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Porafensio Ya Kapa Botjhabela: Lefapha la Thuto

# NATIONAL SENIOR CERTIFICATE

## KEREITI 12

## LOETSE 2024

### LIFE SCIENCES P2

**MATSHWAO:** 150

**NAKO:** Dihora tse 2½

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Pampiri ena ya dipotso ena le mapephe a 16.



**DDITAELO LE DIKELETSO**

Bala ditaelo tse latelang ka hloko pele o araba dipotso.

1. Araba dipotso KAOFELA.
2. Ngola dikarabo TSOHLE BUKENG YA DIKARABO.
3. Qala Karabo ya potso ka NNGWE leqepheng le LETJHA.
4. Nomora dikarabo tsa hao jwale ka ha ho nomorilwe pampiring ya dipotso.
5. Araba dipotso ho ya ka ditaelo tsa potso ka nngwe.
6. Etsa didayakeramo TSOHLEka pensile o be o di leibole ka pene e bolou kapa e ntsho.
7. Teroya didayakeramo, ditheibole kapa diflotjhate ha FEELA o laetswe ho di etsa.
8. Didayakeramo tse pampiring ena ya dipotso HA DI ya etswa ho latela ditekanyo.
9. O SEKE wa sebedisa pampiri ya kerafo.
10. O ka sebedisa khalekhuleitha e sa porokeramuwang,protraktara.
11. Dikhalekhuleishene tsohle di lokela ho atametswa dibakeng tse PEDI tsa desimale.
12. Ngola ka mongolo o makgethe, o balehang.

**KAROLO YA A****POTSO YA 1**

1.1 Ho fanwe ka dikhetho tse fapaneng e le dikarabo tsa dipotso tse latelang. Kgetha karabo e nepahetseng mme o ngole feela tlhaku (A–D) haufi le dinomoro ya dipotso (1.1.1 ho isa ho 1.1.9) BUKENG YA DIKARABO, mohlala 1.1.10 D.

1.1.1 Di'factors' tse laolang matshwao dientithisi tse arohaneng, ha di na kamano wa mokgwa ofe kapa ofe, hape di ikamahanya ka ho bapa ka mokgwa o ikgethileng ho etsweng ha gamete.

Hona ho hlalosa ...

- A Mendel's Principle of Segregation.
- B Mendel's Principle of Independent assortment.
- C Lamarck's 'law' of the inheritance of acquired characteristics.
- D Chance fertilisation.

1.1.2 Bongata ba diallele bo etsahala ha ...

- A e nngwe ya allele e laola lefutso la jene.
- B diallele tse pedi di laola lefutso la jene.
- C diallele di futsa ho tswa batswading ba babedi.
- D diallele tse fetang bobedi di laola lefutso la jene.

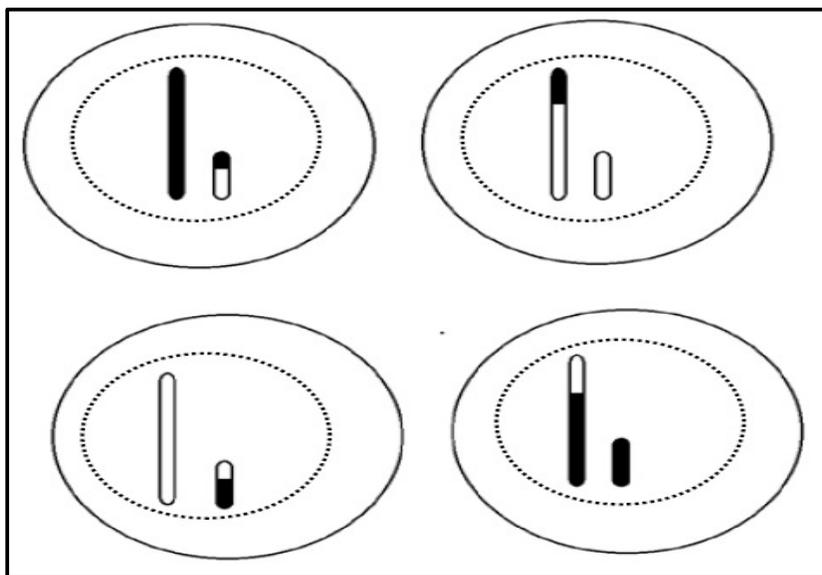
1.1.3 Ke dinitrogenous base tse kae tse fumanwang ho poroteine e entsweng ka 66 ya diamino acid?

- A 198
- B 22
- C 132
- D 66

1.1.4 Phapang dipakeng tsa sebopelo sa dinucleic acid ke.

|   | DNA                                   | RNA                                    |
|---|---------------------------------------|--|
| A | Double-stranded molecule              | Single-stranded                        |
| B | Contains the nitrogenous base, uracil | Contains the nitrogenous base, thymine |
| C | Straight-stranded structure           | Helical structure                      |
| D | Shorter molecule                      | Longer molecule                        |

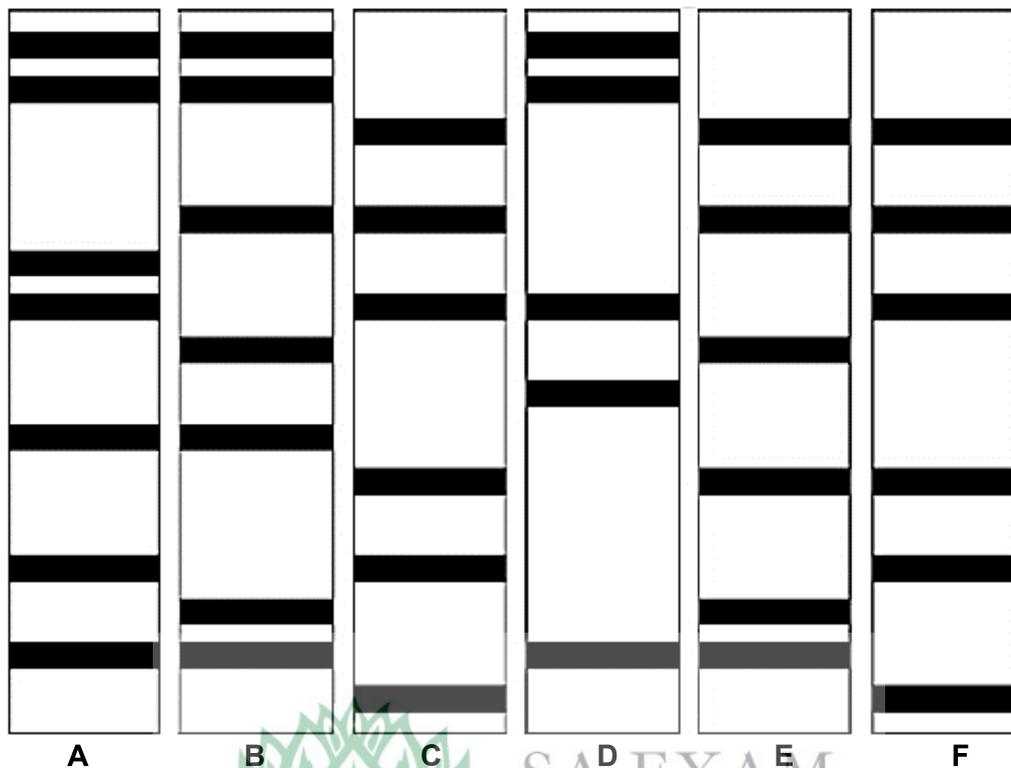
1.1.5 Dayakeramo e latelang e bontsha phase ya cell division.



Mokgahlelo dayakeramong e ka hodimo ke ...

- A profeisi II.
- B thelofeisi II.
- C thelofeisi I.
- D thelofeisi .

**DIPOTSO 1.1.6 LE 1.1.7 DI ITSHETLEHILE HO POROFAELENG YA DNA E KA TLASE.**



1.1.6 Batswadi ba motho **B** ke ...

- A A le F.
- B C le E.
- C A le E.
- D D le F.

1.1.7 Ke efe e le NNGWE ya dikgetho tse latelang e sa sebedisweng ho DNA porofaeleng?

- A Papisong ya dithishu ho diorgan transepolante.
- B Diphuphutso tsa mafu a pherekano a amanang le lefutso.
- C Ho etsuwa ha pheko ya mafu a pherekano amanang le lefutso.
- D Bopaki ba bayoloji ditlolong tsa molao.

1.1.8 Khomposishini ya diploid chromosome ho batho ba banna ba itekanetseng ...

- A 44 autosomes + XX gonosomes.
- B 22 autosomes + Y gonosomes.
- C 22 autosomes + XY gonosomes.
- D 44 autosomes + XY gonosomes.

1.1.9 Mutation e kaba e tshusumetso e latelang:

- (i) E Khouda amino acid e ntseng e tshwana
- (ii) E tjhentjha poroteine e entsweng
- (iii) E bakela mafu ho organism
- (iv) Ha e hlahelle ho fenothaephe ya organism
- (v) E atisa menyetla ya ho phela

Ke efe e le NNGWE ya dikopantsweng tse ka hodimo e bakwang feela ke dimutation tse kotsi?

- A (i), (ii) le (iv)
- B (ii) le (v)
- C (iii) feela
- D (ii) le (iii)

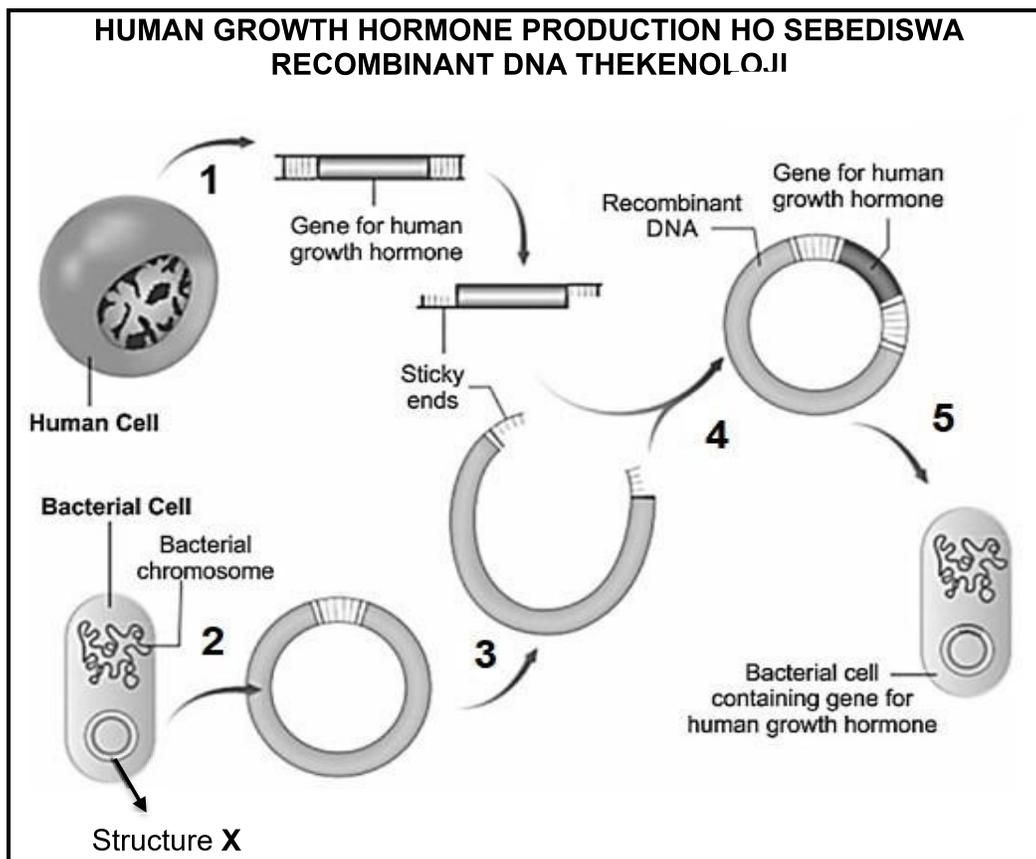
(9 x 2) (18)

- 1.2 Fana ka lentse le nepheletseng **la baeloji** bakeng sa tihaloso ka NNGWE ho tse latelang. Ngola feela lentse pela nomoroya potso (1.2.1 ho isa ho 1.2.9) BUKENG YA DIKARABO.
- 1.2.1 Setshwantsho sa dinomoro, sebopeho le tatellano ya dikromosoumu nucleus ya somatic sele
- 1.2.2 Tulo ya extra-nuclear DNA e ho dimela feela
- 1.2.3 Tulo moo ho kopanang non-sister chromatids ha di ovalepha e nngwe ho e nngwe nakong ya crossing over
- 1.2.4 Mofuta wa madi o nang le diallele tse recessive tse pedi
- 1.2.5 Tulo ya jene ho chromosome
- 1.2.6 Strand sa DNA moo dinucleotide di manamang ho aha DNA strand se setjha
- 1.2.7 Maemo a bonahatswang ke ho eketseha ha keromosoumu ho bohato ba 21
- 1.2.8 Mofuta wa dibond tse kopanyang dinitrogenous beyise tse ho DNA molecule
- 1.2.9 Maemo a cell moo ho nang le sete e le nngwe feela ya dichromosome
- (9 x 1) (9)
- 1.3 Bontsha hore ditlhaloso tse ho KHOLOMO I, Di tsamaelana le **A FEELA, B FEELA**, A le B KA BOBEDI, kapa HA E YO ho tse ho kholomo II. Ngola **A feela, B feela, A le B ka bobedi**, kapa HA e YO haufi le nomoro ya potso (1.3.1 ho isa ho 1.3.3) BUKENG YA DIKARABO.

| KHOLOMO I |  | KHOLOMO II |                         |
|-----------|--|------------|-------------------------|
| 1.3.1     | Mofuta wa variation o fumanehang ho mofuta ya madi | A:         | Co-dominance            |
|           |  | B:         | Discontinuous variation |
| 1.3.2     | Cytokinesis e etsahala habedi                      | A:         | Meiosis                 |
|           |  | B:         | Mitosis                 |
| 1.3.3     | Bosiyo ba difactor tsa blood-clotting              | A:         | Haemophilia             |
|           |  | B:         | Colour-blindness        |

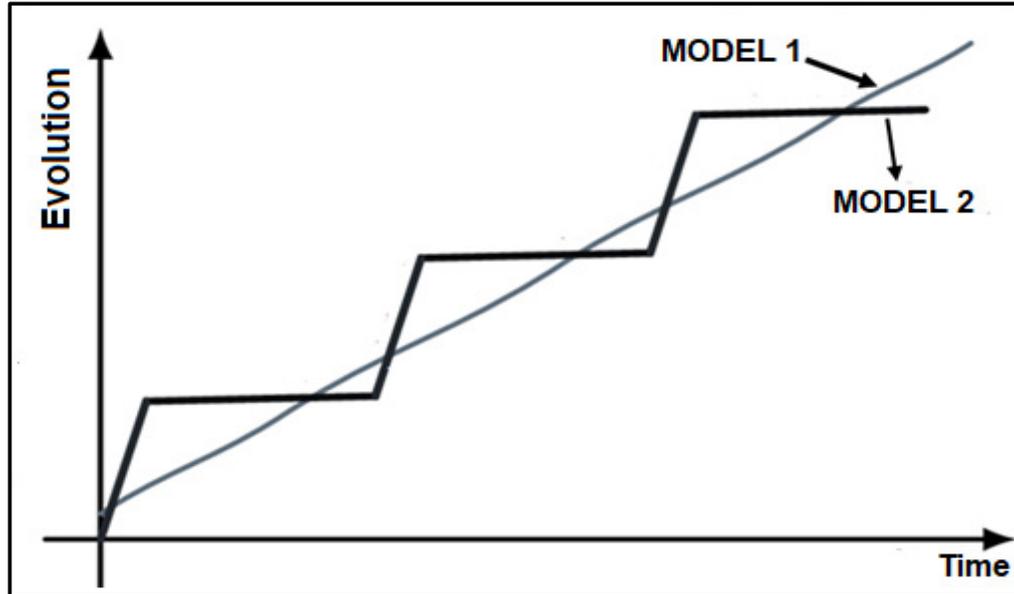
(3 x 2) (6)

- 1.4 Growth hormone e bohlokwa ho susumetseng kgolo ya masapo le mesifa. Eka etsuwa bakeng sa batho ba sa kgoneng ho ntsha, kapa ho ntshuwa ha nyane ha hormone ena ho sebediswa recombinant DNA thekenoloji.



- 1.4.1 Fana ka biotechnological porose e bontshitsweng ka hodimo. (1)
- 1.4.2 Hlwaya structure X se fumanehang ho baketheriyale cell e sebedisitsweng poroseseng e ka hodimo. (1)
- 1.4.3 Fana ka diorganic catalyst tse sebedisitsweng ho seha structure X. (1)
- 1.4.4 FANA ka bohlokwa bo le BONG ba:
- (a) Ho sebediseng homoune ya kgolo ke dimathi (1)
  - (b) Porose e boletsweng ho POTSO 1.4.1 ho batho ba nang le lefu la tsekere (1)
- 1.4.5 Bolela dibopeho tse PEDI tsa baketheriya tse etsang hore di be bohlokwa ho sebedisweng ha porose e ka hodimo. (2)
- 1.4.6 Fana ka tlhaloso e le NNGWE e bonahalang ya mosebetsi wa disticky end/tse manamang tse bonahaditsweng poroseseng e ka hodimo. (1)

- 1.5 Dayakeramo e katlase e bontsha modele tse sebedisitsweng ho hlalosa teori ya evolushene.



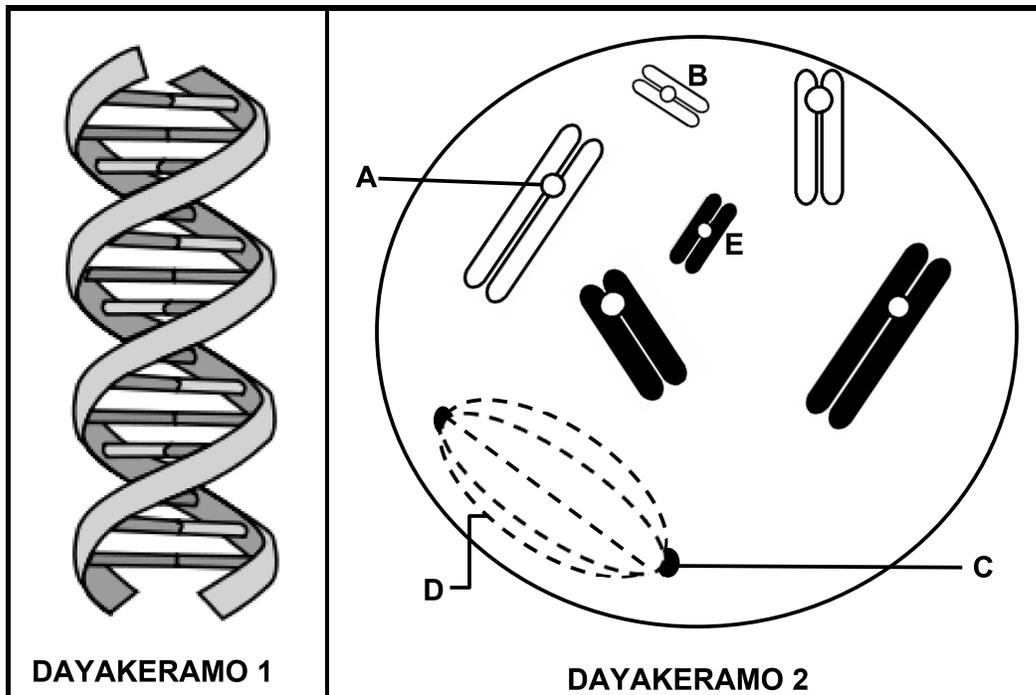
- 1.5.1 Hlwaya evolushenari teori e ho MODELE 2. (1)
- 1.5.2 Fana ka borasaense ba BABEDI ba entseng tlhaiso ka teori ya evolushene ho MODELE 2. (2)
- 1.5.3 Ke efe evolushenari MODELE, 1 kapa 2 e:
- Bontshang dipheleho tsa dikgato tse nyenyane ho diorganism ho tloha ho generation e nngwe ho isa ho enngwe? (1)
  - Tshehetswang ke bosiyo ba ditransitional fossil? (1)
  - Tshehetswang ke rasaense ka theory of evolution by natural selection? (1)
- 1.5.4 Hlalosa ho tla etsahala eng ho species ho dipoint **A** le **B** ho MODELE 2, ka tatellano. (2)
- 1.5.5 Fana ka mofuta wa evolushene moo ho le teng pheleho ya tshobotsi(sebopelo) ya species e nkang nako e telele. (1)

**MATSHWAO A KAROLO YA A: 50**

## KAROLO YA B

## POTSO YA 2

2.1 Didayakeramo tse ka tlase di bontsha molecule wa DNA ho phase ya meiosis.



- 2.1.1 Ke efe phase ya meiosis e emetsweng ke DAYAKERAMO 2? (1)
- 2.1.2 Hlwaya: (1)
- (a) Karolo **C** (1)
- (b) Lebitso le kopanyang chromosome **B** le **E** (1)
- (c) Phase ya meiosis moo karolo **A** e arohanang (1)
- 2.1.3 Di kae dichromatid tse nang le DNA e tshwanang ho dichromosome tse kgohlilweng ka botsho ho DAYAKERAMO 2? (1)
- 2.1.4 Hlalosa sebopelo sa nucleotide ho DAYAKERAMO 1. (2)
- 2.1.5 Bolela o be o Hlalose bohlokwa ba porosese e etsahalang ho DNA nakong ya interphase e isang ho tjebeho ya chromosome ho DAYAKERAMO 2. (3)
- 2.1.6 Hlalosa karolo e etswang ke **D** ho metaphase I ya meiosis. (3)
- 2.2 Bolela o be hlalose porosese moo tRNA e bapalang karaolo ho etsweng ha protein. (5)

## 2.3 Bala tema e ka tlase.

Gene therapy ke mokgwa wa pheko ya tsa bophelo e sebedisang genetic material ho thibela le ho phekola mafu a jwaloka cystic fibrosis, lefu la sickle cell le macular degeneration. Ho macular degeneration diretina cell di ya senyeha. Genetic diseases tsena di bakwa ke digene mutation ho DNA molecule ho lebisang ho etsweng ha porotein e sa nepahalang. Ho gene therapy, dikarolo tsa tatellano tsa mutant gene di a tloswa ho DNA e be ho repoleiswa ka tatellano e nepahetseng bakeng sa tsona. DiStem cell di sebediswa ho fetisetsa tatellano e nepahetseng ya gene ho etsa porotein e sebetsang hantle.

2.3.1 Bolela disource tse PEDI tseo ho ka fumanwang stem cells. (2)

2.3.2 Fana ka lefu le le LENG le amang pono leo gene therapy e etseditsweng ho le phekola. (1)

2.3.3 Gene mutation e etsahetse ho karolo ya DNA molecule e bontshitsweng ka tlase.

|                   |          |          |          |          |          |
|-------------------|----------|----------|----------|----------|----------|
| Original sequence | TTT      | TCA      | GGT      | ACG      | CAC      |
| Mutated sequence  | TTT      | TCA      | GGT      | ACC      | CAC      |
| Base triplet      | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> |

Ngola nomoro ya base triplet e bontshang gene mutation. (1)

2.3.4 Theibole e ka tlase e bontsha tse ding tsa dicodon le diamino acid tseo di tsamaelanang le tsona.

| CODONS | AMINO ACIDS   |
|--------|---------------|
| AAA    | Lysine        |
| GAG    | Glutamic acid |
| CAC    | Histidine     |
| UGC    | Cysteine      |
| ACU    | Threonine     |
| AGU    | Serine        |
| GAU    | Aspartate     |
| UGG    | Tryptophan    |
| UUU    | Phenylalanine |
| CCA    | Proline       |
| GUG    | Valine        |

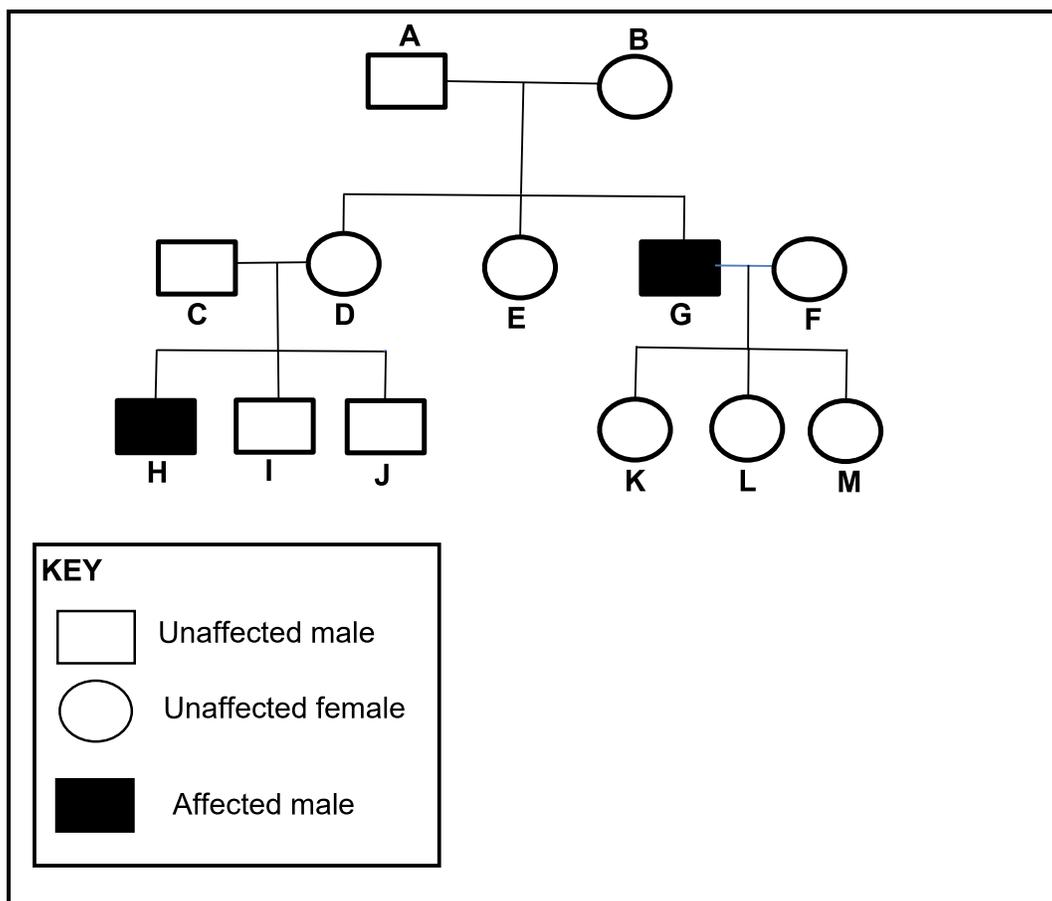
(a) Fana ka amino acid ya base triplet **5** ho POTSO 2.3.3. (1)

(b) Hlalosa ka moo gene therapy e ka lokisang mutated sequence ho etsa porotein e sebetsang ka ho nepahetseng. (3)

(c) Teroya stick dayakeramo sa molecule e nkang coded message ya protein synthesis e nang le complementary codon e nepahetseng ya base triplet **2**. (4)

- 2.4 Leigh syndrome ke autosomal recessive genetic disorder e sa tiwaelehang e amang central nervous system baneng ba ba nyane. Boemo bona bo ka ama le batho ba baholo hape ka nako tse ngata le bakela ho shwa ha bana ba sa le dilemong tse tlase.

Pedigree dayakeramo e ka tlase e bontsha lefutso la disorder ena ho lelapa. Allele **b** e sebedisitswe ho batho ba nang le tshwaetso.



- 2.4.1 E bolela eng term *autosomal recessive*? (2)
- 2.4.2 Ngola fatshe TLHAKU ya ngwana ya ka nnang a shwa ho F<sub>2</sub> generation. (1)
- 2.4.3 Hlalosa ho tla jwang hore ngwana ya boletsweng ho POTSO 2.4.2 a be le tshwaetso ya Leigh syndrome. (2)
- 2.4.4 Fana ka Mendel's Law of Dominance e hlahellang ho diphenotype tsa batho bana **K**, **L** le **M**. (1)
- 2.4.5 Hlalosa karabo e ho POTSO 2.4.4. (3)

- 2.5 Fragile X syndrome ke sex-linked dominant inheritance. Allele e bakang boemo bona e dominant  $X^R$ , ha batho ba se nang fragile X syndrome ba e na le recessive allele  $X^r$ .
- 2.5.1 Bolela phenotype ya motho ya nang le genotype  $X^R X^r$ . (2)
- 2.5.2 Hlalosa hobaneng ka bobedi bannna le basadi ba e na le menyetla e lekanang ya ho kula ke fragile X syndrome. (2)
- 2.5.3 Monna ya nang le genotype  $X^R Y$  o nyala mosadi ya nang le genotype  $X^r X^r$ .
- Sebedisa genetic cross ho hlalosa probability ya banyalani bana hore ba be le mora ya nang le fragile X syndrome. (7)

**[50]**

**QUESTION 3**

- 3.1 Dipereeng, bay hair coat colour (**B**) e dominant ho feta black hair coat colour (**b**), le smooth hair (**H**) e dominant ho feta curly hair (**h**).

Rapolasi o e ntse breed ya dipere tse black hair coated le curly hair bophelo bohle ba hae hape kaofela difoal (offspring) di ne di dula di shebahala jwaloka batswadi ba tsona ka mmala o tshwanang wa black hair coat le curly hair.

- 3.1.1 Fana ka lebaka le le LENG hobaneng sena e le mohlala wa dihybrid cross. (1)
- 3.1.2 Fana ka mofuta wa kgetha o dumelletseeng rapolasi ho etsa breed pakeng tsa dipere tse black hair coated le curly hair bophelo bohle ba hae. (1)
- 3.1.3 Fana ka lebaka le le LENG le entseng rapolasi a etse breed ya dipere tse black hair coated le curly hair ho generation tse ngata. (1)
- 3.1.4 Bolela genotype ya:
- (a) Motswadi wa pere ya nang le black hair coat le curly hair (2)
- (b) Digamete tsa pere e heterozygous ho hair colour le hair type ka bobedi (2)
- 3.1.5 Fana ka phenotypic ratio ya offspring e tla tswa ha dipere tse PEDI tse heterozygous di khroswa tsa dicharacteristic tsena. (2)

## 3.2 Bala tema e ka tlase:

African penguin (*Spheniscus demersus*) population e thohile mona Aforika Borwa hape e ka fela ka selemo sa 2035. Hona ho bakelwa ke tahlehelo ya sebaka sa bodulo le ho tswaswa ka ho fetisitseng bakeng sa dijo tsa moshwelella, sardines (pilchards). DiAfrican penguin di hloisana le commercial fisheries Cape Town bakeng sa disardine. Commercial fisheries di boleng ba dibillione tsa diranta le khiro ya batho ba bangata.

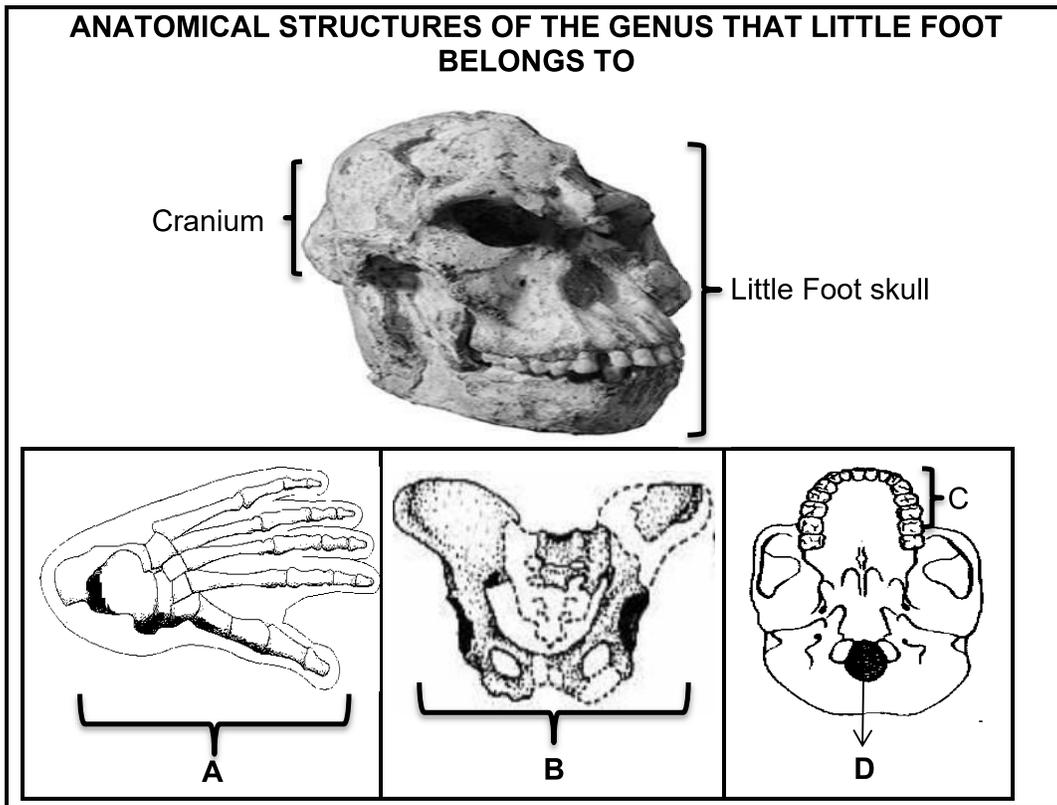
Sardines ke mokgwa wa dijo tsa boleng ba theko e tlase bo tletseng ka diprotein hape dikotulwa ka lenane le phahameng kgwedding ya March ho isa ho May mona Aforika Borwa hape e bile e leng nako ya thobalano ya African penguin. Nakong ya thobalano mefuta e mmedi ya bong ba African penguin bo etsa modumo wa lerata le phahameng ho bitsa bommate tsa tsona. DiNature conservationist di batla mmuso o fokotse lenane la disardine tse kotulwang ke commercial fisheries.



African penguin

- 3.2.1 Fana ka bopaki ho tswa ho tema ena bo hlalose hore African penguin e tla be e fedile nakong e tlang. (1)
- 3.2.2 Ho ya ka tema ena: (1)
- Bolela dintho tse PEDI tse bakelang ho fokotseha ha African penguin population (2)
  - Hlwaya reproductive isolating mechanisms tse PEDI tse hlahellang ho diAfrican penguin (2)
- 3.2.3 Hlalosa hore phokotso ya lenane la kotulo ya disardine e ka etsa jwang ho:
- Theola moruo (2)
  - Fana ka molemo ho diAfrican penguin (2)
- 3.3 Hlalosa hore species se setjha se etsahala ha jwang ho tswa ho geographic barrier. (7)

- 3.4 Little Foot ke hominid fossil e ileng ya fumanwa mahaheng Sterkfontein ke Professor Ron Clarke. Masapo a Little Foot a bontshitse fossil e na le dicharacteristic tse ngata tse tshwanang le tse fumanehang bathong.



- 3.4.1 Ke lefe lebitso la saense la Little Foot? (1)
- 3.4.2 Ngola fatshe TLHAKU ya sebopeho se hlahosang genus ena:
- (a) Enang le dicanine tse nyane (1)
  - (b) Spinal column se kene ho skull ka mokgwa o vertical bakeng sa bipedalism (1)
  - (c) E na le diforelimb tse tshwanang le tsa batho (1)
- 3.4.3 Hlalosa ka moo sebopeho sa **B** se bontshang hore genus ena e na le phetoho e kgolo ho feta primitive apes le phetoho e nyane ho feta ya batho. (2)
- 3.4.4 Hlalosa bohlokwa ba ho tjhentjha ha saese ya cranium ya Little Foot ho batho ba mehleng ena. (2)
- 3.4.5 Little foot e sebediswa e le bopaki ba fossil bo tshehetsang 'Out-of-Africa' hypothesis.
- (a) Bolela bo BONG ba bopaki ba tshehetsang 'Out-of- Africa' hypothesis. (1)
  - (b) Hlalosa hore difossil tsa little foot's genus di sebediswa ha jwang ho tshehetsang 'Out-of- Africa' hypothesis. (2)

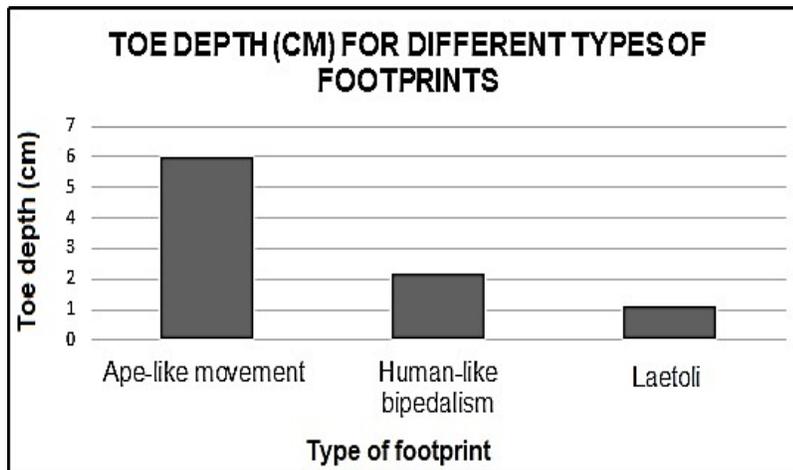
- 3.5 Laetoli footprints ke fossil e dilemong tse 3,6 million e ileng ya fumanwa ke palaeontologist, Mary Leakey Tanzania. Sebopeho sa leoto le monwana le bolelele ba leoto bo hlalosa hore difootprint di ne di entswe ke bipedal hominid ancestor e neng e kgona ho tsamaya e otlohile.

Dipatlisiso di ile tsa etswa ho fumana hore batho bana ba ileng ba etsa Laetoli footprints ba ile ba sebedisa bipedalism e tshwanang le ya motho kapa motsamao o tshwanang haholo le wa-ape (bent-knee, bent-hip).

Mokgwa wa tsamaiso e bile o latelang:

- Botebo ba kगतello ya menwana ho molora o bolokileng Laetoli footprints e kadilwe ya rekhodwa.
- Batho bao e leng bankakarolo ba robedi ba kopilwe ho tsamaya lehlatheng le botebo ba difootprint tsa menwana ya bona bakalwa hape ba rekhodwa.
- Batho bao e leng bankakarolo ba kotjwa ho etsa nketsisane (copy) ya motsamao wa diapi ba sebedisa “bent-knee, bent-hip” motsamao o tshwanang-le wa api lehlatheng.
- Botebo ba difootprint tsa monwana ba kalwa ba rekhodwa.

Diphetho tsa investigation di rekhodilwe kerafong e latelang.



- 3.5.1 Hlalosa maikemisetso a investigation ena. (1)
- 3.5.2 Hlwaya hore dependent variable e kadilwe jwang ho investigation ena. (1)
- 3.5.3 Bolela mehato e MERARO e hlokometsweng ho etsweng ha investigation ena. (3)
- 3.5.4 Fana ka mabaka a MABEDI hobaneng investigation ena e ka nkuwa e sa tshepahale. (2)
- 3.5.5 Bolela mofuta wa footprint o nang le bolelele ba botebo ba monwana. (1)
- 3.5.6 Ke boholo ba makgetlo a ma kae ba botebo ba monwana wa bipedalism bo tshwanang le ba motho ho bapiswa le Laetoli footprint? Bontsha dikhaletjhuleishene KAOFELA. (2)
- 3.5.7 Teroya theibole e bontshang infomeishene e ho kerafo. (4)

[50]

MATSHWAO A KAROLO YA B: 100

MATSHWAO OHLE: 150