education

Department of Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

GRADE 12/*GRAAD 12*

PHYSICAL SCIENCES P1 (PHYSICS)
FISIESE WETENSKAPPE V1 (FISIKA)

SEPTEMBER 2016

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 14 pages.
Hierdie memorandum bestaan uit 14 bladsye.

QUESTION 1/*VRAAG 1*

1.1 C ✓✓ (2)

1.2 C ✓✓ (2)

1.3 C ✓✓ (2)

1.4 C ✓✓ (2)

1.5 C✓✓ (2)

1.6 B ✓✓ (2)

1.7 D ✓✓ (2)

1.8 B ✓✓ (2)

1.9 A ✓✓ (2)

1.10 B ✓✓ (2)
[20]

QUESTION 2/*VRAAG 2*

2.1 It is the force that opposes the motion of an object✓ and which acts parallel to the surface✓
Dit is die krag wat die beweging van 'n voorwerp teenstaan en wat parallel met die oppervlak inwerk. (2)

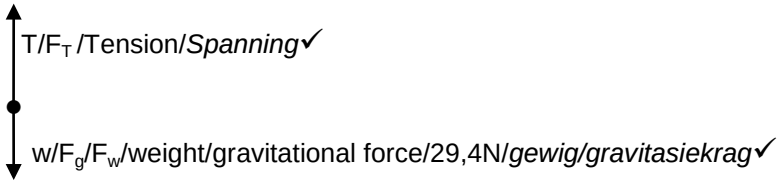
2.2.1 $\tan 20^o = \frac{F_v}{F_H}$
$F_v = (\tan 20^o)(38)$✓
$= 13{,}83$ N✓ (2)

2.2.2 **POSITIVE MARKING FROM 2.2.1**
POSITIEWE NASIEN VANAF 2.2.1

$F_N = F_g - F_v$
$= (5)(9{,}8)$✓ $- 13{,}83$✓
$= 35{,}17$ N✓ (3)

2.3 When a resultant force acts on an object the object will accelerate in the direction of the force at acceleration directly proportional to the force✓ and inversely proportional to the mass of the object.✓
Indien 'n resulterende krag op 'n voorwerp inwerk sal die voorwerp in die rigting van die krag versnel met 'n versnelling direk eweredig aan die grootte van die krag en omgekeerd eweredig aan die massa van die voorwerp. (2)

2.4



(2)

2.5 **POSITIVE MARKING FROM 2.2.2**
POSITIEWE NASIEN VANAF 2.2.2

Option 1/*Opsie 1*
Left/upwards as positive:/ Links*/opwaarts as positief*

5 kg block: $F_{net} = ma$✓
$-T + F_H - f = ma$
$-T + 38 - (0,2)(35,17)$ ✓ $= 5a$✓ [1]

3 kg block : $-F_g + T = ma$
$-(3)(9,8) + T = 3a$✓ [2]

Substitute 2 into 1:
$a = 0,196\ m \cdot s^{-2}$
Substitute a into 2:
$-29,4 + T = (3)(0,196)$ ✓
$T = 29,99\ N$✓

Option 2/*Opsie 2*
Right/downwards as positive:/ *Regs/afwaarts as positief*

5 kg block: $F_{net} = ma$✓
$T - F_H + f = ma$
$T - 38 + (0,2)(35,17)$ ✓ $= -5a$✓ [1]

3 kg block : $F_g - T = ma$
$(3)(9,8) - T = -3a$✓ [2]

Substitute 2 into 1:
$a = 0,196\ m \cdot s^{-2}$
Substitute a into 2:
$29,4 - T = -(3)(0,196)$ ✓
$T = 29,99\ N$✓

(6)
[17]

QUESTION 3/*VRAAG 3*

3.1 The motion of an object if the only force acting on it is the force of gravity.✓
Die beweging van 'n voorwerp indien die enigste krag wat daarop inwerk gravitasiekrag is. (1)

3.2 9,8 $m \cdot s^{-2}$ Downwards✓/ *9,8 $m \cdot s^{-2}$ Afwaarts* (1)

3.3

Upwards positive/*Opwaarts positief:*	**Downwards positive/Af*waarts positief:***
$v_f = v_i + a\Delta t$ ✓ -20 ✓= 20 + (-9,8)(Δt) ✓ Δt = 4,08 s✓	$v_f = v_i + a\Delta t$ ✓ 20✓ = -20 + (9,8)(Δt) ✓ Δt = 4,08 s✓

(4)

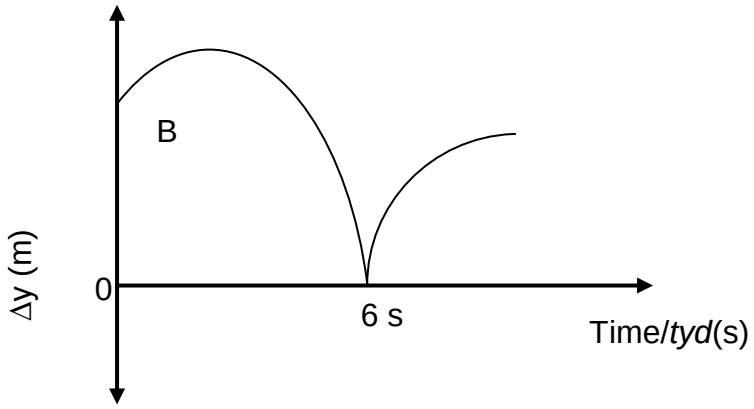
3.4

Upwards positive/*Opwaarts positief:*	**Downwards positive/Af*waarts positief:***
Height of cliff: $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ = 20(6) + ½(-9,8)$(6)^2$✓ = - 56,4 m Height /Hoogte= 56,4 m Ball B: $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ = 20(2,8) + ½(-9,8)$(2,8)^2$✓ = 17,584 m Distance = 56,4 + 17,584✓ = 73,98 m ✓	Height of cliff: $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ = -20(6) + ½(9,8)$(6)^2$✓ = 56,4 m Height /Hoogte= 56,4 m Ball B: $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ = -20(2,8) + ½(9,8)$(2,8)^2$✓ = -17,584 m Distance = 56,4 + 17,584✓ = 73,98 m ✓

(5)

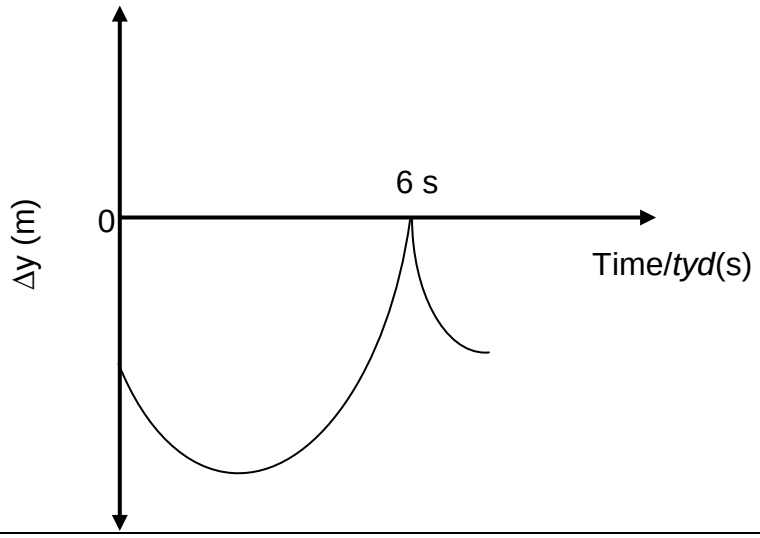
OPTION 1/*OPSIE 1*
Upwards positive/*Opwaarts positief:*

3.5



Criteria for graph/*Kriteria vir grafiek:*	**Marks/ *Punte***
Shape till the ball reaches the ground. *Vorm totdat die bal grond bereik.*	✓
Zero position at 6 s. *Zero posisie by 6s.*	✓
Shape for bounce up till maximum height. *Vorm vir bons tot by maksimum hoogte.*	✓
Ground not zero position (provided everything else is correct): $^2/_3$ *Grond nie zero posisie nie (op voorwaarde die res is korrek) :* $^2/_3$	(3)

<u>OPTION 2/*OPSIE 2*</u>
Upwards negative/ *Opwaarts negatief:*



Criteria for graph/*Kriteria vir grafiek:*	**Marks/ *Punte***
Shape till the ball reaches the ground. *Vorm totdat die bal grond bereik.*	✓
Zero position at 6 s. *Zero posisie by 6s.*	✓
Shape for bounce up till maximum height. *Vorm vir bons tot by maksimum hoogte.*	✓
Ground not zero position (provided everything else is correct): $^2/_3$ *Grond nie zero posisie nie (op voorwaarde die res is korrek) :* $^2/_3$	(3)

[14]

QUESTION 4/*VRAAG 4*

4.1 Impulse is the product of the net force✓ acting on an object and the time the force is acting on the object. ✓
Impuls is die produk van die netto krag wat op 'n voorwerp inwerk en die tyd wat die krag op die voorwerp inwerk.

OR

Impulse is the change in momentum✓✓ of an object.
Impuls is die verandering in die momentum van 'n voorwerp. (2)

4.2 $\Sigma p_{before} = \Sigma p_{after}$ ✓
$(0,04)(800) = (8,04)v_f$ ✓
$v_f = 3,98\ m\cdot s^{-1}$
$\Delta p = m(v_f - v_i)$
$= 8\ (3,98 - 0)$ ✓
$= 31,84\ kg\cdot m\cdot s^{-1}$✓, to the right/east✓/*na regs/oos*
(5)

4.3 **POSITIVE MARKING FROM 4.2**
POSITIEWE NASIEN VANAF 4.2

OPTION 1/*OPSIE 1*
$W_{net} = \Delta K$ ✓
$f\Delta x\cos\Theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
$f(4)\cos180^0$ ✓$= \frac{1}{2}(8,04)0 - \frac{1}{2}(8,04)(3,98)^2$✓
$f = 15,92\ N$✓

OPTION 2/*OPSIE 2*
$W_{nc} = \Delta U + \Delta K$ ✓
$f(4)\cos180^0$ ✓$= 0 + \frac{1}{2}(8,04)0 - \frac{1}{2}(8,04)(3,98)^2$✓
$f = 15,92\ N$✓ (4)
[11]

QUESTION 5/*VRAAG 5*

5.1 The force which a surface excerts on an object with which it is in contact✓ and which is perpendicular to the surface.✓
Die krag wat 'n oppervlak uitoefen op 'n voorwerp waarmee dit in kontak is en wat loodreg op die voorwerp is. (2)

5.2 $F_{net} = ma$ ✓
$F_{applied} - F_{g//} = ma$ ✓
$600✓ - m(9,8)(\sin 25^0)$ ✓ $= 0✓$
$m = 144,87$ kg✓ (5)

5.3 Total mechanical energy in a closed system✓ remains constant. ✓
Totale meganiese energie in 'n geslote sisteem bly konstant. (2)

5.4.1 **POSITIVE MARKING FROM 5.2/*POSITIEWE NASIEN VANAF 5.2***

OPTION 1/ *OPSIE 1*
$(E_p + E_k)_X = (E_p + E_k)_B$✓
$(144,87)(9,8)h$ ✓ $+ 0 = 0 + ½(144,87)(6)^2$✓
$h = 1,84$ m✓

OPTION 2/ *OPSIE 2*
$W_{nc} = \Delta U + \Delta K$ ✓/ $W_{nc} = \Delta E_p + \Delta E_k$
$0 = \underline{0 - (144,87)(9,8)(5)h}$ ✓ $+ \underline{½(144,87)(6)^2 - 0}$✓
$h = 1,84$ m✓ (4)

5.4.2 **POSITIVE MARKING FROM 5.2/*POSITIEWE NASIEN VANAF 5.2***

OPTION 1/ *OPSIE 1*
$W_{net} = \Delta K$ ✓
$W_f = \Delta K$
$\mu_k(144,87)(9,8)$✓$(5)\cos 180^0$✓$= ½(144,87)2^2 - ½(144,87)(6^2)$ ✓
$\mu_k = 0,33$ ✓

OPTION 2/ *OPSIE 2*
$W_{nc} = \Delta U + \Delta K$ ✓
$W_f = \Delta U + \Delta K$
$\mu_k(144,87)(9,8)$✓$(5)\cos 180^0$✓$= 0 + ½(144,87)2^2 - ½(144,87)(6^2)$ ✓
$\mu_k = 0,33$ ✓ (5)

[18]

QUESTION 6/*VRAAG 6*

6.1.1 The (apparent) change in the frequency/pitch of the sound detected✓ by a listener because the sound source and listener have different velocities relative to the medium of sound propagation.✓
Dit is die (skynbare) verandering in die frekwensie/toonhoogte van die klank waargeneem deur deur die luisteraar omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium waarin die klank voortgeplant word, het. (2)

6.1.2 B. ✓There is an increase in the detected/observed frequency✓by the listener.
B. Daar is 'n toename in die waargenome frekwensie deur die luisteraar. (2)

6.1.3

$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ **OR** $f_L = \frac{v - v_L}{v} f_s$ ✓ **OR/OF** $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ **OR**

$f_L = \frac{v + v_L}{v} f_s$ ✓ ✓

$620 = \frac{340 - v}{340}$ ✓ 0 ✓ $680 = \frac{340 + v_L}{340} 650$ ✓

✓

$v_L = 15{,}69\ m.s^{-1}$ ✓ $v_L = 15{,}69\ m.s^{-1}$ ✓

(5)

6.1.4 The listener is moving towards the source with a constant accelaration/constant increase in velocity. ✓✓
Die luisteraar nader die bron met 'n konstante versnelling/konstante toename in snelheid. (2)

6.1.5 Measurement of foetal heart beat.✓OR
Measurement and monitoring of blood flow.
Meting van hartklop van fetus. OF
Meting en waarneming van bloedvloei. (1)

[12]

QUESTION 7/VRAAG 7

7.1 The magnitude of the electrostatic force exerted by one point charge on another point charge is directly proportional to the product of the magnitude of the charges✓ and inversely proportional to the square of the distance between them. ✓

Die grootte van die elektrostatiese krag uitgeoefen deur een puntlading op 'n ander puntlading is direk eweredig aan die produk van die grootte van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen die ladings. (2)

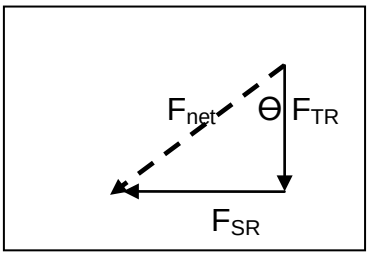
7.2 $\text{Net Charge/netto lading} = \frac{Q_R + Q_S}{2} = \frac{-6+2}{2} = -2\,\mu C$ or $(-2 \times 10^{-6} C)$ ✓

(1)

7.3 **POSITIVE MARKING FROM 7.2/*POSITIEWE NASIEN VANAF 7.2***

$$F_{SR} = \frac{kQ_RQ_S}{r^2} \checkmark$$
$$= \frac{9\times10^9 \times 2\times10^{-6} \times 2\times10^{-6}}{0,2^2} \checkmark$$
$$= 0,9 \text{ N}$$
$$F_{TR} = \frac{kQ_RQ_T}{r^2}$$
$$= \frac{9\times10^9 \times 2\times10^{-6} \times 4\times10^{-6}}{0,3^2} \checkmark$$
$$= 0,8 \text{ N}$$

$F_{net}^2 = F_{SR}^2 + F_{TR}^2$
$= (0,9)^2 + (0,8)^2$ ✓
$F_{net} = 1,20$ N



$\text{Tan } \Theta = \frac{0,9}{0,8}$ ✓
$\Theta = 48,37^o$
$\therefore F_{net} = 1,20$ N✓, $228,37^o$/$48,37^o$ West of South/ $41,63^o$ downwards from negative x-axis✓/*$48,37^o$ Wes van Suid*/*$41,63^o$ afwaarts van negatiewe x-as*

(7)
[10]

QUESTION 8/*VRAAG 8*

8.1.1 To change/vary the external resistance✓in the circuit in order to change/vary the (total) current✓ through the battery.

Om die eksterne weerstand in die stroombaan te verander/varieer om sodoende die (totale) stroom deur die battery te verander/varieer. (2)

8.1.2 Current✓/ *stroom* (1)

8.1.3 6V✓ (1)

8.1.4 $V_i = 6 - 2$ ✓$= 4V$✓ (2)

8.2.1 It is an indication of the maximum amount of energy✓given per colomb of charge passing through the battery. ✓

Dit is 'n aanduiding van die maksimum hoeveelheid energie wat aan elke coulomb lading gegee word wat deur die battery beweeg. (2)

8.2.2 $P = VI$✓
$12 = V(2)$✓
$V_{12W} = 6$ V

$V_{6\Omega} = IR$
$= (2)(6)$✓
$= 12$V
$V_p = 12 + 6 = 18$ V

$$P = \frac{V^2}{R}$$
$$12 = \frac{6^2}{R}$$ ✓
$R_{12W} = 3\ \Omega$

RATIO: $R_{9\Omega} : R_{6\Omega}$
3 : 2
$I_{9\Omega} : I_{6\Omega}$
2 : 3 ✓
$I_{6\Omega} = 3$ A

$I_{6\Omega} = V/R$
$= 18/6$
$= 3$ A ✓

$I_t = 3 + 2$✓ $= 5$ A

OR

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$
$$= \frac{1}{9} + \frac{1}{6}$$ ✓
$R_P = 3{,}6$
$$I_{9\Omega} = \frac{R_P}{R} I$$
$$2 = \frac{3{,}6}{9} I$$ ✓
$I = 5$ A

$V_s = IR$
$= (5)(2)$ ✓$= 10$ V
$V_{ekst} = V_p + V_s$
$= 18 + 10$
$= 28$ V✓ (8)

8.2.3 **POSITIVE MARKING FROM 8.2.2**
POSITIEWE NASIEN VANAF 8.2.2

OPTION 1/ *OPSIE 1*

$$r_i = \frac{V_i}{I} \quad \checkmark$$
$$= \frac{30 - 28}{5} \checkmark$$
$$I = 0{,}4\ A \checkmark$$

OPTION 2/ *OPSIE 2*

emf/*emk* (ε) = I(R + r) ✓
30 = 5(5,6 + r) ✓
r = 0,4 Ω✓

(3)

8.2.4 Increase✓
Total resistance in circuit increase and the total current decrease. ✓
$V_{internal}$ will decrease. ✓
Therefore: $V_{external}$ will increase because emf stays constant. ✓

Toeneem
Totale weerstand in stroombaan neem toe en die totale stroom neem af.
V_{intern} sal afneem.
Dus: *$V_{ekstern}$ sal toeneem omdat die emk konstant bly.*

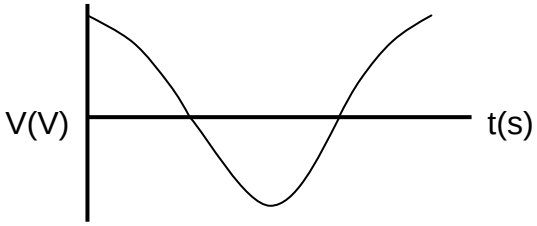
(4)
[23]

QUESTION 9/*VRAAG 9*

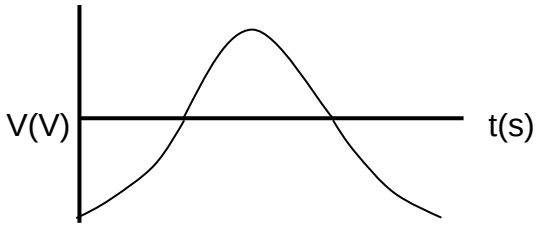
9.1.1 Anticlockwise✓/*anti-kloksgewys* (1)

9.1.2 The rate of change in the magnetic flux✓ is a maximum ✓at this position.
D*ie tempo van verandering in die magnetiese vloed is 'n maksimum by hierdie posisie .* (2)

9.1.3 **OPTION 1/*OPSIE 1***



OPTION 2/*OPSIE 2*



(2)

Criteria for graph/*Kriteria vir grafiek:*	**Marks/ *Punte***
Shape for one complete rotation of coil. *Vorm vir een volledige rotasie van spoel.*	✓
Starting at maximum/minimum emf value. *Begin by maksimum/minimum waarde van emk.*	✓
	(2)

9.1.4 Increase the rotation speed of the coil. ✓
Verhoog die rotasiespoed van die spoel. (1)

9.1.5 Electrical energy can be transmitted over long distances (with the use of transformers). ✓ OR
The voltage can easily be adapted for different needs (by means of transformers.)

Elektriese energie kan oor lang afstande oorgedra word (m.b.v. transformators) OF
Die spanning kan maklik aangepas word vir verskillende behoeftes (m.b.v. transformators.) (1)

9.2

$$I_{rms} = \frac{I_{max}}{\sqrt{2}} \checkmark$$
$$= \frac{7}{\sqrt{2}} \checkmark$$
$$I_{rms} = 4,95 \text{ A}$$

$$P_{ave} = I^2_{rms}R \checkmark$$
$$\underline{80 = 4,95^2(R)} \checkmark$$
$$R = 3,26 \text{ A} \checkmark$$

(5)
[12]

QUESTION 10/VRAAG 10

10.1 The process wereby electrons are ejected from the surface of a metal✓ when irradiated by light✓ of a suitable frequency.
Die proses waardeur elektrone uit 'n metaaloppervlak vrygestel word wanneer lig van geskikte frekwensie invallend op die oppervlak is. (2)

10.2

OPTION 1/*OPSIE 1*

$$\left.\begin{array}{l} E = W_o + E_{k(max)} \\ h\frac{c}{\lambda} = hf_o + \frac{1}{2}mv^2 \end{array}\right\} \checkmark$$

$$\frac{6,63 \times 10^{-34} \times 3 \times 10^8}{\lambda} = 6,63 \times 10^{-34}(6,45 \times 10^{14}) \checkmark + \frac{1}{2}(9,11 \times 10^{-31})(2,78 \times 10^5)^2 \checkmark$$

$$\lambda = 4,30 \times 10^{-7} \text{ m·s}^{-1} \checkmark$$

Ultaviolet✓ light is used/ *Ultaviolet lig is gebruik*

(5)

10.3.1 Increase/*Verhoog* (1)

10.3.2 Stays the same/*Bly dieselfde* (1)

10.3.3 The intensity of the light only has an influence on the number of photo electrons emitted per time unit. ✓
The intensity of the light has no influence on the kinetic energy of the photo electrons. ✓
OR
Only the frequency of the light has an influence on the energy of the photon and the kinetic energy of the photoelectron.
The frequency of the photons stay the same.

Die intensitiet van lig het slegs 'n invloed op die aantal foto-elektrone wat per tydeenheid vrygestel word.
Die intensitiet van lig het geen invloed op die kinetiese energie van die foto-elektrone nie.
OF
Slegs die frekwensie van die lig het 'n invloed op die energie van die foton en die kinetiese energie van die fotoelektron.
Die frekwensie van die fotone bly dieselfde. (2)

10.4 Electrons from atoms in the excited state fall back to the ground state/lower energy state.✓Energy is radiated as light.✓
Elektrone van atome in die opgewekte toestand val terug na die grondtoestand/laer energietoestand. Energie word uitgestraal as lig. (2)
[13]

GRAND TOTAL/*GROOTTOTAAL:* 150