkmark$$

$$F_{\text{up/op}} = -679,20 \text{ N}$$

$$F_{\text{up/op}} = 679,20 \text{ N} \checkmark$$

**UPWARDS AS POSITIVE/
OPWAARTS AS POSITIEF**

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

$$\frac{0 = (-16)^2 + 2a(-0,8)}{a = 160 \text{ m}\cdot\text{s}^{-2}} \checkmark$$

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ -F_g + F_{\text{up/op}} = ma \end{array} \right\} \checkmark \text{Any one/Enige een}$$

$$-(4)(9,8) + F_{\text{up/op}} \checkmark = (4)(160) \checkmark$$

$$F_{\text{up/op}} = 679,20 \text{ N} \checkmark$$

OPTION 2/OPSIE 2**DOWNWARDS AS POSITIVE/
AFWAARTS AS POSITIEF**

$$\Delta x = \left(\frac{v_i + v_f}{2} \right) \Delta t$$

$$0,8 = \left(\frac{16 + 0}{2} \right) \Delta t$$

$$\Delta t = 0,1 \text{ s}$$

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

$$0 = 16 + a(0,1) \checkmark$$

$$a = -160 \text{ m}\cdot\text{s}^{-2}$$

OR/OF

$$\Delta y_B = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$0,8 = (16)(0,1) + \frac{1}{2}(a)(0,1)^2 \checkmark$$

$$a = -160 \text{ m}\cdot\text{s}^{-2}$$

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

$$F_g - F_{\text{up/op}} = ma \checkmark \text{ Any one/Enige een}$$

$$(4)(9,8) - F_{\text{up/op}} \checkmark = (4)(-160) \checkmark$$

$$F_{\text{up/op}} = -679,20 \text{ N}$$

$$F_{\text{up/op}} = 679,20 \text{ N} \checkmark$$

**UPWARDS AS POSITIVE/
OPWAARTS AS POSITIEF**

$$\Delta x = \left(\frac{v_i + v_f}{2} \right) \Delta t$$

$$-0,8 = \left(\frac{-16 + 0}{2} \right) \Delta t$$

$$\Delta t = 0,1 \text{ s}$$

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

$$0 = -16 + a(0,1) \checkmark$$

$$a = 160 \text{ m}\cdot\text{s}^{-2}$$

OR/OF

$$\Delta y_B = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$-0,8 = (-16)(0,1) + \frac{1}{2}(a)(0,1)^2 \checkmark$$

$$a = 160 \text{ m}\cdot\text{s}^{-2}$$

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

$$-F_g + F_{\text{up/op}} = ma \checkmark \text{ Any one/Enige een}$$

$$-(4)(9,8) + F_{\text{up/op}} \checkmark = (4)(160) \checkmark$$

$$F_{\text{up/op}} = 679,20 \text{ N} \checkmark$$

USING ENERGY PRINCIPLES/GEBRUIK VAN ENERGIE BEGINSELS**Marking criteria OPTIONS 3 to 5/Nasienkriteria OPSIES 3 to 5**

- Formula / Formule ✓
- Substitution / Vervanging ✓✓✓
- Final answer/Finale antwoord: 679,20 N ✓

OPTION 3/OPSIE 3

$$W_{\text{net}} = \Delta K$$

$$F_{\text{net}} \Delta x \cos \theta = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 \checkmark \text{ Any one/Enige een}$$

$$(4)(9,8)(0,8) \cos 0^\circ \checkmark + F_{\text{up/op}}(0,8) \cos 180^\circ \checkmark = \frac{1}{2}(4)(0 - 16^2) \checkmark$$

$$F_{\text{up/op}} = 679,20 \text{ N} \checkmark$$

OPTION 4/OPSIE 4

$$W_{\text{nc}} = \Delta K + \Delta U$$

$$F_{\text{up/op}} \Delta x \cos \theta = \frac{1}{2} m (v_f^2 - v_i^2) + mg(h_f - h_i) \checkmark \text{ Any one/Enige een}$$

$$F_{\text{up/op}}(0,8) \cos 180^\circ \checkmark = \frac{1}{2}(4)(0 - 16^2) \checkmark + (4)(9,8)(0 - 0,8) \checkmark$$

$$F_{\text{up/op}} = 679,20 \text{ N} \checkmark$$

OPTION 5/OPSIE 5

$$\Delta x = \left(\frac{v_i + v_f}{2} \right) \Delta t$$

$$0,8 = \left(\frac{16 + 0}{2} \right) \Delta t$$

$$\Delta t = 0,1 \text{ s}$$

$$F_{\text{net}} \Delta t = \Delta p$$

$$F_{\text{net}} \Delta t = (p_{\text{tube/band}})_f - (p_{\text{tube/band}})_i$$

$$(F_g - F_{\text{up/op}}) \Delta t = m(v_{\text{tube/band}(f)} - v_{\text{tube/band}(i)}) \checkmark \text{ Any one/Enige een}$$

$$[(4)(9,8) \checkmark - F_{\text{up/op}}](0,1) \checkmark = (4)(0 - 16) \checkmark$$

$$F_{\text{up/op}} = 679,20 \text{ N} \checkmark$$

(5)
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- Create a leading nation in Maths and Science by transforming the teaching approach.

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Dr. KW. Sibiya

Dr. Sibiya is a Globally Award winning educator. His work has received recognition both locally and internationally:

- 2019 Global Teachers Award in India
- 2019 Global Education Award in Dubai
- 2018 Edu-week Inspirational Award Winner
- 2017 SA Man of the Year Award in Education

Dr. Sibiya is an achiever of excellence and a dedicated educator who leads a team of well trained Tutors who are following on his footsteps. The team of WTS Tutors have also won their first award:

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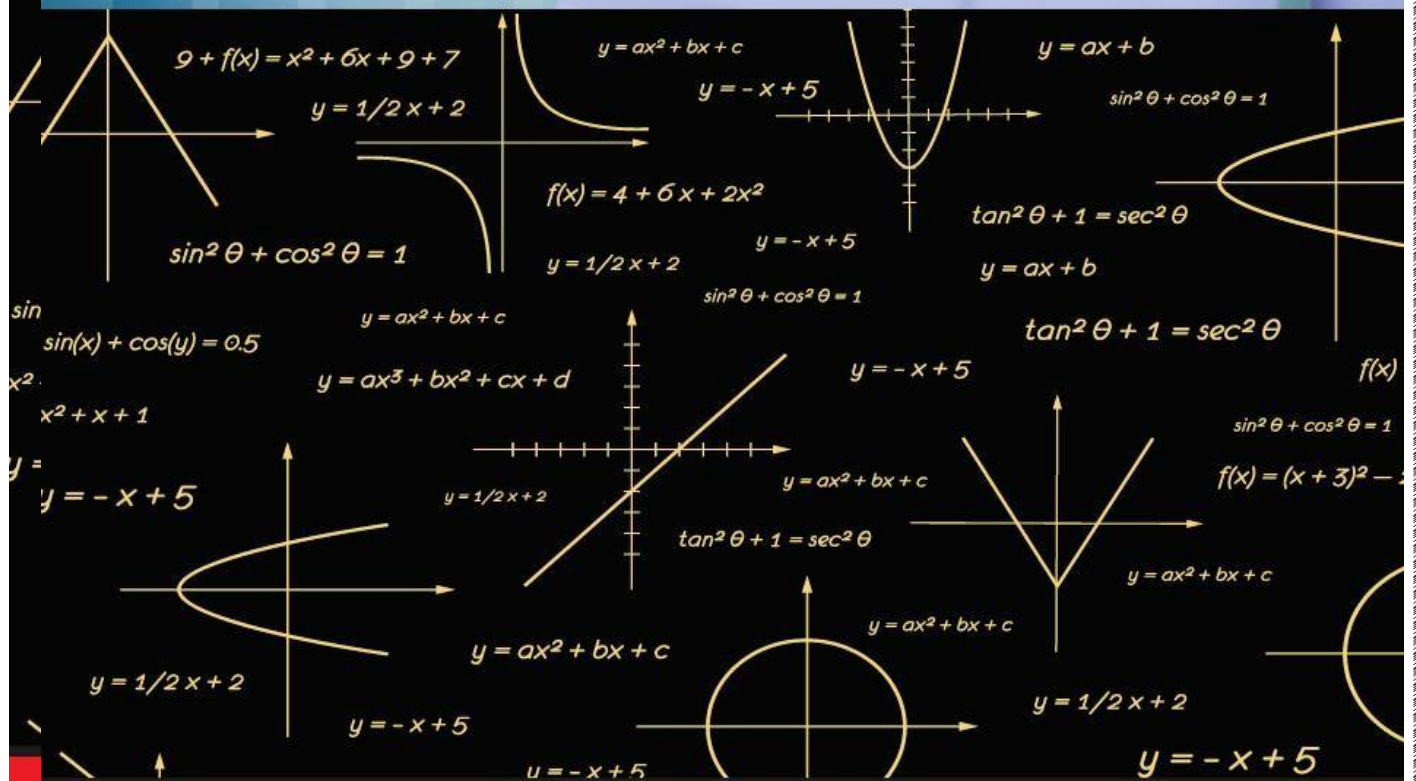
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