education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL
SENIOR CERTIFICATE

GRADE/*GRAAD* 12

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

NOVEMBER 2009

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 16 pages.
Hierdie memorandum bestaan uit 16 bladsye.

Learning Outcomes and Assessment Standards		
Leeruitkomste en Assesseringstandaarde		
LO1/*LU1*	**LO2/*LU2***	**LO3/*LU3***
AS12.1.1: 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.* **AS12.1.2:** 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 die tendense, gebruik wetenskaplike beredenering om gevolgtrekkings te maak en te evalueer, en formuleer veralgemenings.* **AS12.1.3:** Select and use appropriate problem-solving strategies to solve (unseen) problems. *Kies en gebruik geskikte probleemoplossingstrategieë om (ongesiene) probleme op te los.*	**AS12.2.1:** Define, discuss and explain prescribed scientific knowledge. *Definieer, bespreek en verduidelik voorgeskrewe wetenskaplike kennis.* **AS12.2.2** Express and explain prescribed scientific principles, theories, models and laws by indicating the relationship between different facts and concepts in the candidate's own words. *Verduidelik en druk voorgeskrewe wetenskaplike beginsels, teorieë, modelle en wette uit deur die verwantskap tussen verskillende feite en konsepte in die kandidaat se eie woorde aan te dui.* **AS12.2.3:** Apply scientific knowledge in everyday-life contexts. *Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.*	**AS12.3.1** Research, discuss, compare and evaluate scientific and indigenous knowledge systems and knowledge claims by indicating the correlation among them, and explain the acceptance of different claims. *Doen navorsing, bespreek, vergelyk en evalueer wetenskaplike en inheemse kennissisteme en kennisaansprake deur die ooreenkoms tussen hulle aan te dui, en verduidelik die aanvaarding van verskillende aansprake.* **AS12.3.2:** 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 bied etiese en morele argumente aan uit verskillende perspektiewe om die impak (voordele en nadele) van verskillende wetenskaplike en tegnologiese toepassings aan te dui.*

GENERAL GUIDELINES/*ALGEMENE RIGLYNE*

1.   CALCULATIONS/*BEREKENINGE*

1.1   Marks will be awarded for: correct formula, correct substitution, correct answer with unit.
Punte sal toegeken word vir: korrekte formule, korrekte substitusie, korrekte antwoord met eenheid.

1.2   No marks will be awarded if an incorrect or inappropriate formula is used, even though there may be relevant symbols and applicable substitutions.
Geen punte sal toegeken word waar 'n verkeerde of ontoepaslike formule gebruik word nie, selfs al is daar relevante simbole en relevante substitusies.

1.3   When an error is made during **substitution into a correct formula**, a mark will be awarded for the correct formula and for the correct substitutions, but **no further marks** will be given.
*Wanneer 'n fout gedurende **substitusie in 'n korrekte formule** begaan word, sal 'n punt vir die korrekte formule en vir korrekte substitusies toegeken word, maar **geen verdere punte** sal toegeken word nie.*

1.4   If no formula is given, but all substitutions are correct, a candidate will forfeit one mark.
Indien geen formule gegee is nie, maar al die substitusies is korrek, verloor die kandidaat een punt.

1.5   No marks will be awarded if no formula is given, but correct substitutions OMITTING ZERO SUBSTITUTIONS, are given.
Geen punte sal toegeken word indien 'n kandidaat geen formule gee nie, maar korrek substitueer met WEGLATING VAN NULWAARDES.

1.6   No penalisation if zero substitutions are omitted in calculations where correct formula/principles are given.
Geen penalisering indien nulwaardes nie getoon word nie in berekeninge waar die formule/beginsels korrek gegee is.

1.7   Mathematical manipulations and change of subject of appropriate formulae carry no marks, but if a candidate starts off with the correct formula and then changes the subject of the formula incorrectly, marks will be awarded for the formula and the correct substitutions. The mark for the incorrect numerical answer is forfeited.
Wiskundige manipulasies en verandering van die onderwerp van toepaslike formules tel geen punte nie, maar indien 'n kandidaat met die korrekte formule begin en dan die onderwerp van die formule verkeerd verander, sal punte vir die formule en korrekte substitusies toegeken word. Die punt vir die verkeerde numeriese antwoord word verbeur.

1.8   Marks are only awarded for a formula if a calculation had been **attempted**, i.e. substitutions have been made or a numerical answer given.
*Punte word slegs vir 'n formule toegeken indien 'n **poging** tot 'n berekening aangewend is, d.w.s. substitusies is gedoen of 'n numeriese antwoord is gegee.*

1.9   Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.
Punte kan slegs toegeken word vir substitusies wanneer waardes in formules vervang is en nie vir waardes wat voor 'n berekening gelys is nie.

1.10   All calculations, when not specified in the question, must be done to two decimal places.
Alle berekenings, wanneer dit nie in die vraag gespesifiseer word nie, moet tot twee desimale plekke gedoen word.

2.   DEFINITIONS/*DEFINISIES*

Two marks will be awarded for a correct definition. No marks will be awarded for an incorrect or partially correct definition.
Twee punte sal vir 'n korrekte definisie toegeken word. Geen punte sal vir 'n verkeerde of gedeeltelik korrekte definisie toegeken word nie.

3.   UNITS/*EENHEDE*

3.1   Candidates will only be penalised once for the repeated use of an incorrect unit **within a question or subquestion**.
*Kandidate sal slegs een keer gepenaliseer word vir die herhaaldelike gebruik van 'n verkeerde eenheid **in 'n vraag of subvraag**.*

3.2   Units are only required in the final answer to a calculation.
Eenhede word slegs in die finale antwoord op 'n berekening verlang.

3.3   Marks are only awarded for an answer, and not for a unit. Candidates will therefore forfeit the mark allocated for the answer in each of the following situations:
- Correct answer + wrong unit
- Wrong answer + correct unit
- Correct answer + no unit
Punte word slegs vir 'n antwoord toegeken en nie vir 'n eenheid nie. Kandidate sal derhalwe die punt vir die antwoord in die volgende gevalle verbeur:
- *Korrekte antwoord + verkeerde eenheid*
- *Verkeerde antwoord + korrekte eenheid*
- *Korrekte antwoord + geen eenheid nie*

3.4   SI units must be used, except in certain cases, e.g. $V \cdot m^{-1}$ instead of $N \cdot C^{-1}$, and $cm \cdot s^{-1}$ or $km \cdot h^{-1}$ instead of $m \cdot s^{-1}$ where the question warrants this.
SI-eenhede moet gebruik word, behalwe in sekere gevalle, bv. $V \cdot m^{-1}$ in plaas van $N \cdot C^{-1}$, en $cm \cdot s^{-1}$ of $km \cdot h^{-1}$ in plaas van $m \cdot s^{-1}$ waar die vraag dit regverdig.

4.   GENERAL/*ALGEMEEN*

4.1   If one answer or calculation is required, but two given by the candidate, only the first one will be marked, irrespective of which one is correct. If two answers are required, only the first two will be marked, etc.
Indien een antwoord of berekening verlang word, maar twee word deur die kandidaat gegee, sal slegs die eerste een nagesien word, ongeag watter een korrek is. Indien twee antwoorde verlang word, sal slegs die eerste twee nagesien word, ens.

4.2   For marking purposes, alternative symbols (s, u, t, etc.) will also be accepted
        Vir nasiendoeleindes sal alternatiewe simbole (s, u, t, ens.) ook aanvaar word.

4.3   Separate compound units with a multiplication dot, not a full stop, for example, $m \cdot s^{-1}$. For marking purposes $m.s^{-1}$ will also be accepted.
        Skei saamgestelde eenhede met 'n vermenigvuldigpunt en nie met 'n punt nie, byvoorbeeld $m \cdot s^{-1}$. Vir nasiendoeleindes sal $m.s^{-1}$ ook aanvaar word.

5.   POSITIVE MARKING/POSITIEWE NASIEN

        Positive marking regarding calculations will be followed in the following cases:
        Positiewe nasien met betrekking tot berekenings sal in die volgende gevalle geld:

5.1   **Subquestion to subquestion:** When a certain variable is calculated in one subquestion (e.g. 3.1) and needs to be substituted in another (3.2 or 3.3), e.g. if the answer for 3.1 is incorrect and is substituted correctly in 3.2 or 3.3, **full marks** are to be awarded for the subsequent subquestions.
        Subvraag na subvraag: *Wanneer 'n sekere veranderlike in een subvraag (bv. 3.1) bereken word en dan in 'n ander vervang moet word (3.2 of 3.3), bv. indien die antwoord vir 3.1 verkeerd is en korrek in 3.2 of 3.3 vervang word, word **volpunte** aan die daaropvolgende subvrae toegeken.*

5.2   **A multistep question in a subquestion:** If the candidate has to calculate, for example, current in the first step and gets it wrong due to a substitution error, the mark for the substitution and the final answer will be forfeited.
        'n Vraag met veelvuldige stappe in 'n subvraag: *Indien 'n kandidaat byvoorbeeld die stroom verkeerd bereken in 'n eerste stap as gevolg van 'n substitusiefout, verloor die kandidaat die punt vir die substitusie sowel as die finale antwoord.*

5.3   If a final answer to a calculation is correct, full marks will not automatically be awarded. Markers will always ensure that the correct/appropriate formula is used and that workings, including substitutions, are correct.
        Indien 'n finale antwoord tot 'n berekening korrek is, sal volpunte nie outomaties toegeken word nie. Nasieners sal altyd verseker dat die korrekte/toepaslike formule gebruik word en dat bewerkings, insluitend substitusies, korrek is.

5.4   Questions where a series of calculations have to be made (e.g. a circuit diagram question) do not necessarily always have to follow the same order. FULL MARKS will be awarded, provided it is a valid solution to the problem. However, any calculation that will not bring the candidate closer to the answer than the original data, will not count any marks.
        Vrae waar 'n reeks berekenings gedoen moet word (bv. 'n stroomdiagramvraag) hoef nie noodwendig dieselfde volgorde te hê nie. VOLPUNTE sal toegeken word op voorwaarde dat dit 'n geldige oplossing vir die probleem is. Enige berekening wat egter nie die kandidaat nader as die oorspronklike data aan die antwoord bring nie, sal geen punte tel nie.

5.5   If one answer or calculation is required, but two given by the candidate, only the first one will be marked, irrespective of which one is correct. If two answers are required, only the first two will be marked, etc.
Indien een antwoord of berekening verlang word, maar twee word deur die kandidaat gegee, sal slegs die eerste een nagesien word, ongeag watter een korrek is. Indien twee antwoorde verlang word, sal slegs die eerste twee nagesien word, ens.

5.6   Normally, if based on a conceptual mistake, an incorrect answer cannot be correctly motivated. If the candidate is therefore required to motivate in QUESTION 3.2 the answer given to QUESTION 3.1, and 3.1 is incorrect, no marks can be awarded for QUESTION 3.2. However, if the answer for 3.1. is based on a calculation, the motivation for the incorrect answer in 3.2 could be considered.
'n Verkeerde antwoord, indien dit op 'n konsepsuele fout gebaseer is, kan normaalweg nie korrek gemotiveer word nie. Indien 'n kandidaat gevra word om in VRAAG 3.2 die antwoord op VRAAG 3.1 te motiveer en 3.1 is verkeerd, kan geen punte vir VRAAG 3.2 toegeken word nie. Indien die antwoord op 3.1 egter op 'n berekening gebaseer is, kan die motivering vir die verkeerde antwoord in 3.2 oorweeg word.

SECTION A/*AFDELING A*

QUESTION 1/*VRAAG 1*

1.1   Net (resultant) force/*Netto (resulterende) krag* ✓   [12.2.1]   (1)

1.2   Free fall/*Vryval* ✓   [12.2.1]   (1)

1.3   Refraction/*Breking* ✓   [12.2.1]   (1)

1.4   Ohm's law/*Ohm se wet* ✓   [12.2.1]   (1)

1.5   Laser ✓   [12.2.1]   (1)
                                                                          [5]

QUESTION 2/*VRAAG 2*

2.1   … is equal to the change in <u>kinetic energy</u> ... ✓✓
        … is gelyk aan die verandering in <u>kinetiese energie</u> ...   [12.2.2]   (2)

2.2   … is 2 m·s^{-1} east./*… is 2 m·s^{-1} oos.* ✓✓   [12.2.3]   (2)

2.3   The number of bright bands per unit length observed in an interference
        pattern on a screen will <u>decrease</u> …✓✓
        *Die aantal helder bande per eenheidslengte wat in 'n
        interferensiepatroon waargeneem word, sal <u>afneem</u> ...*

        OR/*OF*
        … when the wavelength of the waves passing through a double slit
        <u>decreases</u>.
        *… wanneer die golflengte van die golwe wat deur die dubbelspleet
        beweeg, <u>afneem</u>.*

        OR/*OF*
        … when the <u>frequency</u> of the waves passing through a double slit
        increases.
        *… wanneer die <u>frekwensie</u> van die golwe wat deur die dubbelspleet
        beweeg, toeneem.*   [12.2.2]   (2)

2.4   A lamp functioning at RMS voltage …/*'n Lamp wat teen WGK-
        potensiaalverskil ...* ✓ ✓

        OR/*OF*
        … glow dimmer than when connected to the same voltage (DC). ✓ ✓
        *… dowwer gloei as wanneer dit gekoppel is aan dieselfde
        potensiaalverskil (GS).*   [12.2.3]   (2)

2.5   … of the <u>same</u> energy./ *… van <u>dieselfde</u> energie.* ✓ ✓

        OR/*OF*
        White light has .../*Wit lig het ...*   [12.2.2]   (2)
                                                                          [10]

QUESTION 3/*VRAAG 3*

3.1   A ✓✓   [12.1.2]   (2)

3.2   C ✓✓   [12.1.2]   (2)

3.3   C ✓✓   [12.2.2]   (2)

3.4   D ✓ ✓   [12.2.2]   (2)

3.5   A ✓ ✓   [12.2.1]   (2)
                                                                                            [10]

TOTAL SECTION A/*TOTAAL AFDELING A:*   25

SECTION B/*AFDELING B*

QUESTION 4/*VRAAG 4*

4.1   t = 0 s:
        ball starts <u>from rest</u>/*bal begin <u>uit rus</u>* ✓
        OR/*OF*
        ball starts at 0 (m·s^{-1})/*bal begin teen 0 (m·s^{-1})*

        t = 0 s – 0,4 s:
        Falls at <u>constant acceleration</u>/*val teen <u>konstante versnelling</u>* ✓

        OR/*OF*
        no change in acceleration/*geen verandering in versnelling* nie

        OR/*OF*
        constant increase in velocity/*konstante toename in snelheid*

        t = 0,4 s: Reaches the floor at 4 m·s^{-1} (or 4 m·s^{-1} downwards)/*bereik die
        vloer teen 4 m·s^{-1} (of 4 m·s^{-1} afwaarts)* ✓

        t = 0,4 s: Bounces back at -3 m·s^{-1} (or 3 m·s^{-1} upwards)/*Bons terug
        teen -3 m·s^{-1} (of 3 m·s^{-1}opwaarts)* ✓   [12.1.2]   (4)

4.2 $\triangle$y = area of triangle =/*oppervlakte van driehoek* = $\frac{1}{2}$bh ✓

        = $\frac{1}{2}$ (0,4) ✓ (4) ✓
        = 0,8 m ✓   [12.1.2]   (4)

4.3
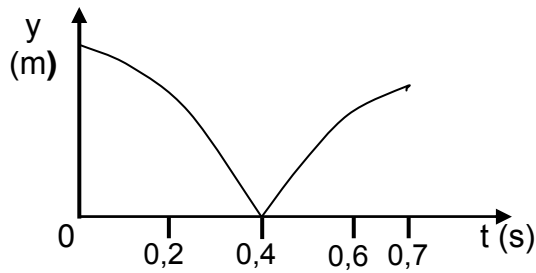
Checklist/*Kontrolelys* Criteria for graph/*Kriteria vir grafiek*	Marks/ *Punte*
Correct shape (as shown on graph) *Korrekte vorm (soos op grafiek aangetoon)*	✓
Zero position at 0,4 s *Nulposisie by 0,4 s*	✓
Maximum position of 2nd bounce smaller than that of 1st bounce *Maksimum posisie van 2de bons is kleiner as dié van 1ste bons*	✓

[12.1.2]   (3)

4.4   Inelastic/*Onelasties* ✓
Decrease/change in speed (from 4 m·s⁻¹ to 3 m·s⁻¹) ✓
Afname/verandering in spoed (vanaf 4 m·s⁻¹ tot 3 m·s⁻¹)

OR/*OF*
Decrease/change in kinetic energy during collision
Afname/verandering in kinetiese energie tydens botsing   [12.1.2]   (2)
                                                                              [13]

QUESTION 5/ *VRAAG 5*

5.1   0 (N)/Zero/*nul* ✓
no acceleration/constant velocity ✓
geen versnelling/konstante snelheid   [12.2.3]   (2)

5.2   0 (J)/Zero/*nul* ✓   [12.2.3]   (1)

5.3.1

Option 1/*Opsie 1*:
$U_i + K_i + W_{friction/wrywing} + W_{applied/toegepas} = U_f + K_f$ ✓
$0 + f \Delta x \cos \theta + W_{applied/toegepas} = mgh$ $(K_i = K_f)$
$0 + (50)(10)(-1)$ ✓ $+ W_{applied/toegepas} = (120)(9,8)(1,5)$ ✓ ✓
$\therefore W_{applied/toegepas} = 2\,264$ J ✓ $(2,26 \times 10^3$ J)

Accept/*Aanvaar*: E_k, E_p

Option 2/ *Opsie 2*:
For equilibrium:/ *Vir ewewig:*
$F = f + w_{parallel\ to\ incline/parallel\ met\ helling} = f + mg\sin \alpha$ (α - angle of incline with horizontal/*hoek van helling met horisontaal*)
$F = 50$ ✓ $+ (120)(9,8)(\frac{1,5}{10})$ ✓
$\therefore F = 226,4$ N

$W_{applied/toegepas} = F \Delta x \cos \theta$ ✓
$= (226,4)(10)(\cos 0°)$ ✓ OR $(226,4)(10)$
$= 2\,264$ J ✓ $(2,26 \times 10^3$ J)

Option 3/ *Opsie 3*:
$W_{net/netto} = \Delta K$ ✓
$W_{applied/toegepas} + W_{friction/wrywing} + W_{gravity/gravitasie} = \Delta K$
$W_{applied/toegepas} + (50)(10)(-1)$ ✓ $- (120)(9,8)(1,5)$ ✓ $= 0$ ✓
$\therefore W_{applied/toegepas} = 2\,264$ J ✓ $(2,26 \times 10^3$ J)

Option 4/ *Opsie 4*:
W(external forces/*eksterne kragte*) $= \Delta U + \Delta K$ ✓
OR/ *OF*
$W_{applied/toegepas} + W_{friction/wrywing} = (U_f - U_i) + (K_f - K_i)/ \Delta U + \Delta K$

$W_{applied/toegepas} + (50)(10)(-1)$ ✓ $= (120)(9,8)(1,5) - 0)$ ✓ $+ 0$ ✓
$\therefore W_{applied/toegepas} = 2\,264$ J ✓ $(2,26 \times 10^3$ J)

(+)

[12.1.3]   (5)

5.3.2 $W_{applied/toegepas} = F \Delta x \cos \theta$ ✓
$2\,264$ J ✓ $= F(10)(1)$ ✓
$\therefore F = 226,4$ N ✓ $(2,26 \times 10^2$ N)

OR/ *OF*
$F = f + w_{par\ to\ incline/par\ met\ helling} = f + mg\sin \beta$ ✓ (α - angle of incline with horizontal/*hoek van helling met horisontaal*)

$F = 50$ ✓ $+ (120)(9,8)(\frac{1,5}{10})$ ✓
$\therefore F = 226,4$ N ✓ $(2,26 \times 10^2$ N)

[12.2.3]   (4)
[12]

QUESTION 6/*VRAAG 6*

6.1   The total linear momentum in a closed/isolated system is conserved in magnitude and direction. ✓✓
Die totale lineêre momentum in 'n geslote/geïsoleerde sisteem bly behoue in grootte en rigting.

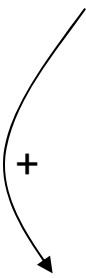Only/*Slegs* $\frac{2}{2}$ or/*of* $\frac{0}{2}$

[12.2.1]   (2)

6.2

$(U + K)$top/*bo* = $(U + K)$bottom/*onder* ✓
$mgh + 0 = 0 + \frac{1}{2}mv_f^2$
$(80)(9,8)(10)$ ✓ $+ 0 = 0 + \frac{1}{2}(80)v_f^2$ ✓
$\therefore v_f = 14$ m·s^{-1} ✓

When using/*Indien gebruik*:
$v_f^2 = v_i^2 + 2a\Delta y$ $\frac{0}{4}$

Accept/*Aanvaar*: E_k, E_p

U(top) = K(bottom) $\frac{0}{4}$
$mgh = \frac{1}{2}mv_f^2$
$(80)(9,8)(10) = \frac{1}{2}(80)v_f^2$ $\therefore$ $v_f = 14$ m·s^{-1}

+

$m_1v_{i1} + m_2v_{i2} = m_1v_{f1} + m_2v_{f2}$ ✓
$(80)(14) + (50)(0)$ ✓ $= (80 + 50)v_f$ ✓
$v_f = 8,62$ m·s^{-1} ✓

Do NOT penalise for zero value not shown if equation is correct./*Moenie vir nulwaarde wat nie getoon is nie, penaliseer indien vergelyking korrek is.*

Alternative formulae/*Alternatiewe formules*:

$\Sigma m_i v_i = \Sigma m_f v_f$

$m_A v_{iA} + m_B v_{iB} = m_A v_{fA} + m_B v_{fB}$
$m_A u_A + m_B u_B = m_A v_A + m_B v_B$

Total p_{before}/*Totale* p_{voor} = Total p_{after}/*Totale* p_{na}

Accept/*Aanvaar*: $p_{before} = p_{after}$ /$p_{voor} = p_{na}$

$p_i = p_f$

[12.1.3]   (8)

6.3   No ✓
Collision is inelastic/total kinetic energy after collision is less than before collision ✓
Nee
Botsing is onelasties/totale kinetiese energie na botsing is minder as voor die botsing

[12.2.3]   (2)

6.4   Smaller than ✓✓
Kleiner as

[12.2.2]   (2)

[14]

QUESTION 7/*VRAAG 7*

7.1   Doppler effect/*Doppler-effek*   [12.2.1]   (1)

7.2   Car approaching/*Motor kom nader*:

$$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark \text{ OR/OF } f_L = \frac{v}{v - v_s} f_s$$

$$= \left(\frac{340}{340 - 16}\right) \checkmark (420) \checkmark$$

$\therefore f_L = 440,74 \text{ Hz } \checkmark$ [12.2.3]   (4)

7.3.1   Smaller than/*Kleiner as* $\checkmark$ [12.2.2]   (2)

7.3.2   Increases/*Toeneem* $\checkmark$ [12.2.2]   (1)

[9]

QUESTION 8/*VRAAG 8*

8.1.1   P: red/*rooi* $\checkmark$
          Q: green/*groen* $\checkmark$ [12.1.2]   (2)

8.1.2   Yellow/*geel* $\checkmark$ [12.1.2]   (1)

8.1.3   Blue/*blou* $\checkmark$

          Red + blue + green = white light $\checkmark$
          Rooi + blou + groen = wit lig   [12.1.2]   (2)

8.2.1   Any two colours that together will give white light. $\checkmark\checkmark$
          Enige twee kleure wat saam wit lig sal gee.

          Only/*Slegs* $\frac{2}{2}$ or/*of* $\frac{0}{2}$

          [12.2.1]   (2)

8.2.2   Reflected blue light (from blue dye in detergent) $\checkmark$ + reflected yellow
          light (from stains) $\checkmark$ = white light (and garment appears whiter) $\checkmark$

          *Weerkaatste blou lig (vanaf kleurstof in seep) + weerkaatste geel lig
          (vanaf vlekke) = wit lig (en kledingstuk kom witter voor)*

          OR/*OF*
          Red light + green light (reflected by stains) $\checkmark$ + blue light (reflected by
          dye) $\checkmark$ = white (and garment appears white) $\checkmark$

          *Rooi lig + groen lig (weerkaats deur vlekke) + blou lig (weerkaats deur
          kleurstof) = wit lig (en die kledingstuk kom witter voor)*   [12.3.2]   (3)

[10]

QUESTION 9/*VRAAG 9*

9.1 diffraction (pattern) ✓
diffraksie (patroon)

OR/*OF*
Interference/*interferensie* [12.2.1] (1)

9.2 Do not look directly into the laser ✓
Moenie direk in die laser kyk nie

OR/*OF*
Do not shine the laser in the direction of other people
Moenie die laser in die rigting van ander mense skyn nie [12.1.1] (1)

9.3 $\tan\theta = \dfrac{0,035}{0,4}$ ✓ $\therefore \theta = 5°$

$\sin\theta = \dfrac{m\lambda}{a}$ ✓

$\sin 5°$ ✓ $= \dfrac{(1)\lambda}{7,25 \times 10^{-6}}$ ✓

$= 6,31 \times 10^{-7}$ m ✓ $= 631$ nm

$\tan\theta \approx \sin\theta = \dfrac{m\lambda}{a}$ ✓

$\dfrac{0,035}{0,4}$ ✓✓ $= \dfrac{(1)\lambda}{7,25 \times 10^{-6}}$ ✓

$= 6,31 \times 10^{-7}$ m ✓ $= 631$ nm

[12.1.3] (5)

9.4 Increase the slit width ✓
Vergroot die spleetwydte

OR/*OF*
Move the screen closer to the slit/decrease distance between screen
and slit
*Beweeg die skerm nader aan die spleet/verminder die afstand tussen
die skerm en die spleet* [12.2.2] (1)

[8]

QUESTION 10/*VRAAG 10*

10.1 Discharges very fast ✓when touched and can cause electric shock (that can be fatal) ✓
Ontlaai baie vinnig wanneer aangeraak word en kan 'n (dodelike) elektriese skok tot gevolg hê [12.3.2] (2)

10.2.1 $C = \dfrac{\varepsilon_o A}{d}$ ✓

$= \dfrac{(8{,}85 \times 10^{-12})(2 \times 10^{-4})}{(0{,}03 \times 10^{-3})}$ ✓ ✓

$\therefore C = 5{,}9 \times 10^{-11}$ F ✓ [12.2.3] (4)

10.2.2 $C = \dfrac{Q}{V}$ ✓

$\therefore Q = \boxed{5{,}9 \times 10^{-11} \times 6}$ ✓

$\therefore Q = 3{,}54 \times 10^{-10}$ C ✓ [12.2.3] (3)

10.3.1 Increases/*Toeneem*✓ [12.2.2] (1)

10.3.2 Decreases/*Afneem* ✓ [12.2.2] (1)

[11]

QUESTION 11/*VRAAG 11*

11.1 Amount of charge that passes a cross-section of a conductor per unit time. ✓✓
Aantal lading wat deur die deursnit van 'n geleier per eenheid tyd beweeg

Only/*Slegs* $\frac{2}{2}$ or/*of* $\frac{0}{2}$

OR/*OF*
Rate of flow of charge/*Tempo van vloei van lading* [12.2.1] (2)

11.2 $q = I \Delta t$ ✓
$20 = I(1{,}1 \times 10^{-4})$ ✓
$\therefore I = 1{,}82 \times 10^{5}$ A ✓ [12.2.3] (3)

11.3 $W = VQ$ ✓
$= (1{,}2 \times 10^{8})(20)$ ✓
$= 2{,}4 \times 10^{9}$ J ✓ [12.2.3] (3)

11.4.1 Lightning tends to strike the highest points ✓
Weerlig is ge neig om die hoogste punte te tref [12.3.1] (1)

11.4.2 To prevent a potential difference from building up ✓ (between your feet)
Om te verhoed dat 'n potensiaalverskil (tussen jou voete) opbou [12.3.1] (1)

[10]

QUESTION 12/*VRAAG 12*

12.1.1 V_1 = 12 V ✓
        V_2 = 12 V ✓   [12.1.2]   (2)

12.1.2 V_2 = 0 V ✓   [12.1.2]   (1)

12.1.3 $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ ∴ $\frac{1}{R_p} = \frac{1}{12} + \frac{1}{6}$ ✓ ∴ R_p = 4 Ω

⊕

        R(total/*totaal*) = 4 + 2 ✓ = 6 Ω ✓   [12.2.3]   (4)

12.1.4 R = $\frac{V}{I}$ ✓ ∴ 6 = $\frac{9}{I}$ ✓ ∴ I = 1,5 A

        EMF/*EMK* = IR + Ir ✓

        12 = 9 ✓ + (1,5)r

        ∴ r = 2 Ω ✓   [12.1.3]   (5)

12.2.1 In parallel:
        $P_Y > P_X$ (given/*gegee*)

        $V_Y = V_X$ ✓ (V is constant – parallel/*V is konstant – parallel*)
        ∴ $\frac{V^2}{R_Y} > \frac{V^2}{R_X}$ ✓
        ∴ $R_Y < R_X$ ✓   [12.1.3]   (3)

12.2.2 In series/*In serie*
        $I_Y = I_X$ / I is the same/*is dieselfde* ✓
        $I^2 R_Y < I^2 R_X$ ✓
        P α R ✓ (I constant/*konstant*) OR/*OF* $P_Y < P_X$ [12.2.2]   (3)

                                                                                                    [18]

QUESTION 13/*VRAAG 13*

13.1 (Splitring) commutator/*kommutator* ✓   [12.2.1]   (1)

13.2 Coil/*Spoel* ✓   [12.2.1]   (1)

13.3 No/*Nee* ✓

      OR/*OF*
      E(electrical) > E(mechanical)
      E(elektries) > E(meganies)

      W(electrical/*elektries*) = VIΔt ✓ = (12)(1,2)(3) ✓ = 43,2 J ✓

      E_p = mgΔy ✓ = (1,6)(9,8)(0,8) ✓ = 12,544 J ✓   [12.1.3]   (7)

                                                                                                    [9]

QUESTION 14/*VRAAG 14*

14.1   The minimum frequency of light needed to emit electrons from a certain metal. ✓✓
Die minimum frekwensie van lig wat benodig word om elektrone uit 'n sekere metaal vry te stel   [12.2.1]   (2)

14.2   Increases/*Toeneem* ✓
Higher intensity, <u>more photons strike metal plate per second</u> ✓
<u>More photo-electrons emitted per second</u> ✓
Hoër intensiteit, <u>meer fotone tref die metaalplaat per sekonde</u>
<u>Meer fotoëlektrone vrygestel per sekonde</u>   [12.2.3]   (3)

14.4 $hf = W_o + E_k$ ✓

$$\frac{(6{,}63 \times 10^{-34})(3 \times 10^8)}{100 \times 10^{-9} \;✓} = 8{,}7 \times 10^{-19} \;✓ + \frac{1}{2}(9{,}1 \times 10^{-31})v^2 \;✓$$

$\therefore v = 1{,}57 \times 10^6 \text{ m·s}^{-1}$ ✓   [12.2.3]   (6)

[11]

TOTAL SECTION B/*TOTAAL AFDELING B***:   125**

GRAND TOTAL/*GROOTTOTAAL***:   *150***