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VOORBEREIDENDE EKSAMEN

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MARKING GUIDELINES
NASIENRIGLYNE

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PHYSICAL SCIENCES: PHYSICS (PAPER 1) /
FISIESE WETENSKAPPE*: *FISIKA (VRAESTEL 1)

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GAUTENG DEPARTMENT OF EDUCATION /
GAUTENGSE DEPARTEMENT VAN ONDERWYS

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PHYSICAL SCIENCE: PHYSICS /
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(Paper 1 / ***Vraestel 1*****)**

MARKING GUIDELINES /
NASIENRIGLYNE

QUESTION / ***VRAAG*** **1**

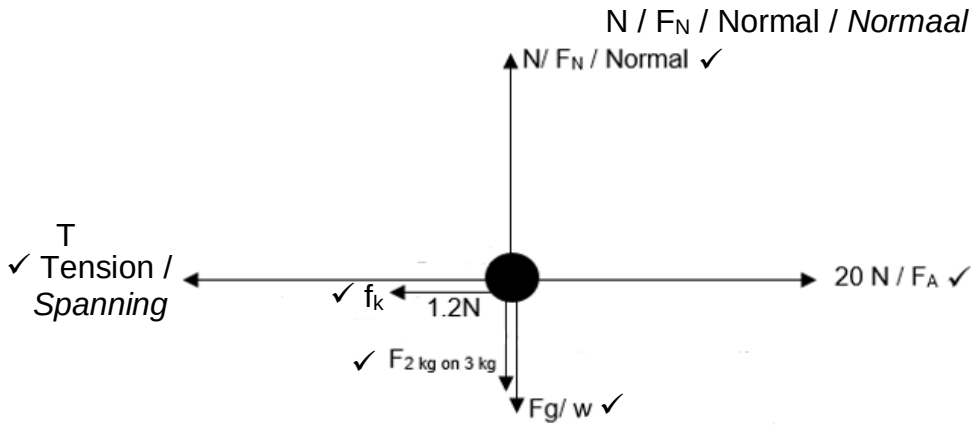
1.1	D✓✓	2
1.2	D✓✓	2
1.3	D✓✓	2
1.4	B✓✓	2
1.5	A✓✓	2
1.6	D✓✓	2
1.7	A✓✓	2
1.8	B✓✓	2
1.9	A✓✓	2
1.10	D✓✓	2

[20]

QUESTION / *VRAAG* 2

2.1.1 When a net force acts on an object, the object will accelerate in the direction of the force✓ and the acceleration is directly proportional to the force and inversely proportional to the mass✓ of the object.
OR
The net (or resultant) force acting on an object is equal to the rate of change of momentum of the object in the direction of the net force. ✓✓
Wanneer 'n netto krag op 'n voorwerp inwerk sal die voorwerp versnel in die rigting van die netto krag. Die versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.
OF
Die netto krag wat inwerk op 'n voorwerp is gelyk aan die tempo van verandering van momentum van die voorwerp in die rigting van die netto krag. 2

2.1.2



6

2.3 **3 kg block / *3 kg blok***
F_{net} = ma✓
F_A –T – f_k = 3a
20 – T– 1.2 = 3a✓
18,8 – T = 3a
T = 18,8 – 3a……(1)
2 kg block / *2 kg blok*
F_{net} = ma
T = 2a✓.....(2)
18,8 – 3a = 2a Set the two equations equal ✓ *Stel die twee vergelykings gelyk aan mekaar*
a= 3,76 m·s^{-2}
T = 2(3.76) ✓= 7,52 N✓ 6

2.2.1 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 liggaam in die heelal trek elke ander liggaam aan met 'n krag wat direk eweredig is aan die produk van hul massas en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle middelpunte. 2

2.2.2 To the right as positive. *Neem na regs as positief*

Force attracting m to earth, $F_E = -G\frac{mM_E}{x^2}$
Krag wat m aantrek na aarde
Force attracting m to moon, $F_M = G\frac{mM_M}{(r-x)^2}$
Krag wat m aantrek na die maan

✓ for both correct expressions. / *vir albei korrekte stellings*

Net force on m, $F_E + F_M = -G\frac{mM_E}{x^2} + G\frac{mM_M}{(r-x)^2}$ ✓ $= 0$ ✓
Netto krag op m

$$-G\frac{\cancel{m}M_E}{x^2} + G\frac{\cancel{m}M_M}{(r-x)^2} = 0$$

$r^2 - 2rx + 0{,}99x^2 = 0$ ✓ 4

[20]

QUESTION / *VRAAG* 3

3.1 The motion of an object in the force of gravity only. ✓✓
Die beweging van 'n voorwerp in gravitasiekrag alleen. 2

3.2 2 / twice✓ *twee maal* 1

3.3.1

OPTION / *OPSIE* 1
$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$(-10)^2$ ✓ $= 0^2 + (2)(-9{,}8)\Delta y$ ✓
$\therefore \Delta y = -5{,}1$ m
i.e. h = 5,1 m ✓

OPTION / *OPSIE* 2
$v_f = v_i + a\Delta t$ ✓
$-10 = 0 + (-9{,}8)\Delta t$ ✓
$\therefore \Delta t = 1{,}02$ s
$\Delta y = y = \left(\frac{0-10}{2}\right)x1{,}02$ ✓
$= -5{,}1$ m
$\therefore$ h = 5,1 m ✓

OPTION / *OPSIE* 3
$v_f = v_i + a\Delta t$ ✓
$-10 = 0 + (-9{,}8)\Delta t$ ✓
$\therefore \Delta t = 1{,}02$ s
$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$
$\Delta y = 0 + (\frac{1}{2})(-9{,}8)(1{,}02)^2$ ✓
$= -5{,}1$ m
$\therefore$ h = 5,1 m ✓

4

OPTION / *OPSIE* 4
$W_{net} = \Delta K$
$W_{grav} = \Delta K$ } any one ✓
$mghcos\theta = \frac{1}{2} mv_f^2 - \frac{1}{2} mv_i^2$
$(0{,}2)(9{,}8)h(1)$ ✓ $= (\frac{1}{2})(0{,}2)(10)^2 - 0$ ✓
$\therefore$h = 5,1 m ✓

OPTION / *OPSIE* 5
$(U + K)_i = (U + K)_f$
$(mgh + \frac{1}{2} mv^2)_i = (mgh + \frac{1}{2} mv^2)_f$ } ✓
$((0{,}2)(9{,}8)h + 0)$ ✓ $= (0 + (\frac{1}{2})(0{,}2)(10)^2)$ ✓
$\therefore$h = 5,1 m ✓

3.3.2

OPTION / *OPSIE* 1	**OPTION / *OPSIE* 2**
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $(0)^2 = 7.5^2 + (2)(-9,8)\Delta y$ ✓ $\therefore \Delta y = 2.87$ m ✓ i.e. h = 2.87 m	$v_f = v_i + a\Delta t$ $0 = 7.5 + (-9,8)\Delta t$ ✓ $\therefore \Delta t = 0.77$ s $\Delta y = v_i\Delta t + ½ a\Delta t^2$ $\Delta y = 7.5\,(0.77) + (½)(-9,8)(0.77)^2$ ✓ $= 2.87$ m✓ $\therefore$ h = 2.87 m
OPTION / *OPSIE* 3 $W_{net} = \Delta K$ $W_{grav} = \Delta K$ } ✓ $mghcos\theta = ½ mv_f^2 – ½ mv_i^2$ $(0,2)(9,8)h(-1) = (½)(0,2)(0)^2 – (½)(0,2)(7.5)^2$ ✓ $\therefore$ h = 2.87 m ✓	

3.4 5,1 m✓ 1

[11]

QUESTION / *VRAAG 4*

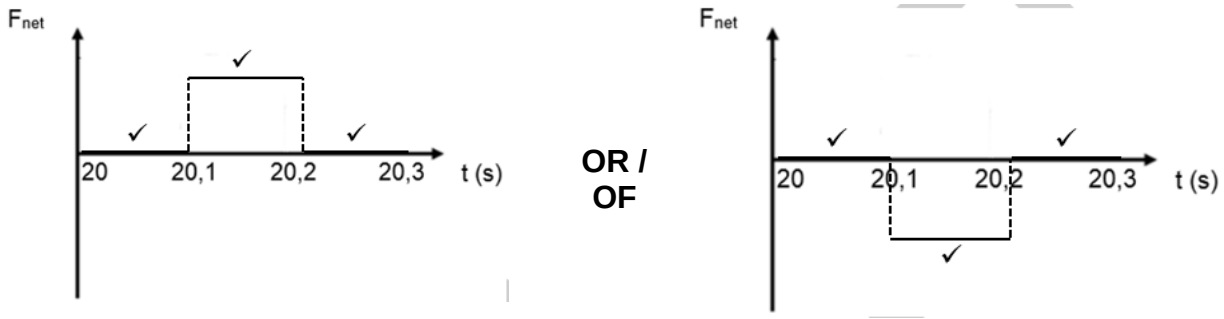
✓

4.1 Isolated (system) or closed system 1
Geïsoleerde sisteem of geslote sisteem

4.2.2 $F_{net}\Delta t = \Delta p$ ✓ 4
F_{net} (0,1) ✓ = 14 000 – 30 000✓
F_{net} = -160 000 N
F_{net} = 160 000 N✓

4.2.2 $\Sigma p_i = \Sigma p_f$ } Any one / *Enige een* ✓ 4
$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$ }
30 000 + (9000)(-1.5) ✓ = 14 000 + (9000)(v_{Bf}) ✓
$v_{Bf} = 0.28$ m·s^{-1} ✓

4.3 3



[12]

QUESTION / *VRAAG* 5

5.1 5.1.1 A force for which the work done in moving an object between two points depends on the path taken. ✓✓
'n Krag waarvoor die arbeid verrig om 'n voorwerp tussen twee punte te beweeg, is afhanklik van die roete wat gevolg word. 2

5.1.2 $W_{nc} = \Delta E_p + \Delta E_k$ ✓
$f\Delta x \cos\theta = \Delta E_p + \Delta E_k$
$18 \times \Delta x \cos 180^0$ ✓$= 5 \times 9.8 \times (3-0)$ ✓ $+ \frac{1}{2} \times 5 \times (0-9.90^2)$ ✓
$\Delta x = 5.4458$ (m) ✓
$\theta = \sin^{-1}\left(\frac{3}{5.4458}\right)$✓
$\theta = 33.43^0$✓ 7

5.2 5.2.1 The work done on an object by a net force✓ is equal to the change in the object's kinetic energy.✓ OR
The net work done on an object by a force✓ is equal to the change in the object's kinetic energy.✓ OR
The net work✓ done on an object is equal to the change in the object's kinetic energy. ✓
Die netto arbeid verrig op 'n voorwerp deur 'n netto krag is gelyk aan die verandering in die voorwerp se kinetiese energie.
Of
Die arbeid verrig deur 'n netto krag is gelyk aan die verandering in die voorwerp se kinetiese energie.
Of
Die netto arbeid verrig op 'n voorwerp is gelyk aan die verandering in die voorwerp se kinetiese energie. 2

5.2.2 $W_{net} = \Delta E_k$✓
$W_{fg} + W_{FA} = F_g \Delta x \cos\theta + W_{app} = \frac{1}{2} m v_{f2} - \frac{1}{2} m v_{i2}$
$(987)(9.8)(46)\cos 180^0$ ✓$+ W_{app} = \frac{1}{2}(987)(0.9)^2 - 0$✓
$W_{FA} = 445339.34$ J✓ 4
[15]

QUESTION / *VRAAG* 6

6.1 The change in frequency (or pitch) of the sound detected by a listener, ✓ because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓

Die verandering in die waarneembare frekwensie van die klankgolwe as gevolg van die relatiewe beweging tussen die snelhede van die luisteraar en die klank se voortplanting. 2

6.2 $f_L = \frac{(v \pm v_o)}{(v \pm v_s)} f_s$ ✓

910 ✓ $= \frac{(340+0)}{(340-v_s)}$ ✓ 800 ✓

$v_s = 41{,}099\ m \cdot s^{-1}$ ✓ 5

6.3 6.3.1 910 Hz ✓ 1

6.3.2 $f_L = \frac{(v \pm v_o)}{(v \pm v_s)} f_s$

$f_L = \frac{340-0}{340+41{,}099}$ ✓ 800 ✓

$= 713{,}73$ Hz ✓ 4

6.4 800 Hz 1

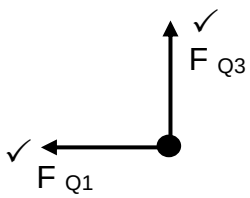
[13]

QUESTION / *VRAAG 7*

7.1 The magnitude of the electrostatic force exerted by one point charge (Q_1) on another point charge (Q_2) is directly proportional to the product of the magnitudes of the charges✓ and inversely proportional to the square of the distance (r) between them✓
If mass is used in definition $^0/_2$

Die grootte van die elektrostatiese krag uitgeoefen deur een puntlading op 'n ander puntlading is direk eweredig aan die produk van die groottes van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.
Indien massas gebruik is in definsie $^0/_2$ 2

7.2



- Arrow and correct label✓
- *Pyl en korrekte byskrif*

2

7.3 $F_{Q2 \text{ due to } Q3} = \frac{kQ_2Q_3}{r^2}$ ✓ $= \frac{9x10^9 x4x10^{-9} x5x10^{-9}}{(20x10^{-3})^2}$ ✓ $= 4{,}5x10^{-4}$ N

$F_{Q2 \text{ due to } Q1} = \frac{kQ_2Q_1}{r^2} = \frac{9x10^9 x2x10^{-9} x4x10^{-9}}{(15x10^{-3})^2}$ ✓ $= 3{,}2x10^{-4}$ N

$F_{net} = \sqrt{(4{,}5x10^{-4})^2 + (3{,}2x10^{-4})^2}$ ✓ $= 5{,}522 \times 10^{-4}$ N ✓ 5

7.4 Take the right is positive / *Regs is positief*

$E_{-2nC} = \frac{kQ}{r^2}$ ✓ $= \frac{9x10^9 x2x10^{-9}}{(25x10^{-3})^2}$ ✓ = 28 800 (N··C^{-1} to the left / *na links*)

$E_{4nC} = \frac{kQ}{r^2} = \frac{9x10^9 x4x10^{-9}}{(10x10^{-3})^2}$ ✓ = 360 000(N·C^{-1} to the right / *na regs*)

$E_{net} = E_{2nC} - E_{4nC}$ ✓ This mark is for subtracting / *Punt vir aftrek*.
$= 360\,000 - 28\,000$
$=$ 331 200 N·C^{-1} to the right / *na regs* ✓ 5

[14]

QUESTION / *VRAAG* 8

8.1 Resistance within / offered by the cell✓ 1
Weerstand gebied deur die sel self.

8.2 Temperature✓ 1
Temperatuur

8.3 Volts (V) ✓ Potential difference / *Potensiaal verskil* 1

8.4 Internal resistance / *interne weerstand* ✓OR / *OF* r 1

8.5 7,2 V✓ 1

8.6 slope / helling = ΔV / ΔI✓ 3
= 0 - 7,2 ✓ / 0,8 – 0 ✓
= -9
r = 9 Ω✓

8.7 7,2 V 1
[10]

QUESTION / *VRAAG 9*

9.1 10V ✓ (1)

9.2 0 V✓ OR / *OF* zero (1)

9.3 $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$

$= \frac{1}{10} + \frac{1}{5}$ ✓

$R_p = 3{,}33$

$R_{ext} = 3{,}33 + 2$ ✓ $= 5{,}33\ \Omega$ ✓

$R_{//} = \frac{R_{10}R_5}{R_{10}+R_5} = \frac{10x5}{10+5}$ ✓ = 3,333 Ω

R_{ext} = 3,333 + 2 ✓= 5,333 Ω✓ (3)

9.4 $R_{ext} = \frac{V_{ext}}{I}$ ✓

$I = \frac{V_{ext}}{R_{ext}} = \frac{8}{5.333} = 1.5\ (A)$ ✓

$emf = IRext + Ir$ ✓

$10 = 8 + 1.5r$ ✓

$r = 1.33\ \Omega$ ✓

Option / *Opsie* 2

$V_{//} = I_c R_{//}$ ✓= 1,5 ✓x 3,333 = 4,9995 V

$V_s = 1,5 \times 2 = 3$ V

$V_{ext} = V_{//} + V_s = 4,9995 + 3 = 7,9995$ V

$V_{int} = \varepsilon - V_{ext}$ ✓= 10-7,9995✓ = 2,00 V

$r_{int} = \frac{V_{int}}{I} = \frac{2}{1.5} = 1,334\ \Omega$ ✓

(5)

9.5 increases ✓ (Negative marking)
vermeerder (negatiewe nasien)
Circuit resistance increases ✓ therefore (circuit) current decreases✓ lost volts decreases / V_{int} decreases.✓
Stroombaan se weerstand vermeerder ✓ daarom sal die stroom afneem ✓ en die verlore volts sal verminder of die Vintern sal verminder. ✓ (4)

[14]

QUESTION / *VRAAG* 10

10.1 10.1.1 Slip rings ✓
Sleepringe (1)

10.1.2 coil / solenoid ✓
spoel / solenoid (1)

10.2 Connects the generator to the external circuit.
OR Generated current exits the generator through C. ✓
OR Allows movement and conductivity between coil and external circuit.

Verbind die generator aan die eksterne stroombaan
OF Gegenereerde stroom verlaat generator deur D
OF Laat beweging toe en geleiding tussen spoel en eksterne stroombaan (1)

10.3 parallel✓ (1)

10.4 $I_{max\ /\ maks}$ = 25 A

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

$= \frac{25}{\sqrt{2}}$ ✓

= 17,678 A ✓ (3)

10.5 Positive marking from 10.4
P_{av} / gem = $I_{rms\ /\ wgk}^2$ x R ✓
= $17,678^2$ x100 ✓
= $3,125 \times 10^4$ W ✓ (3)
[10]

QUESTION / *VRAAG* 11

11.1 Is the minimum energy that an electron in the metal needs to be emitted from the metal surface. ✓✓
Dit is die minimum energie wat 'n elektron in die metaal benodig om vrygestel te word uit die metaal se oppervlakte. 2

11.2 Frequency of green light is <u>below threshold frequency</u> (f_o). ✓✓
OR
Energy of green light lower than work function.
OR
Too low frequency.

Frekwensie van groen lig is onder die drumpelfrekwensie
OF
Energie van groen lig is laer as die werksfunksie.
Of
Die frekwensie is te laag. 2

11.3 INCREASE ✓
Vermeerder 1

11.4 <u>more photons strike the metal per unit time</u>✓ <u>hence more electrons ejected per unit time</u>✓ thus rate of flow of charge increases hence increased current reading.

Meer fotone tref die metaal per eenheid tyd daarom word meer elektrone vrygestel per eenheid tyd dus vermeerder die vloei van die lading dus word die stroom lesing verhoog. 2

11.5 $E = hf$
$= h\frac{c}{\lambda}$ ✓ any one / *enige een*
$= 6{,}02 \times 10^{-34}$ ✓ $\times \frac{3.0\times10^{8}}{500\times10^{-9}}$ ✓
$= 3{,}6 \times 10^{-19}$ J ✓ 4

[11]