

(a) Similarities.

Both have a dominant sporophyte; ✓

Both have a reduced gametophyte; ✓

Both have complex vascular tissues; ✓

In both, pollen tube is present; ✓

In both, fertilized embryo sac develops into seed; ✓

In both embryo sac is enclosed in an ovule; ✓

Both have separate male (pollen grains) and female (embryo sacs) spores; ✓

Differences

Gymnosperms

Angiosperms.

Ovules not protected; ✓ Ovules protected

No style or stigma; ✓ Stigma and style present

No fruits formed; ✓ Fruits formed after fertilization

Only tracheids in xylem; ✓ Xylem tracheids and vessels

No companion cells

✓ Companion cells present

in phloem

No flowers/cones; ✓ Flowers | No cones.

Any four

(b) Virus/phage approaches bacterium; ✓ becomes attached to the surface of the bacterial cell surface; ✓ its DNA is injected into the host cell; ✓

Phage DNA codes for production of phage enzymes using host's protein-synthesizing machinery; ✓

Immediately phage inactivates host DNA replication of the bacterial DNA; ✓ and the enzyme production ceases; ✓

All of host systems are taken over by the viral DNA to produce more strands of viral DNA. ✓

Host enzyme and synthetic systems are used to produce protein coats for viral DNA; Wall of the host cell ruptures; by action of lytic enzymes / lysozymes synthesized by phage DNA; new viruses / phages are released; infecting further bacteria; ✓ DB.

(c) Breakdown of plant and animal remains; recycling of essential elements; symbiotic relationships with other organisms such as cellulose digesting bacteria in gut of ruminants; Bacteria in the human gut synthesize some of the Vitamin B complex.

Food production; e.g. yoghurt, some cheeses, vinegar, coffee, tea.

Industrial processes; such as tanning leather; making soap powders.

Source of antibiotics; e.g. streptomycin.

Easily cultured therefore used for research;

Causes disease by pathogenic bacteria;

Biological control. ✓

Decomposition of sewage; reducing the bulk of faeces; ✓ DB.

3(a) (i)

Mast cells<sup>✓</sup> secrete anticoagulant/heparin that prevents blood clotting within blood vessels<sup>✓</sup>; blood flows continuously distributing metabolites to respiration tissues<sup>✓</sup>.

Mast cells also release histamine and cytokines<sup>✓</sup>, causing local vaso dilatation; blood flow carrying with it white blood<sup>✓</sup> cells to injured sites is increased; preventing infection from pathogenic bacteria.

Large amoeboid cells/macrophages<sup>✓</sup> for defence against infections<sup>✓</sup>; though phagocytosis of pathogenic bacteria<sup>✓</sup>.

Made up of tough, non-stretchable, densely packed collagen fibres<sup>✓</sup> with great tensile strength<sup>✓</sup>; for packing and binding muscles to bones at the tendons<sup>✓</sup>.

Made up of stretchable elastic fibres, permitting tissues to recover shape quickly on distortion such as larger arteries and alveoli of the lungs.

Elastic fibres are also strong<sup>✓</sup>, allowing binding of bones together at ligaments.

Fat<sup>✓</sup> cells store fat in<sup>✓</sup> bulky structures, insulating the body against heat loss in cold weather; and form a sheath around body organs, separating them from each other reducing interference with each other's activities<sup>✓</sup>.

Fibroblasts<sup>✓</sup> produce<sup>✓</sup> collagen fibres and elastic fibres.

Max ox

(ii) Elongated fibres; allowing considerable contraction.

Parallel fibres; shorten along the same axis; producing a more powerful contraction of the muscle as a whole; Fibre ends are tapered and interwoven to form attachment giving additional strength to the muscle;

Richly supplied by blood vessels; providing adequate supply of oxygen and nutrients for respiration; and carry away waste.

Actin and myosin filaments fit into each other; allowing sliding during muscle contraction.

Numerous mitochondria in the sarcoplasm; providing large quantities of ATP to effect contraction.

Myoglobin; it stores oxygen for release when oxygen levels are low.

Motor end-plate; to allow stimulation of the muscle.

Extensive sarcoplasmic reticulum that releases calcium ions stimulation via a system of transverse tubules important for muscle contraction.

Has motor units; several muscle fibres which work collectively to allow stimulation of muscle for them to contract and relax simultaneously.

Maxes

Structure related to function.

4(a) A cell or tissue which can transform stimulus energy into an action potential in neurons; 02

Informs the central nervous system of changes in the internal and external environment of an organism; 01

- (b) Convert stimulus energy into nerve impulses / action potential; ✓  
Sensitive to low level intensity stimulus;  
Each receptor has a threshold value of stimulus; ✓  
Produce generator potential / receptor potential when stimulated; ✓  
Become adapted / fail to respond to repeated stimulus; ✓  
Specific to a single stimulus; ✓  
Transmit precise information about the stimulus without alteration; ✓  
Has general cellular features (Nucleus, cytoplasm and cell membrane) but one end of cell is frequently extended; ✓

Any 05

Rej spontaneous activity;

- (c) Ear functions both as an organ of hearing and of balance;  
Sound waves in air are collected by the pinna / auricle; ✓ and focused into the ear canal / auditory canal / external auditory meatus; ✓ down which they travel to the ear drum / tympanum / tympanic membrane; ✓ vibrating it; these vibrations are transmitted to

the ear ossicles that too vibrate; and conduct vibrations to the oval window/penestra ovalis. Vibrations of the oval window generate pressure waves in the perilymph within the vestibular canal, causing the Reissner's membrane to vibrate which in turn sets pressure waves in the endolymph within the median canal, causing vibration of the relatively elastic basilar membrane. Sensory hair cells attached here are pulled against the rigid tectorial membrane, become deflected producing generator potential, which rises to a threshold level, forming an action potential in the axons of the auditory nerve.

12 marks

Ques functioning of the ear in balance.

(i) Vascular tissues (xylem and phloem) are formed from procambium; in turn formed by mitotic division of apical meristematic tissue (initials);

Daughter cells elongate by osmotic uptake of water and vacuolate; Innermost cells of procambial strand differentiate into protoxylem [primary xylem] coupled with loss of protoplasm, breakdown of end walls of adjacent cells, and secretion of lignified secondary wall as annular or spiral bands.

Outermost cells of procambial strand differentiate into protophloem [primary phloem] consisting sieve tube elements and companion cells joined along each other. cytoplasmic contents retained. sieve plates are formed at end of end walls of sieve tubes.

Max 12

#### As allele of gene

- (i) Occurrence of genes determining a given character on the same chromosome transfer. Are transmitted together; as they are carried in the same gamete.
- (ii) Haemophilia is potentially lethal; the selected gamet; survives less likely survive to sexual maturity / die young before reproductive age. Haemophiliac may choose not to have children knowing the risk that their offspring may suffer the disease,

Haemophiliac females rarely survive to child-bearing age. ~~time~~ only carriers pass on the disease while with color blindness both ~~suffers~~ and carriers pass on the condition.

ob

i) Cutting down of trees; to provide shelter, and more land for cultivation, and industrialisation.

Use of agrochemicals such as fertilisers, and pesticides, pollute aquatic environment, thus inhabitable by aquatic organisms.

Domestication of animals that regularly graze, prevents land from reaching its climax vegetation.

Use of heavy machinery in agriculture. Mining, results into erosion, contamination of soil, water by chemicals emitted from mining process.

Generation of power stations in water, discharge large quantities of heated water, causing thermal pollution in aquatic environment.

Use of detergents in homes, washed in water bodies, lead to algal bloom, as a result of eutrophication.

Use of engine boats and oil tankers on water bodies, whose oil spills pollute water bodies.

Solid pollution from industries affect aerial life.

Introduction of alien species, which overtime have outcompeted the native flora and fauna.

Fishing using ~~soo~~ wrong mesh, sized nets that kill small sized immature fish, and use of poison to catch fish.

Incorrect laying of bricks to build houses,

Road construction.

Construction of fish ponds;

(b)(ii) Non-specific; they kill beneficial species  
Disrupt food webs; due to biomagnification / concentrate along food chain,  
killing organisms at the top.  
Non-biodegradable; the effects are  
long term;  
Overuse also results in pest resistance.

(ii) Extinction of some animal and plant species.

Reduced crop yields due to drought,  
Rising sea levels due to melting of polar ice and thermal expansion of sea.

Increased wild fires.

Flooding of low lying islands.  
Increased pest and disease due to species migration.

Increased risk of skin cancer

injections.