



DEPARTMENT OF EDUCATION
DEPARTEMENT VAN ONDERWYS
LEFAPHA LA THUTO
ISEBE LEZEMFUNDO

**PROVINCIAL PREPARATORY EXAMINATION/
PROVINSIALE VOORBEREIDINGSEKSAMEN**

GRADE/GRAAD 12

**PHYSICAL SCIENCES P1: PHYSICS/
FISIESE WETENSKAPPE V1: FISIKA
MARKING GUIDELINES/NASIENRIGLYNE
SEPTEMBER 2021**

MARKS/PUNTE: 150

TIME/TYD: 3 hours/uur

**This memorandum consist of 26 pages
Hierdie memorandum bestaan uit 26 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 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 penalisation if zero substitutions are omitted** in calculations where **correct formula/principle is given correctly**.
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 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.
- 1.7 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 is 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 two decimal places.

Alle berekenings, wanneer nie in die vraag gespesifiseer word nie, moet tot 'n minimum van twee desimale plekke gedoen word.

2. UNITS/EENHEDE

- 2.1 Candidates will only be penalised once for the repeated use of an incorrect unit **within a question or sub-question**.

Kandidate sal slegs een keer gepeenaliseer 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 word slegs vir 'n antwoord en nie vir 'n eenheid per se toegeken 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

- 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 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 vermenigvuldigpunt 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 berekenings 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 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 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 multi-step question in a sub-question:** 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.*
- 4.5 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 to 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 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 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 A✓✓ (2)
1.4 B✓✓ (2)
1.5 C✓✓ (2)
1.6 D✓✓ (2)
1.7 D ✓✓ (2)
1.8 A✓✓ (2)
1.9 B✓✓ (2)
1.10 C✓✓ (2)
- [20]**

QUESTION 2/VRAAG 2

2.1

NOTE: -1 mark for each key word/phrase omitted in the correct context.
LET WEL: -1 punt vir elke sleutel word/frase in die korrekte konteks weggelaat.

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

'n Liggaam sal in sy toestand van rus of beweging teen konstante snelheid volhard, tensy 'n nie-nul resulterende/netto krag daarop inwerk.

OR/OF

A body will remain in its state of motion (at rest or moving at constant velocity) until a net force acts on it. ✓✓

'n Liggaam sal in sy toestand van beweging (in rus of beweging teen konstante snelheid) volhard, totdat 'n netto krag daarop inwerk.

(2)

2.2 **OPTION 1/OPSIE 1**

Block A/Blok A

$$\left. \begin{array}{l} \vec{F}_{\text{net}}=0 \\ \vec{f}_s + \vec{T}=0 \\ -f_s + T=0 \end{array} \right\} \quad \boxed{\checkmark \text{ Any one/Enige een}}$$

Block B/Blok B

$$\left. \begin{array}{l} \vec{F}_g + \vec{T}=0 \\ F_g - T=0 \\ m_B g - T=0 \end{array} \right\} \quad \boxed{\checkmark \text{ Any one/Enige een}}$$

Solving

$$-f_s + T + m_B g - T = 0$$

$$f_s = m_B g$$

$$f_s = 5 \times 9,8 \checkmark$$

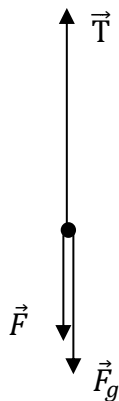
$$f_s = 49,00 \text{ N } \checkmark$$

Note/Aantekening: Do not penalise if vectors notation is not used./Moenie

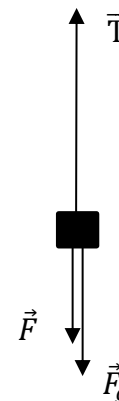
(4)

penaliseer indien vektornotasie nie gebruik word nie.

2.3.1



ACCEPT/AANVAAR



Accepted labels/Aanvaarde benoemings		
F	F _{app} / F _A /applied force F _{toegepas} / F _T /toegepaste krag	✓
F _g	w/F _w /weight/mg/gravitational force w/F _w /gewig/mg/gravitasiekrag	✓
T	F _T /Tension/Spanning	✓

Notes/Aantekeninge

- Marks awarded for label and arrow./Punt toegeken vir benoeming en pyltjie.
- Do not penalise for length of arrows since drawing is not to scale./Moenie vir die lengte van die pyltjies penaliseer nie aangesien die tekening nie volgens skaal is nie.
- Any other additional force(s)./Enige ander ekstra krag(te). Max/Maks $\frac{2}{3}$
- If force(s) do not make contact with body./Indien krag(te) nie met die voorwerp kontak maak nie: Max/Maks $\frac{2}{3}$
- Do not penalise if vector notation is not used./Moenie penaliseer indien vektor notasie nie gebruik is nie.

(3)

2.3.2 **OPTION 1/OPSIE 1**

Direction of motion as positive/*Rigting van beweging as positief*

Block A/*Blok A*

$$\Sigma \vec{F} = m\vec{a} \quad \text{OR/OF} \quad \vec{F}_{\text{net}} = m\vec{a} \quad \text{OR/OF} \quad F_{\text{net}} = ma$$

$$\vec{T} + \vec{f}_k = m_A \vec{a} \quad \text{OR/OF} \quad T + f_k = m_A a$$

$$T - f_k = m_A a$$

$$T - 46 \checkmark = 4a \checkmark \quad (1)$$

Block B/*Blok B*:

$$\vec{T} + \vec{F}_g + \vec{F} = m_B \vec{a} \quad \text{OR/OF} \quad T + F_g + F = m_B a$$

$$-T + F_{g(B)} + F = m_B a$$

$$-T + m_B g + F = m_B a$$

$$-T + (5)(9,8) + 15 \checkmark = 5a$$

$$4a \quad \text{OR/OF} \quad 5a \checkmark$$

$$-T + 49 + 15 = 5a$$

$$-T + 64 = 5a \quad (2)$$

Solving (1) and (2)/*Los (1) en (2) op*:

$$T - 46 - T + (5)(9,8) + 15 = 4a + 5a$$

$$T - 46 - T + 49 + 15 = 9a$$

$$a = 2,00 \text{ m} \cdot \text{s}^{-2} \checkmark \quad \text{Accept/Aanvaar} \quad a = 2 \text{ m} \cdot \text{s}^{-2}$$

✓ Any one/*Enige een*

OPTION 2/OPSIE 2

Direction of motion as negative/*Rigting van beweging as negatief*

Block A/*Blok A*

$$\Sigma \vec{F} = m\vec{a} \quad \text{OR/OF} \quad \vec{F}_{\text{net}} = m\vec{a} \quad \text{OR/OF} \quad F_{\text{net}} = ma$$

$$\vec{T} + \vec{f}_k = m_A \vec{a} \quad \text{OR/OF} \quad T + f_k = m_A a$$

$$-T + f_k = m_A a$$

$$-T + 46 \checkmark = 4a \checkmark \quad (1)$$

Block B/*Blok B*:

$$\vec{T} + \vec{F}_g + \vec{F} = m_B \vec{a} \quad \text{OR/OF} \quad T + F_g + F = m_B a$$

$$+T - F_{g(B)} - F = m_B a$$

$$+T - m_B g - F = m_B a$$

$$+T - (5)(9,8) - 15 \checkmark = 5a$$

$$4a \quad \text{OR/OF} \quad 5a \checkmark$$

$$+T - 49 - 15 = 5a$$

$$+T - 64 = 5a \quad (2)$$

Solving (1) and (2)/*Los (1) en (2) op*:

$$-T + 46 + T - (5)(9,8) - 15 = 4a + 5a$$


$$-T + 46 + T - 49 - 15 = 9a$$

$$a = 2,00 \text{ m} \cdot \text{s}^{-2} \checkmark \quad \text{Accept/Aanvaar} \quad a = 2 \text{ m} \cdot \text{s}^{-2}$$

Note/Aantekening: Do not penalise if vector notation is not used./*Moenie*

penaliseer indien vektornotasie nie gebruik is nie.

✓ Any one/*Enige een*

2.4  *Smaller than /Kleiner as* ✓

F_{net} decreases./F_{net} Neem af. ✓

(5)

(2)

[16]

QUESTION 3/VRAAG 3

3.1 A projectile is an object which has been given an initial velocity and then it moves under the influence of the gravitational force only. ✓✓
'n Projektiel is 'n voorwerp waaraan 'n beginsnelheid gegee is en wat dan slegs onder die invloed van die gravitasiekrag beweeg.

(2 or/of 0)

3.2 $\Delta y = 0$ (m)/Zero ✓

3.3.1 **Marking criteria/Nasienriglyne**

- | |
|--|
| <ul style="list-style-type: none">• Any correct formula/Enige korrekte formule ✓• Whole substitution/Hele vervanging ✓• Final answer/Finale antwoord ✓ |
|--|

(1)

OPTION 1/OPSIE 1

Positive downwards/Positief afwaarts:

$$\Delta \vec{y} = \vec{v}_i \Delta t + \frac{1}{2} \vec{a} \Delta t^2 \quad \text{OR/OF} \quad \Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \quad \checkmark$$

$$+19,6 = (0) \Delta t + \frac{1}{2} (+9,8) \Delta t^2 \quad \checkmark$$

$$\Delta t = 2 \text{ s}$$

$$\Delta t_{\text{TOTAL}} = 4 \text{ s/ total } t = 4 \text{ s} \quad \checkmark$$

OPTION 2/OPSIE 2

Positive upwards/Positief opwaarts:

$$\Delta \vec{y} = \vec{v}_i \Delta t + \frac{1}{2} \vec{a} \Delta t^2 \quad \text{OR/OF} \quad \Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \quad \checkmark$$

$$-19,6 = (0) \Delta t + \frac{1}{2} (-9,8) \Delta t^2 \quad \checkmark$$

$$\Delta t = 2 \text{ s}$$

$$\Delta t_{\text{TOTAL}} = 4 \text{ s/ total } t = 4 \text{ s} \quad \checkmark$$

OPTION 3/OPSIE 3

Positive downwards/Positief afwaarts:

$$\vec{v}_f^2 = \vec{v}_i^2 + 2\vec{a}\Delta\vec{y} \quad \text{OR/OF} \quad v_f^2 = v_i^2 + 2a\Delta y$$

$$v^2 = 0^2 + 2(9,8)(+19,6)$$

$$v_f = +19,6 \text{ m}\cdot\text{s}^{-1}$$

$$\Delta \vec{y} = \left(\frac{\vec{v}_i + \vec{v}_f}{2} \right) \Delta t \quad \checkmark \quad \text{OR/OF} \quad \Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t$$

$$+19,6 = \left(\frac{0 + 19,6}{2} \right) \Delta t \quad \checkmark$$

$$\Delta t = 2 \text{ s}$$

$$\Delta t_{\text{TOTAL}} = 4 \text{ s/ total } t = 4 \text{ s} \quad \checkmark$$

OPTION 4/OPSIE 4

Positive upwards/Positief opwaarts:

$$\vec{v}_f^2 = \vec{v}_i^2 + 2\vec{a}\Delta\vec{y} \quad \text{OR/OF} \quad v_f^2 = v_i^2 + 2a\Delta y$$

$$v^2 = 0^2 + 2(9,8)(-19,6)$$

$$v_f = -19,6 \text{ m}\cdot\text{s}^{-1}$$

$$\Delta \vec{y} = \left(\frac{\vec{v}_i + \vec{v}_f}{2} \right) \Delta t \quad \checkmark \quad \text{OR/OF} \quad \Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t$$

$$-19,6 = \left[\frac{0 + (-19,6)}{2} \right] \Delta t \quad \checkmark$$

$$\Delta t = 2 \text{ s}$$

$$\Delta t_{\text{TOTAL}} = 4 \text{ s/ total } t = 4 \text{ s} \quad \checkmark$$

OPTION 5/OPSIE 5

Positive downwards/Positief afwaarts:

$$\vec{v}_f^2 = \vec{v}_i^2 + 2\vec{a}\Delta\vec{y} \quad \text{OR/OF} \quad v_f^2 = v_i^2 + 2a\Delta y$$

$$v^2 = 0^2 + 2(9,8)(+19,6)$$

$$v_f = + 19,6 \text{ m}\cdot\text{s}^{-1}$$

$$\vec{v}_f = \vec{v}_i + \vec{a}\Delta t \quad \checkmark \quad \text{OR/OF} \quad v_f = v_i + a\Delta t$$

$$+19,6 = 0 + (+9,8)\Delta t \quad \checkmark$$

$$\Delta t = 2\text{s}$$

$$\Delta t_{\text{TOTAL}} = 4\text{s} / \text{total } t = 4 \text{ s} \quad \checkmark$$

OPTION 6/OPSIE 6

Positive upwards/ Positief opwaarts:

$$\vec{v}_f^2 = \vec{v}_i^2 + 2\vec{a}\Delta\vec{y} \quad \text{OR/OF} \quad v_f^2 = v_i^2 + 2a\Delta y$$

$$v^2 = 0^2 + 2(9,8)(-19,6)$$

$$v_f = - 19,6 \text{ m}\cdot\text{s}^{-1}$$

$$\vec{v}_f = \vec{v}_i + \vec{a}\Delta t \quad \checkmark \quad \text{OR/OF} \quad v_f = v_i + a\Delta t$$

$$-19,6 = 0 + (-9,8)\Delta t \quad \checkmark$$

$$\Delta t = 2\text{s}$$

$$\Delta t_{\text{TOTAL}} = 4\text{s} / \text{total } t = 4 \text{ s} \quad \checkmark$$

Note/Aantekening: Do not penalise if vector notation is not used./Moenie penaliseer indien vektornotasie nie gebruik is nie.

(3)

3.3.2 **Marking criteria/Nasienriglyne**

- | |
|--|
| <ul style="list-style-type: none">• Any correct formula/Enige kprrekte formule ✓• Whole substitution/Hele vervanging ✓• Final answer/Finale antwoord ✓ |
|--|

POSITIVE MARKING FROM 3.3.1/POSITIEWE NASIEN VANAF 3.3.1

OPTION 1/OPSIE 1

From bottom to top/Van onder na bo

Positive upwards/ Positief opwaarts:

$$\Delta\vec{y} = \left(\frac{\vec{v}_i + \vec{v}_f}{2}\right) \Delta t \quad \checkmark \quad \text{OR/OF} \quad \Delta y = \left(\frac{v_i + v_f}{2}\right) \Delta t$$

$$+19,6 = \left(\frac{v_i + 0}{2}\right) 2 \quad \checkmark$$

$$v_i = + 19,6 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

OR/OF

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts.} \quad \checkmark \quad \text{Accept}$$

OPTION 2/OPSIE 2

From bottom to top/Van onder na bo

Positive downwards/Positief afwaarts:

$$\Delta\vec{y} = \left(\frac{\vec{v}_i + \vec{v}_f}{2}\right) \Delta t \quad \checkmark \quad \text{OR/OF} \quad \Delta y = \left(\frac{v_i + v_f}{2}\right) \Delta t$$

$$-19,6 = \left(\frac{v_i + 0}{2}\right) 2 \quad \checkmark$$

$$v_i = - 19,6 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

OR/OF

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts.} \quad \checkmark$$

OPTION 3/OPSIE 3

From bottom to top/Van onder na bo

Positive upwards/ *Positief opwaarts*:

$$\vec{v}_f = \vec{v}_i + \vec{a}\Delta t \quad \checkmark \text{ OR/OF } v_f = v_i + a\Delta t$$

$$0 = v_i + (-9,8)2 \quad \checkmark$$

$$v_i = + 19,6 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

OR/OF

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts.} \quad \checkmark$$

OPTION 4/OPSIE 4

From bottom to top/Van onder na bo

Positive downwards/ *Positief afwaarts*:

$$\vec{v}_f = \vec{v}_i + \vec{a}\Delta t \quad \checkmark \text{ OR/OF } v_f = v_i + a\Delta t$$

$$0 = v_i + (+9,8)2 \quad \checkmark$$

$$v_i = - 19,6 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

OR/OF

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts.} \quad \checkmark$$

OPTION 5/OPSIE 5

From bottom to top/Van onder na bo

Positive upwards/ *Positief opwaarts*:

$$\vec{v}_f^2 = \vec{v}_i^2 + 2\vec{a}\Delta\vec{y} \quad \checkmark \text{ OR/OF } v_f^2 = v_i^2 + 2a\Delta y$$

$$0^2 = v_i^2 + 2(-9,8)(+ 19,6) \quad \checkmark$$

$$v_i = + 19,6 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

OR/OF

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts.} \quad \checkmark$$

OPTION 6/OPSIE 6

From bottom to top/Van onder na bo

Positive downwards/ *Positief afwaarts*:

$$\vec{v}_f^2 = \vec{v}_i^2 + 2\vec{a}\Delta\vec{y} \quad \checkmark \text{ OR/OF } v_f^2 = v_i^2 + 2a\Delta y$$

$$0^2 = v_i^2 + 2(+9,8)(- 19,6) \quad \checkmark$$

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts.} \quad \checkmark$$

OR/OF

$$v_i = + 19,6 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

OPTION 7/OPSIE 7

From top to bottom/ Van bo na onder

Positive downwards/ *Positief afwaarts*:

$$\Delta\vec{y} = \left(\frac{\vec{v}_i + \vec{v}_f}{2}\right) \Delta t \quad \checkmark \text{ OR/OF } \Delta y = \left(\frac{v_i + v_f}{2}\right) \Delta t$$

$$+19,6 = \left(\frac{0 + v_f}{2}\right) 2 \quad \checkmark$$

$$v_f = + 19,6 \text{ m}\cdot\text{s}^{-1}$$

$$v_i = - 19,6 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

OR/OF

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts.} \quad \checkmark$$

OPTION 8/OPSIE 8

From top to bottom/ Van bo na onder

Positive upwards/ Positief opwaarts:

$$\Delta \vec{y} = \left(\frac{\vec{v}_i + \vec{v}_f}{2} \right) \Delta t \checkmark \text{ OR/OF } \Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t$$

$$-19,6 = \left(\frac{0 + v_f}{2} \right) 2 \checkmark$$

$$v_f = -19,6 \text{ m}\cdot\text{s}^{-1}$$

$$v_i = +19,6 \text{ m}\cdot\text{s}^{-1} \checkmark$$

OR/OF

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts. } \checkmark$$

OPTION 9/OPSIE 9

From top to bottom/ Van bo na onder

Positive downwards/ Positief afwaarts:

$$\vec{v}_f = \vec{v}_i + \vec{a}\Delta t \checkmark \text{ OR/OF } v_f = v_i + a\Delta t$$

$$v_f = 0 + (+9,8)2 \checkmark$$

$$v_f = +19,6 \text{ m}\cdot\text{s}^{-1}$$

$$v_i = -19,6 \text{ m}\cdot\text{s}^{-1}$$

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts. } \checkmark$$

OPTION 10/OPSIE 10

From top to bottom/ Van bo na onder

Positive upwards/ Positief opwaarts:

$$\vec{v}_f = \vec{v}_i + \vec{a}\Delta t \checkmark \text{ OR/OF } v_f = v_i + a\Delta t$$

$$v_f = 0 + (-9,8)2 \checkmark$$

$$v_f = -19,6 \text{ m}\cdot\text{s}^{-1}$$

$$v_i = +19,6 \text{ m}\cdot\text{s}^{-1} \checkmark$$

OR/OF

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts. } \checkmark$$

OPTION 11/OPSIE 11

From top to bottom/ Van bo na onder

Positive downwards/ Positief afwaarts:

$$\vec{v}_f^2 = \vec{v}_i^2 + 2\vec{a}\Delta \vec{y} \checkmark \text{ OR/OF } v_f^2 = v_i^2 + 2a\Delta y$$

$$v_f^2 = 0^2 + 2(+9,8)(+19,6) \checkmark$$

$$v_f = +19,6 \text{ m}\cdot\text{s}^{-1}$$

$$v_i = -19,6 \text{ m}\cdot\text{s}^{-1} \checkmark$$

OR/OF

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts. } \checkmark$$

OPTION 12/OPSIE 12

From top to bottom/ Van bo na onder

Positive upwards/ Positief opwaarts:

$$\vec{v}_f^2 = \vec{v}_i^2 + 2\vec{a}\Delta \vec{y} \checkmark \text{ OR/OF } v_f^2 = v_i^2 + 2a\Delta y$$

$$v_f^2 = 0^2 + 2(-9,8)(-19,6) \checkmark$$

$$v_f = 19,6 \text{ m}\cdot\text{s}^{-1}$$

$$v_i = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ upwards/afwaarts. } \checkmark$$

OR/OF

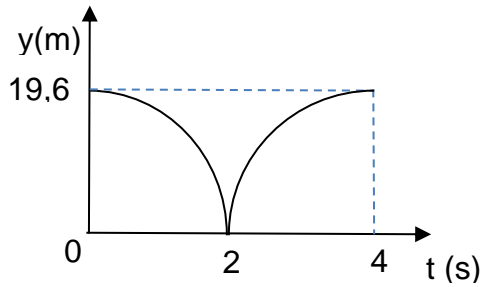
$$v_i = +19,6 \text{ m}\cdot\text{s}^{-1} \checkmark$$

Note/Aantekening: Do not penalise if vector notation is not used./Moenie penaliseer indien vektorenotasie nie gebruik is nie.

(3)

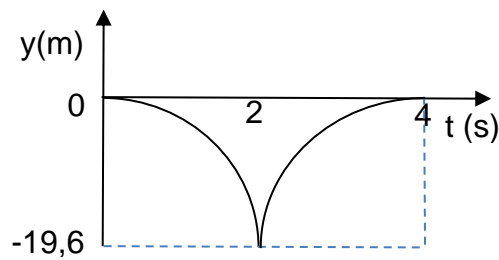
3.4 **POSITIVE MARKING FROM 3.3.1/POSITIEWE NASIEN VANAF 3.3.1**
OPTION 1/ OPSIE 1

Positive upwards/Positief opwaarts:



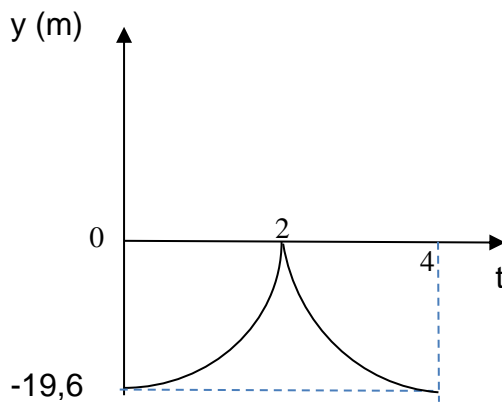
OPTION 2/ OPSIE 2

Positive upwards/Positief opwaarts:



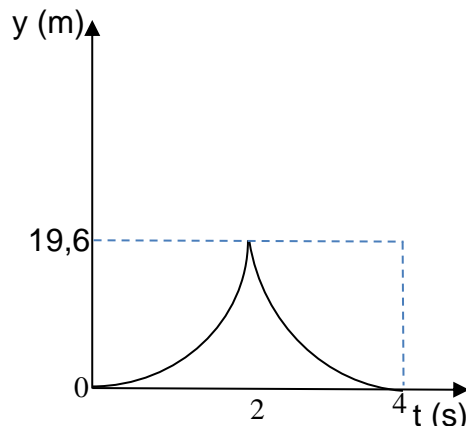
OPTION 3/ OPSIE 3

Positive downwards/Positief afwaarts:



OPTION 4/OPSIE 4

Positive downwards/Positief afwaarts:



Criteria for marking the graph/ Kriteria vir die nasien van die grafiek.	Marks/ Punte
Initial and final position (19,6 m) / Aanvanklike en finale posisie (19,6m).	✓
The time taken by the ball to reach the ground and the time taken by the ball to reach the starting point./ Die tyd wat die bal neem om die grond te bereik en die tyd wat die bal neem om die beginpunt te bereik.	✓
Correct shape/Korrekte vorm.	✓

(3)
[12]

QUESTION 4/VRAAG 4

4.1

NOTE: -1 Mark for each key word /phrase omitted in the correct context.
LET WEL: - 1 punt vir elke sleutelwoord/frase weggelaat in die korrekte konteks.

(2)

The total mechanical energy (sum of gravitational potential energy and kinetic energy) in an isolated system remains constant. ✓✓

Die totale meganiese energie (som van gravitasie- potensiële energie en kinetiese energie) in 'n geslote sisteem bly konstant.

4.2 **OPTION 1/OPSIE 1**

$$\Delta E_M = 0$$

$$E_{Mf} - E_{Mi} = 0$$

$$E_{Mi} = E_{Mf}$$

$$E_{Ki} + E_{Pi} = E_{Kf} + E_{Pf}$$

$$\frac{1}{2}(m_P + m_Q)v_i^2 + (m_P + m_Q)gh_i = \frac{1}{2}(m_P + m_Q)v_f^2 + (m_P + m_Q)gh_f$$

$$\left[\frac{1}{2}(4+6)(4,5)^2 + (4+6)(9,8)(6) \right] \checkmark = \left[\frac{1}{2}(4+6)v_f^2 + (4+6)(9,8)(0) \right] \checkmark$$

OR/OF

$$\left[\frac{1}{2}(10)(4,5)^2 + (10)(9,8)(6) \right] \checkmark = \left[\frac{1}{2}(10)v_f^2 + (10)(9,8)(0) \right] \checkmark$$

$$v = 11,74 \text{ m} \cdot \text{s}^{-1} \checkmark$$

✓ Any One/Enige een

OPTION 2/OPSIE 2

$$\Delta E_M = 0$$

$$\Delta E_K + \Delta E_p = 0$$

$$(E_{Kf} - E_{Ki}) + (E_{Pf} - E_{Pi}) = 0$$

$$\left[\frac{1}{2}(m_P + m_Q)v_f^2 - \frac{1}{2}(m_P + m_Q)v_i^2 \right] + [(m_P + m_Q)gh_f - (m_P + m_Q)gh_i] = 0$$

$$\left[\frac{1}{2}(4+6)v_f^2 - \frac{1}{2}(4+6)(4,5)^2 \right] \checkmark + [(4+6)(9,8)(0) - (4+6)(9,8)(6)] \checkmark = 0$$

OR/OF

$$\left[\frac{1}{2}(10)v_f^2 - \frac{1}{2}(10)(4,5)^2 \right] \checkmark + [(10)(9,8)(0) - (4+6)(9,8)(6)] \checkmark = 0$$

$$v = 11,74 \text{ m} \cdot \text{s}^{-1} \checkmark$$

✓ Any One/Enige een

OPTION 3/OPSIE 3

$$\Delta E_M = 0$$

$$\Delta E_K + \Delta E_p = 0$$

$$(E_{Kf} - E_{Ki}) = -(E_{Pf} - E_{Pi})$$

$$\left[\frac{1}{2}(m_P + m_Q)v_f^2 - \frac{1}{2}(m_P + m_Q)v_i^2 \right] = - [(m_P + m_Q)gh_f - (m_P + m_Q)gh_i]$$

$$\left[\frac{1}{2}(4+6)v_f^2 - \frac{1}{2}(4+6)(4,5)^2 \right] \checkmark + [(4+6)(9,8)(0) - (4+6)(9,8)(6)] \checkmark$$

OR/OF

$$\left[\frac{1}{2}(10)v_f^2 - \frac{1}{2}(10)(4,5)^2 \right] \checkmark = - [(10)(9,8)(0) - (4+6)(9,8)(6)] \checkmark$$

$$v = 11,74 \text{ m} \cdot \text{s}^{-1} \checkmark$$

✓ Any One/Enige een

(4)

4.3 **OPTION 1/OPSIE 1**

(1)

$$\sum \vec{p}_{\text{after/na}} - \sum \vec{p}_{\text{(before/voor)}} = 0$$

$$\sum \vec{p}_{\text{(before/voor)}} = \sum \vec{p}_{\text{(after/na)}}$$

$$m_P \vec{v}_{P(\text{bef/voor})} + m_Q \vec{v}_{Q(\text{bef/voor})} = (m_P) \vec{v}_{P(\text{after/na})} + m_Q \vec{v}_{Q(\text{aft/na})}$$

✓ Any one / Enige een

positive to the right/*na regs is positief*:

$$(4)(+11,74) + (6)(+11,74) \checkmark = (4) \vec{v}_{P(\text{after/na})} + (6)(+12,914) \checkmark$$

$$\vec{v}_{P(\text{after/na})} = +9,979 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ OR/OF } \vec{v}_{P(\text{after/na})} = +9,98 \text{ m}\cdot\text{s}^{-1}$$

OR/OF

$$\vec{v}_{P(\text{after/na})} = 9,98 \text{ m}\cdot\text{s}^{-1} \text{ to the right/na regs} \checkmark$$

OPTION 2/OPSIE 2

$$\sum \vec{p}_{\text{after/na}} - \sum \vec{p}_{\text{(before/voor)}} = 0$$

$$\sum \vec{p}_{\text{(before/voor)}} = \sum \vec{p}_{\text{(after/na)}}$$

$$m_P \vec{v}_{P(\text{bef/voor})} + m_Q \vec{v}_{Q(\text{bef/voor})} = (m_P) \vec{v}_{P(\text{after/na})} + m_Q \vec{v}_{Q(\text{aft/na})}$$

✓ Any one / Enige een

positive to the left/*na links is positief*:

$$(4)(-11,74) + (6)(-11,74) \checkmark = (4) \vec{v}_{P(\text{after/na})} + (6)(-12,914) \checkmark$$

$$\vec{v}_{P(\text{after/na})} = -9,979 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ OR/OF } \vec{v}_{P(\text{after/na})} = -9,98 \text{ m}\cdot\text{s}^{-1}$$

OR/OF

$$\vec{v}_{P(\text{after/na})} = 9,98 \text{ m}\cdot\text{s}^{-1} \text{ to the right/na regs} \checkmark$$

Note/Aantekening: Do not penalise if vector notation is not used./*Moenie penaliseer indien vektornotasie nie gebruik is nie.*

NOTE/LET WEL:

$$11,74 - 100\%$$

$$X - 10\%$$

$$X = \frac{11,74 \times 10}{100} = 1,174$$

$$v_Q = 11,74 + 1,174$$

$$v_Q = 12,914 \text{ m}\cdot\text{s}^{-1}$$

4.4 **OPTION 1/OPSIE 1**

$$\vec{F} \Delta t = \Delta \vec{p} \text{ OR/OF } F \Delta t = \Delta p$$

$$\vec{J} = \Delta \vec{p} \text{ OR/OF } \vec{J} = \Delta \vec{p} \text{ OR/OF Impulse/Impuls} = \Delta p$$

$$\vec{J} = \vec{p}_f - \vec{p}_i$$

$$\vec{J} = m(\vec{v}_f - \vec{v}_{fi}) \text{ OR/OF } \vec{J} = m\vec{v}_f - m\vec{v}_{fi}$$

positive to the right/*na regs is positief*:

$$\vec{J} = 4[(+9,98 - (+11,74))] \checkmark \text{ OR/OF } \vec{J} = [(4)(+9,98)] - [(4)(+11,74)]$$

$$\vec{J} = -7,00 \text{ N}\cdot\text{s}$$

$$J = 7,00 \text{ N}\cdot\text{s} \checkmark \text{ Accept/Aanvaar } J/I/\text{Impulse/Impuls} = 7 \text{ N}\cdot\text{s}$$

OPTION 2/OPSIE 2

$$\vec{F} \Delta t = \Delta \vec{p} \text{ OR/OF } F \Delta t = \Delta p$$

$$\vec{J} = \Delta \vec{p} \text{ OR/OF } \vec{J} = \Delta \vec{p} \text{ OR/OF Impulse/Impuls} = \Delta p$$

$$\vec{J} = \vec{p}_f - \vec{p}_i$$

$$\vec{J} = m(\vec{v}_f - \vec{v}_{fi}) \text{ OR/OF } \vec{J} = m\vec{v}_f - m\vec{v}_{fi}$$

positive to the left/*na links is positief*:

$$\vec{J} = 4[(-9,98 - (-11,74))] \checkmark \text{ OR/OF } \vec{J} = [(4)(-9,98)] - [(4)(-11,74)]$$

$$\vec{J} = +7,00 \text{ N}\cdot\text{s}$$

$$J = 7,00 \text{ N}\cdot\text{s} \checkmark \text{ Accept/Aanvaar } J/I/\text{Impulse/Impuls} = 7 \text{ N}\cdot\text{s}$$

Note/Aantekening: Do not penalise if vector notation is not used./*Moenie penaliseer indien vektornotasie nie gebruik is nie.*

(4)

[13]

QUESTION 5/VRAAG 5

5.1

NOTE: -1 Mark for each key word /phrase omitted in the correct context.
LET WEL: - 1 punt vir elke sleutelwoord/frase weggelaat in die korrekte konteks.

(2)

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 die voorwerp deur 'n netto krag is gelyk aan die verandering in kinetiese energie van die voorwerp.

5.2 **OPTION 1/OPSIE 1**

$$W_{\text{net}} = \Delta E_K$$

$$(F_g - f_f) \Delta x \cos \theta = E_{Kf} - E_{Ki}$$

$$(F_g - f_f) \Delta x \cos \theta = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

Any One /Enige een ✓

$$[(80 \times 9,8) - 172] \times 4 \times (\cos 0^\circ) \checkmark = \frac{1}{2} (80) v_f^2 - \frac{1}{2} (80) (0)^2 \checkmark$$

$$v = 7,82 \text{ m} \cdot \text{s}^{-1} \checkmark$$

OPTION 2/OPSIE 2

$$W_{\text{net}} = \Delta E_K$$

$$W_f + W_{Fg} = E_{Kf} - E_{Ki}$$

$$f_f \Delta x \cos 180^\circ + F_g \Delta x \cos 0^\circ = E_{Kf} - E_{Ki}$$

$$f_f \Delta x \cos 180^\circ + mg \Delta x \cos 0^\circ = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

Any One /Enige een ✓

$$172 \times 4 \times (-1) + (80)(9,8)(4)(1) \checkmark = \frac{1}{2} (80) v_f^2 - \frac{1}{2} (80) (0)^2 \checkmark$$

$$v = 7,82 \text{ m} \cdot \text{s}^{-1} \checkmark$$

OPTION 3/OPSIE 3

$$W_{\text{net}} = \Delta E_K$$

$$W_{Fg} + W_f = E_{Kf} - E_{Ki}$$

$$-\Delta E_p + W_f = E_{Kf} - E_{Ki}$$

$$-(mgh_f - mgh_i) + f_f \Delta x \cos 180^\circ = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

Any One /Enige een ✓

$$-[(80)(9,8)(0) - (80)(9,8)(4)] + 172 \times 4 \times (-1) \checkmark = \frac{1}{2} (80) v_f^2 - \frac{1}{2} (80) (0)^2 \checkmark$$

$$v = 7,82 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(4)

5.3 No/Nee ✓

The net work done by the non-conservative forces is not zero./Die netto arbeid deur die nie-konservatiewe kragte is nie nul nie. ✓

OR/OF

There is friction/non-conservative forces doing work./Daar is wrywing/nie-konservatiewe kragte wat arbeid verrig. ✓

OR/OF

It is not an isolated system. ✓

Dit is nie 'n geïsoleerde sisteem nie.

(2)

5.4 **OPTION 1/OPSIE 1**

$$E_{Mf} = E_{Mi} + W_{nc}$$

$$\left(\frac{mv_f^2}{2} + mgh_f\right) = \left(\frac{mv_i^2}{2} + mgh_i\right) + W_{nc}$$

$$\left(\frac{mv_f^2}{2} + mg(-d)\right) = \left(\frac{mv_i^2}{2} + mgh\right) + W_{nc}$$

$$\left(\frac{80 \times 0^2}{2} + 80 \times 9,8(-d)\right) \checkmark = \left[\left(\frac{80 \times 0^2}{2} + 80 \times 9,8 \times 4\right) + (-6240)\right] \checkmark$$

$$d=3,96 \text{ m} \checkmark$$

✓ Any one/Enige een

OPTION 2/OPSIE 2

$$W_{nc} = \Delta E_K + \Delta E_p \checkmark$$

$$W_{nc} = (E_{Kf} - E_{Ki}) + (E_{Pf} - E_{Pi})$$

$$W_{nc} = \left(\frac{mv_f^2}{2} - \frac{mv_i^2}{2}\right) - (mgh_f - mgh_i)$$

$$W_{nc} = \left(\frac{mv_f^2}{2} - \frac{mv_i^2}{2}\right) + (mg(-d) - mgh)$$

$$-6240 \checkmark = \left(\frac{80 \times 0^2}{2} - \frac{80 \times 0^2}{2}\right) + [80 \times 9,8 \times (-d) - (80 \times 9,8 \times 4)] \checkmark$$

$$d=3,96 \text{ m} \checkmark$$

✓ Any one/Enige een

OPTION 3/OPSIE 3

$$W_{net} = \Delta E_K$$

$$W_c + W_{nc} = E_{Kf} - E_{Ki}$$

$$-\Delta E_p + W_{nc} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$-(E_{Pf} - E_{Pi}) + W_{nc} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$-[(mg(-d) - mgh)] + W_{nc} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$-[(80 \times 9,8(-d) - (80)(9,8)(4))] \checkmark + (-6240) = \frac{1}{2}80(0)^2 - \frac{1}{2}80(0)^2 \checkmark$$

$$d=3,96 \text{ m} \checkmark$$

✓ Any one/Enige een

OPTION 4/OPSIE 4

$$W_{nc} = \Delta E_M$$

$$W_{nc} = E_{Mf} - E_{Mi} \checkmark$$

$$W_{nc} = (E_{Kf} - E_{Ki}) + (E_{Pf} - E_{Pi})$$

$$W_{nc} = \left(\frac{mv_f^2}{2} + mgh_f \right) - \left(\frac{mv_i^2}{2} + mgh_i \right)$$

$$W_{nc} = \left(\frac{mv_f^2}{2} + mg(-d) \right) - \left(\frac{mv_i^2}{2} + mgh \right)$$

$$\underline{-6240 \checkmark = \left[\frac{80 \times 0^2}{2} + 80 \times 9,8 \times (-d) \right] - \left[\frac{80 \times 0^2}{2} + (80 \times 9,8 \times 4) \right] \checkmark}$$

$$d = 3,96 \text{ m } \checkmark$$

✓ Any one/Enige een

OPTION 5/OPSIE 5

$$W_{nc} = \Delta E_K + \Delta E_p \checkmark$$

$$W_{nc} = (E_{Kf} - E_{Ki}) + (E_{Pf} - E_{Pi})$$

$$W_{nc} = \left(\frac{mv_f^2}{2} - \frac{mv_i^2}{2} \right) - (mgh_f - mgh_i)$$

$$\underline{-6240 \checkmark = \left(\frac{80 \times 0^2}{2} - \frac{80 \times 0^2}{2} \right) + [80 \times 9,8 \times (0) - 80 \times 9,8 \times (4+d)] \checkmark}$$

$$d = 3,96 \text{ m } \checkmark$$

✓ Any one/Enige een

(4)
[12]

QUESTION 6/VRAAG 6

- 6.1 Doppler effect is the change in frequency (or pitch) of the sound detected by a listener ✓ because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓

Doppler-effek is die verandering in frekwensie (of toonhoogte) van die klank waargeneem deur 'n luisteraar ✓ omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium waarin die klank voortgeplant word, het. ✓

OR/OF

The change in the observed frequency ✓ when there is relative motion between the source and the observer. ✓

Die verandering in die waargenome frekwensie ✓ as daar relatiewe beweging tussen die klankbron en die luisteraar is. ✓

(2)

- 6.2 Longer/Langer ✓

For the same (constant) speed of sound ✓ the frequency of sound is inversely proportional to the wave length and as the fire truck moves away from the listener the listener hears a lower frequency. ✓.

Vir dieselfde (konstante) spoed van klank ✓ is die frekwensie van klank omgekeerd eweredig aan die golflengte en as die brandweerwa beweeg weg van die luisteraar die luisteraar hoor 'n laer frekwensie. ✓

OR/OF

Speed of sound is constant ✓, frequency detected (by the observer) is lower wevelenghts is inversely propotional to frequency. ✓

Klankspoed is konstant, frekwensie waargeneem deur die waarnemer is laer, golflengtes is omgekeerd eweredig aan frekwensie

(3)

- 6.3 $f_L = \left(\frac{v \pm v_L}{v \pm v_s}\right) f_s$ ✓ **OR/OF** $f_L = \left(\frac{v}{v \pm v_s}\right) f_s$

Approaching

$$460 = \left(\frac{340}{340 - v_s}\right) f_s \checkmark$$

Moving away

$$410 = \left(\frac{340}{340 + v_s}\right) f_s \checkmark$$

Solving

$$460 = \left(\frac{340}{340 - v_s}\right) \left(\frac{410}{340 + v_s}\right)$$

$$v_s = 19,54 \text{ m} \cdot \text{s}^{-1}$$

$$460 \checkmark = \left(\frac{340}{340 - 19,54}\right) f_s \checkmark \text{ **OR/OF** } 410 \checkmark = \left(\frac{340}{340 + 19,54}\right) f_s \checkmark$$

(6)

$$f_s = 433,56 \text{ Hz} \checkmark$$

- 6.4 The star is movin away from the Erath ✓ because the spectrum shows a shift towards the red end ✓ which is a lower frequency ✓

Die ster beweeg van die aarde ✓ af omdat die spektrum 'n verskuiwing na die rooi einde ✓ toon wat 'n laer frekwensie is. ✓

(3)

6.5 **ANY ONE**✓

- To measure rate of blood flow.
- Detect heartbeat of foetus.
- It is used (in flow meters) in medical science to measure:
 - the speed and direction (velocity) of blood flow.
 - movement of the heart of a foetus.
- To find the rate of blood flow (Doppler scanning)
- To see the unborn child (Ultra sound scanning)
- To hear the heart of a foetus (Ultra sound scanning)
- It is used in medical sonography to generate images (and sounds) of flowing blood.
- To detect blood clotting (Doppler ultrasound test)

ENIGE EEN

- Om die bloedvloeitempo te meet.
- Ontdek die hartklop van die fetus.
- *Dit word (in vloeimeters) gebruik in mediese wetenskap om die volgende te meet:*
 - Die spoed en rigting (snelheid) van bloedvloei.
 - Beweging van 'n fetus se hart.
- *Om die tempo van bloedvloei te meet (Doppler skandering)*
- *Om 'n ongebore baba te sien (Ultraklankskandering)*
- *Om die hart van 'n fetus te hoor (Ultraklankskandering)*
- *Dit word gebruik in mediese sonografie om beelde (en klanke) te vorm van vloeiende bloed.*
- *Om vorming van bloedklonte op te spoor. (Doppler- ultraklamktoets)*

(1)
[15]

QUESTION 7/VRAAG 7

7.1 Positive/Positief.✓ (1)

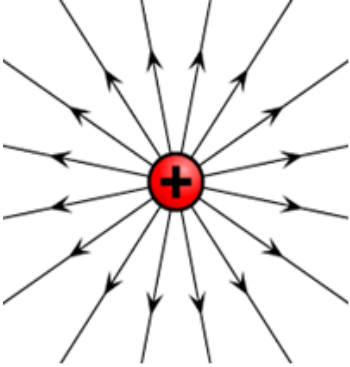
7.2 $Q = ne$ ✓ **OR/OF** $n = \frac{q}{e}$
 $Q = 938(1,6 \times 10^{-19} \text{ C})$ ✓ **OR/OF** $Q = 938(1,6 \times 10^{-19})$
 $Q = 1,50 \times 10^{-16} \text{ C}$ ✓ (3)

7.3

NOTE: -1 Mark for each key word /phrase omitted in the correct context. LET WEL: - 1 punt vir elke sleutelwoord/frase weggelaat in die korrekte konteks.

The electric field at a point is the electrostatic force experienced per unit positive charge placed at that point.

Die elektriese veld by 'n punt is die elektrostatiese krag wat per eenheidspositiewe-lading wat by daardie punt geplaas is, ondervind word. (2)

7.4	 <table border="1" data-bbox="612 237 1217 383"> <thead> <tr> <th colspan="2">Marking criteria/ Nasienkriteria</th> </tr> </thead> <tbody> <tr> <td>Shape (radial)/Vorm (radiaal)</td> <td>✓</td> </tr> <tr> <td>Correct direction/Korrekte rigting</td> <td>✓</td> </tr> </tbody> </table>	Marking criteria/ Nasienkriteria		Shape (radial)/Vorm (radiaal)	✓	Correct direction/Korrekte rigting	✓	(3)
Marking criteria/ Nasienkriteria								
Shape (radial)/Vorm (radiaal)	✓							
Correct direction/Korrekte rigting	✓							
7.5	<p>At A. ✓ The distance from A to the charged sphere X is smaller than the distance from B to the charged sphere X ✓ and the electric field at a point due to a point charge is inversely proportional to the square distance between the point and the charge ($E \propto \frac{1}{d^2}$) ✓ By A Die afstand vanaf A na die gelaaiede sfeer X is kleiner as die afstand van B na die gelaaiede sfeer X en die elektriese veld op 'n punt as gevolg van 'n puntlading omgekeerd eweredig is aan die vierkante afstand tussen die punt en die lading ($E \propto \frac{1}{d^2}$).</p>	(3)						

7.6.1 The magnitude of the electrostatic force exerted by one point charge on another point charge is directly proportional to the product (of the magnitudes) of the charges ✓ and inversely proportional to the square of the distance between them. ✓

Die grootte van die elektrostatiese krag wat een puntlading op 'n ander puntlading uitoefen, is direk eweredig aan die produk van die groottes van die ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle.

(2)

7.6.2 **OPTION 1/OPSIE 1**

$$F = \frac{kQ_1Q_2}{r^2} \quad \checkmark \quad \text{OR/OF} \quad F = \frac{kQ_XQ_Y}{r^2}$$

$$F_{YonX} = \frac{9 \times 10^9 \times (1,5 \times 10^{-16}) \times (2,8 \times 10^{-16})}{(0,03)^2} \quad \checkmark$$

$$F_{YonX} = 4,2 \times 10^{-19} \text{ N .to the right/na regs}$$

$$F = \frac{kQ_XQ_Z}{r^2}$$

$$F_{ZonX} = \frac{9 \times 10^9 \times (1,5 \times 10^{-16}) \times (3,2 \times 10^{-16})}{(0,01)^2} \quad \checkmark$$

$$F_{ZonX} = 43,2 \times 10^{-19} \text{ N . to the right/na regs}$$

Positive to the right/Positief na regs

$$\vec{F}_{net} = \vec{F}_{YonX} + \vec{F}_{ZonX} \quad \text{OR/OF} \quad F_{net} = F_{YonX} + F_{ZonX}$$

$$\vec{F}_{net} = 4,2 \times 10^{-19} + 43,2 \times 10^{-19} \quad \checkmark$$

$$\vec{F}_{net} = 47,4 \times 10^{-19} \text{ N.to the right/na regs} \quad \checkmark$$

OR/OF

$$F_{net} = 4,74 \times 10^{-18} \text{ N to the right/na regs} \quad \checkmark$$

OPTION 2/OPSIE 2

$$F = \frac{kQ_1Q_2}{r^2} \quad \checkmark \text{ OR/OF } F = \frac{kQ_XQ_Y}{r^2}$$

$$F_{YonX} = \frac{9 \times 10^9 \times (1,5 \times 10^{-16}) \times (2,8 \times 10^{-16})}{(0,03)^2} \quad \checkmark$$

$$F_{YonX} = 4,2 \times 10^{-19} \text{ N .to the right/na regs}$$

$$F = \frac{kQ_XQ_Z}{r^2}$$

$$F_{ZonX} = \frac{9 \times 10^9 \times (1,5 \times 10^{-16}) \times (3,2 \times 10^{-16})}{(0,01)^2} \quad \checkmark$$

$$F_{ZonX} = 43,2 \times 10^{-19} \text{ N . to the right/na regs}$$

Positive to the left/Positief na links

$$\vec{F}_{net} = \vec{F}_{YonX} + \vec{F}_{ZonX} \quad \text{OR/OF } F_{net} = -F_{YonX} - F_{ZonX}$$

$$\vec{F}_{net} = -4,20 \times 10^{-23} - 43,2 \times 10^{-23} \quad \checkmark$$

$$\vec{F}_{net} = 47,4 \times 10^{-19} \text{ N.to the right/na regs} \quad \checkmark$$

OR/OF

$$F_{net} = 4,74 \times 10^{-18} \text{ N to the right/na regs} \quad \checkmark$$

OPTION 3/OPSIE 3

Positive to the right/ Positief na regs

$$E = K \frac{Q}{r^2}$$

$$E_x = 9 \times 10^9 \times \frac{(3,2 \times 10^{-16})}{(0,01)^2} \quad \checkmark$$

$$E_A = 28,8 \times 10^{-3} \text{ N} \cdot \text{C}^{-1} \text{ to the right/na regs}$$

$$E_Y = 9 \times 10^9 \times \frac{(2,8 \times 10^{-16})}{(0,03)^2} \quad \checkmark$$

$$\vec{E}_B = 2,8 \times 10^{-3} \text{ N} \cdot \text{C}^{-1} \text{ to the right/na regs}$$

$$\vec{E}_{net} = \vec{E}_X + \vec{E}_Y$$

$$E_{net} = E_X + E_B$$

$$E_{net} = 28,8 \times 10^{-3} + 2,8 \times 10^{-3}$$

$$E_{net} = 31,6 \times 10^{-3} \text{ N} \cdot \text{C}^{-1}$$

$$\vec{E}_{net} = 31,60 \times 10^{-3} \text{ N} \cdot \text{C}^{-1} \text{ to the right/na regs}$$

$$F = qE \quad \checkmark$$

$$F = 1,5 \times 10^{-16} \times 31,60 \times 10^{-3} \quad \checkmark$$

$$F = 47,4 \times 10^{-19} \text{ N to the right/na regs} \quad \checkmark$$

OR/OF

$$F = 4,74 \times 10^{-18} \text{ N to the right/na regs} \quad \checkmark$$

OPTION 4/OPSIE 4

Positive to the left/ Positief na links

$$E = K \frac{Q}{r^2}$$

$$E_x = 9 \times 10^9 \times \frac{(3,2 \times 10^{-16})}{(0,01)^2} \quad \checkmark$$

$$E_A = 28,8 \times 10^{-3} \text{ N} \cdot \text{C}^{-1} \text{ to the right/na regs}$$

$$E_Y = 9 \times 10^9 \times \frac{(2,8 \times 10^{-16})}{(0,03)^2} \checkmark$$
$$\vec{E}_B = 2,8 \times 10^{-3} \text{ N} \cdot \text{C}^{-1} \text{ to the right/na regs}$$
$$\vec{E}_{\text{net}} = \vec{E}_X + \vec{E}_Y$$
$$E_{\text{net}} = -E_X - E_B$$
$$E_{\text{net}} = -28,8 \times 10^{-3} - 2,8 \times 10^{-3}$$
$$E_{\text{net}} = -31,60 \times 10^{-3} \text{ N} \cdot \text{C}^{-1}$$
$$\vec{E}_{\text{net}} = 31,60 \times 10^{-3} \text{ N} \cdot \text{C}^{-1} \text{ to the right/na regs}$$

$$F = qE \checkmark$$
$$F = 1,5 \times 10^{-16} \times 31,60 \times 10^{-3} \checkmark$$
$$F = 47,4 \times 10^{-19} \text{ N to the right/na regs} \checkmark$$

OR/OF

$$F = 4,74 \times 10^{-18} \text{ N to the right/na regs} \checkmark$$

Note/Aantekening: Do not penalise if vector notation is not used./Moenie (5)
penaliseer indien vektornotasie nie gebruik is nie.

[18]

QUESTION 8/VRAAG 8

8.1 Power is the rate at which work is done ✓✓

OR/OF

Power is the rate at which energy is supplied to the device.

(2 or/of 0)

(2)

8.2.1 OPTION 1/OPSIE 1

$$R_s = R_A + R_B$$

$$R_s = 8 + 8 \checkmark$$

$$R_s = 16 \Omega$$

$$R_p = \frac{R_s \times R_C}{R_s + R_C}$$

$$R_p = \frac{16 \times 8}{16 + 8} \checkmark$$

$$R_p = 5,333 \Omega$$

$$V = IR \checkmark$$

$$V = 2 \times 5,333 \checkmark$$

$$V = 10,67 \text{ V} \checkmark$$

OPTION 2/OPSIE 2

$$R_s = R_A + R_B$$

$$R_s = 8 + 8 \checkmark$$

$$R_s = 16 \Omega$$

$$R_p = \frac{R_{AB} \times R_C}{R_{AB} + R_C}$$

$$R_p = \frac{[(8+8) \times 8]}{[(8+8)+8]} \checkmark \text{ OR/OF } R_p = \frac{(16 \times 8)}{(16+8)} \checkmark$$

$$R_p = 5,333 \Omega$$

$$V = IR \checkmark$$

$$V = 2 \times 5,333 \checkmark$$

$$V = 10,67 \text{ V} \checkmark$$

OPTION 3/OPSIE 3

$$R_s = R_A + R_B$$

$$R_s = 8 + 8 \quad \checkmark$$

$$R_s = 16 \, \Omega$$

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R_p} = \frac{1}{16} + \frac{1}{8} \quad \checkmark$$

$$R_p = 5,333 \, \Omega$$

$$V = IR \quad \checkmark$$

$$V = 2 \times 5,333 \quad \checkmark$$

$$V = 10,67 \, V \quad \checkmark$$

(5)

8.2.2 **POSITIVE MARKING FROM 8.2.1/POSITIEWE NASIEN VANAF 8.2.1.**

OPTION 1/OPSIE 1

$$\left. \begin{aligned} \varepsilon &= V_{\text{ext}} + V_{\text{int}} \\ \varepsilon &= IR + Ir \end{aligned} \right\}$$

✓ Any one/Enige een

$$12 = 10,67 + 2r \quad \checkmark$$

$$r = 0,67 \, \Omega \quad \checkmark$$

OPTION 2/OPSIE 2

$$\left. \begin{aligned} V_{\text{int}} &= \varepsilon - V_{\text{ext}} \\ Ir &= \varepsilon - V_{\text{ext}} \end{aligned} \right\}$$

✓ Any one/Enige een

$$2r = 12 - 10,67 \quad \checkmark$$

$$r = 0,67 \, \Omega \quad \checkmark$$

OPTION 3/OPSIE 3

$$I = \frac{\varepsilon}{R+r} \quad \checkmark$$

$$2I = \frac{12}{5,33+r} \quad \checkmark$$

$$r = 0,67 \, \Omega \quad \checkmark$$

OPTION 4/OPSIE 4

$$I = \frac{\varepsilon}{R+r} \quad \checkmark$$

$$2 = \frac{12}{\left(\frac{(8+8) \times 8}{(8+8)+8}\right) + r} \quad \checkmark \text{ OR/OF } \quad 2 = \frac{12}{\left(\frac{(16 \times 8)}{(16+8)}\right) + r} \quad \checkmark$$

$$r = 0,67 \, \Omega \quad \checkmark$$

(3)

8.3 Bulbs **A** and **B** are connected in series across the battery, therefore they glow equally brightly, ✓ whereas bulb **C** is connected itself across the battery, then the voltage drop across **C** has the same magnitude as the terminal potential difference, ✓ whereas the same terminal potential difference splits between bulbs **A** and **B**, ✓ as a result, bulb **C** glows more brightly than either of bulb **A** and **B**. ✓

Gloeilampe A en B word in serie oor die battery gekoppel, daarom gloei hulle ewe helder, terwyl gloeilamp C self oor die battery gekoppel is, dan is die spanningsval oor C dieselfde grootte as die potensiaalverskil van die terminale, terwyl dieselfde potensiaalverskil dieselfde is verdeel tussen gloeilampe A en B, gevolglik gloei gloeilamp C helderder as een van gloeilamp A en B.

(4)

8.4 INCREASES/ VERHOOG ✓

- External resistance increases/total resistance increases./
Eksterne weerstand neem toe/total weerstand neem toe. ✓
- As emf is constant total current decreases./Aangesien emk konstant is, neem die totale stroom af. ✓
- Potential difference in the internal resistance (V_{internal}) decreases/
Potensiële verskil in die interne weerstand (V_{internal}) neem af ✓
- According to the equation; $V_{\text{ext}} = \epsilon - V_{\text{int}}$, terminal potential difference across the battery increases/Volgens die vergelyking; $V_{\text{ext}} = \epsilon - V_{\text{int}}$ word terminale potensiaalverskil oor die battery verhoog..

(4)

[18]

QUESTION 9/VRAAG 9

9.1 **A** is a Generator/**A** is 'n Generator ✓

It converts mechanical energy to electrical energy. Dit omskakel meganiese energie na elektriese energie. ✓

B is a DC motor/**B** is 'n GS-motor. ✓

It converts electrical energy to mechanical energy./ Dit omskakel elektriese energie na meganiese energie. ✓

(4)

9.2 DC generator./GS-generator. ✓

It has a split ring/commutator./ Dit het 'n spleetring/Kommutator. ✓

(2)

9.3 Electromagnetic induction./Elektromagnetiese induksie. ✓

(1)

9.4 S ✓

(1)

9.5 **OPTION 1/OPSIE 1**

$$V_{\text{rms}} = \frac{V_{\text{max}}}{\sqrt{2}} \checkmark$$

$$V_{\text{rms}} = \frac{311,13}{\sqrt{2}} \checkmark$$

$$V_{\text{rms}} = 220,00 \text{ V}$$

$$P_{\text{ave}} = \frac{V_{\text{rms}}^2}{R} \checkmark$$

$$P_{\text{ave}} = \frac{(220)^2}{40} \checkmark$$

$$P_{\text{ave}} = 1210,00 \text{ W} \checkmark$$

OPTION 2/OPSIE 2

$$I_{\text{max}} = \frac{V_{\text{max}}}{R} \checkmark$$

$$I_{\text{max}} = \frac{311,13}{40} \checkmark$$

$$I_{\text{max}} = 7,77825 \text{ A}$$

$$P_{\text{ave}} = \frac{V_{\text{max}} I_{\text{max}}}{2} \checkmark$$

$$P_{\text{ave}} = \frac{311,13 \times 7,77825}{2} \checkmark$$

$$P_{\text{ave}} = 1210,02 \text{ W} \checkmark$$

(5)

[13]

QUESTION 10/VRAAG 10

10.1 NOTE: -1 Mark for each key word /phrase omitted in the correct context.
LET WEL: - 1 punt vir elke sleutelwoord/frase weggelaat in die korrekte konteks.

The work function of a metal is the minimum energy that an electron in the metal needs to be emitted from the metal surface. ✓✓
Die werkfunksie van 'n metaal is die minimum energie benodig om 'n elektron uit die oppervlak van 'n metaal vry te stel. (2)

10.2 **OPTION 1/OPSIE 1**

$$W_o = h \frac{c}{\lambda_o} \checkmark$$

$$3,648 \times 10^{-19} = (6,63 \times 10^{-34}) \frac{(3 \times 10^8)}{\lambda_o} \checkmark$$

$$\lambda_o = 5,45 \times 10^{-7} \text{ m} \checkmark$$

OPTION 2/OPSIE 2

$$W_o = hf_o \checkmark$$

$$3,648 \times 10^{-19} = (6,63 \times 10^{-34}) f_o$$

$$f_o = 5,50 \times 10^{14} \text{ Hz}$$

$$c = \lambda_o f_o$$

$$3 \times 10^8 = \lambda_o (5,50 \times 10^{14}) \checkmark$$

$$\lambda_o = 5,45 \times 10^{-7} \text{ m} \checkmark$$

(3)

10.3 $E = W_o + E_{K(max)}$
 $hf = W_o + \frac{1}{2} mv_{max}^2$ } Any one/Enige een ✓

$$(6,63 \times 10^{-34})(6,2 \times 10^{14}) \checkmark = 3,648 \times 10^{-19} + \frac{1}{2} (9,11 \times 10^{-31}) v_{max}^2 \checkmark$$

(4)

$$v = 3,18 \times 10^5 \text{ m} \cdot \text{s}^{-1} \checkmark$$

10.4 **B** ✓

As the intensity of light increases the *number* of photons per second increase. ✓
Soos die intensiteit van lig toeneem, neem die aantal fotone per sekonde toe.
Since each photon releases one electron, the number of ejected electrons per second increases. ✓
Aangesien elke foton een elektron vrystel, neem die aantal vrygestelde elektrone per sekonde toe.
This causes the current /ammeter reading to increase.
Dit veroorsaak dat die stroom/ammeterlesing toeneem. (3)

(3)

10.5 Equal to. ✓

(1)

[13]

TOTAL/TOTAAL: 150