



Province of the  
**EASTERN CAPE**  
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo  
Provinsie van die Oos Kaap: Departement van Onderwys  
Porafensie Ya Kapa Botjhabela: Lefapha la Thuto

# **NATIONAL SENIOR CERTIFICATE**

**GREYIDI 12**

**SEPTEMBER 2024**

**IFIZIKHALI SAYENSIZ P1  
ISIKHOKHELO SOKUMAKISHA**

**AMANQAKU: 150**

\_\_\_\_\_  
Esisikhokhelo sokumakisha sinamaphepha ayi18.  
\_\_\_\_\_

**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 verkeerd 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 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 formules 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, 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 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 **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 word korrek in 3.2 of 3.3 vervang, word volpunte vir 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 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 QUESTION 3.1 is incorrect, no marks can be awarded for QUESTION 3.2. However, if the answer for e.g. QUESTION 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 VRAAG 3.1 is verkeerd, kan geen punte vir VRAAG 3.2 toegeken word nie. Indien die antwoord op bv. VRAAG 3.1 egter op 'n berekening gebaseer is, kan die motivering vir die verkeerde antwoord in VRAAG 3.2 oorweeg word.*

**UMBUZO 1:****IMIBUZO YEMALTIPLI TSHOYISI**

1.1	B ✓✓	(2)
1.2	C ✓✓	(2)
1.3	C ✓✓	(2)
1.4	A ✓✓	(2)
1.5	B ✓✓	(2)
1.6	A ✓✓	(2)
1.7	D ✓✓	(2)
1.8	D ✓✓	(2)
1.9	B ✓✓	(2)
1.10	A ✓✓	(2)
		<b>[20]</b>

## UMBUZO 2

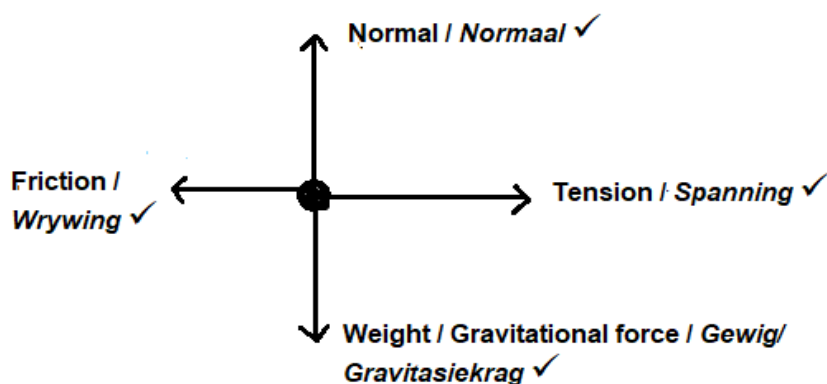
- 2.1 Xa irizalthingi/inethi fosi isebenza kwiobhjekhthi, iobhjekhthi izakuakhselereyithela ngakwidayirekhshini yefosi. Iakhselereyishini idayirekhthli propowushinali kwifosi ze ibe-invesili propowushinali kwimesi yeobhjekhthi. ✓✓

### OKANYE

Irizalthingi/inethi fosi esebenza kwiobhjekhthi ilingana nereyithi yetsheyinji yemomentam yeobhjekhthi kwidayirekhshini yerizalthingi/nethi fosi, kwidayirekhshini yerizalthingi/nethi fosi ✓✓

(2)

2.2



### Ezinye iileyibheli

<b>w</b>	$F_g/F_w$ /weyithi/gravitheyishinali fosi	✓
<b>T</b>	$F_T$ /Thenshini/ ifosi ekwisitrini	✓
<b>N</b>	$F_N/N$ /Nomali fosi	✓
<b>F<sub>k</sub></b>	$f_k$ /Frikhshinali fosi	✓

(4)

2.3.1  $f_k = \mu_k N$  ✓

$$f_k = \mu_k F_g$$

$$f_k = (0,25)(4)(9,8) \quad \checkmark$$

$$f_k = 9,8 \text{ N} \quad \checkmark$$

(3)

## 2.3.2 INDLELA 1

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

$$F_{\text{net}} = T - f$$

$$F_{\text{net}} = F_g - T$$

Nayiphi na ✓

**Ibhlokhi u4 kg**

$$T - 9,8 \checkmark = 4a$$

$$T = 4a + 9,8$$

**ibhlokhi u2 kg**

$$(2)(9,8) - T \checkmark = 2a$$

$$T = 19,6 - 2a$$

$$19,6 - 2a = 4a + 9,8$$

$$a = 1,63 \text{ m} \cdot \text{s}^{-2}$$

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

$$v_f^2 = 0^2 + 2(1,63)(1) \checkmark$$

$$v_f = 1,81 \text{ m} \cdot \text{s}^{-1} \checkmark$$

Nayiphi na (4a okanye 2a) ✓

(7)

- 2.4 Igravitheyishinali fosi (weyithi) akuyiyo yodwa ifosi esebenza kwi bhlokhi u2 kg ✓✓

**OKANYE**Iakhselereyishini ayingo  $9,8 \text{ m} \cdot \text{s}^{-2}$ . ✓✓

(2)

**[18]**

## UMBUZO 3

3.1 Ukuya ezantsi ✓

(1)

3.2

<b>Ukuya phezulu phozithivu</b> $v_f = v_i + a \Delta t$ ✓ $= 30 \checkmark + (-9,8)(2,135)$ $= 9,08 \text{ m} \cdot \text{s}^{-1}$ , ukuya phezulu ✓	<b>Ukuya ezantsi phozithivu</b> $v_f = v_i + a \Delta t$ ✓ $= -30 \checkmark + (9,8)(2,135)$ $= -9,078 \text{ m} \cdot \text{s}^{-1}$ $= 9,08 \text{ m} \cdot \text{s}^{-1}$ , ukuya phezulu ✓
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(3)

3.3

## INDLELA 1

<b>Ukuya phezulu phozithivu</b> Ibhola uA: $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓ $\Delta y = -12(2,5) + \frac{1}{2}(-9,8)(2,5)^2$ ✓ $\Delta y = -60,625 \text{ m}$ (hayithi = 29,375 m) Ibhola uB: $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ $= 30(2,5) + \frac{1}{2}(-9,8)(2,5)^2$ ✓ $= 44,375 \text{ m}$ Idistensi = $44,375 - 29,375$ ✓ $= 15 \text{ m}$ ✓	<b>Ukuya ezantsi phozithivu</b> $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓ $\Delta y = 12(2,5) + \frac{1}{2}(9,8)(2,5)^2$ ✓ $\Delta y = 60,625 \text{ m}$ (ihayithi = 29,375 m) Ibhola uB: $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ $= -30(2,5) + \frac{1}{2}(9,8)(2,5)^2$ ✓ $= -44,375 \text{ m}$ Idistensi = $44,375 - 29,375$ ✓ $= 15 \text{ m}$ ✓
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## INDLELA 2

## Ibhola uA

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

$$v_f = -12 + (-9,8)(2,135)$$

$$v_f = 32,923 \text{ m} \cdot \text{s}^{-1}$$
, ukuya ezantsi

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

$$\Delta y = -32(2,5 - 2,135) + \frac{1}{2}(-9,8)(2,5 - 2,135)^2$$
 ✓

$$\Delta y = -12,6696 \text{ m}$$

## Ibhola uB

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

$$\Delta y = 9,08(2,5 - 2,135) + \frac{1}{2}(-9,8)(2,5 - 2,135)^2$$
 ✓

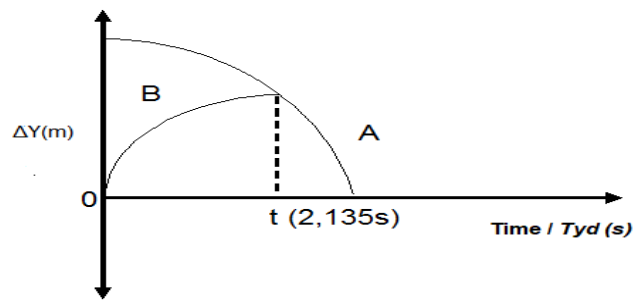
$$\Delta y = 2,66 \text{ m}$$

$$\text{idistensi} = 2,66 + 12,6696$$
 ✓

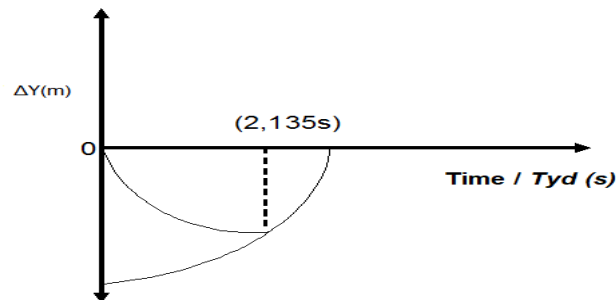
$$15,33 \text{ m}$$
 ✓



### 3.4 INDLELA 1 Ukuya phezulu phozithivu



### INDLELA 2 Ukuya phezulu negethivu



Indlela yegrafu	Amanqaku
Isheyiphu ngokwebhola uA de iyokufika kuziro pozishini	✓
Isheyiphu ngokwebhola uB de iyokufika kwi-intasekhshini yelayini yamaxesha. 2,135 s	✓
Ukubonisa ixesha u2,135 s	✓
Igrawundi engengo ziro pozishin (xa yonke into ichanekile): $\frac{2}{3}$	

(3)  
[12]

**UMBUZO 4**

4.1 Itotali liniya momentam ye-ayisolelyithedi sistim ihlala injalo/igciniwe

(2)

4.2 **Ngasekunene nguphozithivu**

$$\left. \begin{aligned} \Sigma p_i &= \Sigma p_f \\ (mv_i)_1 + (mv_i)_2 &= (mv_f)_1 + (mv_f)_2 \end{aligned} \right\} \text{Any one / Enige een } \checkmark$$

$$(5\,000)(15) + (2\,000)(-20) \checkmark = (5\,000)v_f + (2\,000)(5) \checkmark$$

$$v_i = 5 \text{ m} \cdot \text{s}^{-1} \checkmark$$

**Ngasekunxele nguphozithivu**

$$\left. \begin{aligned} \Sigma p_i &= \Sigma p_f \\ (mv_i)_1 + (mv_i)_2 &= (mv_f)_1 + (mv_f)_2 \end{aligned} \right\} \text{Any one / Enige een } \checkmark$$

$$(5\,000)(-15) + (2\,000)(20) \checkmark = (5\,000)v_f + (2\,000)(-5) \checkmark$$

$$v_i = -5 \text{ m} \cdot \text{s}^{-1}$$

Imagnityhudi yevelosithi =  $5 \text{ m} \cdot \text{s}^{-1} \checkmark$

(4)

4.3 **INDLELA 1**

$$\left. \begin{aligned} F_{\text{nethi}} \Delta t &= \Delta p \\ F_{\text{nethi}} \Delta t &= mv_f - mv_i \end{aligned} \right\} \text{Nayiphi na } \checkmark$$

$$F_{\text{nethi}} (0,4) \checkmark = (5\,000)(5) - (5\,000)(15) \checkmark$$

$$F_{\text{nethi}} = -125\,000 \text{ N}$$

$$F_{\text{nethi}} = \underline{125\,000 \text{ N Ukuya ngasekunene}} \checkmark$$

**INDLELA 2**

$$\left. \begin{aligned} F_{\text{net}} \Delta t &= \Delta p \\ F_{\text{net}} \Delta t &= mv_f - mv_i \end{aligned} \right\} \text{Ukuya ngasekunene } \checkmark$$

$$F_{\text{net}} (0,4) \checkmark = (2\,000)(-5) - (2\,000)(20) \checkmark$$

$$F_{\text{net}} = -125\,000 \text{ N}$$

$$F_{\text{net}} = \underline{125\,000 \text{ N Ukuya ngasekunene}} \checkmark$$

(4)  
[10]

**UMBUZO 5**

5.1 Ukuya ngasemva/ngasemva kwakhe ✓ (1)

5.2 Nyuthonz thed lo ✓ of mowushini  
Xa ibhodi yokuqala isebenzisa ifosi kwibhodi yesibini, ibhodi yesibini isebenzisa ifosi enemagnithyudi elinganayo ✓ kwidayirekhshini eophozithi kwibhodi yokuqala ✓. (3)

**5.3 INDLELA 1**

$$\left. \begin{aligned} W_{\text{nethi}} &= \Delta K \\ W_g + W_f &= \Delta K \end{aligned} \right\} \text{Nayiphi na } \checkmark$$

$$F_g \Delta x \cos \Theta + f \Delta x \cos \Theta = \Delta K$$

$$(57)(9,8)(4) \cos 180^\circ \checkmark + 40 \Delta x \cos 180^\circ \checkmark = \underline{0 - \frac{1}{2}(57)(6^2)} \checkmark$$

$$\Delta x = -30,21 \text{ m}$$

$$\sin \Theta = \frac{4}{30,21}$$

$$\Theta = 7,61^\circ \checkmark$$

**INDLELA 2**

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

$$40 \Delta x \cos 180^\circ \checkmark = \underline{(57)(9,8)(4) - (57)(9,8)(0)} \checkmark + \underline{\frac{1}{2}(57)(0)^2 - \frac{1}{2}(57)(6)^2} \checkmark$$

$$\Delta x = -30,21 \text{ m}$$

$$\sin \Theta = \frac{4}{30,21}$$

$$\Theta = 7,61^\circ \checkmark$$

(5)

**5.4 INDLELA 1**

$$\left. \begin{aligned} W_{\text{net}} &= \Delta K \\ W_T + W_g + W_f &= \Delta K \end{aligned} \right\} \text{Nayiphi na } \checkmark$$

$$(80)(5)(4) \cos 0^\circ \checkmark + \underline{(4)(9,8) \sin 30^\circ \cdot (5) \cos 180^\circ} \checkmark + (15)(5) \cos 180^\circ \checkmark$$

$$= \frac{1}{2}(4)v_f^2 - \frac{1}{2}(4)(3^2) \checkmark$$

$$v_f = 11,07 \text{ m} \cdot \text{s}^{-1} \checkmark$$

**INDLELA 2**

$$\left. \begin{aligned} W_{\text{nc}} &= \Delta U + \Delta K \\ W_T + W_f &= \Delta U + \Delta K \end{aligned} \right\} \text{Nayiphi na } \checkmark$$

$$(80)(5)(4) \cos 0^\circ \checkmark + (15)(5) \cos 180^\circ \checkmark =$$

$$\underline{(4)(9,8)(\sin 30^\circ)(5) - (4)(9,8)(0)} \checkmark + \underline{\frac{1}{2}(4)v_f^2 - \frac{1}{2}(4)(3)^2} \checkmark$$

$$v_f = 11,07 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(6)  
[15]

## UMBUZO 6

- 6.1 U (apharenti) kutshintsha kwefrikhwensi/pitshi ✓ ye (sawundi) weyivu eviwa yilisina xa kukho irelethivu mowushini phakathi kwelisina nesosi eyenza iisawundi weyivu ✓

(2)

6.2.1 IYANDA ✓

(1)

6.2.2 IYANCIPHA ✓

(1)

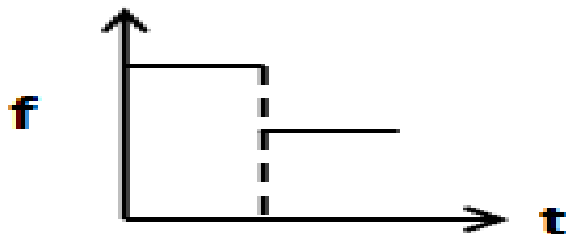
6.3  $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$  ✓ or  $f_L = \frac{v + v_L}{v} f_s$  ✓

$$f_L = \frac{330 + 30}{330 - 0} \times 1800$$

$$f_L = 1963,6 \text{ Hz}$$

(5)

6.4



### Indlela Yokumakisha

lileyibheli zee-ekhziz

✓

Ifrikhwensi ephezulu ekuqaleni

✓

Ifrikhwensi esezantsi ngokuya linyuka/lisanda ixesha

✓

(3)

- 6.5 Bhladiflowu mitha ✓ / Dopla flow mitha ✓

(1)

**[13]**

**UMBUZO 7**

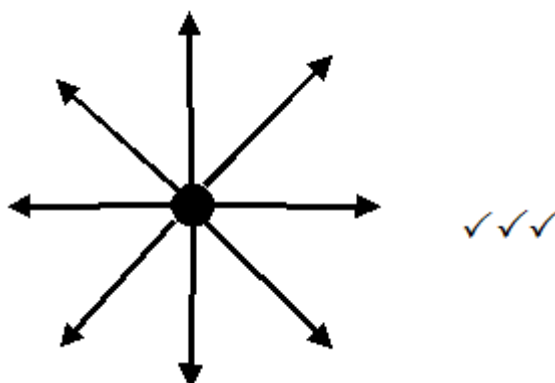
7.1 Ifosi ye-athrakhshini okanye iriphalzhini phakathi kweetshaji ezimbini idayirekhthli propowushinail kwiphrodakhthi yemagnityhudi yeetshaji ze ibe invesli prpopowushinali kwiskwe sedistensi phakathi kwazo (2)

7.2 Kuba  $uF_{K \text{ on } M} = noF_{G \text{ on } M} \checkmark$   
 $(F_{net})^2 = (F_{K \text{ on } M})^2 + (F_{G \text{ on } M})^2 \checkmark$   
 $(2,864 \times 10^{-6})^2 \checkmark = F^2 + F^2$   
 $F = 2,025 \times 10^{-6} \text{ N} \checkmark$  (4)

7.3  $F = \frac{kQ_1Q_2}{r^2} \checkmark$   
 $2,025 \times 10^{-6} \checkmark = \frac{9 \times 10^9 \times 6 \times 10^{-9} \times 6 \times 10^{-9} \checkmark}{(X)^2}$   
 $X = 0,4 \text{ m} \checkmark$  (4)  
**[10]**

## UMBUZO 8

8.1



(3)

Indlela yokumakisha	
Isheyiphu echanekileyo	✓
Idayirekhshini echanekileyo	✓
Iilayini ezifika/ezibamba kwitshaji kwaye zinganqumlani/khrosani	✓

8.2 Yi-elekhthrostatikhi fosi esetyenziswayo kwiphozothivu tshaji nganye ebekwe kuloopoyinti

(2)

8.3  $E_P = \frac{kQ_1}{r^2}$  ✓

$$E_P = \frac{9 \times 10^9 \times 200 \times 10^{-9}}{(0,2)^2} \quad \checkmark$$

$$E_P = 45\,000 \text{ N.C}^{-1} \text{ Ukuya ngasekunene}$$

$$E_Q = \frac{kQ_2}{r^2}$$

$$E_Q = \frac{9 \times 10^9 \times 200 \times 10^{-9}}{(0,4)^2} \quad \checkmark$$

$$E_Q = 11\,250 \text{ N.C}^{-1} \text{ ukuya ngasexele}$$

$$E_{\text{nethi}} = 45\,000 + (-11\,250) \quad \checkmark$$

$$E_{\text{nethi}} = 33\,750 \text{ N.C}^{-1} \text{ Ukuya ngasekunene} \quad \checkmark$$

(5)

**[10]**

**UMBUZO 9**

9.1 Ukuqinisekisa ukuqhubeleka kokujikeleza kwekhoyili ✓ (1)

9.2 (i) Tshintsha isosi yephothenshiyali diferensi ngelowudi  
(ii) Tshintsha ispliti ringi (khomyutheyitha) ngee (ezimbini) slip ringi (2)

9.3 
$$I_{\text{rms}} = \frac{I_{\text{max}}}{\sqrt{2}} \quad \checkmark$$
$$I_{\text{rms}} = \frac{0,54}{\sqrt{2}} \quad \checkmark$$
$$I_{\text{rms}} = 0,38 \text{ A}$$
$$P_{\text{ave}} = V_{\text{rms}} I_{\text{rms}} \quad \checkmark$$
$$60 = V_{\text{rms}} \times 0,38 \quad \checkmark$$
$$V_{\text{rms}} = 157,89 \text{ V} \quad \checkmark$$

(5)  
[8]

## UMBUZO 10

- 10.1 Iphothenshiyali diferensi idayirekthli propowushinali kwikharenti ✓ xa itempiritsha ihlala injalo/ingaguqukiyo ✓.

### OKANYE

Ireyshiyo yepothenshiyali diferensi kwikharenti ✓ Xa itempiritsha ihlala injalo ayiguquki/ihlala injalo ✓

(2)

10.2	<b>INDLELA 1</b> $P = \frac{V^2}{R}$ ✓ $13,5 = \frac{(18)^2}{R}$ ✓ $R = 24 \Omega$ ✓	<b>INDLELA 2</b> $P = VI$ ✓ $I_R = P/V = 13,5/18$ ✓ = 0,75 A $V = IR$ $R = V/I_R = 18/0,75 = 24 \Omega$ ✓
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(3)

10.3	<b>INDLELA 1</b> $R = \frac{V}{I}$ ✓ $24 = (18)$ ✓ $I = \frac{V}{R}$ $I = \frac{18}{24}$ $I = 0,75 A$ $R = \frac{V_P}{I_{12}}$ $12 = \frac{18}{I_{12}}$ $I_{12} = 1,5 A$ ✓ $I_{Totali} = 1,5 + 0,75 = 2,25 A$ ✓	<b>INDLELA 2</b> $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $\frac{1}{R_p} = \frac{1}{12} + \frac{1}{24}$ ✓ $R_p = 8 \Omega$ ✓ $V = IR_p$ $18 = I(8)$ ✓ $I = 2,25 A$ ✓
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(5)

- 10.4 I-inthenali reszistensi yi-ophozishini kwiflowu yetshaji ngaphakathi kwibhethri ✓✓/

(2)

- 10.5  $V_{10} = IR_{10}$  ✓  
 $V_{10} = 2,25 \times 10$  ✓  
 $V_{10} = 22,5 V$  ✓

(3)



10.6 **INDLELA 1**

$$V_1 = V_{\text{ext}}$$

$$V_1 = V_P + V_{10}$$

$$V_1 = 18 + 22,5 \checkmark$$

$$V_1 = 40,5 \text{ V}$$

$$\text{Xa iswitshi ivuliwe iemfu} = 45,9 \text{ V}$$

$$\text{I'losti volthi' ingu: } V_{\text{losti}} = \text{emf} - V_{\text{ext}} = 45,9 - 40,5 \checkmark = 5,4 \text{ V}$$

$$r = \frac{V_L}{I} \checkmark$$

$$r = \frac{5,4}{2,25} \checkmark$$

$$r = 2,4 \Omega \checkmark$$

**INDLELA 2**

$$\text{Emfu} = I (R + r) \checkmark$$

$$45,9 \checkmark = (2,25) (8 + 10 + r) \checkmark$$

$$r = 2,4 \Omega \checkmark$$

$$\begin{aligned} \frac{1}{R_p} &= \frac{1}{r_1} + \frac{1}{r_2} \\ \frac{1}{R_p} &= \frac{1}{12} + \frac{1}{24} \checkmark \\ R_p &= 8 \Omega \end{aligned}$$

(5)

10.7 **Iyanda**

(1)

**[21]**

**UMBUZO 11**

11.1  $c = f \times \lambda$  ✓

**Yamkela**  $v = f \lambda$

$3 \times 10^8 = f \times 229 \times 10^{-9}$  ✓

$f = 1,31 \times 10^{15} \text{ Hz}$  ✓ (3)

11.2 Ithresholdi frikhwensi ✓ (1)

11.3 Iwekhi fankhshini ngowona mlinganiselo umncinci we-eneji efunekayo ukijekhtha ielekhthroni ukusuka kwisafeeyisi yesolidi enikiweyo, kudla ngokuba yimethali. ✓✓ (2)

11.4  $E = W_o + E_{k(\text{makhz})}$  ✓

$hf = W_o + \frac{1}{2} mv^2$

$6,63 \times 10^{-34} \times f$  ✓ =  $(6,63 \times 10^{-34} \times 1,31 \times 10^{15}) + \frac{1}{2} (9,11 \times 10^{-31}) (1,57 \times 10^6)^2$  ✓

$f = 3 \times 10^{15} \text{ Hz}$  ✓ (4)

11.5 **IYANDA** ✓

Ukuncipha kweweyivulenti kwenza ukuba ifrikhwensi yande. ✓ Iwekhi fankhshini iyanda. ✓

**Okanye**

$W_o \propto \frac{1}{\lambda_o}$  ✓

(3)

[13]

**AMANQAKU XA EWONKE: 150**