education

Department of Education
FREE STATE PROVINCE

GRADE 11/*GRAAD 11*

PHYSICAL SCIENCES/*FISIESE WETENSKAPPE*

JUNE 2016/*JUNIE 2016*

MARKS/*PUNTE*: 150

MEMORANDUM

This memorandum consists of 13 pages.
Hierdie memorandum bestaan uit 13 bladsye.

QUESTION 1/*VRAAG 1*

1.1 C ✓✓ (2)

1.2 D ✓✓ (2)

1.3 C ✓✓ (2)

1.4 D ✓✓ (2)

1.5 B ✓✓ (2)

1.6 B ✓✓ (2)

1.7 D ✓✓ (2)

1.8 C ✓✓ (2)

1.9 B ✓✓ (2)

1.10 A ✓✓ (2)
[20]

QIESTION 2/*VRAAG 2*

2.1 A single vector having the same effect as two or more vectors together. ✓✓
'n Enkele vektor met dieselfde effek as twee of meer vektore saam.
(2 marks or zero/*2 punte of nul.)* (2)

2.2

2.2.1 **East as positive/*oos as positief:***
R_x= 30 + (-75) ✓
= -45 N
= 45 N West/*Wes* or/*of* 270° ✓

OR /OF

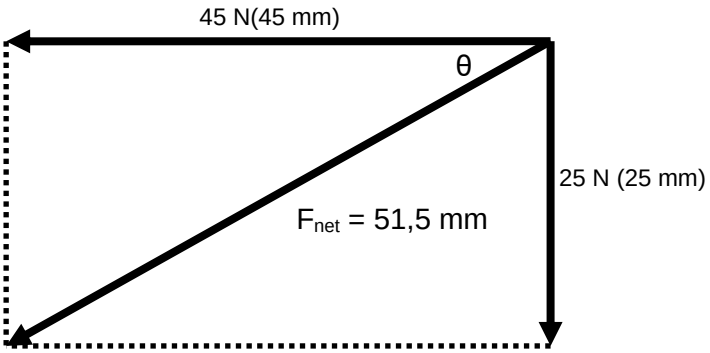
West as positive/*wes as positief:*
R_x= 75 + (-30) ✓
= 45 N
= 45 N West/*Wes* or/*of* 270° ✓ (2)

2.2.2 **South as positive/*suid as positief:***
R_y= 7 + 18 ✓
= 25 N South/*Suid* or/*of* 180° ✓

OR /OF

North as positive/*noord as positief:*
R_y= (-7)+ (-18) ✓
= -25 N South/*Suid* or/*of* 180° ✓ (2)

2.3



θ = 29° south of west/*suid van wes*
F_{net} = 51,5 N; 241°

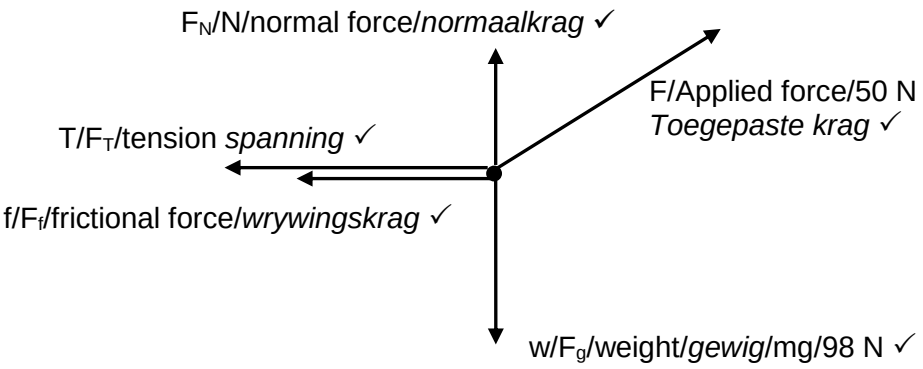
Marking criteria/*Nasienriglyne:*	
Magnitude of R_Y and R_X correctly drawn according to scale with labels. *Grootte van R_Y en R_X korrek geteken volgens skaal met byskrifte.*	✓
R_y and R_x both drawn in correct direction. Arrow heads must be shown/ *R_y en R_x beide getrek in regte rigting. Pylpunte moet getoon word.*	✓
Resultant correctly drawn as diagonal of parallelogram as shown. Arrow head must be shown./*Resultant korrek geteken as 'n diagonaal van parallelogram soos aangedui. Pylpunt moet getoon word.*	✓
Measurement of resultant: 49 mm > F_{net} < 55 mm *Meting van resultant: 49 mm > F_{net} < 55 mm*	✓
θ = 26° to 32° south of west/*suid van wes* or 244°	✓
Resultant/F_{net} = 49 to/*tot* 55 N; 238° to/*tot* 244°	✓

(6)
[12]

QUESTION 3/*VRAAG 3*

3.1. When a net/resultant force acts on an object, the object accelerates in the direction of the net force ✓at an acceleration directly proportional to the force ✓and inversely proportional to the mass of the object. ✓
Wanneer 'n netto/resulterende 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. (3)

3.2



Note/*Aantekening*:
One mark is allocated for each force represented by an arrow pointing in the correct direction and correctly labelled.
Een punt word toegeken vir elke krag voorgestel as pyl in die regte rigting en korrek benoem.

(5)

3.3.1 Upward positive/*Opwaarts positief:*

$F_N + F_V + w = 0$ / $F_N + F_V - w = 0$ ✓
$F_N + \underline{50 \sin 30°}$ ✓ $\underline{- (10)(9,8)}$ ✓$= 0$
$F_N = 73$ N ✓ (4)

3.3.2 To the right as positive/*Na regs as positief:*

For 10 kg crate/*Vir 10 kg-krat*:
F_{net} = ma ✓
F_H+ f + T = ma
50 cos 30° – 20 ✓- T = 10a ✓
23,3 - T = 10a (1)

For 5 kg crate/*Vir 5 kg-krat*:
F_{net} = ma
T + f = ma
T – (0,2 x 5 x 9,8) ✓ = 5a ✓
T – 9,8 = 5a (2)
Add (1) and (2):
13,5 = 15a (1) + (2) ✓
a = 0,9 m·s^{-2}✓

IF/*INDIEN*:
F_{net} = ma ✓
43,30 – 20 – 9,8 ✓ = 10a ✓ + 5a ✓
a = 0,9 m·s^{-2} ✓ Max./*Maks.* $\frac{5}{7}$

(7)

3.3.3 Substitute a = 0,9 m·s^{-2} in equation 1 or 2:
Vervang a = 0,9 m·s^{-2} in vergelyking 1 of 2:
23,30 – T = 10(0,9) ✓
T = 14,3 N ✓
OR/***OF***
T – 9,8 = 5(0,9) ✓
T = 14,3 N ✓ (2)

3.4 Increases/*Vermeerder* ✓
If the angle decreases, the vertical component (F_v) decreases. ✓
For the same w, ✓ F_N increases.
As die hoek kleiner word, word die komponent (F_v) kleiner.
Vir dieselfde w, word F_N groter. (3)

3.5 When a car comes to a sudden stop the child will continue moving at its initial velocity ✓ according to Newton's first law ✓ and be flung against the windscreen or even out of the car. ✓
Wanneer 'n motor tot 'n skielike stilstand kom sal die kind steeds beweeg teen sy oorspronklike snelheid volgens Newton se eerste wet en sal die kind bots met die voorruit of selfs uit die motor geslinger word. (3)
[27]

QUESTION 4/VRAAG 4

4.1 Any two particles in the universe attract each other ✓ with a force directly proportional to the product of their masses ✓and inversely proportional to the square of the distance between their centres.✓
Enige twee deeltjies in die heelal trek mekaar onderling aan met 'n krag direk eweredig aan die produk van hul massas en omgekeerd eweredig aan die kwadraat van die afstand tussen hul middelpunte. (3)

4.2 Newton's Third Law (of Motion)/*Newton se Derde (Bewegings)wet* ✓
When object A exerts a force on object B,✓ object B will exert an equal but opposite force on object A.✓
Wanneer voorwerp A 'n krag uitoefen op die voorwerp B, sal voorwerp B 'n gelyke maar teenoorgestelde krag op voorwerp A uitoefen. (3)

4.3 $F = \frac{Gm_1m_2}{r^2}$ ✓

250 ✓ $= \frac{6{,}67 \times 10^{-11} \times 500 \times 5{,}98 \times 10^{24}}{r^2}$ ✓

$r = 2{,}82 \times 10^7$ m

Distance/*Afstand* = $2{,}82 \times 10^7 - 6{,}38 \times 10^6$ ✓

$= 2{,}18 \times 10^7$ m ✓ (5)

[11]

QUESTION 5/VRAAG 5

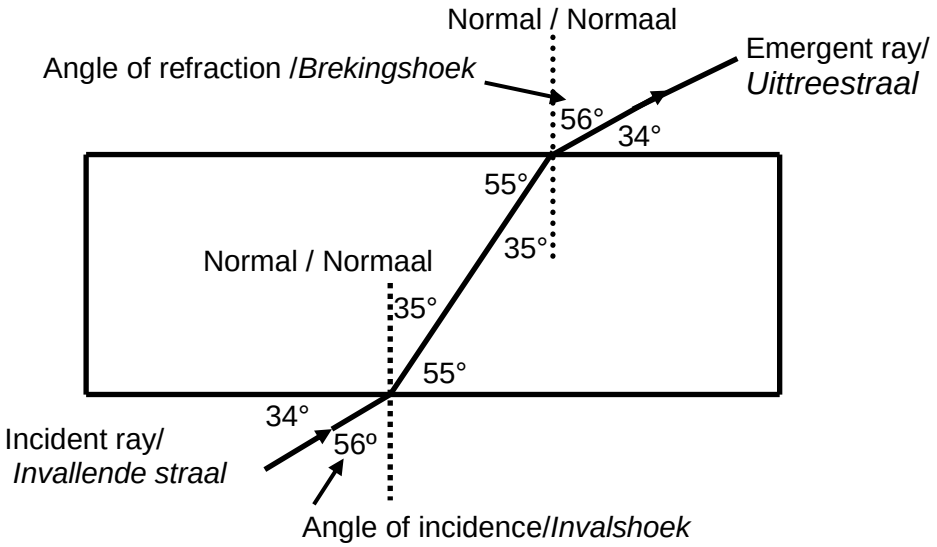
5.1 The ratio of the sine of the angle of incidence in one medium✓to the sine of the angle of refraction in the other medium is constant.✓
Die verhouding van die sinus van die invalshoek in een medium tot die sinus van die brekingshoek in die ander medium is konstant. (2)

5.2 Refractive index/*Brekingsindeks* $n_r = \frac{\sin i}{\sin r}$ ✓ $= \frac{\sin 56°}{\sin 35°}$ ✓ $= 1{,}45$ ✓

OR/OF

$n_i \sin\theta_i = n_r \sin\theta_r$ ✓
$1 \times \sin 56° = n_r \times \sin 35°$ ✓
$n_r = 1{,}45$ ✓ (3)

5.3



Marking criteria/*Nasienriglyne:*	
Normal on both interfaces shown and labelled. *Normaal by beide skeidingsvlakke getoon en benoem.*	✓
Light ray at 1st interface refracts towards normal./*Ligstraal by 1ste skeidingsvlak breek na normaal toe.*	✓
Light ray at 2nd interface refracts away from normal./*Ligstraal by 2de skeidingsvlak breek weg van normaal.*	✓
Emergent ray || incident ray./*Uittreestraal || invallende straal.*	✓
Angle of incidence shown and labelled./*Invalshoek getoon en benoem.*	✓
Angle of refraction shown and labelled./*Brekingshoek getoon en benoem.*	✓

(6)

5.4 Greater than/*Groter as* ✓

Water: $1{,}33 = \frac{3 \times 10^8}{v_w}$ ✓ ✓

Perspex: $1{,}5 = \frac{3 \times 10^8}{v_p}$ ✓

$v_w > v_p$ ✓

(4)

Alternative for the reason:

According to n = c/v ✓

the speed of light is inversely proportional to the refractive index, ✓

because c (speed of light) is constant. ✓

5.5 $n = \frac{c}{v}$ ✓

$1{,}52$ ✓ $= = \frac{3 \times 10^8}{v}$ ✓

$v = 1{,}97 \times 10^8 \text{ m·s}^{-1}$ ✓

(4)

[19]

QUESTION 6/*VRAAG 6*

6.1 The ability of a wave to spread out in wavefronts✓ as the wave passes through a small opening or around a sharp edge.✓
Die vermoë van 'n golf om in golffronte uit te sprei✓soos die golf deur 'n klein opening of om 'n skerp rand beweeg.✓ (2)

6.2 Wave nature of light✓/*Golfgeaardheid van lig*✓ (1)

6.3 **Criteria for investigative question/*Riglyne vir ondersoekendevraag*:**
The dependent and independent variables are stated.✓
Die afhanklike en onafhanklike veranderlikes is genoem.

Asks a question about the relationship between dependent and independent variables.✓
Vra 'n vraag oor die verhouding tussen afhanklike en onafhanklike veranderlikes.

Examples/ *Voorbeelde:*
How will the broadness/width of the central band change/differ when slit width changes/is increased/is decreased?
Hoe sal die breedte/wydte van die sentrale band verander/verskil wanneer spleetwydte verander/verhoog/verlaag word?

What is the relationship between the broadness of the central bright band and slit width?/
Wat is die verhouding tussen die breedte van die sentrale helder band en spleetwydte? (2)

6.4 Wavelength (of light)/Frequency (of light)/Colour of light/Light source ✓
Golflengte (lig)/Frekwensie (lig)/kleur van die lig/Ligbron
Distance between the screen and the slit.✓/
Afstand tussen die skerm en die spleet. (2)

6.5 Broad central bright band ✓ with an alternate dark and bright/violet bands.✓
Breë sentrale helder band met alternatiewe donker en helder/violet bande. (2)

6.6 Increases/*Vermeerder*✓
Diffraction is inversely proportional to slit width.✓
Diffraksie is omgekeerd eweredig aan spleetwydte.

ACCEPT/*AANVAAR:*
The larger/smaller the slit width, the smaller/larger the diffraction.
Hoe groter/kleiner die spleetwydte hoe kleiner/groter is die diffraksie. (2)
[11]

QUESTION 7/VRAAG 7

7.1 As the atoms approach each other/comes closer to each other,✓ the forces of attraction between nuclei and electron clouds become stronger. ✓
Soos die atome mekaar nader/nader kom aan mekaar, sal die aantrekkingskragte tussen kerne en elektronwolke sterker word. (2)

7.2.1 A ✓
The potential energy is closest to zero/more positive.✓
Die potensiële energie is die naaste aan nul/meer positief.✓ (2)

7.2.2 B ✓
Lowest potential energy/*Laagste potensiële energie*✓ (2)

7.3.1 140 pm ✓ (1)

7.3.2 334 $kJ \cdot mol^{-1}$✓ (1)

7.4 From B to C atoms move very close to each other and forces of repulsion between atomic nuclei increases.✓
The potential energy of the system of atoms increases.✓
Vanaf B na C atome beweeg baie naby aan mekaar en afstotingskragte tussen atoomkerne verhoog.
Die potensiële energie van die sisteem van atome verhoog. (2)
[10]

QUESTION 8/VRAAG 8

8.1 Two or more atoms bonded covalently✓ and take part as a unit in a chemical reactions.✓/
Twee of meer atome kovalent gebind en neem as 'n eenheid deel aan chemiese reaksies. (2)

8.2.1 Covalent (bond)/*Kovalente (binding)* ✓ (1)

8.2.2 Ionic (bond)/*Ioniese (binding)* ✓ (1)

8.3 Polar/*Polêr*✓
$\Delta E_N = 4 - 2,1$ ✓
$= 1,9$ ✓ (3)

8.4.1 Angular/Bent/*Hoekig/Gebuig* ✓ (1)

8.4.2 Trigonal planar/*Trigonaal-planêr* ✓ (1)

8.4.3 Trigonal bipramidal/*Trigonaal Bipiramidaal* ✓ (1)

8.4.4 Tetrahedral/Tetraëdries ✓ (1)
[11]

QUESTION 9/VRAAG 9

9.1 Temperature ✓at which the vapour pressure of a substance equals to the atmospheric pressure.✓
Temperatuur waar die dampdruk van 'n stof gelyk is aan die atmosferiese druk. (2)

9.2 London forces/induced dipole forces/dispersion forces ✓
Londonkragte/geïnduseerde dipoolkragte/dispersiekragte (1)

9.3 Between HCℓ molecules/molecules of **B** are dipole-dipole forces.✓
Between H_2O molecules/molecules of **C** are hydrogen bonds.✓
Hydrogen bonds are stronger than dipole-dipole forces.✓
More energy needed to overcome intermolecular forces in H_2O than in HCℓ.✓
Tussen HCℓ molekule/molekule van B is dipool-dipool kragte.
Tussen H_2O molekule/molekule van C is waterstofbindings.
Waterstofbindings is sterker as dipool-dipool kragte.
Meer energie wat nodig is om intermolekulêre kragte te oorkom in H_2O as in HCℓ. (4)

9.4 Vapour pressure increases as boiling point decreases. ✓
Dampdruk neem toe soos kookpunt afneem. (1)

9.5 A ✓

- The intermolecular forces/London forces/induced dipole forces/dispersion forces between molecules of **A**/CH_4 molecules are weaker than the intermolecular forces/dipole-dipole forces between HCℓ molecules/molecules of **B**.✓

A

- *Die intermolekulêre kragte/Londonkragte/geïnduseerde dipoolkragte/dispersie kragte tussen molekule van A/CH_4 molekules is swakker as die intermolekulêre kragte/dipool-dipool kragte tussen HCℓ molekules/molekules van **B**.*

- Less energy is needed to overcome/break the intermolecular forces/ London forces/induced dipole forces/dispersion forces in **A**/CH_4.✓

  *Minder energie nodig is om te oorkom/die intermolekulêre kragte te breek/Londonkragte/geïnduseerde dipoolkragte/dispersiekragte in **A**/CH_4.* (3)

[11]

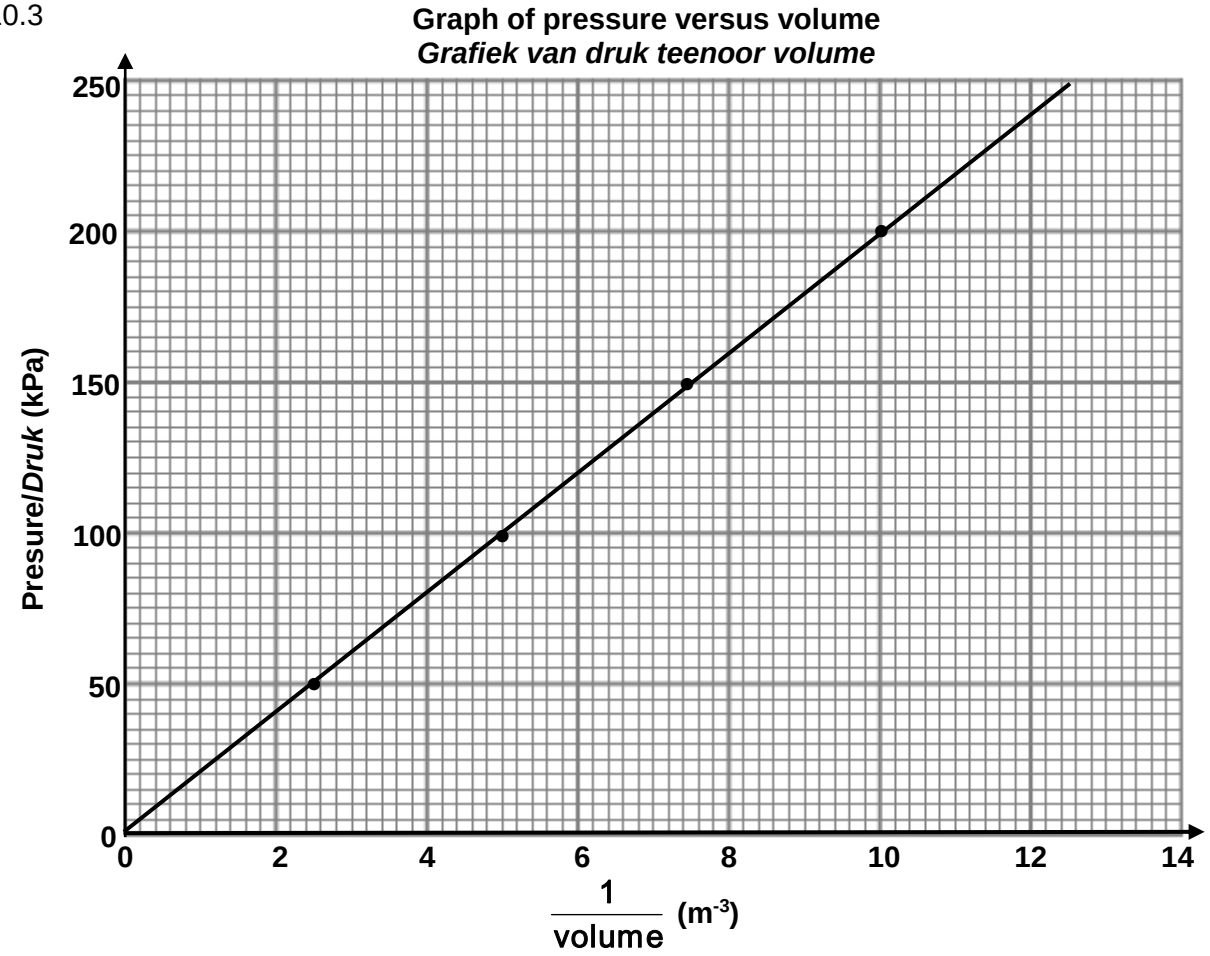
QUESTION 10/*VRAAG 10*

10.1 Boyle's Law/*Boyle se Wet* ✓ (1)

10.2 $a = \frac{1}{\text{volume}} = \frac{1}{0,4} = 2,5\ m^{-3}$

$B = \frac{1}{\text{volume}} = \frac{1}{0,2} = 5\ m^{-3}$ ✓ (1)

10.3



Criteria for the graph:/ *Kriteria vir die grafiek:*	
Marking/Nasienriglyne.	
Axes correctly labelled with units./ *Asse korrek benoem met eenhede.*	✓
Correct scale on both axes/*Korrekte skaal op beide asse*	✓
Two points correctly plotted./*Twee punte korrek geplot.*	✓
A straight line graph drawn through points. *'n Reguitlyngrafiek getrek deur punte.*	✓

(5)

The missing mark should be for plotting co-ordinates three and four.

10.4 $p \propto \frac{1}{\text{volume}}$ ✓ (1)

10.5 $\frac{1}{\text{volume}} = 8$ ✓ ∴ V = 0,125 m^3 ✓

Notes/*Aantekeninge:*
IF/*INDIEN:*
Only answer given, allocate 2 marks./*Slegs antwoord gegee, ken 2 punte toe.*

(2)

10.6 Number of moles O_2 gas/*Aantal mol O_2 gas:*

$n(O_2) = \frac{m}{M} = \frac{173,8}{32} = 5,43$ mole✓

pV = nRT ✓
50 x 10^3 x 0,4 ✓ = 5,43 x 8,31 ✓x T.
T = 443,23 K ✓
T = t +273°C
t = 170,23°C ✓ (6)

10.7 Gradient = pV/*Gradiënt = pV*
At higher T, pV=nRT will increase✓
By hoër T, sal pV=nRT toeneem (2)
[18]

GRAND TOTAL/*GROOTTOTAAL*: 150