Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12
GRAAD 12

SEPTEMBER 2010

PHYSICAL SCIENCES – PAPER 1/ FISIESE WETENSKAPPE – VRAESTEL 1

MEMORANDUM

This memorandum consists of 12 pages.
Hierdie memorandum bestaan uit 12 bladsye.

SECTION A / *AFDELING A*

QUESTION 1: ONE-WORD ITEMS/ VRAAG 1: EEN-WOORD ITEMS

1.1	Inertia / Traagheid ✓	(1) 12.2.1
1.2	Force / Krag ✓	(1) 12.2.1
1.3	Emf/ Potential difference / Emk / Potensiaalverskil✓	(1) 12.2.1
1.4	Microwaves / Mikrogolwe✓	(1) 12.2.3
1.5	Capacitor / Kapisitator ✓	(1) 12.2.1

[5]

QUESTION 2: MULTIPLE-CHOICE QUESTIONS/ VRAAG 2: MEERVOUDIGEKEUSE-KEUSE VRAE

2.1	C ✓✓	(2) 12.1.2
2.2	C ✓✓	(2) 12.2.1
2.3	D ✓✓	(2) 12.2.2
2.4	D ✓✓	(2) 12.2.3
2.5	B ✓✓	(2) 12.3.2
2.6	B ✓✓	(2) 12.2.2
2.7	B ✓✓	(2) 12.1.2
2.8	A ✓✓	(2) 12.2.1
2.9	C ✓✓	(2) 12.2.1
2.10	A ✓✓	(2) 12.2.2

[20]

TOTAL SECTION A / TOTAAL AFDELING A: 25

SECTION B / AFDELING B

QUESTION 3 / VRAAG 3

3.1 Yes. ✓ A body projected vertically upwards has zero ✓velocity but a downward acceleration✓ at the highest point.
Ja. 'n Liggaam wat vertikaal opwaarts geprojekteer word het nul snelheid maar afwaartse versnelling by die hoogste punt. (3) 12.1.4

3.2 3.2.1 Let the two bodies meet after Δt s at a distance Δx from the top.
Laat die twee liggame na Δt s op 'n afstand Δx van bo af ontmoet.
∴ The first body travels a distance Δx in time Δt with zero initial velocity.✓ Die eerste liggaam beweeg 'n afstand Δx in die tyd Δt met nul begin snelheid.
The second body travels a distance $(300 - \Delta x)$ ✓in time Δt with an initial velocity of 150 $m.s^{-1}$. Die tweede liggaam beweeg 'n afstand $(300 - \Delta x)$ in die tyd Δt met 'n begin snelheid van 150 $m.s^{-1}$.

$$\Delta x = v_i \Delta t + \frac{1}{2} g \Delta t^2 \quad \checkmark$$

∴ for falling body $\Delta x = \frac{1}{2} g \Delta t^2$ ✓(1)

and for projected body $\overset{\checkmark}{300} - \Delta x = 150 \Delta t \overset{\checkmark}{-} \frac{1}{2} g \Delta t^2$ (2)

(1)+ (2) ⟹
$300 = 150 \Delta t$
∴ $\Delta t = 2$ s ✓ (7) 12.1.3

3.2.2
$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$\Delta x = \frac{1}{2} \text{x } 9{,}8 \text{ x } (2)^2 = 19{,}6 \text{ m} \checkmark$$

∴ height = 280,4 m from the ground or 19,6 m from the top.✓
∴ hoogte = 280,4 m vanaf die grond of 19,6 m van bo af. 12.2.3 (3)

[13]

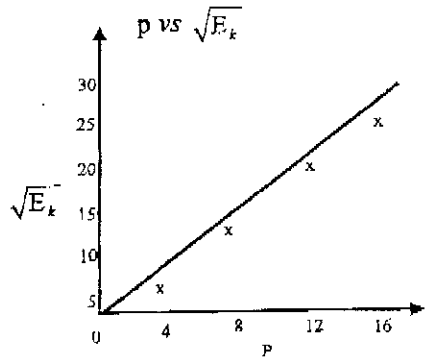
QUESTION 4 / VRAAG 4

4.1.1 What is the relation between momentum and kinetic energy?✓✓OR (2)
How is kinetic energy related to momentum?
Wat is die verband tussen momentum en kinetiese energie? OF
Hoe is kinetiese energie verwant aan momentum? 12.1.1

4.1.2 Momentum is proportional to $\sqrt{E_k}$ ✓✓ OR
Momentum is inversely proportional $\sqrt{E_k}$
Momentum is eweredig aan $\sqrt{E_k}$ OF
Momentum is omgekeerd eweredig aan $\sqrt{E_k}$ 12.1.1 (2)

OR/OF $p \propto E_k$ OR $p \propto \frac{1}{E_k}$

4.1.3



Heading and both axes labelled.✓
Opskrif en beide asse se byskrifte.
Straight line / Reguit lyn.✓
Minimum of 3 correct points /✓✓
Minimum van 3 korrekte punte
Total / Totaal: 4 marks / punte

12.1.2 (4)

4.1.4 ___ OR momentum is directly proportional to ___ (2)
___ OF momentum is direk eweredig aan ___ 12.1.2

4.1.5 Yes / Ja. ✓No – if hypothesis was $p \propto \frac{1}{\sqrt{E_k}}$ Nee, as die hipotese $p \propto \frac{1}{\sqrt{E_k}}$ was. (1) 12.1.2

4.1.6 Mass of trolley / Massa van die trollie.✓ (1) 12.1.1

[12]

QUESTION 5/ VRAAG 5

5.1 5.1.1 $144\ \text{km.h}^{-1} = \frac{144\text{x}1000}{60\text{x}60} = 40\text{m.s}^{-1}$ ✓

(1)
12.2.3

5.1.2 Impulse imparted to cricket ball ✓ = change in momentum
Impuls oorgedra na krieketbal = verandering in momentum

$$F\Delta t = mv_f - mv_i$$
$$= m(v_f - v_i)$$
✓ ✓
$$= 150 \text{ x } 10^{-3}(-35 - 40)$$
$$= 150 \text{ x } 10^{-3}(-75)$$
$$= 11{,}25\ \text{kg.m.s}^{-1} \text{ or N.s} \checkmark$$

(4)
12.2.3

5.1.3 $11{,}25\ \text{kg.ms}^{-1}$ ✓

(1)
12.3.2

5.2 By pulling the hands back, the time taken to stop the ball increases. Therefore, the change of momentum per second or rate of change of momentum is reduced.✓ Since force equals change of momentum per second, the force of impact is reduced✓ by this technique.
Deur sy hande terug te trek neem die tyd om die bal te stop toe. Die verandering in momentum per sekonde of die tempo van verandering in momentum neem af. Aangesien krag gelyk is verandering in momentum per sekonde, word die impak van die krag verminder deur hierdie tegniek te gebruik.

(3)
12.2.3

[9]

QUESTION 6/VRAAG 6

6.1 The work done on a body by a resultant force is equal to the change in the kinetic energy of the body. ✓✓
Die arbeid wat op 'n liggaam verrig word deur 'n resulterende krag is gelyk aan die verandering in die kinetiese energie van die liggaam. (2)
12.2.1

6.2 $\Delta E_k = \frac{1}{2}mv^2 \overset{\checkmark}{-} 0$

$= \frac{1}{2} x1x10^{-3}x4x4$ ✓

$=8x10^{-3}J$ ✓

$\Delta E_p = mg\Delta h$ ✓

$= 1 \times 10^{-3} \times 9,8 \times 10$ ✓

$= 98 \times 10^{-3}$ J ✓

Work done by friction force $= \Delta E_k \overset{\checkmark}{-} \Delta E_p$ ✓

$= 8 \times 10^{-3}$ J – $98x10^{-3}$ J

$= -9,0 \times 10^{-2}$ J ✓

(or $9,0 \times 10^{-2}$ J in opposite direction.)

OR

$W_{down} = \Delta E_k$	$W_{up} = \Delta E_p$
$F\Delta x\cos\theta = \frac{1}{2} mv_f^2 - \frac{1}{2} mv_i^2$ ✓	$F\Delta x\cos\theta = mgh_1 - mgh_2$ ✓
$Fx10\overset{\checkmark}{x}\cos 0 = (\frac{1}{2} \times 1 \times \overset{\checkmark}{10^{-3}} \times 4x4)-0$	$Fx10x\cos\overset{\checkmark}{1}80 = (1x10^{-3} x9,8x10)-0$ ✓
$10F = 8 \times 10^{-3}$ J	$-10F = 98 \times 10^{-3}$ J
$F_{down} = 8 \times 10^{-4}$ N	$F_{up} = -98 \times 10^{-4}$ N (- means upward)

$F_{friction} = 98x10^{-4} \overset{\checkmark}{-} 8x10^{-4} = 90 \times 10^{-4}$ N

Work done by frictional force = $F\Delta x\cos\theta$

= $90x10^{-4}x10x\cos180^0$ ✓

= $-90x10^{-3}$] ✓

= $-9,0 \times 10^{-2}$ J (- means work done by upward force which is frictional force)

(9)
12.1.3
[11]

QUESTION 7 / VRAAG 7

7.1 The apparent change in the frequency of sound when the source of sound, the observer and the medium are in relative motion is called the Doppler Effect. OR
Die skynbareverandering in die frekwensie van klank wanneer die bron van klank, die waarnemer en die medium in relatiewe beweging is staan bekend as die Doppler-effek. OF
The apparent change in the frequency of the source due to the relative motion between the source and the observer is called the Doppler Effect. ✓✓
Die skynbare verandering in die frekwensie van die bron as gevolg van die relatiewe beweging tussen die bron en die waarnemer staan bekend as die Doppler-effek. (2)
12.2.1

7.2 To determine the speed of an approaching submarine, etc. ✓
Om die spoed van 'n naderende duikboot te bepaal, ens. (1)
12.3.3

7.3 7.3.1

Source approaching the listener
Bron wat die hoorder nader

$f_L = \frac{V \pm V_L}{V \pm V_S} f$ ✓

$= \frac{340+0}{340-20} \times 640$ ✓ ✓

= 680 Hz ✓

also accept / aanvaar ook

$f_L = \frac{V_S f_S}{V - V_S}$

$= \frac{340 \times 640}{340-20}$

= 680 Hz

(5)
12.2.3

7.3.2 A person standing at C hears a lower ✓ frequency. Waves are less compressed at an angle to the motion. ✓
'n Persoon by C hoor 'n laer frekwensie. Die golwe is minder saamgepers teen 'n hoek met die beweging. (2)
12.2.2

[10]

QUESTION 8 / VRAAG 8

8.1 Light of single wavelength OR single colour. ✓✓
Lig van 'n enkele golflengte OF enkele kleur. (2)
12.2.1

8.2 Diffraction / Diffraksie ✓ (1)
12.2.1

8.3 8.3.1 A central blue band is seen which is narrower than central red band.✓ ✓
'n Sentrale blou band word waargeneem wat smaller is as die rooi band. (2)
12.1.2

8.3.2 Red has a longer wavelength than blue.✓
Rooi het 'n langer golflengte as blou. (1)
12.1.4

8.4 $\sin\theta = \frac{m\lambda}{a}$ ✓

$= \frac{2 \times 800 \times 10^{9}}{4 \times 10^{-6}}$ ✓ $= 0,4$ ✓

$\therefore \theta = \sin^{-1} 0,4 = 23,58^{0}$ ✓ (4)
12.2.3
[10]

QUESTION 9 / VRAAG 9

9.1 $F = \frac{kQ_1Q_2}{r^2}$ ✓

$= \frac{(9 \times 10^9) \times (6 \times 10^{-6}) \times (6 \times 10^{-6})}{(1)^2}$ ✓

$= 3,24 \times 10^{-1}$ N ✓ (4)

12.2.2

9.2 Repulsion / Afstoting ✓ (1)

12.1.2

9.3 16 ✓✓ (2)

9.4 Electric field E_A at O / Elektriese veld E_A by O

$E_A = \frac{kQ_A}{r^2_{AO}}$ ✓

$= \frac{9x10^9x6x10^{-6}}{(0,10)^2}$ ✓

$= 5,4x10^6 NC^{-1}$ ✓ to the right

Electric field E_B at O / Elektriese veld E_B by O (6)

$E_B = \frac{kQ_B}{r^2_{BO}}$

$E_B = \frac{9\times10^9\times6\times10^{-6}}{(0,90)^2}$ ✓

$= 6,67\times10^4$ N.C^{-1} to the left. / na links. ✓

Net electric field = $5,4 \times 10^6 - 6,67 \times 10^4$

$= 5,33 \times 10^6$ N.C^{-1} to the right. / na regs. ✓

12.1.3

[13]

QUESTION 10 / VRAAG 10

10.1 24 V✓, This is the voltage when no current is flowing or when the switches are open.
Dit is die potensiaal wanneer geen stroom vloei nie of wanneer die skakelaars oop is.✓ (2) 12.2.2

10.2 10.2.1 Resistance of parallel combination. / Weerstand van parallellekombinasie.

$$R_p = \frac{R_1 R_2}{R_1 + R_2} = \frac{6x3}{6+3} = 2\ \Omega \quad ✓$$

OR/OF

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{6} + \frac{1}{3}$$
$$R_p = 2\ \Omega$$

then total resistance in the circuit / totale weerstand van die stroombaan

$R = R_3 + R_p + r$
$= 5 + 2 + r = 7 + r$ ✓

Therefore current in the main circuit. / Daarom stroom in die hoofbaan.

$$I = \frac{E}{R}$$
$$3 = \frac{24}{7+r} \quad ✓$$
$$\therefore 7 + r = 8$$
$$\therefore r = 1\ \Omega \quad ✓$$

12.1.3 (4)

10.2.2 Potential difference across parallel combination.
Potensiaalverskil oor die parallellekombinasie.

$V = I \times R$
$= 3 \times 2 = 6\ V$ ✓
$\therefore I_{R_2} = \frac{V}{R_2}$ ✓
$= \frac{6}{3} = 2\ A$ ✓

12.2.3 (3)

10.3 10.3.1 Increases. / Neem toe.✓ 12.2.2 (1)

10.3.2 Decreases. / Neem af. ✓ 12.2.2 (1)

[11]

QUESTION 11 / VRAAG 11

11.1 11.1.1 $V_{rms} = \frac{V_{max}}{\sqrt{2}}$ ✓

$= \frac{200}{\sqrt{2}}$ ✓ $= 141{,}42$ V ✓ (3) 12.2.3

11.1.2 $I_{rms} = \frac{V_{max}}{R}$ ✓

$= \frac{141{,}42}{10}$ ✓ $= 14{,}14$ A ✓ (3) 12.2.3

11.1.3 $P_{av} = V_{rms} \times I_{rms}$ ✓

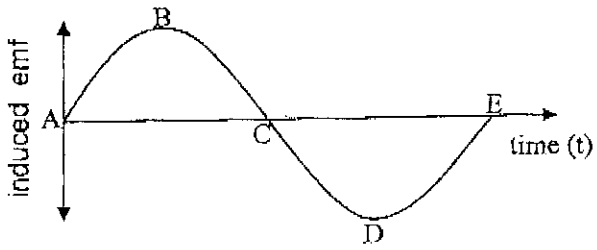
$= 141{,}42 \times 14{,}14$ ✓ $= 1999{,}68$ W (accept/aanvaar 2 000 W) ✓ (3) 12.2.3

11.2 **14,14 A** ✓ (1) 12.2.2

[10]

QUESTION 12 / VRAAG 12

12.1



Correct shape ✓
Correct A to E
labelling ✓

(2) 12.1.2

12.2 **a.c. dynamo uses slip rings. / ws-dinamo gebruik sleepringe.**✓
d.c. dynamo uses a commutator. / gs-dinamo gebruik 'n kommutator.✓ (2) 12.2.1

12.3 **Voltage can be stepped up or down easily. OR Current can be transported over long distance with little loss of energy.**✓
Potensiaalverskil kan maklik verhoog of verlaag word. OF Stroom kan oor lang afstande vervoer word met min energie verlies. (1) 12.2.3

12.4 The a.c. always flows on the outer layer of the wire. When many wires are put together a strong flow is maintained.✓
Die wsvloei is in die buitenste laag van die draad. As baie drade bymekaar gesit word 'n sterk vloei gehandhaaf. 12.3.2

OR when many wires are put together it reduces the heating effect.
OF wanneer baie drade bymekaar gesit word verminder dit die verhittingseffek. (2)

[7]

QUESTION 13 / VRAAG 13

13.1 13.1.1 Light energy to electrical energy. / Ligenergie na elektriese energie. ✓✓ 12.2.1 (2)

13.1.2 Photo electric effect. / Fotoëlektriese effek. ✓✓ 12.2.1 (2)

13.1.3 $\text{Energy of photon} = \frac{hc}{\lambda}$ ✓

$= \frac{6,63\text{x}10^{-34}\text{x}3\text{x}10^{8}}{6,8\text{x}10^{-19}}$ ✓

$= 2,925\text{x}10^{-19}\text{J}$ ✓ 12.2.3

Photo electric emission **will not** ✓ take place. Energy of the photon is less than the work function for Na. ✓
Fotoëlektriese emissie sal nie plaasvind nie. Energie van die foton is minder as die werksfunksievir Na. (5)
[9]

QUESTION 14 / VRAAG 14

14.1 14.1.1 The spectrum produced by a source of light is an emission spectrum. ✓✓
Die spektrum wat geproduseer word deur die bron van lig is 'n emissie spektrum. (2) 12.2.1

14.1.2 To identify the elements in the source. ✓✓
Om die elemente in die bron te identifiseer. (2) 12.3.2

14.2 14.2.1 One electron can be excited to different levels ✓ and the electron can fall back to different levels, therefore emitting different energies ✓ that corresponds to different frequencies. ✓
Een elektron kan opgewek word tot verskillende vlakke en die elektron kan terugval tot verskillende vlakke en daarom verskillende energies uitstraal wat ooreenstem met verskillende frekwensies. (3) 12.1.3

14.2.2 $c = f\lambda$ ✓

$3\text{x}10^{8} = 4,5\text{x}10^{14}\lambda$ ✓

$\lambda = 6,66\text{x}10^{-7}m$ ✓ (3) 12.2.3
[10]

TOTAAL SECTION B / TOTAAL AFDELING B: 125

GRAND TOTAL / GROOTTOTAAL: 150