NATIONAL SENIOR CERTIFICATE/
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

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PHYSICAL SCIENCES P1/
FISIESE WETENSKAPPE V1
MARKING GUIDELINE/*NASIENRIGLYN*

MARKS/*PUNTE*: 150

This marking guideline consists of 17 pages./
Hierdie nasienriglyn bestaan uit 17 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 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 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 verkeerd 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 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 formules ingestel word en nie vir waardes wat voor 'n berekening gelys is nie.

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 not count any marks.
Vrae waar 'n reeks berekeninge gedoen moet word (bv. 'n stroombaandiagramvraag) 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, not a full stop, for example, $m \cdot s^{-1}$.
   For marking purposes, $m \cdot s^{-1}$ and m/s will also be accepted.
   Skei saamgestelde eenhede met 'n vermenigvuldigingspunt en nie met 'n punt nie, byvoorbeeld $m \cdot s^{-1}$. Vir nasiendoeleindes sal $m \cdot s^{-1}$ 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 **Sub-question to sub-question:** When a certain variable is calculated in one sub-question (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 sub-questions.
   *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 the a sub-question**: 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 QUESTION 3.1 is incorrect, no marks can be awarded for QUESTION 3.2. However, if the answer for e.g. QUESTION 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 VRAAG 3.1 is verkeerd, kan geen punte vir VRAAG 3.2 toegeken word nie. Indien die antwoord op bv. VRAAG 3.1 egter op 'n berekening gebaseer is, kan die motivering vir die verkeerde antwoord in VRAAG 3.2 oorweeg word.

QUESTION/*VRAAG* 1: MULTIPLE-CHOICE QUESTIONS/ *MEERVOUDIGEKEUSE-VRAE*

1.1 C ✓✓ (2)

1.2 A ✓✓ (2)

1.3 B ✓✓ (2)

1.4 C ✓✓ (2)

1.5 D ✓✓ (2)

1.6 A ✓✓ (2)

1.7 D ✓✓ (2)

1.8 B ✓✓ (2)

1.9 A ✓✓ (2)

1.10 D ✓✓ (2)

[20]

QUESTION/*VRAAG* **2**

2.1   A body will <u>remain at rest</u> or motion with <u>constant velocity</u> unless a <u>non-zero resultant/net force</u> acts on it. ✓✓
'n Liggaam sal in sy <u>toestand van rus</u> of beweging teen <u>konstante snelheid</u> bly tensy 'n <u>nie-nul resulterende/netto</u> krag daarop inwerk. ✓✓

<div align="center">**OR/ *OF***</div>

An object will continue in a <u>state of rest or uniform velocity</u>, unless it is acted upon by an unbalanced force. ✓✓
'n Liggaam sal in sy toestand van <u>rus of uniforme beweging</u> volhard tensy 'n ongebalanseerde (resulterende/netto) krag daarop inwerk. ✓✓   (2)

NOTE:/*LET WEL:*
If any of the underlined key words in the **correct context** is omitted deduct 1 mark.
*Indien enige van die onderstreepte sleutel woorde in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

2.2
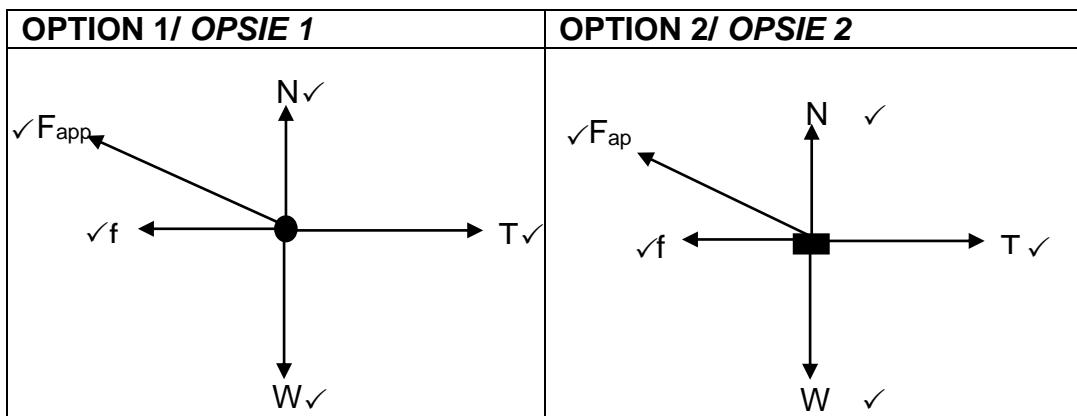
(5)

Accept if learners draw the components of the applied force.
Aanvaar as leerders die komponente van toegepaste krag teken.
Mark awarded for arrow and label.
Punt word toegeken vir byskrif en pyltjie.
Do not penalise for length of arrows since drawing is not drawn to scale.
Moenie vir die lengte van die pyltjies penaliseer nie aangesien skets nie na skaal geteken is nie.

Any other additional force(s) / *Enige addisionele kragte* $\frac{4}{5}$

If force(s) do not make contact with body. Max. $\frac{4}{5}$

Indien krag(te) nie met die voorwerp kontak maak nie. Maks. $\frac{4}{5}$

2.3

OPTION 1 (To the right is positive) *OPSIE 1 (Neem regs as positief)*	**OPTION 2 (To the right is negative)** *OPSIE 2 (Neem links as negatief)*
$F_{net} = ma$ $F_{net} = 0$ N $\quad$ Any one/*Enige een* ✓ $F_g - T = ma$	$F_{net} = ma$ $F_{net} = 0$ N $\quad$ Any one/*Enige een* ✓ $T - F_g = ma$
<u>12 kg mass</u> <u>12 x 9,8 – T = 0</u> ✓ T = 117,6 N	<u>12 kg mass</u> <u>T – 12 x 9,8 = 0</u> ✓ T = 117,6 N
<u>m kg mass</u> $T - F\cos\theta - f = ma$ ✓ <u>117,6 – 88 cosθ – 32 = 0</u> ✓ θ = 13,41º ✓	<u>m kg mass</u> $F\cos\theta + f - T = ma$ ✓ <u>88 cosθ + 32 – 117,6 = 0</u> ✓ θ = 13,41º ✓

(5)

2.4 **Positive marking from 2.3/ *Postiewe nasien vanaf 2.3***

$f_k = \mu_k N$ ◄

32 = (0,12) N ✓ $\qquad$ Any one/ *Enige een* ✓

N = 266,67 N

N = mg – F sinθ ◄

266,67 = m x 9,8 – 88 sin13,41º ✓

m = 29,29 kg ✓ (4)

2.5 Remains the same ✓
Bly dieselfde (1)

[17]

QUESTION/*VRAAG* 3

3.1   3.1.1

OPTION 1/*OPSIE 1* **UPWARD POSITIVE/** ***OPWAARTS AS POSITIEF***	**OPTION 2/*OPSIE 2*** **UPWARD NEGATIVE/** ***OPWAARTS AS NEGATIEF***
$v_f^2 = v_i^2 + 2g\Delta y$ ✓ 0 ✓ $= v_i^2 + 2(-9,8)(2)$ ✓ v_i = 6,26 m.s⁻¹ upwards/*opwaarts* ✓	$v_f^2 = v_i^2 + 2g\Delta y$ ✓ 0 ✓ $= v_i^2 + 2(9,8)(-2)$ ✓ v_i = 6,26 m.s⁻¹ upwards/*opwaarts* ✓

(4)

3.1.2

OPTION 1/ *OPSIE 1* **UPWARD POSITIVE/** **OPWAARTS AS POSITIEF**	**OPTION 2/ *OPSIE 2*** **UPWARD NEGATIVE/** ***OPWAARTS AS NEGATIEF***

$\Delta y = v_i\Delta t + \frac{1}{2} g\Delta t^2$ ✓
 	
    = <u>24 x 1,5</u> ✓ + ½ (-9,8)1,5² ✓
    = 24,98 m ✓
	$\Delta y = v_i\Delta t + \frac{1}{2} g\Delta t^2$ ✓
	
	    = <u>-24 x 1,5</u> ✓ + ½ (9,8)1,5² ✓
	    = 24,98 m ✓

OPTION 3/*OPSIE 3* **UPWARD POSITIVE/** ***OPWAARTS AS POSITIEF***	**OPTION 4/ *OPSIE 4*** **UPWARD NEGATIVE/** ***OPWAARTS AS NEGATIEF***

$v_f = v_i + g\Delta t$
 	
    = 24 + (-9,8)(1,5) ✓
 v_f = 9,3 m.s⁻¹
 	
 $\Delta y = \frac{v_f + v_i}{2}\Delta t$ ✓
 	
 $\Delta y = \frac{9,3 + 24}{2}$ x 1,5 ✓
 	
 Δy = 24,98 m ✓
	$v_f = v_i + g\Delta t$
	
	    = -24 + (9,8)(1,5) ✓
	 v_f = - 9,3 m.s⁻¹
	
	 $\Delta y = \frac{v_f + v_i}{2}\Delta t$ ✓
	
	 $\Delta y = \frac{-9,3 + (-24)}{2}$ x 1,5 ✓
	
	 Δy = - 24,98 m
	
	 Δy = 24,98 m,
	
	 (upwards/*opwaarts*) ✓

(4)

3.2   **Positive marking from 3.1.1/ *Positiewe nasien vanaf 3.1.1***

OPTION 1/*OPSIE 1* **UPWARD POSITIVE/** ***OPWAARTS AS POSITIEF***	**OPTION 2/*OPSIE 2*** **UPWARD NEGATIVE/** ***AFWAARTS AS NEGATIEF***

$v_f = v_i + g\Delta t$
 	
    = 24 + (-9,8)(1,5) ✓
 v_f = 9,3 m.s⁻¹
 	
 $v_f^2 = v_i^2 + 2g\Delta y$ ✓
 	
 6,26² = 9,3² + 2(-9,8) Δy ✓
 	
 Δy = 2,41 m ✓
 Height/*Hoogte* = 24,98 + 2,41 ✓
 Height/*Hoogte* = 27,39 m ✓
	$v_f = v_i + g\Delta t$
	
	    = -24 + (9,8)(1,5) ✓
	 v_f = -9,3 m.s⁻¹
	
	 $v_f^2 = v_i^2 + 2g\Delta y$ ✓
	
	 (-6,26)² = (-9,3)² + 2(9,8) Δy ✓
	
	 Δy = -2,41 m ✓
	 Height/*Hoogte* = -24,98 + (-2,41) ✓
	 Height/*Hoogte* = -27,39 m
	 Height/*Hoogte* = 27,39 m,
	 (upwards/*opwaarts*) ✓

(6)

[14]

QUESTION/*VRAAG* 4

4.1 In an isolated system total linear momentum is conserved. $\checkmark\checkmark$
In 'n geïsoleerde sisteem bly die totale liniêre momentum konstant. $\checkmark\checkmark$ (2)

NOTE:/*LET WEL:*
If any of the underlined key words in the **correct context** is omitted deduct 1 mark.
*Indien enige van die onderstreepte sleutel woorde in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

4.2 **EAST IS POSITIVE/ *OOS IS POSITIEF***

$\sum p_i = \sum p_f$
$m_A v_{iA} + m_B v_{iB} = m_A v_{fA} + m_B v_{fB}$
$m_A v_{iA} + m_B v_{iB} = (m_A + m_B)v_f$ ⎤ Any one/ *Enige een* $\checkmark$

$52{,}5 \times v_{iA} + 42 \times -4 \checkmark = 0 \checkmark$
$v_{iA} = 3{,}2$ m.s^{-1}, right/regs $\checkmark$ (4)

4.3 670 N west/wes $\checkmark$ (No mark if only magnitude is given / *Geen punt as slegs grootte gegee word nie.*) (1)

4.4 $F_{net} \Delta t = \Delta p$
$F_{net} \Delta t = mv_f - mv_i$ ⎤ Any one/*Enige een* $\checkmark$

$670 \times 0{,}5 \checkmark = 42 (v_f - 0) \checkmark$
$v_f = 7{,}98$ m.s^{-1} $\checkmark$ (4)

[11]

QUESTION/*VRAAG* 5

5.1   In an <u>isolated system</u> the <u>total mechanical energy remains constant</u>. ✓✓
      In 'n <u>geïsoleerde sisteem</u> bly die <u>totale meganiese energy konstant</u>. ✓✓   (2)

> **NOTE:/*LET WEL:***
> If any of the underlined key words in the **correct context** is omitted deduct
> 1 mark.
> *Indien enige van die onderstreepte sleutel woorde in die **korrekte konteks**
> uitgelaat is, trek 1 punt af.*

5.2 $W_{Fg} = -\Delta E_p$
      $W_{Fg} = -mg(h_2 - h_1)$ | Any one/ *Enige een* ✓

      $W_{Fg} = -1,5 \times 9,8 (0 - 3)$ ✓

      $W_{Fg} = 44,1 \text{ J}$ ✓   (3)

5.3   A force is non-conservative if the <u>work</u> it does on an object which is moving
      between two points <u>depends on the path taken</u>. ✓✓
      *Is 'n krag waarvoor die <u>arbeid</u> verrig om 'n voorwerp tussen twee punte te
      beweeg, afhanklik is <u>van die roete</u> wat gevolg word. ✓✓*   (2)

> **NOTE:/*LET WEL:***
> If any of the underlined key words in the **correct context** is omitted deduct 1
> mark.
> *Indien enige van die onderstreepte sleutel woorde in die **korrekte konteks**
> uitgelaat is, trek 1 punt af*

5.4   **Positive marking from 5.2/ *Positiewe nasien vanaf 5.2***

OPTION 1/ *OPSIE 1*	OPTION 2/ *OPSIE 2*
$W_{nc} = \Delta E_k + \Delta E_p$ $W_f = \Delta E_k + \Delta E_p$ $W_f = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mgh_2 - mgh_1$ ✓	$W_{net} = \Delta E_k$ $W_{net} = E_{kf(Crate)} - E_{ki(Crate)}$ $W_{net} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ ✓

$E_{ki(Crate)} = \Delta E_{p(Ball)}$
        $= 44,1 \text{ J}$ ✓
	$E_{ki(Crate)} = \Delta E_{p(Ball)}$
	        $= 44,1 \text{ J}$ ✓

$W_f = \frac{1}{2}\underline{(1,5)(6,2)^2 - 44,1}$ ✓ $+ \underline{0}$ ✓ $W_f = -15,27 \text{ J}$ ✓	$W_{net} = \frac{1}{2}(1,5)(6,2)^2 - 44,1$ ✓ $W_{net} = 28,83 - 44,1$ $W_{net} = -15,27 \text{ J}$ ✓ (But $W_{net} = W_f$) $W_f = -15,27 \text{ J}$ ✓

OPTION 3/ *OPSIE 3*

$ME_{Top} = ME_{Bottom}$

$(E_k + E_p)_{Top} = (E_k + E_p)_{Bottom}$

$(\frac{1}{2}mv^2 + mgh)_{Top} = (\frac{1}{2}mv^2 + mgh)_{Bottom}$ ✓

$(0 + 44,1) = (\frac{1}{2} \times 1,5 \times v^2 + 0)$ ✓

$v = 7,67 \text{ m.s}^{-1}$

$W_{net} = \Delta E_k$ ✓

$W_{net} = \frac{1}{2}(1,5)(6,2)^2 - \frac{1}{2}(1,5)(7,67)^2$ ✓

$W_f = 28,83 - 44,12$

$W_f = -15,29 \text{ J}$ ✓

(5)

[12]

QUESTION/*VRAAG* 6

6.1 The <u>change in frequency (or pitch),</u> of the sound detected by a listener because <u>the</u> sound <u>source and the listener have different velocities relative to the medium of</u> sound <u>propagation</u>. ✓✓
Dit is die <u>verandering in frekwensie (of toonhoogte) van die klank waargeneem deur 'n luisteraar omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium van klankvoortplanting het</u>. ✓✓

OR/*OF*

An (apparent) change in observed/detected <u>frequency (pitch),</u> as a result of the <u>relative motion</u> between <u>a source and an observer.</u> ✓✓
'n (Skynbare) verandering in <u>waargenome frekwensie (toonhoogte),</u> as gevolg van die <u>relatiewe beweging</u> tussen die bron en 'n <u>waarnemer / luisteraar.</u> ✓✓ (2)

NOTE:/*LET WEL:*
If any of the underlined key words in the **correct context** is omitted deduct 1 mark.
Indien enige van die onderstreepte sleutel woorde in die korrekte konteks uitgelaat is, trek 1 punt af.

6.2 871 Hz ✓ (1)

6.3 As the learner stands next to the sound source, the detector registers the frequency of the source because there is no relative motion. ✓ As the learner moves away from the source the waves become stretched out, ✓ the wavelength become longer and the frequency become lower. ✓

Soos die leerder langs die klankbron staan, registreer die detektor die frekwensie van die bron omdat daar geen relatiewe beweging is nie. ✓ Soos die leerder wegbeweeg van die bron, word die golwe uitgerek, ✓ die golflengte word langer en die frekwensie word laer. ✓ (3)

6.4 $v = \dfrac{\Delta x}{\Delta t}$ ✓

$v = \dfrac{110 - 94}{8 - 6}$ ✓

$v = 8$ m.s^{-1}

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

850 ✓ $= \dfrac{v - 8}{v}$ ✓ x 871 ✓

$v = 331{,}81$ m.s^{-1} ✓ (7)

6.5 Used to measure the direction and speed of blood flow in arteries and veins. ✓
Dit word gebruik om die rigting en spoed van bloedvloei in slagare en are te bepaal. ✓
Used to monitor the heartbeat of a newly formed foetus. ✓
Dit word gebruik om die hartklop van 'n pasgemaakte fetus te monitor. ✓ (2)

[15]

QUESTION/*VRAAG* 7

7.1 25° ✓ (1)

7.2 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 een puntlading (Q1) op 'n ander puntlading (Q2) uitoefen, is direk eweredig aan die grootte van die produk van die ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle. ✓✓ (2)

NOTE:/*LET WEL:*
If any of the underlined key words in the correct context is omitted deduct 1 mark.
Indien enige van die onderstreepte sleutel woorde in die korrekte konteks uitgelaat is, trek 1 punt af.

7.3 $T \sin \theta = F_E$
$480 \sin 25^\circ = F_E$ ✓
$F_E = 202{,}8567656$ N

$F_E = \dfrac{kQ_1Q_2}{r^2}$ ✓

$202{,}8567656$ ✓ $= \dfrac{9 \times 10^9 \times Q^2}{0{,}02^2}$ ✓

$Q = 3{,}00 \times 10^{-6}$ C ✓ (5)

7.4.1 **Positive marking from 7.3. / *Positiewe nasien vanaf 7.3***

OPTION 1/ *OPSIE 1*	OPTION 2 / *OPSIE 2*
$E = \dfrac{kQ}{r^2}$ ✓ $E_1 = \dfrac{9 \times 10^9 \times 3,00 \times 10^{-6}}{0,15^2}$ ✓ $E_1 = 1\,200\,000$ N.C^{-1} left/*links* $E_2 = \dfrac{9 \times 10^9 \times 3,00 \times 10^{-6}}{0,05^2}$ ✓ $E_2 = 10\,800\,000$ N.C^{-1} right/*regs* $E_{net} = E_1 + E_2$ $E_{net} = 10\,800\,000 - 1\,200\,000$ ✓ $E_{net} = 9\,600\,000$ N.C^{-1}, right/*regs* **OR/OF** $E_{net} = 9,60 \times 10^6$ N.C^{-1}, right/*regs*. ✓	$E_{net} = E_1 + E_2$ $E_{net} = \dfrac{kQ}{r_1^2} + \dfrac{kQ}{r_2^2}$ ⎤ Any one/ *Enige een* ✓ $E_{net} = \dfrac{9 \times 10^9 \times 3,00 \times 10^{-6}}{0,15^2}$ ✓ $- \dfrac{9 \times 10^9 \times 3,00 \times 10^{-6}}{0,05^2}$ ✓ $E_{net} = 10\,800\,000 - 1\,200\,000$ ✓ $E_{net} = 9\,600\,000$ N.C^{-1}, right/*regs* **OR/OF** $E_{net} = 9,60 \times 10^6$ N.C^{-1}, right/*regs* ✓

(5)

7.4.2 **Positive marking from 7.3. / *Positiewe nasien vanaf 7.3***

OPTION 1/ *OPSIE 1*	OPTION 2/ *OPSIE 2*
$E_{net} = \dfrac{F_{net}}{q}$ ✓ $9\,600\,000 = \dfrac{F_{net}}{1,6 \times 10^{-19}}$ ✓ $F_{net} = 1,536 \times 10^{-12}$ N $F_{net} = ma$ ✓ $1,536 \times 10^{-12} = 9,11 \times 10^{-31}\, a$ ✓ $a = 1,69 \times 10^{18}$ m.s^{-2} ✓	$F = \dfrac{kQ_1Q_2}{r^2}$ ✓ $F_1 = \dfrac{9 \times 10^9 \times 3,00 \times 10^{-6} \times 1,6 \times 10^{-19}}{(50 \times 10^{-3})^2}$ $F_1 = 1,728 \times 10^{-12}$ N right Both/*Beide* ✓ $F_2 = \dfrac{9 \times 10^9 \times 3,00 \times 10^{-6} \times 1,6 \times 10^{-19}}{(150 \times 10^{-3})^2}$ $F_2 = 1,92 \times 10^{-13}$ N left/*links* $F_{net} = F_1 + F_2$ $F_{net} = 1,728 \times 10^{-12} - 1,92 \times 10^{-13}$ $F_{net} = 1,536 \times 10^{-12}$ N right/*regs* $F_{net} = ma$ ✓ $1,536 \times 10^{-12} = 9,11 \times 10^{-31}\, a$ ✓ $a = 1,69 \times 10^{18}$ m.s^{-2} ✓

(5)

[18]

QUESTION/*VRAAG* 8

8.1

OPTION 1/ *OPSIE 1*	OPTION 2/ *OPSIE 2*
$\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2}$ ✓	$R_p = \dfrac{R_1 R_2}{R_1 + R_2}$ ✓
$\dfrac{1}{R_p} = \dfrac{1}{6} + \dfrac{1}{6+2}$ ✓	$R_p = \dfrac{6 \times 8}{6+8}$ ✓
$\dfrac{1}{R_p} = \dfrac{7}{24}$	$R_p = 3{,}43 \ \Omega$ ✓
$R_p = 3{,}43 \ \Omega$ ✓	

(3)

8.2   8.2.1   Cost/*Koste* = E(kWh) x price/*prys*
$6{,}75 = E(kWh) \times 1{,}50$ ✓
$E(kWh) = 4{,}5 \ kWh$

$P = \dfrac{W}{\Delta t}$ ✓

$P = \dfrac{4{,}5}{5 \times 5}$ ✓

$P = 0{,}18 \ kW$
$P = 180 \ W$ ✓

(4)

8.2.2   **Positive marking from 8.2.1/ *Positiewe nasien vanaf 8.2.1***
$P = VI$ ✓
$180 = (60)I$ ✓
$I = 3 \ A$ ✓

(3)

8.3   8.3.1   **Positive marking from 8.1 and 8.2.2/ *Positiewe nasien vanaf 8.2.1 en 8.2. 2***

$R = \dfrac{V}{I}$ ✓

$1 = \dfrac{V_r}{3}$ ✓

$V_r = 3 \ V$

$3{,}43 = \dfrac{V_p}{3}$ ✓

$V_p = 10{,}29 \ V$
Emf/*emk* = V_{load} + V_r
Emf/*emk* = $60 + 10{,}29 + 3$ ✓
Emf/*emk* = $73{,}29 \ V$ ✓

(5)

8.3.2 **Positive marking from 8.1, 8.2.1 & 8.2.2/**
Positiewe nasien vanaf 8.1, 8.2.1 en 8.2.2

OPTION 1/OPSIE 1	**OPTION 2/ OPSIE 2**
$P = I^2R$ ✓ $180 = (3)^2R$ ✓ $R = 20\ \Omega$ ✓	$R = \dfrac{V}{I}$ ✓ $R = \dfrac{60}{3}$ ✓ $R = 20\ \Omega$ ✓
OPTION 3/OPSIE 3	**OPTION 4 /OPSIE 4**
$P = \dfrac{V^2}{R}$ ✓ $180 = \dfrac{60^2}{R}$ ✓ $R = 20\ \Omega$ ✓	emf = I (R + r) ✓ 73,29 = 3 (R + 1) ✓ R = 23,43 Ω $R = R_p + R_s$ 23,43 = 3,43 + R_s $R_s = 20\ \Omega$ ✓

(3)

[18]

QUESTION/*VRAAG* 9

9.1 Mechanical ✓ to electrical ✓ / *Meganies* ✓ *na elektries* ✓ (2)

9.2 To reverse the direction of the current each half cycle. ✓
Om die rigting van die stroom elke halfsiklus om te keer. ✓
OR/ OF
Allow for constant direction of rotation of the coil. ✓
Laat toe vir die konstante draairigting van die spoel. ✓ (1)

9.3

Time/*Tyd* (s)
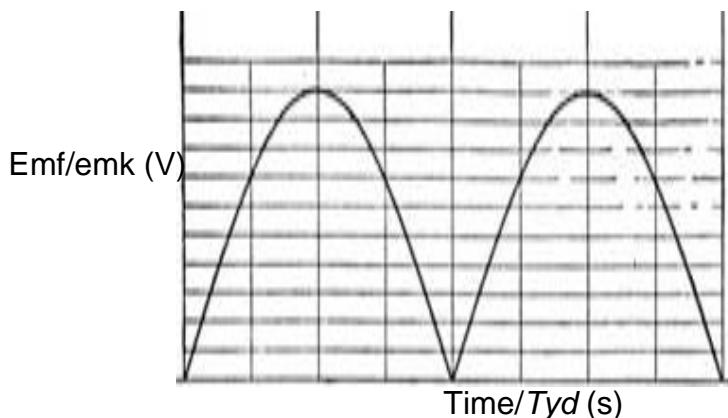
D.C. graph /Correct shape ✓
GS grafiek/ korrekte vorm
Two peaks only (one cycle) ✓
Slegs twee pieke (een siklus) (2)

9.4 Increase the strength of the magnetic field
Verhoog die sterkte van die magnetiese veld
Increase the number of turns on the coil
Verhoog die aantal draaie op die spoel   Any one/*Enige een* ✓
Rotate the coil faster
Draai die spoel vinniger (1)

[6]

QUESTION/*VRAAG* 10

10.1 The <u>DC potential difference/voltage</u> that <u>dissipate the same amount of energy as an AC</u> source. ✓✓
Die wgk-waarde van WS is die <u>GS-potensiaalverskil/spanning</u> <u>wat dieselfde hoeveelheid energie verbruik as die WS</u>-bron. ✓✓ (2)

NOTE:/*LET WEL:*
If any of the underlined key words in the correct context is omitted deduct 1 mark.
Indien enige van die onderstreepte sleutel woorde in die korrekte konteks uitgelaat is, trek 1 punt af.

10.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$P_{Average} = I_{rms/wgk}V_{rms/wgk}$ ✓ $2\,000 = I_{rms/wgk} \times 230$ ✓ $I_{rms/wgk} = 8,70$ A $I_{rms} = \dfrac{I_{max}}{\sqrt{2}}$ $8,70 = \dfrac{I_{max}}{\sqrt{2}}$ ✓ $I_{max/maks} = 12,30$ A ✓	$P_{Average} = \dfrac{V_{rms}^2}{\sqrt{2}}$ $2\,000 = \dfrac{230^2}{R}$ ✓ $R = 26,45\,\Omega$ $R = \dfrac{V_{rms}}{I_{rms}}$ $26,45 = \dfrac{230}{I_{rms}}$ ✓ $I_{rms/wgk} = 8,70$ A $I_{rms} = \dfrac{I_{max}}{\sqrt{2}}$ $8,70 = \dfrac{I_{max}}{\sqrt{2}}$ ✓ $I_{max/maks} = 12,30$ A ✓

(4)

[6]

QUESTION/*VRAAG* 11

11.1 The <u>minimum frequency</u> required to emit electrons <u>from a metal surface</u>. ✓✓
Die <u>minimum frekwensie</u> benodig om elektrone uit 'n sekere <u>metaaloppervlak</u> vry te stel. ✓✓ (2)

NOTE:/*LET WEL:*
If any of the underlined key words in the correct context is omitted deduct 1 mark.
Indien enige van die onderstreepte sleutel woorde in die korrekte konteks uitgelaat is, trek 1 punt af.

11.2 $W_o = hf_o$ ✓
$W_o = (6,63 \times 10^{-34})(1,50 \times 10^{14})$ ✓
$W_o = 9,95 \times 10^{-20}$ J ✓ (3)

11.3 **Positive marking from 11.2/ *Positiewe nasien vanaf 11.2***

$\left. \begin{array}{l} E = W_0 + E_{k(max/maks)} \\[4pt] E = W_0 + \frac{1}{2} m v^2_{(max)} \\[4pt] \dfrac{hc}{\lambda} = W_0 + \dfrac{1}{2} m v^2_{(max)} \end{array} \right]$ Any one/*Enige een* ✓

$\dfrac{6,63 \times 10^{-34} \times 3 \times 10^8}{5,4 \times 10^{-7}}$ ✓ $= 9,95 \times 10^{-20}$ ✓ $+ \dfrac{1}{2} \times 9,11 \times 10^{-31} v^2_{(max)}$ ✓

$v_{(max/maks)} = 7,68 \times 10^5$ m.s^{-1} ✓ (5)

11.4
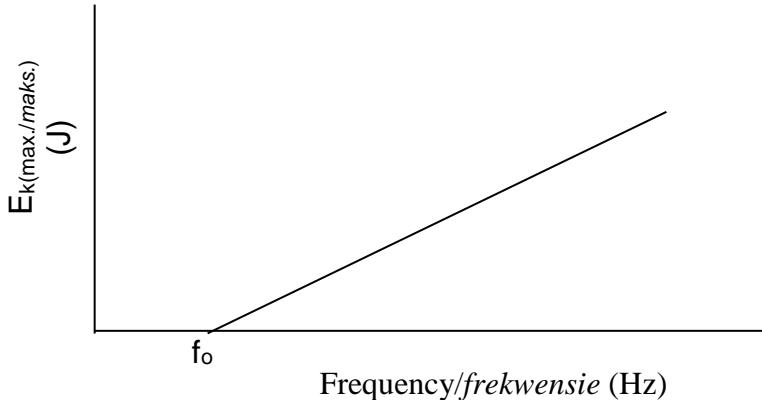
Correct shape/*Korrekte vorm*	✓
Both axes labeled/ *Albei asse gemerk*	✓
Threshold frequency, f_o / *Drumpelfrekwensie, f_o*	✓

(3)

[13]

TOTAL/*TOTAAL*: 150