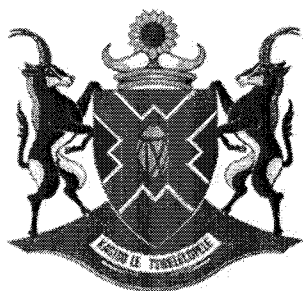




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Education and Sport Development

Department of Education and Sport Development
Departement van Onderwys en Sportontwikkeling
Lefapha la Thuto le Tihabololo ya Metshameko

NORTH WEST PROVINCE

**NATIONAL
SENIOR CERTIFICATE/
NASIONALE
SENIOR SERTIFIKAAT**

**GRADE 12/
GRAAD 12**

**PHYSICAL SCIENCES: PHYSICS (P1)/
FISIESE WETENSKAPPE: FISIKA (V1)
MEMORANDUM**

SEPTEMBER 2015

MARKS/PUNTE: 150

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

QUESTION 1 / VRAAG 1

- | | | |
|------|-----|-------------|
| 1.1 | A✓✓ | (2) |
| 1.2 | B✓✓ | (2) |
| 1.3 | C✓✓ | (2) |
| 1.4 | C✓✓ | (2) |
| 1.5 | A✓✓ | (2) |
| 1.6 | C✓✓ | (2) |
| 1.7 | D✓✓ | (2) |
| 1.8 | D✓✓ | (2) |
| 1.9 | D✓✓ | (2) |
| 1.10 | B✓✓ | (2) |
| | | [20] |

QUESTION 2 / VRAAG 2

- 2.1 When a resultant force acts on an object, the object accelerates in the direction of the force. This acceleration is directly proportional to the force ✓ and inversely proportional to the mass of the object. ✓

OR

The resultant/net force acting on an object is equal to ✓ the rate of change of momentum of the object in the direction of the resultant/net force ✓.

Indien 'n resulterende krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel. Hierdie versnelling is direk eweredig aan die resultante krag ✓ en omgekeerd eweredig aan die massa van die voorwerp. ✓

OF

Die resultante/netto krag wat op 'n voorwerp inwerk is gelyk aan ✓ die tempo van verandering van momentum van die voorwerp, in die rigting van die resultante/netto krag. ✓

(2)

2.2.1 $F_{\text{net}} = m \cdot a \checkmark$

For 2 kg object / Vir 2 kg voorwerp

Subst. (2) into (1):

$2 \times 9,8 - T \checkmark = 2 \times a \checkmark \text{-----}(1)$

$2 \times 9,8 = 5a + 2a$

$a = 2,8 \text{ m} \cdot \text{s}^{-2} \checkmark$

For 5 kg object

Vir 5 kg voorwerp

$\checkmark T = 5 \times a \text{-----}(2)$

2.2.2 $T = 5 \times 2,8 \checkmark$

OR/OF

$2 \times 9,8 - T = 2 \times 2,8 \checkmark$

$T = 14 \text{ N} \checkmark$

$T = 14 \text{ N} \checkmark$

2.3 For the 2 kg mass
/Vir die 2 kg massa:

For the 5 kg mass
/Vir die 5 kg massa:

$2 \times 9,8 - T = 2 \times 2 \checkmark$

$T - f \checkmark = 5 \times 2 \checkmark$

$19,6 - 4 = T \text{}(1)$

$T = 10 + f \text{}(2)$

Subst. (1) into (2):

$f = 5,6 \text{ N} \checkmark$

2.4 $F_{\text{net}} = 0 \checkmark$

Horizontal forces on the incline/
Horisontale kragte op die helling

Vertical forces/ Vertikale kragte

$T = F_{\parallel} \rightarrow \text{Both equations } \checkmark \leftarrow$
Albei vergelykings

$T = m \times g$

$= 2 \times 9,8$

$19,6 \checkmark = 5 \times 9,8 \times \sin \theta \checkmark$

$= 19,6 \text{ N}$

$\theta = 23,58^\circ \checkmark$

(5)

[18]

QUESTION 3 / VRAAG 3

3.1 $0 \text{ (J)} \checkmark$

(1)

3.2 The total mechanical energy (sum of gravitational potential energy and kinetic energy) in an isolated system remains constant. /
Die totale meganiese energie (som van gravitasie potensiele en kinetiese energie) in 'n geslote sisteem bly konstant

(2)

3.3

OPTION 1/ OPSIE 1

$$E_{\text{mech (at C)}} = E_{\text{mech (at A)}} / E_{\text{meg (by C)}} = E_{\text{meg (by A)}}$$

$$(mgh + \frac{1}{2} mv^2)_C = (mgh + \frac{1}{2} mv^2)_A$$

$$m(gh + \frac{1}{2} v^2)_C = m(gh + \frac{1}{2} v^2)_A$$

$$9,8 \times 1,5 \checkmark + 0 = 9,8 \times 1 \checkmark + \frac{1}{2} v^2 \checkmark$$

any equation✓/

enige vergelyking

OR write the equation using the mass as m/

OF gebruik m as die massa wanneer die vergelyking geskryf word

$$v^2 = 9,8$$

$$v = \underline{3,13 \text{ m}\cdot\text{s}^{-1}} \checkmark$$

(5)

OPTION 2/ OPSIE 2

$$E_{\text{mech (at C)}} = E_{\text{mech (at B)}} / E_{\text{meg (by C)}} = E_{\text{meg (by A)}}$$

$$(mgh + \frac{1}{2} mv^2)_C = (mgh + \frac{1}{2} mv^2)_B$$

$$m(gh + \frac{1}{2} v^2)_C = m(gh + \frac{1}{2} v^2)_B$$

$$\underline{m \times 9,8 \times 1,5 = \frac{1}{2} \times m \times v^2} \checkmark$$

$$v = 5,42218$$

$$E_{\text{mech (at B)}} = E_{\text{mech (at A)}} / E_{\text{meg (by B)}} = E_{\text{meg (by A)}}$$

$$\underline{\frac{1}{2} \times m \times (5,42218)^2} \checkmark = \underline{\frac{1}{2} m \times v^2 + m \times 9,8 \times 1} \checkmark$$

any equation✓/

✓
enige
vergelýking

OR write the equation without mass /OF skryf die vergelyking sonder massa

$$v = \underline{3,13 \text{ m}\cdot\text{s}^{-1}} \checkmark$$

3.4

OPTION 1/ OPSIE 1

+

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$\underline{1 \checkmark = 3,13 t + \frac{1}{2} 9,8 t^2} \checkmark$$

$$t = 0,2338 \text{ s} \checkmark$$

OPTION 2 / OPSIE 2

$$v_f^2 = v_i^2 + 2a\Delta x$$

$$\underline{v_f^2 = 9,8 + 2 \times 9,8 \times 1} \checkmark$$

$$= 5,42218 \text{ m}\cdot\text{s}^{-1}$$

$$v_f = v_i + g \Delta t$$

$$\underline{5,42218 = 3,13 + 9,8 t} \checkmark$$

$$t = 0,2336 \text{ s} \checkmark$$

both
equations
1 mark ✓

(4)

3.5

Equal to C / Gelyk aan C

(1)

[13]

QUESTION 4 / VRAAG 4

- 4.1.1 $F_{m1} = F_{m2}$ ✓ (1)
- 4.1.2 Newton's 3rd law ✓ OR (state it in words)/
 Newton se 3^{de} wet ✓ OF (stel in woorde) (1)
- 4.2.1 $v_{m1} > v_{m2}$ ✓ (1)
- 4.2.2 Newton's 2nd law ✓ OR (state it in words)/
 Newton se 2^{de} wet ✓ OF (stel in woorde) (1)
- 4.3 Momentum is conserved/
 Momentum word behou
 $\Sigma p_i = \Sigma p_f$ or/of
 $(m_1 + m_2)v_i = m_1 v_{1f} + m_2 v_{2f}$ ✓
 both equations 1 mark/
 let velocity of $m_1 = x$ and $m_2 = y$
 ✓ $0 = 0,4x + 1,2(-y)$ ✓
 $x = 3y$
 $y = 0,306 \text{ m}\cdot\text{s}^{-1}$
- Energy is conserved/
 Energie word behou
 $\frac{1}{2} mv^2_{\text{before/voor}} = \frac{1}{2} mv^2_{\text{after/na}}$
 albei vergelykings 1 punt
 laat snelheid van $m_1 = x$ en $m_2 = y$
 $\checkmark 0,225 = \frac{1}{2} 0,4x^2 + \frac{1}{2} 1,2y^2$ ✓
 $0,225 = \frac{1}{2} 0,4(3y)^2 + \frac{1}{2} 1,2y^2$ ✓
- (6)
 [10]

QUESTION 5 / VRAAG 5

- 5.1 Normal force ✓ / Normaalkrag ✓ (1)
- 5.2 X OR force of gravity OR weight ✓ / X OF gravitasiekrag OF gewig ✓ (1)
- 5.3 0 ✓ (1)
- 5.4 Z OR frictional force ✓ / Z OF wrywingskrag ✓ (1)
- 5.5 The net/total work done on an object is equal to ✓ the change in the object's
 kinetic energy ✓ OR the work done on an object by a resultant/net force is
 equal to the change in the object's kinetic energy./
 Die netto/totale werk wat op die voorwerp gedoen word, is gelyk aan ✓ die
 verandering in die voorwerp se kinetiese energie. ✓
 OF
 Die werk gedoen op 'n voorwerp deur 'n resultante/netto krag is gelyk aan
 die verandering in kinetiese energie van die voorwerp. (2)
- 5.6 $f_k = \mu_k N$ ✓
 $= 0,42 \times 800 \times 9,8$ ✓
 $= 3292,8 \text{ N}$ ✓ (3)

5.7 $W_{\text{net}} = \Delta K$ ✓ OR/OF $W_{\text{net}} = \Delta E_k$ $\Delta K = K_f - K_i$ OR/OF $\Delta E_k = E_{kf} - E_{ki}$

$3292,8 \times 88 \times \cos 180^\circ = 0 - \frac{1}{2} 800 \times v^2$ ✓ OR/OF

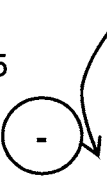
$3292,8 \times 88 \times -1 = 0 - \frac{1}{2} 800 \times v^2$

$v = 26,915 \text{ m.s}^{-1}$ ✓

(4)

[13]

QUESTION 6 / VRAAG 6

- 6.1 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 frekwensie (of toonhoogte) van die klank wat die
 luisteraar waarneem, want die klankbron en die luisteraar het verskillende
 snelhede relatief tot die medium of klankvoortplanting* ✓ (2)
- 6.2 180 Hz ✓ (1)
- 6.3 There is no relative motion between the source ✓ and the listener ✓/.
Daar is geen relatiewe beweging tussen die bron en die luisteraar nie. ✓ (2)
- 6.4 Increases ✓ *toeneem* (1)
- 6.5  For constant velocity / speed of sound ✓
If the frequency decreases λ increases ✓/
Vir 'n konstante snelheid/ spoed van klank ✓
As die frekwensie afneem, neem λ toe ✓ (2)
 OR/OF
 The wave length inversely proportional to the wavelength when v is
 constant/
*Die golflengte is omgekeerd eweredig aan die frekwensie indien v konstant
 bly.*
- 6.4 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓
 $188 = \frac{340 + v_L}{340}$ ✓ 180 ✓
 $v_L = 15,11 \text{ m.s}^{-1}$ ✓ (5)

(5)

[13]

QUESTION 7 / 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 ✓/

Die grootte van die elektrostatiese krag wat uitgeoefen word deur een puntlading (Q_1) op 'n ander puntlading (Q_2) is direk eweredig aan die produk van die groottes van hul lading ✓ en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle ✓

(2)

7.2

$$F = \frac{kQ_1Q_2}{r^2} \checkmark$$

$$F = \frac{9 \times 10^9 \times 12 \times 10^{-9} \times 2 \times 10^{-9}}{(10 \times 10^{-3})^2} \checkmark$$

$$= 2,16 \times 10^{-3} \text{ N} \checkmark$$

(4)

7.3

$$F_{\text{net}} = 0 \quad \text{OR/OF} \quad F_1 + (-F_2) = 0 \quad \text{OR/OF} \quad F_1 = F_2 \checkmark$$

ANY ONE EQUATION / ENIGE EEN VERGELYKING 1 mark/punt

$$F_1 = \frac{9 \times 10^9 \times 12 \times 10^{-9} \times 1 \times 10^{-9}}{(x)^2}$$

$$F_2 = \frac{9 \times 10^9 \times 1 \times 10^{-9} \times 2 \times 10^{-9}}{(10 \times 10^{-3} - x)^2}$$

4 marks allocated for substitution/

4 punte toegeken vir vervanging

$$\frac{9 \times 10^9 \times 12 \times 10^{-9} \times 1 \times 10^{-9}}{(x)^2} \checkmark$$

$$= \frac{9 \times 10^9 \times 1 \times 10^{-9} \times 2 \times 10^{-9}}{(10 \times 10^{-3} - x)^2} \checkmark$$

$$x = 7.1 \times 10^{-3} \text{ m} \checkmark$$

(6)

[12]

QUESTION 8 / VRAAG 8

8.1 6 V ✓ (1)

8.2 $R = \frac{V}{I}$ ✓ $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓
 $\frac{1}{R} = \frac{1}{2} + \frac{1}{2}$ ✓
 $I = \frac{6}{1}$ ✓ $R = 1 \Omega$ (5)

8.3 $R = \frac{V}{I}$ ✓ $\epsilon = I(R + r)$ ✓
 $\checkmark 2 = \frac{6}{I}$ ✓ $\checkmark 6 = 3(1 + r)$ ✓
 $I = 3 \text{ A}$ ✓ $r = 1 \Omega$ ✓ (6)

8.4 Smaller than / kleiner as ✓ (1)

8.5 With both S_1 and S_2 closed the total resistance decreases, the current increases, ✓ ϵ (emf) remain the same ✓ and Ir (lost volts) increases ✓
 Met beide S_1 en S_2 gesluit, neem die totale weerstand af/ die stroom verhoog ✓, ϵ (emk) bly dieselfde ✓ en Ir (verloor volts) verhoog ✓ (3)

[16]

QUESTION 9 / VRAAG 9

9.1 clockwise ✓ / kloksgewys ✓ (1)

9.2 Reverse the direction of the current ✓ OR
 Reverse the polarity of the magnet/
 Draai die stroomrigting om ✓ OF
 Draai die pole van die magneet om (1)

9.3 $W = VI \Delta t$ ✓ $W = F \Delta x \cos \theta$ ✓
 $= 6 \times I \times 2$ ✓ $= 3 \times 0,8 \times 1$ ✓
 $= 12 I$
 $\frac{80}{100} \times 12 \times I = 3 \times 0,8 \times 1$ ✓
 $I = 0,25 \text{ A}$ ✓ (6)

[8]

QUESTION 10 / VRAAG 10

10.1 B_1 ✓

(1)

10.2

$$\left. \begin{aligned} V_{\text{rms}} &= \frac{V_{\text{max}}}{\sqrt{2}} \\ V_{\text{rms}} &= \frac{12}{\sqrt{2}} = 8,485 \text{ V} \end{aligned} \right\} \checkmark$$

V_{rms} value in AC is less than the V value in DC ✓

Power of bulb B_1 or $\left(\frac{V^2}{R}\right) >$ Power in bulb B_2 ✓

V_{wgk} waarde in AC is minder as die V-waarde in DC ✓

Drywing van gloeilamp B_1 of $\left(\frac{V^2}{R}\right) >$ Drywing in gloeilamp B_2 ✓

(3)

10.3

OPTION 1 / OPSIE 1

OPTION 2 / OPSIE 2

$$P_1 = \frac{V^2}{R} = \frac{12^2}{R}$$

$$P_2 = \frac{8,485^2}{R}$$

$$P_1 : P_2 = \sqrt{\frac{12^2}{R}} \div \frac{(8,485)^2}{R} \checkmark$$

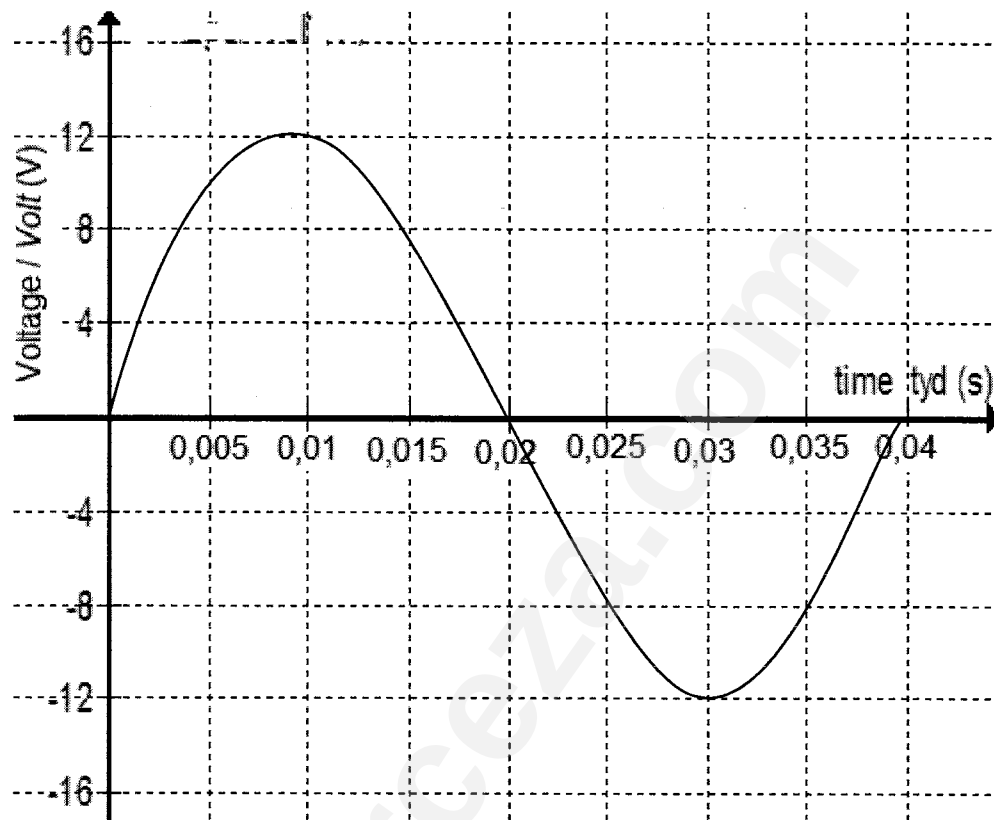
$$= \underline{2 \checkmark} \text{ OR / OF } \underline{2:1}$$

$$\begin{aligned} P_1 : P_2 &= \frac{12^2}{R} \checkmark \div \frac{\left(\frac{12}{\sqrt{2}}\right)^2}{R} \checkmark \\ &= \underline{2 \checkmark} \text{ OR / OF } \underline{2:1} \end{aligned}$$

(3)

10.4

Volt vs time graph / Volt teenoor tyd grafiek



Sinusoidal curve/ <i>Sinuskurwe</i>	Axes marked/ <i>Asse gemerk</i>	Peak at 12 & - 12 <i>Piek by 12 & -12</i>	Graph changes direction at 0,02/ <i>Grafiek verander rigting by 0,02</i>	Ends at 0,04 <i>Eindig by 0,04</i>
1	1	1	1	1

(5)
[12]

QUESTION 11 / VRAAG 11

11.1 Photoelectric effect / *Fotoëlektriese effek* (1)

11.2 Minimum frequency of light ✓ needed to emit electrons from the surface of the metal ✓ /
Minimum frekwensie van lig ✓ wat nodig is om elektrone uit te straal uit die oppervlak van 'n metaal ✓ (2)

11.3 $1,2 \times 10^{15} \text{ Hz}$ ✓ (1)

11.4 Planck's constant OR (h) OR $6,63 \times 10^{-34} \text{ J}\cdot\text{s}$ ✓ (1)
Planck se konstante OF (h) OF $6,63 \times 10^{-34} \text{ J}\cdot\text{s}$

11.5 $E = hf$ OR/OF $W_0 = hf_0$ ✓
 $= 6,63 \times 10^{-34} \times 0,68 \times 10^{15}$ ✓
 $= \underline{4,5084 \times 10^{-19} \text{ J}}$ ✓ (3)

11.6 $E = W_0 + E_k$ ✓
 $6,63 \times 10^{-34} \frac{3 \times 10^8}{187 \times 10^{-9}}$ ✓ ✓ $= W_0 + 4 \times 10^{-19}$ ✓
 $W_0 = 6,63636 \times 10^{-19}$ ✓
 $W_0 = hf_0$
 $f_0 = 1,0009 \times 10^{15} \text{ Hz}$ ✓
Al ✓ (7)

[15]

GRAND TOTAL / GROOTTOTAAL: 150

ANALYSIS GRID PHYSICAL SCIENCE PAPER 1 2015

Question No.	Taxonomy														Knowledge area				TOTAL MARKS	Question Totals
	Content	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		
		E	M	D	E	M	D	E	M	D	E	M	D		Marks					
1.1	projectile	2												2	2				2	20
1.2	projectile		2											2	2				2	
1.3	newton law					2								2	2				2	
1.4	momentum						2							2	2				2	
1.5	energy		2											2	2				2	
1.6	doppler			2										2		2			2	
1.7	electrostatics	2												2			2		2	
1.8	electrodynamics	2												2			2		2	
1.9	circuits									2				2			2		2	
1.10	matter and materials					2								2				2	2	
2.1	newton law	2												2	2				2	18
2.2.1	newton law									5				5	5				5	
2.2.2	newton law						2							2	2				2	
2.3	newton law									4				4	4				4	
2.4	newton law											5		5	5				5	
3.1	projectile	1												1	1				1	13
3.2	projectile	2												2	2				2	
3.3	projectile									5				5	5				5	
3.4	projectile									4				4	4				4	
3.5	projectile					1								1	1				1	
4.1.1	newton law					1								1	1				1	10
4.1.2	newton law		1											1	1				1	
4.2.1	newton law					1								1	1				1	
4.2.2	newton law		1											1	1				1	
4.3	momentum												6	6	6				6	
5.1	forces	1												1	1				1	13
5.2	forces		1											1	1				1	
5.3	forces		1											1	1				1	
5.4	work		1											1	1				1	
5.5	work	2												2	2				2	
5.6	work									3				3	3				3	
5.7	work									4				4	4				4	
6.1	doppler		2											2		2			2	13
6.2	doppler	1												1		1			1	
6.3	doppler						2							2		2			2	

17	11,3%	10%
49	32.7%	36%
15	10.0%	8%
64	46%	45%
150		
35	10.0%	10
61	40.0%	40
19	34.7%	35
35	15.3%	15

E	M	D
35	80	35
23%	53%	23%
30	40	30

150