education

Department of Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

GRADE 12/*GRAAD 12*

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

SEPTEMBER 2015

MEMORANDUM

MARKS/*PUNTE*: 150

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

SECTION A/*AFDELING A*

QUESTION 1/*VRAAG 1*

1.1 D ✓✓ (2)

1.2 C ✓✓ (2)

1.3 A ✓✓ (2)

1.4 D ✓✓ (2)

1.5 C✓✓ (2)

1.6 B ✓✓ (2)

1.7 C✓✓ (2)

1.8 B ✓✓ (2)

1.9 B ✓✓ (2)

1.10 B ✓✓ (2)

[20]

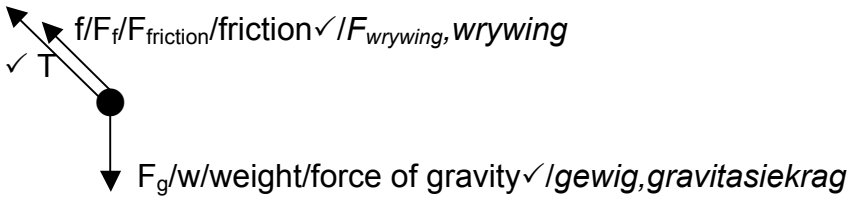
TOTAL SECTION A/*TOTAAL AFDELING A*: 20

SECTION B/*AFDELING B*

QUESTION 2/*VRAAG 2*

2.1 The force that opposes the motion✓ of an object and which act parallel to the surface✓
Die krag wat die beweging van 'n voorwerp teenstaan en parallel aan die oppervlak inwerk. (2)

2.2



(3)

2.3.1 $f_{k(max)} = \mu_k F_N$✓
$= \underline{0,15(3)(9,8)}(\cos 30^0)$✓
$= 3,82$ N✓ (3)

2.3.2 **Positive marking from 2.3.1/ *Positiewe merk van 2.3.1***
Right/downwards as positive:/ *Regs/afwaarts as positief*

5 kg block: $F_{net} = ma$ ✓
$T + f = ma$
$\underline{T - (8) = 5a}$✓ 1

3 kg block : $T + f + F_{g//} = ma$
$\underline{-T - 3,82 + (3)(9,8)\sin 30^o}$ ✓$= 3a$✓ 2
$-T + 10,88 = 3a$
Substitute 2 into 1:
$a = 0,36\ m\cdot s^{-2}$
Substitute a into 1:
$T - 8 = (5)(0,36)$ ✓
$T = 9,8$ N✓ (6)
[14]

QUESTION 3/*VRAAG 3*

3.1 Downwards/*Afwaarts*✓ (1)

3.2

Upwards positive/*Opwaarts positief:*	**Downwards positive/Af*waarts positief:***
$v_f = v_i + a\Delta t$ ✓ = 30✓ + (-9,8)(2,135) = 9,08 m·s^{-1}, upwards✓	$v_f = v_i + a\Delta t$ ✓ = - 30✓ + (9,8)(2,135) = - 9,078 m·s^{-1} = 9,08 m·s^{-1}, upwards ✓

(3)

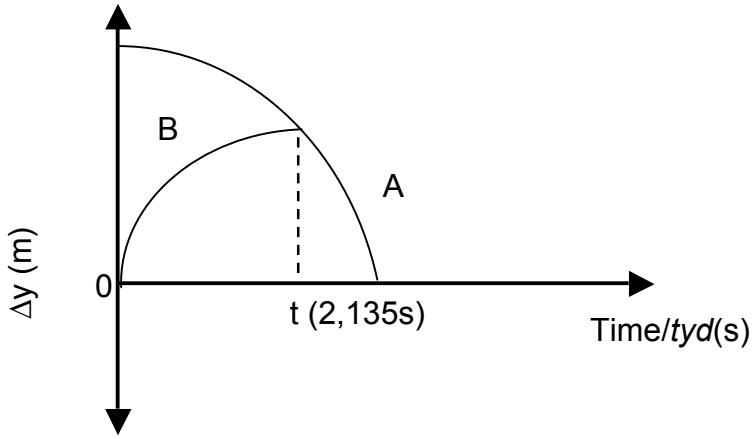
3.3

Upwards positive/*Opwaarts positief:*	**Downwards positive/Af*waarts positief:***
Ball A: $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ = -12(2,5) + ½(-9,8)(2,5)^2✓ = - 60,625 m (Height /Hoogte= 19,375 m) Ball B: $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ = 30(2,5) ✓ + ½(-9,8)(2,5)^2✓ = 44,375 m Distance = 44,375 - 19,375✓ = 25 m ✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ = 12(2,5) + ½(9,8)(2,5)^2✓ = 60,625 m (Height /Hoogte= 19,375 m) Ball B: $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ = -30(2,5) ✓ + ½(9,8)(2,5)^2✓ = - 44,375 m Distance = 44,375 - 19,375✓ = 25 m✓

(6)

3.4 **OPTION 1/*OPSIE 1***

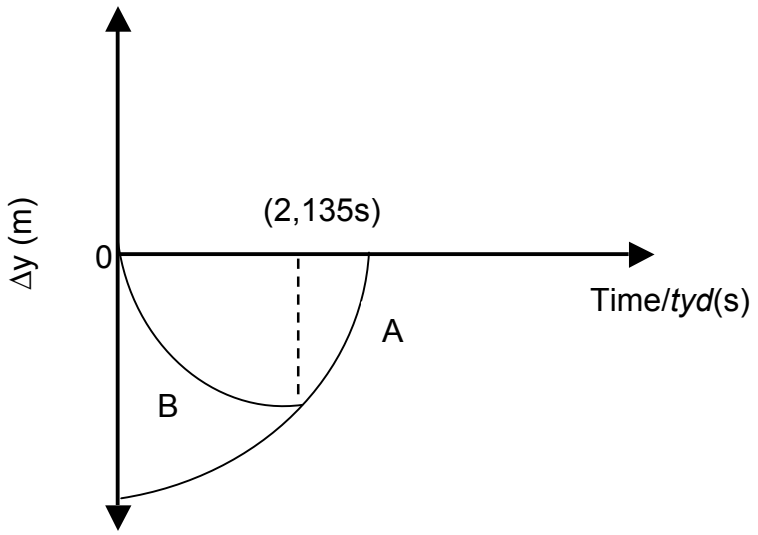
Upwards positive/*Opwaarts positief:*



Criteria for graph/*Kriteria vir grafiek:*	**Marks/ *Punte***
Shape for ball A up till zero position. *Vorm vir bal A tot zero posisie.*	✓
Shape for ball B up till intersection of lines time. *Vorm vir bal B tot grafieklyne kruis.* 2,135 s.	✓
Indication of time 2,135 s. *Aanduiding van tyd 2,135 s.*	✓
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)

OPTION 2/*OPSIE 2*

Upwards negative/ *Opwaarts negatief:*



Criteria for graph/*Kriteria vir grafiek:*	**Marks/ *Punte***
Shape for ball A up till zero position. *Vorm vir bal A tot zero posisie.*	✓
Shape for ball B up till intersection of lines time. *Vorm vir bal B tot grafieklyne kruis.* 2,135 s.	✓
Indication of time 2,135 s. *Aanduiding van tyd 2,135 s.*	✓
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)

[13]

QUESTION 4/*VRAAG 4*

4.1 The total linear momentum of a closed system✓ remains constant ✓

Die totale linieëre momentum in 'n geslote sisteem bly konstant (2)

4.2 The kinetic energy remains constant. ✓ OR
The kinetic energy before the collision equals kinetic energy after the collision.

Die kinetiese energie bly konstant. OF Die kinetiese energie voor botsing is gelyk aan die kinetiese energie na botsing. (1)

4.3 $\Sigma p_{before} = \Sigma p_{after}$ ✓
$(5)(4) = (6,5)v_f$ ✓
$v_f = 3,077 \text{ m·s}^{-1}$
$\Delta p = m(v_f - v_i)$
$= 5 (3,077 – 4)$ ✓
$= - 4,62 \text{ kg·m·s}^{-1}$
$= 4,62 \text{ kg·m·s}^{-1}$✓, left/west/ opposite to direction of motion ✓
Links/wes/teenoorgesteld aan bewegingsrigting (5)
[8]

QUESTION 5/*VRAAG 5*

5.1.1 Backwards/behind him✓/*Terugwaarts/agter hom.* (1)

5.1.2 Newton's third Law✓of motion: When one body exerts a force on a second body, the second body exerts a force of equal magnitude✓ in the opposite direction on the first body. ✓

Newton se derde bewegingswet: Wanneer een liggaam 'n krag op 'n tweede liggaam uitoefen sal die tweede liggaam 'n krag van gelyke grootte in die teenoorgestelde rigting op die eerste liggaam uitoefen. (3)

5.1.3 **OPTION 1/ *OPSIE 1***

$W_{net} = \Delta K$ ✓
$W_g + W_f = \Delta K$
$F_g \Delta x \cos\Theta + f\Delta x \cos\Theta = \Delta K$
$(57)(9,8)(4)\cos180^o$ ✓ $+ 40\Delta x \cos180^o$ ✓ $= 0 - ½(57)(6^2)$ ✓
$\Delta x = -30,21$ m
$\sin\Theta = \frac{4}{30,21}$ ✓
$\Theta = 7,61^o$ ✓

OPTION 2/ *OPSIE 2*

$W_{nc} = \Delta U + \Delta K$ ✓/ $W_{nc} = \Delta E_p + \Delta E_k$
$40\Delta x \cos180^o$ ✓ $= \underline{(57)(9,8)(4) - (57)(9,8)(0)}$ ✓ $+ \underline{½(57)(0)^2 - ½(57)(6)^2}$ ✓
$\Delta x = -30,21$ m
$\sin\Theta = \frac{4}{30,21}$ ✓
$\Theta = 7.61^o$ ✓

(6)

5.2 **OPTION 1/ *OPSIE 1***

$W_{net} = \Delta K$ ✓
$W_T + W_g + W_f = \Delta K$
$(80)(5)(4)\cos0^o$ ✓ $+ (4)(9,8)\sin30^o$ ✓ $(5)\cos180^o$ ✓ $+ (15)(5)\cos180^o$ ✓ $=$
$½(4)v_f^2 - ½(4)(3^2)$ ✓
$v_f = 11,07$ m·s^{-1} ✓

OPTION 2/ *OPSIE 2*

$W_{nc} = \Delta U + \Delta K$ ✓
$W_T + W_f = \Delta U + \Delta K$
$(80)(5)(4)\cos0^o$ ✓ $+ (15)(5)\cos180^o$ ✓ $= \underline{(4)(9,8)(\sin30^o)(5)}$ ✓ $\underline{- (4)(9,8)(0)}$ ✓ $+$
$\underline{½(4)v_f^2 - ½(4)(3)^2}$ ✓
$v_f = 11,07$ m·s^{-1} ✓

(7)
[16]

QUESTION 6/*VRAAG 6*

6.1 Red shift implies that light emitted by stars shows a shift towards the lower frequencies✓ of the spectrum.
According to the Doppler effect this means that the source (star) is moving away from the observer. ✓

Rooiverskuiwing impliseer dat lig vrygestel deur sterre 'n verskuiwing na die laer frekwensies van die spektrum toon.
Volgens die Doppler effek dui dit daarop dat die bron (ster) weg van die waarnemer af beweeg. (2)

6.2.1 Away ✓ (from submarine)
The detected/observed frequency is lower than the actual frequency. ✓ (2)

Weg ✓ (van duikboot)
Die waargenome frekwensie is laer as die werklike frekwensie. ✓

6 2.2

OPTION 1/ *OPSIE 1*

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

$\frac{f_L}{f_S} = \frac{v}{v + v_s}$

✓ ✓

$0{,}985 = \frac{1470}{1470 + v_s}$ ✓

v_s = 22,39 m·s^{-1} ✓

OPTION 2/ *OPSIE 2*

f_L = (0,985) f_s
437 = (0,985) f_s
f_s = 443,655 Hz

$f_L = \frac{v}{v + v_s} f_s$ ✓

✓

$437 = \frac{1470}{1470 + v_s} 443{,}655$ ✓

✓

v_s = 22,39 m·s^{-1} ✓

(5)

6.2.2 To measure the velocity of blood flowing through blood vessels.✓
To scan a foetes.✓

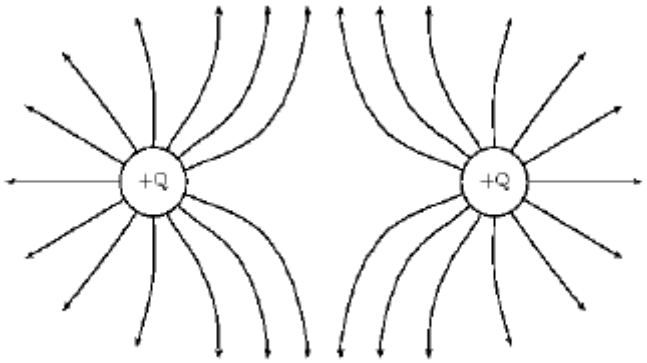
Om die snelheid van bloedvloei deur bloedvate te bepaal.
Om 'n fetus te skandeer. (2)
[11]

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



Criteria for field pattern/*Kriteria vir veldpatroon:*	**Marks/ *Punte***
Correct direction away from the spheres. *Korrekte vorm weg vanaf sphere.*	✓
Correct shape of field pattern. *Korrekte vorm vir veldpatroon.*	✓
Field lines not crossing/ not drawn inside the sphere *Veldlyne kruis nie/ nie binne-in spheer geteken.*	✓
	(3)

7.3

$$F_{ZY} = \frac{kQ_PQ_Q}{r^2} \checkmark$$

$$= \frac{9\times10^{9}\times6\times10^{-9}\times6\times10^{-9}}{0,2^2} \checkmark \checkmark$$

$$= 8,1 \times 10^{-6}\ N \checkmark$$ (4)

7.4

$$E_{net} = \frac{kQ_P}{r^2} \checkmark + \frac{kQ_Q}{r^2} + \frac{kQ_R}{r^2}$$

$$= \frac{9\times10^{9}\times6\times10^{-9}}{0,5^2} \checkmark + \frac{9\times10^{9}\times6\times10^{-9}}{0,3^2} \checkmark - \frac{9\times10^{9}\times2\times10^{-9}}{0,1^2} \checkmark$$

$$= -9,84 \times 10^{2}\ N.C^{-1}$$

$$= 9,84 \times 10^{2}\ N.C^{-1} \checkmark,\ \text{left} \checkmark \textit{links}$$ (6)

[15]

QUESTION 8/*VRAAG 8*

8.1.1 $V_i = (3,0 - 2,0) = 1,0\ V$ ✓✓ (2)

8.1.2
$$\text{Gradient} = \frac{\Delta I}{\Delta V} \checkmark$$
$$= \frac{0,4 - 0,6}{1 - 0} \checkmark$$
$$= -0,2\ \Omega^{-1}$$
$$r_i = 5\ \Omega \checkmark$$ (4)

8.2.1 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 deur die geleier by konstante temperatuur. (2)

8.2.2 $V_i = 24 - 22,5$
$= 1,5\ V$

$$r_i = \frac{V_i}{I} \checkmark$$
$$0,8 = \frac{1,5}{I} \checkmark$$
$$I = 1,875\ A$$
$$V_{3\Omega} = IR$$
$$= (1,875)(3) \checkmark$$
$$= 5,625\ V$$
$$V_{//} = V_{ext} - V_s$$
$$= 22,5 - 5,625 \checkmark$$
$$= 16,875\ V$$
$$P = \frac{V^2}{R} \checkmark$$
$$= \frac{16,875^2}{16} \checkmark$$
$$= 17,80\ W \checkmark$$ (7)

8.2.3 **Positive marking from 8.2.2/*Positiewe nasien van 8.2.2***

$$I = \frac{V_{//}}{R}$$

$$= \frac{16,875}{16} \checkmark$$

$= 1,055$ A

$I_R = 1,875 - 1,055 \checkmark$

$= 0,82$ A

$$R = \frac{V}{I}$$

$$= \frac{16,875}{0,82} \checkmark \checkmark$$

$= 16,06\ \Omega \checkmark$ (5)

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

Afneem
Totale weerstand in stroombaan neem af en die totale stroom neem toe.
V_{intern} sal toeneem.
Dus: *$V_{ekstern}$ sal afneem omdat die emk konstant bly.* (4)
[24]

QUESTION 9/*VRAAG 9*

9.1.1 Electromagnetic Induction✓/*elektromagnetiese induksie* (1)

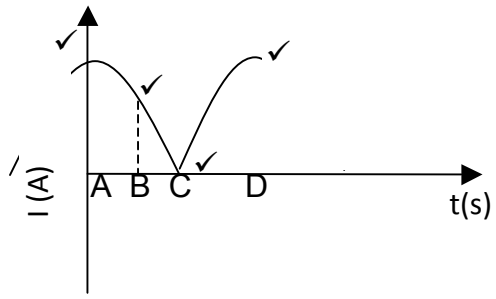
9.1.2 The rate of change in the magnetic flux✓ is a maximum✓ at position A.

D*ie tempo van verandering in die magnetiese vloed is 'n maksimum by punt A*. (2)

9.1.3 DC generator : split ring commutator✓
AC generator : slip rings✓

GS generator: splitring kommutator
WS generator: sleepringe (2)

9.1.4



(4)

9.2.1 18 V ✓ (1)

9.2.2 $P_{ave} = V_{rms}I_{rms}$ ✓
60 ✓ = 18(I_{rms}) ✓
(I_{rms}) = 3,33 A

$$I_{rms} = \frac{I_{max}}{\sqrt{2}}$$

$$3,33 = \frac{I_{max}}{\sqrt{2}} \checkmark$$

I_{max} = 4,71 A✓ (5)
[15]

QUESTION 10/*VRAAG 10*

10.1 The energy of the photons of red light is greater✓ than the work function of the metal in the photocell.✓OR
The frequency of red light is higher than the threshold/cut-off frequency of the metal in the photocell.

Die energie van die fotone van rooi lig is groter as die werksfunksie van die metaal in die fotosel.OF
Die frekwensie van rooi lig is groter as die drumpel/afsnyfrekwensie van die metaal in die fotosel. (2)

10.2.1 Increase✓/ *Neem toe* (1)

10.2.2 Stays the same ✓
The change in colour/frequency only has an influence on the kinetic energy of the photo electrons. ✓
Only the intensity of the light has an influence on the number of photo electrons emitted per time unit. ✓
The intensity of the light stays the same and therefore the number of photo electrons emitted per unit time /current stays the same. ✓ (4)

Bly dieselfde
Die verandering in kleur/frekwensie beïnvloed slegs die kinetiese energie van die foto-elektrone.
Slegs intensitiet van lig het 'n invloed op die aantal foto-elektrone wat per tydeenheid vrygestel word.
Die intensiteit van die lig het dieselfde gebly en daarom het die aantal foto-elektrone per tydeenheid/stroom konstant gebly.

10.3 **OPTION 1/*OPSIE 1***

$E = W_o + E_{k(max)}$ ✓

$h\frac{c}{\lambda} = hf_o + \frac{1}{2}mv^2$

$\frac{6,63 \times 10^{-34} \times 3 \times 10^8}{4,5 \times 10^{-7}}$ ✓ $= 6,63 \times 10^{-34}(f_o)$ ✓ $+ \frac{1}{2}(9,11 \times 10^{-31})(4,78 \times 10^5)^2$ ✓

$f_o = 5,10 \times 10^{14}$ Hz ✓

(6)

[13]

TOTAL SECTION B/*TOTAAL AFDELING B*: 130
GRAND TOTAL/*GROOTTOTAAL*: 150