



Province of the  
**EASTERN CAPE**  
EDUCATION



# **NATIONAL SENIOR CERTIFICATE**

**IBANGA 12**

**SEPTEMBER 2023**

**IFIZIKHALI SAYENSIZ P1**

**AMANQAKU: 150**

**IXESHA: 3 iiyure**

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Eli phepha lemibuzo linamaphepha ayi19, kuquka needatha shiti ezi 3.

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**IMIYALELO NEENKCUKACHA**

1. Bhala igama nefani yakho kwizithuba ezilungele oko KWINCADI YAKHO YOKUPHENDULELA.
2. Phendula YONKE imibuzo kweli phepha.
3. Uvumelekile ukusebenzisa ikhaltyhuleyitha engafakwanga lwazi.
4. Uvumelekile ukusebenzisa imathematical instruments.
5. Nambarisha iimpendulo zakho NGQO ngale Ndlela imibuzo yakho inambarishwe ngayo.
6. Uyacetyiswa ukuba uyisebenzise IIDATHA SHITHI ezincanyathiselwe ngasemva kweli phepha.
7. Bonakalisa ZONKE iifomyula nee SABSTITYUSHINI kuzo ZONKE iikhaltyhuleyishini.
8. Xhasa okanye unike ingxoxwana, njalo-njalo kuloombuzo ifuna oko.
9. Iimpendulo yakho yokugqibela yezibalo yishiye kwi desimali pleysizi EZIMBINI.
10. Qala umbuzo ngamnye KWIPHEPHA ELITSHA kwincwadi yakho yeempendulo.
11. Imizobo AYENZIWANGA ngokomlinganiselo (scale).
12. Bhala ngokucekileyo nangokucacileyo.

**UMBUZO 1: UKHETHO-XUBO MIBUZO**

Unikwe iimpendulo ezahlukeneyo kule mibuzo ilandelayo. Khetha impendulo echanekileyo uze ubhale kuphela unobumba (A–D) ecaleni kwenombolo yombuzo (1.1 ukuya ku 1.10) kwincwadi yakho yempendulo, umzekelo 1.11 E.

1.1 YEYIPHI ikhwantithi kwezi zilandelayo eyimezha yeineshiya yebhodi?

A Iakhselereyishini

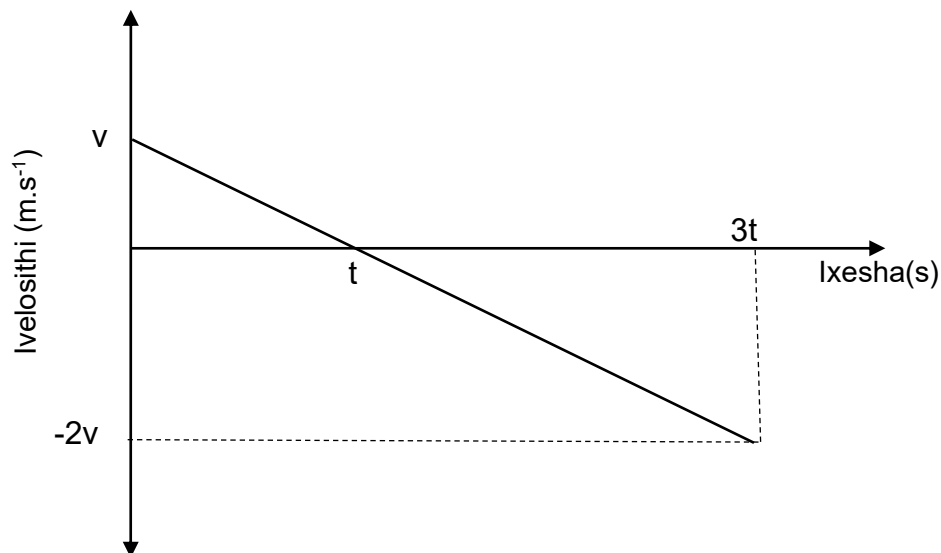
B Ieneji

C Ivelosithi

D Iimesi

(2)

1.2 Igrafu ivelosithi vesaz ixesha engezantsi imele imowushini yeobjekhthi xa isiva igravitheyishinali fosi kuphel.



Idispleyisimenti yeobjekhthi ngexesha  $3t$  ingu ...

A  $vt$ .

B  $-vt$ .

C  $\frac{-3}{2} vt$ .

D ziro.

(2)

- 1.3 ii-ebhegi zingamkhusela umqhubi ekulimaleni kakhulu xa kusenzeka ikholizhini. YEYIPHI kwezi zilandelayo iindibanisela kwitheyibhile eyona icacisa nzulu i-ifekthi eyenziwa zii-ebhegi kwixesha lekhontakhthi nakwinethi fosi esebenza kumqhubi ngexesha lekholizhini necacisa uba kutheni umqhubi ekhuseleke ngokungaphaya ekulimaleni?

	<b>IXESHA LEKHONTAKHTHI</b>	<b>NETHI FOSI</b>
A	Iyanda	Iyanda
B	Iyanda	Iyancipha
C	Iyancipha	Iyanda
D	Iyancipha	Iyancipha

(2)

- 1.4 Iobhjekhthi iphoswe phezulu ngokukavethikhali ukusuka phantsi ukuyofika kweyona hayithi iphezulu. SESIPHI esona siteyithimenti sichanekileyo kwezi zilandelayo ngokubhekiselele ekuhambeni kweobhjekhthi ukusuka phantsi ukuya kwihayithi u*h*? Ungayinanzi ifrikhshini yomoya.

- A Imekhanikhali eneji yeobhjekhthi kwihayithi u*h* inguziro
- B Itsheyinji kwikhayinethikhi eneji yeobhjekhthi inguziro
- C Ilosi kwikhayinethikhi eneji yeobhjekhthi ilingana negeyini kwi Igravitheyshinal phothenshiyali eneji yeobhjekhthi
- D Work done kwiobhjekhthi ilingana noziro

(2)

- 1.5 Ifosi yegravitheishinali athrakhshini *kumhlaba* inkulu ngokuphindaphindene kayi 6 kunaleyo ekwinyanga. Isizathu sesokuba:

- A Inyanga ayinawo amanzi kwisafeyisi yayo
- B Imesi nerediyasi zommhlaba zinkulu kunezo zenyanga.
- C Imesi yomhlaba yiyo kuphela eekulu kuneyenyanga.
- D Irediyasi yomhlaba yiyo kuphela eekulu kunerediyasi yenyanga.

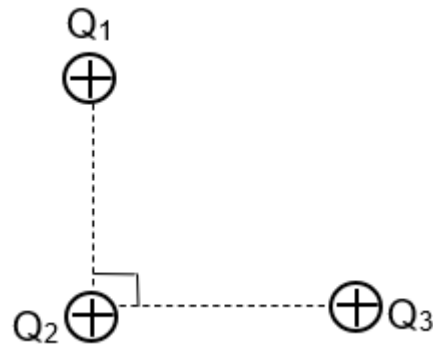
(2)

- 1.6 Iobhzeva ihamba ngesipidi esingaguqukiyo iyemka kwisosi yesawundi emileyo, iqaphela ukuba ipitshi yeesawundi weyvu iyancipha. Okukuncipha kwenziwa kukuba kwenzeka le ilandelayo.

	<b>IWEYIVULENTH</b>	<b>IFRIKWHWENSI</b>
A	Iyanda	Iyancipha
B	Iyancipha	Ayitshintshi
C	Iyanda	Iyanda
D	Iyancipha	Iyanda

(2)

- 1.7 lipoyinti tshaji ezintathu eziphozithivu ezifanayo, u $Q_1$ , u $Q_2$  no  $Q_3$  zibekwe njengokubonakalisiwe kwidayagram engezantsi.

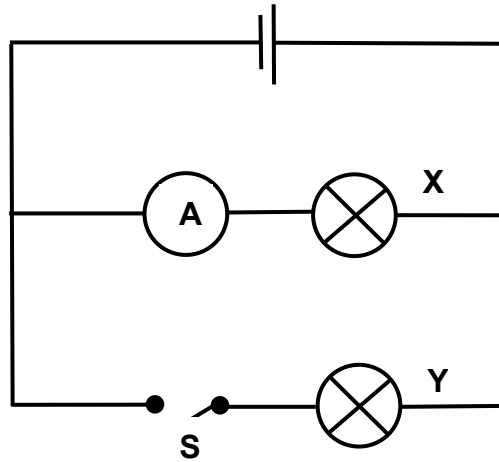


YEYIPHI kwezi dayagram zilandelayo echanekileyo ebonisa iNETHI elekhthrostatikhi fosi eviwa yitshaji u  $Q_2$ ?

A		B	
C		D	

(2)

- 1.8 Kwidayagram yesekethe engasezantsi, ilayithi bhalbhu uX no Y ziyafana. Iswitshi uS ivuliwe.



Iswitshi uS ngoku ivaliwe.

Yeyiphi indibanisela kwezi zingezantsi eyona icacisa utshintsho kwi totali rezistensi. Yesekethe neridingi yeamitha xa iswitshi uS ivaliwe?

	ITOTALI RESISTENSI	IRIDINGI YEAMITHA
A	Iyanda	Iyancipha
B	Iyanda	Ayitshintshi
C	Iyancipha	Iyanda
D	Iyancipha	Ayitshintshi

(2)

- 1.9 Ilempu ikonekhthwe kwi AC jenereyitha, ilayita ngebhraythnesi fanayo naxa ikonekhthwe kwi DC jenereyitha ikhupha iphothensshiyali diferense engu Y volts. Iphawa esetyenziwe yilamp xa ikonekhthwe kwi AC jenereyitha ilingana no ...

A  $\frac{Y}{\sqrt{2}} (I_{\text{makhs}}).$

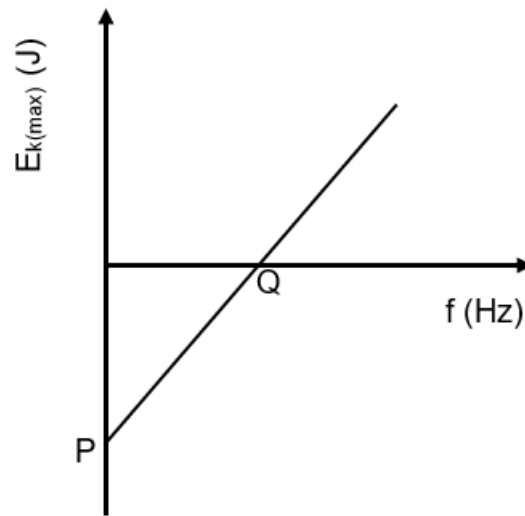
B  $\frac{1}{2} I_{\text{makhs}} (Y).$

C  $I_{\text{makhs}} (Y).$

D  $\frac{Y}{\sqrt{2}} (I_{\text{rms}}).$

(2)

- 1.10 Igrafu engezantsi ibonisa irileyishinshipu phakathi kwemakhzimam khayinethikhi eneji yeefotoelectroni ezikhutshiweyo kunye frikhwensi yeinsident fothoni.



Ziintoni eboniswa zii intasephth uP noQ kwigrafu?

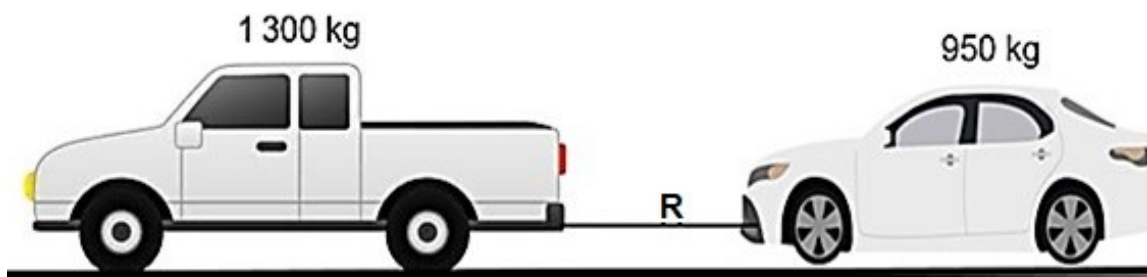
	I-INTASEPHTH P	I-INTASEPHTH Q
A	Plankiz khonstent	Thresholdi frikhwensi
B	Thresholdi frikhwensi	Wekhi fankhshini
C	Wekhi fankhshini	Thresholdi frikhwensi
D	Thresholdi frikhwensi	Planck's constant

(2)  
[20]

**UMBULO 2**

Ithrakhi enemisi engu 1 300 kg ikonekthwe kwimoto enemisi engu 950 kg ngerowuphu engandisekiyo, engenemesi, uR, itasla le moto kwindlela engqalileyo ehorizontali erhabaxa. Injini yethrakhi isebenza ifosi engu 9 000 N ukuhambisa indibanisela yethrakhi nemoto ukuya ngasekhohlo njengoko kubonisiwe ngezantsi. Ithrakhi ifumana ifrikshinal fosi engatshintshiyo engu 3 500. Ithrakhi nemoto zihamba ngevelosithi ENGATSHINTSHIYO.

Ungayinanzi iroteyshinali efekhthi yamavili.



- 2.1 Umfundi uthi ukuba ithrakhi ima ngesaquphe, imoto izoqhubeleka nggesipidi esingatshintsiyo.  
Yeyiphi ifiziks lwe esetyenziswe ngumfundi ukwenza lenkcaza? (1)
- 2.2 Zoba ifree-body dayagram eleyibhelishiweyo yazo zonke iifosi ezisebenza kwitrakhi (5)
- 2.3 Khaltyhuleyitha i:
  - 2.3.1 Thenshini kwirowuphu ekonekthwa itrakhi nemoto (3)
  - 2.3.2 Ikhoefishiyenti yekhayinethikhi frikhshini phakathi kwemoto nendlela (4)
- 2.4 Irowuphu ephakathi kwetrakhi nemoto iqhawuka ngesaquphe imoto iqhubeleka ukuya ngasekhohlo. Phambi kokuba ime.  
Khaltyhuleyitha imagnityhudi ye akhselereyishini yemoto emva kokuqhawuka kwerowuphu. (3)

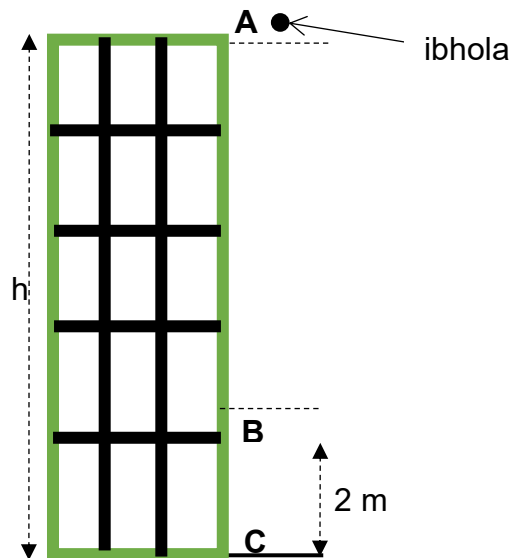
**[16]**



**UMBUZO 3**

Igruphu yabafundi yenza iekhsperiment ukufumana ihayithi  $uh$  yesakhiwo sesikolo sabo. Bawisa ibhola yetenisi ukusuka kwipoyinti u**A** ekungqameko lophahla lwendlu yesikolo njengoko kubanakalisiwe kwidayagram ngasezantsi. Ipoyinti u **B** ukwi 2 m ukusuka phantsi kwaye ibhola ithatha i 0,125 s ukugqiba umgama ukusukka kwipoyinti u**B** ukuya phantsi (ipoyinti u**C**).

Ungayinanzi ifrikhshini yomoya.



3.1 Bhala imagnityhudi yereyithi of tsheyinji yevelosithi yebhola. (1)

3.2 Khaltyhuleyitha i:

3.2.1 Hayithi,  $uh$ , yesakhiwo sesikolo (5)

3.2.2 Ixesha elithathwa yibhola ukufika phantsi (4)

3.2.3 Ivelosithu ebetha ngayo phantsi ibhola (3)

3.3 Zoba igrafu pozishini vesaz thayim ebonisa imowushini yebhola ukusuka ekuphosweni kwayo ide iyobetha phantsi. Sebenzisa:

Bonisa oku kulandelayo kwigrafu:

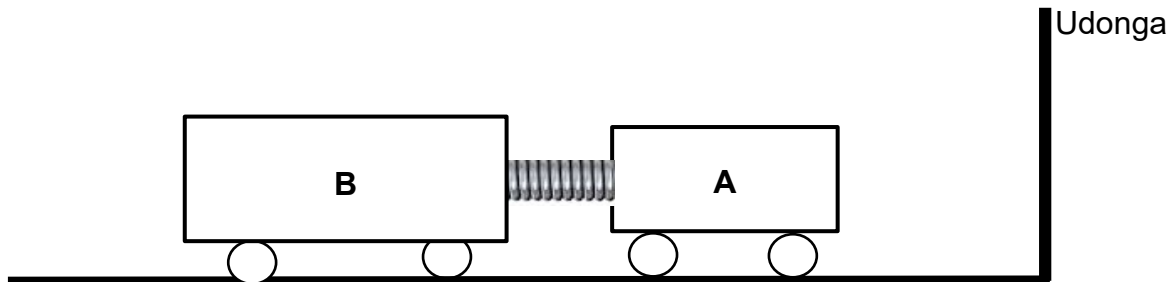
- Ihayithi ebiphoswe isuka kuyo ibhola
- Ixesha ebethe ngalo phantsi ibhola

(3)  
**[16]**

**UMBUZO 4**

litroli ezimbini, u**A** onemesi engu 1 kg, no **B** onemesi engu 2 kg, zigcinwe zimile kwisafeyisi egudileyo ehorizontali ngesipringi esifinyeziweyo phakathi kwazo, njengoko ibonisa idayagram engezantsi. Isipringi sikhululiwe sawa phantsi. Itroli u**A** uya ngasekunene ngevelosithi engatshintshiyo engu  $5,0 \text{ m} \cdot \text{s}^{-1}$  angqubane nodonga.

Thatha ngoba yiayisolelyithedi sistimu.

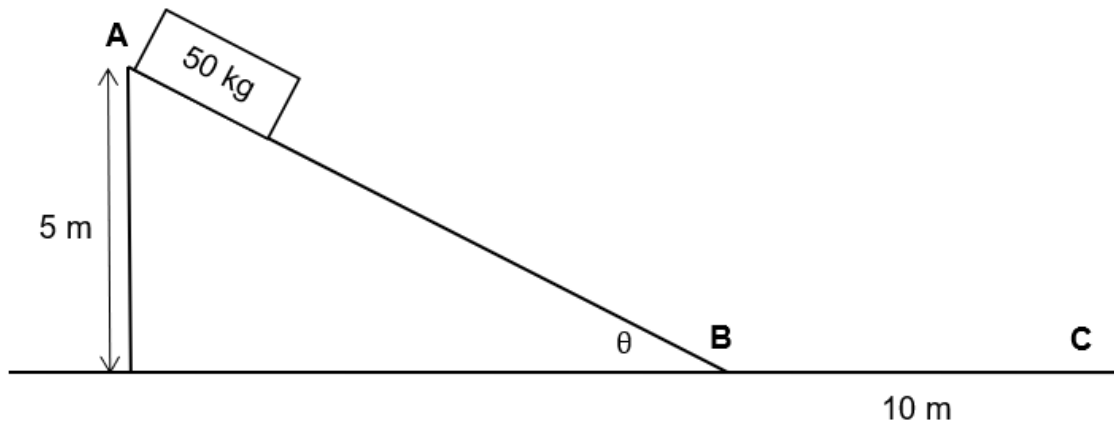


- 4.1 Chaza igama *ayisolelyithedi sistimu*. (2)
- 4.2 Khaltyhuleyitha ivelosithi yekhathi u**B** kanye emva kokukhululwa kwesipringi. (4)
- 4.3 Iavereyiji fosi esetyenziswe ludonga kwitroli u**A** ingu 80 N kwaye ikholizhini yetroli nodonga ihlala i 0,5 s.
- Khaltyhuleyitha ivelosithi eshiye ngalo udonga itroli u**A**. (4)
- 4.4 Umfundi uthi ikholizhini yetroli u**A** kunye nodonga i-inelastikhi. Cacisa ngokufutshane uinelastikhi kholizhini uthetha ukuthini. (2)

**[12]**

**UMBUZO 5**

Ikhreyithi enemesi engu 50 kg imile kwipoyinti **A** ekwihayithi evethikhali engu 5 m ngasentla ukusuka kwisafeyisi ehorizontali. Isafeyisi ethambekileyo yenza iengile engu  $\theta$  ukusuka kuhorizontal, njengoko idayagram engezantsi ibonisa. Xa ikhreyithi iyekwa, iyatyibilika isihla kumthambeko iyofika kwipoyinti u**B** ngesipidi u  $8 \text{ m}\cdot\text{s}^{-1}$ . Umthambeko usebenzisa ifrikhshinali fosi engatshintshiyo engu 72 N kwikhreyithi ngexesha ityibilika ukusuka kwipoyinti u**A** ukuya ku**B**.



5.1 Chaza iwekhi-eneji thiyoremu ngamagama. (2)

5.2 Sebenzisa ieneji phrinsipli ukukhaltyhuleyitha iengile u $\theta$ . (6)

Emva kokudlula upoyinti **B**, ikhreyithi ityibilika kwisafeyisi erhabaxa ehorizontali, iyoma kwi poyinti u**C**, ekumgama we 10 m ukusuka kupoyinti **B**.

5.3 Zoba ifree-body dayagram ebonisa zonke iifosi ezisebenza kwikhreyithi ngexesha isuka ku **B** isiya ku **C**. (3)

5.4 Khaltyhuleyitha iwekhi dani eyenziwe yifrikhshishinali fosi ukumisa ikhreyithi. (4)

**[15]**

**UMBUZO 6**

Iveni yamapolisa enesayireni evuliweyo, ihamba ngesipidi esingatshintshiyo phakathi kwee-obzeva u**A** no**B**. Iobzeva u**A** idithekhtha isawundi enefrikhwensi engu 545 Hz esuka kwisayireni, ngaxesha-nye iobzeva u**B** idithekhtha ifrikhwensi engu 615 Hz.

6.1 Chaza iDopla ifekthi ngamagama. (2)

6.2 Iya ngakweliphi iveni yamapolisa?

Khetha ku IYA NGAKU OBZEVA u**A** okanye IYA NGAKU OBZEVA u**B**.

Nika isizathu sempendulo yakho. (2)

6.3 Iasipindi sesawundi emoyeni ngu  $343 \text{ m}\cdot\text{s}^{-1}$ . Khaltyhuleyitha frikhwensi yesayireni. (7)

6.4 Izipekhtral layini zegesi ethile ezisuka kwiinkwenkwezi ezikude zibonakala zine redi shifti. Cacisa leobzeveyishini ngokubhekiseleleki MOTION OF THE STAR kunye NEFRIKHWENSI yezspektral layini. (2)  
**[13]**

**UMBUZO 7**

lipoyinti tshaji ezimbini, uP noT, zibekwe ku 0,03 m ukusuka kwenye ukuya kwenye. Itshaji kuP ingu  $+36 \times 10^{-6} \text{ C}$  yena ke uT uthwele itshaji engu  $16 \times 10^{-6} \text{ C}$  ESAYINI YAYO INGAZIWAYO.



- 7.1 Chaza iKhulombz lo ngamagama. (2)
- 7.2 Zoba ielekhthriki fildi pateni ejikeleze itshaji ephozithivu. (3)
- 7.3 Khaltyhuleyitha imagnityhudi yefosi esetyenziswe zizifiye uP noT esinye kwesinye. (3)

Xa itesti tshaji ibekwe kupoyinti X, kwidistensi u r m ukuya ngasekunene kuka tshaji uT njengoko kubonisiwe kwidayagram engezantsi, itesti tshaji ihlala IMILE.

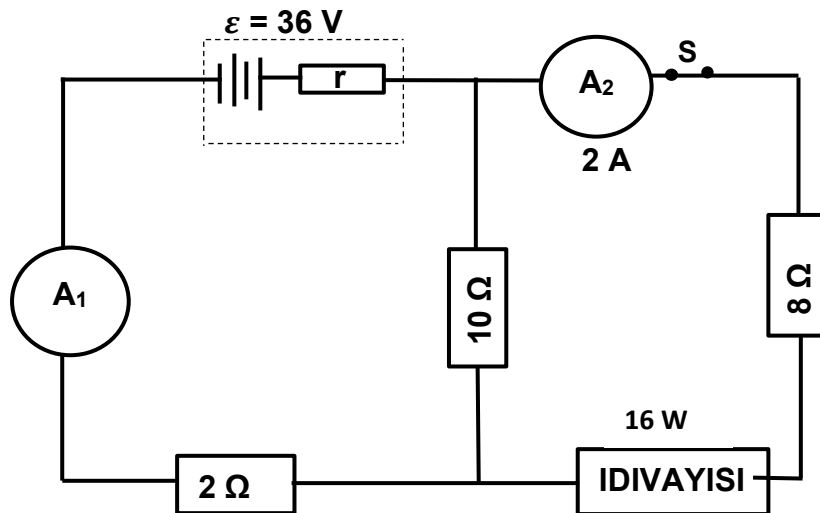


- 7.4 Bhala isayini yetshaji ka T (POSITHIVU or NEGITHIVU). Cacisa impendulo yakho. (3)
- 7.5 Khaltyhuleyitha idistensi u r. (5)

**[16]**

### UMBUZO 8

Irezista ezintathu nedivayisi yombane ereyithwe u 16 W zikonekhthwe ukuya kwibhethri ene-emfu engu 36 V ne-inthenali rezistensi engaziwayo u  $r$ , njegoko kubonakalisiwe kwi sekethi dayagram engezantsi. Iametha u  $A_2$  urida u 2 A xa iswitshi  $S$  ivaliwe.



8.1 Chaza igama *emf yebhetri*. (2)

8.2 Khalityhuleyitha i:

8.2.1 rezistensi yedivayisi yombane (3)

8.2.2 kharienti edlula kwibhetri (5)

8.2.3 inthenali rezistensi yebhetri (6)

8.3 Iswitshi u  $S$  ngoku ivuliwe. Izakuchaphazeleka njani iridingi kwiametha u  $A_1$ ?

Khetha ku IYANDA, IYANCIPHA okanye IHLALA INJALO.

Cacisa impendulo yakho.

(2)  
[18]

**UMBUZO 9**

Iphawa steyishini yekhowuli isebenzisa iiAC jenereyitha ukuvelisa umbane.

- 9.1 Chaza ieneji khonvezhini eyenzeka kwijenereyitha. (2)
- 9.2 Zoba isiketshi grafu ye emf evelisiweyo vesaz ixesha yeesayikile ezipheleleyo ezimbini ze AC jenereyitha. (2)
- 9.3 Lolithaneyithingi kharenti isetyenzisa ukuhambisa umbane imigama emide. Nika isizathu sokuba kukhethwe iAC kune DC ukuhambisa umbane imigama emide. (1)
- 9.4 Iketile yombane iphawulwe 220 V. Yintoni eboniswa ngu 220 V? (1)
- 9.5 IAC jenereyitha ethile ivelisa iphikhi kharenti engu 6,25 A xa ikonekhthwe kwi ketile yombane enerezistensi engu 45  $\Omega$ .

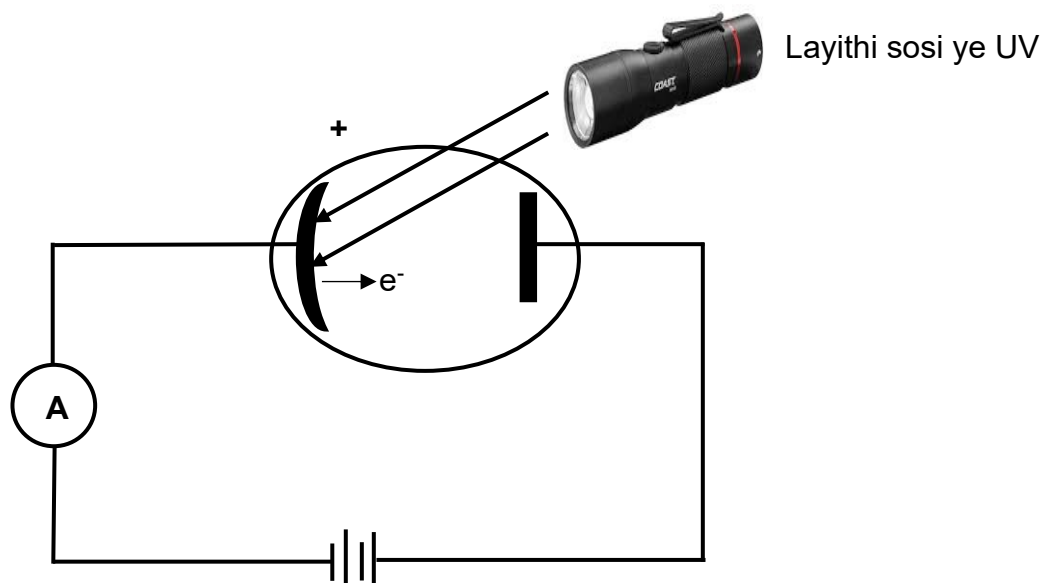
Khalityhuleyitha i:

- 9.5.1 Root mean square (rms) kharenti (3)
- 9.5.2 Iavareyiji phawa esetyenziswe yiketile xa ikonekhthwe kulejenereyitha. (3)

**[12]**

## UMBUZO 10

I-investigeyishini yenziwe ukufumanisa i-*ifekthi yephawa* ye layithi bhalbhu kwikharanti eyenziwe kwifofo-elekhthrikseli. Iapharathas esetyenziswe kule investigeyishini ibonisiwe kwidayagrama eyenziwe lula engezantsi. Ilayithi ye althravayoethi eneweyivulenthini engu 490 nm ekhutshwe ziilayithi bhalbhu ezimbini u**A** no**B** itsoliswe kwikathodi kwifofo-elekhthrikseli kwamezharishwa imakhzimam spidi sefofoelekhthroni.



Iziphumo zeinvestigeyishini ziboniswe kwitheyibhile engezantsi.

BHALBHU	IPHAWEA YELAYITHI BHALBHU	IMAKHZIMAM SIPIDI SEEFOTO-ELEKHTHHRONI
<b>A</b>	100 W	$7,5 \times 10^5 \text{ m} \cdot \text{s}^{-1}$
<b>B</b>	200 W	$7,5 \times 10^5 \text{ m} \cdot \text{s}^{-1}$

10.1 Cacisa nzulu igama *ifofoelekhtrikhi ifekthi*. (2)

10.2 Chaza ngokufutshane ukuba kutheni iphawa yeelayithi bhalbhu ingenampembelelo kwimakhzimam spidi seefofoelekhroni esikhutshiweyo. (2)

10.3 YEYIPHI ilayithi bhalbhu, u**A** okanye u**B**, ezokhupha eyona ridingi inkulu kwiametha?  
Cacisa impendulo yakho. (2)

10.4 Khaltyhuleyitha i:

10.4.1 Eneji yeefothoni zealthravayoethi (3)

10.4.2 Wekhifankshini yemethali khathodi (4)

[13]

AMANQAKU EWONKE: 150



**IDATA FIZIKALI SAYENSIZ YEENZULULWAZI IBANGA LE 12**

**IPHEPHA 1 (FIZIKHSI)**

**ITHEYIBHILE 1: IIFIZIKHALI KHONSTENTI**

IGAMA	ISIMBOLI	IVELYU
Akhselereyshini ye gravithi	$g$	$9,8 \text{ m}\cdot\text{s}^{-2}$
Iyunivesal gravitheyshinali khonstenti	$G$	$6,67 \times 10^{-11} \text{ N}\cdot\text{m}^2\cdot\text{kg}^{-2}$
Ispidisantya se litha kwi vakhthym	$c$	$3,0 \times 10^8 \text{ m}\cdot\text{s}^{-1}$
IPlankiz khonstenti	$h$	$6,63 \times 10^{-34} \text{ J}\cdot\text{s}$
IKhulombz khonstenti	$k$	$9,0 \times 10^9 \text{ N}\cdot\text{m}^2\cdot\text{C}^{-2}$
Itshaji ye-elektroni	$e$	$-1,6 \times 10^{-19} \text{ C}$
Imesi ye-elektroni	$m_e$	$9,11 \times 10^{-31} \text{ kg}$
Imesi yomhlaba	$M$	$5,98 \times 10^{24} \text{ kg}$
Ireyidiyasi yomhlaba	$R_E$	$6,38 \times 10^3 \text{ km}$

**ITHEYIBHULI 2: IIFOMYULA**

**IMOWUSHINI**

$v_f = v_i + a \Delta t$	$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$ okanye $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ okanye $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left( \frac{v_i + v_f}{2} \right) \Delta t$ okanye $\Delta y = \left( \frac{v_i + v_f}{2} \right) \Delta t$

**IFOSI**

$F_{\text{net}} = ma$	$p = mv$
$f_{s,\text{makhs}} = \mu_s N$	$f_k = \mu_k N$
$F_{\text{net}} \Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm_1m_2}{d^2}$	$g = G \frac{M}{d^2}$

**WEKHI, ENJI NEPHAWA**

$W = F \Delta x \cos \theta$	$U = mgh$ okanye $E_p = mgh$
$K = \frac{1}{2}mv^2$ okanye $E_k = \frac{1}{2}mv^2$	$W_{\text{nett}} = \Delta K$ okanye $W_{\text{nett}} = \Delta E_k$ $\Delta K = K_f - K_i$ okanye $\Delta E_k = E_{kf} - E_{ki}$
$W_{\text{nc}} = \Delta K + \Delta U$ okanye $W_{\text{nc}} = \Delta E_k + \Delta E_p$	$P = \frac{W}{\Delta t}$
$P_{\text{ave}} = Fv$	

**IWORK, IENEJI NEPHAWA**

$v = f \lambda$	$T = \frac{1}{f}$
$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ $f_L = \frac{v \pm v_L}{v \pm v_b} f_b$	$E = hf$ okanye $E = h \frac{c}{\lambda}$
$E = W_0 + E_{k(\text{makhz})}$ apho $E = hf$ kwaye $W_0 = hf_0$ kwaye $E_{k(\text{makhz})} = \frac{1}{2}mv_{\text{makhs}}^2$ okanye $K_{(\text{makhz})} = \frac{1}{2}mv_{\text{makhz}}^2$	

**IELEKHTHROSTATIKI**

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{kQ}{r^2}$
$V = \frac{W}{q}$	$E = \frac{F}{q}$
$n = \frac{Q}{q_e}$	

**IISEKETHE ZOMBANE**

$R = \frac{V}{I}$	$\text{emf } (\mathcal{E}) = I(R + r)$
$R_s = R_1 + R_2 + R_3 + \dots$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$	$Q = I\Delta t$
$W = Vq$ $W = VI\Delta t$ $W = I^2 R \Delta t$ $W = \frac{V^2 \Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$  $P = I^2 R$ $P = \frac{V^2}{R}$

**OLTHANEYITHINGI KHARENTI**

$I_{\text{rms}} = \frac{I_{\text{makhz}}}{\sqrt{2}} \quad / \quad I_{\text{wgk}} = \frac{I_{\text{maks}}}{\sqrt{2}}$  $V_{\text{rms}} = \frac{V_{\text{makhz}}}{\sqrt{2}} \quad /$  $V_{\text{wgk}} = \frac{V_{\text{makhz}}}{\sqrt{2}}$	$P_{\text{av erey iji}} = V_{\text{rms}} I_{\text{rms}} \quad / \quad P_{\text{gemiddeld}} = V_{\text{wgk}} I_{\text{wgk}}$  $P_{\text{av erey iji}} = I_{\text{rms}}^2 R \quad / \quad P_{\text{gemiddeld}} = I_{\text{wgk}}^2 R$  $P_{\text{av erey iji}} = \frac{V_{\text{rms}}^2}{R} \quad / \quad P_{\text{gemiddeld}} = \frac{V_{\text{wgk}}^2}{R}$
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