



Education and Sport Development

Department of Education and Sport Development
Departement van Onderwys en Sportontwikkeling
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NORTH WEST PROVINCE

**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

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

JUNE 2018 / JUNIE 2018

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/ PUNTE: 150



**This memorandum consists of 16 pages.
Hierdie vraestel bestaan uit 16 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.



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NSC-Marking Guidelines

- 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.



NSC-Marking Guidelines

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.



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NSC-Marking Guidelines

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

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

[20]

NSC-Marking Guidelines

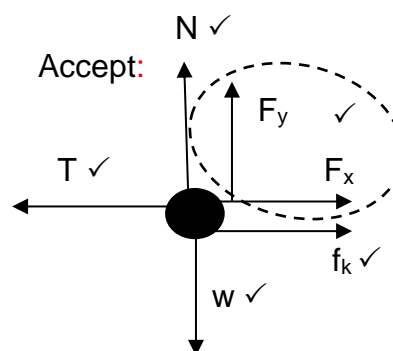
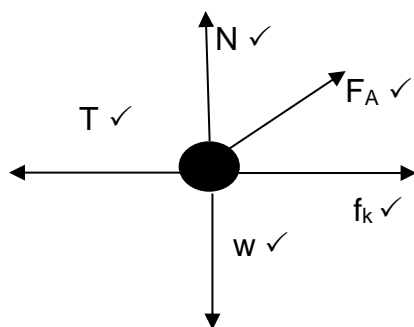


QUESTION 2 / VRAAG 2

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2.1

Accepted labels / Aanvaarbare byskrifte	
w	F _g / F _w /force of earth on block/weight / 68,6 N / mg / gravitational force F _g / F _w /krag van aarde op blok/gewig / 68,6 N / mg / gravitasiekrag
f _k	f/friction/wrywing
T	Tension / Spanning F _T
F _A	F _{app}
N	Normal force / Normaalkrag F _N / Force of surface on block / Krag van oppervlakte op blok



(5)

Notes

- Any additional forces / Enige addisionele kragte: max 4/5
- No arrows / Geen pyle: 0/5

Force(s) not touching object / Krag(te) wat nie aan voorwerp raak nie: max 4/5

2.2

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

OR

The resultant/net force acting on an object is equal to the rate of change of momentum ✓ of the object in the direction of the resultant/net force ✓

Wanneer 'n resulterende / netto krag op 'n voorwerp inwerk, sal die voorwerp versnel in die rigting van die krag en die versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

OF

Die resulterende / netto krag wat op 'n voorwerp inwerk, is gelyk aan die tempo van verandering van momentum van die voorwerp in die rigting van die resulterende / netto krag (2)

2.3

$$\left. \begin{aligned} F_{\text{net}} &= ma \\ F_N + F_y &= F_g \end{aligned} \right\} \text{Any one / } \checkmark \text{Enige een}$$

$$F_N + 40 \sin 20^\circ = 7(9,8) \checkmark$$

$$F_N = 54,92 \text{ N } \checkmark$$

(3)

NSC-Marking Guidelines

2.4

For 10 kg block:



$$F_g - T = ma$$

$$10(9,8) - T = 10(3,35) \checkmark$$

$$T = 64,5 \text{ N} \checkmark$$

(2)

2.5

**POSITIVE MARKING FROM /
POSITIEWE NASIEN VAN 2.3 & 2.4**

For 7 kg block / blok:

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

$$-F_x - f_k + T = ma$$

Both formulae \checkmark / Beide formules

$$-40 \cos 20^\circ \checkmark - f_k + 64,5 = 7(3,35) \checkmark$$

$$f_k = 3,47 \text{ N}$$

$$f_k = \mu_k \cdot F_N$$

$$3,47 = \mu_k (54,92) \checkmark$$

$$\mu_k = 0,063 \checkmark$$

(5)

[17]**QUESTION 3 / VRAAG 3**3.1 The stone moves up first then moves down. / Die klip beweeg eers op en dan af \checkmark (1)

3.2 Choose up as positive / Kies opwaarts as positief

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

$$\Delta y = 20 \times 2 + \frac{1}{2} (-9,8) \times 2^2 \checkmark$$

$$= 20,4 \text{ m upwards relative to / opwaarts relatief tot Q} \checkmark$$

(3)

3.3 $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$

$$\Delta y = 20 \times 2 + 0 \checkmark$$

$$= 40 \text{ m up relative to / opwaarts relatief tot Q} \checkmark$$

(2)

3.4 Distance apart = height of balloon - height of stone

Afstand = hoogte van ballon - hoogte van die klip

$$= 40 - 20,4 \checkmark$$

$$= 19,6 \text{ m apart} \checkmark$$

(2)

NSC-Marking Guidelines

3.5 $v_f = v_i + a\Delta t$
 $= 20 + (-9,8) \times 6$
 $= 38,8 \text{ m}\cdot\text{s}^{-1} \text{ down / afwaarts}$ (2)

3.6 Option 1 / Opsie 1

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

$$-400 = 20 \times \Delta t + \frac{1}{2} (-9,8) \times \Delta t^2$$

$$= 11,3 \text{ s} \quad (\text{ignore } 7,22 \text{ s})$$

(Ignoreer 7,22 s)

Option 2 / Opsie 2

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

$$0 = 20 + (-9,8) \times \Delta t$$

$$= 2,04 \text{ s}$$

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

$$= 20 \times 2,04 + \frac{1}{2} (-9,8) \times 2,04^2$$

$$= 20,41 \text{ m up / op (immediately the stone was released. / onmiddelik nadat die klip vrygelaat is)}$$

Total distance travelled by stone /
 Totale afstand deur klip geval
 $= 400 + 20,41 = 420,41 \text{ m}$

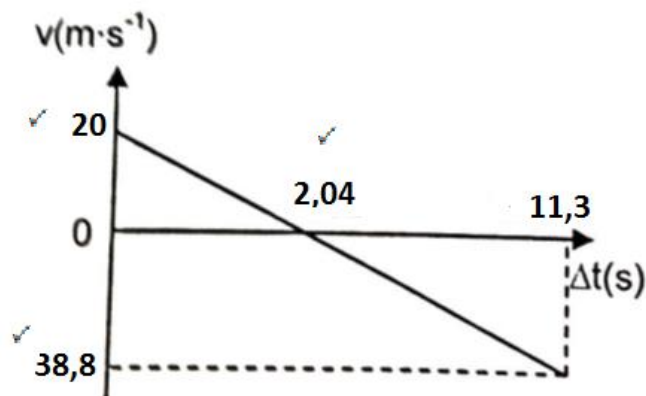
$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$420,41 = 0 + \frac{1}{2} 9,8 \Delta t^2$$

$$\Delta t = 9,26 \text{ s}$$

Total time / Totale tyd = $9,26 + 2,04 = 11,3 \text{ s}$ (4)

3.7



(3)



[17]

NSC-Marking Guidelines

**QUESTION 4 / VRAAG 4**

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4.1.1 $\sum P_{\text{before}} = \sum P_{\text{after}} \checkmark$

$$4 \times 2 + 2 \times 0 = (4+2) v_f \checkmark$$

$v_f = 1,33 \text{ m}\cdot\text{s}^{-1}$ in the original direction of motion of the trolley / In die oorspronklike rigting. \checkmark

(3)

4.1.2 Inelastic / Onelasties \checkmark The two objects move together after the collision / Die twee voorwerpe beweeg saam na die botsing

(1)

4.1.3 $E_k = \frac{1}{2}mv^2 \checkmark$

Total kinetic energy before collision = kinetic energy of the trolley + kinetic energy of the brick / Totale kinetiese energie voor die botsing = kinetiese energie van die trollie + kinetiese energie van die baksteen

$$\begin{aligned} \text{Total } E_{k \text{ before}} &= \frac{1}{2}mv^2 \text{ (trolley / trollie)} + \frac{1}{2}mv^2 \text{ (brick / baksteen)} \\ &= \frac{1}{2} \times 4 \times 2^2 + \frac{1}{2} \times 2 \times 0^2 \checkmark \\ &= 8 \text{ J} \checkmark \end{aligned}$$

$$\begin{aligned} \text{Total } E_{k \text{ after}} &= \frac{1}{2}mv^2 \text{ (trolley / trollie)} + \frac{1}{2}mv^2 \text{ (brick / baksteen)} \\ &= \frac{1}{2} \times 4 \times 1,33^2 + \frac{1}{2} \times 2 \times 1,33^2 \checkmark \\ &= 5,31 \text{ J} \checkmark \end{aligned}$$

The collision is inelastic since total kinetic energy before the collision is not equal to the total kinetic energy after the collision / Die botsing is onelasties aangesien die totale kinetiese energie voor die botsing nie gelyk is aan die totale kinetiese energie na die botsing nie

(5)

4.2.1 The impulse-momentum theorem states that the impulse is the change in momentum. / Die impuls-momentum stelling stel dat impuls die verandering in momentum is. $\checkmark\checkmark$

$$F_{\text{net}} \Delta t = \Delta p.$$

(2)

4.2.2 $F_{\text{net}} \Delta t = \Delta p. \checkmark$ Impulse = $m(v_f - v_i)$ (any one of the formulae one mark / Enige een van die twee formules is een punt)

Take direction of ball as positive / neem rigting van bal as positief

$$= 0,2(-4,2 - 6) \checkmark$$

$$= -2,04 \text{ N}\cdot\text{s} \text{ exerted by the cushion / uitgeoefen deur die kussing. } \checkmark$$

OR / OF

Impulse exerted by ball on cushion / Impuls deur bal uitgeoefen op kussing
= $2,04 \text{ N}\cdot\text{s}$ towards the cushion / na die kussing \checkmark

(3)

NSC-Marking Guidelines

$$4.2.3 \quad F_{\text{net}} = \Delta p / \Delta t$$

$$= -2,04 / 0,02 \checkmark$$

$$= -102 \text{ N}$$

=102 away from the cushion / weg van die kussing af \checkmark

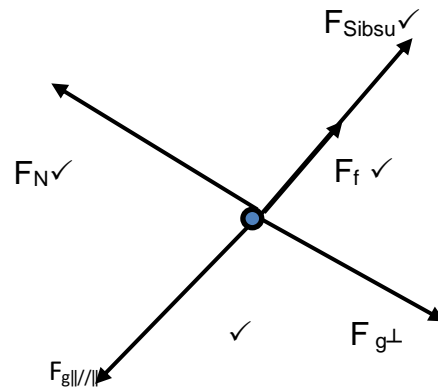
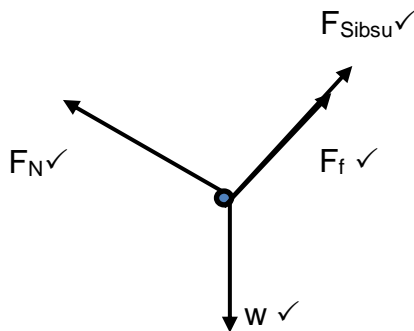
(2)

[16]



QUESTION 5

5.1



Accepted labels

F_{Sibsu} or Fapplied / Ftoegepas \checkmark

w or mg or weight / gewig \checkmark or F_{gll} and $F_{\text{g}\perp}$

F_{N} or normal force / normaalkrag \checkmark

F_{f} or force of friction / wrywingskrag \checkmark

(4)

5.2 Net force applied parallel to the slope / Nettokrag toegepas parallel aan die helling

$$F_{\text{net}} = F_{\text{gll}} - F_{\text{Sibsu}} - F_{\text{f}} = 0 \checkmark$$

$$F_{\text{gll}} = 280 \times 9,8 \times \sin 30^\circ \checkmark$$

$$= 1372 \text{ N} \checkmark$$

$$F_{\text{Sibsu}} = 1372 - 950$$

$$= 422 \text{ N up the slope / teen die helling op} \checkmark$$

(4)

NSC-Marking Guidelines

- 5.3 Work done on the wheel barrow by gravitational force. / Werk gedoen deur gravitasie op die kroiwa

$$W_{\text{gll}} = F_{\text{gll}} \Delta X \cos \theta \checkmark$$

$$= 1372 \times 4,3 \cos 0^\circ$$

$$= 1372 \times 4,3 \times 1 \checkmark$$

$$= 5899,6 \text{ J} \checkmark$$

(3)

- 5.4 $W_f = F_f \Delta X \cos \theta$

$$= 950 \times 4,3 \cos 180^\circ \checkmark$$

$$= -4085 \text{ J} \checkmark$$

(2)

- 5.5 A force for which the work done in moving an object between two points is independent of the path taken. / 'n Krag wat werk verrig maar onafhalklik is van die roete gevolg $\checkmark\checkmark$ **Examples:** gravitational force OR elastic force in a spring OR electrostatic forces (coulomb forces). / Voorbeelde: Gravitasiekrag OF elastiese krag van 'n veer OF Elektrostatische kragte soos coulombkragte

Accept any one / Aanvaar enige een \checkmark

(3)

[16]**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. $\checkmark\checkmark$

(Accept any other correct statement)

Die verandering in frekwensie (of toonhoogte) van die klank wat deur 'n luisteraar waargeneem word omdat die klankbron en die luisteraar verskillende snelhede relatief het ten opsigte van mekaar

(Aanvaar enige ander korrekte stelling)

(2)

6.2.1 $f_L = \left(\frac{v \pm v_L}{v \pm v_s} \right) f_s \checkmark$

$$467 \checkmark = \left(\frac{v - 0}{v - 31,9} \right) 426 \checkmark$$

$$v = 331,6 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(4)

NSC-Marking Guidelines

6.2.2 (a) Source is moving towards the observer and waves are compressed.

Bron beweeg nader aan die waarnemer en die golwe word saamgepers. ✓

(b) Source is moving away from the observer and waves are rarefied.

Bron beweeg weg van die waarnemer af en die golwe uitgerek. ✓

(2)

6.3 Lower pitch. / Laer toonhoogte ✓

Source is moving to the left, the centre of successive rings moves towards left. ✓ If the observer is stationary, then the time interval between the arrival of successive rings at the ear is greater.

Bron beweeg na links, die middelpunt van opeenvolgende ringe beweeg ook na links. As die waarnemer stasionêr is, is die tydsinterval tussen die aankoms van opeenvolgende ringe by die oor groter ✓

(3)



[11]

QUESTION 7 / VRAAG 7

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

Die elektriese veld op 'n punt is die elektrostatische krag ervaar per eenheid positiewe lading wat op daardie punt geplaas is.

(2)

7.2 The sphere Q is negatively charged and the electric field at R will be directed towards Q along the given line. ✓✓

Die sfeer Q is negatief gelaai en die elektriese veld by R sal in die rigting van Q wees.

(2)

7.3 Electric field at S / Elektriese veld by S

$$E_s = \frac{1}{4} \times 5,6 \times 10^3 \checkmark$$

$$= 1,4 \times 10^3 \text{ N}\cdot\text{C}^{-1} \checkmark$$

The point S is twice the distance away from point R. Electric field is inversely proportional to the square of the distance from the charge.

Punt S is twee keer die afstand weg van punt R. Elektriese veld is omgekeerd eweredig aan die kwadraat van die afstand tussen die ladings.

(3)

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7.4

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

$$5,6 \times 10^3 \checkmark = \frac{9 \times 10^9 \times Q}{0,2^2} \quad \checkmark$$

$$Q = 2,49 \times 10^{-8} \text{ C} \quad \checkmark$$

(4)

7.5.1 $E = F/Q \checkmark$

$$5,6 \times 10^3 = F / 15 \times 10^{-9} \quad \checkmark$$

$$F = 8,4 \times 10^{-5} \text{ N} \quad \checkmark$$

OR / OF

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

$$= \frac{9 \times 10^9 \times 2,5 \times 10^{-8} \times 15 \times 10^{-9}}{0,2^2} \quad \checkmark$$

$$= 8,4 \times 10^{-5} \text{ N}$$

(3)

7.5.2 Electric field at S due to charge q / Elektriese veld by S agv lading q

$$E_q = \frac{kQ}{r^2}$$

$$= \frac{9 \times 10^9 \times 15 \times 10^{-9}}{0,2^2} \quad \checkmark$$

$$= 3,4 \times 10^3 \text{ N}\cdot\text{C}^{-1} \quad \checkmark \text{ to the right / na regs}$$

Electric field at S due to charge Q / Elektriese veld by S agv lading Q

$$E_Q = 1,4 \times 10^3 \text{ N}\cdot\text{C}^{-1} \text{ to the left / na links}$$

$$E_{\text{net}} = 3,4 \times 10^3 - 1,4 \times 10^3 \quad \checkmark$$

$$= 2,0 \times 10^3 \text{ N}\cdot\text{C}^{-1} \quad \checkmark \text{ to the right / na regs}$$

(4)



[18]

NSC-Marking Guidelines

QUESTION 8 / VRAAG 8

8.1.1 24 V (1)

8.1.2 0 V (1)

8.2.1 $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$

$$\frac{1}{R_p} = \frac{1}{3} + \frac{1}{9} + \frac{1}{6} \quad \checkmark$$

$$R_{//} = 1,64 \, \Omega$$

$$R_T = 1,64 + 2 + 2 \quad \checkmark$$

$$= 5,64 \, \Omega \quad \checkmark$$

(3)

8.2.2 $\varepsilon = I(R + r) \quad \checkmark$

$$24 = I \times 5,64 \quad \checkmark$$

$$I = 4,26 \, A \quad \checkmark$$

(3)

8.3.1 $\varepsilon = 1,5 \, V \quad \checkmark$

(1)

8.3.2 Gradient =

$$= \frac{(0,65 - 1,5)}{(1 - 0)} \quad \checkmark$$

$$= -0,85 \, \Omega \quad \checkmark$$

(2)

8.3.3 Internal resistance / Interne weerstand \checkmark

(1)

8.3.4 $\varepsilon = I(R + r)$

$$1,5 \quad \checkmark = 0,75 (R + 0,85) \quad \checkmark$$

$$R = 1,15 \, \Omega \quad \checkmark$$

(3)

8.3.5 $\varepsilon = I(R + r)$

$$\varepsilon = V_{\text{ext}} + V_{\text{lost}}$$

When current increases $V_{\text{lost}} = I_r$ increases \checkmark

Indien stroom toeneem $V_{\text{verlore}} = I_r$ neem toe

V_{ext} decreases, \checkmark since ε remains constant \checkmark

V_{ekstern} neem toe \checkmark omdat Emk konstant bly \checkmark

(3)

**[18]**

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**QUESTION 9 / VRAAG 9**

- 9.1.1 The brushes make contact to external circuit ✓ and allows current to flow to external circuit. ✓

OR

Allows the induced current to flow into and away from the resistor in the external circuit. ✓✓

Die borsels maak kontak met die eksterne stroombaan en laat stroom toe om te vloei na eksterne stroombaan.

OF

Laat die geïnduseerde stroom toe om na en weg van die resistor in die eksterne stroombaan te vloei.

- 9.1.2 Generator Y. ✓ It consists of split rings which changes the direction of current. ✓ (2)

Generator Y. ✓ Dit bestaan uit splitringe wat die rigting van die stroom verander. ✓ (2)

- 9.1.3 Electric energy could be transmitted over a long distances without much power loss. ✓

It is more cost effective or economical. The voltage can be stepped up or down to save energy during transportation. ✓

Elektriese energie kan oor 'n lang afstand sonder veel kragverlies oorgedra word.

Dit is meer koste-effektief of ekonomies. Die spanning kan verhoog of verlaag word om energie tydens vervoer te bespaar.

- 9.2.1 Vertical / Vertikaal ✓ (2)

- 9.2.2 DC. ✓ Current flows in one direction only. / Stroom vloei net in een rigting (1)

- 9.3.1 $V_{\text{rms}} = \frac{V_{\text{max}}}{\sqrt{2}}$ ✓ (1)

$$200 = \frac{V_{\text{max}}}{\sqrt{2}} \quad \checkmark$$

- $V_{\text{max}} = 282,84 \text{ V}$ ✓ (3)

- 9.3.2 $V_{\text{rms}} = I_{\text{rms}} \times R$ ✓ (3)

$$I_{\text{rms}} = 200/10 \quad \checkmark$$

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$$= 20 \text{ A} \checkmark$$

$$9.3.3 \quad P_{\text{ave}} = I_{\text{rms}} V_{\text{rms}} \checkmark$$

$$= 200 \times 20 \checkmark$$

$$= 4000 \text{ W} \checkmark$$



(3)

[17]

TOTAL: 150