Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE/*GRAAD 12*

SEPTEMBER 2014

**PHYSICAL SCIENCES P1/
FISIESE WETENSKAPPE V1
MEMORANDUM**

MARKS/PUNT: 150

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

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 are many 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 sustitusies.*

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** began 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 penalisation** if **zero substitutions are omitted** in calculations where **correct formula**/**principle** is correctly given.
*Geen penalisering indien **nulwaardes nie getoon** word nie in berekeninge waar die **formule/beginsel korrek gegee is nie**.*

1.6   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 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 verkeerde verander, sal die punte vir die formule en korrekte substitusies toegeken word. Die punt vir die verkeerde numeriese antwoord word verbeur.

1.7   Marks are only awarded for a formula if a **calculation has 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.*

1.8   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 formule ingestel word en nie vir waardes wat voor 'n berekening gelys is nie.

Please turn over

1.9   All calculations, when not specified in the question, must be done to a minimum of two decimal places.
Alle berekenings, wanneer nie in die vraag gespesifiseer word nie, moet tot 'n minimum van twee desimale plekke gedoen word.

1.10   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 van '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, insluitende substitusies korrek is.

1.11   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 no count any marks.
Vrae waar 'n reeks berekeninge gedoen moet word (bv. 'n stroombaan-diagramvraag) 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 aan die antwoord as die oorspronklike data bring nie, sal geen punte tel nie.

2.   **UNITS/**_EENHEDE_

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

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

2.3   Marks are only awarded for an answer, and not for a unit _per se_. 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 sal slegs vir 'n antwoord en nie vir 'n eenheid per se toegeken word nie. Kandidate sal die punt vir die antwoord in die volgende gevalle verbeur:
*   _Korrekte antwoord + verkeerde eenheid_
*   _Verkeerde antwoord + korrekte eenheid_
*   _Korrekte antwoord + geen eenheid_

2.4   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.

3. **GENERAL/***ALGEMEEN*

3.1   If one answer or calculation is required, but two are 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.

3.2   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.

3.3   Separate compound units with a multiplication dot, no a full stop, for example, $m^.s^{-1}$. For marking purposes, m.s^{-1} and m/s will also be accepted.
Skei saamgestelde eenhede met 'n vermenigvuldigingspunt en nie met 'n punt nie, byvoorbeeld $m^.s^{-1}$. Vir nasiendoeleindes sal m.s^{-1} en m/s ook aanvaar word.

4. **POSITIVE MARKING/***POSITIEWE NASIEN*

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

4.1   **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 of 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 word korrek in 3.2 of 3.3 vervang, word **volpunte** vir die daaropvolgende subvraag toegeken.*

4.2   **A multistep question in a subquestion**: If the candidate has to calculate, for example, current in die 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 bv. 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. **NEGATIVE MARKING/***NEGATIEWE NASIEN*

Normally an incorrect answer cannot be correctly motivated if based on a conceptual mistake. If the candidate is therefore required to motivate in QUESTION 3.2 the answer given in QUESTION 3.1, and 3.1 is incorrect, no marks can be awarded for QUESTION 3.2. However, if the answer for e.g. 3.1 is based on a calculation, the motivation for the incorrect answer 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 bv. 3.1 egter op 'n berekening gebaseer is, kan die motivering vir die verkeerde antwoord in 3.2 oorweeg word.

QUESTION 1/*VRAAG 1*

1.1   D ✓✓   (2)

1.2   B ✓✓   (2)

1.3   B ✓✓   (2)

1.4   A ✓✓   (2)

1.5   D ✓✓   (2)

1.6   A ✓✓   (2)

1.7   B ✓✓   (2)

1.8   C ✓✓   (2)

1.9   C ✓✓   (2)

1.10   B ✓✓   (2)
                                                                              [20]

QUESTION 2/*VRAAG 2*

2.1

OPTION 1/*OPSIE 1* **DOWNWARDS AS POSITIVE** $v_f^2 = v_i^2 + 2g\Delta y$ ✓ $\quad = 0^2 + 2(9,8)(15)$ ✓ $v_f = 17,15 \text{ m·s}^{-1}$ ✓　(3) **OR/*OF*** **DOWNWARDS AS NEGATIVE** $v_f^2 = v_i^2 + 2g\Delta y$ ✓ $\quad = 0^2 + 2(-9,8)(-15)$ ✓ $v_f = 17,15 \text{ m·s}^{-1}$ ✓　(3)	NOTES/*AANTEKENINGE* **Accept/Aanvaar** *g* or/of *a* $v^2 = u^2 + 2a\Delta x$ $v^2 = u^2 + 2as$
OPTION 2/*OPSIE 2* **DOWNWARDS AS POSITIVE** $W_{net} = \Delta K$ ✓ $F_{net}\Delta y\cos\theta = \frac{1}{2}m(v_f^2 - v_i^2)$ $m(9,8)(15)\cos 0^0 = \frac{1}{2}m(v_f^2 - 0^2)$ ✓ $\therefore v_f = 17,15 \text{ m·s}^{-1}$ ✓　(3) **OR/OF** **DOWNWARDS AS NEGATIVE** $W_{net} = \Delta K$ ✓ $F_{net}\Delta y\cos\theta = \frac{1}{2}m(v_f^2 - v_i^2)$ $m(-9,8)(-15)\cos 0 = \frac{1}{2}m(v_f^2 - 0^2)$ ✓ $\therefore v_f = 17,15 \text{ m·s}^{-1}$ ✓　(3) **OR/OF**	NOTES/*AANTEKENINGE* **Accept/Aanvaar:** $F_{net}\Delta x \cos\theta$ $W_{net} = \Delta E_k$
OPTION 4/*OPSIE 4* $F_{net} = ma$　✓ $mg = \dfrac{m(v_f^2 - v_i^2)}{2\Delta x}$ $(0,156)(9,8) = \dfrac{0,156(v_f^2 - 0)}{15}$ ✓ $v_f = 17,15 \text{ m·s}^{-1}$ ✓　(3) **OR/OF** **DOWNWARDS AS NEGATIVE** $F_{net} = ma$　✓ $mg = \dfrac{m(v_f^2 - v_i^2)}{2\Delta x}$ $(0,156)(-9,8) = \dfrac{0,156(v_f^2 - 0)}{-15}$ ✓ $v_f = 17,15 \text{ m·s}^{-1}$ ✓　(3)	NOTES/*AANTEKENINGE*: **Accept/*Aanvaar*:** *g* or/of *a* $v^2 = u^2 + 2a\Delta x$ $v^2 = u^2 + 2as$
OPTION 5/*OPSIE 5* $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$ $15 = 0(\Delta t) + \frac{1}{2}(9,8)\Delta t^2$ $\Delta t = 1,75 \text{ s}$ ✓ $v_f = v_i + g\Delta t$ $\quad = 0 + 9,8(1,75)$ ✓ $\quad = 17,15 \text{ m·s}^{-1}$ ✓	NOTES/ *AANTEKENINGE*: **Accept/Aanvaar:** *g* or/of *a* $s = ut + \frac{1}{2}a\Delta t^2$ $v = u + at$

(3)

2.2   Lower/*Laer* ✓   (1)

2.3   **POSITIVE MARKING FROM QUESTION 2.1/**
       POSITIEWE NASIEN VAN VRAAG 2.1

       IF/INDIEN:
       Downwards taken as negative in any one of QUESTION 2.3 and deduct only
       ONE mark at the first infringement.
       Indicate at which question the mark is deducted by cancelling one tick and draw
       an upward arrow with positive sign next to it.

       Afwaarts as negatief geneem in enige van VRAAG 2.3 en trek slegs EEN punt
       by die eerste oortreding af.
       Dui aan by watter vraag die punt afgetrek is deur een reg merkie te kanselleer en
       trek 'n opwaartse pyl met 'n positiewe teken langsaan.   ↑ +

2.3.1

DOWNWARDS AS POSITIVE	**NOTES/ *AANTEKENINGE***
$v_f^2 = v_i^2 + 2g\Delta y$ ✓	**Accept/*Aanvaar***
0^2 ✓ $= v_i^2 + 2(9,8)\,(-4)$✓	***g*** or/of ***a***
$v_i = 8,85$ m·s^{-1}✓	$v^2 = u^2 + 2a\Delta x$
	$v^2 = u^2 + 2as$
$F_{net}\Delta t = \Delta p$ ✓	
$F_{net}\Delta t = m\,(v_f - v_i)$ } Any **ONE**/Enige **EEN**	
$\Delta p = (0,156)$ ✓ $(-8,85 - 17,15)$ ✓	
$= -4,056$ kg·m·s^{-1}	
$= 4,06$ N·s upwards/opwaarts✓ (8)	
DOWNWARDS AS NEGATIVE	
$v_f^2 = v_i^2 + 2g\Delta y$ ✓	
0^2✓ $= v_i^2 + 2(-9,8)\,(4)$✓	
$v_i = 8,85$ m·s^{-1}✓	
$F_{net}\Delta t = \Delta p$ ✓	
$F_{net}\Delta t = m\,(v_f - v_i)$ } Any **ONE**/Enige **EEN**	
$\Delta p = (0,156)$ ✓ $(8,85 - (-17,15)$ ✓	
$= 4,056$ kg·m·s^{-1}	
$= 4,06$ N·s upwards/opwaarts✓ (8)	

                                                                                                          (8)

2.3.2   **POSITIVE MARKING FROM QUESTION 2.3.1/**
         POSITIEWE NASIEN VAN VRAAG 2.3.1

         DOWNWARDS AS POSITIVE
         $F_{net} = \dfrac{\Delta p}{\Delta t}$ ✓ $= -\dfrac{4,056}{0,80}$✓ $= -5,07$ N $= 5,07$ N upwards/opwaarts ✓
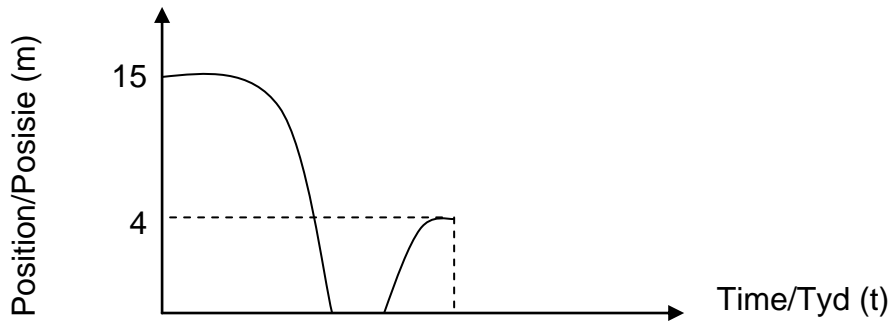   (4)

         DOWNWARDS AS NEGATIVE
         $F_{net} = \dfrac{\Delta p}{\Delta t}$ ✓ $= \dfrac{4,056}{0,80}$✓ $= 5,07$ N upwards/opwaarts ✓
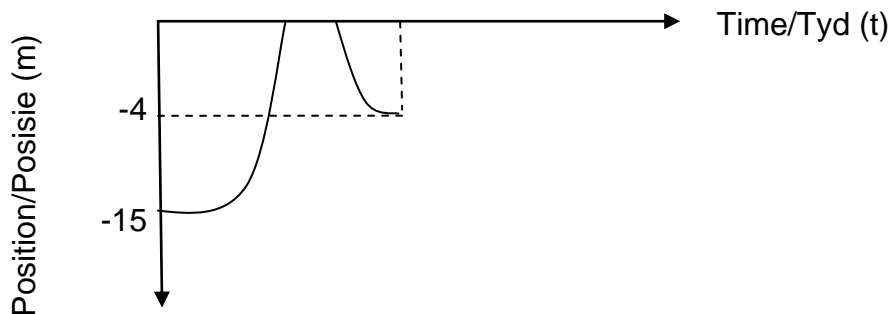   (4)

2.4   **DOWNWARD POSITIVE/AFWAARTS POSITIEF:**

Criteria for graph/Kriteria vir grafiek	Marks/Punte
Correct shape (Both curves)/ *Korrekte vorm (Beide kurwes)*	✓
Graph starts at y = 15 m at t = 0 s *Grafiek begin by y= 15 m by t = 0 s*	✓
Second maximum height at y = 4 m *Tweede maksimum by y = 4 m*	✓
Contact time shown as space on x-axis between two curves *Kontak tyd aangetoon as spasie op x-as tussen twee krommes*	✓

(4)

DOWNWARD NEGATIVE/AFWAARTS POSITIEF:

Criteria for graph/Kriteria vir grafiek	Marks/Punte
Correct shape (Both curves)/ *Korrekte vorm (Beide kurwes)*	✓
Graph starts at y = -15 m at t = 0 s *Grafiek begin by y= -15 m by t = 0 s*	✓
Second maximum height at y = -4 m *Tweede maksimum by y = -4 m*	✓
Contact time shown as space on x-axis between two curves *Kontak tyd aangetoon as spasie op x-as tussen twee krommes*	✓

(4)

2.5   SMALLER/KLEINER ✓

$$F_{net}= \frac{\Delta p}{\Delta t}$$
OR/OF
$$F_{net} \propto \frac{1}{\Delta t} (\Delta p \text{ constant})$$

Δt increases/*neem toe* ✓

∴ F_{net} decreases/*neem af*

(3)

[23]

QUESTION 3/VRAAG 3

3.1 The total linear momentum of a closed system remains constant
(is conserved) ✓✓ or ✓
Total linear momentum before a collision = total linear momentum after a collision
in a closed system. ✓
Die totale liniêre momentum in 'n geslote sisteem bly konstant (behoue).✓✓
Totale liniêre momentum voor 'n botsing = totale liniêre momentum na 'n
botsing ✓ in 'n geslote sisteem. ✓ (2)

3.2 **Consider LEFT as positive/***Beskou LINKS as positief*
$\sum p_{i} = \sum p_{f}$ ✓
$m_{M}v_{iM} + m_{C}v_{iC} = m_{M}v_{fM} + m_{C}v_{fC}$

$\underline{(2000)(20)}$ + (1 500)(0) ✓ = $\underline{(2000)(12)}$ + 1500v_{fC} ✓
V_{fM} = 11 m·s^{-1} ✓ (4)

Other formulae/*Ander formules:*
$m_{M}v_{iM} + m_{C}v_{iC} = m_{M}v_{fM} + m_{C}v_{fC}$
or/of
$m_{M}u_{M} + m_{C}u_{C} = m_{M}v_{M} + m_{C}v_{C}$
or/of
$m_{1}v_{i1} + m_{2}v_{i2} = m_{1}v_{f1} + m_{2}v_{f2}$
or/of
$m_{1}u_{i1} + m_{2}u_{i2} = m_{1}v_{f1} + m_{2}v_{f2}$
$p_{total\ before} = p_{total\ after}$

Accept/Aanvaar: $p_{before} = p_{after}$ or/of $p_{i} = p_{f}$

3.3 The driver will continue moving foward at the same velocity until the driver strikes
the dashboard or windscreen. ✓

Die bestuurder hou aan vorentoe beweeg teen dieselfde snelheid totdat die
bestuurder die paneel of voorruit tref. ✓ (1)

3.4 A body will remain in its state of rest or motion at constant velocity✓ unless a
non-zero resultant force acts on it. ✓

'n Liggaam sal in sy toestand van rus of beweging teen 'n konstante snelheid
volhard,✓ *tensy 'n nie-nul resulterende krag daarop inwerk.*✓ (2)
[9]

QUESTION 4/*VRAAG 4*

4.1 $W = \Delta K + \Delta U$ ✓
          $= \frac{1}{2}m(v_f^2 - v_i^2) + mg(h_2 - h_1)$
          $= \frac{1}{2}(90)(2^2 - 0^2)$ ✓ $+ (90)(9,8)(37)$ ✓
          $= 32\ 814$ J ✓   (4)

4.2   **POSITIVE MARKING FROM QUESTION 4.1/**
         POSITIEWE NASIEN VAN VRAAG 4.1

         $P = \dfrac{W}{t}$ ✓
           $= \dfrac{32\ 814}{1 \times 60}$ ✓
           $= 546,9$ W ✓   (3)

4.3   4.3.1   No/*Nee* ✓   (1)

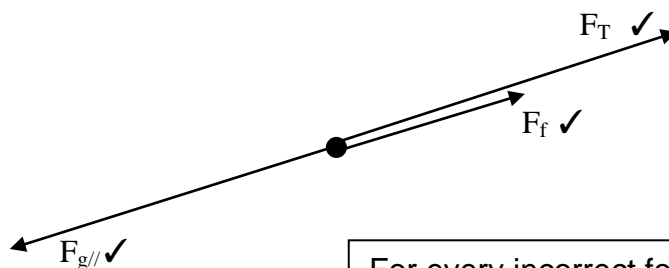   4.3.2   Windmill is more environmental friendly. ✓ (Or similar)
                     Windpomp is meer omgewingsvriendelik. ✓ *(Of soortgelyk)*   (1)
                                                                                                         [9]

QUESTION 5/*VRAAG 5*

Accepted Labels/*Aanvaarbare Benoemings*	
$F_{applied}$ *Ftoegepas*	F_T/T/Force on crate/F_A/Tension/300 N *F_T/T/Krag op krat/F_A/Spanning/300 N*
Friction *Wrywing*	F_f/$F_{friction}$/friction *F_f/$F_{wrywing}$/wrywing*
$F_{g//}$	$F_{//}$/mg sin 30°/F_g sin 30°/$F_{W//}$

5.1

For every incorrect force shown (-1 mark)
Vir enige verkeerde krag getoon (-1 punt)   (3)

5.2   The <u>net (total) work done</u> (on an object) ✓ <u>is equal to</u> the <u>change in kinetic energy</u> (of the object). ✓ **OR**
          The work done (on an object) by a net (resultant) force ✓ is equal to the change in (the object's) kinetic energy. ✓

          *Die <u>netto (totale) arbeid</u> (verrig op 'n voorwerp) ✓ is gelyk aan die <u>verandering in kinetiese energie</u> (van die voorwerp) ✓ **OF***
          Die arbeid verrig (op 'n voorwerp) deur 'n netto (resulterende) krag ✓ is gelyk aan die verandering in kinetiese energie (van die voorwerp). ✓   (2)

5.3 **OPTION 1/***OPSIE 1*

W_{NET} = ΔK
W_{Fg}+ W_{FT} + W_{Ff} + W_{FN} = ΔK ⎬ ✓ Any one/*Enige een*

F_gΔxcosθ + F_fΔxcosθ + F_TΔxcosθ + 0 = 450

(50)(9,8)Δxcos60°✓ + 50Δxcos180° + 300Δxcos180°✓ = 450 ✓

(245 − 50 − 300) Δx = 450

Δx = 4,29 m ✓ (5)

OPTION 2/*OPSIE 2*

W_{NET} = ΔK ⎫ ✓
$W_{Fg//}$+ W_{Ff} + W_{FT} + W_{FN} + $W_{Fg\perp}$ = ΔK ⎬ Any one/*Enige een*

$F_{g//}$Δxcosθ + F_fΔxcosθ + F_TΔxcosθ + 0 + 0 = 450

(50)(9,8)sin30°Δxcos0°✓ + 50Δxcos180° + 300Δxcos180°✓ = 450✓

(245 − 50 − 300) Δx = 450

Δx = 4,29 m ✓ (5)

OPTION 3/*OPSIE 3*

F_{net} = F_T + F_f + $W_{//}$
= 300 + 50 − mg sin 30°
= 300 + 50 − (50)(9,8) sin30° ✓ ⟩ ✓ Both formulae/*Albei formules*
= 105

F_{net} Δxcosθ = ΔK
105 Δxcos0° ✓ = 450✓
Δx= 4,29 m ✓ (5)

5.4 f_k = μ_k N
  = μ_k (mg cos θ) ⎬ ✓ Any ONE/*Enige EEN*
50 ✓ = μ_k (50)(9,8)cos 30°✓
μ_k = 0,12 ✓ (4)

[14]

QUESTION 6/*VRAAG 6*

6.1 The Doppler Effect is the perceived change in frequency of sound caused by either the listener or the source moving relative to each other. ✓ ✓

Die Dopplereffek is die waargenome verandering in frekwensie van 'n klank wat veroorsaak deurdat óf die luisteraar óf die bron met betrekking tot mekaar beweeg. ✓ ✓ (2)

6.2

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

$1,07 f_s$ ✓ = $\dfrac{340}{340 - v_s}$ ✓ f_s ✓

v_s = 22,24 m.s^{-1}✓ (5)

6.3 Ambulance moves towards detector, <u>with constant velocity (speed) of sound,</u>✓ <u>λ decreases and the frequency increases</u>. ✓

Ambulans beweeg na die detektor met <u>konstante snelheid (spoed) van klank,</u>✓ <u>λ neem af en frekwensie neem toe</u>. ✓ (2)

6.4
- Determine whether arteries are clogged/narrowed ✓
- Determine heartbeat of fetus✓

- *Bepaal of are verstop/vernou is.* ✓
- *Bepaal die hartklop van 'n fetus* ✓ (2)

6.5 AWAY/*WEG* ✓
Light from a star is shifted towards a lower frequency (red light has the lowest frequency). ✓
Die ster se lig word verskuif na 'n laer frekwensie (rooi lig besit die laagste frekwensie.) ✓ (2)

[13]

QUESTION 7/*VRAAG 7*

7.1 (Electrostatic) force experienced per unit positive charge placed at a point. ✓ ✓

(Elektrostatiese) krag wat per eenheidspositiewe-lading by daardie punt geplaas is, ondervind word. ✓ ✓ (2)

7.2 $E = \dfrac{kQ_M}{r^2}$ ✓ $= \dfrac{(9 \times 10^9)(-4 \times 10^{-9})}{(15 \times 10^{-3})^2}$ ✓✓ $= 1{,}6 \times 10^5 \text{N·C}^{-1}$ ✓ east/*oos*✓ (5)

7.3 $E_{net} = E_M + E_N$
2×10^5✓ $= 1{,}6 \times 10^5 + E_N$✓
$E_N \quad = 4{,}5 \times 10^5 \text{N·C}^{-1}$ east/*oos*✓

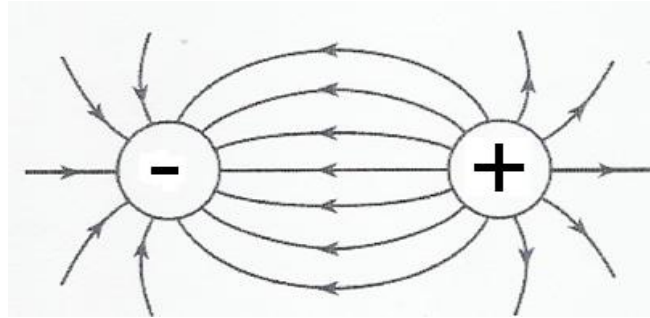| **NOTES/AANTEKENINGE** |
| --- |
| Mark direction independently./*Merk rigting onafhanklik.* |

$E_N = \dfrac{kQ_N}{r^2}$
$4{,}5 \times 10^5 = \dfrac{(9 \times 10^9)Q_N}{(45 \times 10^{-3})^2}$ ✓

$Q_N = 9 \times 10^{-9}$ C east/*oos* ✓ (5)

7.4 Positive/*Positief*✓ (1)

7.5   **POSITIVE MARKING FROM QUESTION 7.4**
          POSITIEWE NASIEN VANAF VRAAG 7.4

Criteria for sketch:/*Kriteria vir skets*:	Marks/Punte
Correct shape *Korrekte vorm*	✓
Correct direction *Korrekte rigting*	✓
Field lines not touching each other or entering the spheres. *Veldlyne raak nie mekaar nie of wat die sfere binnegaan.*	✓

(3)

7.6 $E = \dfrac{F}{q}$ ✓

$2 \times 10^5 = \dfrac{F}{1{,}6 \times 10^{-19}}$ ✓

$F = 3{,}2 \times 10^{-4}\,N$ ✓

(3)

[19]

QUESTION 8/VRAAG 8

8.1   Motor effect/*Motor-effek* ✓   (1)

8.2   Electrical (energy) to mechanical (energy) ✓
          Elektriese (energie) na meganiese (energie) ✓   (1)

8.3   Current in section BC is parallel ✓ to the magnetic field. ✓
          Stroom in gedeelte BC is parallel ✓ *aan die magneetveld.* ✓   (2)

8.4   ANTI-CLOCKWISE/ANTI-*KLOKSGEWYS* ✓   (1)

8.5   Increase the speed of rotation/
          Increase the number of turns in the coil.   ⎫ ANY ONE ✓
          Increase the strength of the magnetic field   ⎭

          Verhoog spoed van rotasie.
          Vermeerder die aantal windings van die spoel. ✓   ⎫ *ENIGE EEN* ✓
          Verhoog die magnetiese veldsterkte.   ⎭   (1)

8.6.1 $T = \dfrac{0,075 \times 2}{5}$ ✓   **OR/*OF*** $f = \dfrac{\text{no of cycles}}{\text{time}}$ ✓ $= \dfrac{2,5}{0,075}$ ✓ $= 33,3$ Hz ✓

        $= 0,03$ s

      $f = \dfrac{1}{T}$

                               $f = \dfrac{aantal\ siklusse}{tyd}$ ✓ $= \dfrac{2,5}{0,075}$ ✓ $= 33,3$ Hz ✓

        $= \dfrac{1}{0,03}$ ✓

        $= 33,3$ Hz ✓   (3)

8.6.2

OPTION 1/*OPSIE 1*

$P_{ave} = V_{rms}I_{rms}$ ✓

$\quad = \left(\dfrac{V_{max}}{\sqrt{2}}\right)\left(\dfrac{I_{max}}{\sqrt{2}}\right)$ ✓   BOTH formulae/*ALBEI formules*

$2\ 700$ ✓ $= \left(\dfrac{325}{\sqrt{2}}\right)$ ✓ $\left(\dfrac{I_{max}}{\sqrt{2}}\right)$

$I_m \quad I_{max} = 16,62$ A ✓   (5)

OPTION 2/*OPSIE 2*	**OPTION 3/*OPTION 3***

$P_{ave} = \dfrac{V_{max}\,I_{max}}{2}$ ✓✓   ✓
 	
 $2\ 700$ ✓ $= \dfrac{(325)I_{max}}{2}$ ✓
      $I_{max} = 16,62$ A ✓   (5)
	✓ $\begin{cases} V_{rms} = \dfrac{v_{max}}{\sqrt{2}} = \dfrac{325}{\sqrt{2}} ✓ = 229,80\text{ V} \\[4mm] P_{ave} = V_{rms}\dfrac{I_{max}}{\sqrt{2}} \end{cases}$
	
	 $\quad 2\ 700$ ✓ $= (229,80)\dfrac{I_{max}}{\sqrt{2}}$ ✓
	
	      $I_{max} = 16,62$ A ✓

                                                                             (5)

                                                                             [14]

QUESTION 9/*VRAAG 9*

9.1   The battery has internal resistance ✓ therefore work per Coulomb charge must be done by charges to move through the battery. ✓

Die battery het interne weerstand ✓ daarom word arbeid per Coulomb lading deur ladings verrig om deur die battery te beweeg. ✓   (2)

9.2   **OPTION 1/*OPSIE 1***
$P = I^2R$ ✓
$6 = I^2(6)$
$I = 1$ A

$V_{6\Omega} = IR = 1(6) = 6V$ ✓
$V_{3\Omega} = 12 - 6 = 6\,V$ ✓
$I_{3\Omega} = \dfrac{V}{R} = \dfrac{6}{3}$✓ $= 2$ A ✓

$\varepsilon = IR + Ir$ ✓
$13 = 12 + 2r$✓
$r = 0,5\ \Omega$ ✓   (9)

OPTION 2/*OPSIE 2*

$P = \dfrac{V^2}{R}$ ✓
$6 = \dfrac{V^2}{6}$ ✓
$V = 6V$ ✓

$6V + Ir + 3I = 13$ ✓
$6 + 1 + 3I = 13$ ✓
$3I = 6$
$I = 2A$ ✓

Lost/*Verlore volt*: Ir = 1 ✓
            $2r = 1$✓
            $r = \tfrac{1}{2}\ \Omega$ ✓   (9)

9.3 $R = \dfrac{V}{I}$ ✓ $= \dfrac{6}{1}$ ✓ $= 6\ \Omega$ ✓   (3)

9.4   Increases/*Vermeerder* ✓
Total Resistance decreases/*Totale Weerstand verminder* ✓
Current increases/*Stroom vermeerder* ✓
Ir increases/*Ir vermeerder* ✓   (4)
                                                                [18]

QUESTION 10/*VRAAG 10*

10.1 What is the relationship between the frequency of the incident light and the number of photo electrons emitted?
Wat is die verwantskap tussen die frekwensie van die invallende lig en die aantal foto-elektrone wat vrygestel word?

CRITERIA for investigation question: *KRITERIA vir ondersoekende vraag*:	Mark/*Punt*	
The <u>dependent</u> and <u>independent variables</u> are stated. *Die <u>afhanklike</u> en <u>onafhanklike veranderlikes</u> is genoem.*	✓	
Asks a question about the relationship between dependent and independent variables. *Vra 'n vraag oor die verwantskap tussen afhanklike en onafhanklike veranderlikes.*	✓	(2)

NOTES/*AANTEKENINGE*

A question that results in a "YES" or "NO" answer MAX. ½
'n Vraag wat "JA" of "NEE" as antwoord het MAKS. ½

10.2 Cut-off frequency/Threshold frequency ✓
Afsnyfrekwensie/Drumpelfrekwensie ✓ (1)
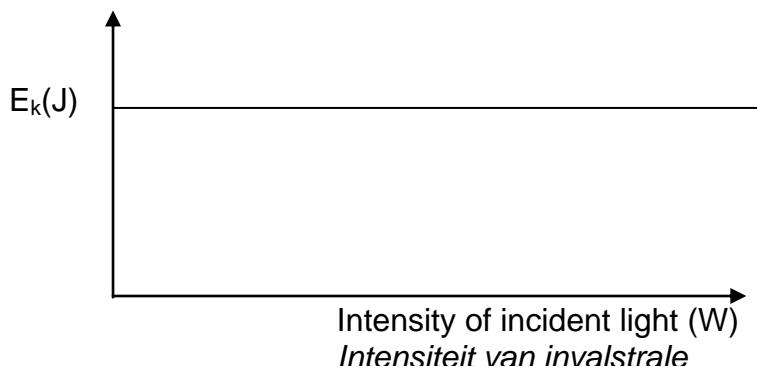
10.3 $hf_x = W_o + E_K$
$hf_x = hf_0 + E_K$ } ✓ ANY one/*ENIGE een*

$(6{,}63 \times 10^{-34}) f_x$ ✓ $= (6{,}63 \times 10^{-34})(4{,}29 \times 10^{14})$ ✓ $+ (2{,}18 \times 10^{-19})$ ✓

$f_x = \dfrac{5{,}02 \times 10^{-19}}{6{,}63 \times 10^{-34}}$

$= 7{,}58 \times 10^{14}$ Hz ✓ (5)

10.4

CRITERIA/*KRITERIA*	MARK/*PUNT*	
Correct unit and labels/*Korrekte beskrywings en eenhede*	✓	
Correct shape/*Korrekte vorm*	✓ ✓	(3)

[11]

TOTAL/*TOTAAL*: 150