education

Department of Education
FREE STATE PROVINCE

EXAMINATION/*EKSAMEN*

GRADE 11 / *GRAAD 11*

PHYSICAL SCIENCES (P1)
FISIESE WETENSKAPPE (V1)

MEMORANDUM

NOVEMBER 2022

MARKS: 100 / *PUNTE: 100*

TIME: 2 HOURS / *TYD: 2 UUR*

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

QUESTION 1 / *VRAAG 1*

1.1	B ✓✓	1.2	D ✓✓	1.3	D ✓✓	1.4	C ✓✓
1.5	C ✓✓	1.6	D ✓✓	1.7	A ✓✓	1.8	A ✓✓
1.9	B ✓✓	1.10	B ✓✓				**[20]**

QUESTION 2 / *VRAAG 2*

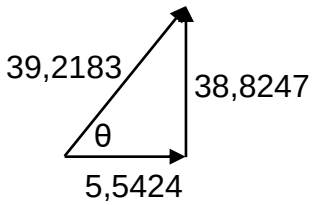
2.1.1 A force has both magnitude and direction. ✓✓ (2 or/of 0)
'n Krag het beide grootte en rigting. (2)

Marking criteria 2.1.2 and 2.1.3	**Nasienriglyne vir 2.1.2 en 2.1.3**
One component correct: ✓ Two other components correct: ✓ Answer: ✓	Een komponent korrek: ✓ Twee ander komponente korrek: ✓ Antwoord: ✓

2.1.2 $R_x = A_x + B_x + C_x$
$= -20\cos60° + 30\cos25° + (-45\sin15°)$
or/of **or/of** **or/of**
$-20\sin30° + 30\sin65° + (-45\cos75°)$
$= 5{,}5424$ N (3)

2.1.3 $R_y = A_y + B_y + C_y$
$= -20\sin60° + 30\sin25° + 45\cos15°$
or/of **or/of** **or/of**
$-20\cos30° + 30\cos65° + 45\sin75°$
$= 38{,}8247$ N (3)

2.1.4 **POSITIVE MARKING FROM 2.1.2 and 2.1.3.**
POSITIEWE NASIEN VANAF 2.1.2 EN 2.1.3.



$R = \sqrt{R_x^2 + R_y^2}$
$= \sqrt{(5{,}54)^2 + (38{,}82)^2}$ ✓
= 39,21 N to/tot 39,22 N

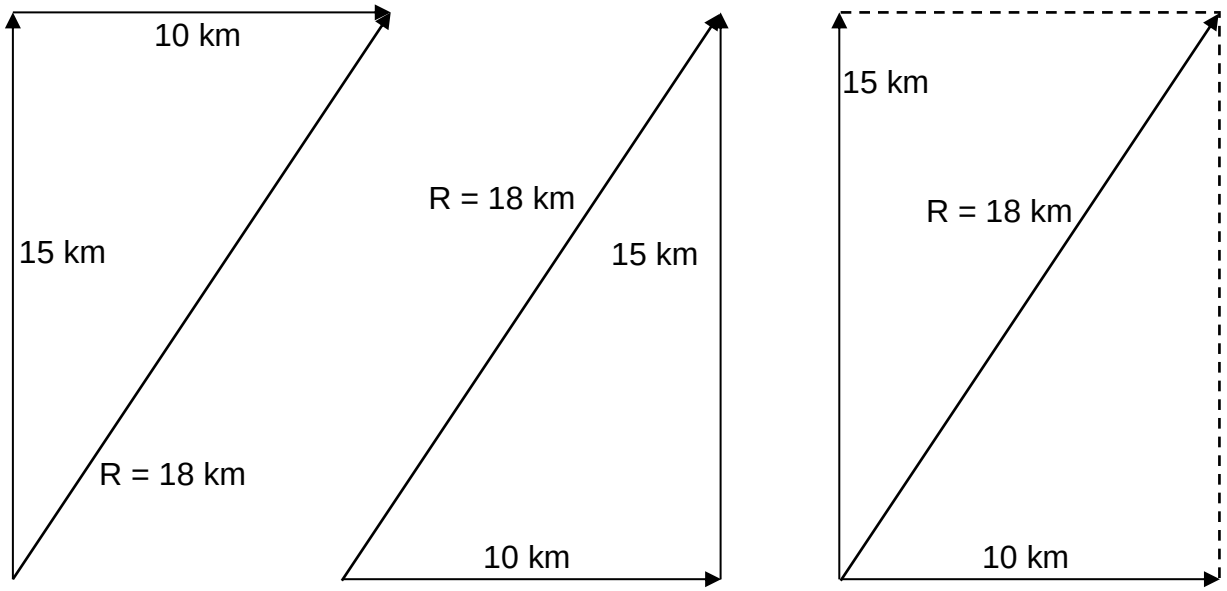
$\Theta = tan^{-1}\left(\frac{R_y}{R_x}\right)$ **OR/OF** $\Theta = sin^{-1}\left(\frac{R_y}{R}\right)$ **OR/OF** $\Theta = cos^{-1}\left(\frac{R_x}{R}\right)$
$= tan^{-1}\left(\frac{38{,}82}{5{,}54}\right)$ ✓ $= sin^{-1}\left(\frac{38{,}82}{39{,}21}\right)$ $= cos^{-1}\left(\frac{5{,}54}{39{,}21}\right)$
$= 81{,}88°$ $= 81{,}88°$ $= 81{,}88°$

Resultant = 39,21 N; 81,88° ✓ (anticlockwise from + x-axis) (3)

2.2

Marking criteria		Nasienriglyne	
Tail-to-head or //[m] method correctly used.	✓	Stert-by-kop- of //[m]-metode korrek gebruik.	✓
Correct measurements according to given scale.	✓	Korrekte metings volgens gegewe skaal.	✓
Magnitudes of both displacements and resultant indicated.	✓	Grootte van beide verplasings en resultant is aangedui.	✓
Correct answer	✓	Korrekte antwoord	✓

OPTION 1 / *OPSIE 1* **OPTION 2 / *OPSIE 2*** **OPTION 3 / *OPSIE 3***

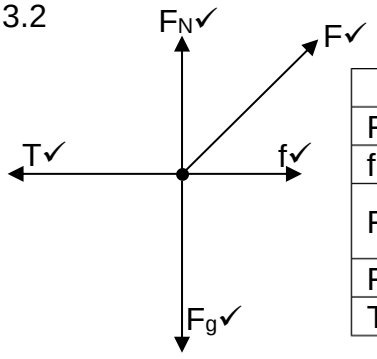


(4)
[15]

QUESTION 3 / *VRAAG 3*

3.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the net force✓ and inversely proportional to the mass of the object. ✓
Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die netto krag met 'n versnelling direk eweredig aan die netto krag en omgekeerd eweredig aan die massa van die voorwerp. (2)

3.2



Acceptable labels / *Aanvaarbare byskrifte*		
F_g	w/F_w/mg/weight/*gewig*	✓
f	F_f /$F_{friction/wrywin}$/f_k/friction/*wrywing*	✓
F_N	N/$F_{normal/normaal}$/Normal force/*Normaalkrag* Normal/*Normaal*	✓
F	$F_{applied/Toegepas}$/50N	✓
T	F_T/Tension/Spanning	✓

(5)

3.3.1 $F_N = F_g - F_V$
$= mg - Fsin\theta$
$= 5 \times 9{,}8\checkmark - 50sin25°\checkmark$
$= 27{,}87\ N\ \checkmark$ (3)

3.3.2 **POSITIVE MARKING FROM 3.3.1. / *POSITIEWE NASIEN VANAF 3.3.1.***

LEFT + / LINKS + **OPTION 1 / *OPSIE 1***

5 kg:

$$\left.\begin{aligned} F_{net} &= ma \\ T + (-f) + (-F_H) &= ma \\ T - \mu_k F_N - Fcos\theta &= ma \end{aligned}\right\} \checkmark \text{ Any one}$$

$$\underline{T - 0{,}2 \times 27{,}87 - 50cos25°\checkmark} = \underline{5 \times 3\checkmark}$$
$$T = 65{,}8894\ N$$

X:

$$F_{net} = ma$$
$$F_g + (-T) = ma$$
$$m \times g - T = ma$$
$$\underline{X \times 9{,}8 - 65{,}8894\checkmark} = \underline{X \times 3\checkmark}$$
$$X = 9{,}69\ kg\checkmark$$

LEFT + / LINKS + **OPTION 2 / *OPSIE 2***

5 kg:

$$\left.\begin{aligned} F_{net} &= ma \\ T + (-f) + (-F_H) &= ma \\ T - \mu_k F_N - Fcos\theta &= ma \end{aligned}\right\} \checkmark \text{ Any one}$$

$$\underline{T - 0{,}2 \times 27{,}87 - 50cos25°\checkmark} = \underline{5 \times 3\checkmark} \quad .....(1)$$

X:

$$F_{net} = ma$$
$$F_g + (-T) = ma$$
$$m \times g - T = ma$$
$$\underline{X \times 9{,}8 - T\checkmark} = \underline{X \times 3\checkmark} \quad .....(2)$$

(1) + (2): $-5{,}574 - 45{,}315 + 9{,}8X = 15 + 3X$
$X = 9{,}69\ kg\ \checkmark$

LEFT: - / *LINKS: -* **OPTION 3 / *OPSIE 3***

5 kg:

$$F_{net} = ma$$
$$-T + (f) + (F_H) = -ma$$
$$-T + \mu_k F_N + F\cos\theta = -ma$$ ✓ Any one

$$\underline{-T + 0{,}2 \times 27{,}87 + 50\cos 25°}\checkmark = \underline{5 \times -3}\checkmark$$

$$T = 65{,}88938\ N$$

X:

$$F_{net} = ma$$
$$-F_g + (T) = -ma$$
$$m \times -g + T = -ma$$
$$\underline{X \times -9{,}8 + 65{,}88938}\checkmark = \underline{X \times -3}\checkmark$$
$$X = 9{,}69\ kg\checkmark$$

(6)

3.4 Decreases✓ Verminder
If Θ increase, F_N decreases ✓ As Θ toeneem, word F_N kleiner
$f \propto F_N$ / $f_k = \mu_k F_N$✓ $f \propto F_N$ / $f_k = \mu_k F_N$ (3)

[19]

QUESTION 4 / *VRAAG 4*

4.1 Each body in the universe attracts every other body with a 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 krag wat direk eweredig is aan die produk van hulle massas en omgekeerd eweredig is aan die kwadraat van die afstand tussen hulle middelpunte. (2)

4.2 4027,88 N✓ (1)

4.3 When object A exerts a force on object B, object B SIMULTANEOUSLY exerts an oppositely directed force ✓ of equal magnitude on object A.✓
OR
When the satellite exerts a force on earth, earth SIMULTANEOUSLY exerts an oppositely directed force of equal magnitude on the satellite.

Wanneer voorwerp A 'n krag op voorwerp B uitoefen, oefen voorwerp B GELYKTYDIG 'n krag van gelyke grootte in die teenoorgestelde rigting op voorwerp A uit.
OF
Wanneer die satelliet 'n krag op die aarde uitoefen, oefen die aarde GELYKTYDIG 'n krag van gelyke grootte in die teenoorgestelde rigting op die satelliet uit. (2)

4.4 **OPTION 1 / *OPSIE 1***

$$F = \frac{GM_1M_2}{r^2} \checkmark$$
$$4\,027{,}88 \checkmark = \frac{6{,}67 \times 10^{-11} \times 550 \times 5{,}98 \times 10^{24} \checkmark}{(6{,}38 \times 10^6 + h)^2 \checkmark}$$
$$h = 1 \times 10^6 m$$
$$h = 1\,000\ km \checkmark$$

OPTION 2 / *OPSIE 3*

$$F = \frac{GM_1M_2}{r^2} \checkmark$$
$$4\,027{,}88 \checkmark = \frac{6{,}67 \times 10^{-11} \times 550 \times 5{,}98 \times 10^{24} \checkmark}{r^2}$$
$$r = 7{,}38 \times 10^6 m$$
$$r = R_E + h$$
$$7{,}38 \times 10^6 m = 6{,}38 \times 10^6 m + h \checkmark$$
$$h = 1{,}0 \times 10^6 m$$
$$h = 1\,000\ km \checkmark$$

(5)
[10]

QUESTION 5 / *VRAAG 5*

5.1 Negative/*Negatief* ✓ (1)

5.2 Up/Op ✓ (1)

5.3 The magnitude of the electrostatic forces exerted by two point charges on each other is directly proportional to the product of the (magnitudes of the) charges and inversely proportional to the square of the distance between them. ✓✓

Die grootte van die elektrostatiese kragte wat deur twee puntladings op mekaar uitgeoefen word, is direk eweredig aan die produk van die (grootte van die) ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. (2)

5.4

$$F_{XZ} = \frac{kQ_XQ_Z}{r^2} \checkmark$$
$$= \frac{9 \times 10^9 \times 3 \times 10^{-6} \times 2 \times 10^{-6}}{(1)^2} \checkmark$$
$$= 5{,}4 \times 10^{-2} N$$

$$F_{net}^2 = F_{XZ}^2 + F_{YZ}^2$$
$$\underline{(5{,}85 \times 10^{-2})^2 = (5{,}4 \times 10^{-2})^2 + F_{YZ}^2 \checkmark}$$

$$F_{YZ}^2 = 5{,}0625 \times 10^{-4}$$

$$F_{YZ} = 2{,}25 \times 10^{-2} N$$

$$F_{YZ} = \frac{kQ_YQ_Z}{r^2}$$
$$2{,}25 \times 10^{-2} \checkmark = \frac{9 \times 10^9 \times 5 \times 10^{-6} \times 2 \times 10^{-6}}{(d)^2} \checkmark$$
$$d = 2\ m \checkmark$$

(6)

5.5

Option 1 / *Opsie 1*

$$E_{net} = \frac{F_{net}}{Q} \checkmark$$
$$= \frac{5{,}85 \times 10^{-2}}{2 \times 10^{-6}} \checkmark$$
$$E_{net} = 2{,}925 \times 10^4 N \cdot C^{-1} \checkmark$$

Option 2 / *Opsie 2*

$$E_Y = \frac{kQ}{r^2}$$
$$= \frac{(9x10^9)(5x10^{-6})}{2^2}$$
$$= 11\,250\ N \cdot C^{-1}$$

$$E_X = \frac{kQ}{r^2}$$
$$= \frac{(9x10^9)(3x10^{-6})}{1^2}$$
$$= 27\,000\ N \cdot C^{-1}$$

$$E_{net}^2 = 27\,000^2 + 11\,250^2$$
$$E_{net} = 2{,}93x10^4\ N \cdot C^{-1}$$

(3)
[13]

QUESTION 6 / *VRAAG 6*

6.1 No reading (deflection) on the galvanometer. ✓
An emf is only induced when there is a change in magnetic flux linkage ✓ when the coil and magnet move relative to each other.

Geen lesing (uitwyking) op die galvanometer nie.
'n Emk word slegs geïnduseer as daar 'n verandering in die magnetiese vloedkoppeling is wanneer die spoel en magneet relatief tot mekaar beweeg. (2)

6.2 South/S ✓ Suid/S (1)

6.3 Right-hand rule ✓ *Regterhandreël* (1)

6.4 b to/*na* a✓ (2)
[6]

QUESTION 7 / *VRAAG 7*

7.1.1 The rate at which work is done / energy is transferred. ✓✓
Die tempo waarteen arbeid verrig / energie oorgedra word. (2)

7.1.2 **OPTION 1 / *OPSIE 1***

$V_X = V_Y$ ✓
From/*Van*: P = VI **OR/*OF*** P α I ✓
$I_X < I_Y$ ✓

$P_X < P_Y$
Y is brighter.
Y is die helderste. ✓

OPTION 2 / *OPSIE 2*

$V_X = V_Y$ ✓
From/*Van*: $P = \frac{V^2}{R}$ **OR/*OF*** $P \propto \frac{1}{R}$ ✓
$R_X > R_Y$ ✓

$P_X < P_Y$
Y is brighter.
Y is die helderste. ✓

(4)

7.2.1 The potential difference across a conductor is directly proportional to the current✓ in the conductor at constant temperature. ✓
Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur. (2)

7.2.2 $P = VI$✓
$30 = 10 \times I$✓
$I = 3\ A$✓ (3)

7.2.3 5 V✓ (1)

7.2.4 **POSITIVE MARKING FROM 7.2.2 and 7.2.3.**
POSITIEWE NASIEN VANAF 7.2.2 en 7.2.3.

OPTION 1 / *OPSIE 1*

$V_p = IR_p$✓
$5 = 3 \times R_p$✓
$R_p = 1{,}667\ \Omega$

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓
$\frac{1}{1{,}667} = \frac{1}{R+R} + \frac{1}{R}$✓
$R = 2{,}5\ \Omega$ ✓

OPTION 2 / *OPSIE 2*

$V_t = IR_t$✓
$15 = 3 \times R_t$✓
$R_t = 5\ \Omega$

$P = I^2 R_{bulb;lamp}$
$30 = 3^2 \times R_{bulb}$
$R_{bulb;lamp} = 3{,}3333\ \Omega$

$R_p = R_t - R_{bulb;lamp}$
$R_p = 1{,}667\ \Omega$

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓
$\frac{1}{1{,}667} = \frac{1}{R+R} + \frac{1}{R}$✓
$R = 2{,}5\ \Omega$ ✓

(5)
[17]

GRAND TOTAL / *GROOTTOTAAL*: 100