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DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

NATIONAL SENIOR CERTIFICATE EXAM

PHYSICAL SCIENCES: PHYSICS (P1)

GRADE 12

SEPTEMBER 2014

MEMORANDUM

MARKS: 150

TIME: 3 HOURS

GENERAL GUIDELINES**1. CALCULATIONS**

- 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 **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 had been attempted**. i.e. substitutions have been made or a numerical answer given.
Punte word slegs vir 'n formule toegeken indien 'n **poging tot 'n berekening aangewend is**, d.w.s. substitusies is gedoen of 'n numeriese antwoord is gegee.
- 1.8 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 genoem 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 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 tot 'n berekening korrek is, sal volpunte nie outomaties toegeken word nie. Nasieners sal altyd verseker dat die korrekte/toepaslike formule gebruik word en dat bewerkings, 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 berekenings gedoen moet word (bv. 'n stroomdiagramvraag) hoef nie noodwendig dieselfde volgorde te hê nie. VOLPUNTE sal toegeken word op voorwaarde dat dit 'n geldige oplossing vir die probleem is. Enige berekening wat egter nie die kandidaat nader 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 or subquestion**.
'n Kandidaat sal slegs een keer gepeenaliseer word vir die herhaaldelike gebruik van 'n verkeerde eenheid **in 'n vraag of subvraag**.
- 2.2 Units are only required in the final answer to a calculation.
Eenhede word slegs in die finale antwoord tot '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. Kandidaat 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, $\text{m}\cdot\text{s}^{-1}$. For marking purposes $\text{m}\cdot\text{s}^{-1}$ and m/s will also be accepted.
Skei saamgestelde eenhede met 'n vermenigvuldigpunt en nie met 'n punt nie, byvoorbeeld, $\text{m}\cdot\text{s}^{-1}$. Vir nasiendoeleindes sal $\text{m}\cdot\text{s}^{-1}$ 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 **Subquestion to subquestion:** When a certain variable is calculated in one subquestion (e.g. 3.1) and needs to be substituted in another (3.2 or 3.3), e.g. if the answer for 3.1 is incorrect and is substituted correctly in 3.2 or 3.3, **full marks** are to be awarded for the subsequent subquestions.
Subvraag na subvraag: Wanneer 'n sekere veranderlike in een subvraag (bv. 3.1) bereken word en dan in 'n ander vervang moet word (3.2 of 3.3), bv. indien die antwoord vir 3.1 verkeerd is en korrek in 3.2 of 3.3 vervang word, word **volpunte** aan die daaropvolgende subvraag toegeken.
- 4.2 **A multistep question in a subquestion:** If the candidate has to calculate, for example, current in the first step and gets it wrong due to a substitution error, the mark for the substitution and the final answer will be forfeited.
'n Vraag met veelvuldige stappe in 'n subvraag: Indien 'n kandidaat byvoorbeeld, die stroom verkeerd bereken in 'n eerste stap as gevolg van 'n substitusiefout, verbeur 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 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.

SECTION A**QUESTION 1 / VRAAG 1**

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

[20]**TOTAL SECTION A/TOTAAL AFDELING A: 20****SECTION B/AFDELING B****QUESTION 2 / VRAAG 2**

$$\begin{aligned}
 2.1 \quad F_x &= F \cdot \cos \Theta \\
 &= 8,25 \cos 20^\circ \checkmark \\
 &= 7,75 \text{ N } \checkmark
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 2.2 \quad F_N + F_y + F_g &= 0 \\
 F_N + (8,25 \times \sin 20^\circ) \checkmark + (-19,6) \checkmark &= 0 \\
 F_N &= 16,78 \text{ N } \checkmark
 \end{aligned}
 \tag{3}$$

$$\begin{aligned}
 2.3 \quad &\text{POSITIVE MARKING FROM QUESTION 2.1 + 2.2} \\
 f &= \mu_k \cdot F_N \checkmark \\
 7,75 \checkmark &= \mu_k (16,78 + 1,5 \times 9,8) \checkmark \\
 \mu_k &= 0,25 \checkmark
 \end{aligned}
 \tag{4}$$

$$2.4 \quad \text{Increases } \checkmark / \text{Toeneem}
 \tag{1}$$

[10]

QUESTION 3 / VRAAG 33.1 $9,8 \text{ m}\cdot\text{s}^{-2}$ ✓ downwards ✓ / afwaarts

(2)

3.2

OPTION 1**upwards positive:**

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \quad \checkmark$$

$$21 \checkmark = v_i(3,1) + \frac{1}{2}(-9,8)(3,1)^2 \quad \checkmark$$

$$v_i = 21,96 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

downwards positive

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \quad \checkmark$$

$$-21 \checkmark = v_i(3,1) + \frac{1}{2}(9,8)(3,1)^2 \quad \checkmark$$

$$v_i = -21,96 \text{ m}\cdot\text{s}^{-1}$$

$$v_i = 21,96 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

Notes:

Accept / Aanvaar:

g or/of a

$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

(4)

3.3 POSITIVE MARKING FROM 3.2

OPTION 1/OPSIE 1**Upwards as positive**

$$v_f^2 = v_i^2 + 2a\Delta y \quad \checkmark$$

$$0^2 = 21,96^2 + 2(-9,8)\Delta y \quad \checkmark$$

$$\Delta y = 24,6 \text{ m}$$

$$\text{Max height} = 24,6 + 0,6 \checkmark = 25,2 \text{ m} \quad \checkmark$$

(4)

Downwards as positive

$$v_f^2 = v_i^2 + 2a\Delta y \quad \checkmark$$

$$0^2 = (-21,96)^2 + 2(9,8)\Delta y \quad \checkmark$$

$$\Delta y = -24,6 \text{ m}$$

$$\text{Max height} = 24,6 + 0,6 \checkmark = 25,2 \text{ m} \quad \checkmark$$

(4)

OPTION 2/OPSIE 2

$$(E_p + E_k)_{\text{bottom}} = (E_p + E_k)_{\text{top}} \quad \checkmark$$

$$(mgh + \frac{1}{2}mv^2)_{\text{bottom}} = (mgh + \frac{1}{2}mv^2)_{\text{top}} \quad \checkmark$$

$$0 + \frac{1}{2}(21,96)^2 = 9,8h + 0^2 \quad \checkmark$$

$$h = 24,6 \text{ m}$$

$$\text{Max height above the ground} = 24,6 + 0,6 \checkmark = 25,2 \text{ m} \quad \checkmark$$

(4)

OPTION 3/OPSIE 3**Upwards as positive**

$$v_f = v_i + a\Delta t$$

$$0 = 21,96 + (-9,8)\Delta t$$

$$\Delta t = 2,24 \text{ s}$$

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$$

$$= \frac{(21,96)(2,24)}{2} + \frac{1}{2}(-9,8)(2,24)^2$$

$$\Delta y = 24,6 \text{ m}$$

$$\text{Max height} = 24,6 + 0,6 = 25,2 \text{ m}$$

(4)

Downwards as positive

$$v_f = v_i + a\Delta t$$

$$0 = (-21,96) + (9,8)\Delta t$$

$$\Delta t = 2,24 \text{ s}$$

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$$

$$= \frac{(-21,96)(2,24)}{2} + \frac{1}{2}(9,8)(2,24)^2$$

$$\Delta y = -24,6 \text{ m}$$

$$\text{Max height} = 24,6 + 0,6 = 25,2 \text{ m}$$

(4)

OPTION 4/OPSIE 4**Upwards as positive**

$$v_f = v_i + a\Delta t$$

$$0 = (21,96) + (-9,8)\Delta t$$

$$\Delta t = 2,24 \text{ s}$$

$$\Delta y = \frac{v_f + v_i}{2}\Delta t$$

$$= \frac{0 + (21,96)}{2}(2,24)$$

$$\Delta y = 24,6 \text{ m}$$

$$\text{Max height} = 24,6 + 0,6 = 25,2 \text{ m}$$

(4)

Downwards as positive

$$v_f = v_i + a\Delta t$$

$$0 = (-21,96) + (9,8)\Delta t$$

$$\Delta t = 2,24 \text{ s}$$

$$\Delta y = \frac{v_f + v_i}{2}\Delta t$$

$$= \frac{0 + (-21,96)}{2}(2,24)$$

$$\Delta y = -24,6 \text{ m}$$

$$\text{Max height} = 24,6 + 0,6 = 25,2 \text{ m}$$

(4)

Notes/Aantekeninge:

Accept/Aanvaar:

g or/of a

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$$

Notes/Aantekeninge:

Accept/Aanvaar:

g or/of a

$$v = u + at$$

$$s = \frac{v+u}{2}t$$

$$\Delta x = \frac{v_f + v_i}{2}\Delta t$$

- 3.4 Inelastic✓, the ball bounces lower as the max height before the bounce ✓
Onelasties, die bal hop laer as die maksimum hoogte voor die bons

(2)

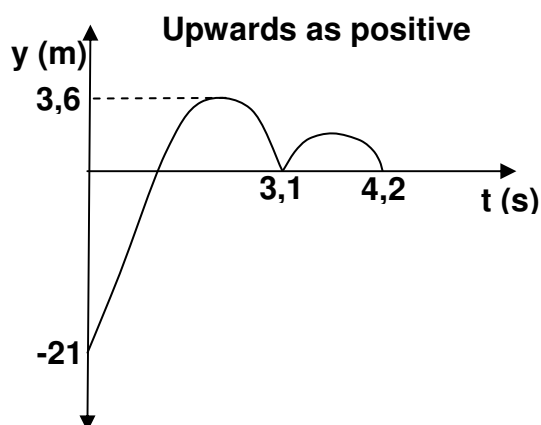
OR/OF

Inelastic✓, Max height before bounce > max height after bounce ✓

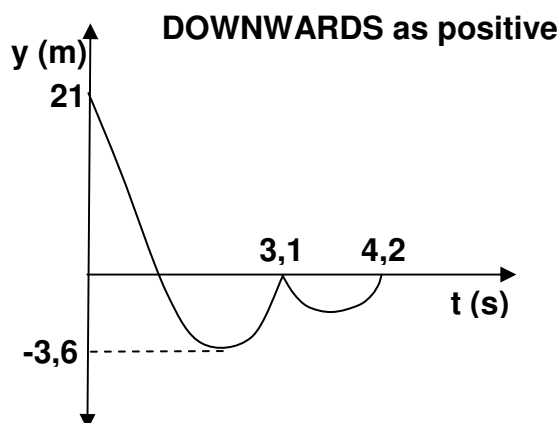
Onelasties Maksimum hoogte voor bons > maksimum hoogte na bons

(2)

- 3.5 POSITIVE MARKING FROM QUESTION 3.3

OPTION 1/OPSIE 1

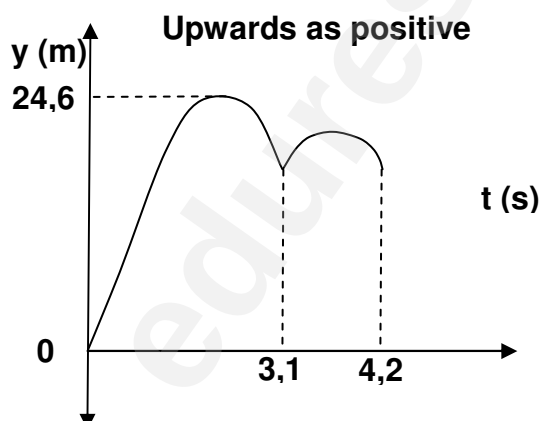
Marking criteria for graph: Nasienriglyne vir grafiek:	
Graph starts at -21 m at t = 0 s Grafiek begin by -21 m by t = 0 s	✓
Correct shape as shown up to t = 3,1 s	✓
Maximum height = 3,6 m [(Answer of h in Q3.3) -21]	✓
Time of bounce as t = 3,1 s	✓
Correct shape for second part from t = 3,1 s to t = 4,2 s	✓



Marking criteria for graph: Nasienriglyne vir grafiek:	
Graph starts at 21 m at $t = 0$ s Grafiek begin by 21 m by $t = 0$ s	✓
Correct shape as shown up to $t = 3,1$ s	✓
Maximum height = $-3,6$ m [(Answer of Δy in Q3.3) +21]	✓
Time of bounce as $t = 3,1$ s	✓
Correct shape for second part from $t = 3,1$ s to $t = 4,2$ s	✓

NOTES/AANTEKENINGE:**OTHER POSSIBILITIES**

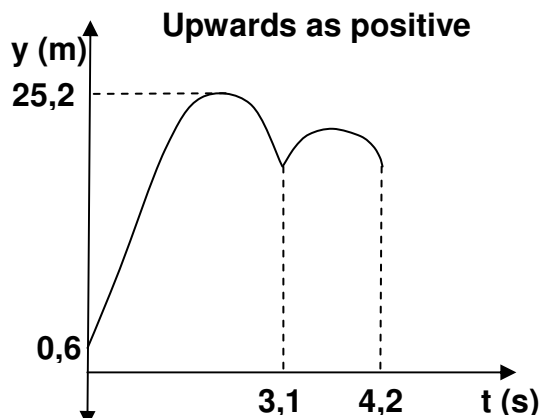
[Position from where he kicked, as reference point]



Max: $\frac{4}{5}$

Marking criteria for graph: Nasienriglyne vir grafiek:	
Graph starts at -21 m at $t = 0$ s Grafiek begin by -21 m by $t = 0$ s	×
Correct shape as shown up to $t = 3,1$ s	✓
Maximum height = $24,6$ m	✓
Time of bounce as $t = 3,1$ s	✓
Correct shape for second part from $t = 3,1$ s to $t = 4,2$ s	✓

[Ground as reference point]



Marking criteria for graph: Nasienriglyne vir grafiek:	
Graph starts at -21 m at t = 0 s Grafiek begin by -21 m by t = 0 s	×
Correct shape as shown up to t = 3,1 s	✓
Maximum height = 25,2 m	✓
Time of bounce as t = 3,1 s	✓
Correct shape for second part from t = 3,1 s to t = 4,2 s	✓

[22]

QUESTION 4/VRAAG 4

- 4.1 The total (linear) momentum remains constant ✓ (in magnitude and direction) in a closed system ✓ (2)

Die totale (liniêre) momentum in 'n geslote sisteem bly konstant (in grootte en rigting)

Notes/Aantekeninge:

Allocate mark for "closed system" only in conjunction with momentum

- | | <u>OPTION 1/OPSIE 1</u>

$\Sigma p_i = \Sigma p_f$ ✓
$45(5) + 18(5) \checkmark = 45(-1) + 18v_f \checkmark$
$v_f = 20 \text{ m}\cdot\text{s}^{-1} \text{ west} \checkmark$
<div style="text-align: right;">(4)</div> | <u>OPTION 2/OPSIE 2</u>

$\Delta p_{\text{boy}} = -\Delta p_{\text{trolley}} \checkmark$
$45(-1) - 45(5) \checkmark = -(18v_f - 18(5)) \checkmark$
$v_f = 20 \text{ m}\cdot\text{s}^{-1} \text{ west} \checkmark$
<div style="text-align: right;">(4)</div> |
|-----|--|---|
| 4.2 | <p>OR/OF</p> $\Sigma p_i = \Sigma p_f \checkmark$
$(45+18)(5) \checkmark = 45(-1) + 18v_f \checkmark$
$v_f = 20 \text{ m}\cdot\text{s}^{-1} \text{ west} \checkmark$
<div style="text-align: right;">(4)</div> | |

- 4.3 Remains the same / Dieselfde ✓
F remains the same ✓ (newton III) and Δt remains the same ✓

OR/OF

Remains the same / Dieselfde ✓

$\Delta p_{\text{trolley}} = -\Delta p_{\text{boy}} \checkmark$ and impuls = Δp : $F\Delta t = \Delta p \checkmark$ (3)

- 4.4 POSITIVE MARKING FROM 4.2

- | | <u>OPTION 1/OPSIE 1</u>

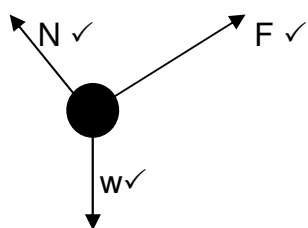
$F_{\text{net}} \cdot \Delta t = mv_f - mv_i \checkmark$
$F_{\text{trolley}} (0,4 \checkmark) = 18(20) - 18(5) \checkmark$
$F_{\text{trolley}} = 675 \text{ N west} \checkmark$
<div style="text-align: right;">(4)</div> | <u>OPTION 2/OPSIE 2</u>

$F_{\text{net}} \cdot \Delta t = mv_f - mv_i \checkmark$
$F_{\text{boy}} (0,4 \checkmark) = 45(-1) - 45(5) \checkmark$
$F_{\text{boy}} = -675 \text{ N}$
$F_{\text{boy}} = 675 \text{ N east}$
$F_{\text{trolley}} = 675 \text{ N west} \checkmark$
<div style="text-align: right;">(4)</div> |
|-----|--|--|
| 4.4 | | |

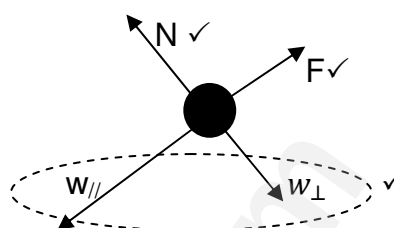
[13]

QUESTION 5/VRAAG 5

5.1

OPTION 1/OPSIE 1

(3)

OPTION 2/OPSIE 2

(3)

Take note:

DON'T penalise for relative lengths of vectors, although:

[N and $w_{\perp}$ should be equal in length][F should be shorter than $w_{\parallel}$]

Notes/Aantekeninge:

- Any additional forces (like friction) max $2/3$
- No arrows: $0/3$
- Force(s) not touching object: max $2/3$

5.2

No✓, it is not an isolated system✓

Nee, dit is nie 'n geslote sisteem nie

OR/OF

No✓, there is an external force acting on the object✓

Nee, daar is 'n eksterne krag wat op die voorwerp inwerk

(2)

5.3

Gravitational force / weight ✓

Gravitasie (aantrekkings) krag / gewig

Note: NOT $F_g/w/w_{\parallel}$ /parallel component of weight $0/1$

(1)

5.4

The force is perpendicular to the displacement ✓

OR/OF

 $\theta = 90^\circ$ therefore $\cos\theta = 0$

(1)

5.5

B to A ✓

5.6

OPTION 1/OPSIE 1

$$W_{\text{net}} = \Delta E_k \checkmark$$

$$F_{g\parallel} \cdot \Delta x \cdot \cos\theta + F \cdot \Delta x \cdot \cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$(25 \times 9,8 \times \sin 30^\circ) \checkmark (3,5) \cos 180^\circ \checkmark + F(3,5) \cos 0^\circ \checkmark = \frac{1}{2}(25)(10,8)^2 - \frac{1}{2}(25)(12)^2 \checkmark$$

$$(63,41)(3,5)(-1) + F(3,5)(1) = 1458 - 1800$$

$$F = 24,79 \text{ N} \checkmark$$

(6)

OPTION 2/OPSIE 2

$$W_{\text{net}} = \Delta E_k \checkmark$$

$$F_g \cdot \Delta x \cdot \cos\theta + F \cdot \Delta x \cdot \cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$(25 \times 9,8) \checkmark (3,5) \cos 120^\circ \checkmark + F(3,5) \cos 0^\circ \checkmark = \frac{1}{2}(25)(10,8)^2 - \frac{1}{2}(25)(12)^2 \checkmark$$

$$(245)(3,5)(-0,5) + F(3,5)(1) = 1458 - 1800$$

$$F = 24,79 \text{ N} \checkmark$$

(6)

OPTION 3/OPSIE 3

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

$$F \cdot \Delta x \cdot \cos \theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mgh_f - mgh_i$$

$$F(3,5)\cos 0^\circ \checkmark = \left[\frac{1}{2}(25)(10,8)^2 - \frac{1}{2}(25)(12)^2 \right] \checkmark + [(25)(9,8) \checkmark (3,5\sin 30^\circ) \checkmark - 0]$$

$$F = 24,79 \text{ N} \checkmark$$

(6)

[14]**QUESTION 6/VRAAG 6**

- 6.1 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.

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)

- 6.2 Higher / Hoër ✓ (1)

- 6.3 [Boat = S, Whale = L]

$$f_L = \frac{v \pm v_L}{v \pm v_S} f_S \checkmark$$

$$= \frac{1435 + 8}{1435} (23000) \checkmark$$

$$= 23128,223 \text{ Hz}$$

(4)

- 6.4 Futher away ✓

λ increases ✓ $\Rightarrow$ If $c = \text{constant}$ ✓, f will decrease ✓ $[f \propto 1/\lambda \text{ if } c = \text{constant}]$

Verder weg ✓

λ neem toe ✓ $\Rightarrow$ As $c = \text{konstant}$ ✓ dan sal f afneem ✓ $[f \propto 1/\lambda \text{ as } c = \text{konstant}]$

OR

Futher away ✓

A shift towards the red end of the spectrum is observed ✓ $\Rightarrow$ If $c = \text{constant}$ ✓, f will decrease ✓

Verder weg ✓

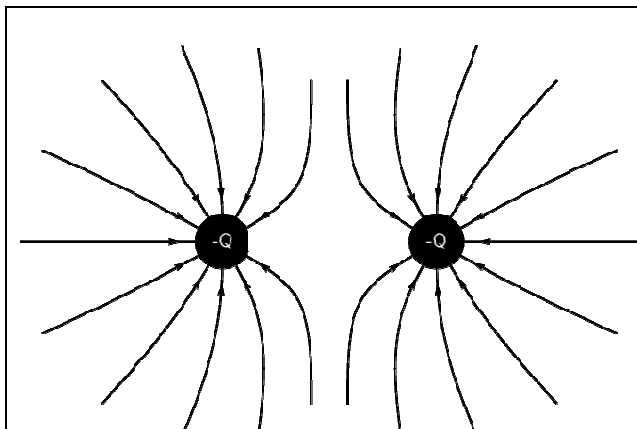
'n Verskuiwing na die rooi end van die spektrum word waargeneem ✓ $\Rightarrow$ As $c = \text{konstant}$ ✓ dan sal f afneem ✓

(4)

[11]

QUESTION 7/VRAAG 7

7.1



Marking Criteria :

- Shape✓
- Arrows pointing towards Q✓
- Fieldlines don't touch/cross & perpendicular on charge✓

(3)

7.2

$$E = \frac{kQ}{r^2} \checkmark$$

$$4,44 \times 10^5 \checkmark = \frac{(9 \times 10^9)(4 \times 10^{-9})}{r^2} \checkmark$$

$$r = 9 \times 10^{-3}$$

$$\therefore d = 9 \times 10^{-3} - 6 \times 10^{-3} \checkmark$$

$$d = 3 \times 10^{-3} \text{ m} \checkmark \text{ (OR 3 mm)}$$

(5)

7.3

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 (Q_1) op 'n ander puntlading (Q_2) 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)

7.4

$$F_{Q2} = \frac{kQ_1Q_2}{r^2} \checkmark$$

$$= \frac{(9 \times 10^9)(-4 \times 10^{-9})(-4 \times 10^{-9})}{(0,006)^2} \checkmark$$

$$F = 4 \times 10^{-3} \text{ N (west or left)}$$

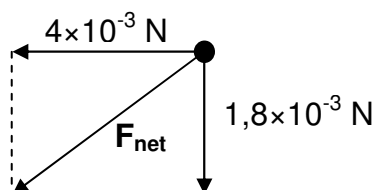
$$F_{Q3} = \frac{kQ_1Q_3}{r^2}$$

$$= \frac{(9 \times 10^9)(-4 \times 10^{-9})(-5 \times 10^{-9})}{(0,01)^2} \checkmark$$

$$F = 1,8 \times 10^{-3} \text{ N (south or down)}$$

$$F^2 = (4 \times 10^{-3})^2 \checkmark + (1,8 \times 10^{-3})^2 \checkmark$$

$$\therefore F = 4,39 \times 10^{-3} \text{ N} \checkmark$$



(6)

QUESTION 8/VRAAG 8

8.1	Criteria for investigative question/Kriteria vir ondersoekende vraag:	
	Dependent and independent variables correctly identified. Afhanklike en onafhanklike veranderlikes korrek geïdentifiseer.	✓
	Question about the relationship between the independent and dependent variables correctly formulated. Vraag oor die verwantskap tussen die afhanklike en onafhanklike veranderlikes korrek geformuleer.	✓

Example/Voorbeeld:

What is the influence of the type of material of a conductor on the conductivity of the conductor? / Wat is die verband tussen die tipe materiaal van die geleier op die geleidingsvermoë van die geleier

Dependent variable/Afhanklike veranderlike:

- Conductivity of the conductor / Geleidingsvermoë van die geleier

Independent variable/Onafhanklike veranderlike:

- Type of material/metal / Tipe materiaal/metaal

Example/Voorbeeld

How will the conductivity of a conductor change if different types of materials/metals are used?

Hoe sal die geleidingsvermoë van 'n geleier verander indien verskillende tipe metale gebruik word?

Notes/Aantekeninge:

A question that results in a 'yes' / 'no' answer: max $\frac{1}{2}$
 'n Vraag wat 'n 'ja' of 'nee' as antwoord het: maks $\frac{1}{2}$

Example:

Will the type of metal have an influence on the conductivity of the metal?

8.2 Any TWO: ✓✓

Temperature / Temperatuur

Thickness of conductor / Dikte van die geleier

Length of conductor / lengte van geleier.

(2)

8.3

P✓

Gradient = $\frac{1}{R}$ ✓

Gradient Q < gradient P

∴ $R_Q > R_P$ ✓

(3)

[7]

QUESTION 9/VRAAG 9

- 9.1 Due to internal resistance✓ energy is transferred inside the battery✓
 As gevolg van interne weerstand✓ word energie binne in die battery oorgedra. ✓
 (2)

9.2.1 $V = IR$ ✓
 $4,5 = I(3)$ ✓
 $I = 1,5 \text{ A}$ ✓
 (3)

9.2.2 POSITIVE MARKING FROM QUESTION 9.2.1

$\epsilon = I(R+r)$ ✓ $= 1,5 \times ((12 + 40) + 3)$ ✓ $\epsilon = 82,5 \text{ V}$ ✓ (5)	OR/OF: $V = IR$ ✓ $= 1,5 \times (12 + 40 + 3)$ ✓ $V = 82,5 \text{ V}$ ✓ (5)
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9.2.3 OPTION 1/OPSIE 1 $V_{//} = IR$ $= 1,5(12)$ $= 18 \text{ V}$ $V = IR$ $18 = I(30)$ $I = 0,6 \text{ A}$ ✓ (3)	OPTION 2/OPSIE 2 $I = \frac{20}{50}$ ✓ (1,5 ✓) $I = 0,6 \text{ A}$ ✓ (3)
---	--

- 9.3 Decreases✓
 Total resistance increases ✓
 Total current decreases ✓
If R remains constant✓ then P will decrease as well ($P \propto I^2$)
 Afneem✓
 Totale weerstand neem toe ✓
 Totale stroomsterkte neem af ✓
 Aangesien R konstant bly✓ sal P dus afneem ($P \propto I^2$)

(4)
[17]

QUESTION 10/VRAAG 10

- 10.1 Mechanical energy to electric energy ✓
 Meganiese energie na elektriese energie ✓

OR/OF

Kinetic energy to electric energy ✓
 Kinetiese energie na elektriese energie ✓

(1)

- 10.2.1 Brush(es) / Carbon brush(es) ✓
 Borsel(s) / Koolstofborsel(s)

(1)

- 10.2.2 Slipring(s) / Sleeping(e) ✓

(1)

- 10.3.1 A ✓

(1)

- 10.3.2 **OPTION 1/OPSIE 1**

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

$$= \frac{300}{\sqrt{2}} \checkmark$$

$$V_{\text{rms}} = 212,13 \text{ V}$$

$$I_{\text{rms}} = \frac{I_{\text{max}}}{\sqrt{2}}$$

$$= \frac{21}{\sqrt{2}} \checkmark$$

$$I_{\text{rms}} = 14,85 \text{ A}$$

$$P_{\text{avg}} = V_{\text{rms}} \cdot I_{\text{rms}} \checkmark$$

$$= (212,13)(14,85) \checkmark$$

$$= 3150,13 \text{ W} \checkmark$$

(5)

OPTION 2/OPSIE 2

$$P_{\text{avg}} = V_{\text{rms}} \cdot I_{\text{rms}} \checkmark$$

$$= \frac{V_{\text{max}}}{\sqrt{2}} \times \frac{I_{\text{max}}}{\sqrt{2}}$$

$$= \frac{300 \checkmark \times 21 \checkmark}{2 \checkmark}$$

$$= 3150 \text{ W} \checkmark$$

(5)

[8]

QUESTION 11/VRAAG 11

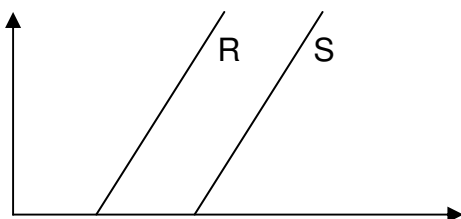
- 11.1 Frequency of P < threshold frequency of metal cathode R ✓
 Frekwensie van P < drumpelfrekwensie van metaalkatode R

OR/OF

Energy of light P < Workfunction of metal cathode R ✓
 Energie van P < werksfunksie van metaalkatode R

(1)

11.2



Criteria for marking:

- X-intercept to the right of R ✓
- Graph S parallel to graph R ✓

(2)

11.3 $E = hf$ ✓
 $= (6,63 \times 10^{-34})(1,5 \times 10^{15})$ ✓
 $E = 9,95 \times 10^{-19} \text{ J}$ ✓

(3)

11.4 $W = W_o + E_k$ ✓
 $9,95 \times 10^{-19} \text{ J} = (6,63 \times 10^{-34})(5,79 \times 10^{14}) \text{ J} + E_k$ ✓
 $E_k = 6,11 \times 10^{-19} \text{ J}$ ✓

(4)

[11]**QUESTION 12/VRAAG 12**

12.1 $\Delta E = E_f - E_i$
 $= -5,44 \times 10^{-19} - (-2,40 \times 10^{-19})$ ✓
 $\Delta E = 3,04 \times 10^{-19} \text{ J}$

$E = \frac{hc}{\lambda}$ ✓
 $3,04 \times 10^{-19} \text{ J} = \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{\lambda}$ ✓

$\lambda = 6,54 \times 10^{-7} \text{ m}$ ✓
 $\therefore \text{RED/ROOI}$ ✓

(6)

[6]**TOTAL SECTION B/TOTAAL AFDELING B: 130****GRAND TOTAL/GROOTTOTAAL: 150**