



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

KEREITE YA 12

LOETSE 2021

DISAENSE TSA BOPHELO P2

MATSHWAO: 150

NAKO: Dihora tse 2½



Pampiri ena ya dipotso e na le maqephe a-18.

DITAELO LE DIKELETSO

Bala ditaelo tsena ka hloko pele o araba dipotso.

1. Araba potso KAOFELA.
2. Ngola dikarabo BUKENG ya DIKARABO o e fanweng.
3. Qala Karabo E NNGWE le E NNGWE leqepheng le LETJHA.
4. Nomora dikarabo tsa hao jwalo ka ha dipotso di nomorilwe pampiring ya dipotso.
5. Ngola dikarabo tsa hao ho ya ka ditaelo tsa potso ka NNGWE.
6. Meralo YOHLE e etswe ka pensele e leibelwe ka pene e ntsho kapa e bolou.
7. Etsa meralo, ditheibole kapa ditjhate tsa phallo moo ho tshwanelang.
8. Meralo pampiring ena ya dipotso ha e a latela ditekanyo.
9. O SE KE wa sebedisa pampiri ya kerafo.
10. O ka sebedisa khalkhuleitha e sa programuwang, diprotractara mmoho le dikhampase moo ho hlokahalang.
11. Dipalo tsohle di raundelwe ho dibaka tse PEDI tsa desimale.
12. Ngola ka mongolo o makgethe mme o balehang.

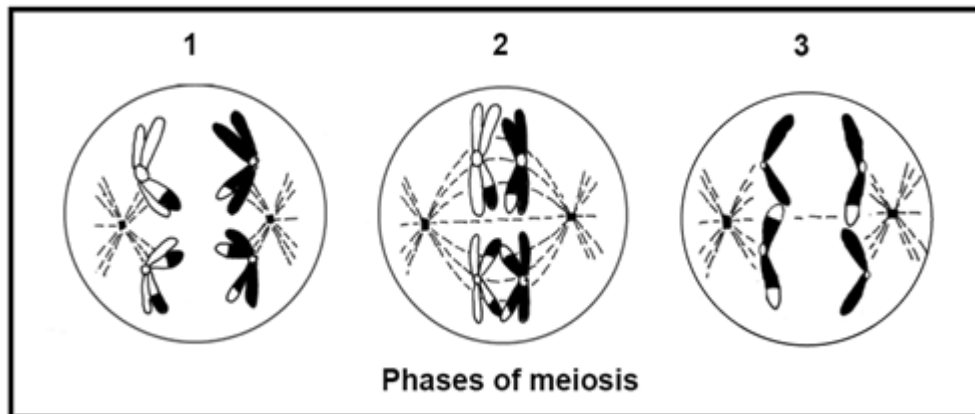
KAROLO YA A**POTSO YA 1**

1.1 Dikarabo tse fapaneng di fanwe e le dikarabo tsa dipotso tse latelang. Kgetha karabo e nepahetseng o ngole feela tlhaku (A–D) pela nomoro ya potso (1.1.1–1.1.10) BUKANENG YA DIKARABO, mohlala 1.1.11 D.

1.1.1 Ke tlhaloso efe e tsamaelanang le sebopeho sa tlhaho sa molekhule ya DNA?

- A e na le sugar-phosphate frame.
- B e double-stranded.
- C e na le sebopeho se helix.
- D e na le complementary nucleotides.

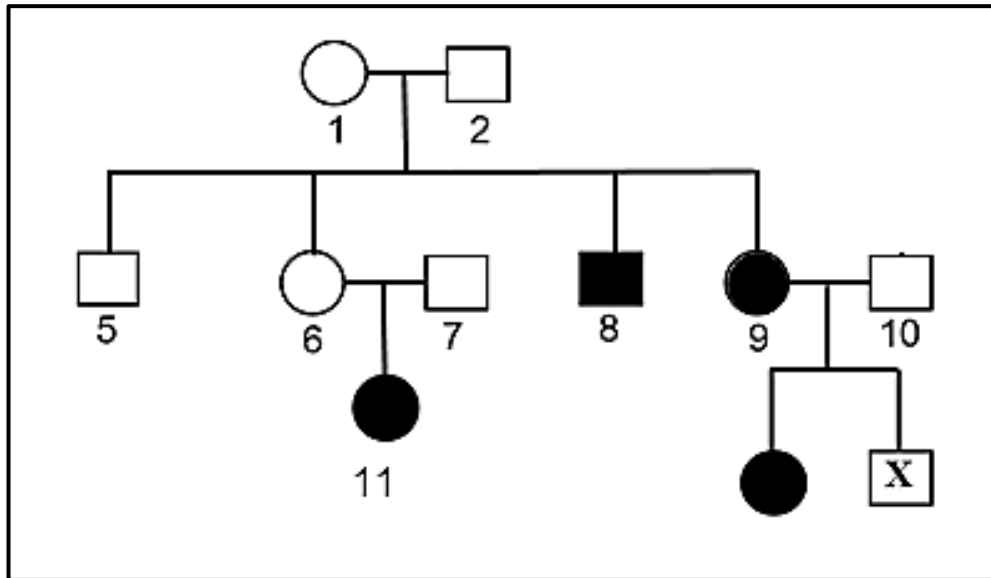
1.1.2 Ditshwantsho tse ka tlase di bontsha mekgahlelo e fapaneng ya meiosis.



Tatellano e nepahetseng eo mekgahlelo e etsahalnang ka yona ...

- A 1, 2, 3.
- B 3, 2, 1.
- C 1, 3, 2.
- D 2, 1, 3.

- 1.1.3 Cystic Fibrosis ke pherekano ya tlhaho hape lefutso la pherekano ena le bontshitswe dayakeramong ya pedigree e ka tlase.



Ke efeng ya tse latelang e hlalolang phenotype ya motho X?

- A Monna ya sa amehang
- B Monna ya amehileng
- C Mosadi ya sa amehang
- D Mosadi ya amehileng

- 1.1.4 Dihlekehlekeng tsa Galapagos ho na le mefuta e 13 ya dithaha dihlekehlekeng tse fapaneng. Boramahlale ba dumela hore kaofela di tswa ho moholo-holo a le mong ya tswang naheng e kgolo.

Ke lefe ho a mang a mabaka a latelang a bakileng mohato wa pele ho ntlafatso ya mefuta e 13 ya dithaha ho tswa ho moholo-holo a le mong?

- A Ho tswala ka dinako tse fapaneng tsa selemo
- B Ho arohana ka mawatle ka mokgwa wa Jeokerafi
- C Producing infertile offspring
- D Natural selection

- 1.1.5 Moriri o haraneng o mongata ho feta moriri o otlohileng. Mosadi ya homozygous bakeng sa moriri o haraneng o nyalana le mona ya homozygous bakeng sa moriri o otlohileng.

Ke difeng di chances tsa ho fumana ngwana ana le moriri o straight?

- A 25%
- B 50%
- C 100%
- D 0%

- 1.1.6 Monna wa madi a Sehlopha A le mosadi wa madi a Sehlopha O ba na le ngwana mmoho.

Ke genotype efe ho tse latelang e ka bang ya ngwana wa bona?

- A I^i
- B $I^A I^B$
- C $I^A I^A$
- D $I^B i$

- 1.1.7 Ke efe e le NNGWE ho tse latelang e etsehang ka meiosis ya pele?

- A Dichromatids di arohana ho ya mahlakoreng a fapaneng
- B Disele tse tshwanang tse-haploid di a etsahala
- C Non-disjunction
- D DiAlleles tsa gene di a kopana(fused)

- 1.1.8 Ke efe e le NNGWE ho tse latelang e leng nnete ka mitochondrial DNA (mtDNA)?

- A E feta ho tswa ho ntate ho ya ho ngwana
- B E ka sebediswa ho tseba leloko la basadi
- C E ka sebediswa ho tseba baholo-holo ba banna ba basadi
- D E bontsha hore baholo-holo ba banna ba ne ba le Afrika

- 1.1.9 Haemophilia ke lefu la pherekano le amanang le bong bathong. Ntate le mora wa hae ka bobeli ba na le haemophilia, empa mme o tlwaelehile. Mofuta wa hae wa genotype e tla ba ...

- A $X^h X^h$.
- B $X^H X^h$.
- C $X^H X^H$.
- D $X^h Y$.

- 1.1.10 20% ya dibeisi tsa naetrojene molekhuleng ya DNA ke adenine. Ke diperesente tse kae tsa dibeisi tseo e leng guanine?

- A 20%
- B 30%
- C 40%
- D 60%

(10 x 2) (20)

1.2 Fana ka **lentswe le nepahetseng la tlhaho** (biological term) bakeng sa tlhaloso ka NNGWE ho tse latelang. Ngola feela lentswe pela nomoro ya potso (1.2.1–1.2.8) BUKENG YA DIKARABO.

1.2.1 Producing infertile offspring

1.2.2 Dichromosome tseo eseng tsa bong

1.2.3 Ntlha eo dichromatids di kopanang nakong ya phetano (crossing over)

1.2.4 Karolo ya molekhule ya DNA e khethollang tšobotsi e itseng

1.2.5 Porosese eo ka wona mRNA e hlahiswang ka hara nucleus nakong ya synthesis ya protheine

1.2.6 Tlhahiso ya setshwantsho se tshwanang ka kakaretso sa sephedi ka tshebediso ya bioteknoloji

1.2.7 Di-chromosome tse nale the same gene

1.2.8 Sebaka seo jene e itseng e fumanwang ho sona ho chromosome

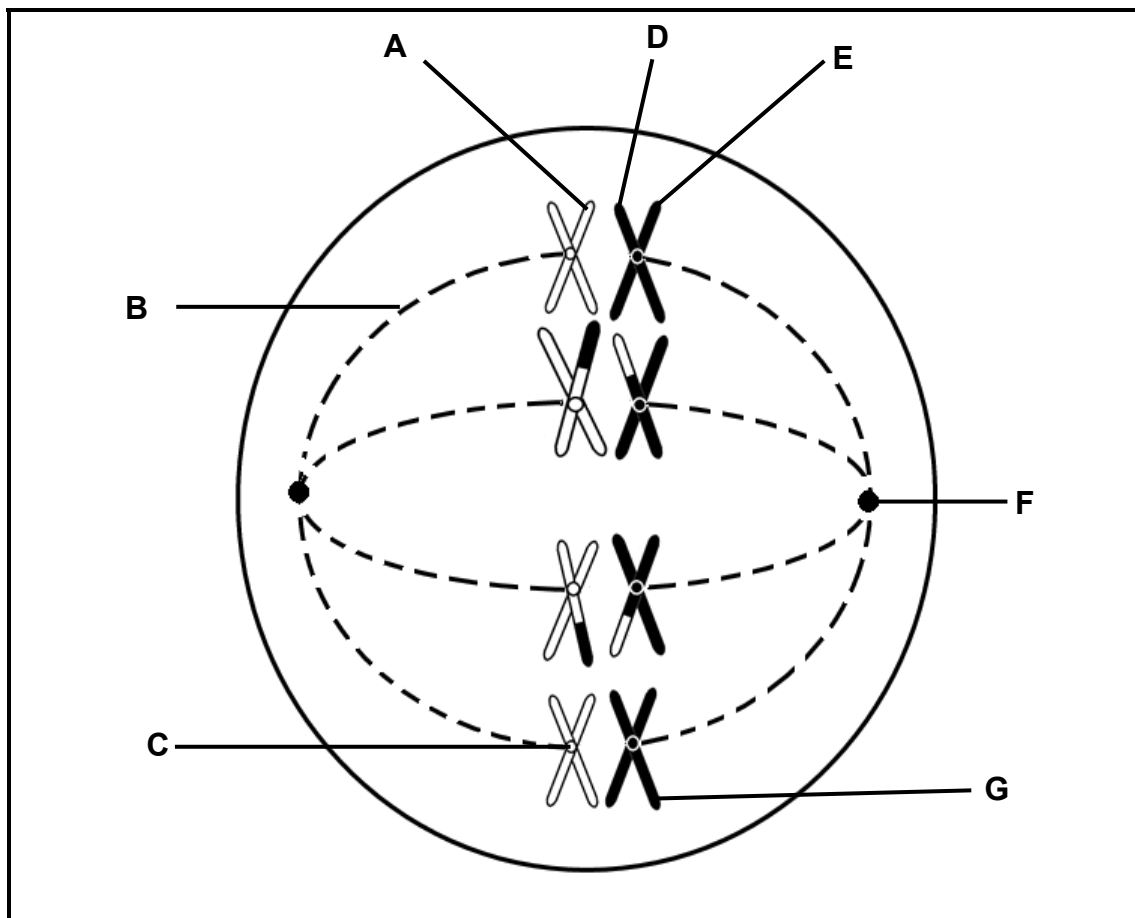
(8 x 1) (8)

1.3 Bontsha hore na ditlhaloso tse KHOLOMONG YA I di sebetsa ho **A FEELA B FEELA, A LE B** kapa **HA EYO** ho dintho (items) tse ho KHOLOMO YA II. Ngola **A feela, B feela, A le B** kapa **ha e yo** pela nomoro ya dipotso (1.3.1–1.3.3) BUKENG YA DIKARABO.

KHOLOMO YA I	KHOLOMO YA II
1.3.1 Mofuta oa lefa moo ho se nang di-alleles tse pedi tse matla ho feta tse ding mme ho hlahisoa mofuta oa dipakeng oa phenotype	A: Co-dominance B: Incomplete dominance
1.3.2 Mohlala wa mekhanisimo ya reprodakshene isolation	A: Mokgwa wa Species-specific courtship B: Ho thibelwa ha fethiliseishene
1.3.3 Nomoro ya di-allele tse controlang group ya madi a motho	A: Tse pedi B: Tharo

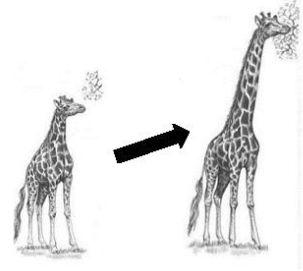


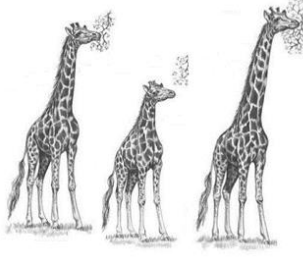
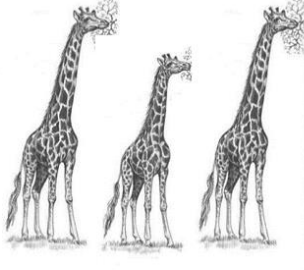
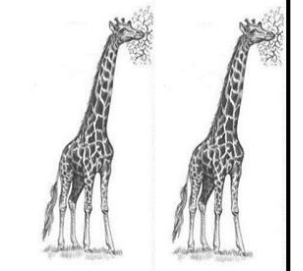
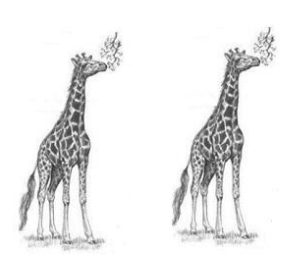
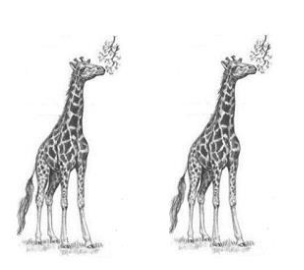
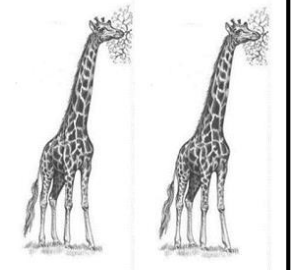
(3 x 2) (6)

1.4 Setshwantsho se ka tlase se bontsha sele ka nako ya ho aroarohana ha sele.



- 1.4.1 Bolela mofuta wa sele e arotsweng setshwantshong se ka holimo. (1)
- 1.4.2 Hlwaya mokgahlelo wa karokarohano ya sele eo setshwantso sena se emelang. (1)
- 1.4.3 Fana ka TLHAKU / DITLHAKU tse emetseng:
- (a) sebopeho se tsamaisang di-chromosome / chromatids dipalong nakong ya karokarohanohano ya sele (1)
 - (b) karolo e ikarabellang bakeng sa ho etsa disindle fibres (1)
 - (c) DI-chromatid tse PEDI tse tswanang (2)
- 1.4.4 Ke dichromosome tse kae tse tla fumanwa ka seleng ya moradi (daughter cell) ka nngwe qetellong ya karokarohano ya sele ena. (1)
- 1.4.5 Fana ka lebitso la disele tse tla hlaha mofuteng ona wa karohano ya sele ho e tona. (1)

1.5 Ditshwantsho tse ka tlase di emetse mehopolo e meraro e hlahisitsweng mabapi le mekhanisimo ya evolushene.

IDEA	10 MYA	5 MYA	PRESENT
A			
B			
C			

1.5.1 MYA e emetse eng? (1)

1.5.2 Fana ka LENGOLO la setshoantsho (**A**, **B** kapa **C**) se ka emelang hantle:

- (a) punctuated equilibrium (1)
- (b) Tlhaloso ya Lamarck ya ho iphetola ha lintho haeba ho bile le phetoho ya tikoloho 10mya (1)
- (c) Tlhaloso ya Charles Darwin ya ho iphetola ha lintho (1)

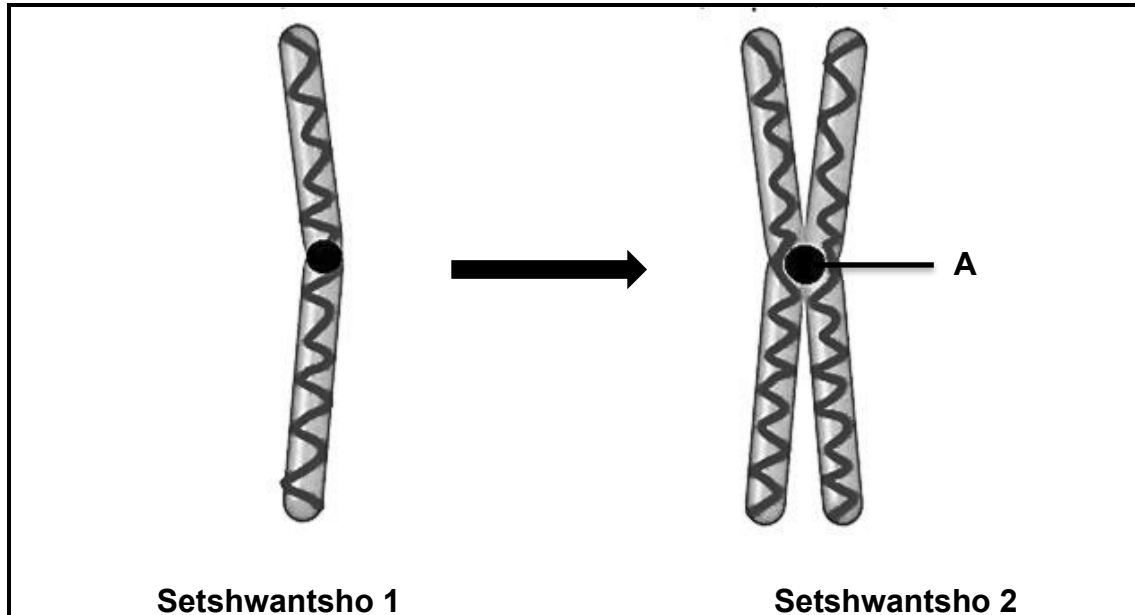
1.5.3 Ke hobaneng ha 'Theori ya Evolushene e nkuwa e le theori ya mahlale/saense? (scientific theory) (1)

1.5.4 Bolela dibaka tse THARO tse fanang ka bopaki ba evolushene. (3)

KAKARETSO YA KAROLO A: 50

KAROLO YA B**POTSO YA 2**

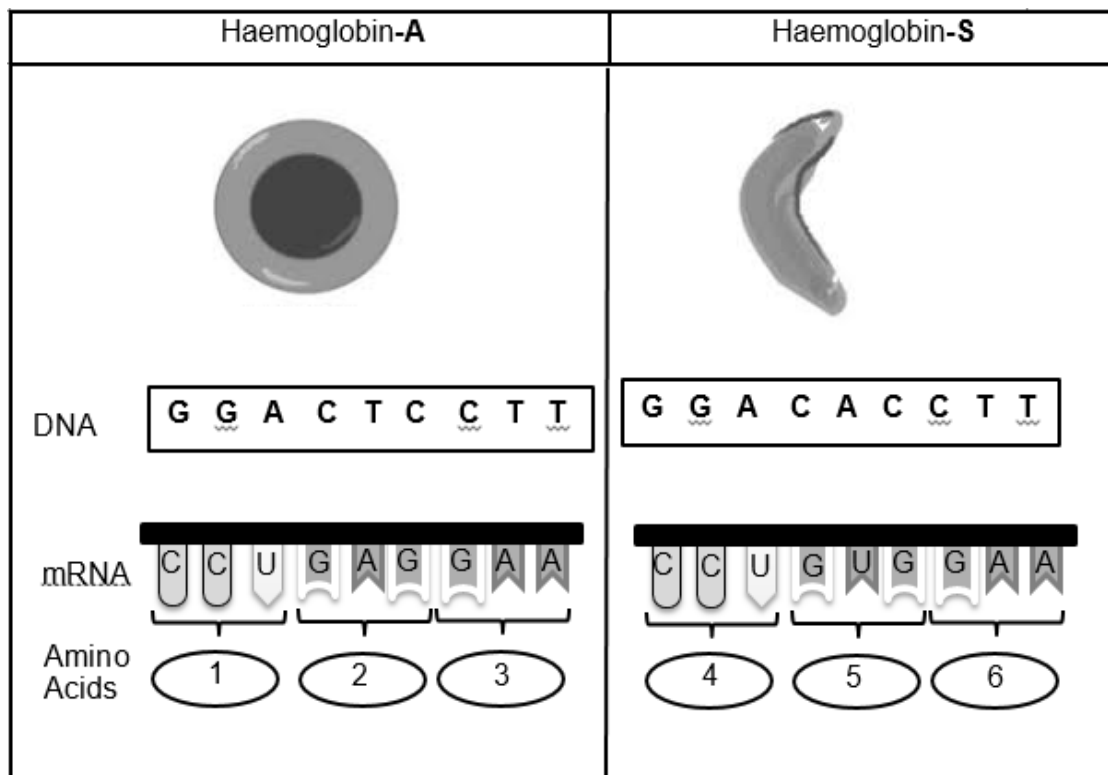
2.1 Dintshwantsho tse ka tlase di bontsha mekgwa e mebedi ya di- chromosome.



- 2.1.1 Fana ka leibele (label) ya **A**. (1)
- 2.1.2 Hlwaya porosese e lebisitseng ho sebopeho sa chromosome e emetsweng ke setshwantsho sa **2**. (1)
- 2.1.3 Hlalosa porosese e boletsweng ho POTSO YA 2.1.2. (4)
- 2.1.4 Fana ka mabaka a PEDI a hore hobaneng tshebetso e hlalositsweng ho POTSO 2.1.3 e le bohlokwa. (2)

2.3 Protheine e diseleng tse kgubelu tsa madi e tsamayisang oksijene mading e bitswa hemoglobin-**A**. Ha mutheishene e etsahala ho jene ya hemoglobin-**A**, thymine e nkelwa sebaka ke adenine. Sebakeng sa ho hlahisa hemoglobin-**A** e tlwaelehileng jene ya mutheishene e hlahisa haemoglobin-**S**. Sena se etsa hore disele tse kgubedu tsa madi di tielane mme di bōpehe jwaloka sekele(sickle), di felle ka lefu la disele tse sekele. Disele tse kgubelu tsa madi tse bopehileng jwaloka sekele(sickle) di baka tshitiso methapong ya madi. Ha jwale pheko e le nngwe feela bakeng sa lefu la disele tse sekele ke ho fetisa mooko wa masapo(bone marrow transplant). le kalafo ya sele ya stem.

Setshwantsho se ka tlase se bontsha sebopeho sa sele ya madi le tatellano ya DNA ya hemoglobin-**A** (sele e tlwaelehileng ya madi) le hemoglobin-**S** (sele ya madi e bopehileng jwaloka sekele).



2.3.1 Hobaneng ha lefu la sele yasekele le le kotsi?

(1)

2.3.2 Disele tsa stem ke eng?

(2)

2.3.3 Sebedisa theibole e ka tlase ho araba dipotso tse latelang.

Amino Acid	tRNA anticodon
Leucine	GAA
Lycine	CUU
Glycine	GGA
Glutamic acid	GAG
Histidine	GUA
Methionine	UAC
Proline	CCU
Valine	CAC
Glutamine	CUC

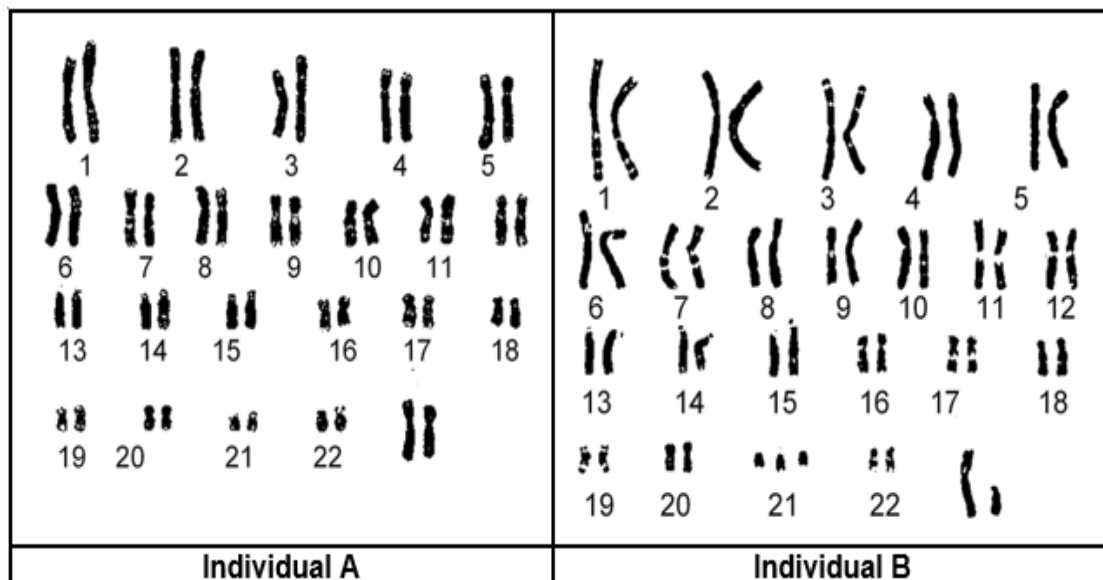
(a) Fana ka anticodon ya amino acid **6**. (1)

(b) Fana ka lebitso la amino acid **1**. (1)

(c) Hlalosa hore na mutheishene ena e ama tatellano ya amino acid jwang. (4)

2.3.4 Phallo ea hemoglobin-**A** e matla ho feta **H** ea hemoglobin-**S (h)**. Monna ea homozygous bakeng sa hemoglobin-**A** o na le ngoana ea nang le mosali ea heterozygous. Sebelisa sefapano sa lefutso ho bontsha monyetla oa hore ba be le ngoana ea nang le hemoglobin-**S**. (6)

2.4 Ditshwantsho tse ka tlase di bontsha di-chromosome diseleng tsa batho ba babedi.



2.4.1 Bolela mofuta wa setshwantsho se bontshitsweng ka hodimo. (1)

2.4.2 Bolela hore na hobaneng ho ka fihlela qeto ya hore setshwantsho sa **A** ke sa mosadi. (2)

2.4.3 Bolela hore na hobaneng ditshwantsho tse ka hodimo di bontshang di-chromosome tsa sele ya somatic eseng gamete. (2)

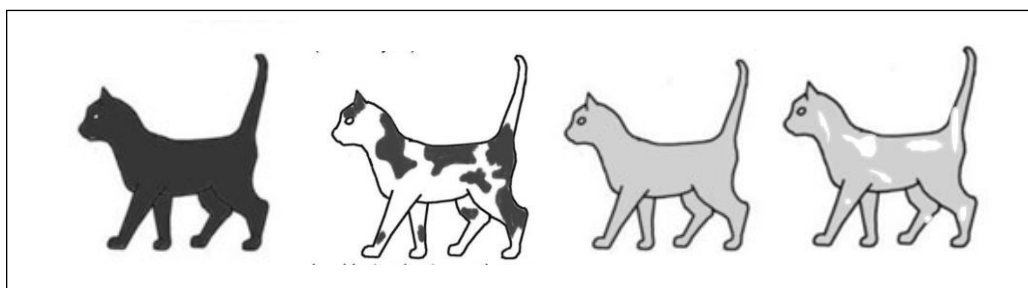
2.4.4 Bolela lefu la pherekano leo motho wa **B** a nang le yona. (1)

2.4.5 Hlalosa sesosa sa lefu le bo boletsweng ho POTSQ 2.4.4. (3)

2.5 Dikatseng, dijene tse pedi ho diautosome tse fapaneng di na le di alleles tse latelang.

B: mmala wa letlalo o montsho T: ha ho na matheba a masweu letlalong
b: mmala wa letlalo o mothokwa t: matheba a masweu letlalong

Dikatse tse pedi di kopane ka thobalano (mated). Madinyane a tsona a leshome le metso e tsheletseng a ne a e-na le diphenotype tse latelang tse bontshitsweng ka tlase ho **9 : 3 : 3 : 1**.



Phenotype A	Phenotype B	Phenotype C	Phenotype D
mmala wa letlalo o montsho	e ntsho e nale matheba a masweu	mmala wa letlalo o mothokwa	e mothokwa e nale matheba a masweu

2.5.1 Bolela mofuta wa sekere (cross) se emetsweng mona. (1)

2.5.2 Fana ka lebaka la karabo ya hao ho POTSQ 2.4.1. (1)

2.5.3 (a) Jenotype ya phenotype **D** ke efe? (2)

(b) Phenotype ya batswadi? (2)

2.5.4 Hlalosa hore na hobaneng madinyane ohle tse a le matsho le matheba a masweu letlalong a se na genotype e tshwanang. (2)

2.5.5 Bolela molao wa Mendel wa segregation (Mendel's principle of segregation) (3)

[50]

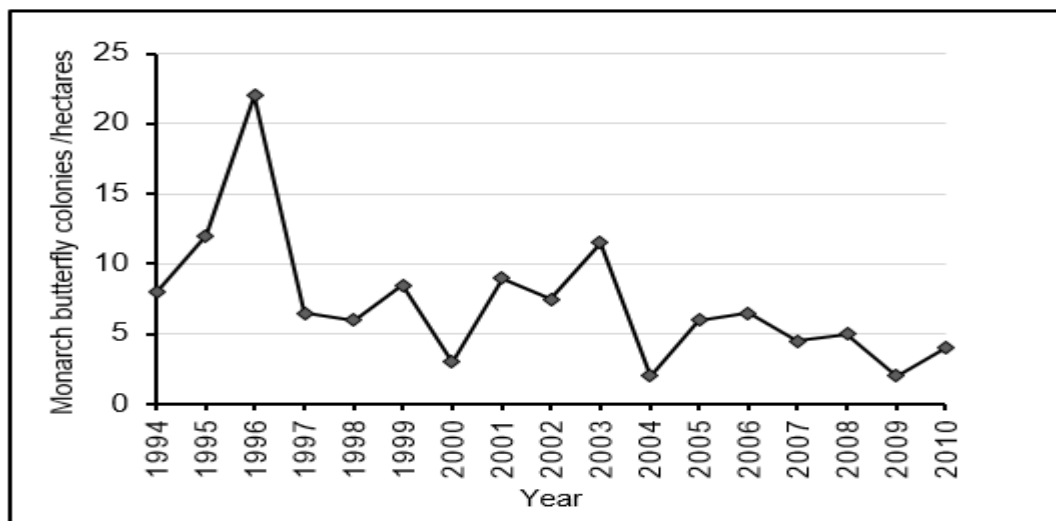
POTSO YA 3

- 3.1 Dijalo tse ding tsa poone di fetotsoe ka diphatsa tsa lefutso hore di sebetsane le sebolayalehola. Sena se bolela hore ha sehoai se fafatsa mobu oa sejalo sa hae ka sebolayalehola ho bolaea mofoka, poone e ke ke ea ameha. Semela sa milkweed ke lehola le holang dipakeng tsa dijalo tsa poone. Serurubele se behela mahe semeleng sa milkweed. Bacha ba fepa makhasi a semela sa milkweed.

Bo-rasaense ba batlisitse hore na tshebediso e eketsehang ya meriana e bolaeang dikokoana-hloko e ama palo ya dihlopha tsa seurubele sa monarch tshimong ya lijalo.

Ba leme lijalo tsa poone tse hananang le sebolayalehola ho tloha ka 1994 ho fihla ka 2010. Ho tloha ka selemo sa 1998 ba ile ba qala ho sebelisa ditlama tse bolaeang mofoka. Selemo se seng le se seng ba ne ba bala palo ea dihlopha tsa seurubele.

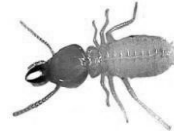
Kerafo e ka tlase e bontsha data eo ba e bokelletse ho tloha 1994 ho isa 2010.



- 3.1.1 Fana ka sehlooho bakeng sa kerafo (graph) e kahodimo. (1)
- 3.1.2 Hlwaya:
- (a) Independent variable (1)
- (b) Dependent variable (1)
- 3.1.3 Ho tswa ho kerafo fana ka bopaki ba hore na hobaneng dibolayalehola, di ka bewa molato ka lebaka la ho fokotseha ha palo ya dirurubele (monarch butterflies) (2)
- 3.1.4 Sephedhi se lokisitsweng ka dijene (Genetically Modified organism) ke eng? (2)
- 3.1.5 Fana ka monyetla o le MONG wa moruo oa tsebeliso ya dijalo tsa poone tse thibelang dikokoana-hloko e ka bang le ona ho molemi. (2)

3.2 Bala qotso e ka tlase.

Naheng ya Brazil ho ka fumanwa mefuta e mengata ya mekgodutswane e jang bohlwa (termite- eating lizards).



Bohlwa ke dikokonyana tse nyane tse tshwanang le marwana.
Li fapana ka boholo.

Mekgodutswane e meholo e nang le dihloho tse kgolo e ka ja mefuta e fapaneng ya bohlwa bo kenyeletsang bohlwa bo boholo.

Ka 1996 letamo la Brazil le ile la tlala haholo, metsi a etsa dihlekehleke tse ngata.

Ho ile ha eba le kgaello ya dijo mme mekgodutswane e meholo ya shwa dihlekehlekeng, hobane ho ne ho se na dijo tse lekaneng hore di phele. Empa mekgodutswane o menyane, *Gymnodactylus amarali*, e ile ya kgona ho phela. Ho ne ho e-na le bohlwa bo bongata boo e neng e ka e ja.

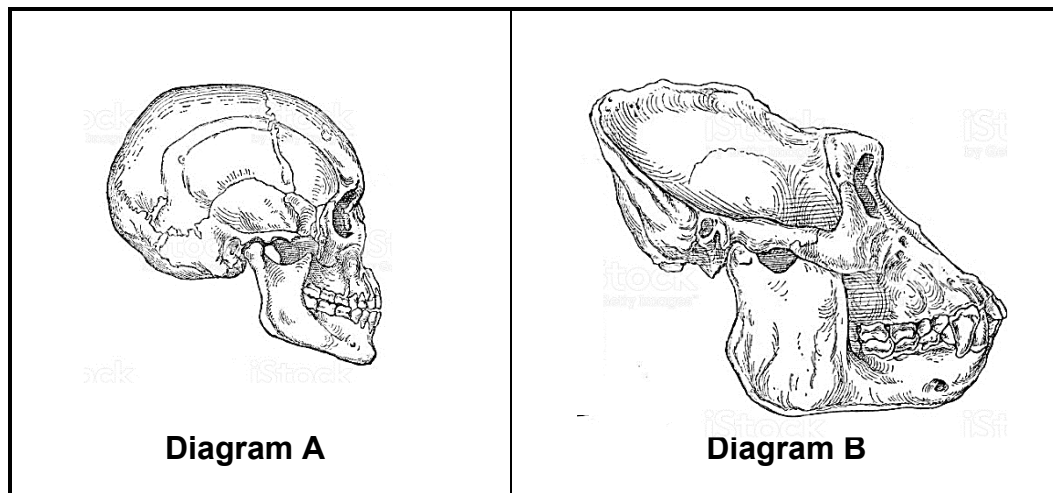
Empa ho ne ho e-na le bothata: Mekgodutswane ya *Gymnodactylus amarali* e ne e na le dihlooho tse nyane mme bohlwa bo bong bo ne bo batla bo lekana le bona ka boholo. Le ha ho le jwalo, mekgodutswane e meng e ne e na le dihlooho tse kgolwanyane mme e ne e kgona ho ja bohlwa bona.

Ha bo-rasaense ba etela dihlekehleke tsena dilemo tse 15 hamorao ba ile ba fumana hore mekgodutswane ya *Gymnodactylus amarali* dihlekehlekeng tsena e na le dihlooho tse kgolo ka diperesente tse nne ho feta tse fumanwang naheng e kgolo.



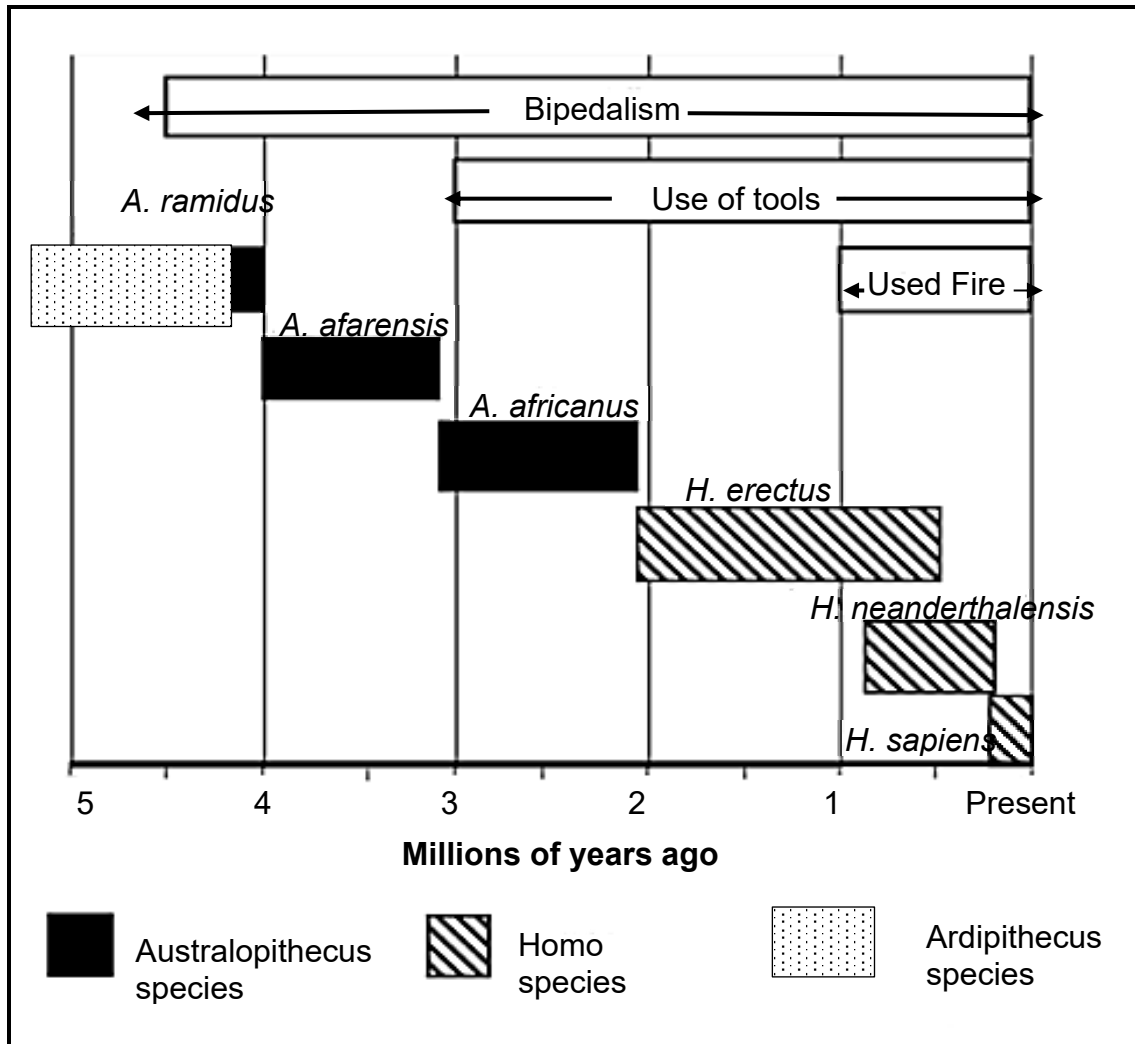
- 3.2.1 Bolela hore na ke hobaneng ha mekgodutswane e e meholo e sa ka ya phela dihlekehlekeng tse nyane. (1)
- 3.2.2 Hobaneng ho ne ho se phallo ya dijene (gene flow) dipakeng tsa dihlopha tse fapaneng tsa mekgodutswane ka mora difloods tsa 1996? (2)
- 3.2.3 Sebedisa theori ya Darwin ya kgetho ya tlhaho (natural selection) ho hlalosa hore na hobaneng palo ya mekgodutswane ya *Gymnodactylus amarali* dihlekehlekeng e na le dihlooho tse kgolo. (5)
- 3.2.4 Hlalosa hore na ho ka pakwa jwang hore mofuta wa mekgodutswane dihlekehlekeng tse fapaneng ke mofuta o tshwanang le wa naheng e kgolo. (2)

3.3 Ditshwantsho tse ka tlase di bontsha di skull sa motho le sa gorilla.



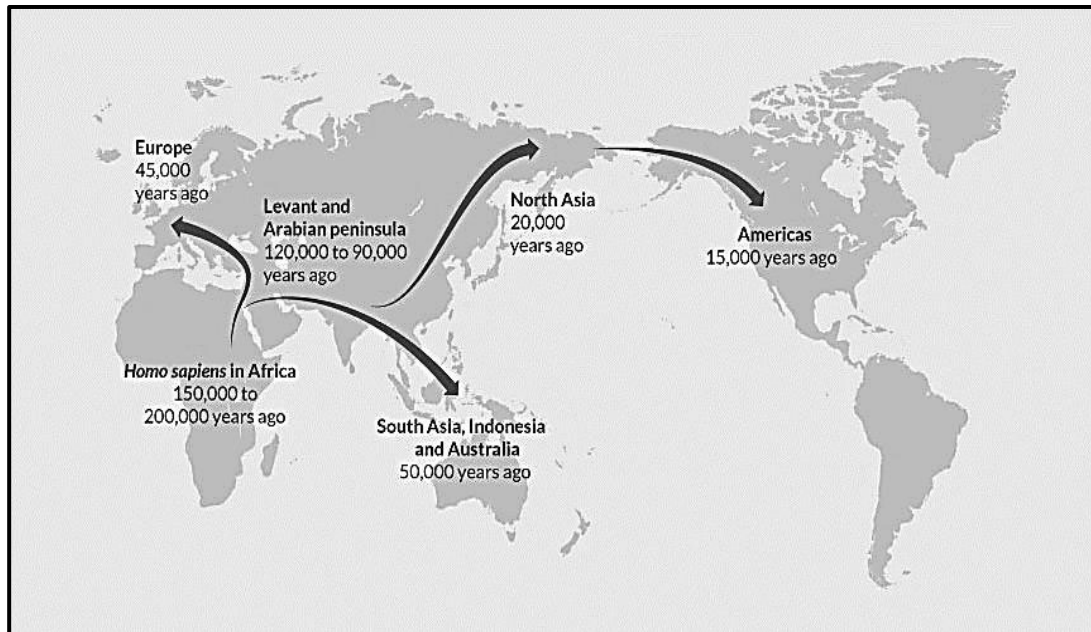
- 3.3.1 Fana ka scientific name ya organism ho Setshwantshong **A**. (1)
- 3.3.2 Hlalosa hore na hobaneng meno a le maholo lehateng le Setshwantshong **B** (2)
- 3.3.3 Ntle le boholo ba meno, thathamisa diphapang tse ding tse THARO tse bonahalang pakeng tsa lehata la motho le gorilla. (7)
- 3.3.4 Thathamisa dintho tse pedi tse tshwanang ka sebopeho sa monna le gorilla. (2)

- 3.4 Setshwantsho se ka tlase se emetse kgoneho ya evolushene e ka bang teng ya batho, hammoho le nako ya evolushene ya bipedalism, tshebediso ya majwe le tshebediso ya mollo.



- 3.4.1 Bolela **genera** mofuta e MEBEDI o neng o na le bipedal empa o sa sebedise mollo. (2)
- 3.4.2 *A. afarensis* e bile teng neng? (1)
- 3.4.3 Ho nkile nako e kae hore mofuta ea hominin e qale ho sebelisa mollo kamora hore e be le bipedal? (2)
- 3.4.4 Hlalosa liphetofo tse peli tsa masapo tse etsahetseng ho thusa bipedalism. (4)
- 3.4.5 Mrs Ples ke fosili ya hominin e fumanweng Afrika e ka Borwa ka 1947.
- (a) Fana ka lebitso le felletseng la saense la Mrs Ples. (1)
 - (b) Mrs Ples o fumanwe kae Afrika e ka Borwa? (1)
 - (c) Bolela rasaense a le MONG ya sibollotseng Mrs Ples. (1)

- 3.5 Mmapa o ka tlase o bontsha tshimoloho le motsamao wa batho ba pele ho latela hypothesis ya 'Out of Africa'. Dilemo tsa difosili tsa kgale ka ho fetisisa tse fumanwang kontinenteng ka nngwe le tsona di bontshitswe ka tlasa lebitso.



- 3.5.1 Bolela hypothesis ya 'Out of Africa'. (2)
- 3.5.2 Fana ka mela e MEBEDI ya bopaki e sebedisitsweng ho tshehetsa hypothesis ya Out of Africa. (2)
- 3.5.3 Ho ya ka mmapa, ke khontinente efe e bileng ya ho qetela ho etswa kolone (colonised) ke batho ba pele? (1)
- 3.5.4 Phapano ke efe dilemong tsa difosili tsa kgale ka ho fetisisa tse fumanwang Afrika le tse fumanwang Europe? Bontsha dipalo TSOHLE tsa hao. (2)

[50]

MATSHWAO OHLE A KAROLO YA KAROLO B: 100
MATSHWAO OHLE A PAMPIRI ENA: 150