Education and Sport Development

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Departement van Onderwys en Sportontwikkeling
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NORTH WEST PROVINCE

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

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

SEPTEMBER 2019

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 7 pages./
Hierdie memorandum bestaan uit 7 bladsye.

QUESTION 1/*VRAAG 1*

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

[20]

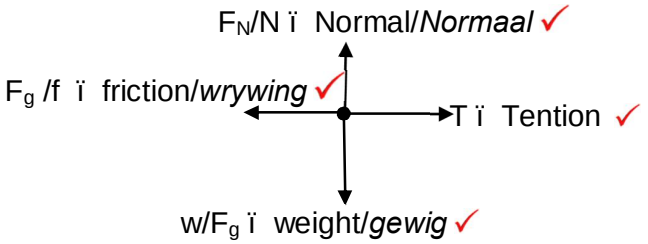
QUESTION 2

2.1 A body will remain in its state of motion (at rest or moving at constant velocity) until a net force acts on it. ✓✓*I'n Liggaam sal in sy toestand van beweging (in rus of beweging teen konstante snelheid) volhard, totdat 'n netto krag daarop inwerk.* ✓✓

(2)

2.2 The two surfaces gliding across each other are the same (rubber and gras)✓/*Die twee oppervalktes wat oor mekaar gly is dieselfde (rubber en gras)* ✓ (2)

2.3.1



(4)

2.3.2 $f_k = \mu_k \cdot N$✓

$f_k = 0,6(15)(9,8)$✓

$f_k = \underline{88,2\ N}$ ✓ (3)

2.3.3 **+ marking from/*nasien van* 2.3.2**

$F_{Net} = ma$✓ $= 0$

For B: $T = f_k$ ✓ $\therefore T = 88,2$ N

For A: $F_x = T + f_k$ ✓

$F \cdot \cos 14^\circ$ ✓ $= 88,2 + 0,6 \cdot 10 \cdot 9,8$✓

$F = \underline{151,5\ N}$✓ (6)

2.4 2.4.1 **+ marking from/*nasien van* 2.3.2**
$F_{Net} = ma$
$88,2 = 15 \cdot a$ ✓
$a = 5,88 \text{ m} \cdot \text{s}^{-2}$ ✓ (2)

2.4.2 The work done on an object by a net force is equal to the change in the object's kinetic energy ✓✓/*Die arbeid verrig op 'n voorwerp deur 'n netto krag is gelyk aan die verandering in kinetiese energie van die voorwerp.* ✓✓
Or/*of*
The net work done on an object by a force is equal to the change in the object's kinetic energy ✓✓/*Die netto arbeid verrig op 'n voorwerp deur 'n krag is gelyk aan die verandering in kinetiese energie van die voorwerp.* ✓✓ (2)

2.4.3 **+ marking from/*nasien van* 2.3.2**
$W_{net} = \Delta K = K_f - K_i$ ✓
$-88,2 \cdot \Delta x$ ✓ $= ½ \cdot 15 \cdot 0$ ï $½ \cdot 15 \cdot 8^2$ ✓
$\Delta x = 5,44 \text{ m}$ ✓ (4)
[25]

QUESTION 3

3.1 Only force acting on the object is gravitational force(gravity) ✓✓/*Die enigste krag wat op die voorwerp inwerk is gravitasie krag.* ✓✓ (2)

3.2 $v_f^2 = v_i^2 + 2 \cdot a \cdot \Delta y$ ✓ Take downwards as +
$31^2 = 0 + 2 \cdot 9,8 \cdot \Delta y$ ✓
$\Delta y = 49,03 \text{ m}$ ✓ (3)

3.3 $W_{net} = m \cdot a \cdot \Delta x \cdot \cos\theta = \Delta K = K_f - K_i = = ½ \cdot m \cdot v_f^2 - ½ \cdot m \cdot v_i^2$ ✓
$80 \cdot a \cdot 10 \cdot \cos 180^\circ$ ✓ $= ½ \cdot 80 \cdot 25^2$ ï $½ \cdot 80 \cdot 0$ ✓
$a = - 31,25 \text{ m} \cdot \text{s}^{-2}$ ✓ (4)

3.4 **+ marking from/*nasien van* 3.2**
$\Delta y = 75 - 49,03 - 10$ ✓ $= 15,97 \text{ m}$
$\Delta y = v_i \Delta t + ½ \cdot a \cdot \Delta t^2$ ✓
$15,97$ ✓ $= 0 + ½ \cdot 9,8 \cdot \Delta t^2$ ✓
$\Delta t = 1,81 \text{ s}$ ✓ (5)

3.5 $v_f = v_i + a \cdot \Delta t$
$25 = 0 + 31,25 \cdot \Delta t$ ✓
$\Delta t = 0,8 \text{ s}$ (Time for 10 m)

Time in free fall = 1,81 ï 0,8 ✓
= 1,01 s

$\Delta y = v_i \Delta t + ½ \cdot a \cdot \Delta t^2$ ✓
$\Delta y = 25 \cdot 1,01 + ½ \cdot -9,8 \cdot 1,01^2$ ✓
$\Delta y = 20,25 \text{ m}$

Δy of John from the ground $= 15,97 + 20,25 + 10$ ✓ $= 46,22 \text{ m}$ ✓ (6)

3.6 $P = F \cdot v$ ✓ $= 80 \cdot 9,8 \cdot 2$ ✓ $= 1568 \text{ W}$ ✓ (3)
[23]

QUESTION 4

4.1 The product of the net force (acting on an object) and the time the (net) force acts (on the object)✓✓/*Die produk van die netto krag wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk.* ✓✓ (2)

4.2 $\sum p \text{ before} = \sum p \text{ after}$ ✓

$m_p \cdot v_i + m_T \cdot v_i = (m_b + m_T) \cdot v_f$

$100 \cdot 5 + 65 \cdot 0$ ✓ $= (100 + 65)\, v_f$ ✓

$v_f = 3{,}03 \text{ m} \cdot \text{s}^{-1}$ ✓ In same direction as the original direction of boat ✓ (5)

4.3 $F_{NET} \Delta t = \Delta p$ ✓

$F_{NET} (0{,}2) = 165\,(0 - 3{,}03)$ ✓

$F_{NET} = -2499{,}75$

$F_{NET} = 2499{,}75$ N ✓ in opposite direction as boat ✓ (4)

[11]

QUESTION 5

5.1. $v = f\lambda$ ✓

$340 = \lambda \cdot 384$ ✓

$\lambda = 0{,}89$ m ✓ (3)

5.2. Longer ✓/*Langer* ✓ (1)

5.3. Remains the same ✓/*Bly dieselfde.* ✓ (1)

5.4 Towards ✓/*Na* ✓ (1)

5.5 $f_L = \frac{v \pm v_L}{v \pm v_s} \cdot f_s$ ✓

$f_L = \frac{v + v_p}{v + v_s} \cdot 384$ ✓ (f_L become/*word* f_s)

391 ✓ $= \frac{v + v_p}{v + v_s}$ ✓ $\cdot \frac{v + v_p}{v + v_s} \cdot 384$ ✓ ($v_L = v_s$)

$391 = \frac{v + v_p}{v + v_s} \cdot \frac{v + v_p}{v + v_s} \cdot 384$

$v = 13{,}55 \text{ m} \cdot \text{s}^{-1}$ ✓ (Range: 13,50 – 13,70) (6)

[12]

QUESTION 6

6.1 The magnitude of the electrostatic force exerted by one point charge (Q1) on another point charge (Q2) is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance (r) between them✓✓/*Die grootte van die elektrostatiese krag wat een puntlading (Q1) op 'n ander puntlading (Q2) uitoefen, is direk eweredig aan die produk van die groottes van die ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle.* ✓✓ (2)

6.2.1 $F_{XY} = 5 \times 10^{-3} \cos 58^{o}$ (or $\sin 32^{o}$) ✓= 2,65 x 10^{-3} N✓ (2)

6.2.2 $F_{XY} = \frac{k \cdot Q_1 \cdot Q_2}{r^2}$ ✓

$2,65 \times 10^{-3}$ ✓= $\frac{9 \times 10^{9} \cdot 5 \times 10^{-3} \cdot 1,20 \times 10^{-6}}{r^2}$ ✓

r = 4,51 m

(∴ ½r = 2,26 m)

$5 \times 10^{-3} \cos 32^{o}$ (or $\sin 58^{o}$) ✓ = $\frac{9 \times 10^{9} \cdot 5 \times 10^{-3} \cdot Q_Z}{2,26^2}$ ✓

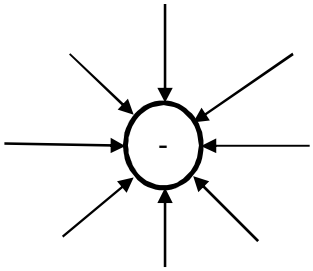
Q_Z = -✓1,20 x 10^{-6} C✓ (7)

(mark polarity independent) **[11]**

QUESTION 7

7.1 Negative/*Negatief* (1)

7.2



Negative	✓
Arrow direction	✓
Arrows touching charge	✓

(3)

7.3 A region of space in which an electric charge experiences a force✓✓ /*'n Gebied in die ruimte waarin 'n elektriese lading 'n krag ondervind.* ✓✓ (2)

7.4 $E_{Net} = E_V + E_W$✓

2×10^{-2}✓ = $\frac{9 \times 10^{9} \cdot Q}{2,26^2}$ ✓+ $\frac{9 \times 10^{9} \cdot Q}{2,26^2}$ ✓ ($Q_V = Q_W$)

Q = 6.15 x 10^{-16} C✓ (5)

[11]

QUESTION 8

8.1. The total amount of energy supplied (by the source) per coulomb charge or per unit charge/*Die totale hoeveelheid energie (deur die bron) per coulomb of per eenheidslading.* ✓✓ (2)

8.2.1 $\frac{1}{R_P} = \frac{1}{R_{parallel}}$ ✓ $\frac{1}{R_P} = \frac{1}{R}$ ✓ $\frac{1}{R}$ ✓ $= \frac{1}{R}$

$R_E = 2{,}67\ \Omega$

$R_T = R_E + R_4 + R_r$ ✓ $= 2{,}67 + 3 + 1$ ✓ $= \underline{6{,}67\ \Omega}$ ✓ (4)

8.2.2 $I = \frac{V_{ext}}{R_P}$ ✓ $= \frac{12}{6{,}67}$ ✓ $= \underline{1{,}8\ A}$

$V = I \times R$ ✓ $= 1{,}8 \times 2{,}67$ ✓ $= \underline{4{,}80\ V}$ ✓ (4)

8.2.3 $W = \frac{\varepsilon \cdot \Delta Q}{Q}$ ✓ $= \frac{12 \cdot 57{,}84}{Q}$ ✓ $= \underline{694{,}08\ J}$ ✓

or/*of*

$I = \frac{Q}{t} = \frac{57{,}84}{48} = 1{,}20\ A$

$W = I^2Rt$ ✓
$= 1{,}2^2 \times 4 \times 120$ ✓
$= 691{,}20\ J$ ✓

or/*of*

$W = VIt$ ✓
$= 4{,}80 \times 1{,}2 \times 120$ ✓
$= 691{,}20\ J$ ✓

(3)
[13]

QUESTION 9

9.1 $T = \frac{1}{f} = \frac{1}{30}$ ✓= 0,033 s
0,033 x 2,5 ✓= 0,0825 s✓ (2)

9.2 The value of the direct current that dissipates power in a resistor/*Die waarde van die gelykstroom wat drywing in 'n weerstand vrystel.* (3)

9.3 $V_{rms} = \frac{V_{max}}{\sqrt{2}} = \frac{311}{\sqrt{2}}$ ✓= 219,91 V $R = \frac{V}{I} = \frac{219,91}{12}$ ✓= 18,325Ω

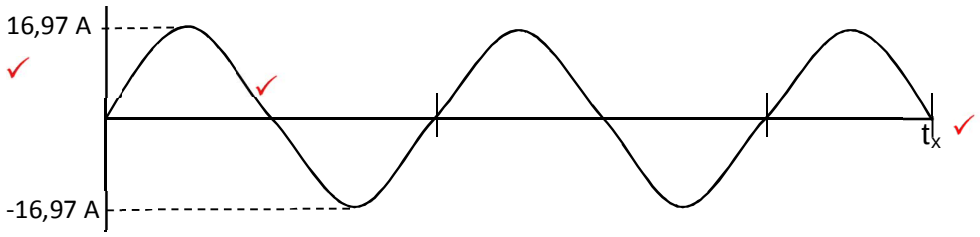
$P_{av} = V_{rms} \cdot I_{rms}$ ✓= 219,91 ·12 ✓= 2638,92 W✓

or/*of* $P_{av} = \frac{Vrms^2}{R}$ ✓= $\frac{219,91^2}{18,325}$ ✓= 2639,04 W✓

or/*of* $P_{av} = I_{rms}^2 R$✓ = $12^2 \cdot 18,325$ ✓= 2638,8 W✓ (4)

9.4 $I_{rms} = \frac{I_{max}}{\sqrt{2}}$
$12 = \frac{I_{max}}{\sqrt{2}}$✓
I_{max} = 16,97 A✓ (2)

9.5



I_{max} shown	✓
Time interval (2,5 wave lengths)	✓
Graph line (sinus graph)	✓

(3)
[14]

QUESTION 10

10.1 Absorption of specific wave lengths or frequencies of light when passing through a cold gas/*Absorbsie spektrum van spesifieke golflengte of frekwensie van lig wat deur 'n koue gas beweeg*. ✓✓ (2)

10.2 Emission (line) spectrum/*emmisie spektrum* ✓ (1)

10.3.1 $E = \frac{hc}{\lambda}$ ✓= $\frac{6,63 \times 10^{-34} \cdot 3 \times 10^{8}}{6,0 \times 10^{-7}}$ ✓= 3,32 x 10^{-19} J✓ (3)

10.3.2 $E = W_o + E_k$✓
3,32 x 10^{-19} ✓= 2,3 x 10^{-19} + ½ Ã9,11 x 10^{-31} Ãv^2✓ (4)
v = 4,72 x 10^5 m.s^{-1}✓ **[10]**

TOTAL: 150

ANALYSIS GRID 2017 PHYSICAL SCIENCE P1

Question No.	Taxonomy														Knowledge area					
		Knowledge,Recall, Low Demand			COMPREHENSION, Basic Questions			APPLICATION, ANALYSIS, Problem Solving			SYNTHESIS, EVALUATION,Higher Abilities, Hard new problems, Challenge Level			TOTAL	MECHANICS	WAVES, SOUND & LIGHT	ELECTRICITY & MAGNETISM	MATTER & MATERIALS	TOTAL MARKS	Question Totals
	Content	E	M	D	E	M	D	E	M	D	E	M	D		Marks					
1.1	force	2													2				2	
1.2	work						2								2				2	
1.3	energy					2									2				2	
1.4	momentum		2												2				2	
1.5	work						2								2				2	
1.6	sound				2											2			2	
1.7	charge		2														2		2	
1.8	fields					2											2		2	
1.9	electricity								2								2		2	
1.10	light												2					2	2	**20**
2.1	Newton's Law	2													2				2	
2.2	Newton's Law	2													1				2	
2.3.1	Newton's Law				4										4				4	
2.3.2	Newton's Law					3									3				3	
2.3.3	Newton's Law						6								6				6	
2.4.1	Newton's Law							3							3				3	
2.4.2	Energy							2							2				2	
2.4.3	Energy								4						4				4	25
3.1	projectile	2													2				2	
3.2	Projectile							3							3				3	
3.3	Energy									4					4				4	
3.4	Projectile								5						5				5	
3.5	Projectile												6		6				6	
3.6	Energy								3						3				3	**23**
4.1	momentum	2													2				2	
4.2	momentum								5						5				5	
4.5	momentum								4						4				4	**11**

5.1	Doppler	3														3			3	
5.2	Doppler							1								1			1	
5.3	Doppler							1								1			1	
5.4	Doppler		1													1			1	
5.5	Doppler									6						6			6	**12**
6.1	electrostatics	2															2		2	
6.2.1	electrostatics				2												2		2	
6.2.2	electrostatics								7								7		7	**11**
7.1	electrostatics					1											1		1	
7.2	electrostatics				3												3		3	
7.3	electrostatics	2															2		2	
7.4	electrostatics								5								5		5	**11**
8.1	circuit		2														2		2	
8.2.1	circuit								4								4		4	
8.2.2	circuit											4					4		4	
8.2.3	circuit											3					3		3	**13**
9.1	dynamics								3								3		3	
9.2	dynamics		2														2		2	
9.3	dynamics								4								4		4	
9.4	dynamics							2									2		2	
9.4	dynamics								3								3		3	**14**
10.1	photoelectric		2															2	2	
10.2	photoelectric				1													1	1	
10.3.1	photoelectric							3										3	3	
10.3.2	photoelectric								4									4	4	**10**
														69	14	55	12	150	150	
												0	69	14	55	12				
		%			%			%			%		46 %	9.3 %	36.7 %	8 %				
		15			35			40			10		45 %	8 %	36 %	10 %				

Overall

E	M	D
%	%	%
30	40	30