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HARNIT SINGH SUDAN

AIR 177 CSE 2023

ANTHROPOLOGY

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Anthropology Test Series

TEST - 02

ANTHROPOLOGY

Time Allowed: 3 Hrs. *Max. Marks: 250*

Instructions to Candidate

- There are FIVE questions. All Questions are compulsory.
- Answers must be written in the medium authorized in the Admission certificate which must be stated clearly on the cover of this Question-cum-Answer (QCA) booklet in the space provided. No marks will be given for answers written in medium other than the authorized one.
- Word limit in questions, wherever specified, should be adhered to.
- Attempts of questions shall be counted in chronological order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the answer book must be clearly struck off.
- 107

Name HARNIT SINGH

Mobile No. _____

Date _____

Signature _____

1. *Invigilator's Signature* _____

2. *Invigilator's Signature* _____

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REMARKS

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Hello Harnit,

① Overall answers are good.

② Few General Feedback you should keep in mind –

↳ Improve your diagrams and label them

↳ Use of examples are something you can work on. In physical Anthro. we have ample scope to used diag. and examples

↳ Sometimes you write a point in one or two words. Try to frame those points in ~~sig~~ single line.

↳ Overall structure of Answers are fine

↳ if possible make handwriting more legible.

Good work! Keep Writing!

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Roll No. 81317

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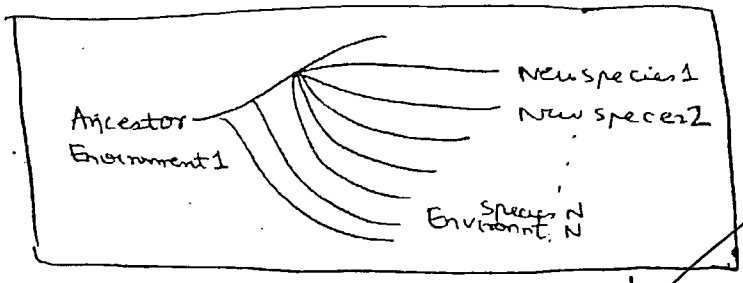
1. (a) Adaptive radiation in primates. (150 Words) (10)

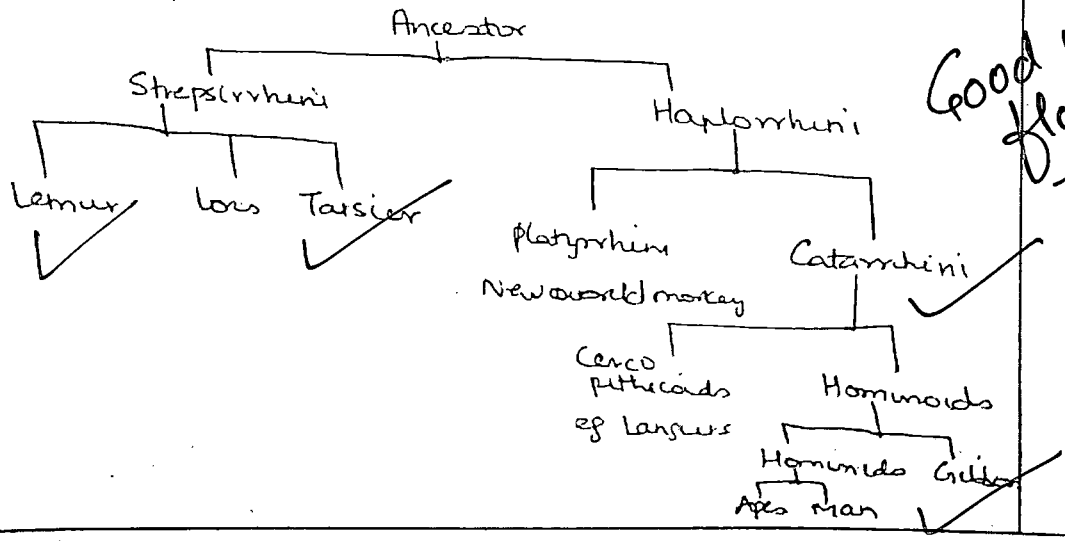
A Adaptive radiation refers to the diversification of a species into various new species on account of adaptation to different environments and reproductive isolation.



Good use of diag.

examples:- After Mesozoic extinction of Dinosaurs, Mammals got opportunity to expand into diverse habitats and developed into various new species like Pisces (water), aves (air), and Primates (arboreal + terrestrial) etc.

Adaptive Radiation in Primates:- on occurence on different environmental conditions, predator risks etc, primates further diversified into differ families and subfamilies



Good use of flow chart

Remarks

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Some examples of Adaptive Radiations

① Locomotory habits :- Loris – slower climbers
Gorilla – Knuckle walkers

② Diet : Baboons : Carnivore
Gorilla Herbivore

③ Feeding activity :- Nocturnal eg Loris
Diurnal : eg humans

④ Size : Loris 30g
Gorilla 200kg

Overall, Adaptive radiation is one the mechanisms of Speciation that help organism develop specialisations wrt to env conditions & stresses.

Overall Good attempt

5½/10

Remarks

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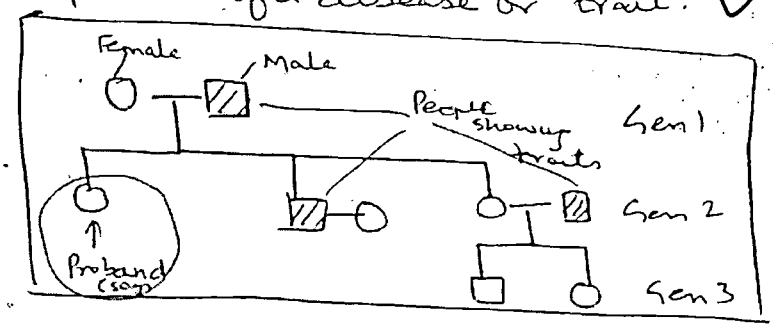
1. (b) Pedigree Analysis (150 Words) (10)

A Geneticists are always debating about relative role of genes & env in humans & other species. However, the exact & empirical answer is still elusive.

Pedigree analysis is one of the methods that can help us in this.

- It refers to drawing of a chart/family tree, consisting of generations related to the proband to understand inheritance pattern of a disease or trait.

Talk about dominant pedigree and recessive pedigree



Good use of diag.

Procedure:-

- Proband is questioned regarding prevalence of traits in various generations above and below him/her.
- Patterns are analysed to discern if it is dominant/recessive, autosomal/sex linked.
- If required help of geneticists is also taken.
- Then the concerned person is referred to Genetic Counsellor or Doctor.

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Principle

- Recessive traits can skip generations, but dominant traits don't.
- Autosomal traits affect both sexes equally but sex linked usually affect males more

Benefits of using Pedigree Analysis

- Disease Prevention
- Marriage advice
- Family Illnesses
- Human phylogeny

Method does not take account of environmental impact

Concerns:-

- Need to ensure sample size is large
- Info needs to be correct

Elaborate a bit on these points

Overall, Pedigree analysis can be combined with DNA sequencing to make it error proof & more accurate.

4/10

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1. (c) Cro-Magnon (150 Words) (10)

A Cro-Magnon is the name of an Archaic Homo sapien skeleton/remains discovered in France, in 1880's by E Lartet. It was discovered in a shallow pit, having cultural remains as well.

General characters

Dated:- 40k to 10,000 years ago.

Height:- Around 5 feet.

Features :-

1. Cranial Features

- Long & narrow skull was discovered
- The face was broad & long.
- This led to creation of Cranial Disharmony
- The remains had human like teeth but jaw was massive.
- Rectangular eye orbits, but very low.
- Well developed chin.
- Long and narrow nose.

· Cranial Capacity: 1500-1600 cc

2. Post cranial features

- Muscular built and strong bones.
- Almost modern human like features including Linea aspera.

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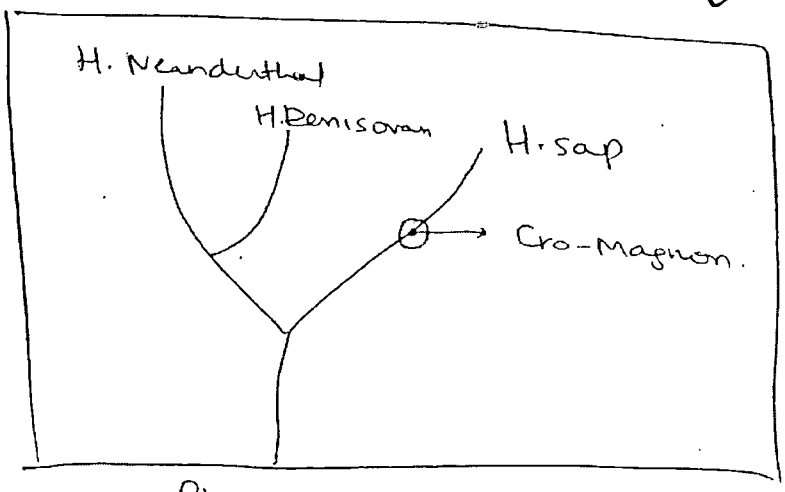
Cultural Features

- Acheulean culture : consisting of sharpened hand axes, chopping tools of upper Paleolithic age.
- Burial of dead like Neanderthals.
- Fire pits and year long dwelling in caves.
- Artistic tendencies seen :- Cave drawing and Statuettes built
- Body covered by fur.

if possible show cranial features in diagram.

Phylogenetic Implications :- It was concluded that he is closely related to modern Homo sapiens & in fact he did not go extinct but is present among DNA of modern day europeans

5/10



Phylogenetic Implications

Good use of diag

Remarks

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1. (d) Foster Child. (150 Words). (10)

A To what extent do environment affects is in tandem without genetics has been the question geneticists are looking to answer. Foster child method is one of them. A Foster child simply is an adopted child / or non biological child.

(Nature vs. Nurture)

Procedure:-

- Different foster child are sent to diff homes belonging to different socio-economic conditions.
- Then, after some time an evaluation or test is taken for all of them.
- The wider the divergence in score greater is the effect of environment, the lesser the divergence, more is the role of genes.

Precautions:-

1. Children should be adopted as early as possible.
2. Children should be of same ethnic community to avoid any extravariables.
3. The households should be segregated on objective criteria strictly

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(4) Orphanages can be a good source of study of nature vs nurture debate

Add limitations also. Talk about ethical issues related to the method

Case study

Chicago studies:- Conducted in 20th century, it found a correlation of IQ with socio economic conditions of homes, with wealthy household children scoring the best and poor household children scoring the least.

Overall, this method is still not fool-proof and errors can be better removed by combining it with DNA sequencing.

Write 2 ~~sa~~ case studies
One for influence of Environment only
One for influence of Env. & Genetics

4/10

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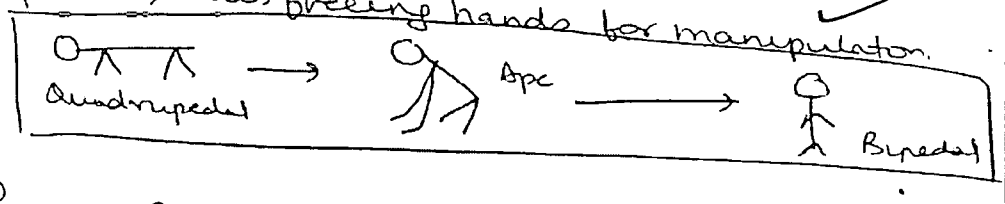
1. (e) Biological and cultural factors in Human Evolution (150 Words) (10)

A Human evolution or Hominization is process of evolution of Hominoids & Hominids (Apes, Monkeys etc) in Humans. It is a long process that has taken millions of years to make us what we are today. It is combination of both biological & cultural factors

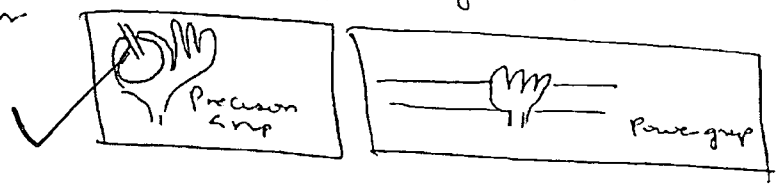
Biological Factors

1. Bipedalisation & erect posture :- Migration of Foramen magnum to the centre of skull, helped us become bipedal, thus freeing hands for manipulation.



Good use of diag.

2. Precision Grip & Power grip :- Opposability of thumb & prehensility of digits helped us grab & move things better.



3. Encephalisation :- Development of brain especially the cerebral region help in fine motor controls & enhanced comprehension & memory

4. Longer Gestation & Post Natal Dependence :- Human have the longest gestation period & post natal development

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period away to such a big brain.

5. Generalised Adaptation : From teeth to other body parts, we avoided specialisation and today we can live in almost any environment.

Try to use a cause and effect flow chart. connect how one cultural feature led to emergence of other.

Cultural Features

1. Tool Making & use :- We have been able to use our biology to make & adapt tools & evolve culture to help us survive better.

2. Complex Division of Labour :- We divide work not just by sex, but by skill, competence

3. Complex Social Political Economic Organisation :- The level of sophistication in these institutions is unprecedented.

4. Language & Communication :- From big game hunting day to now, our ability to communicate has done wonders

4/10

Overall, human being is a mosaic of culture and biology in perfect harmony, making us what we are today.

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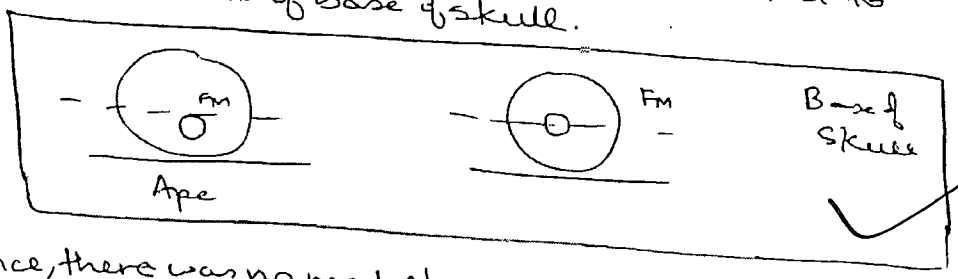
2. (a) Discuss the evolutionary significance of bipedalism and erect posture. (200 Words) (15)

A Bipedalism & erect posture refer to us (humans) being able to walk on two legs, without any support or help. Though this tendency of upright posture is seen in many other primates, but none have achieved perfection in it like we have. To accomodate such a locomotion, various body parts had to under go modification, in the evolutionary time line.

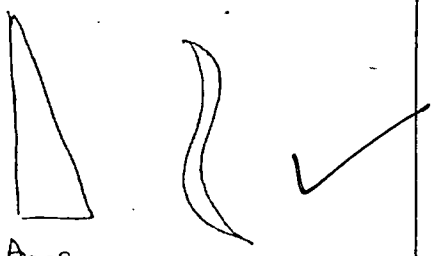
Some of them are :-

① Skull :- To keep the body upright, skull needs to be balanced on spine, so Foramen magnum had to move in the centre of base of skull.



Since, there was no need of occipital frontalis muscle, we lost the supra orbital brow ridges & sagittal crest.

② Spine :- To have an erect posture our spine has two curves in the thoraic + lumber portion unlike Apes. Moreover sacrum is embedded into pelvic girdle to support body weight.



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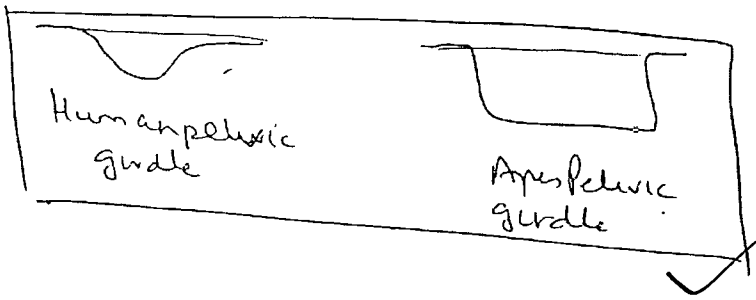
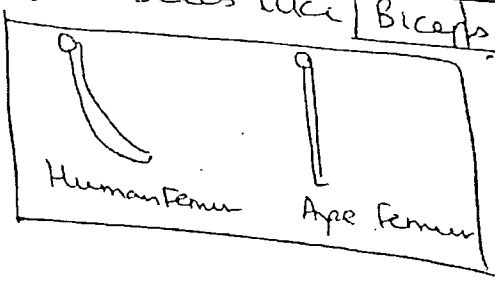
(3) Hands :- Since we dont use hands to walk or brachiate our fingers & hands are less robust than apes.

(4) Pelvic Girdle :- our pelvic girdle has to support body weight entirely, so it is basin shaped (as opposed to rectangular in apes) and has strongest muscles of body (Gluteus Maximus, Minimus)



(5) Legs :- Our femur is bent to make our knees anatomically correct and have large length & strong muscles like Biceps Femoris



(6) Knee :- Our knees face forward, are bigger and are always below our body to allow us move. This helps avoid bent knee posture of Apes

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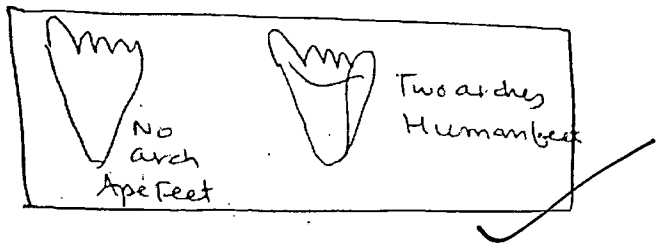
(7) Feet: Apes have flat feet and that makes it unstable. Our feet have arches and help in optimum weight transfer



But 'being bipedalism, has its own pathological implications like

(1) Disc problems (2) Cervical problems

(3) Back pains.

Accordingly modern research says sitting is the new cancer. Thus we can conclude, that we're still adapting morphologically to erect bipedal motion

$5\frac{1}{2}/15$

Connect how these changes leads to cultural significance.

You have mentioned all the changes but relevance and significance part is lacking.

Also diagrams can improve.

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2. (b) What is a Mendelian population and Hardy-Weinberg equilibrium. What is the explanatory value of these concepts in the field of anthropology. (200 Words) (15)

A

Mendelian population (MP) refers to a population where the individuals can breed randomly. It signifies no restrictions, no barriers to mating, even potentially interbreed.

(example ?)

- However, today we have lots of restrictions of caste, Race, gender, incest, socio-economic status etc.

- MP as a concept has the following traits.
  - no restrictions on breeding
  - continuity in time
  - non changing allelic frequencies.

For such a non evolving population → Hardy & Weinberg presented a mathematical formula than predict the allelic and phenotypic frequency across generations.

Consider two alleles of trait A → p & q with allelic frequency of "P" & "Q" & say p dominates over q.

Since sum of allelic frequencies is 1 → $P+Q=1$.

Possible genotypes — PP, Pq, qP, qq.

Probabilities — P^2, PQ, PQ, Q^2

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You can explain the equation with an example

Sum of all genotypic frequencies should also be one

$p^2 + q^2 + 2pq = 1 \Rightarrow (p+q)^2 = 1$

$p + q = 1$

This is the Hardy weinberg equilibrium which states that in a non changing population, allelic frequencies will never change and genotypic frequencies can be predicted by the help of H-W. law.

Conditions for Hardy W. law / equm.

1. Population size should be ∞ to avoid Genetic Drift
2. No mutations are allowed.
3. No Immigrations / emmigrations i.e no gene flow.
4. Population can mate randomly.

However in real life, such conditions are not followed & mutations, gene flow, genetic drift, & non random mating occurs

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Utility

- Hardy weinberg law gives the ideal conditions, deviating from it we can certainly conform that the population is evolving.
- It can help us study various traits & alleles and find out reasons behind its trends.
- It can be applied in lethal traits and identify what are the reasons for its existence
- It can help us in applications in human genetics & pathology

Overall, it is a great tool to help us study evolution in detail

6/15

In utility / Application part try to give specific examples.

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2. (c) Describe major skeletal similarities and differences between Homo Erectus and Homo Sapiens. (250 Words) (20)

A The genus Homo has evolved through many millions of years to arrive today at Homo sapiens. One of the ancestors of our was Homo Erectus that lived around 2.6 mya to 1.5 mya.

Some of the features of H. erectus

- 1st Homo to move out of Africa
- 1st Homo to use fire
- 1st Homo to use tools extensively.
- 1st Homo to cover body using fur.

Major Skeletal features v is-a-vis Homo sapiens

1. Cranial Features

Similar	Different
• Has a much bigger brain (1000-1300cc), almost touching Humans.	• However, it is only one the lower bounds, whereas H. sapiens have upto 1500cc of cranial capacity.
• Presence of forehead in H. erectus.	• However, it is slanting and receding.

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For better representation

Difference

HE	HS
1 —	—
2	
3	

Similarities

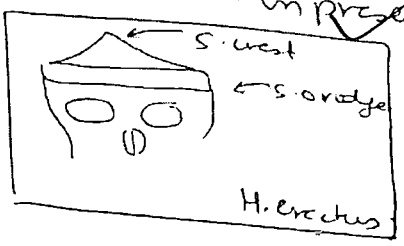
1
2
3

Similar

3. It has a rounded skull like humans.
4. It has no sumanshelf.
5. Flat face, almost like modern man
6. Foramen Magnum is centre like Humans.
7. Teeth like humans, no diastema.
8. No prognathus
9. No projecting canines
10. Parabolic dental arcade

Different

3. However the cranial vault here is very thick
4. But it also has no chin.
5. However, slight supra orbital ridge + sagittal crest un present



6. Nothing different, this feature is absolutely human.
7. But the jaw is still very massive.
8. But nasal bridge is very wide compared to humans.
9. Zygomatic Arch is still very massive

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Post Cranial features

Similar

- presence of chin
- Presence of Linea Aspera

Different

- However joints are very robust and massive as compared to humans.

Mention more points in postcranial features

~~Talk about~~

Use skeletal diagram to show difference and similarity.

9/20

Homo erectus later evolved into H. neanderthal in europe and archaic Homo sapiens, & leading to today becoming Homo sapiens.

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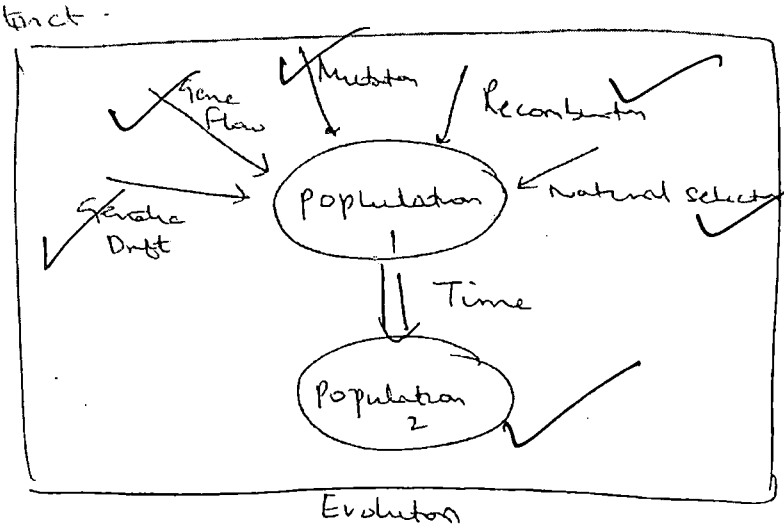
3. (a) Give a critical account of the processes of organic evolution and explain how they contribute to speciation. (200 Words) (15)

A Organic evolution according to Darwin is "Descent with Modification". It refers to process of progressive changes in a population in response to various factors like environment stresses etc. It is a rule of nature and what does not evolve goes extinct.



Good representation through flow chart

Processes of organic revolution refers to

Primary processes	Sec. Process
1. Mutation	1. Natural Selection
2. Gene flow	2. Reproductive Isolation
3. Genetic Drift	
4. Recombination	

Remarks

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1. Mutation: Refers to rare and unpredictable changes in DNA sequence that may or may not lead to phenotypic variation. This the primary source of creation of variations and new alleles in a population. These changes may get accumulated & become a new species

Types of Mutation

- autosomal vs allosomal
- point or non-point
- induced or spontaneous

2. Gene flow: Refers to change in allelic frequency on account of immigration or emmigration of individuals. It introduces new alleles that may ~~get~~ selected ~~Good~~ lead to new species

3. Genetic Drift: Refers to a random process that acts on alleles, either fixing them or eradicating them. Eg. A group of blue snails crushed by a cow lead to their elimination.

4. Recombination: It refers to exchange of alleles at gamete stage to create new combination that may offering advantages for a group/ individual.

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Natural Selection :- One cause of variation accumulated variations from previous generations and individual may have an adaptive advantage or disadvantage. Natural selection eliminates the disadvantage & propagates the advantageous traits.

Reproductive Isolation :- Refers to non mating b/w individuals of different groups. This creates & preserves the unique variations in a gene pool and with time may create a new species all together

Since we are discussing about speciation, try to mention about different types of speciation as well.

Overall, speciation is a collaborative effect of all the above factors combined with time leading to all biodiversity around us.

6½/15

Remarks

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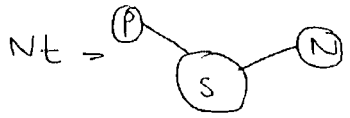
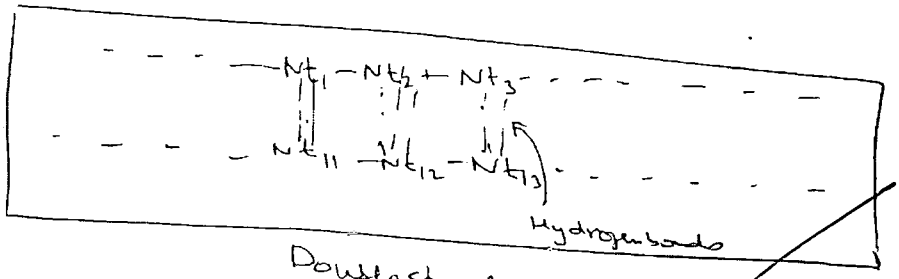
3. (b) Discuss the relevance of DNA technology in prevention and cure of diseases. (200 Words) (15)

Good Intro

A DNA is the genetic material responsible for functioning of an organism and propogation of traits across generations. It is a polymer of Nucleotides (Nt) which consist of a sugar, a nitrogenous base & phosphate group





Double stranded DNA.

- DNA technology refers to the advances in techniques of studying, modifying & creating new DNA according to our need.

Take example Here

- Earlier man was a slave of the unknowns of his biology, now with advances, he has a much better understanding and clarity of processes behind all the processes & reactions.

Thus DNA technology has various tools like DNA sequencing, DNA fingerprinting, DNA editing, PCR, RT-PCR, vaccines etc

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Applications in Prevention & cure of Diseases

1. Genetic Screening :- It refers to reading the DNA of apparently healthy individual to identify certain traits that could be harmful.

(Eg) A women can be carrier of "Haemphilia gene". If she marries a man with "Haemophilia", the child may also suffer from it. Genetic screening can help to avoid this and give them preventive advice.

Good points

2. Gene Therapy:- It refers to modifying / knocking out / adding a part of gene to relieve the person from pathological conditions.

(Eg) A person having faulty Haemtopoetic stem cell will suffer from frequent anaemia. With Genetherapy we can give correct gene encoded Haemopoetic stem cell to cure anaemia

3. Understanding Pathogens:- Today pathogens are evolving very fast, and we can only be ahead of them by understanding their genome, working & processes which can be done by help of DNA sequencing

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4. Vaccines developed :- Today, thanks to recombinant DNA technology we can develop vaccines quickly and save millions of lives

Eg CoVDshield & Covaxin in case of COVID-19.

5. Disease Resistant plants :- Like Bt cotton we can have other such plants and ensure food security of lives.

Not related to disease

Overall, DNA technology has widened the horizon for applications & potential benefits out of it.

For better presentation mention separate examples of cure and prevention.

cure → Medicines

prevention → Vaccines, Genetic Screening etc.

6/15

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3. (c) Compare the fossil remains of progressive and 'classic' Neanderthal men for anatomical characteristics and spatial distribution. Examine their phylogenetic position in human evolution. (250 Words) (20)

A Neanderthal Man or H. Sapien. neanderthalensis is as a member of Homo that existed in cold climate of europe around 2 lakh years ago to 35,000 years ago. Various fossils of Him have been found, creating an mosaic of Neanderthal. The two most important fossils are

1. classic / La-chappel-Aux-saints
2. Progressive neanderthal

La-chapelle-Aux saints	Progressive Neanderthal
• Discoverd in La-chapple France • 1908 by Armadee et.al This fossil is dated around 64000 years old of a 40 years old man having Osteo arthrits.	• Discoved in Mount Carmel, Israel. + Skhull Caves Palestine.

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Cranial Features LCAS	Cranial Features Progressive
• Long low heighted skull	• massive skulls.
• Cranial capacity 1400 cc	• Cranial capacity 1600 cc
• Teeth were worn out; he must have survived till 40 with some help — Neanderthal altruism	• Teeth were human like
• Immense Supra orbital ridge	• Immense supra orbital ridge
• Prognathism in face	• Orthognathus face.
Protruding occipit	• Protruding occipit
• Comparatively smaller face	• Massive face
• receding forehead	• vertical forehead.
• Poorly developed chin	• Prominent chin
• Foramen magnum is not in centre	• Foramen Magnum in centre

Good points in comparision

Remarks

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Post Cranial	
LCAS • Short stature • Hands are small, • Femur, Tibia - though short were strong.	• Progressive • 5 ft 5 inch tall. • limbs like modern man

Phylogenetic implications

3 theories

1. Neanderthal phase of Man :- by Schwalbe

It proposes a unilinear progression of Homos neanderthal into homo sapiens from an undiscovered ancesta

H. erectus → ? ⟶ H. Neanderthal ⟶ H. Sapiens

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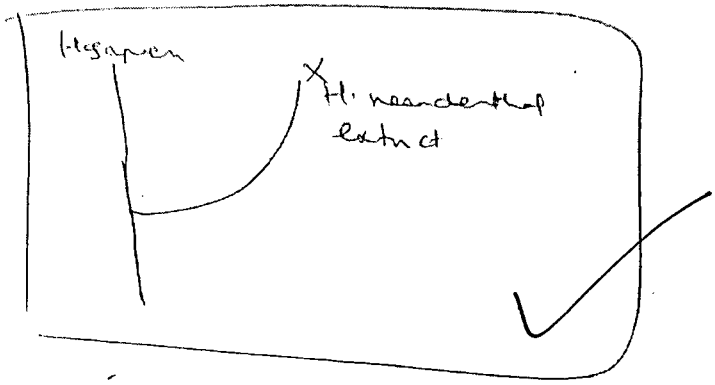
2. Pre Sapien Hypothesis by Boriska :-

· It says Homo Sapiens evolved seperately from Homo neanderthal which went extinct)

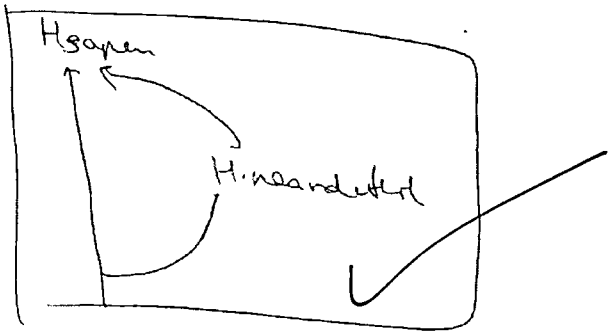


Overall good attempt.

3. Pre Neanderthal Hypothesis :- by Legross Clark.

It says the same thing as above, but instead of going extinct, neanderthal merged with Homo sapiens

10/20



Genetic data today also shows presence of Hneanderthal DNA in european population (1-4%). Final position is still debatable

Remarks

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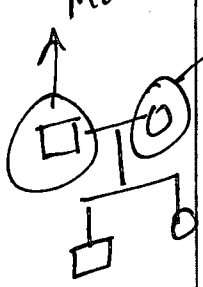
4. (a) Consanguineous mating (150 Words) (10)

Consanguinous mating refers to mating between closely related individuals. The closely related here means sharing a same ancestor.

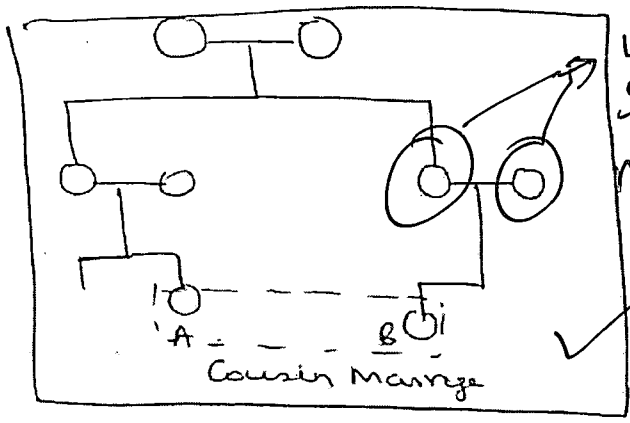
Male

female



eg

Cousin marriage a kind of consanguinous mating



use different symbol for male & female

Use examples of communities where we see consanguineous mating.

Usually, we all have some recessive genes of some diseases (eg Haemophilia c) in heterozygous condition, so they do not express. However if closely related individuals mate, the chances of such recessive diseases to occur i.e become homozygous, increase considerably.

eg In the above pedigree, the chance of a faulty gene from grandparent to become homozygous in mating of A & B is 1/8 or 1/64 depending upon probability. which is very high.

Mention different types

- cousin marriage
- Uncle-niece marriage etc.

Remarks

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Some of communities in India having high prevalence of this

1. Nalband community of UP
2. Parsis population.

These populations also show prevalence of rare autosomal recessive diseases.

As per ICMR, within last 10 years, consanguinous mating has come down by 19%.

We need a strict law and educational awareness to stop spread of such diseases

Talk about the consequences → connect it with Inbreeding and related changes in population

3½/10

Remarks

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4. (b) Klinefelter's Syndrome (150 Words) (10)

A Chromosomal aberrations in number or in structure are responsible for various types of diseases. The Klinefelters Syndrome is an allosomal - chromosomal number based disorder in which males are affected.

Genetic condition = 46+XXY or 46+XXXY.

General characteristics

- Male sterility results in unable to produce sperms known as azoospermia.
- Though penis is present, but the person has very low libido.
- Shy behaviour as a kid.
- Easily irritable + easily angered.
- Slower to learn + needs additional care + help.
- very less body hair
- Testes don't fully develop.
- Longer limbs than usually
- Poor secondary sexual characters

Mention about the reason of this aberration

↓

Explain the process of non-disjunction and how it leads to numerical aberration

↓

Then mention about the symptoms, diagnosis prevalence/1000 population possible Treatment etc.

Remarks

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Though, testosterone injections can help to develop secondary sexual characters, but still sterility prevails.

Such diseases cannot be cured, can only be prevented by Genetic screening + counselling.

3½/10

Remarks

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4. (c) Dollo's law (150 Words) (10)

A Dollo's law :- given by L. Dollo it suggests the irreversibility of evolution along the same path. It states that :- an organ or organism will never trace the same evolutionary path, ~~to~~ gain a functionality even if same environmental conditions are provided.

3 postulates

① evolution is rather a process with jumps, i.e. it can occur in quick successions, as to otherwise understood gradual course taking millions of years.

② An organism has a fixed number of evolutionary cycles before it goes extinct. It suggests the limits within which an organism can adapt to changes in environment.

③ The ~~organ~~ functionality lost can be gained back but not via same evolutionary path, but by

Remarks

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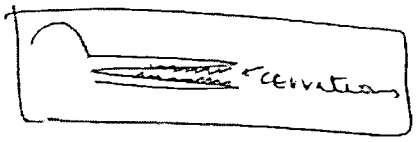
an alternate evolutionary track.

(eg) Merganser Duck lost it teeth in course of evolution, so to chew, it developed cervations on beak to act like teeth



Overall, this signifies an important trend of evolution i.e. irreversibility.

In these Type of Short notes there is lack of content so always try to provide multiple examples here to fill the gap of content.

↳ Here you could also discuss about the reasons for irreversability.

3/10

Remarks

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4. (d) Jane Goodall's contributions to primatology (150 Words) (10)

A. Jane Goodall, is a primatologist who studied chimpanzees. She is one the Louis Leakey's trimates, whole personally guided and trained.

- She is best known for her research in Tanzania's Gombe Stream Nat^l Park.

Observations by her

- Use of tools by chimps :- Dipping a salivary stick into heap of ants and eating off of it
- Hugs, kisses, pats on back & tickling in chimps
- Chimps are also non vegetarians
- Human chimp similarities across emotions ~~feeling~~, intelligence, family & social interaction.
- Chimps have tendency for hostility & aggression
- Chimps even adopted orphaned baby chimps.
- She was the first and only human to be welcomed in chimp community.

Remarks

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Overall, she brought insights into deep social behaviours of chimps + broke the two myths.

① That only human can build tools

② Chimps are vegetarians.

Mention her contribution as guiding light for primatologists.

→ Try to mention one of her finding as Case Study : Meaning elaborate a little more on that.

(For example you can elaborate more about the Tool usage)

$3\frac{1}{2}/10$

Remarks

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4. (e) Rhodesian Man (150 Words) (10)

A. The Rhodesian man is a skeletal remain found in Zambia in 1920's, over a place k/as Broken hill. He is also k/as Broken hill man.

· He is supposed to be 1st pre-Modern Homo in Africa

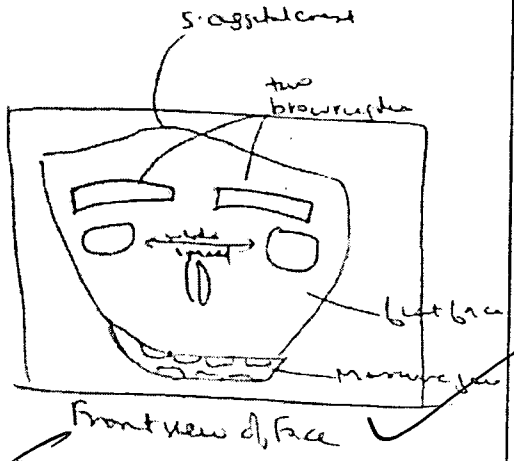
Features

· Dated: 2lakh - 3lakh years ago.

· Height 5 feet 10", weight 95 kg.

· Cranial capacity = 1300 cc.

Skeletal features



Front view of Face

These features you can elaborate a little (1 line each)

- Slight saggital crest
- Foramen Magnum in centre
- No Occipital torus
- Two independent massive supra orbital brow ridges
- Widely spaced orbits
- Occipital torus
- teeth like modern human
- Massive jaw.
- Flat face

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GS SCORE

- Sac bum like human but joints were massive.

Phylogenetic Implications

- Pycraft said it could not be erect and called him Cyprianthropus Rhodensiensis
- But this is not accepted.
- Woodward called him H. Rhodesiensis
- To day, he is merged with H. heidelbergensis (Heidelberg of Europe)
- Some even consider him to be ancestor of Archaic Homo Sapiens Idaltu.

draw a diagram to show the positions

4½/10

Remarks

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5. (a) Define Genetic polymorphism. Discuss various types with suitable examples. (200 Words) (15)

A Mutations are random and rare changes in DNA sequences that may or may not have phenotypic implications. Mutations with other factors can create more than one form of alleles and nature may select them for some adaptive purpose. Such existence of multiple forms of a gene, traits or organisms are known as Genetic Polymorphism.

Good Intro

Types of Genetic Polymorphism

(1) Monomorphic :- only one form is favoured/exists. This simply mean no polymorphism. (eg) Most abortions/mortality are of child/fetus of too low weight or too high weight, but middle weighted ones are having high rates of survival

(2) Stable :- when two forms exist in their own unique environments helping to adapt.

(eg) Hb^A — normal

Hb^S — sickle cells → but exists to help survive brunt of malaria mostly in African continent.

Remarks

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3) Transient :- When the forms are transitioning because of change of environment.

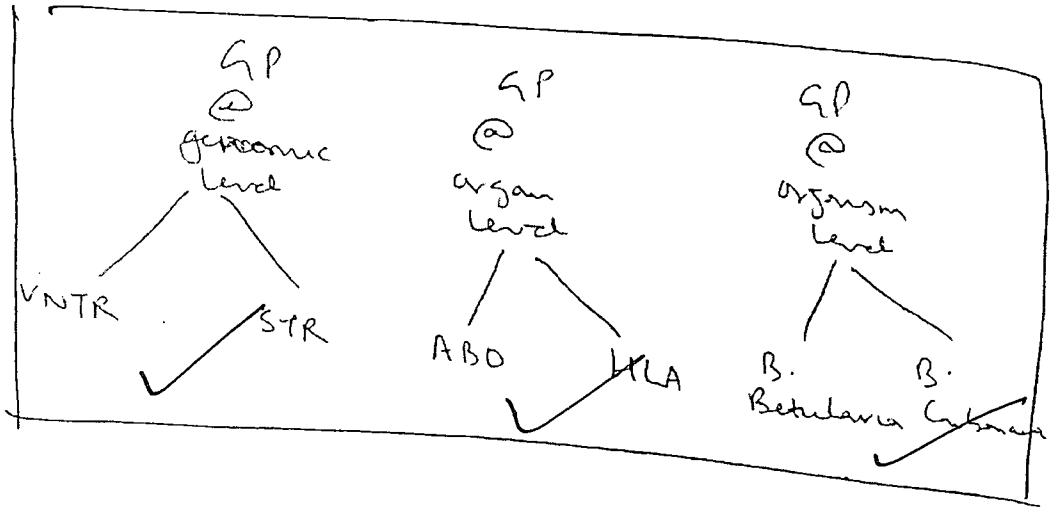
(eg) Biston Betularia $\xrightarrow{\text{Pollution} \uparrow}$ Biston Carbonaria

$\xleftarrow{\text{Pollution} \downarrow}$

Benefits of GP

- Helps maintain diversity.
- Helps a species tideover extreme conditions.
- Helps study phylogenetic implications in past

In addition to this there are GPs at other levels also



Remarks

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VNTR'd STR's: These are the repeat sequences present in genomes. The sequence is species specific but the number of repeats is individual specific this helps in DNA fingerprinting

ABO :- These are blood antigens responsible for self identification & outside agent identification

& HLA These help in immunogenic reactions & maintain immunity

→ These are Human leukocyte Antigen present on diff organs cells. These are unique to individuals.

GP in overall sense mimic the biodiversity outside of this, to creating variations within & amongst individuals of same species

7/15

Remarks

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5. (b) Discuss numerical and structural chromosomal aberrations in man illustrating with examples. (200 Words) (15)

A Chromosome is the functional unit of heredity. These are basically compressed chromatin, histones, RNA & non histone proteins. These are most visible at Metaphase and are studied for various diseases and pathological condition.

Techniques for chromosome study: Banding

Types of Banding: Q, G, C, R

Collection of image of chromosomes = Karyotyping.

Structure of chromosome

Consists of two arms p & q arm with a central constriction k/as Centromere

Humans have 23 pairs of chromosomes in normal cells (autosomes). However during gamete formation, no. of chromosomes are halved and become haploid.

These can be disjunction malfunction leading to chromosomal aberrations: numerical & structural

Remarks

You have consumed one page in explaining about the basics of chromosome

↓

Try to compress it and directly address the aberration part

↓

Try to explain the method of non-disjunction

↓

Also discuss about the reasons for aberrations like mutations etc

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Numerical Aberrations :- These refers to change in number of chromosomes in a cell. They can be in autosomes and allosomes.

Autosomal Numerical Aberrations :- Instead of two copies, three or no copies are present. (Can be more than 2 or less than two)

eg Down's Syndrome → 3 copies of chr 21.

eg Patau Syndrome → ———— chr 13.

Allosomal Numerical Aberrations :- Instead of 2 copies, different no of copies of chromosome present in sex cells.

eg Turners Syndrome → only one X present i.e 46+XO

eg Superfemale → three copies of X → 46+XXX.

Structural Aberrations :- These refers to alteration in structure of chromosome. Different types are

① Breakage & Loss :- one arm of a chromosome breaks off

eg p arm of chr 5 breaks → Cri du chat Syndrome

Remarks

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Structural

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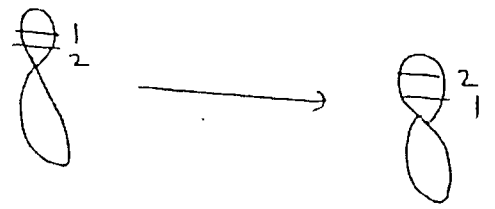
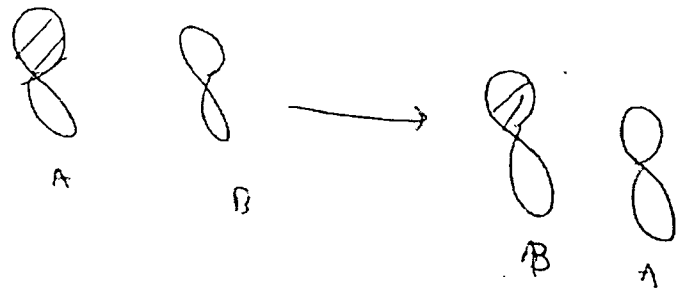
Exchange
Addition
deletion
Inversion
Translocation

(2) breakage of inversion :- an arm breaks but attaches in reverse

(eg)



(3) Breakage of exchange :- two chromosome exchange broken branches



$6\frac{1}{2}/15$

Overall these are some of types of aberrations, which can be visualised and treated by proper screening of banding.

Remarks

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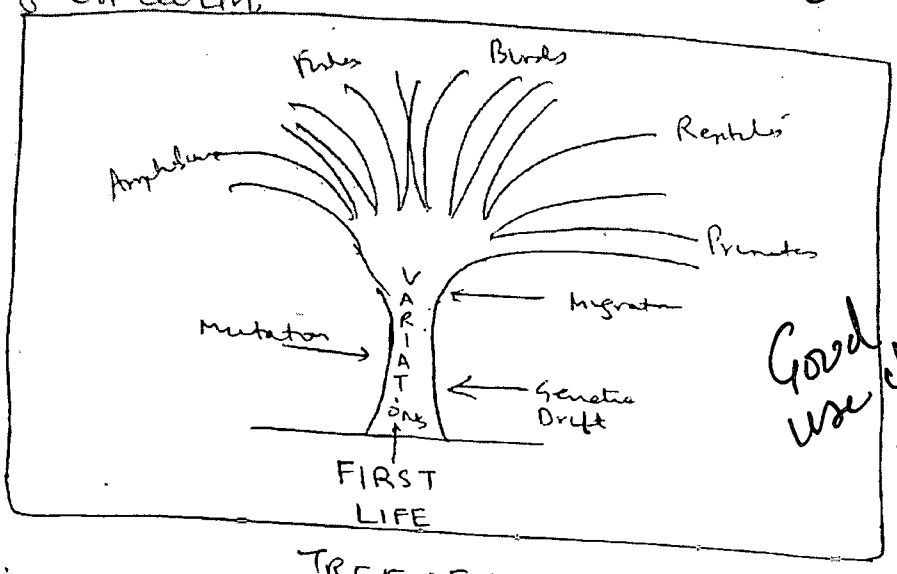
5. (c) Discuss role of genetic drift, mutation and migration as the causes of variation. Provide suitable examples in each case. (250 Words) (20)

A Variations refers to differences in genomic construction of different individuals of a species. These are sources of diversity and sustenance of such a vid life on earth.



TREE OF LIFE

Good use of diagram

Variations are created by sustained by process of Genetic Drift, Mutation, Migration.

Genetic Drift:- It refers to random changes in frequency of an allele leading to its fixation or its elimination from the population. It is a totally random process that cant be predicted

Some features

It's effect is seen more pronounced in small population

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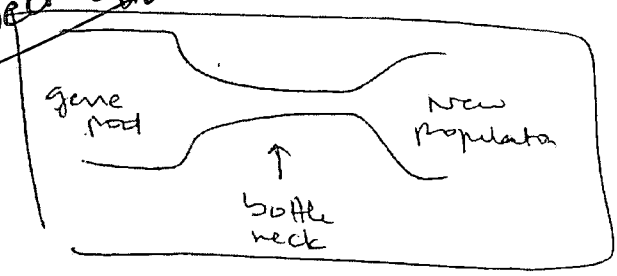
Take examples of founder effect and bottleneck effect

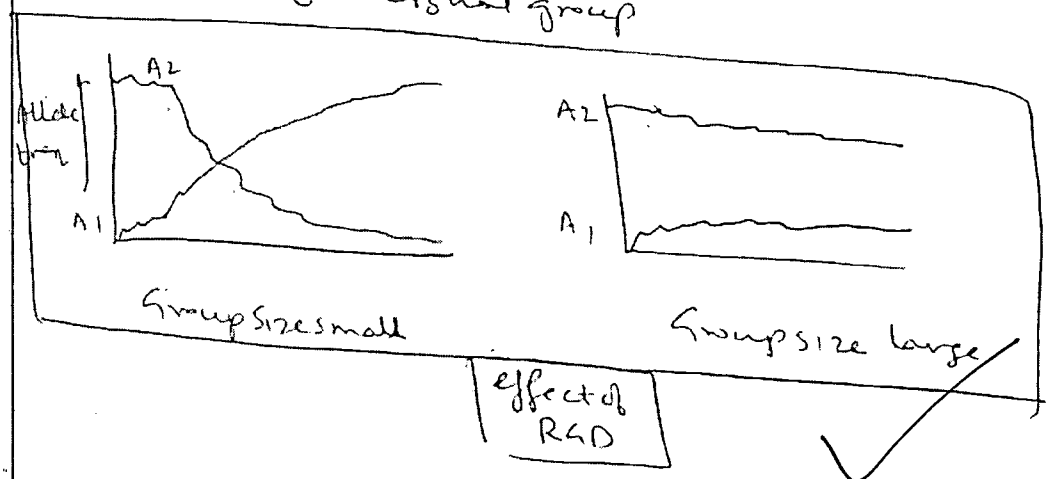
(eg) Founder's effect

↳ Suppose a group of indiv of species is seperated from main group → creating a bottleneck.



There is a good chance that this group might not represent the original group allelic frequencies

Here Random genetic drift will act & create variations in short time making this group different from original group



effect of RGD

2. Mutation :- It refers to rare & random variations in DNA sequence of an indiv that may or may not phenotypic expression.

Remarks

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Mutations are the basic source of new allele & genotypes in a population.

Various types of mutation are

- based on cell affect
  - germ cell based → passed to next generation
  - autosomal based → die with individual
- based on occurance
  - Spontaneous → (eg) DNA replication error
  - Induced → caused by Mutagens eg X Rays
- based on size
  - non point → affect large part of DNA
  - point → only one Nucleotide

(eg) It is deduced that Hb^S (sickle cell type Haemoglobin) was created as a part of mutation in Haemoglobin but today it has adaptive purpose of evading Malaria.

3. Gene Flow/Migration :- Refers to emmigration/immigration of individuals from area to other. It leads to introduction of new variations in gene pool that can help the population become more

Remarks

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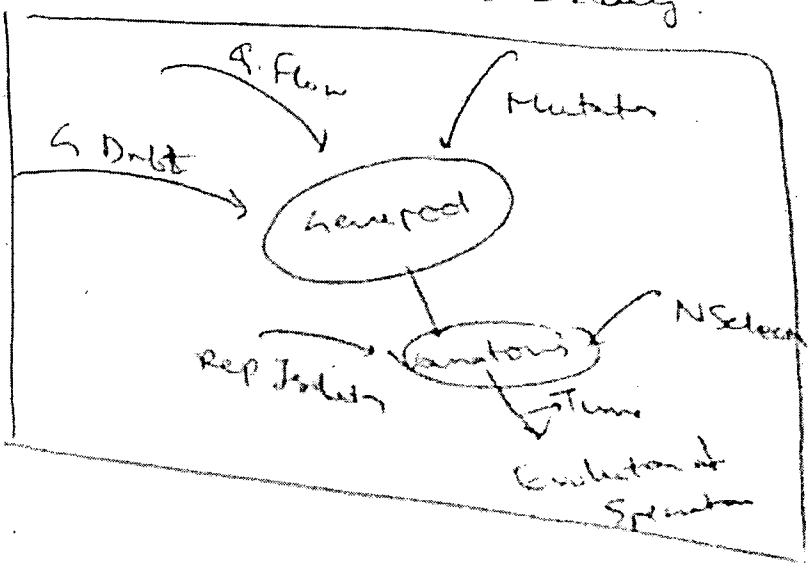
adaptive.

(eg) Migration of black beetles into an area of red beetles can impart a colour combination that can better help camouflage from predators.

These all ~~var~~ variation when coupled with selection by nature, reproductive isolation & time are the source of biodiversity & evolution around us that we see today.



Overall Good attempt

Good use of flow chart

10/20

Remarks

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