



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

SEHLOPHA SA 12

LOETSE 2021

THUTO YA TSA MAHLALE P1

MATSHWAO: 150

NAKO: dihora tse 3

Pampiri ena e na le maqephe a 19 le datha shiti tse 3.

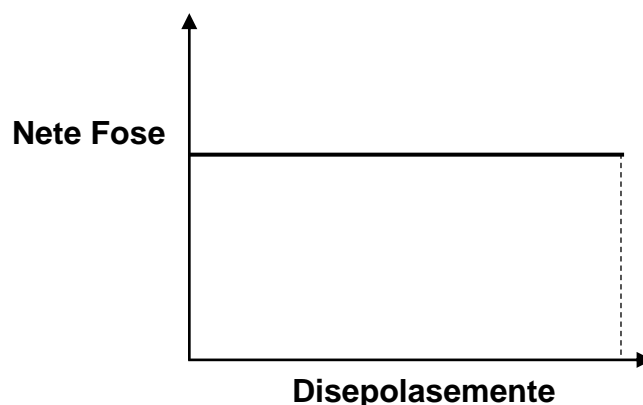
DITAELO LE TLHAISO-LESEDING

1. Ngola LEBITSO le FANE ya hao sebakeng se nepaahetseng BUKENG YA HO ARABELA.
2. Pampiri ena e na le dipotso tse LESHOME. Arabela dipotso tsohle BUKENG YA HO ARABELA.
3. Qala potso KA NGWE leqepheng LE LETJHA BUKENG YA HO ARABELA.
4. Nomora dikarabo ka nepo jwalo ka ha ho entswe pampering ena ya dipotso.
5. Siya mola O LE MONG dipakeng tsa dipotswana tse pedi, mohlala, dipakeng tsa POTSO YA 2.1 le POTSO YA 2.2.
6. O ka sebedisa sesebediswa sa ho bala (calculator) se sa porokerengwang
7. O ka sebedisa dihlobo tse nepahetseng tsa dipalo.
8. Bontsha diforomo TSOHLE le tsela eo di kenyelletsweng ka yona lipalong TSOHLE.
9. QETELLONG, Phethela dikarabo tsa hao ka ho sebedisa bonnyane dinomoro TSE PEDI tsa di desimali.
10. Fana ka lebaka, tlhaloso, le tse ding ka bokgutshwanyane moo ho hlokehang.
11. O eletswa ho sebedisa DI DATHA SHITI tse hokelletsweng.
12. Ngola ka makhetha le ka mongolo o balehang.

POTSO YA 1: DIPOTSO TSA KGETHO

O filwe dikgetho tse fapaneng ele dikarabo tse ka kgonehang tse latelang. Kgetha Karabo e be o ngola feela tlhaku (A–D) pela nomoro ya potso (1.1 ho isa ho 1.10) BUKENG YA HO ARABELA. MOHLALA 1.11 E.

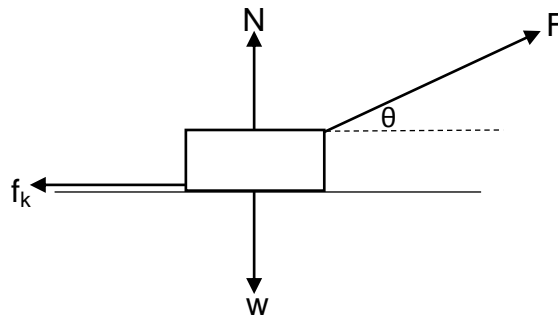
- 1.1 Imphalese e fitiswang ke nete fose e etsahalang ho ntho e lekana le ...
- A momentamo wa ntho wa qalo.
 - B Momemtamo wa ntho wa qetelo.
 - C Ho fetoha ha momemtamo wa ntho.
 - D Sekgahla sa phetoho ya momentamo ya ntho. (2)
- 1.2 Kerafo e latelang e ka tlase e bontsha kamano dipakeng tsa nete fose e sebedisitsweng ho ntho le disepolasemente e enkileng. Fose le disepolasemente di ya nqa e le ngwe.



Ke efe ele NGWE ho di polelo tse latelang e hlalosang se kerafong?

- A Sebaka se dipakeng tsa kerafo le disepolacemente akisise e emetse nete weke (*network*) e entsweng ke fose.
- B Sebaka se dipakeng tsa kerafo le disepolacemente akisise se emetse phawara (*power*) e senyehang ka ho susumetswa ke fose.
- C Moepa wa kerafo o emetse ho fetoha ha matla a kaenetiki ya ntho.
- D Moepa wa kerafo o emetse mosebetsi o entsweng ke fose. (2)

- 1.3 Setshwantsho se latelang se bontsha di fose tse etsahalang ho ntho e hulwang ho ya ka ho le letona ke fose F e etsahalang enkeleng θ e motsitsong.



Ke e fe e le NNGWE ho tse latelang dikemedi tse ka sebediswang ho fumana boholo ba kaenetiki forikishinale fose (f_k) e etsahalang ho ntho.

A $\mu(w + F\sin\theta)$

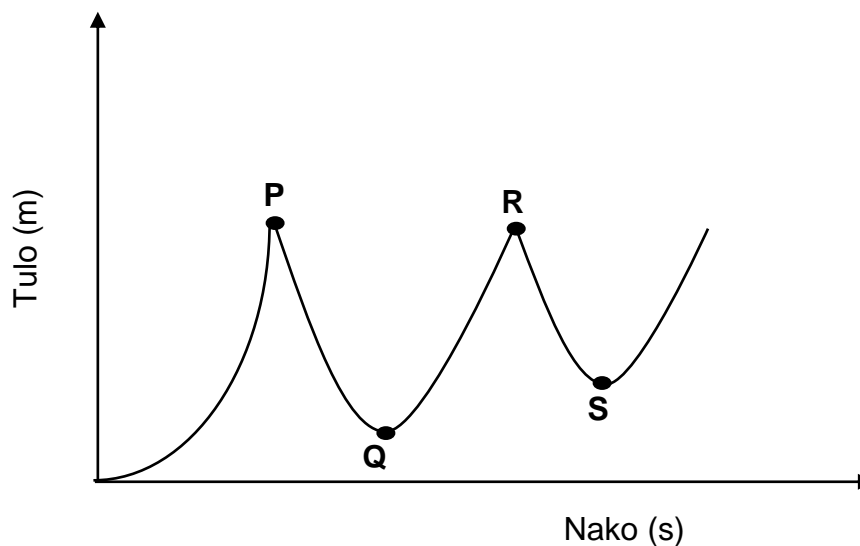
B $\mu(w - F\sin\theta)$

C $\mu(N - w)$

D μw

(2)

- 1.4 Tulo-nako kerafo e latelang e bontsha motsamao wa bolo ho tloha hang ha e lokollwa hore e tsamae maemong a itseng ho tloha fatshe ebe e qhoma makgetlo a itseng. Se natse ditla morao tse ka bakwang ke thibello ya moya.



Ke ntlha efe (**P**, **Q**, **R** or **S**) kerafong e emetseng tulo-nako coordinatse tsa bophahamo bo hodimo dim obo fihlelletsweng ke bolo ka mora ho qhoma kgetlo la BOBEDI?

A **P**

B **Q**

C **R**

D **S**

(2)

1.5 Matla a kaenetiki ya koloi e tsamayang ka lebelo v ke K . lebelo la koloi le ya fetoha ho na $2v$. matla a kaenetiki ya koloi a matjha ke bokae?

- A $\frac{1}{4}K$
- B $\frac{1}{2}K$
- C $2K$
- D $4K$

(2)

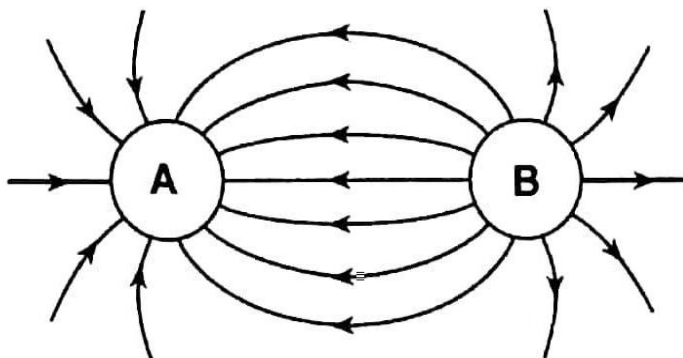
1.6 mohlodi wa modumo o atamela molebelli a emeng ka lebelo le sa fetoheng.

Ke efe ele NNGWE ho tse latelang e hlalosing ho fapana ha forikwensi e shebuweng le weibelenfo ho tloha ho ela ya mohlodi ya modumo.

	wabelenthe e bonweng	Forikwensi e bonweng
A	E kgolo ho	E kgolo ho
B	E nyane ho	E nyane ho
C	E nyane ho	E kgolo ho
D	E kgolo ho	E nyane ho

(2)

1.7 Eleketiriki filiti phathene dipakeng tsa di dikadikwe tse tshatjhileng, **A** le **B**, e bontshitswe ka tlase.



Ke efe ele NNGWE ho tse latelang tsa dipolelo ho latela tshatjhe ho sedikadikwe sa **A** le **B** e nepahetseng?

- A Sedikadikwe sa **A** se na le nekethifo tshatjhe, ha sedikadikwe sa **B** se na le phosithifo tshatjhe.
- B Sedikadikwe sa **A** ke phosethifo tshatjhe, ha sedikadikwe sa **B** e le nekethifo tshatjhe.
- C Sedikadikwe **A** le **B** di phosethifo ka bobedi.
- D Sedikadikwe **A** le **B** di nekethifo ka bobedi.

(2)

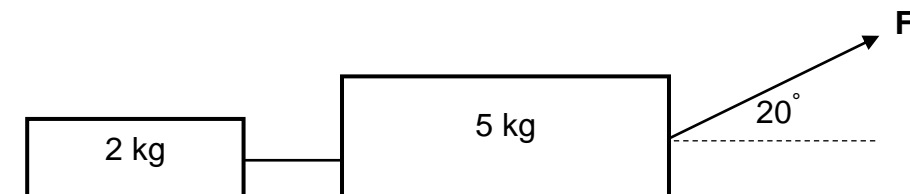
- 1.8 SI uniti ya hokala hwa sekgahla SA HOTSAMAYA HWA TJHATJHE ka hara kontaktara ke ...
- A watt.
 - B volt.
 - C ampere.
 - D coulomb. (2)
- 1.9 Ke efe ele NNGWE ho tse latelang tsa diphetoho ho aha AC jenereitara e tla eketsa sehlaiswa se hodimo sa emf?
- A Fetola polarity ya di makenete.
 - B Sebedisa di silipi ring tse kgolo.
 - C Sebedisa marashe a maholo.
 - D Ho eketsa lenane la ho harela coiling. (2)
- 1.10 Laene emishine sepeketeramo e etsahala ha ...
- A d eleketerone tse maamong a fatshe di ya maamong a matla a hodimo.
 - B di eleketerone tse maamong a matla a hodimo di ya maamong a matla a tlase.
 - C kganya e tshweu e feta ho kgalase e batang.
 - D kganya e tshweu e feta ho kgutlo tharo ya porisimo. (2)

[20]

POTSO YA 2

- 2.1 Di boloko tse pedi tsa boima 2 kg le 5kg di kopantswe ka kgwele e bebe e thata. Diboloko di hulwa ho bokahodimo bo mahwashe bo tsitsitseng ke fose, **F**. fose e etsa enkele ya 20° le motsitso. Sheba setshwantshong se latelang.

Diboloko 2 kg le 5 kg di utlwa kaenetiki forikitionale fose ya 10 N le 15 N kaholatellana.



- 2.1.1 Bolela molao wa motsamao wa bobedi wa Newton. (2)
- 2.1.2 Taka o be o bontshe free-body diakeramo ya boloko ba 5 kg. (5)
- 2.1.3 Bala boholo ba fose **F** e tlamehang ho ntshwa ka enkele ya 20° ho botsitso ho etsa hore diboloko tse pedi di potlake ka 2 m.s^{-2} ho ya ho le letona. (5)
- 2.2 Lefatshe le ntsha fose ya 1 842,50 N ho boloka sethelite ya boima(*mass*) ba 200 kg e potolohang le lefatshe jwalo ka ha ho bontshitswe setshwantshong.



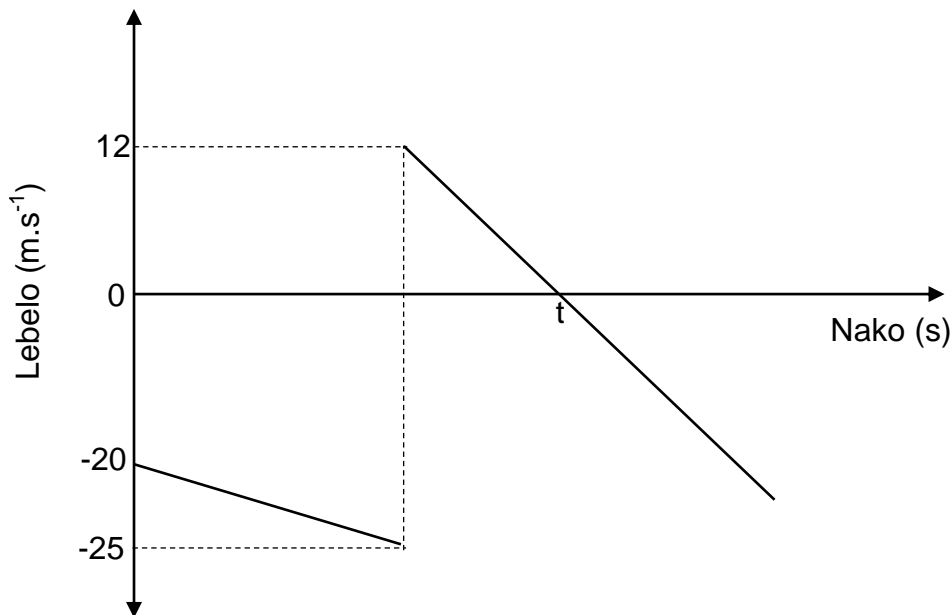
Bala sebaka, ka hodimo ho BOKAHODIMO BA LEFATSHE moo sethelite e potapotang lefatshe.

(5)
[17]

POTSO YA 3

Lebelo kgahlanong le nako kerafo e latelang e bontsha motsamao wa bolo e akgetsweng **ka ho tsepama tlase** ho tloha ka hodimo ho moaho ebe e qhoma ha e thula fatshe.

Se natse ditlamorao tsa kgohlano ya moya. NKA MOTSAMAO O YANG HODIMO ELE PHOSETHIFO.



3.1 Sebedisa TEKANYO YA MOTSAMAO FELA, bala:

3.1.1 Bophahamo ho tloha moo bolo e akgetsweng. (3)

3.1.2 Nako t kerafong. (5)

3.1.3 Boholo ba disepolasemente ya boloho ho tloha nako eo e akgelwang ho fihlela nako t . (4)

3.2 Teroya tulo kgahlanong le nako kerafo ya motsamao wa bolo ho tloha Nakong eo e akgelwang ho fihlela e fihetse bophahamo bo ka hodimodimo ka mora ho qhoma. SEBEDISA FATSHE ELE TULO YA NOTO.

Bontsha tse latelang kerafong:

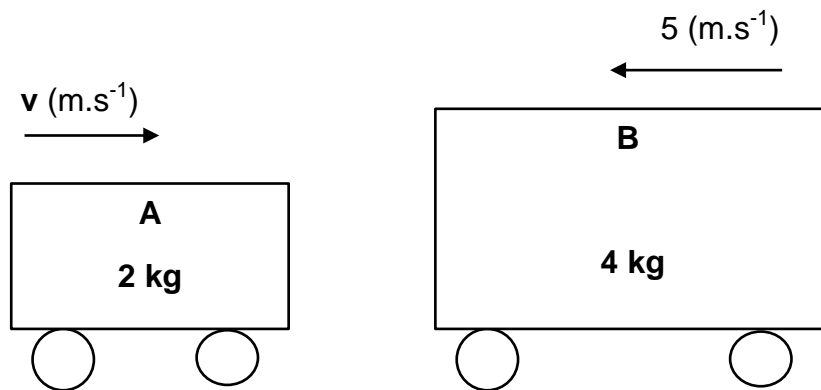
- Bophahamo ho tloha ha bolo e akgelwa.
- Nako t

(3)
[15]

POTSO YA 4

Setshwantsho se latelang se bontsha teroli **A** ya boima ba 2 kg e tsamayang ka lebelo la $v \text{ m}\cdot\text{s}^{-1}$ e yang botjhabela e tsepame ka lehlakore ho bokahodimo e thulana sa dipheleu le teroli **B** ya boima ba 4 kg e tsamayang ka lebelo la $5 \text{ m}\cdot\text{s}^{-1}$ ho ya bophirima.

Ka mora ho thulana, di teroli tse pedi di kopana mmoho mme di tsamaya ka lebelo la $1,67 \text{ m}\cdot\text{s}^{-1}$ ho ya bophirima. Thulano e tihiseditse 0,01 s. Se natse ditlamorao tsa kgohlano.



4.1 Bolela poringsipole ya consefeishine ya lineya momentamo ka mantswe. (2)

4.2 Bala:

4.2.1 Boholo ba lebelo v ba teroli **A** pele e thulana le teroli **B**. (4)

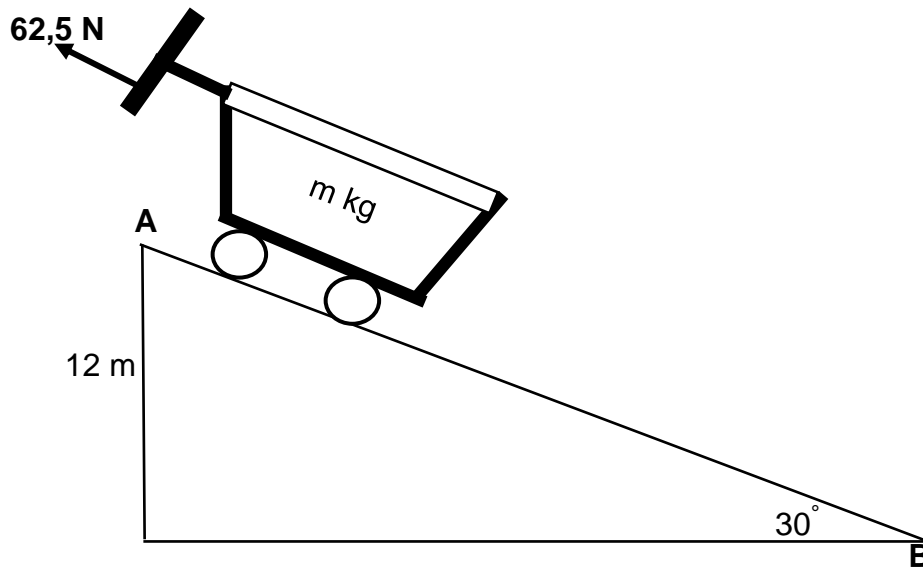
4.2.2 Fose e bang teroli **B** e e etsa ho teroli **A** (4)

[10]

POTSO YA 5

Fose ya 62,5 N e etsahalang ho teroli ya boima ba m bo pharalele le bokahodimo bo sekameng jwalo ka ha ho bontshitswe ho boloka motsamao o yang tlase bokahodimong bo sekameng ka LEBELO LE SA FETOHENG. Bophahamo bo tsepameng ba bokahodimo bo sekameng ke 12 m. Sheba setshwantsho se latelang.

Kaenetiki forikishinale fose ya 35,5 N e etsahala ho teroli e tsamayang e ya tlase bokahodimong bo sekameng.



- 5.1 Ngola lebitso la consevethifo fose e etsahalang ho teroli. (1)
- 5.2 Bala mosebetsi o entsweng(*work done*) ke forikishinale fose ho teroli. (4)
- 5.3 Ngola fatshe phetoho ho matla a kaenetiki(*kinetic energy*) ha teroli e fihlela qetellong ya bokahodimo bo sekameng. (1)
- 5.4 Sebedisa mosebetsi-matla fiyoremo ho bala boima, m , ba teroli. (5)

[11]

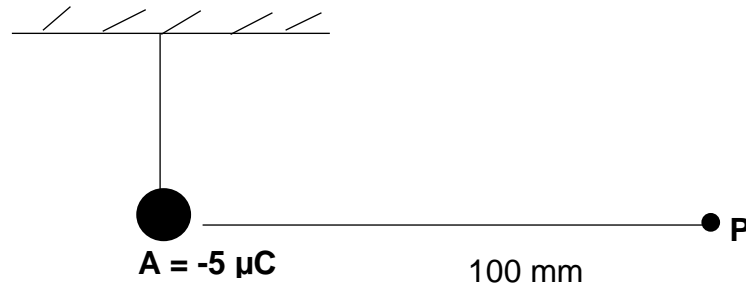
POTSO YA 6

- 6.1 Ditheketara ya modumo e emeng ntlheng e itseng e rekota 520 ya maqhubu a modumo ka motsotswana ho tloha ho mohlodi wa modumo o tsamayang o ntshang maqhubu a modumo wa forikwensi ya 480 Hz.
- 6.1.1 Ngola forikwensi ya maqhubu a modumo e rekotwang ke ditheketara ka Hz. (1)
- 6.1.2 Fana ka tlhaloso ya fenomenon e bontshang phetoho ya forikwensi e bonweng. (2)
- 6.1.3 Mohlodi wa modumo o ya ATAMELA kapa o ya HOLE le moshebelli? Fana ka lebaka laa Karabo. (2)
- 6.1.4 Bala lebelo leo mohlodi wa modumo o tsamayang ka lona. Nka lebelo la modumo e le $343 \text{ m}\cdot\text{s}^{-1}$. (5)
- 6.1.5 Ho tla etsahala eng ha weifolenfo ya maqhubu a modumo a entsweng ke mohladi wa modumo o fetohang ha forikwensi ya maqhubu a modumo aba hodimo ho 480 Hz?
- Ngola fatshe fela EKETSEHA, FOKOTSEHA kapa E DULA E LE JWALO. Hlalosa Karabo o sebedisa tekano ya maqhubu (*wave equation*). (2)
- 6.2 Mela ya di sepeketerale hotswa naleding e hole e shebuwe ho bokgubedu bo suthileng. Hlalosa lentswe le sehelletsweng. (2)
- 6.3 Ngola mosebetsi o le MONG wa Doppler efekete ho tsa meriyana. (1)
- [15]**

POTSO YA 7

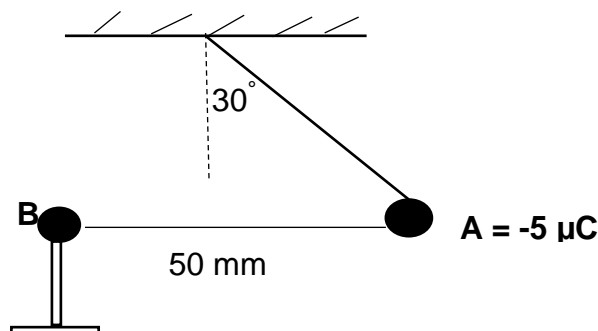
- 7.1 Sedikadikwe se senyane **A** se se nang le tihatjhe ya $-5 \mu\text{C}$ se leketlile ho tsepameng ho tloha ho seling ka mokgwa wa kgwele e bebe e thata. Ntlha ya **P** ke 100 mm hoya ka ho le letona ho sedikadikwe **A** jwalo ka ha ho bontshitswe **setshwantshong sa 1** se latelang.

SETSHWANTSHO SA 1



- 7.1.1 Na sedikadikwe se tihatjhileng sa **A** se LAHLEHELWA kapa AMOHELA di elecketerone ho re ebe le tihatjhe ya $-5 \mu\text{C}$? (1)
- 7.1.2 Bala dinomoro tsa di eleketorone tse lahlehileng kapa tse amohetsweng ke sedikadikwe sa **A**, ho fumala tihatjhe ya $-5 \mu\text{C}$. (3)
- 7.1.3 Bala eleketiriki filite e ntlheng ya **P**, ka lebaka la sedikadikwe se tihatjhileng sa **A**. (5)
- 7.2 Sedikadikwe se tshwanang sa **B** se nkileng tihatjhe e sa tsejweng se behilwe hodima kalana e tliswang hautshwanyane le sedikadikwe sa **A**. sedikadikwe se tihatjhileng sa **A** se bidikela ka ho le letona ebe se ya ema ele hore kgwele e etse enkele ya 30° le ho tsepama ho yang tlase, hape tsistipano e kgweleng ke 25 N. Sebaka se di pakeng tsa di dikadikwe tsa pedi tse tihatjhileng ke 50 mm jwalo ka ha ho bontshitse **setshwantshong sa 2** se latelang.

SETSHWANTSHO SA 2



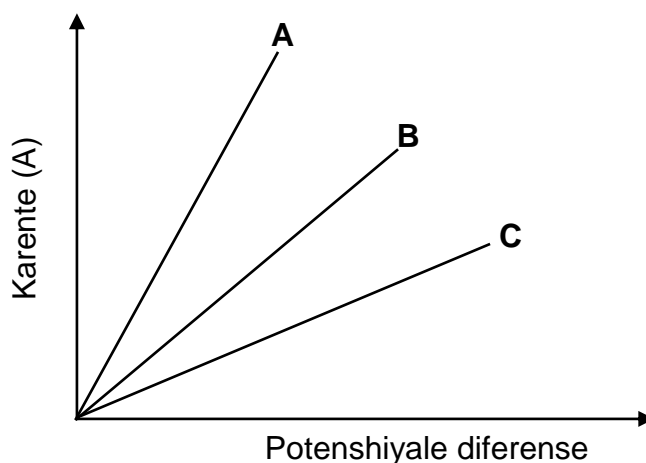
- 7.2.1 Ebe tihatjhe e ho sedikadikwe **B** e PHOSITIFO kapa NEKETHIFO? Fana ka lebaka ho Karabo? (2)
- 7.2.2 Bala boholo ba tihatjhe e sedikadikweng sa **B**. (6)

[17]

POTSO YA 8

8.1 Lequlwana la ban aba sehlopha sa 12 se batla ho fumana efishiente kontaktara e ka sebediswang ele koile e tjhesang ya ketlele e bang baya e aha ho lukisetsa porojeke ya Eskom Expo.

Ba ile ba kopanya di kontaktara tse tharo (**A**, **B** le **C**) seketeng yaba ba kala karente e fetang ho di kontaktara le potenshiale diferense ho tshela di kontaktareng. Diphetho di bontshitswe kerafong e latenag.

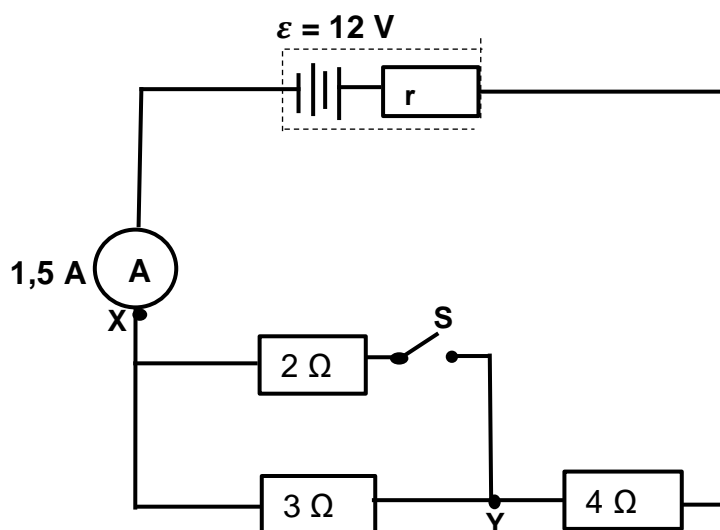


8.1.1 Reya tse PEDI tsa di barebole tse tlamehang ho se fetohe ho etsa hore phuphutso e sebe le eme. (2)

8.1.2 Ngola fisikale kwantiti e emetsweng ke moepa wa kerafo ka nngwe. (1)

8.1.3 Ke efe ele NNGWE ya di kontaktara e ifishente ho ka sebediswa bakeng sa ho tjhesa koile ya ketlele? Fana ka lebaka karabong. (2)

8.2 Setshwantsho sa sekete se latelang se bontsha ho kopana ha di resistara ka serisi le pharalele. Leshala le na le emf ya 12 V le resistense e ka hare e sa tsebisahaleng r .



Ha switjhe **S** e BUTSWE, ammeta **A** e bala 1,5 A. Bala:

8.2.1 Kakaretso ya resistense seketeng. (3)

8.2.2 Resistense e ka hare ya leshala. (4)

8.2.3 Matla a ileng a lahlwa ke $3\ \Omega$ resista ka metsotso e 3. (3)

8.3 Switjhe **S** e KWETSWE jwale.

E NGWE LE E NGWE ya tse latelang e tla ameha jwang? Ngola fela EKETSEHA, FOKOTSEHA kapa E DULA E TSHWANA.

8.3.1 Kakaretso ya resistense seketeng (1)

8.3.2 Palo ya ammeta **A** (1)

8.4 Terata e kontakatang e nang le resistense e sa tsotellweng ha a jwale e kopantswe dipakeng tsa ntlha **X** le **Y** jwalo ka ha ho bontshitswe setshwantshong se ka hodimo. Sena se tla ama motjheso wa leshala jwang?

Ngola fela EKETSEHA, FOKOTSEHA kapa E DULA E TSHWANA. Hlalosa Karabo.

(3)
[20]

POTSO YA 9

Jeneretara ya AC e ho koale-fayate seteshine e fana ka matla a motlakase naheng ya rona.

- 9.1 Fana ka matla a konbeshine a etsahalang ha jeneretara e sebetsa. (2)
- 9.2 Fana ka e le NNGWE ya phapang seeming dipakeng tsa AC jeneretara le DC jeneretara. (1)
- 9.3 Taka setshwantsho sa kerafo ya potenshiale diferecse kgahlanong le nako ho AC jeneretara. Ka hloko bontsha di akisisi le ho ngola V_{\max} ho potenshiale diferense akisisi. (2)

Elekitirikale apolaense e fuwe 2 000 W, 230 V. Apolaense e kopantswe ho aletenaiting karente phawara sose.

Bala:

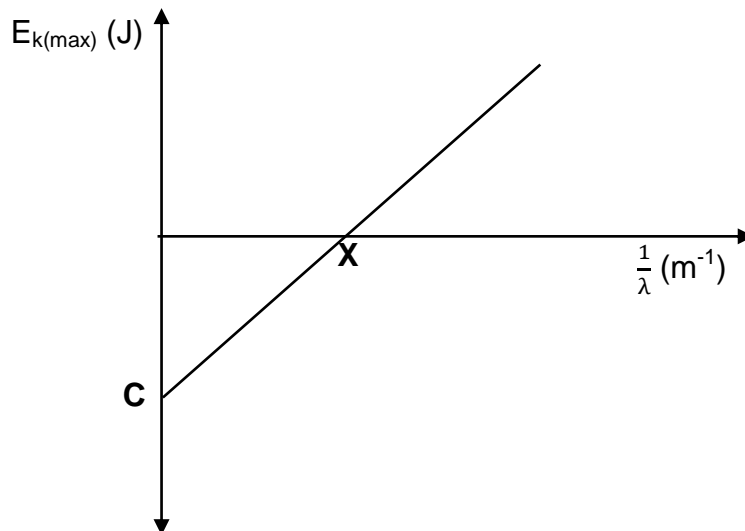
- 9.4 Karentse e hodimo (I_{\max}) e entsweng ke jeneretara. (4)
- 9.5 Boletheje e hodimo (V_{\max}) e tswang ho jeneretara. (3)

[12]

POTSO YA 10

Lequlwana la baithuti le entse patlisiso ya ho fumana kamano dipakeng tsa inbese

ya weifolenfo $\left(\frac{1}{\lambda}\right)$ ya insidente fothose ho tshepe le matla a kaenetiki a hodimo ($E_{k(max)}$) a ntshitsweng ke difothoeleketerone ho bokahodimo ba poleiti ya tshepe. Ba bontshitse diphetho tsa bona jwalo ka ha ho bontshitswe kerafong.



- 10.1 Ke fisikale kwantiti efe e emetsweng ke tlhaku **C** (inthasepote ya akisisi e yang hodimo ka hotsepama) kerafong? Sebedisa tekano e nepahetseng ho hlalosa Karabo. (3)
- 10.2 Kganya ya di fothone tsa futikwensi ya $6,16 \times 10^{14}$ Hz di insidente ho poleiti ya tshepe le difothoeleketerone di ntshuwe ka matla a kaenetic a maholo ba $5,6 \times 10^{-20}$ J.
- Bala boholo ba fisikale kwantiti e emetsweng ke tlhaku **X** kerafong. (5)
- 10.3 Ho kganya hwa kganya ya insidente jwale ho ekeditswe. Ke kameho efe etla etsahala ka lebaka la phetoho e latelang? (Ngola fela EKETSEHA, FOKOTSEHA kapa E DULA E TSHWANA.)
- 10.3.1 Ho sekama hwa kerafo. Hlalosa Karabo. (2)
- 10.3.2 Matla a kaenetiki a hodimo a ntshitseng difotoeleketerone. Taka kerafo ya kamano dipakeng tsa ho kganya hwa insidente fothons le matla a kaenetiki a maholo a difothoeleketerone ho hlalosa Karabo ya hao. (3)

[13]**KAKARETSO YA MATSHWAO: 150**

TLHAHISO LESEDING YA THUTO TSA MAHLALE SEHLOPHA SA 12
PAMPIRI YA 1 (PHYSICS)

TAFOLE 1: DI FISIKALE KONSETENTE

LEBITSO	LETSHWAO	BOLENG
Acceleration due to gravity	g	$9,8 \text{ m}\cdot\text{s}^{-2}$
Unifesele kerafitashinale constant	G	$6,67 \times 10^{-11} \text{ N}\cdot\text{m}^2\cdot\text{kg}^{-2}$
Lebelo l a kganya ka hara vacuum	c	$3,0 \times 10^8 \text{ m}\cdot\text{s}^{-1}$
Planck's constant/Lenane le sa fetoheng la Plank	h	$6,63 \times 10^{-34} \text{ J}\cdot\text{s}$
Coulomb's constant/Lenane le sa fetoheng la Coulomb	k	$9,0 \times 10^9 \text{ N}\cdot\text{m}^2\cdot\text{C}^{-2}$
tjhatjhe ho eleketorone	e	$-1,6 \times 10^{-19} \text{ C}$
Eleketorone mass	m_e	$9,11 \times 10^{-31} \text{ kg}$
Boima ba lefatshe	M	$5,98 \times 10^{24} \text{ kg}$
Radiyase ya lefatshe	R_E	$6,38 \times 10^3 \text{ km}$

TAFOLE 2: DIFOROMO**MOTSAMAO**

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

FOSE

$F_{\text{net}} = ma$	$p = mv$
$f_s^{\text{max}} = \mu_s N$	$f_k = \mu_k N$
$F_{\text{net}} \Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm_1 m_2}{d^2}$	$g = G \frac{M}{d^2}$

MOSEBETSI, MATLA LE PHAWA

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

ELEKETEROSETETIKI

$F = \frac{kQ_1 Q_2}{r^2}$	$E = \frac{kQ}{r^2}$
$E = \frac{V}{d}$	$E = \frac{F}{q}$
$V = \frac{W}{q}$	$n = \frac{Q}{q_e}$

ELEKETIRIKI SEKETE

$R = \frac{V}{I}$	emf (ϵ) = $I(R + r)$ emk (ϵ) = $I(R + r)$
$R_s = R_1 + R_2 + \dots$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$	$q = I\Delta t$
$W = Vq$ $W = VI\Delta t$ $W = I^2 R \Delta t$ $W = \frac{V^2 \Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2 R$ $P = \frac{V^2}{R}$

ALETENAITING KARENTE

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$ / $I_{wgk} = \frac{I_{maks}}{\sqrt{2}}$	$P_{average} = V_{rms} I_{rms}$ $P_{average} = I_{rms}^2 R$ $P_{average} = \frac{V_{rms}^2}{R}$
$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ / $V_{wgk} = \frac{V_{maks}}{\sqrt{2}}$	