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**NATIONAL  
SENIOR CERTIFICATE /  
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**GRADE / GRAAD 12**

**JUNE / JUNIE 2022**

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

**MARKS/ PUNTE: 150**

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This marking guideline consists of 14 pages./  
*Hierdie nasienriglyn bestaan uit 14 bladsye.*

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**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 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.*

- 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 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,  $m \cdot s^{-1}$ .

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 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 multistep 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 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/VRAAG 1**

- 1.1 C ✓✓ (2)
- 1.2 C ✓✓ (2)
- 1.3 B ✓✓ (2)
- 1.4 D ✓✓ (2)
- 1.5 A ✓✓ (2)
- 1.6 C ✓✓ (2)
- 1.7 B ✓✓ (2)
- 1.8 A ✓✓ (2)
- 1.9 C ✓✓ (2)
- 1.10 A ✓✓ (2)

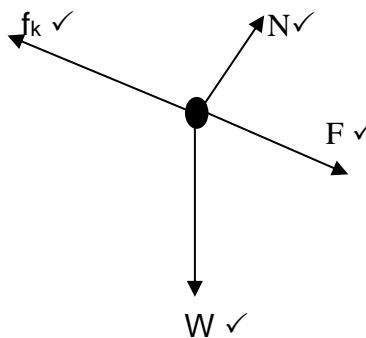
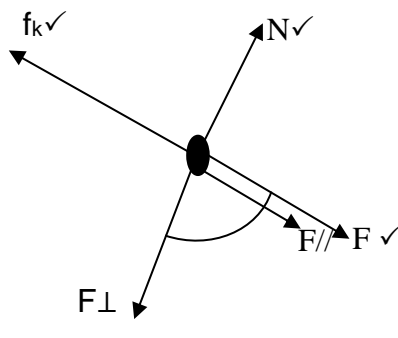
**[20]**

**QUESTION/VRAAG 2**

2.1 When a resultant/net force acts on an object, it accelerates in the direction of the force. The acceleration is directly proportional to the force ✓ and inversely proportional to the mass of the object. ✓

*Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, versnel dit in die rigting van die krag. Die versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.* (2)

2.2

OPTION 1 / OPSIE 1	OPTION 2 / OPSIE 2
	 <p>F<sub>⊥</sub> and / en F<sub>//</sub> ✓</p>

Mark awarded for arrow and label / Punt vir beide pyl en byskrif toegeken. Do not penalise for length of arrows since drawing is not drawn to scale *Moenie vir die lengte van die pyltjie penaliseer nie aangesien skets nie na skaal geteken is nie*

Any other additional force(s) / Enige ander addisionele kragte <sup>3</sup>/<sub>4</sub>

If force(s) do not make contact with body. Max. <sup>3</sup>/<sub>4</sub>

Indien krag(te) nie met die voorwerp kontak maak nie. Maks. <sup>3</sup>/<sub>4</sub>

(4)

- 2.3 The force that opposes the motion of an object and acts parallel to the surface. ✓✓

*Die krag wat die beweging van 'n voorwerp teenstaan en parallel met die oppervlak inwerk.*

(2)

- 2.4.1 **OPTION 1 (Upwards on the plane is positive) / OPSIE 1 (Teen die skuinsvlak op as positief)**

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ F_{\text{net}} = 0 \text{ N} \\ f_k - F_R - F_{\parallel} = 0 \\ f_k - F_R - mg \sin \theta = 0 \end{array} \right\} \text{Any one/ Enige een } \checkmark$$

$$\left[ f_k - 240 - \frac{(50)(9,8)\sin 12^\circ}{\checkmark} \right] \checkmark = 0$$

$$f_k = 341,88 \text{ N } \checkmark$$

(4)

- 2.4.2 **Positive marking from QUESTION 2.3 / Positiewe nasien vanaf VRAAG 2.3**

**Marking criteria / Nasienkriteria**

$$\left. \begin{array}{l} \mu_k = \frac{f_k}{N} \\ \mu_k = \frac{f_k}{mg \cos \theta} \end{array} \right\} \text{Any one/ Enige een } \checkmark$$

$$\mu_k = \left[ \frac{341,88}{(50 \times 9,8) \cos 12^\circ} \right] \checkmark$$

$$\mu_k = \frac{341,88}{479,29}$$

$$\mu_k = 0,71 \checkmark$$

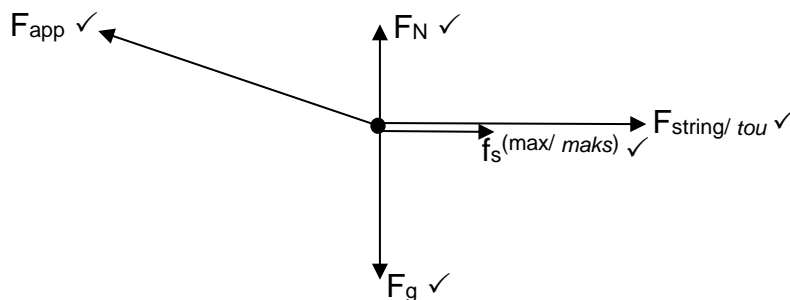
(4)  
[16]

### QUESTION/VRAAG 3

- 3.1 Maximum static force of friction. ✓  
*Maksimum statiese wrywingskrag.*

(1)

- 3.2



Mark awarded for arrow and label / *Punt vir beide pyl en byskrif.*

Do not penalise for length of arrows since drawing is not drawn to scale.  
*Moenie vir die lengte van die pyltjie penaliseer nie aangesien nie na skaal geteken nie*

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

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

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

(5)

3.3.1 **OPTION 1 / OPSIE 1**

$$\left. \begin{aligned} F_{\text{net}} &= ma \\ F_T - mg &= ma \\ F_x - F_T - f_s^{(\text{max})} &= ma \end{aligned} \right\} \text{Any one / Enige een } \checkmark$$

$$\underline{F_T - (5)(9,8) = 0} \checkmark$$

$$= 49 \text{ N}$$

$$F_x = F_{\text{app}} \cos 30^\circ$$

$$= \underline{65 \cos 30^\circ} \checkmark$$

$$= 56,29 \text{ N}$$

$$\underline{56,29 - 49 - f_s^{(\text{max})} = 0} \checkmark$$

$$f_s^{(\text{max})} = 7,29 \text{ N } \checkmark$$

**OPTION 2/OPSIE 2**

$$\left. \begin{aligned} F_{\text{net}} &= ma \\ F_T - mg &= ma \\ F_x - F_T - f_s^{(\text{max})} &= ma \end{aligned} \right\} \text{Any one/ Enige een } \checkmark$$

$$[\underline{65 \cos 30^\circ} \checkmark - \underline{(5)(9,8)} \checkmark - f_s^{(\text{max})} = 0] \checkmark$$

$$56,29 - 49 - f_s^{(\text{max})} = 0$$

$$f_s^{(\text{max})} = 7,29 \text{ N } \checkmark$$

(5)

3.3.2 **Vertical forces on metal box are in equilibrium / Vertikale kragte op metaalhouer is in ewewig:**

$$\left. \begin{aligned} F_g - F_v - F_N &= 0 \\ mg = F_{\text{app}} \sin 30^\circ - F_N \end{aligned} \right\} \text{Any one / Enige een } \checkmark$$

$$mg = [\underline{65 \sin 30^\circ} \checkmark - 36,1] \checkmark$$

$$m \times 9,8 = 68,6$$

$$m = 7 \text{ kg } \checkmark$$

(4)

**[15]****QUESTION 4 / VRAAG 4**

- 4.1 There exists a force of attraction between any two masses in the universe. This force is directly proportional to the product of the masses  $\checkmark$  and inversely proportional to the square of the distance between their centres.  $\checkmark$

*Daar bestaan 'n aantrekkingskrag tussen enige twee massas in die heelal. Die krag is direk eweredig aan die produk van die massas en omgekeerd eweredig aan die kwadraat van die afstand tussen hul middelpunte.*

(2)

4.2  $F = \frac{Gm_1m_2}{d^2} \checkmark$

$$= \frac{(6,67 \times 10^{-11})(1,2 \times 10^{18})(3 \times 10^{18})}{(2 \times 10^{10})^2} \checkmark \checkmark$$

$$= 6,0 \times 10^6 \text{ N } \checkmark$$

(5)

- 4.3 LESS THAN  $\checkmark$   
Mass of planet P < Mass of planet Q  $\checkmark$   
 $g \propto \text{Mass}$

**KLEINER AS**

*Massa van planeet P < Massa van planeet Q*  
 $g \propto \text{Massa}$

(2)

**[9]**



**QUESTION/VRAAG 5**

- 5.1 Motion of an object upon which the only force acting on it is gravitational force. ✓✓

*Die beweging waartydens die enigste krag wat op 'n voorwerp inwerk, die gravitasiekrag is.* (2)

5.2.1	<b>UPWARDS IS POSITIVE / OPWAARTS AS POSITIEF</b>	<b>DOWNWARDS IS POSITIVE / AFWAARTS AS POSITIEF</b>
	$v_f = v_i + g\Delta t$ ✓ $0 = 20$ ✓ + $(-9,8)\Delta t$ ✓ $\Delta t = 2,04$ s ✓	$v_f = v_i + g\Delta t$ ✓ $0 = -20$ ✓ + $9,8\Delta t$ ✓ $\Delta t = 2,04$ s ✓

5.2.2	<b>OPTION 1 / OPSIE 1</b>	
	<b>Positive marking from QUESTION 5.2.1 / Positiewe nasien vanaf VRAAG 5.2.1</b>	
	<b>UPWARDS IS POSITIVE/ OPWAARTS AS POSITIEF</b>	<b>DOWNWARDS IS POSITIVE / AFWAARTS AS POSITIEF</b>
	Total time / <i>Totale tyd</i> = $2,04 + 1,66$ ✓ = $3,7$ s $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$ ✓ $\Delta y = (20)(3,7)$ ✓ + $\frac{1}{2}(-9,8)(3,7^2)$ ✓ $\Delta y = 6,92$ m ✓	Total time/ <i>Totale tyd</i> = $2,04 + 1,66$ ✓ = $3,7$ s $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$ ✓ $\Delta y = (-20)(3,7)$ ✓ + $\frac{1}{2}(9,8)(3,7^2)$ ✓ $\Delta y = -6,919$ m $\Delta y = 6,92$ m ✓ (If answer left as negative, then loses last mark) (As antwoord as negatief gelaat word, verloor dan laaste punt)

	<b>OPTION 2 / OPSIE 2</b>	
	<b>Positive marking from QUESTION 5.2.1 / Positiewe nasien vanaf VRAAG 5.2.1</b>	
	<b>UPWARDS IS POSITIVE/ OPWAARTS AS POSITIEF</b>	<b>DOWNWARDS IS POSITIVE / AFWAARTS AS POSITIEF</b>
	Time taken from B to ground <i>Tyd geneem van B na grond</i> $\Delta t = 2,04 - 1,66$ ✓ = $0,38$ s $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$ ✓ $\Delta y = (20)(0,38)$ ✓ + $\frac{1}{2}(-9,8)(0,38^2)$ ✓ $\Delta y = 6,89$ m ✓	Time taken from B to the ground <i>Tyd geneem van B na grond</i> $\Delta t = 2,04 - 1,66$ ✓ = $0,38$ s $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$ ✓ $\Delta y = (-20)(0,38)$ ✓ + $\frac{1}{2}(9,8)(0,38^2)$ ✓ $= -6,89$ m Height / <i>Hoogte</i> = $6,89$ m above the ground / <i>bo die grond</i> ✓

<b>OPTION 3 / OPSIE 3</b>	<b>OPTION 3 / OPSIE 3</b>
<b>Positive marking from QUESTION 5.2.1 / Positiewe nasien vanaf VRAAG 5.2.1</b>	
<b>UPWARDS IS POSITIVE / OPWAARTS AS POSITIEF</b>	<b>DOWNWARDS IS POSITIVE / AFWAARTS AS POSITIEF</b>
Calculate the maximum height:  <i>Bereken die maksimum hoogte:</i>  $v_f^2 = v_i^2 + 2g\Delta x$ $0^2 = 20^2 + 2(-9,8)\Delta x$ ✓ $\Delta x = 20,41$ m  Ball falls for 1,66 m / <i>Bal val vir 1,66 m</i> $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$ $\Delta y = (0)(1,66) + \frac{1}{2}(-9,8)(1,66^2)$ ✓ $\Delta y = -13,05$ m  Height of the balcony / <i>Hoogte van die balkon = 20,41 - 13,51</i> ✓  Height of the balcony / <i>Hoogte van die balkon = 6,91 m</i> ✓	Calculate the maximum height:  <i>Bereken die maksimum hoogte:</i>  $v_f^2 = v_i^2 + 2g\Delta x$ $0^2 = (-20)^2 + 2(9,8)\Delta x$ ✓ $\Delta x = 20,41$ m  Ball falls for 1,66 m / <i>Bal val vir 1,66 m</i> $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$ $\Delta y = (0)(1,66) + \frac{1}{2}(9,8)(1,66^2)$ ✓ $\Delta y = 13,05$ m  Height of the balcony / <i>Hoogte van die balkon = 20,41 - 13,51</i> ✓  Height of the balcony / <i>Hoogte van die balkon = 6,91 m</i> ✓

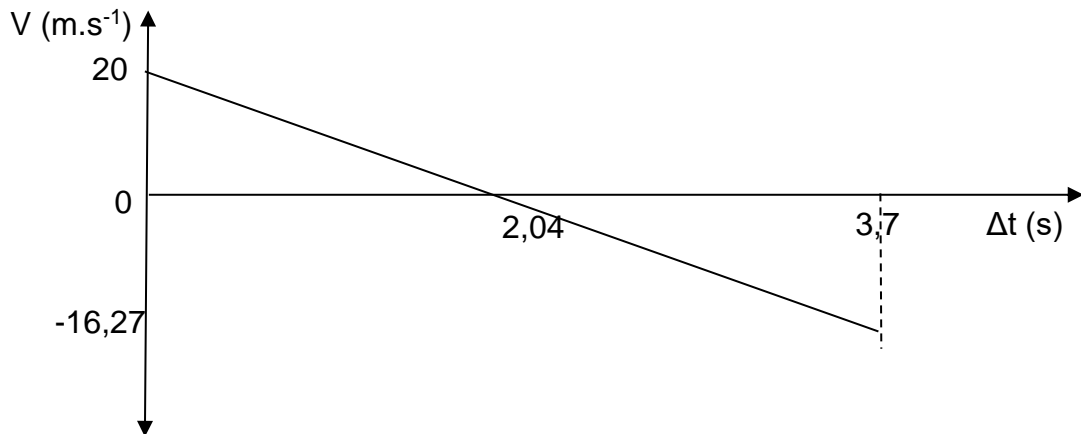
(5)

5.2.3

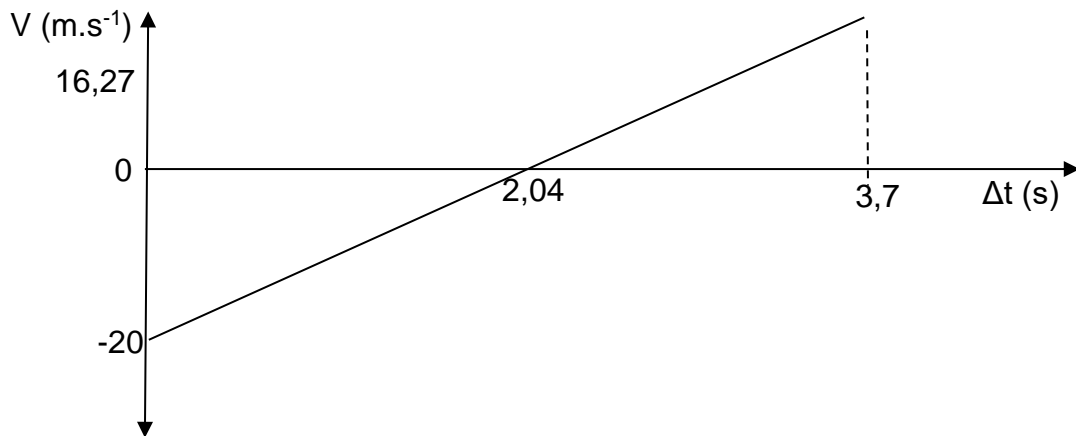
<b>OPTION 1 / OPSIE 1</b>	
<b>Positive marking from QUESTION 5.2.1 / Positiewe nasien vanaf VRAAG 5.2.1</b>	
<b>UPWARDS IS POSITIVE / OPWAARTS AS POSITIEF</b>	<b>DOWNWARDS IS POSITIVE / AFWAARTS AS POSITIEF</b>
$v_f = v_i + g\Delta t$ ✓ $v_f = 0 + (-9,8)(1,66)$ ✓ $v_f = 16,27 \text{ m}\cdot\text{s}^{-1}$ ✓	$v_f = v_i + g\Delta t$ ✓ $v_f = 0 + 9,8(1,66)$ ✓ $v_f = 16,27 \text{ m}\cdot\text{s}^{-1}$ ✓
<b>OPTION 2 / OPSIE 2</b>	
<b>Positive marking from QUESTION 5.2.1 / Positiewe nasien vanaf VRAAG 5.2.1</b>	
<b>UPWARDS IS POSITIVE / OPWAARTS AS POSITIEF</b>	<b>DOWNWARDS IS POSITIVE / AFWAARTS AS POSITIEF</b>
$v_f = v_i + g\Delta t$ ✓ $v_f = 20 + (-9,8)(3,7)$ ✓ $v_f = -16,26$ $v_f = 16,26 \text{ m}\cdot\text{s}^{-1}$ ✓	$v_f = v_i + g\Delta t$ ✓ $v_f = -20 + 9,8(3,7)$ ✓ $v_f = 16,26 \text{ m}\cdot\text{s}^{-1}$ ✓

(3)

- 5.3 Positive marking from QUESTION 5.2.3 / *Positief nasien vanaf VRAAG 5.2.3*  
UPWARDS IS POSITIVE / OPWAARTS AS POSITIEF



DOWNWARDS IS POSITIVE / AFWAARTS AS POSITIEF



Marking criteria / <i>Nasienkriteria</i>	
Shape / <i>Vorm</i>	✓
Initial velocity / <i>Begin snelheid</i>	✓
Time at maximum height / <i>Tyd by maksimum hoogte</i>	✓
Velocity when man catches the ball / <i>Snelheid wanneer man bal vang</i>	✓
Time when man catches the ball / <i>Tyd wanneer man bal vang</i>	✓

(5)  
[19]

**QUESTION/VRAAG 6**

- 6.1 The momentum of an object is the product of its mass and velocity. ✓✓  
(2 or 0)

*Die momentum van 'n voorwerp is die produk van sy massa en snelheid.*  
(2 of 0)

(2)

- 6.2.1  $p = mv$  ✓  
 $p = 3200 \times 18$  ✓  
 $p = 56\,700 \text{ kg}\cdot\text{m}\cdot\text{s}^{-1}$  ✓

(3)

- 6.2.2  $\Sigma p_i = \Sigma p_f$  } Any one/Enige een ✓  
 $p_{Ti} + p_{Ci} = p_{Tf} + p_{Cf}$  }  
 $57600 + (12 \times 1800)$  ✓ =  $(10 \times 3200) + 1800 v_{Cf}$  ✓  
 $v_{Cf} = 26,22 \text{ m}\cdot\text{s}^{-1}$  ✓ to the right / regs (or any indication of direction / of enige aanduiding van rigting) ✓

(5)

- 6.3 Inelastic. ✓ (Only momentum is conserved) Kinetic energy is not conserved. ✓✓  
*Onelasties (Slegs momentum word behoue) Kinetiese energie is nie behoue nie.*

(3)

- 6.4 Airbags/seatbelts/Crumble zones (Any two ✓✓)  
Accept headrests

*Lugsakke/veiligheidsgordel/frommelsone (Enige twee)*  
*Aanvaar hoofstutte*

(2)

**[15]****QUESTION/VRAAG 7**

7.1	<b>UPWARDS IS POSITIVE/ OPWAARTS AS POSITIEF</b>	<b>DOWNWARDS IS POSITIVE / AFWAARTS AS POSITIEF</b>
	$v_f = v_i + g\Delta t$ ✓ $v_f = 0 + -9,8(0,35)$ ✓ $v_f = -3,43 \text{ m}\cdot\text{s}^{-1}$ $v_f = 3,43 \text{ m}\cdot\text{s}^{-1}$ ✓ downwards/afwaarts ✓	$v_f = v_i + g\Delta t$ ✓ $v_f = 0 + -9,8(0,35)$ ✓ $v_f = 3,43 \text{ m}\cdot\text{s}^{-1}$ ✓ downwards/afwaarts ✓

(4)

- 7.2 Impulse is the product of the net force acting on an object and the time for which the net force acts on the object. ✓✓

*Impuls is die produk van die netto krag wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk.*

(2)

**Positive marking from QUESTION 7.1 / Positiewe nasien vanaf VRAAG 7.1**

- 7.3  $F_{\text{net}}\cdot\Delta t = \Delta p$  } Any one / Enige een ✓  
 $F_{\text{net}}\cdot\Delta t = mv_f - mv_i$  }  
 $F_{\text{net}} \times 0,69$  ✓ =  $45 \times 0 - 45 \times 3,43$  ✓  
 $F_{\text{net}} = 223,7 \text{ N}$  ✓ Upwards / Opwaarts ✓

(5)

$$7.4 \quad F_{\text{net}} = \frac{m\Delta v}{\Delta t}$$

$\Delta v$  remains the same. ✓

If the knees are not bent, the time to come to rest is very small ( $\Delta t$  decreases) ✓

$F_{\text{net}}$  increases and can cause injury. ✓

$$F_{\text{net}} = \frac{m\Delta v}{\Delta t}$$

$\Delta v$  bly dieselfde

As die knieë nie gebuig is nie, is die tyd om tot rus te kom baie klein

( $\Delta t$  verminder)

$F_{\text{netto}}$  verhoog en kan beserings veroorsaak.

(3)

**[14]****QUESTION/VRAAG 8**

- 8.1 In an isolated system, the total mechanical energy remains constant. ✓✓  
*In 'n geïsoleerde sisteem bly die totale meganiese energie konstant.* (2)

- 8.2  $E_{\text{mec(B)}} = E_{\text{mec(C)}}$   
 $(E_p + E_k)_B = (E_p + E_k)_C$   
 $(mgh + \frac{1}{2}mv^2)_B = (mgh + \frac{1}{2}mv^2)_C$  } Any one / Enige een ✓  
 $(540)(9,8)(0) + \frac{1}{2}(540)v_B^2 \checkmark = (540)(9,8)(4,5 \sin 7,5^\circ) \checkmark + \frac{1}{2}(540)(0^2)$   
 $v_B = 3,39 \text{ m}\cdot\text{s}^{-1} \checkmark$  (4)

- 8.3  $f_k = \mu_k N \checkmark$   
 $f_k = (0,8) \times (540)(9,8) \checkmark$   
 $f_k = 4233,6 \text{ N} \checkmark$  (3)

- 8.4 The net work done on an object is equal to the change in kinetic energy of the object. ✓✓

*Die netto werk verrig op 'n voorwerp is gelyk aan die verandering in kinetiese energie van die voorwerp.* (2)

- 8.5.1 **Positive marking from QUESTION 8.2 / Positiewe nasien van VRAAG 8.2.**  
**OPTION 1 / OPSIE 1**

$$W_{\text{net}} = \Delta E_k \quad \left. \begin{array}{l} \\ W_f = \frac{1}{2}m(v_f^2 - v_i^2) \end{array} \right\} \text{Any one / Enige een } \checkmark$$

$$W_f = \frac{1}{2} \times 540 (3,39)^2 \checkmark - \frac{1}{2} \times 540 (12^2) \checkmark$$

$$W_f = -35\,777,13 \text{ J} \checkmark$$

**OPTION 2 / OPSIE 2**

$$W_{\text{nc}} = \Delta E_k + \Delta E_p \quad \left. \begin{array}{l} \\ W_f = \frac{1}{2}m(v_f^2 - v_i^2) + 0 \end{array} \right\} \text{Any one / Enige een } \checkmark$$

$$W_f = \frac{1}{2} \times 540 \times 3,39^2 \checkmark - \frac{1}{2} \times 540 \times 12^2 \checkmark$$

$$W_f = -35\,777,13 \text{ J} \checkmark$$
 (4)

- 8.5.2 **Positive marking from QUESTION 8.3 and 8.5.1**  
**Positiewe nasien vanaf VRAAG 8.3 en 8.5.1**

$$W_f = F_f \cdot \Delta x \cdot \cos \theta \checkmark$$

$$-35777,13 \checkmark = (4233,6) \cdot \Delta x \cdot \cos 180^\circ \checkmark$$

$$\Delta x = 8,45 \text{ m} \checkmark$$

(4)

**[19]**

**QUESTION/VRAAG 9**

- 9.1 The change in frequency or pitch detected by a listener because the listener and the sound source have different velocity relative to the medium of sound propagation. ✓✓

*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.* (2)

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

$$875 \checkmark = \frac{(340 + 0)}{(340 - v_s)} \cdot 680 \checkmark$$

$$v_s = 75,77 \text{ m}\cdot\text{s}^{-1}$$

$$v_s = 75,77 \times 3,6 \checkmark$$

$$v_s = 272,77 \text{ km}\cdot\text{h}^{-1} \checkmark$$

(6)

- 9.3 Decreases ✓

As it moves away, wavelength increases ✓ but velocity remains constant. ✓  
Frequency decreases.

*Afneem*

*Soos dit wegbeweeg, verleng die golflengte maar die snelheid bly konstant.  
Frekwensie neem af.* (3)

- 9.4 Measuring foetal heartbeat ✓  
Monitoring and measuring of blood flow ✓

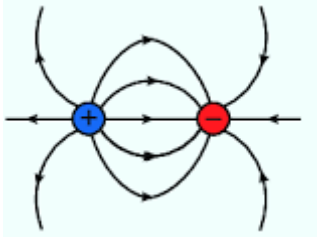
*Meet fetus se hartklop*

*Monitering en meting van bloedvloe.* (2)

**[13]**

## QUESTION/VRAAG 10

10.1

**Marking criteria / Nasienkriteria**

Direction / Rigting ✓

Shape / Vorm ✓

Lines all touching charges and not crossing / Lyne raak aan ladings en kruis nie ✓

(3)

$$10.2 \quad F = \frac{kQ_1Q_2}{r^2} \quad \checkmark$$

$$F = \frac{(9 \times 10^9)(4 \times 10^{-6})(4 \times 10^{-6})}{(0,75)^2} \quad \checkmark$$

$$F = 0,256 \text{ N right / regs} \quad \checkmark$$

(4)

$$10.2 \quad Q_e = nq_e \quad \checkmark$$

$$4 \times 10^{-6} = n \times (1,6 \times 10^{-19}) \quad \checkmark$$

$$n = 2,5 \times 10^{13} \text{ protons / protone} \quad \checkmark$$

(3)

**[10]****TOTAL/ TOTAAL: 150**