education

Department of Education
FREE STATE PROVINCE

EXAMINATION
EKSAMEN

GRADE 11/*GRAAD 11*

PHYSICAL SCIENCES
FISIESE WETENSKAPPE

MEMORANDUM

JUNE 2017/*JUNIE 2017*

TIME/*TYD*: 3 HOURS/*UUR*

MARKS/*PUNTE*: 150

This memorandum consists of 9 pages.
Hierdie memorandum bestaan uit 9 bladsye.

QUESTION 1 / *VRAAG 1*

1.1	D ✓✓	1.6	A ✓✓
1.2	C ✓✓	1.7	B ✓✓
1.3	C ✓✓	1.8	C ✓✓
1.4	B ✓✓	1.9	B ✓✓
1.5	C ✓✓	1.10	C ✓✓

[10 x 2 = 20]

QUESTION 2 / *VRAAG 2*

2.1 The vector sum ✓ of two or more vectors ✓
OR the single vector ✓ that has the same effect as two or more vectors together. ✓

Die vektorsom ✓ van twee of meer vektore ✓
OF die enkele vektor ✓ wat dieselfde effek het as twee of meer vektore tesame. ✓ (2)

2.2.1

OPTION 1/ *OPSIE 1*	
P:	F_x = 130 cos 60° ✓ = 65 N ✓
Q:	F_x = 91,92 cos 45° ✓ = 65 N ✓
OPTION 2/ *OPSIE 2*	
P:	F_x = 130 sin 30° ✓ = 65 N ✓
Q:	F_x = 91,92 sin 45° ✓ = 65 N ✓

(4)

2.2.2

OPTION 1/ *OPSIE 1*	
P:	F_y = 130 sin 60° ✓ = 112,58 N ✓
Q:	F_y = 91,92 sin 45° ✓ = 65 N ✓
OPTION 2/ *OPSIE 2*	
P:	F_y = 130 cos 30° ✓ = 112,58 N ✓
Q:	F_y = 91,92 cos45° ✓ = 65 N ✓

(4)

2.2.3 **POSITIVE MARKING FROM 2.2.1 / *POSITIEWE NASIEN VANAF 2.2.1***
R_x = 65 + (-65) = 0 N ✓ (1)

2.2.4 **POSITIVE MARKING FROM 2.2.2 / *POSITIEWE NASIEN VANAF* 2.2.2**
R_y = 112,58 + 65 = 177,58 N ✓ (1)

2.2.5 **POSITIVE MARKING FROM 2.2.4 / *POSITIEWE NASIEN VANAF* 2.2.4**
R = 177,58 N ✓ (1)

2.3 **POSITIVE MARKING FROM 2.2.5 / *POSITIEWE NASIEN VANAF* 2.2.5**
w = mg ✓
177,58 = m(9,8) ✓
m = 18,12 kg ✓ (3)
[16]

QUESTION 3 / *VRAAG 3*

3.1 The force, or component of the force, which a surface exerts on an object in contact ✓with it, and which is perpendicular to the surface ✓
Die krag, of komponent van die krag, wat 'n oppervlak uitoefen op 'n voorwerp wat daarmee in kontak is ✓ *en wat loodreg op die vlak* ✓ *is*. (2)

3.2

Acceptable labels/*Aanvaarbare byskrifte*	**MARK/ *PUNT***
F_g / F_w /weight/gravitational force/ *F_g / F_w /gewig/gravitasie krag*	✓
F_N / F_{normal} / normal force/*Normaalkrag*	✓

(2)

Notes/*Aantekeninge*
• One mark awarded for label and arrow. • *Een punt toegeken aan byskrif en pyltjie.*
• Do not penalise for length of arrows. • *Moenie vir die lengte van die pyltjies penaliseer nie.*
• Any additional force(s) • *Enige addisionele krag(te) Max/Maks ½*
• If force(s) do not make contact with body • *Indien krag(te) nie met die voorwerp kontak maak nie:* Max/*Maks: ½*
• No arrows indicated/*Geen pyltjies aangedui.* 0/2
• No labels indicated /*Geen byskrifte aangedui nie.* 0/2

3.3

OPTION 1/ *OPSIE 1*	**OPTION 2 / *OPSIE 2***
Upwards: + /*Opwaarts: +*	Upwards: - /*Opwaarts: -*
F_{net} = ma ✓ N + w = 0 N - (18)(9,8) ✓ = 0 N = 176,4 N ✓	F_{net} = ma ✓ N + w = 0 N + (18)(9,8) ✓ = 0 N = -176,4 N ✓

(3)

3.4.1 INCREASE / *TOENAME* (✓✓) (2)

3.4.2 DECREASE / *AFNAME* (✓✓) (2)

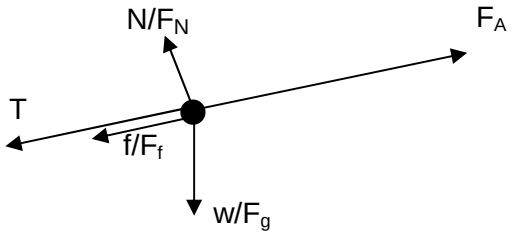
3.4.3 DECREASE / *AFNAME* (✓✓) (2)
[13]

QUESTION 4 / *VRAAG 4*

4.1 When a resultant/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/netto krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel ✓ *teen 'n versnelling direk eweredig aan die krag* ✓*en omgekeerd eweredig aan die massa van die voorwerp*. ✓ (3)

4.2



Acceptable labels/*Aanvaarbare byskrifte*		**MARK/ *PUNT***
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*	✓
f	F_f/f_k/friction/*wrywing*	✓
N	F_N/Normal/*Normaal*	✓
T	F_T/Tension force/*Spanningskrag/Spanning*	✓
F_A	F	✓

Notes/*Notas*
One mark awarded for label and arrow. *Een punt toegeken vir byskrif en pyltjie.*
If components of forces are shown, penalise 1 mark. *Indien die komponente van kragte getoon word, penaliseer 1 punt.*
If the value of forces are shown, penalise 1 mark. *Indien die waarde van kragte getoon word, penaliseer 1 punt.*
Any additional force: deduct 1 mark maximum (maximum 4/5). *Enige addisionele krag: trek 1 punt af (maksimum 4/5).*
Lines must touch dot/square otherwise (maximum 4/5). *Lyne moet kolletjie/vierkant raak anders (maksimum 4/5).*
Do not penalise if angle is shown/not shown. *Moenie penaliseer as hoek getoon/nie getoon is nie.*

(5)

4.3.1

OPTION 1/ *OPSIE 1* **15 kg block/blok:**	**OPTION 2 / *OPSIE 2*** **15 kg block/blok:**
Upwards along the slope: + *Opwaarts teen helling:+*	Upwards along the slope: - *Opwaarts teen helling:-*
F_{net} = ma ✓ T + f_k + $w_{//}$ = ma T + f_k + mg sin θ = ma T – 26,5 + (–15x9,8 sin 30°) = 15a ✓ ✓ T - 100 = 15a	F_{net} = ma ✓ T + f_k + $w_{//}$ = ma T + f_k + mg sin θ = ma -T + 26,5 + (+15x9,8 sin 30°) = -15a ✓ ✓ -T + 100 = -15a

OPTION 1/ *OPSIE 1* **12 kg block/blok:**	**OPTION 2 / *OPSIE 2*** **12 kg block/blok:**
Upwards along the slope: + *Opwaarts teen helling:+*	Upwards along the slope: - *Opwaarts teen helling:-*
F_{net} = ma F +T + f_k + $w_{//}$ = ma F +T + μ_k (mg)cosθ + mgsin θ = ma 224 - T + (-0,11x12x9,8xcos 30°) + ✓ ✓ (-12x9,8xsin30°) = 12a ✓ 154 - T = 12a a = 2 m·s^{-2} ✓	F_{net} = ma F +T + f_k + $w_{//}$ = ma F +T + μ_k (mg)cosθ + mgsin θ = ma -224 + T + (0,11x12x9,8xcos 30°) + ✓ ✓ (12x9,8xsin30°) = -12a ✓ -154 + T = -12a a = 2 m·s^{-2} ✓

System method/*Sisteemmetode*

Max/Maks: 5/8

F_{net} = ma ✓ ✓

224 + (-0,11x12x9,8xcos 30°) - 26,5 + (-15x9,8xsin 30°) - (12x9,8xsin30°) = 27a
✓ ✓

(8)

a = 2 m·s^{-2} ✓

4.3.2 **POSITIVE MARKING FROM QUESTION 4.3.1**
POSITIEWE NASIEN VANAF VRAAG 4.3.1

T – 100 =15a T - 100 = 15(2) ✓ T = 130 N ✓	**OR OF**	-T + 100 = -15a -T + 100 = -15(2) ✓ T = 130 N ✓
OR/*OF* 154 - T = 12a 154 - T = 12(2) ✓ T = 130 N ✓		**OR/*OF*** -154 +T = -12a -154 +T = -12(2) ✓ T = 130 N ✓

(2)
[18]

QUESTION 5 / *VRAAG 5*

5.1.1 Normal/Normal force / *Normaal/Normaalkrag* ✓ (1)

5.1.2 Inertia/*Traagheid* ✓ (1)

5.1.3 Weightlessness/ *Gewigloosheid* ✓ (1)

5.2.1 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 hul middelpunte. ✓ (3)

5.2.2 $g = \frac{GM}{r^2}$ ✓ $3{,}2 = \frac{6{,}67 \times 10^{-11} \times M}{(2{,}6 \times 10^6)^2}$ ✓ ✓ ⇨ M = 3,24 x 10^{23} kg ✓ (4)

5.2.3 w = mg ✓ = (18)(3,2) ✓ = 57,6 N ✓ (3)
[13]

QUESTION 6 / *VRAAG 6*

6.1.1 The change in direction of a light ray ✓ due to a change in speed ✓ when light travels from one medium to another of different optical density. ✓

Die verandering in rigting van 'n ligstraal ✓ as gevolg van die verandering in spoed ✓ wanneer die lig van een medium na 'n ander van verskillende optiese digtheid beweeg. ✓ (3)

6.1.2 $n_1 \sin\theta_1 = n_2 \sin\theta_2$ ✓
1 sin 36° ✓ = 1,52 $\sin\theta_2$ ✓
$\theta_2 = 22{,}75°$ ✓ (4)

6.1.3 22,75° ✓ (1)

6.1.4 Refracted / *Gebreek* ✓

– The angle of incidence is less than the critical angle. ✓
Die invalshoek is kleiner as die grenshoek. ✓

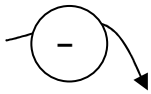
No marks are awarded for: "No total internal reflection"
Geen punte word gegee vir: "Geen totale interne weerkaatsing nie." (2)

6.2.1 Communications / *Kommunikasie* ✓
OR / OF Medical / *Medies* (1)

6.2.2 Total internal reflection ✓ / *Totale interne weerkaatsing* ✓. (1)

6.3.1 A central ✓ broad green band ✓ with alternating green and dark bands on both sides ✓

Sentrale ✓ *breë band van groen lig* ✓ *met afwissellende groen en donker bande aan weerskante*. ✓ (3)

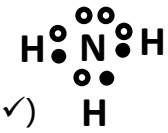
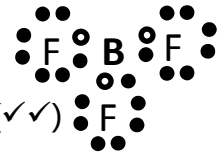
6.3.2 Wider / *Wyer* ✓  (1)

6.3.3 Similarities are accepted/*Soortgelykes word aanvaar*.
Wavelength ✓ of green light is less then yellow ✓
OR Frequency of green light is higher than that of yellow
Diffraction of green is less than diffraction of yellow. ✓

Golflengte ✓ *van groen lig is korter as geel* ✓
OF *Frekwensie* *van groen lig is hoër as die van geel*
Diffraksie van groen is minder as diffraksie van geel. ✓ (3)

[19]

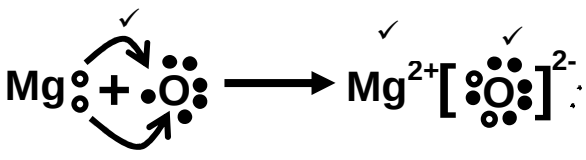
QUESTION 7 / *VRAAG 7*

		NH_3	BF_3
7.1.1	Lewis diagram	 (✓✓)	 (✓✓)
7.1.2	Lone pairs *Alleenpare*	1 ✓	0 ✓
7.1.3	Bonding pairs / *Bindings-pare*	3 ✓	3 ✓
7.1.4	Polarity: Molecule / *Molekule*	Polar / Polêr ✓	*Non polar* / *Nie-polêr*✓
7.1.5	Shape / *Vorm*	Trigonal pyramidal Trigonaal piramidaal ✓	*Trigonal planar* *Trigonaalplanêr* ✓

(12)

7.2.1 ΔEN = 3,5 – 1,2 = 2,3 ✓; greater than 2,1 ✓; Ionic ✓

ΔEN = 3,5 – 1,2 = 2,3 ✓; *groter as 2,1* ✓*; Ionies* ✓ (3)

7.2.2 

Or three separate steps.

(3)

[18]

QUESTION 8 / *VRAAG 8*

8.1.1 Bond length / *Bindingslengte* ✓ (1)

8.1.2 Bond energy / *Bindingsenergie* ✓ (1)

8.2 Question was withdrawn.

~~Attractive~~ ✓

~~The negative electron clouds attract the positive nuclei ✓; repulsive forces play a more dominant role when the atoms are very close to each other. ✓~~

~~*Aantrekkend* ✓~~

~~*Die negatiewe elektronwolke en die positiewe kerne trek mekaar aan ✓; afstotingskragte speel 'n meer dominante rol wanneer die atome baie na aan mekaar is.✓*~~ ~~(3)~~

8.3 Energy is given off ✓ as the atoms move closer to each other.✓

Energie word afgegee ✓ *soos die atome nader aan mekaar beweeg*. ✓ (2)

8.4 Increase / Neem toe ✓ (1)

[5] ~~[8]~~

QUESTION 9 / *VRAAG 9*

9.1 The volume of an enclosed gas is directly proportional to its kelvin temperature ✓ provided the pressure stays constant. ✓

Die volume van 'n ingeslote gas is direk eweredig aan sy kelvintemperatuur ✓ *indien die druk konstant gehou word*. ✓ (2)

9.2.1 160 (kPa) (✓✓) (2)

9.2.2 0,5 (dm^3) (✓✓) (2)

9.2.3 Gradient ✓ $= \dfrac{\Delta p}{\Delta\left(\dfrac{1}{V}\right)} = \dfrac{120 - 40}{3 - 1}$ ✓ $= 40$ J ✓ (3)

Gradient with any correct sets of coordinates are acceptable.
Gradiënt met enige korrekte stelle koördinate is aanvaarbaar.

9.3 DECREASE / *AFNEEM* ✓ (1)

9.4 Boyle's law ✓ $p \propto 1/V$ ✓ (2)

[12]

QUESTION 10 / *VRAAG 10*

10.1.1 pV= nRT ✓
(400×10^3) ✓ $(3\ 360 \times 10^{-6})$ ✓ = n(8,31)(303) ✓
n = 0,534 mol

m = n x M ✓
m = 0,534 x 32 ✓
m = 17,08 g ✓

OR/*OF*

$$pV = nRT \checkmark$$
$$= \frac{mRT}{M}$$
$$(400 \times 10^3) \checkmark (3\ 360 \times 10^{-6}) \checkmark = \frac{m(8,31)(303) \checkmark}{32 \checkmark}$$
$$m = 17,08 \text{ g} \checkmark$$

(7)

10.1.2 If the temperature increases the <u>average kinetic energy of the particles also increase</u> ✓ and <u>there would be more collisions per unit time</u> ✓ against the sides of the container and the <u>intensity of the collisions will increase</u> ✓, which will cause the <u>pressure to increase</u>. ✓

As die temperatuur toeneem sal die <u>gemiddelde kinetiese energie van die deeltjies ook toeneem</u> ✓ en dan sal daar <u>meer botsings per eenheidstyd teen die kante van die houer wees</u> ✓ en die <u>intensiteit van die botsings sal ook toeneem</u> ✓, wat die <u>druk sal laat toeneem</u>. ✓ (4)

10.2 High pressure ✓and low temperature ✓/ *Hoë druk ✓en lae temperatuur* ✓ (2)
[13]

<u>GRAND TOTAL/*GROOTTOTAAL*: 147 ~~150~~</u>