education

Department of Education
FREE STATE PROVINCE

PROVINCIAL CONTROL TEST
PROVINSIALE KONTROLETOETS

GRADE/*GRAAD* 11

PHYSICAL SCIENCES
FISIESE WETENSKAPPE

MEMORANDUM

MARCH/*MAART* 2017

TIME/*TYD*: 2 HOURS/*URE*

MARKS/*PUNTE:* 100

This memorandum consists of eight pages.
Hierdie memorandum bestaan uit agt bladsye.

QUESTION 1 / *VRAAG 1*

1.1 A ✓✓ (2)

1.2 C ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 A ✓✓ (2)

1.6 D ✓✓ (2)

1.7 D ✓✓ (2)

1.8 A ✓✓ (2)

1.9 C ✓✓ (2)

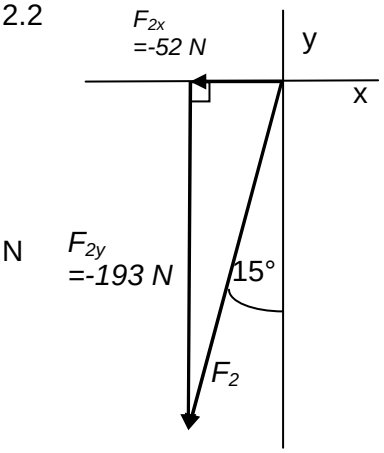
1.10 A ✓✓ (2)

[10 x 2 = 20]

QUESTION 2 / ***VRAAG 2***

2.1.1 The vector sum of two or more vectors, ✓ i.e. a single vector having the same effect as two or more vectors together. ✓
Die vektorsom van twee of meer vektore, ✓ *d.i. 'n enkele vektor wat dieselfde uitwerking het as twee of meer vektore te same.* ✓ (2)

2.2



Direction of F_2**: /** *Rigting van* F_2 15° to the left of –y-axis or 75° below the –x-axis 15° *na links van die –y-as of 75° onder die –x-as*	✓
Length of F_2 is 5 cm / *Lengte van* F_2 *is 5 cm*	✓
Direction of x-component: -x-axis / *Rigting van x-komponent: -x-as* Magnitude of x-component between / *Grootte van x-komponent tussen* *50 N (12,5 mm) ≤ x≤ 54 N (13,5 mm)*	✓
Direction of y-component: -y-axis / *Rigting van y-komponent: -y-as* Magnitude of y-component between / *Grootte van y-komponent tussen* *192 N (48 mm) ≤ y ≤ 196 N (49 mm)*	✓

(4)

2.3

OPTION 1/ ***OPSIE 1***	**OPTION 2 /** ***OPSIE 2***
F_{1Y} = 200 sin 20° ✓ = 68,40 N ✓	F_{1Y} = 200 cos 70° ✓ = 68,40 N ✓
F_{1X} = 200 cos 20° ✓ = 187,94 N✓	F_{1X} = 200 sin 70° ✓ = 187,94 N✓

(4)

OPTION 3/*OPSIE 3*
Pythagoras can also be used to calculate the second component. / *Pythagoras kan ook gebruik word om die tweede komponent te bepaal.*

2.4 Mark positively from 2.2 and 2.3 / *Merk positief vanaf 2.2 en 2.3*

$R_X = F_{1X} + F_{2X} = 187,94 - 52$ ✓ $= 135,94$ N
$R_Y = F_{1Y} + F_{2Y} = 68,40 - 193$ ✓ $= -124,6$ N
$R^2 = 135,94^2 + 124,6^2$
R = 184,40 (accept 180,84 – 187,23) ✓

$\theta = \tan^{-1}\frac{(-124,6)}{(135,94)}$ ✓ $= \tan^{-1}(0,9166) = 42,51°$ ✓

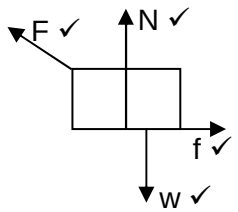
(accept values between/ *aanvaar waaardes tussen* 41,3° to 43,7°)

Resultant force = 184,40 N (accept 180,84 – 187,23 N) in the direction 42,5° below the x-axis. (accept values between 41,3° to 43,7°) ✓
Resulterende krag = 183,71 N (aanvaar 180,84 – 187,23 N) *in die rigting* 42,5° onder die x-as. (aanvaar waaardes vanaf 41,3° tot 43,7°) (6)
[16]

QUESTION 3 / VRAAG 3

3.1 The force that opposes the motion of an object ✓ and which acts parallel to the surface. ✓
Die krag wat die beweging van 'n voorwerp teenwerk ✓ en wat parallel aan die oppervlak werk. ✓ (2)

3.2



Accepted labels/*Aanvaarbare byskrifte:*	
w	F_g / F_w / force of Earth on object / weight / mg / gravitational force *F_g / F_w / krag van Aarde op voorwerp / gewig /mg / gravitasiekrag*
N	F_N / normal / *F_N / normaal*
f	Frictional force / F_f / f_s / *Wrywingskrag*
F	F_{App} / Applied force / *F_{Toe} /Toegepaste krag*

Notes/*Aantekeninge*
• If the components for F / Applied force are shown, penalise 1 mark. *Indien die komponente van F / Toegepaste krag getoon word , penaliseer 1 punt.*
• 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 3/4*
• If force(s) do not make contact with body/ *Indien krag(te) nie met die voorwerp kontak maak nie:* Max/*Maks: 3/4*
• If no arrows indicated /.*Indien geen pyltjies aangedui. 0/4*
• If no labels indicated / *Indien geen benoemings aangedui is nie. 0/4*
• If a free-body diagram is drawn; Max ¾. • *Indien 'n vryekragtediagram geteken is; Maks ¾*

(4)

3.3.1 Consider forces and components in vertical plane.
Oorweeg kragte en komponente in vertikale vlak.

OPTION 1/ *OPSIE 1*	**OPTION 2/ *OPSIE 2***
Upward positive: / *Opwaarts positief:*	Downward positive: /*Afwaarts positief:*
F_{net} = ma ✓	F_{net} = ma ✓
N +F_y + w = ma	N +F_y + w = ma
N + 50 x sin 40° - 40 x 9,8 ✓ = 40 x 0 ✓	N - 50 x sin 40° + 40 x 9,8 ✓ = 40 x 0 ✓
∴N = 359,86 N	∴N = - 359,86 N
The magnitude of/	The magnitude of/
Die grootte van N = 359,86 N ✓	*Die grootte van* N = 359,86 N ✓

... (4)

3.3.2

OPTION 1/ *OPSIE 1*	**OPTION 2/ *OPSIE 2***
To the left as positive: / *Na links is positief:*	To the left as positive: / *Na links is positief:*
F_{net} = ma	F_{net} = ma
F_x + $f_{s(max)}$ = ma	F_x + $f_{s(max)}$ = ma
50 x cos 40° + $f_{s(max)}$ ✓ = 40 x 0 ✓	-50 x cos 40° + $f_{s(max)}$ ✓ = 40 x 0 ✓
38,3 + $f_{s(max)}$ = 0	- 38,3 + f = 0
f = -38,3 N	f = 38,3 N
The magnitude of/	The magnitude of/
Die grootte van f = 38,3 N ✓	*Die grootte van* f = 38,3 N ✓

(3)

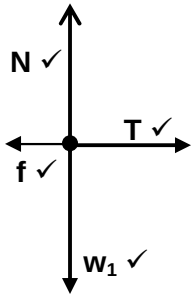
3.3.3 **POSITIVE MARKING FROM QUESTION 3.3.1 AND 3.3.2. / *POSITIEWE NASIEN VAN VRAAG 3.3.1 EN 3.3.2.***
$f_{s,(max)} = \mu_s N$ ✓
$38,3 = \mu_s(359,86)$ ✓
$\therefore \mu_k = 0,11$ ✓ (3)

3.4.1 Increase/*Toeneem* ✓ ✓ (2)
3.4.2 Increase/Toeneem ✓ ✓ (2)
3.4.3 Remain the same/Bly dieselfde ✓✓ (2)
[22]

QUESTION 4/ *VRAAG 4*

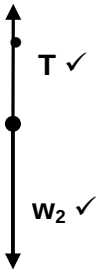
4.1 When a resultant (or net) force acts on an object, the object will accelerate in the direction of the force ✓ at an acceleration directly proportional to the force ✓ and inversely proportional to the mass of the object. ✓
Wanneer 'n resulterende (of netto) krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die krag ✓ *teen 'n versnelling direk eweredig aan die krag* ✓ *en omgekeerd eweredig aan die massa van die voorwerp*. ✓ (3)

4.2 For 8 kg block/ *Vir die 8 kg blok*:



Accepted labels/*Aanvaarbare byskrifte:*	
w	F_g / F_w / force of Earth on block / weight/ mg / gravitational force *F_g / F_w / krag van Aarde op blok / gewig / mg / gravitasiekrag* 78,4 N not acceptable/ *nie aanvaarbaar nie*
N	F_N/normal / *normaal*
f	F_f / f_k / Friction force / wrywingskrag
T	F_T/Tension in rope / *Spanning in die tou*

For 6 kg block / *Vir die 6 kg blok*:



Accepted labels/ *Aanvaarbare byskrifte:*	
w_2	F_g / F_w / force of Earth on block / weight/ mg / gravitational force *F_g / F_w / krag van Aarde op blok / gewig / mg / gravitasiekrag* 58,8 N not acceptable/ *nie aanvaarbaar nie*
T	F_T/Tension in rope / *Spanning in die tou*

(6)

4.3 For the 8 kg block(take to the right as positive)/
Vir die 8 kg blok (neem regs as positief)

$F_{net} = m_1a$ ✓

$m_1a = f_k + T$

$8a = -\mu_kN + T$

$8a$ ✓ $= -(0,3)(8 \times 9,8) + T$ ✓

$8a = -23,52 + T$ ----------(1)

For the 6 kg block (take downwards as positive)/
Vir die 6 kg blok (neem afwaarts as positief)

$F_{net} = m_2a = -T + w_2$

$6a = -T + mg$

$6a$ ✓ $= -T +(6)(9,8)$ ✓

$6a = -T + 58,8$ ----------(2)

Eq 1 + eq 2: $14a = 35,28$

$a = 2,52\ m.s^{-2}$ ✓

If system method: one mark for formula and one mark for answer, max 2/6.
Indien sisteemmetode gebruik word: een punt vir formule en een punt vir antwoord, maks 2/6.

(6)
[15]

QUESTION 5 / VRAAG 5

5.1 Each particle in the universe attracts every other particle with a gravitational force ✓
that is directly proportional to the product of their masses ✓ and
inversely proportional to the square of the distance between their centres. ✓
Elke deeltjie in die heelal trek elke ander deeltjie aan met 'n gravitasiekrag ✓wat direk eweredig is aan die produk van hulle massas ✓en omgekeerd eweredig is aan die kwadraat van die afstand tussen hulle middelpunte.✓ (3)

5.2 $F = \frac{GMm}{r^2}$ ✓

$F = \frac{6,67 \times 10^{-11} \times 5,98 \times 10^{24} \times 4,2 \times 10^{5}}{r^2} = 3,64 \times 10^{6}$ N ✓ ✓ ✓

$r = 6,78 \times 10^{6}$ m $= 6,78 \times 10^{3}$ km ✓ (5)

[8]

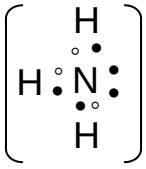
QUESTION 6/VRAAG 6

6.1 Covalent / *Kovalent* ✓ (1)

6.2 Valence electrons or outer electrons are the electrons in the highest energy level ✓
of an atom, in which there are electrons. ✓/
Valens-elektrone of buite-elektrone is elektrone in die hoogste energievlak ✓
van 'n atoom, waarin daar elektrone voorkom. ✓ (2)

6.3 5 ✓ (1)

6.4.1



Marking criteria/*Nasienriglyne:*
- N atom shown with 8 electrons around it. ✓
  N-atoom getoon met 8 elektrone rondom dit.
- Three electron pairs on N atom shared with three H atoms as shown. ✓
  Drie elektronpare op N-atoom word gedeel met drie H-atome soos getoon.

(2)

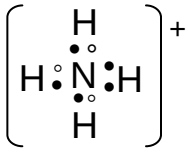
6.4.2 4 pairs / *4 pare* ✓ (1)

6.4.3 3 ✓ (1)

6.4.4 trigonal-pyramidal OR trigonal planar ✓ (1)

6.5.1 coordinate covalent or dative covalent / *koördinaat-kovalent* of *datief-kovalent* (✓) (1)

6.5.2

	**Marking criteria/ *Nasienriglyne:*** • N atom shown with four electron pairs shared with four H atoms as shown. ✓ • Brackets around ammonia with a + sign indicating a positive ion. ✓
• *N-atoom getoon met vier elektronpare wat gedeel word met vier H-atome soos getoon.* • *Hakies on die ammonium met 'n + teken wat wys die ion is positief*	

(2)
[12]

QUESTION 7 / VRAAG 7

7.1 The (average) distance between nuclei ✓ of two bonded atoms. ✓
Die (gemiddelde) afstand tussen kerne ✓ van twee gebinde atome. ✓ (2)

7.2.1 92 pm (accept 87 - 97 pm)✓ (1)

7.2.2 565 kJ·mol^{-1} (accept 560-570 kJ·mol^{-1})✓ (1)
The range of 7.2.2 is unfairly small for the given graph; 550 – 570 is better.

7.2.3 Bond energy ✓
Bindingsenergie ✓ (1)

7.3 Less than ✓
Cℓ atoms are bigger than F atoms and further away from H atom and weaker attracked to H atom. ✓
Minder as ✓
Cℓ *-atome is groter as F-atome en verder weg van H-atoom en word dus swakker aangetrek tot H-atoom.* ✓ (2)
[7]
TOTAL/*TOTAAL*:100