EXPLORING ESSAYS

LIFE SCIENCES

SBU

learner's book

Grade 12

SBUMKANSI • SOLLY MAKHONGELA

TABLE OF CONTENT

TO VARIATION (Paper2)	

TERM ONE POSSIBLE ESSAYS

Water Quality Essay

Explain four management strategies to improve the quality of drinking water. Uncle Two sources of water pollution and Two effect of water pollution on human health.

Management strategies to improve water quality

- Monitoring of emissions from industries
- To discourage water pollution
- Providence of adequate sewage system
- So that excretories don't pass near water
- Providence of clean containers to collect water
- So that pollutants don't contaminate water
- Educating people
- On the importance of caring for environment
- Reduction of pesticides usage
- So that there is less run-off of fertilizers to rivers
- Conduct research how to reduce pollution

Sources of pollution

- Sewage
- Wastes from factories
- Dumping of wastes
- Dropping chemicals in water

Effects of pollution on human health

- Cancer
- Typhoid
- Allergies
- Cholera
- Diarrhoea
- Rashes

Eutrophication Essay

Eutrophication is one of most important water quality problem South Africa. Describe Eutrophication, what causes it and how it affects water quality

Eutrophication

- Is the process which start with the addition of excess nutrients to water(river, lakes, ponds) and ends with the collapse of the aquatic ecosystem

Causes of Eutrophication

- Sewers, abattoirs, farm animals
- And run-off of fertilizers from crops to rivers
- Resulting in addition of excess nutrients phosphate into rivers

The effects of Eutrophication

- The increase OE nutrients in water
- Causes pants such as alga
- To flourish to such an extend all water becomes covered
- Light an no longer penetrate below water surface
- Which cause deeper dwelling of aquatic life to die
- Resulting in no release of oxygen during photosynthesis
- Oxygen supply for aquatic animals decline
- Leading to death of aquatic life
- Decomposition of dead plants and animals
- Introduces further usage of oxygen
- With methane being released
- Giving dams a strong smell of purification
- Resulting to unhealthy dams to ecosystem
- And collapse of its aquatic food webs and pyramids

Thread To Biodiversity

The greatest thread to biodiversity is the destruction of habitats. Describe how the various human activities may lead to habitat loss.

Urbanization

- Land is cleared for housing, industries and roads
- Leading to habitat fragmentation
- Causing some populations to become extinct

Deformation

- The demands for wood products caused clearance of many plants
- Destroying the ecosystem of some populations
- Leading to extinction of some populations

Destruction of wetlands and grasslands

- Areas are cleared for human inhabatiions
- Reducing biodiversity of organisms
- That depend on these lands

Golf estates

- Requires plenty of water to vast clearance of vegetation
- So that only few species exist.

Mining

- Results in degradation of water and the PH of the environment
- Causes soil erosion
- No species can exist t mine areas

Poor farming methods

- Monoculture allow few of species to survive
- Losing large amount of plants and animals
- Due to non crop varying

Overgrazing

- Lead to loss of topsoil
- Decreasing soil fertility

Use of pesticides

- Kills secondary consumers
- Leading to extinction of some populations

DNA REPLICATION ESSAY

Described the process of DNA replication and different types of mutations that occur during this process

DNA REPLICATION

- This process occurs during interphases
- Double stranded DNA molecule unwinds and unzips
- When weak hydrogen bonds break
- To form two single stands of DNA molecule
- Each strand is used as a template
- Each stand receives a complementary base pair
- At the end of this process two identical copies of DNA molecule are formed
- This process is controlled by enzymes

Mutations

- **Gene mutations (point and frame shift)**
- Occurs and cause changes on the sequence of DNA molecule
- **Chromosomal aberration**
- Occurs and cause a change in the structure of chromosome
- **Mutations that occurs in sex cells**
- Are passed to the subsequent generation

DNA REPLICATION

Describe the significance of DNA replication and meiosis and how the foetus is protected and nourished in the uterus

Significance of DNA replication

- Allow duplication of genetic material
- Ensure that four haploid gametes are formed from a diploid cell

Significance of meiosis

- Ensure genetic variation when crossing over occur
- Ensure that chromosome number remains the same as in adults
- Produce haploid gametes are diploid chromosome pair

Protection of foetus

- It is surrounded by amniotic fluid
- Which act as shock absorber
- And protects it against dehydration
- Also protect it against temperature deflactuation

Nourishment of foetus

- It receives nutrients through the placenta
- Which are passed into foetus by means of blood
- These substances read the foetus via umbilical vein

PROTEIN SYNTHESIS ESSAY

Describe different stages of protein synthesis and mutations that lead to formation of a wrong protein

Transcription

- The double helix DNA molecule unwinds/Unzips
- When weak hydrogen bonds break
- Two separate single strands are formed
- One strand is used as a template
- To form mRNA
- Using free nucleotides from nucleoplasm
- He coded message for protein is thus copied into mRNA
- mRNA moves through nuclear pores to cytoplasm and attaches to ribosomes

Translation

- tRNA contains of specific amino acids
- When the anticodon on tRNA
- Matches the codons on mRNA
- tRNA brings specific amino acids to ribosomes
- Amino acids become attached by peptide bonds
- To form required protein

Mutations

- Errors that may occur during DNA replication
- **Point mutation:** replace of one base of codon with another
- Resulting in the formation of a wrong protein
- **Frame shift mutations:** addition/deletion of one or more bases on codons
- Resulting in change of sequence of all bases on codons
- Which results in the formation of a different protein with different function

MEIOSIS

Describe the structural suitability of a chromosome and different events in meiosis1

Structural suitability of chromosome

- It must contain of two chromatids
- That are joined by a centromere
- It must be in X-shape
- It must be able to overlap at point called chiasmata

Stages of meiosis 1

- **Interphase**
- Chromosomes coil up
- DNA Replication takes place
- **Prophase 1**
- Homologous chromosome pair up and crossing over occurs
- Nuclear membrane disintegrates and centrioles move to opposite poles
- **Metaphase 1**
- Microtubules form Spindle fibers which attaches to centromere
- Pair of homologous chromosome align at the equator of a cell
- **Anaphase 1**
- Spindle fibers shortens pulling paired homologous chromosome to opposite poles
- Paired homologous chromosomes become separated so that each pole have one chromosome
- **Telophase 1**
- Nuclear membrane integrates around chromosomes at opposite poles.
- The cell undergoes cytokinesis to form two haploid daughter cells

MEIOSIS AND DOWN SYNDROME

Describe how meiosis contribute to genetic variation and how abnormal meiosis leaf to down syndrome and polyploidy. Also describe advantages of polyploidy in agriculture.

Meiosis

- **Crossing over** occurs during prophase1
- Homologous chromosome pair up
- Each chromosome has two chromatids
- Chromatids overlap
- At point called chiasma
- To exchange genetic material
- Between non-sister chromatids
- Each gamete will have mixture of genes from both parents
- Which brings about variation Max6
- **Random arrangement of chromosomes at equator**
- Each pair of homologous chromosomes
- May line up either way on spindle
- Independently of each other
- Genetics will form differing mix of parental chromosomes. Max6

Down syndrome

- In meiosis1 chromosome pair 21 fails to separate
- In meiosis2 chromatics of chromosome 21 fails to separate
- Referred to as Non-disjunction
- One gamete will have extra copy of chromosome 21
- If this gamete fuses with normal gamete
- The resulting zygote will 47 chromosomes
- Leading to down syndrome. Max 06

REPRODUCTION IN VERTEBRATES

Describe how vertebrates reproduce and different strategies of their reproduction as well as advantages and disadvantages of these strategies

Internal fertilisation – sperm cell fertilise the egg cell inside the female body

- Advantage is that it is more controlled which increase the chances of fertilisation
- Disadvantage is that there might a transmission of STDs

External fertilisation -sperm cell fertilises the egg cell outside the female body

- Advantage is that there is no need for compulsory organ to deposit a male gamete
- Disadvantage is that there is less control of over fertilisation

REPRODUCTIVE STRATEGIES

- **OVIPORY**
- Embryo develops outside the mother's body
- Advantage is that more eggs are laid
- Disadvantage is that embryo has less amount of protection
- **VIVIPORY**
- Embryo develops inside the mother's body
- Advantage is that embryo gets more protection and is nourished
- **OVIVIPORY**
- Fertilised egg cell is retained in the mother's body
- Advantage is that embryo gets more protection
- And is nourished by the egg yolk
- **PRECOCIAL DEVELOPMENT**
- Have well-developed young that can walk and feed themselves soon after birth
- **ALTRICIAL**
- Have poorly developed young that can't walk
- Parental care is required as young can't feed themselves

MENSTRUAL CYCLE

Is the series of events that occur in a female body for 28 days to pre pare for possible pregnancy?

It occurs in two cycles namely the ovarian cycle and uterine cycle

- The pituitary gland secretes **FSH**
- Which stimulates the development of primary follicle into Graafian follicle
- Graafian follicle secretes **Oestrogen**
- Which stimulates the thickening if endometrium in preparation for pregnancy
- Around day 13, the pituitary gland secretes LH
- Which causes ovulation to occur
- The Graafian follicle develops into corpus luteum
- Which secretes progesterone
- High level of progesterone inhibits the secretion of FSH
- So that overlies are no longer stimulated to release more follicles
- If fertilisation doesn't occur the corpus luteum degenerates
- Secretion of progesterone stops
- The pituitary gland/hypophisis is no longer inhibited in its secretion of FSH
- The thickening of endometrium is no linger maintained
- Endometrium is then shed with blood (after shrinking and bursting of corpus luteum)

Note : Know functions of placenta as this process is capable of carrying 8 marks based on roles played by placenta.

Example : Describe the role of FSH and progesterone in menstrual cycle as well as the role of placenta during pregnancy.

Hint: write menstrual cycle as it is but fusion occurs and 7-8 roles/functions of placenta.

- Allow movement of dissolved food substances, oxygen and antibodies
- From the mother to the foetus
- Allow excretory products
- To diffuse from foetus to the mother
- Act as barrier
- To prevent movement of drugs from mother to foetus
- It also secretes progesterone
- To maintain pregnancy

Sperm cell essay

Describe the structural suitability of a sperm cell an also how it reaches the ovum during fertilization

Structural suitability of a sperm cell

- It must have a head containing
- Acrosome filled with enzymes that barrow the jelly layer of ovum
- Mitochondria that provide energy to sperm cell
- Nucleus containing of genetic materials
- Tail that enables it to swim in the semen
- Tail must not be too small

How do sperm reach the female ova

- Firstly sperm cell is produced in the testes due to presence of testosterone
- Sperm cells produced are stored in the epididymis
- During fertilisation this sperm cells move from epididymis to the sperm duct
- Seminal vessels secretes semen that protect the sperm cells against acidic conditions in the vagina
- Cowper's gland secretes more semen
- Sperm cells swim in the semen and move out of a male body through the urethra
- Enters the vagina with high energy and reaches to the oviduct
- Where there is ovum and sperm cells collides with the ovum
- Thus fertilization took place

SPERM CELL ESSAY PAPER ONE

Explain the structural suitability of a sperm cell for its function and describe its involvement in the formation of a zygote until implantation

Structural suitability of a sperm

- Head of sperm consists of Acrozome
- Which is filled with enzymes or vesicles to dissolve a path ay into ovum
- Nucleus of the sperm
- Carries genetic material of a male
- The presence of a long tail
- Enables the sperm to propel forward
- The content of sperm such s cytoplasm is reduced
- Making the sperm light for efficient movement

Fertilisation

- In the Fallopian tube or Oviduct
- One sperm cell makes a contact with an ovum
- The nucleus of sperm cell enters the ovum
- Then the ovum's membrane becomes impenetrated to other sperm cells
- The sperm fuses with an ovum
- To form Zygote
- This is called fertilisation

Events of fertilisation until implantation

- The zygote divides by mitosis many times
- To form embryo
- It first consist of a ball of cells
- Called morula
- Which then develop in to hollow of cells
- Called blastocyst
- It embeds itself into the endometrium
- Using chronic villi

HORMONE ESSAY

Name the hormone produced by testes and ovaries and describe their roles in human reproduction

Testosterone- Produced by seminiferous tubules in

testes **During puberty testosterone stimulates**

- The deepening of voice and vocal cord elongates
- The development of muscles
- The growth of facial pubic and body hair
- Development of testes and body hair
- The production of sperm in the testes

Oestrogen- produced by Graafian follicle in the ovary

- Causing the endometrium
- To become thicker
- In preparation for implantation

During puberty oestrogen stimulates

- The widening of pelvis
- The growth and development of breasts
- The growth of female sex organs
- The start of menstrual cycle

Progesterone- produced by corpus luteum and placenta

- Stimulates endometrium
- To maintain pregnancy if fertilization takes place
- High level of progesterone
- Inhibit the secretion of FSH
- In the pituitary gland
- Which prevents further development of new follicles in the ovary

PREGNANCY

DISCRIBE THE FORMATION OF FOETUS AS WELL AS ROLES OF PARTS TGAT CONNECTS MOTHER TO FOETUS

- Zygote undergoes meiotic division to form morula cells
- Which also undergoes meiotic division to form blastocysts cells
- Which attaches to endometrium
- The outer layer of blastocysts called chorion
- Develops projections called villi
- Which implant on the uterine wall
- The cells if embryo continues to divide and differentiate
- To form different organs and limbs
- It is now called foetus.
- Which is enclosed by amnion
- Filled with amniotic fluid
- To protect the foetus against mechanical injuries
- To protect the foetus against dehydration
- To protect the foetus against temperature fluctuations
- The chorion villi and endometrium forms a placenta
- Which enables the blood of foetus and the mother to flow closer
- Allow diffusion of nutrients
- The umbilical cord
- Carries nutrients from the foetus to the mother

End of term1 Good luck and all the best on march exams

Important note:

From term no.2 ESSAYS ARE RANDOMLY CHOSEN SO IT IS BEST IF YOU NOW ALL ESSAYS BEFORE GETTING INTO EXAM ROOM

TEARM TWO

Genetic variation essay

Describe different stages of meiosis and mutations that contribute to genetic variation and name two genetic disorders you have studied

Meiosis

- **Prophase1** crossing over occurs
- Non-sister chromatids overlap at point called chiasma
- Genetic material are exchanged leading to genetic variation
- **Metaphase1**
- Independent assortment of paired homologous chromosome
- So chromosomes separate randomly
- Resulting in new combination of characteristics

Mutations

- **Gene mutations(point and frame shift) occurs**
- Resulting in the change of sequence of Nitrogenous base
- **Chromosomal aberration occurs**
- Resulting in the change if chromosome
- Which will form an abnormal organ
- **Mutations that occur in sex cells**
- Are inherited by the subsequent generation
- Creating new traits

Genetic disorders

- **Haemophilia**
- The inability of blood clotting caused by a recessive allele
- **Down syndrome**
- Due to extra copy of chromosome 21
- As a result of non-disjunction during

GENETIC VARIATION AND GENETIC DISORDERS

Describe how a change in sequence of DNA nitrogenous bases can lead to the formation of a different protein and how that lead to altered traits in two genetic disorders you have studied. Also describe three other sources of variation

Changes in different protein

- Altered nucleotide bases
- May cause the DNA structure to change
- That will produce mRNA
- With a different code
- During Transcription
- Resulting in usage of different tRNA
- To pick-up a different amino acid
- The sequence of amino acids will change
- Leading to formation of a different protein
- Thus leading to genetic disorders

Genetic disorders

- **Haemophilia**
- Blood don't clot
- Due to unproduced protein for blood clotting
- **Colour blindness**
- The person can't differentiate between different colours
- Due to gene mutations
- Which caused the absence of necessary protein

Variation sources

- **Crossing over***
- During prophase1 of meiosis chromatids overlap
- Genetic material is exchanged
- Each gamete formed has mixture of parental genes
- **Random arrangement of chromosomes at equator**
- Each pair of homologous chromosomes align either way at equator
- Independent assortment
- Resulting in mixture of parental chromosomes
- **Random fertilization**
- Fertilization between different ova and sperm cell brings a out different offspring
- **RANDOM MATING**
- Mating between organisms in a species

STEM CELLS ESSAY

Describe two types of stem cell therapy and for each type explain Two advantages and Two disadvantages of processes

Embryonic stem cell therapy

- It is extracted rom the human foetus/ umbilical cord
- To allow the development of other types of cells or organs
- Which ay be required for the body

Advantages

- Medical benefits on therapeutic cloning
- Discovery for treatment and cure for diseases
- Limbs or organs formed can be used in transplantations
- Cells can be cultured relatively under lab conditions
- To form large number of required cells

Disadvantages

- Patient's body might reject them
- Destruction of blastocysts might be involved
- And can lead to long term effects due to interference with nature

Adult stem cell therapy

- Undifferentiated cells among
- Differentiated cells in tissues or organs
- Can renew Sir specialized cells types

Advantages

- They are able to generate new cells
- They can b cultured to produce larger quantity of cells
- Therefore they can treat injuries and diseases
- Your own cells can be used leading to no rejection

Disadvantages

- Generating of large quantity of cells may be difficult
- Due to small number of removed strong cells
- Differentiation of cell type is limited
- Undifferentiated cells are rare in mature tissues
- Isolation of these cells will be difficult

HUMAN EYE(ACCOMMODATION), HEARING ,BALANCE AND EQUILIBRIUM

A goal keeper prevented a ball from scoring when he dived to his right after that ball was kicked towards him. Just before he dived he heard his team-mate shout “your ball”. Describe how his eye adjusted to see the ball travelled towards him and describe how he heard his team-mate and maintained his balance as he dived.

As the ball travelled towards him

- accommodation took place
- ciliary muscles contracted
- suspensory ligaments became slack
- causing reduction of tension in lens
- lens became more convex
- refractive power of lens increased
- Image of ball fell on the retina. Max(6)

Hearing

- Pinna trapped sound waves into auditory canal
- Causing tympanic membrane to vibrate
- These vibrations were transferred into 3 ossicles (hammer, anvil and stirrup))
- Which caused oval window to vibrate
- Which increased pressure of waves in cochlear
- Which stimulated the Organs of Corti
- To convert the stimulus into a nerve impulse
- Which was transported by auditory nerve
- And interpreted on the Cerebrum. Max(5)

BALANCE AND EQUILIBRIUM

As he dived

- A change in direction and speed of the body
- Causes the movement if fluid in the semi circular canals
- Which stimulates the cristae
- A change in the position of the head
- Stimulated the maculae in the atriculus and succulus
- The stimuli were converted into impulses
- Which were transported along the auditory nerve
- And interpreted in the cerebrum
- Which sent impulses to the muscles
- To restore balance and equilibrium. Max(7)

Hearing and reflex action:

Explain how a guy hears a sound of howling dog and how he is able to rapidly respond as the dog's nose touched his leg.

Hearing.

- The pinna trapped sound into the auditory canal
- Causing tympanic membrane to vibrate
- That vibrations were transferred into tree ossicles (hammer, anvil and stirrup)
- Which caused oval window to vibrate
- Which increased pressure of waves in cochlear
- Which stimulated organs of corti
- To convert stimulus into impulses
- Which were transported along the auditory nerve
- And interpreted on the cerebrum.

Reflex action

- When the dogs nose touched his leg
- Receptors in the skin received the stimulus
- Which were converted into nerve impulses
- Impulses traveled along the sensory neuron
- Towards the spinal cord along dorsal root
- Of the spinal nerve
- In the spinal cord, Sensory neurons made synaptic contact with connector
- Impulses were transmitted along motor neuron
- Along the ventral root of the spinal nerve
- To the effector muscle
- Which contracted and pulled his leg away

Protection of human body

Describe how nervous and endocrine systems protect the body. Use suitable example to describe how this protection through reflex action and the hormone Adrenalin

Reflex action -removal of hand from being burnt

- Receptors in the skin receives stimulus
- Which are converted into nerve impulses
- This impulses travel via sensory neuron
- To the spinal cord
- Where sensory neuron make synaptic contact
- With connector
- Impulses are transmitted via motor neuron
- Along ventral root
- To the effector muscle
- Which contract and pull hand away

Adrenalin -example when you are chased by a dog

- Brain become aware of danger
- Through impulses from sense organs
- Adrenal gland become stimulated to secrete Adrenalin
- Message is then sent to various organs
- Blood vessels to the heart and brain dilate
- To increase heart rate
- Rate and depth of breathing increases
- Glycogen is converted into glucose
- Vital organs receive more glucose
- To increase muscle tone
- Pupil dilates
- Allowing rapid response to ensure safety

Hypothalamus and Adrenalin

Describe the role of hypothalamus and Adrenal gland in bringing about changes to blood vessels of the skin and explain why this changes take place.

Hypothalamus

- Changes in temperature are detected by thermo-receptors in the skin
- Stimulus are converted into nerve impulses
- Transmitted to the hypothalamus
- Which send impulses to the muscle layer of artrioles of the skin

On cold day

- Artrioles close to the skin surface constrict
- Less blood flows to the capillaries close to skin surface
- Sweat production decreases

On hot day

- Artrioles close to the skin surface dilate
- More blood flows to the capillaries close to the skin surface
- More heat is radiated/ more heat is lost

Adrenal gland

- Secretes adrenalin
- That prepares body to cope with emergency
- Adrenalin causes blood vessels of the skin to constrict
- Less blood flows to the skin surface
- Because skin is not a important organ during emergency
- Redirecting more blood/oxygen and food to vital organs
- To enable the body to respond during emergency

Response to unilateral light

Plants and humans respond to light differently explain how plant stem and human eye respond to unilateral light.

Plant stem

- Plant response to unilateral light is positive phototrophic
- Auxins produced in the tip of the stem
- So that there is high concentration of auxins on the darker side
- Which stimulate growth
- Low concentration of auxins on the light exposed side
- Inhibits growth
- There is uneven growth
- Which causes stem to bend towards light

How humans receive and interprets light

- Light enters the eye trough cornea
- Which refracts light
- Light passes through aqueous humor
- And pupil
- The size of pupil is adjusted by Iris
- To regulate the amount of light entering the eye
- Light then passes through lens
- Which also refracts the light
- Light is then passed through vitreous humor
- And reaches the retina
- Which has photo receptors and cones
- Which convert light stimulus into nerve impulses

MUTATIONS AND GENETIC DISORDERS

Explain how different types of mutations lead to genetic disorders

Types of mutations- is the sudden change in genetic composition of an individual.

- **Gene mutation**
- Result to changes in the structure of DNA in single strand
- **Chromosomal aberration**
- Change in the structure/number of chromosomes in a cell
- **Harmful mutations**
- Result in genetic disorder
- That decrease the structure of an organism

Genetic disorders

- **Haemophilia**
- Blood doesn't clot
- Due to non-produced protein for blood clot
- **Colour blindness**
- Inability to differentiate between different colours
- Due to absence of necessary protein for photo receptors
- **Albinism**
- Lack of pigment in the skin
- Due to absence of protein that forms melanin
- **Down syndrome**
- The person has extra chromosome 21
- Due to non-disjunction (during meiosis)

BLOOD GROUPING ESSAY

You have given a birth to a baby girl. There are two men claiming to be the father of your child. Explain how the inheritance of blood groups and DNA testing could assist in establishing the father of your child.

- Blood groups are controlled by tree alleles IA,IB and I. Which in combination will give four groups namely A,B,AB, and O
- An individual with blood group A, will inherit one allele from each parent and will therefore inherit either IAi or IAIA
- An individual with blood group B will inherit one allele from each parent and will therefore inherit either IBi or IBIB
- An individual with blood group AB will inherit one allele from each parent and will have IAIB Co-dominance
- An individual with blood group O Will inherit one allele from each parent and will have homozygous recessive ii
- The blood of baby and each male must be tested
- If the baby's blood is O then the father with blood group AB will be eliminated as he doesn't have the recessive allele (i) that baby inherited
- Should the father belong to blood group B with IBIB, then he will be eliminated as he doesn't have the recessive allele i
- Should the father belong to blood group A with IAIA, then he will be eliminated as he doesn't have the recessive allele (i)
- The father with blood group A but genotypicaly IAi, could be possible father as he has recessive allele I which the child inherited
- The father with blood group B but genotypically IBi, could be possible father as he has recessive allele that baby inherited
- DNA tests can further establish the father of the baby by matching black bars left on X-ray

Negative feedback mechanism on TSH

Describe the negative feedback mechanism involving TSH and thyroxin and describe the consequences of abnormal level of TSH.

When the thyroxin level is low

- The pituitary gland become stimulated to secrete more TSH
- TSH stimulates
- The thyroid gland
- To secrete more thyroxin
- Thus increasing the level of thyroxin
- In the blood to normal levels

When the thyroxin level is high

- The pituitary gland is not stimulated to release TSH
- There is less stimulation of thyroid gland
- To secrete thyroxin
- Thus decreasing the of thyroxin back to normal

Consequences of abnormal level of TSH

- This causes

hyperthyroidism **High level of**

TSH -results in:

- Weight loss
- Inability
- Hyperactivity
- Increase in heart rate
- Tiredness

Low level of TSH- result in:

- Weight gain
- Decrease in heart rate
- Slow growth of hair and fingernails

THERMOREGULATION AND OSMOREGULATION

Nomsa is sitting in class on a particular day and looks at wall thermometer showing43°C.

Discuss the process and mechanisms that are involved in thermoregulation and osmoregulation in her body on that day.

THERMOREGULATION

- When the external temperature is high
- Hypothalamus become stimulated
- Sends messages to blood vessels of the skin to dilate
- More blood flows to the skin surface
- More heat is lost by radiation from the skin surface
- More sweat is formed due to more blood to the skin
- Therefore more heat is lost by increased evaporation of sweat

OSMOREGULATION

- On that hot day, Nomsa lost water through sweating
- Osmoreceptors detected this
- And caused hypothalamus to release more ADH
- Which caused an increase in permeability of renal tubules to water
- More water was released in kidneys
- Her urine became more concentrated
- And water level were restored

End of term 2 Good luck with your mid year exams

TERM 3

THEORY OF EVOLUTION, PUNCTUATED EQUILIBRIUM AND GRADUALISM

Jean Baptide de Lamarck: explained his theory of evolution using two laws

- **The law of use and disuse :**
- As an organism uses its organ more frequently, the used organ more developed
- As an organism doesn't use its organ more frequently the unused organ become less developed/ may disappear altogether
- **The law of acquired traits**
- Traits acquired during life time of an individual
- Can be passed to the next offspring

Charles Darwin : explained his theory of evolution using natural selection

- Organisms produce large number of offspring
- Which show great deal of variation
- Some have favorable traits
- While others have unfavorable traits
- Due to environmental changes
- Which introduces competition amongst these offspring
- Offspring with favorable traits survive
- While those with unfavorable traits all die out
- This is natural selection
- The survived offspring will interbreed
- And their genotypes are exchanged

PUNCTUATED compared to Gradualism

- Darwin believed that evolution occurs
- Through an accumulation of small
- Gradual changes that occur over a long period of time
- Supported by transitional forms of fossils recorded
- Punctuated equilibrium suggested that evolution sometimes takes a long period of time where species don't change/ very small changes
- This alternates with short changes where rapid changes occur
- To form new species in shirt period of time
- Supported by absence of transitional forms of fossils

Lamarck vs Darwin's theory of evolution

Charles Darwin and Jean Baptide de Lamarck have different ideas of explaining evolution. Describe how each of them explained the evolution of long necks of giraffes. Justify whose idea is more acceptable in science community.

Jean Baptide de Lamarck's explanation

- At first all giraffes had short necks
- So due to environmental changes
- Leaves became scarce in shorter trees
- Giraffes stretched their necks more frequently
- As a result the trait of a long neck s acquired
- And passed to offspring
- Hence the population of giraffes have long necks

Charles Darwin's explanation

- Giraffes produced large amount of offspring
- There were a great deal of variation amongst them
- Some had longer(favourable traits) necks over other(unfavourable traits)
- Due to environmental changes
- Which introduced competition among these offspring
- Giraffes with longer necks survived
- While those with shorter necks all died out
- This is natural selection
- The genotypes of long necks were then passed to offspring
- The subsequent generation of giraffes have long necks

Darwin's theory is accepted.

- Because there is evidence that genes are passed from parents to offspring.
- And traits are not acquired during life time of an individual

NATURAL SELECTION VS ARTIFICIAL SELECTION

Using examples describe the processes of natural and artificial selection and also highlight their differences.

Natural selection e.g Giraffes or any other example

- Organisms of a particular species show a great deal of variation
- Some individuals may have favorable traits
- While others have unfavorable traits
- Selective pressure by environment due to competition
- Organisms with favourable traits survive ad reproduce
- To pass this favourable traits to their offspring
- While those with unfavorable traits die out
- Over time the whole population will have favourable traits
- And these organisms might develop phenotypically and genotypically independently
- Into different species which cannot interbreed

Artificial selection e.g meat production/ any other example

- Organisms of a particular species show a great deal of variation
- Humans select organisms
- With desirable traits
- And interbreed them
- With other Organisms that also have desirable traits
- To improve these traits further in offspring
- Organisms with different desirable traits may be chosen
- To get offspring with combination of these desired traits

Differences between natural and artificial selection

Natural selection	**Artificial selection**
Selective pressure by environment	Humans select desirable traits
It is in response to suitability to environment	It's in response to satisfy human needs
No human effort	Could be labour intensive
Organisms can rely on their own in the environment	Organisms may not often survive on their own in environment

MEIOSIS AND NATURAL SELECTION ESSAY

Describe how meiosis and different types of mutations lead to genetic variation and the role of these genetic variation in natural selection.

Meiosis

- **Crossing over occurs**
- During prophase I
- Homologous chromosomes overlap
- At point called chiasma
- To exchange genetic material
- Resulting in new combination of genetic material
- **Random arrangement of chromosomes**
- Occurs during metaphase
- So tat chromosomes separate independently
- Resulting in new combination of genetic material

Mutations

- **A gene(point and frameshift) mutations Occur**
- As a result of a change in in sequence of nitrogenous bases in DNA molecule
- **Chromosomal aberration occurs**
- As a result of a change in structure/number of chromosomes during meiosis
- **Mutations that occur in sex cells**
- Are passed to the subsequent generation
- Creating new traits

Role of variations in natural selection

- Organisms of a particular species show a great deal of variations
- Some individuals have favourable traits
- While others have unfavorable traits
- When there is a change in environmental conditions
- Organisms with favourable traits survive and reproduce
- To pass this traits to the next generation
- While those with unfavorable traits die out
- Overtime the population of these organisms will all have favourable traits

SPECIATION AND REPRODUCTIVE ISOLATING MECHANISIMS

Describe the formation of a new species due to geographical barrier and reproductive isolating mechanisms

Speciation

- If population of the same species become separated
- By geographical barrier(a, river, mountain, lake)
- There is no gene flow between these population
- Since each population may be exposed to different environmental conditions
- Natural selection occur independently in each population
- Such that these populations become very different
- From each other genotypically and even if they won't interbreed
- They have became different species

Reproductive isolating mechanism

- Breeding in different times of the year
- One species is fertile while the other is not
- Species specific courtship behavior
- Courtship behavior of another species will not attract other species
- Adaptation to different pollinators
- Pollinator of another species is not adapted to pollinator of another species
- Infertile offspring
- A new species can't form because they can't produce a fertile offspring
- Different genitalia
- Unsuited reproductive organ prevents mating

Speciation And Evolution Essay

Describe how single population can form new species and explain how differences in the skull and other parts of the skeleton of primitive ape-like beings and modern humans support the idea that general trend in human evolution has been towards bipedalism and a change in diet from raw food to cooked food

Development of a new species

- If population splits into two populations
- There is now no gene flow among two populations
- Since they may be exposed to different environmental conditions
- Natural selection will occur independently in each population
- Such that these populations become very different from each other
- Phenotypically and genotypically
- Even if they mix again
- They won't successfully interbreed. (Any 5)

The Development From Bipedalism

- The backward position of the foramen magnum on the skull
- The narrow pelvis
- And less-curved spine
- Indicates that ape-like beings ere quadrupedal
- The forward position of the foramen magnum on skull
- The wider pelvis
- And curved spine
- Indicates that humans are bipedal. Any 4

Change from raw food to cooked food

- **Large teeth, especially canines in ape-like beings**
- As well as large a long jaws
- Which makes thy skull more prognathous
- Indicates that ape-like beings ate raw food
- Which required great amount of chewing. Any 3
- **The small teeth, including canines in modern humans**
- As well as smaller jaws
- Which made he skull less prognathous
- As well as absence of cranial ridges
- Due to smaller muscles for chewing
- Indicated that humans eat cooked food
- Which require less amount of chewing. Any 3

EVIDENCE OF COMMON ANCESTORS

Describe the structural changes to the skull that characterize the evolution of modern humans from ape-like ancestors, and explain the significance of these changes

Foramen magnum

- Was in backward position in ape-like beings
- Bit in a forward position in modern humans

Significance

- Represent change from quadrupedalism in ape-like beings
- To bipedalism in modern humans
- Increased awareness of the environment

Cranium

- Larger in modern but smaller in ape-like beings
- Modern humans less sloppy forehead than the ape-like beings
- Modern humans have more rounded cranium than ape-like beings

Significance

- Better co-ordination of movement
- Processing of information more faster
- Development of spoken and written languages to communicate

Dentition

- Ape-like beings had gaps
- But no gaps between human teeth
- Humans have smaller teeth than ape-like beings

Significance

- This correspond with decreased need to bite and tear
- And an increased need to grind and chew in humans
- In view of change in diet to soft cooked food

Eyebrow ridges

- Humans have smaller eyebrow ridges than those ape-like beings

Significance

- There is decreased need to strengthen the skull of humans
- Due to smaller size of jaws

Chin

- Humans have more developed chin
- Han that in ape-like beings

Significance

- Developed chin assist with speech in humans

Zygomatic arch/ Cheekbone

- Humans have less developed zygomatic arch
- Ape-like beings had more developed zygomatic arch

Significance

- There is decreased need to attach strong muscles
- Due to decreased size of jaws

OUT OF AFRICA HYPOTHESIS

Fossils of the bipedal primates Ardipithecus, Australopithecus and early H.Sapiens are used to support the Out Of Africa hypothesis.

State the Out Of Africa hypothesis. Describe the evidence that supports ty Out Of Africa hypothesis and the evidence that shows the three primate genera mentioned above were all bipedal

HYPOTHESIS

- All modern humans
- Originated in Africa
- And migrated to other parts of the world

FOSSIL EVIDENCE

- Fossils of Ardipithecus were only found in Africa
- Fossils of Australopithecus were only found in Africa
- Fossils of H.habillis were only found in Africa
- The oldest fossils of H.erectus were only found in Africa
- The oldest fossils of H.Sapiens were only found in Africa

GENETIC EVIDENCE

- Mt DNA(Mitochondrial DNA)
- Is inherited only from maternal line
- Analysis of mutations on his Mt DNA
- Shows that he oldest female ancestor a located in Africa
- And all hat humans descended rom her/ Mitochondrial Eve
- The Y chromosome shows paternal

CULTURAL EVIDENCE

- The oldest/ most primitive artefacts
- Were in Africa

BIPEDALISM

The fossils of three genera indicates that:

- The foramen magnum
- Is located in a more backward position
- The pelvis is shorter and wider
- The spine is S-shape

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