



education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

**PHYSICAL SCIENCES: PHYSICS (P1)
FISIESE WETENSKAPPE: FISIKA (V1)**

SEPTEMBER 2018

MARKING GUIDELINES / NASIENRIGLYNE

MARKS/PUNTE: 150

These marking guidelines consists of 17 pages

Hierdie nasienriglyne bestaan uit 17 bladsye

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 Kandidate sal slegs een keer gepenaliseer 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. 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 **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.

QUESTION 1 / VRAAG 1

- 1.1 B ✓✓ (2)
- 1.2 B ✓✓ (2)
- 1.3 B ✓✓ (2)
- 1.4 A ✓✓ (2)
- 1.5 B ✓✓ (2)
- 1.6 C ✓✓ (2)
- 1.7 A ✓✓ (2)
- 1.8 C ✓✓ (2)
- 1.9 A ✓✓ (2)
- 1.10 D ✓✓ (2)
- [20]**

QUESTION 2 / VRAAG 2

2.1	OPTION 1		(3)
	Upwards positive: $v_f = v_i + a\Delta t \checkmark$ $0 = 5 + (-9,8) \Delta t \checkmark$ $\Delta t = 0,51 \text{ s} \checkmark$	Downwards positive: $v_f = v_i + a\Delta t \checkmark$ $0 = (-5) + (9,8) \Delta t \checkmark$ $\Delta t = 0,51 \text{ s} \checkmark$	

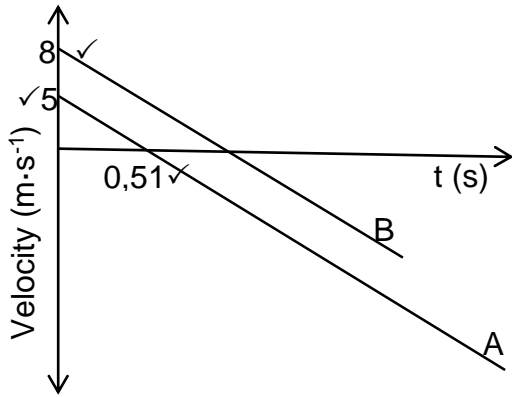
OPTION 2		(3)
Upwards positive: $v_f^2 = v_i^2 + 2a\Delta y$ $0 = 5^2 + 2(-9,8)\Delta y$ $\Delta y = 1,28 \text{ m}$ $\Delta y = \frac{(v_f+v_i)}{2} \Delta t \checkmark$ $1,28 = \frac{(0+5)}{2} \Delta t \checkmark$ $\Delta t = 0,51 \text{ s} \checkmark$	Downwards positive: $v_f^2 = v_i^2 + 2a\Delta y$ $0 = (-5)^2 + 2(9,8)\Delta y$ $\Delta y = -1,28 \text{ m}$ $\Delta y = \frac{(v_f+v_i)}{2} \Delta t \checkmark$ $-1,28 = \frac{(0+(-5))}{2} \Delta t \checkmark$ $\Delta t = 0,51 \text{ s} \checkmark$	

2.2	POSITIVE MARKING FROM Q2.1		(3)
	Upwards positive: $v_f = v_i + a\Delta t \checkmark$ $= 8 + (-9,8)(0,51) \checkmark$ $= 3 \text{ m}\cdot\text{s}^{-1} \checkmark$	Downwards positive: $v_f = v_i + a\Delta t \checkmark$ $= (-8) + (9,8)(0,51) \checkmark$ $= -3,002$ Magnitude of velocity = $3 \text{ m}\cdot\text{s}^{-1} \checkmark$	

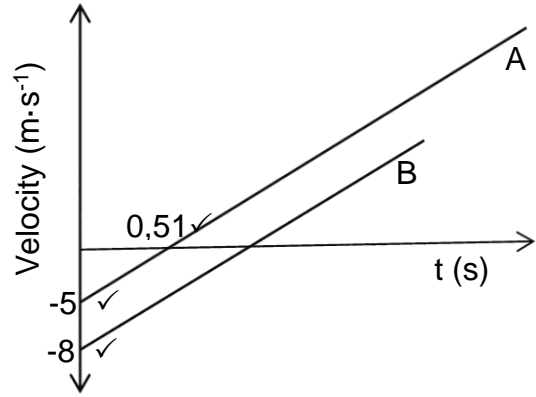
2.3	Upwards positive: FOR BALL A: $v_f = v_i + a\Delta t$ $= 5 + (-9,8) \Delta t \dots\dots\dots(1) \checkmark$ FOR BALL B: $v_f = v_i + a\Delta t$ $= 8 + (-9,8) \Delta t \dots\dots\dots(2) \checkmark$ $\therefore \underline{-[5 + (-9,8) \Delta t] = 8 + (-9,8) \Delta t} \checkmark$ $19,6 \Delta t = 13$ $\Delta t = 0,66 \text{ s} \checkmark$	Downwards positive: FOR BALL A: $v_f = v_i + a\Delta t$ $= (-5) + (9,8) \Delta t \dots\dots\dots(1) \checkmark$ FOR BALL B: $v_f = v_i + a\Delta t$ $= (-8) + (9,8) \Delta t \dots\dots\dots(2) \checkmark$ $\therefore \underline{-[(-5) + (9,8) \Delta t] = (-8) + (9,8) \Delta t} \checkmark$ $19,6 \Delta t = 13$ $\Delta t = 0,66 \text{ s} \checkmark$	(4)
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2.4 POSITIVE MARKING FROM Q2.1

Upwards positive:



Downwards positive:



CRITERIA	
Value of y-intercept for graph A = $\pm 5 \text{ m}\cdot\text{s}^{-1}$	✓
Value of x-intercept for graph A = 0,51 s	✓
Value of y-intercept for graph B = $\pm 8 \text{ m}\cdot\text{s}^{-1}$	✓
Two sloping parallel straight lines	✓

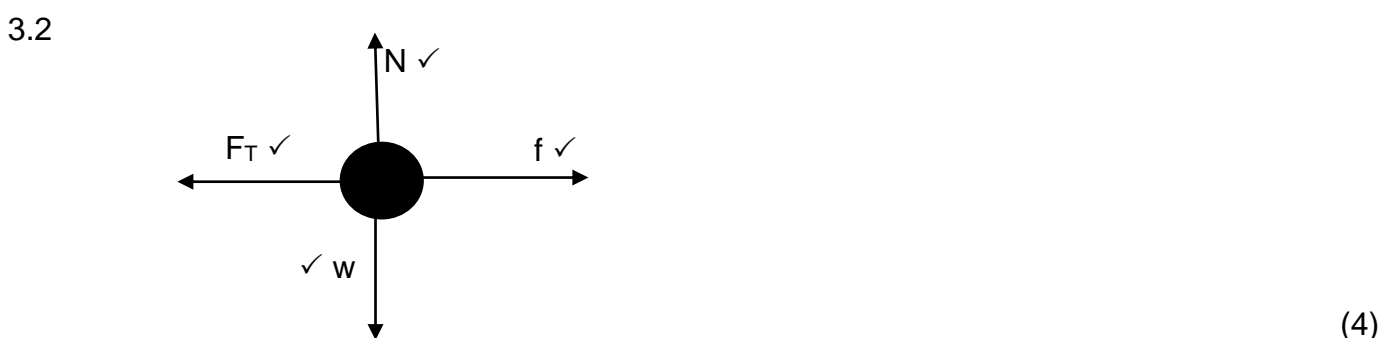
(4)
[14]

QUESTION 3 / VRAAG 3

3.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force ✓ at an acceleration directly proportional to the force and inversely proportional to the mass of the object. ✓
Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die krag teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)



Accepted labels / Aanvaarde benoemings	
w	F _g / F _w / force of earth on block / weight / mg / gravitational force
F _T	Tension in rope / T
N	Normal force
f	f _k / friction / kinetic friction

Notes/Aantekeninge:

- Any additional forces: deduct 1 mark: max 3/4
- No arrows: 0/4
- Force(s) not touching object: deduct 1 mark: max 3/4

3.3 What is the relationship between a net force on a block and the acceleration of the block?

Criteria

Two variables (net force and acceleration) correctly identified	✓	(2)
Question asked about the relationship of these two variables	✓	

3.4 Because of friction ✓ (1)

3.5 0,75 N ✓ (1)

3.6 USE ANY CORRECT VALUE FROM THE GRAPH

$$\begin{aligned} \text{Slope} &= \frac{a_2 - a_1}{F_2 - F_1} \text{ OR } \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{1 - 0}{2 - 0,75} \checkmark \\ &= 0,8 \checkmark \end{aligned}$$

(2)

3.7 Gradient = $\frac{\Delta a}{\Delta F} = \frac{1}{m} = 0,8 \checkmark$
 $m = 1,25 \text{ kg} \checkmark$

(2)

3.8 $-\frac{f_k}{m} \checkmark$

EXPLANATION:

$$F_{\text{net}} = ma$$

$$F_T - f_k = ma$$

$$\frac{F_T}{m} - \frac{f_k}{m} = a$$

$$a = \frac{1}{m} F_T - \frac{f_k}{m}$$

↖
↖
 Gradient y-intercept

(1)
[15]

QUESTION 4 / VRAAG 4

4.1 1,5 s \checkmark

(1)

4.2 Equal distances travelled \checkmark per unit time \checkmark

(2)

4.3 The total (linear) momentum in a closed system remains constant. $\checkmark\checkmark$

NOTE:
 If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

<p>4.4 $\left. \begin{aligned} \Sigma p_i &= \Sigma p_f \\ (m_1+m_2)v_i &= (mv_f)_1 + (mv_f)_2 \\ 0 &= \underline{m(5)} + (3m)v_f \checkmark \\ v_f &= -1,67 \\ v_f &= 1,67 \text{ m}\cdot\text{s}^{-1} \checkmark \end{aligned} \right\} \text{Any one } \checkmark$</p>	<p>$\left. \begin{aligned} \Sigma p_i &= \Sigma p_f \\ (m_1+m_2)v_i &= (mv_f)_1 + (mv_f)_2 \\ 0 &= \underline{m(-5)} + (3m)v_f \checkmark \\ v_f &= 1,67 \text{ m}\cdot\text{s}^{-1} \checkmark \end{aligned} \right\} \text{Any one } \checkmark$</p>
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(4)
[9]

QUESTION 5 / VRAAG 5

5.1 The energy that an objects possesses due to its motion. ✓✓ (2)

5.2 $E_k = \frac{1}{2} mv^2$ ✓
 $= \frac{1}{2} (10)(12)^2$ ✓
 $= 720 \text{ J}$ ✓ (3)

5.3 $f_k = \mu_k \cdot F_N$ ✓
 $= (0,15)(10 \times 9,8)$ ✓
 $= 14,7 \text{ N}$ ✓ (3)

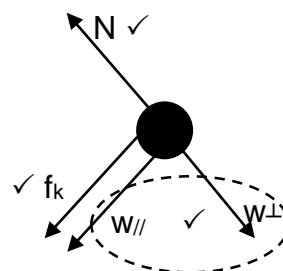
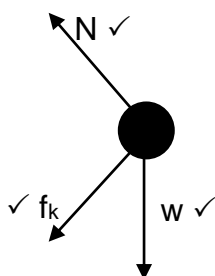
<p>5.4 OPTION 1</p> $F_{\text{net}} = ma$ $\frac{-14,7}{a} = \frac{(10)a}{a}$ $a = -1,47 \text{ m} \cdot \text{s}^{-2}$ $v_f^2 = v_i^2 + 2a\Delta x$ $= (12)^2 + 2(-1,47)(6)$ $v_f = 11,24 \text{ m} \cdot \text{s}^{-1}$	<p>OPTION 2</p> $W_{\text{net}} = \Delta E_k$ $\frac{(14,7)(6)\cos 180^\circ}{-88,2} = \frac{\frac{1}{2} (10)(v_f^2 - 12^2)}{5}$ $v_f = 11,24 \text{ m} \cdot \text{s}^{-1}$
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Both formulae ✓

(4)

5.5

ACCEPT



Accepted labels / Aanvaarde benoemings	
w	F_g / F_w / force of earth on block / weight / 98 N / mg / gravitational force
N	Normal force / F_N / Force of incline on block
f_k	Kinetic friction / friction / f / F_f

(3)

5.6 If the block is on a slope the normal force is less than the normal force when it is on a horizontal surface ✓ (1)

5.7

POSITIVE MARKING FROM Q5.4**OPTION 1**

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

$$W_f + W_{Fg//} + W_N = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$(12,04)(d)\text{Cos } 180^\circ \checkmark + (10 \times 9,8 \times \text{Sin} 35^\circ)(d)\text{Cos} 180^\circ \checkmark = 0 - \frac{1}{2}(10)(11,24)^2 \checkmark$$

$$d = 9,26 \text{ m } \checkmark$$

(5)

OPTION 2

$$W_{\text{net}} = W_f + W_{Fg//} + W_N$$

$$= (12,04)(d)\text{Cos } 180^\circ \checkmark + (10 \times 9,8 \times \text{Sin} 35^\circ)(d)\text{Cos} 180^\circ \checkmark + 0$$

$$= -68,25 d$$

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

$$-68,25 d = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$-68,25 d = 0 - \frac{1}{2}(10)(11,24)^2 \checkmark$$

$$d = 9,26 \text{ m } \checkmark$$

(5)

OPTION 3

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

$$(12,04)(d)\text{Cos } 180^\circ \checkmark = [0 - \frac{1}{2}(10)(11,24)^2 \checkmark] + [(10)(9,8)(d \text{ Sin} 35^\circ) \checkmark - 0]$$

$$d = 9,26 \text{ m } \checkmark$$

(5)

[21]

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. ✓

OR

The change in frequency (or pitch) of the sound detected by a listener ✓ as a result of the relative motion between the source and the observer. ✓ (2)

- 6.2 $v = f\lambda$ ✓
 $340 = 520 \lambda$ ✓
 $\lambda = 0,65 \text{ m}$ ✓ (3)

- 6.3 $f_L = \frac{v \pm v_L}{v \pm v_S} f_S$ ✓
 $= \frac{340}{340-15} (520)$ ✓
 $f_L = 544 \text{ Hz}$ ✓ (4)

- 6.4 520 Hz ✓ (1)

- 6.5 Shorter ✓
 $\lambda \propto \frac{1}{f}$ ✓ if $v = \text{constant}$ ✓

OR

Shorter ✓
 Provided v remains constant ✓, if f increases λ will decrease ✓ (3)

[13]

QUESTION 7 / VRAAG 7

7.1 Removed ✓ (1)

7.2
$$n = \frac{Q}{e} \checkmark$$

$$= \frac{40 \times 10^{-9}}{1,6 \times 10^{-19}} \checkmark$$

$$= 2,5 \times 10^{11} \checkmark$$
 (3)

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 Positive ✓
Repulsive force between spheres ✓ (2)

7.5.1
$$F = \frac{kQ_1Q_2}{r^2} \checkmark$$

$$2,6 \checkmark = \frac{(9 \times 10^9)(40 \times 10^{-9})Q_2 \checkmark}{(3,5 \times 10^{-2})^2 \checkmark}$$

$$Q_2 = 8,85 \times 10^{-6} \text{ C} \checkmark$$
 (5)

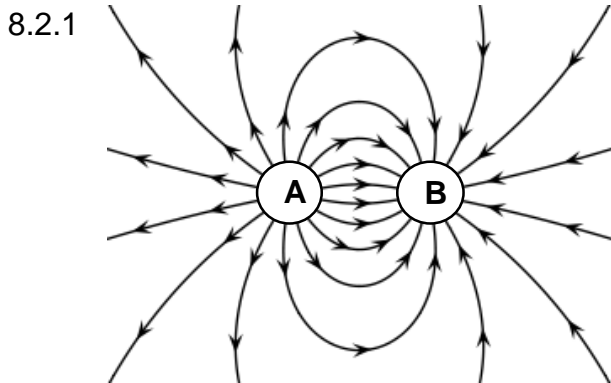
7.5.2
$$T + F_Q = F_g \checkmark$$

$$T = \underline{(0,4 \times 9,8) - 2,6} \checkmark$$

$$= 1,32 \text{ N} \checkmark$$
 (3)
[16]

QUESTION 8 / VRAAG 8

8.1 A region of space ✓ in which an electric charge experiences a force. ✓ (2)

**Criteria:**

Correct shape as shown	✓✓
Correct direction	✓

(3)

8.3

OPTION 1

$$E_{AP} = \frac{kQ_A}{r^2} \checkmark$$

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

$$= \frac{45}{4r^2}$$

$$E_{BP} = \frac{kQ_B}{r^2}$$

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

$$= \frac{36}{r^2}$$

$$E_{\text{net}} = E_{AP} + E_{BP}$$

$$1181,25 \checkmark = \frac{45}{4r^2} + \frac{36}{r^2}$$

$$r = 0,2 \text{ m} \checkmark$$

(6)

OPTION 2

$$E_{\text{net}} = E_{AP} + E_{BP}$$

$$1181,25 = \frac{kQ_A}{r^2} \checkmark + \frac{kQ_B}{r^2}$$

$$1181,25 \checkmark = \frac{(9 \times 10^9)(5 \times 10^{-9})}{(2r)^2} \checkmark + \frac{(9 \times 10^9)(4 \times 10^{-9})}{(r)^2} \checkmark$$

$$r = 0,2 \text{ m} \checkmark$$

(6)

[11]

QUESTION 9 / VRAAG 9

9.1 Ammeter ✓ (1)

<p>9.2.1 OPTION 1 $V = IR$ ✓ $4,5 = I(9)$ ✓ $I = 0,5 \text{ A}$ ✓</p>	<p>OPTION 2 $\varepsilon = I(R+r)$ ✓ $4,5 = I(7+2)$ ✓ $I = 0,5 \text{ A}$ ✓</p>	(3)
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9.2.2 **POSITIVE MARKING FROM Q9.2.1**

$$\begin{aligned}
 V &= IR \quad \checkmark \\
 &= (0,5)(6) \quad \checkmark \\
 &= 3 \text{ V} \quad \checkmark
 \end{aligned}$$
(3)

9.3.1 **POSITIVE MARKING FROM Q9.2.2**

$$V_i = Ir = 4,5 - 3 = 1,5 \text{ V} \quad \checkmark$$
(1)

9.3.2 **POSITIVE MARKING FROM Q9.3.1**

$$\begin{aligned}
 V &= IR \\
 1,5 &= I(2) \quad \checkmark \\
 I &= 0,75 \text{ A} \quad \checkmark
 \end{aligned}$$
(2)

9.3.3 **POSITIVE MARKING FROM Q9.2.2**

$$\begin{aligned}
 V &= IR \\
 3 \checkmark &= (0,25)R \checkmark \\
 R &= 12 \Omega \checkmark
 \end{aligned}$$

NOTE:
 Substitution of 0,25: answer of Q9.3.2 minus
 answer of Q9.2.1

(3)
[13]

QUESTION 10 / VRAAG 10

- 10.1 Electromagnetic induction ✓
OR
Faraday's principle (1)
- 10.2 Increase rotation speed ✓
OR
Use stronger magnets ✓
OR
Use more coils ✓ (1)
- 10.3 Slip rings ✓ (1)

10.4.1	<p>OPTION 1</p> $V_{\text{rms}} = \frac{V_{\text{max}}}{\sqrt{2}} \checkmark$ $= \frac{340}{\sqrt{2}} \checkmark$ $= 240,42 \text{ V}$ $P_{\text{avg}} = \frac{V_{\text{rms}}^2}{R} \checkmark$ $100 = \frac{(240,42)^2}{R} \checkmark$ $R = 578,02 \Omega \checkmark$	<p>OPTION 2</p> $V_{\text{rms}} = \frac{V_{\text{max}}}{\sqrt{2}} \checkmark$ $= \frac{340}{\sqrt{2}} \checkmark$ $= 240,42 \text{ V}$ $P_{\text{avg}} = V_{\text{rms}} \cdot I_{\text{rms}} \checkmark$ $100 = 240,42(I_{\text{rms}}) \checkmark$ $I_{\text{rms}} = 0,42 \text{ A}$ $V_{\text{rms}} = I_{\text{rms}} R \checkmark$ $240,42 = 0,42 R$ $R = 572,43 \Omega \checkmark$	(5)
Range: 572,43 – 578,02			

[8]

QUESTION 11 / VRAAG 11

11.1 The photo electric effect ✓ (1)

11.2 The frequency of photons in light is less than the threshold frequency of zinc metal ✓✓

OR

The energy of photons in light is less than the work function of zinc metal. ✓✓

NOTE: compare frequency (photon) with threshold frequency OR energy (photon) with work function

(2)

11.3.1 $W_0 = hf_0$ ✓
 $5,97 \times 10^{-19} = 6,63 \times 10^{-34} f_0$ ✓
 $f_0 = 9 \times 10^{14} \text{ Hz}$ ✓

(3)

11.3.2 $E = W_0 + E_{k(\max)}$ } Any one ✓
 $\frac{hc}{\lambda} = W_0 + E_k$
 $\frac{(6,63 \times 10^{-34})(3 \times 10^8)}{300 \times 10^{-9}} \checkmark = 5,97 \times 10^{-19} + E_k \checkmark$
 $E_k = 6,6 \times 10^{-20} \text{ J}$ ✓

(4)

[10]

TOTAL/TOTAAL: 150