

(ix) Fungi can be used in biological control. Some fungi can be used in biological control as they obtain their food by destroying other organisms like amoeba, rotifers, and nematode.

(x) Waste Management and sustainability

(b) In three points briefly explain how bryophytes as early plants have managed to overcome various challenges in the terrestrial habitat.

any 07 points @ 20000 = 14 MARKS

(i) They have chlorophyllous "leaf-like structure" for photosynthesis

(ii) They have limited heights to overcome problems associated with lack of vascular tissue. Water and mineral salts can move up by capillarity in their short stems

(iii) They possess rhizoids for anchorage on soils as well as absorption of water and mineral salts

(iv) Male gametes, antherozoids are biflagellate for swimming into archegonia for fertilization

(v) They produce small and light spores that are easily dispersed to allow colonization of new areas

(vi) The spores are tolerant to long periods of unfavourable conditions due to the presence of thick wall with sporopollenin in one major chain

- Components (polymers) on the outer wall of the spores.
- (vii) They have elongated setae to expose capsule to air for easy dispersal of spores.
 - (viii) Archegonia secrete chemical substances attractants antherozoids to swim towards the egg during fertilization.

2 (a) positive feedback mechanism involve self regulatory mechanism which operate when the system is deviated from set point which initiate sequence of events that tends to deviate further system.

- It leads to unstable situation and extreme states @2 marks

Example.

(i) During labour when oxytocin hormone stimulate muscular contraction of the uterus which in turn stimulates the release of more oxytocin hormone.

(ii) During propagation of nerve impulses depolarization of membrane they cause further depolarization which leads to even more sodium ions entering.

(iii) Release of Volatile plant hormone (ethylene) by the ripening of fruits that accelerates the ripening of unripe fruits in its vicinity. As the fruits get unripe they produce more hormones that further continue to ripen more the surrounding fruits @2 marks

Negative feedback Mechanism -
Occurs in the situation where disturbances in the system set in motion a sequence of events which tends to restore the system to its original state
- Associated with increasing stability of the system (02 marks)

Examples

- (i) Control oxygen and Carbon dioxide levels in the blood by controlling rate and depth of breathing
 - (ii) Control heart rate
 - (iii) Control of an increase in the level of glucose in the blood triggers a sequence of events that tend to remove excess glucose from the body blood by converting into glycogen.
 - (iv) Control of blood pressure
 - (v) Control of hormones level eg. Thyroxine, sex hormones
 - (vi) Control water balance
 - (vii) Control regulation of pH
 - (viii) Control body temperature
- (any two points @ 2 marks)

(b) Counter current multiplier system refers to the fact that the fluids flows in opposite direction in the two sides of the loop of henle, down one side and up the other side (01 mark)

Reasons for the loop of Henle to undergo counter current multiplier system

- (i) Close proximity of the loop of Henle (ascending and descending limbs).
- (ii) Permeability of descending limbs to solute.
- (iii) Impermeability of descending limbs to solute.
- (iv) Permeability of ascending limbs to solute.
- (v) Passive transport of thin limbs and active transport of solutes to thick limbs.

3. Seed dormancy involves the state in which seeds are prevented from germination under conditions which are favourable for germination.

02 MARKS

TYPES OF SEED DORMANCY

(a) PRIMARY SEED DORMANCY.

This is the type of dormancy in which seeds will not germinate immediately after dispersal even if the factors for germination is present.

03 MARKS

(b) SECONDARY SEED DORMANCY

This is the type of seed dormancy that occurs when a seed lacks either all or some of the external conditions that are necessary for germination. If these conditions are not met the seeds fail to germinate and such seed dormancy cannot be broken for sometimes. Lack of factors like optimum temperature, oxygen, water and light external factors (03 marks)

WAYS OF OVERCOMING SEED DORMANCY:

- (i) Soaking the seeds in water to soften the seed coat and remove inhibitors
- (ii) Mechanical scarification; the process of weakening hardness of seed coat to allow entry of water and gases by cutting hard test. using hammer or knife respectively
- (iii) Mechanical scarification using sand paper
- (iv) Partial digestion or carving in small intestine such as mammals to soften hard seed coat
- (v) Chemical scarification methods such as soaking the seed in alcohol such as ethanol and concentrated acids such as hydrochloric acid and weakening hard test.

(vi) Treating the seeds with growth promoting hormones or other chemical substances to promote germination to remove germination inhibition

(vii) Dry storage of seeds with growth promoting hormone or other chemicals to promote germination or to remove germination inhibition

(viii) Cold and fire stratification, involve placing the seed close to the together to the moist sand,

(ix) Supply of suitable environment such as adequate moisture, moisture, oxygen, temperature and light

(Any six @ 02 marks)

4 (a) Mendel's success factors

(i) He carried out several preliminary investigations to familiarize himself with experimental organisms

(ii) He accurately recorded all experiments and results obtained

(iii) He gave himself enough time to collect sufficiency data that were significantly

(iv) He chosen pea plant that were easy to cultivate, undergoes self-pollination, consisting several characters to study etc.

Any 3 points @ 01 Marks = 03 Marks.

Mendel's failure

- (i) He failed to explain about incomplete and codominance
 - (ii) He failed to explain about multiple allele inheritance
- any 02 points @ 01 Marks = 02 Marks

b

- (b) (i) Let W-be represent gene/allele for white colour (dominant) 00 1/2 Marks
 w- represent gene for other colour (recessive) 00 1/2
 B- represent allele for black colour (dominant) 00 1/2
 b- represent allele for brown colour (recessive) 00 1/2

P₂ phenotype: White leghorn ^{fault} x White leghorn ^{fault}

P₂ genotype: WwBb x WwBb 01 Marks

Meiosis

Gametes WB, Wb, wB, wb, WB, wb

Random fertilization

Female gametes	Male gametes			
	WB	Wb	wB	Wb
WB	WWBB	WNBB	WwBB	WwBb
Wb	WNBB	WNbb	WwBb	Wwbb
wB	WwBB	WwBb	wwBB	wwBb
wb	WwBb	Wwbb	wwBb	wwbb

00 1/2 Marks = 08 marks

F₂ offspring phenotypes:

- 12 - White plumage
- 3 - Black plumage
- 1 - Brown plumage

F₂ phenotypic ratio: 12 white: 3 black: 1 brown (12:3:1) ⁰¹

The type of gene interaction is EPISTATIC GENE INTERACTION EPISTASIS ^{01 Marks}

(10) The probability of gene getting leghorn with white colour

- Since the number of leghorn fowl with white colour are 12 out of 16 therefore

$$\frac{12}{16} \times 100\% = 0.75 \text{ or } 75\%$$

Therefore, the probability of getting leghorn plumage with white colour is 0.75 or 75% ^{01 Marks}

5

(a) Eutrophication is the natural process during which the concentration of salts build up in the water bodies. The commonest salt build up in water are nitrates (NO_3) salts. 02 Marks

- The accumulation of these salts nitrate will stimulate (cause) the growth of algae (algae blooms). This will lead to coverage of water by blue green algae that hinder penetration of light deeply in water; there by causing deeper water algae not able to photosynthesise and hence will die. 02 (Marks)

The died organisms or died organic matter (D.M.O) require oxygen for their decomposition, that will create biochemical oxygen demand (BOD) due to competition of oxygen gas. Other organisms in the bottom of water will die due to scarcity of water oxygen.

The impact of eutrophication are:

- (i) Rapid growth of algae in water bodies (algae bloom)
- (ii) TOP Covering of water surface by algae resulting in few or no oxygen reach bottom dweller organisms.
- (iii) Biochemical oxygen demand
- (iv) ~~Be~~ Death of bottom water surface.

by algae.

(v) TOP covering of water by algae hinder Penetration of input, hence phytoplankton ^{diversity} cannot photosynthesize. Hence lower species density of phytoplankton. @ 02 MARKS any 04 points = 08 MARKS

(b) Inverted pyramid is an ecological pyramid that is upside down showing the relationship in an ecosystem. @ 02 MARKS

• Under normal circumstance the inverted ecological pyramid is not viable ecosystem, but it can be viable if the mode of life is parasitism. Example in single host. Can take care of millions of parasite, like worms in human body. 02 MARKS

A single tree in the forest can take care of many animals like birds, insects and other organisms. 02 MARKS

• Few phytoplankton as primary producers can feed zooplankton and other marine organisms. 02 MARKS

Total = 20 MARKS

Speciation is the process by which one or more species arise from the pre-existing species. If species have shown sign of evolving into new species, the new species are called sub-species. 01 MARK

If the subspecies cannot interbreed, they are assumed to have acquired the status of new species **01 MARKS**

Speciation is generated by two forms of Isolating Mechanisms which are **01 MARKS**

Geographical Isolation

These are barriers like rivers, mountains, unfavourable temperature etc. This may stop the gene flow between the isolated groups **03 MARKS**

Reproductive Isolation

This is the situation lead to inability to of any animal to interbreed. This might be caused by **03 MARKS**

- Lack of attractor between the couple; non-responding of the genitalia example it may be physically impossible for the penis of male mammal to enter the female Vagina. **04 MARKS**

- Courtship behaviour example in mammals animals one failing to stimulate the other **02 MARKS**

Therefore reproductive Isolation can be brought by two Mechanisms

Pre-zygotic Mechanism, this interferes reproduction before the formation of zygote such as ecological Mechanism that is different in reproductive behaviour Eg. dogs plays, birds sing etc. Seasonal barrier and incompatibility. Example failure of pollen grain to germinate on stigma **02 MARKS**

Post-Zygotic Mechanism

This interferes reproductive process after fertilization.

Eg. hybrid inviability, hybrid sterility and hybrid break down that F_1 - fertile but F_2 and F_1 backcross are not infertile 02 Marks

1 (a) Application of mycology towards industrial revolution in Tanzania

(i) Production of alcohol in brewing industries
Example yeast

(ii) Production of organic acids and inorganic acids solvents. Example fungi

(iii) Improvement of soil fertility in Agriculture industries

(iv) Production of medicine in Medical industry

Some members of Kingdom fungi are used in producing medicine (antibiotic) such as Penicillin, from *Penicillium* sp, and ephedrine extracted from yeast

(v) They can also be used for medical therapy

(vi) Fungi research and technological advancement.

The study of fungi has advanced scientific knowledge in many areas including genetics, evolution and biochemistry

(vii) Food innovation and production

Fungi have long term used in the production of fermented food such as cheese, soya, sour and miso. Example *Aspergillus oryzae*

(viii) They are used in biological studies as specimens for instance *Rhizopus*, *Saccharomyces* and *Agaricus*.

MARKING SCHEME

BIOLOGY.02

F6 (2026)