education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL
SENIOR CERTIFICATE/
NASIONALE SENIOR
SERTIFIKAAT

GRADE/*GRAAD* 12

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

MEMORANDUM

ADDITIONAL EXEMPLAR/ADDISIONELE MODEL 2008

MARKS/PUNTE: 150

TIME/*TYD*: 3 hours/*uur*

This memorandum consists of 15 pages.
Hierdie memorandum bestaan uit 15 bladsye

Learning Outcomes and Assessment Standards ***Leeruitkomste en Assesseringstandaarde***		
LO 1/*LU 1*	**LO 2/*LU 2***	**LO 3/*LU 3***
AS 12.1.1: Design, plan and conduct a scientific inquiry to collect data systematically with regard to accuracy, reliability and the need to control variables. *Ontwerp, beplan en voer 'n wetenskaplike ondersoek uit om data te versamel ten opsigte van akkuraatheid, betroubaarheid en die kontroleer van veranderlikes.* **AS 12.1.2:** Seek patterns and trends, represent them in different forms, explain the trends, use scientific reasoning to draw and evaluate conclusions, and formulate generalisations. *Soek patrone en tendense, stel dit in verskillende vorms voor, verduidelik tendense, gebruik wetenskaplike beredenering om gevolgtrekkings te maak en te evalueer, en formuleer veralgemenings.* **AS 12.1.3:** Select and use appropriate problem-solving strategies to solve (unseen) problems. *Kies en gebruik geskikte probleemoplossingstrategieë om (ongesiene) probleme op te los.* **AS 12.1.4:** Communicate and defend scientific arguments with clarity and precision. *Kommunikeer en verdedig wetenskaplike argumente duidelik en presies.*	**AS 12.2.1:** Define, discuss and explain prescribed scientific knowledge. *Definieer, bespreek en verduidelik voorgeskrewe wetenskaplike kennis.* **AS 12.2.2** Express and explain prescribed scientific principles, theories, models and laws by indicating the relationship between different facts and concepts in own words. *Verduidelik en druk voorgeskrewe wetenskaplike beginsels, teorieë, modelle en wette uit deur die verwantskap tussen verskillende feite konsepte in eie woorde aan te dui.* **AS 12.2.3:** Apply scientific knowledge in everyday life contexts. *Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.*	**AS 12.3.2:** Research case studies and present ethical and moral arguments from different perspectives to indicate the impact (pros and cons) of different scientific and technological applications. *Vors gevallestudies na en lewer etiese en morele argumente uit verskillende perspektiewe om die impak (voordele en nadele) van verskillende wetenskaplike en tegnologiese toepassings aan te dui.* **AS 12.3.3:** Evaluate the impact of scientific and technological research and indicate the contribution to the management, utilisation and development of resources to ensure sustainability continentally and globally. *Evalueer die impak van wetenskaplike en tegnologiese navorsing en dui die bydrae tot bestuur, benutting en ontwikkeling van bronne om volhoubaarheid kontinentaal en globaal te verseker.*

SECTION A/*AFDELING A*

QUESTION 1/*VRAAG 1*

1.1	Work done/*Arbeid of werk verrig* ✓	[12.2.1]	(1)
1.2	Power/*Drywing* ✓	[12.2.1]	(1)
1.3	Interference/*Interferensie* ✓	[12.2.1]	(1)
1.4	Electric field (strength)/*Elektriese veld(sterkte)* ✓	[12.2.1]	(1)
1.5	Spontaneous emission/*Spontane uitstraling* ✓	[12.2.1]	(1)
			[5]

QUESTION 2/*VRAAG 2*

2.1	E ✓	[12.2.1]	(1)
2.2	J ✓	[12.2.3]	(1)
2.3	H ✓	[12.2.1]	(1)
2.4	A ✓	[12.2.1]	(1)
2.5	F ✓	[12.2.1]	(1)
			[5]

QUESTION 3/*VRAAG 3*

3.1	True/*Waar* ✓✓	[12.2.2]	(2)
3.2	False/*Onwaar* ✓ … is broader …✓ /*… is breër …*	[12.2.2]	(2)
3.3	False/*Onwaar* ✓ … increase the electrostatic force four times/.. *verhoog die elektrostatiese krag vier keer …* ✓	[12.2.2]	(2)
3.4	False/*Onwaar* ✓ … a DC generator produces a <u>pulsating</u> direct current/ … *'n GS-generator lewer 'n pulserende direkte stroom* ✓	[12.2.1]	(2)
3.5	True/*Waar* ✓✓	[12.2.1]	(2)
			[10]

QUESTION 4/*VRAAG 4*

4.1	B ✓✓✓	[12.2.2]	(3)
4.2	A ✓✓✓	[12.1.2]	(3)
4.3	B ✓✓✓	[12.2.3]	(3)
4.4	C ✓✓✓	[12.1.3]	(3)
4.5	D ✓✓✓	[12.1.2]	(3)
			[15]

TOTAL SECTION A:/*TOTAAL AFDELING A:* 35

SECTION B/*AFDELING B*

QUESTION 5/*VRAAG 5*

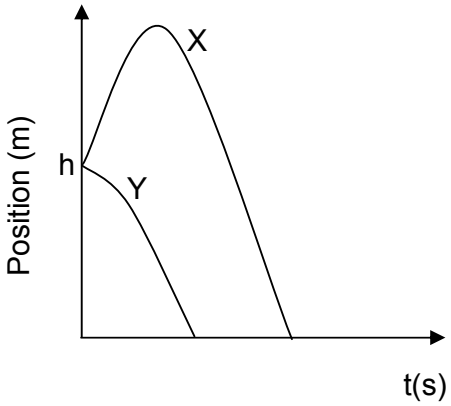
5.1
- Release a stone from the top of the well and let it fall straight down into the well./*Laat val 'n klip vanaf die bopunt van die put reguit in die put in.* ✓
- Take the time from it was released until it splashes in the water./*Neem die tyd vandat die klip laat val is totdat dit die water tref.* ✓
- Use the equation $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓with v_i = 0 to calculate the depth of the water level./*Gebruik die vergelyking* $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ *met* v_i *= 0 om die diepte van die watervlak te bereken.*

[12.1.1] (3)

5.2 Due to air friction gravity is not the only force acting on the object./*Weens lugweerstand is gravitasie nie die enigste krag wat op die voorwerp inwerk nie.* ✓

[12.2.3] (1)

5.3.1



Checklist/*Kontrolelys* Criteria for graph/*Kriteria vir grafiek:*	Marks/ *Punte*
Both graphs starts at height h or same height/*Beide grafieke begin by hoogte h of by dieselfde hoogte*	✓
Shape of graph X as indicated/*Vorm van grafiek X korrek aangedui*	✓
Shape of graph Y as indicated/ *Vorm van grafiek Y korrek aangedui*	✓
Time on x-axis for X longer than for Y/*Tyd op x-as vir X langer as vir Y*	✓

[12.1.2] (4)

5.3.2 Velocities will be the same/*Snelhede sal dieselfde wees.* ✓

Both X and Y experience the same displacement ✓and same acceleration.✓ On its downward flight X has same velocity as Y at a height of h. ✓
Using $v_f^2 = v_i^2 + 2a\Delta y$ will thus give the same final velocity for both.

Beide X en Y ondergaan dieselfde verplasing.✓ en ondervind dieselfde versnelling. .✓ Op sy afwaarste vlug het X dieselfde snelheid as Y op hoogte h. ✓ Deur gebruik te maak van $v_f^2 = v_i^2 + 2a\Delta y$ *sal beide dus dieselfde eindsnelheid hê.*

[12.1.4] (4)

5.4 For X - upward as negative/*Vir X - opwaarts as negatief*:
$v_f^2 = v_i^2 + 2a\Delta y$ = $(2)^2 + 2(9,8)(50) = 31,37$ m·s^{-1}

$v_f = v_i + a\Delta t$ ✓
$\therefore$ 31,37 = 2 + 9,8Δt✓
$\therefore \Delta t = 2,997 = 3$ s

For/*Vir* Y:

$\Delta t = 3 - 1 = 2$ s ✓
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$\therefore 50 = v_i(2) + 0,5(9,8)(2)^2$ ✓
$\therefore v_i = 15,2$ m·s^{-1} downward/*afwaarts*✓

OR/*OF*

For X - upward as negative/*Vir X - opwaarts as negatief*:
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$50 = 2\Delta t + \frac{1}{2}(9,8)\Delta t^2$✓ $\therefore 4,9\Delta t^2 + 2\Delta t - 50 = 0$

$$\Delta t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-2 \pm \sqrt{2^2 - 4(4,9)(-50)}}{2(4,9)}$$

$\therefore \Delta t = 2,997$ s = 3 s

For/*Vir* Y:

$\Delta t = 3 - 1 = 2$ s ✓
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$\therefore 50 = v_i(2) + 0,5(9,8)(2)^2$✓
$\therefore v_i = 15,2$ m·s^{-1} downward/*afwaarts* ✓

[12.1.3] (6)
[18]

QUESTION 6/*VRAAG 6*

6.1 When the airbag inflates during a collision, the contact time of a passenger/driver with an air bag is longer than without an airbag ✓and thus the force on the passenger/driver is reduced ✓ according to $F_{net} = \frac{\Delta p}{\Delta t}$ ✓.

Wanneer die lugsak opblaas tydens 'n botsing, is die kontaktyd van die passasier/bestuurder met 'n lugsak langer as sonder 'n lugsak ✓en dus is die krag op die passasier/bestuurder kleiner ✓volgens $F_{net} = \frac{\Delta p}{\Delta t}$ ✓. [12.3.2] (3)

6.2.1 Take to the right as negative/*Neem na regs as negatief*:

$F_{net}\Delta t = \Delta p = mv_f - mv_i$ ✓

$\therefore F_{net}\Delta t = 1,2 \times 10^3 (-2 - 12)$ ✓ $= -1,68 \times 10^4$

∴ Impulse = $1,68 \times 10^4$ N·s ✓ to the right/*na regs* or/*of* away from wall/*weg vanaf muur* ✓

OR/*OF*

$v_f = v_i + a\Delta t$

$\therefore -2 = 12 + a(0,1)$

$\therefore a = -140$ m·s^{-2}

$\therefore = 140$ m·s^{-2} to the right/*na regs*

$\therefore F_{net} = ma = (1,2 \times 10^3)(-140)$ ✓ $= -1,68 \times 10^5$

$\therefore F_{net} = 1,68 \times 10^5$ N to the right/*na regs* or/*of* away from wall/*weg vanaf muur*

Impulse = $F_{net}\Delta t$ ✓$= (1,68 \times 10^5)(0,1)$ ✓

$= 1,68 \times 10^4$ N·s ✓ to the right/*na regs* or/*of* away from wall/*weg vanaf muur* ✓ [12.2.3] (4)

6.2.2 $F_{net}\Delta t = \Delta p = -1,68 \times 10^4$

$\therefore F_{net}(0,1) = -1,68 \times 10^4$ ✓

$\therefore F_{net} = -1,68 \times 10^5$ N

$\therefore F_{net} = 1,68 \times 10^5$ N ✓to the right/*na regs*✓

OR/*OF*

Take to the right as negative:

$v_f = v_i + a\Delta t$

$\therefore -2 = 12 + a(0,1) \quad \therefore a = -140$ m·s^{-2}

$\therefore F_{net} = ma = (1,2 \times 10^3)(-140)$ ✓ $= -1,68 \times 10^5$

$\therefore F_{net} = 1,68 \times 10^5$ N ✓to the right/*na regs* ✓ or/*of* away from the wall/*weg van die muur af* [12.2.3] (3)

6.3 Decreases/*Neem af* ✓

The final velocity of the car is zero and thus Δp decreases ✓

Die finale snelheid van die motor is nul en dus neem Δp *af.* ✓ [12.2.2] (2)

[12]

QUESTION 7/*VRAAG 7*

7.1 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 is gelyk aan die verandering in kinetiese energie van die voorwerp.* ✓✓

OR/*OF*

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.*

[12.2.1] (2)

7.2 $(E_p + E_k)_f = (E_p + E_k)_i$

$mgh_f + \frac{1}{2}mv_f^2 = mgh_i + \frac{1}{2}mv_i^2$ ✓

$m(9,8)(5)$ ✓ $+ 0$ ✓$= m(9,8)(1,3)$ ✓ $+ \frac{1}{2}mv_i^2$

$v_i = 8,52\ m\cdot s^{-1}$ ✓

OR/*OF*

$W_{net} = \Delta E_k = E_{kf} - E_{ki}$ ✓

(Work done is only due to gravity/*arbeid verrig slegs deur gravitasie*)

$W_{net} = F\cos\theta\ \Delta y = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$\therefore mg\cos180°(h_f - h_i)$ ✓ $= 0 - \frac{1}{2}mv_i^2$ ✓

[$E_{kf} = 0$, v_f at highest point is zero/*by hoogste punt is nul*]

$\therefore m(9,8)\cos180°(5 - 1,3) = -\frac{1}{2}mv_i^2$ ✓

$\therefore m(9,8)(-1)(3,7) = -\frac{1}{2}mv_i^2$

$\therefore\ v_i = 8,52\ m\cdot s^{-1}$ ✓

OR/*OF*

W(external forces/*eksterne kragte*) $= \Delta E_p + \Delta E_k$ ✓

0 ✓$= mg(h_f - h_i) + (\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2)$ ✓

$\therefore -mg(h_f - h_i) = -\frac{1}{2}mv_i^2$

$\therefore -m(9,8)(5 - 1,3) = -\frac{1}{2}mv_i^2$ ✓

$v_i = 8,52\ m\cdot s^{-1}$ ✓

[12.1.3] (5)
[7]

QUESTION 8/*VRAAG 8*

8.1 Doppler effect/*Doppler-effek* ✓

A change in observed frequency (pitch) due to relative motion between observer and sound source./*'n Verandering in waargenome frekwensie (toonhoogte) wanneer daar relatiewe beweging tussen 'n klankbron en 'n waarnemer is.* ✓✓

OR/*OF*

A change in observed frequency (pitch) because the sound source and observer have different velocities with respect to the medium./ *'n Verandering in waargenome frekwensie (toonhoogte) omdat die bron en die waarnemer verskillende snelhede ten opsigte van die medium het.* ✓✓ [12.2.1] (3)

8.2 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓

When car approaches/*Wanneer motor nader beweeg:*

$f_L(\text{approach/}nader) = (\frac{340 + v_L}{340 \pm 0})700$ ✓

When car moves away/*Wanneer motor weg beweeg:*

$f_L(\text{away/}weg) = (\frac{340 - v_L}{340 \pm 0})700$ ✓

$(\frac{340 + v_L}{340 \pm 0})700 - (\frac{340 - v_L}{340 \pm 0})700 = 80$ ✓

$\therefore \frac{700}{340}(340 + v_L - 340 + v_L) = 80$

$\therefore v_L = 19{,}43\ m \cdot s^{-1}$ ✓

OR/*OF*

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

$f_L(\text{approach/}nader) = (\frac{v + v_L}{v \pm 0})f_s$ ✓

$f_L(\text{away/}weg) = (\frac{v - v_L}{v \pm 0})f_s$ ✓

$f_L(\text{approach/}nader) - f_L(\text{away/}weg) = (\frac{v + v_L}{v \pm 0})f_s - (\frac{v - v_L}{v \pm 0})f_s = 80$ ✓

$\therefore 80 = \frac{2f_s v_L}{v} = \frac{2(700)v_L}{340}$

$\therefore v_L = 19{,}43\ m \cdot s^{-1}$ ✓ [12.1.3] (5)
[8]

QUESTION 9/*VRAAG 9*

9.1 Diffraction/*Diffraksie* ✓ [12.1.2] (1)

9.2 Wavelets originating from different points in the slit ✓reach the screen out of phase and interfere destructively ✓on the screen.

Golffronte wat vanaf verskillende punte in die spleet ontstaan✓ bereik die skerm uit fase en ondergaan destruktiewe interferensie. ✓ [12.2.3] (2)

9.3 $\sin\theta = \frac{m\lambda}{a}$ ✓

$= \frac{(1)(675 \times 10^{-9})}{1{,}8 \times 10^{-4}}$ ✓

$= 3{,}75 \times 10^{-3}$

$\therefore \theta = 0{,}21°$ ✓

$\tan 0{,}21° = \frac{y}{0{,}4}$ ✓

$\therefore y = 1{,}47 \times 10^{-3}$ m (1,47 mm) ✓

Width of central bright band/*Breedte van sentrale helder band:*
$2y = 2(1{,}47 \times 10^{-3}) = 2{,}93 \times 10^{-3}$ m (2,93 mm) ✓ [12.1.3] (6)

9.4 Increases/*Toeneem* ✓

Diffraction is inversely proportional to the width of the slit. ✓✓
Diffraksie is omgekeerd eweredig aan die breedte van die spleet. ✓✓ [12.2.2]

OR/*OF*

Amount of diffraction is determined by the ratio $\frac{\lambda}{a}$ ✓. If *a* decreases, $\frac{\lambda}{a}$ will increase. ✓/*Hoeveelheid diffraksie word bepaal deur die verhouding* $\frac{\lambda}{a}$✓. *Indien a afneem, sal* $\frac{\lambda}{a}$ *toeneem*✓. (3)

9.5 Red/*Rooi* ✓

The yellow filter transmits red light. ✓– yellow only transmit red and green light. When the red light reaches the magenta filter it will be transmitted ✓– magenta only transmits red and blue light.

Die geel filter laat rooi lig deur ✓ *– geel laat slegs rooi en groen lig deur. Wanneer die rooi lig die magenta filter bereik, word dit deurgelaat* ✓ *– magenta laat slegs rooi en blou lig deur.* [12.2.3] (3)
[15]

QUESTION 10/*VRAAG 10*

10.1 As the capacitor charges the direct current decreases ✓and eventually becomes zero when the capacitor is fully charged. ✓
Soos wat die kapasitor laai, verminder die direkte stroom ✓en word uiteindelik nul wanneer die kapasitor ten volle gelaai is. ✓ [12.2.3] (2)

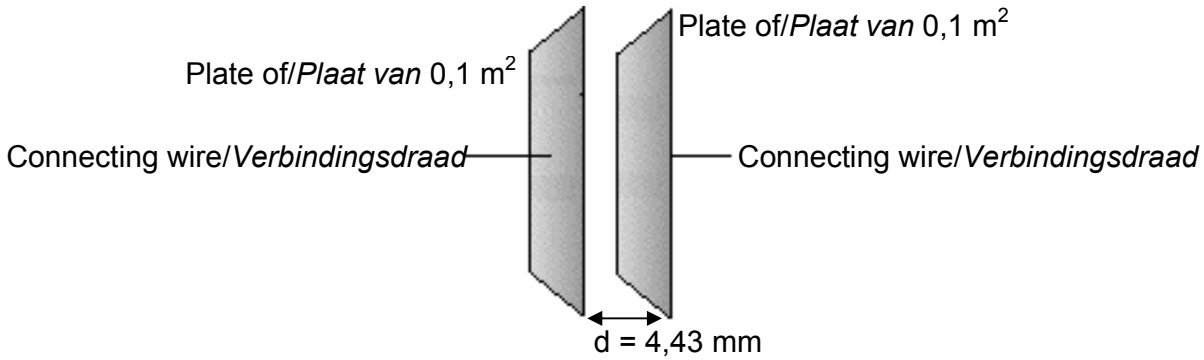
10.2.1 Plate area/*Plaatoppervlakte* = $\frac{0,2}{2}$ = 0,1 m^2 ✓

$C = \frac{\varepsilon_0 A}{d}$ ✓

$\therefore 200 \times 10^{-12} = 8,85 \times 10^{-12} \frac{0,1}{d}$ ✓

$\therefore$ d = 4,43 x 10^{-3} m (4,43 mm) ✓ [12.1.3] (4)

10.2.2



Checklist/*Kontrolelys* Criteria for diagram/*Kriteria vir diagram:*	Marks/ *Punte*
Plates drawn parallel/*Plate parallel geteken*	✓
Area of plates indicated/*Oppervlakte van plate aangedui*	✓
Connecting wires indicated and labelled/Verbindingsdrade aangedui en benoem	✓
Distance between plates indicated/*Afstand tussen plate aangedui*	✓

[12.1.1] (4)

10.2.3 Double the distance between the plates/Increase the distance between the plates to 8,86 mm ✓
Verdubbel die afstand tussen die plate/Vermeerder die afstand tussen die plate na 8,86 mm ✓ [12.2.2] (1)

10.3.1 Batteries store energy in chemical reactions/*Batterye stoor energie in chemiese reaksies* ✓
Capacitors store energy in electric fields/*Kapasitors stoor energie in elektriese velde* ✓ [12.2.1] (2)

10.3.2 Any one/*Enigeen:*
Chemicals e.g. acid or heavy metals can leach into soil and groundwater./*Chemikalieë bv. suur of swaar metale kan in grondwater en grond inbeweeg.* ✓
Plastic casing can pollute environment./*Plastiekomhulsels kan die omgewing besoedel.* [12.3.3] (1)

10.3.3 Capacitors need a source of energy e.g. batteries to obtain charge. ✓
Batteries produce their own energy/electricity from chemical reactions inside the battery. ✓
Kapasitors benodig 'n bron van energie bv. batterye om lading te verkry. ✓ *Batterye produseer hulle eie energie/elektristeit uit chemiese reaksies binne-in die battery*. ✓ [12.1.4] (2)
[16]

QUESTION 11/*VRAAG 11*

11.1 The maximum work done per unit charge/*Maksimum arbeid verrig per eenheidslading* ✓✓ [12.2.1] (2)

11.2 $\frac{1}{R_P} = \frac{1}{4} + \frac{1}{6}$ ✓ $\therefore R_p = 2{,}4\ \Omega$ ✓

R(total/*totaal*) = 2,4 + 6 + 10 + 2 = 20,4 Ω ✓

$I = \frac{V}{R}$ ✓$= \frac{30}{20{,}4}$ ✓= 1,47 A

$V_p = IR_p = (1{,}47)(2{,}4)$ ✓= 3,53 V ✓ [12.1.3] (7)
[9]

QUESTION 12/*VRAAG 12*

12.1 $V_{rms} = \frac{V_{max}}{\sqrt{2}}$ ✓= $\frac{12}{\sqrt{2}}$ ✓= 8,49 V ✓

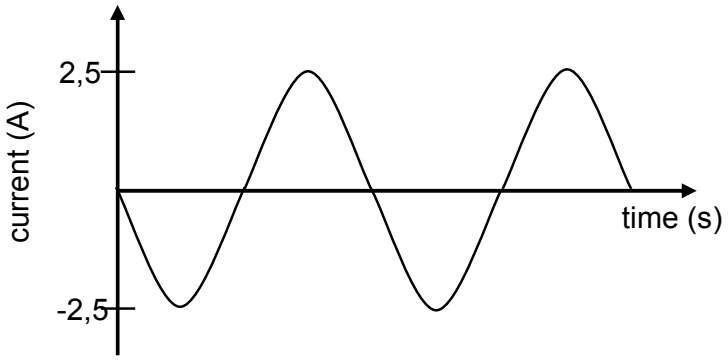
[12.2.3] (3)

12.2 $P_{ave} = V_{rms}I_{rms}$ ✓∴ 15 = 8,49I_{rms} ✓∴ I_{rms} = 1,77 A

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$ ∴ I_{max} = 1,77$\sqrt{2}$ ✓= 2,5 A ✓

[12.2.3] (4)

12.3



Checklist/*Kontrolelys* Criteria for graph/*Kriteria vir grafiek:*	Marks/ *Punte*
Axes drawn and correctly labelled./*Asse geteken en korrek benoem.*	✓
Shape of graph as indicated./*Vorm van grafiek soos getoon.*	✓
Peak current correctly indicated on y-axis/*Kruinstroom korrek op y-as aangedui.*	✓

[12.1.2] (3)
[10]

QUESTION 13/*VRAAG 13*

13.1 DC generator/GS-generator ✓
Split-ring commutator ✓present/*Splitringkommutator teenwoordig* [12.1.2] (2)

13.2 Decrease/*afneem* ✓ as the coil rotates clockwise from the vertical to the horizontal position/*soos wat spoel kloksgewys vanaf die vertikale na horisontale posisie roteer.*

When the coil is in the vertical position in the diagram, the magnetic flux linkage is a minimum, ✓but the change in flux linkage with time is a maximum and thus the induced potential difference in the coil is a maximum. ✓

In the horizontal position the magnetic flux linkage is maximum, ✓but the change in magnetic flux linkage with time is now a minimum, thus the induced potential difference in the coil is a minimum. ✓

Wanneer die spoel in die *vertikale posisie* in die diagram is, is die *magneetvloedkoppeling 'n minimum,* ✓ maar die verandering in vloedkoppeling met tyd is 'n maksimum en dus is die geïnduseerde potensiaalverskil in die spoel 'n maksimum. ✓

Sodra die spoel die horisontale posisie in die diagram bereik, is die magneetvloedkoppeling 'n maksimum, ✓ maar die verandering in vloedkoppeling met tyd is 'n minimum en dus is die geïnduseerde potensiaalverskil in die spoel 'n minimum. ✓ [12.1.2] [12.2.3] (5)

13.3 Any ONE/*Enige EEN:*
Increase the number of wire loops in the coil/*Verhoog aantal windinge in spoel.* ✓
Use a stronger magnet/*Gebruik 'n sterker magneet* [12.2.3] (1)
Rotate the coil faster/*Roteer die spoel vinniger* **[8]**

QUESTION 14/*VRAAG 14*

14.1 Minimum energy needed to eject electrons from a certain material/metal. ✓✓

Minimum energie benodig om elektrone uit 'n spesifieke metaal/materiaal vry te stel. ✓✓ [12.2.1] (2)

14.2 $E = \frac{hc}{\lambda}$ ✓

$\therefore$ 6,9 x 10^{-19} ✓ = $\frac{(6{,}63 \times 10^{-34})(3 \times 10^{8})}{\lambda}$ ✓

$\therefore \lambda$ = 288,26 x 10^{-9} m ✓= 288,26 nm [12.2.3] (4)

14.3 $E_k = \frac{hc}{\lambda}$ - W ✓

$= \frac{(6{,}63 \times 10^{-34})(3 \times 10^{8})}{260 \times 10^{-9}}$ ✓- 6,9 x 10^{-19} ✓

= 7,65 x 10^{-19} – 6,9 x 10^{-19}

= 7,5 x 10^{-20} J ✓ [12.1.3] (4)

14.4 The positively charged zinc plate will attract electrons ✓preventing them from being emitted. ✓

Die positief gelaaide sinkplaat sal elektrone aantrek ✓en vrystelling verhoed. ✓ [12.2.3] (2)

[12]

GRAND TOTAL/*GROOTTOTAAL:* 150