

A Level Biology 9700 Paper 2 Complete Revision Notes

Detailed revision for: Cardiac Cycle, SAN & AVN, Bohr Shift, Chloride Shift, Proteins, Enzymes, Alveoli, Malaria, T Cells, Mitosis, Xerophytes and Transpiration.

Cardiac Cycle

- The cardiac cycle is the sequence of events in one heartbeat.
- Atrial systole: atria contract forcing blood into ventricles.
- Ventricular systole: ventricles contract and blood enters pulmonary artery and aorta.
- Diastole: heart relaxes and fills with blood.
- Pressure changes cause valves to open and close.
- Atrioventricular valves prevent backflow into atria.
- Semilunar valves prevent backflow from arteries.
- Left ventricle has thicker muscular wall because it pumps blood at high pressure around body.

SAN and AVN

- SAN = sinoatrial node located in right atrium.
- SAN acts as pacemaker and generates electrical impulses.
- Wave of excitation spreads across atria causing atrial systole.
- Collagen at centre of heart prevents direct spread to ventricles.
- Impulse reaches AVN = atrioventricular node.
- AVN delays impulse to allow ventricles to fill with blood.
- Impulse travels through Bundle of His and Purkyne tissue.
- Ventricles contract from apex upwards.

Bohr Shift

- At high carbon dioxide concentration, haemoglobin releases oxygen more easily.
- This is useful in actively respiring tissues.
- Carbon dioxide lowers pH causing haemoglobin shape change.
- Oxygen dissociation curve shifts right.
- Allows more oxygen delivery to tissues.

Chloride Shift

- Carbon dioxide enters red blood cells.
- Carbonic anhydrase converts CO_2 and water into carbonic acid.
- Carbonic acid dissociates into H^+ and bicarbonate ions.
- Bicarbonate ions diffuse out into plasma.
- Chloride ions diffuse into red blood cells to maintain electrical neutrality.
- This process is called chloride shift.

Proteins and Amino Acid Chains

- Amino acids contain amino group, carboxyl group and variable R group.
- Peptide bonds form between amino acids by condensation reaction.
- Primary structure = sequence of amino acids.
- Secondary structure = alpha helices and beta pleated sheets.
- Hydrogen bonds stabilise secondary structure.
- Tertiary structure formed by ionic bonds, hydrogen bonds and disulfide bridges.
- Quaternary structure formed from multiple polypeptide chains.
- Globular proteins are soluble and metabolic.
- Fibrous proteins are structural and insoluble.
- Denaturation changes active site shape causing loss of function.

Enzymes, V_{max} and K_m

- Enzymes are biological catalysts.
- Active site is complementary to substrate.
- Enzyme-substrate complexes form.
- Increasing substrate concentration increases rate until all active sites occupied.
- V_{max} = maximum rate of reaction when enzyme saturated.
- K_m value = substrate concentration at half V_{max} .
- Low K_m means high affinity between enzyme and substrate.
- Competitive inhibitors compete for active site.
- Non-competitive inhibitors bind elsewhere and alter active site shape.
- Temperature above optimum denatures enzyme.
- Extreme pH changes ionic bonds and active site shape.

Respiratory System and Alveoli

- Alveoli are site of gas exchange.
- Millions of alveoli provide very large surface area.
- Walls are one cell thick reducing diffusion distance.

- Dense capillary network maintains concentration gradient.
- Ventilation constantly replaces air.
- Moist lining allows gases to dissolve before diffusion.
- Elastic fibres allow recoil during breathing.
- Oxygen diffuses into blood while carbon dioxide diffuses into alveoli.

Malaria

- Malaria caused by Plasmodium parasite.
- Vector = female Anopheles mosquito.
- Mosquito injects parasite into bloodstream.
- Parasite enters liver then red blood cells.
- Red blood cells burst releasing more parasites.
- Symptoms include fever and chills.
- Antigens on parasite surface stimulate immune response.
- Vaccines are difficult because parasite changes antigens frequently.

Helper T Cells and Killer T Cells

- Helper T cells have CD4 receptors.
- Antigen-presenting cells display antigens on surface.
- Helper T cells activate B cells and killer T cells.
- Cytokines released stimulate immune response.
- Killer T cells destroy infected body cells.
- They release perforin causing holes in membranes.
- Memory cells remain after infection giving faster secondary response.

Mitosis Phases

- Mitosis produces genetically identical cells.
- Used for growth, repair and asexual reproduction.
- Prophase: chromosomes condense and spindle forms.
- Metaphase: chromosomes align at equator.
- Anaphase: sister chromatids separate to opposite poles.
- Telophase: nuclear envelopes reform.
- Cytokinesis divides cytoplasm into two daughter cells.

Xerophytes

- Xerophytes are plants adapted to dry conditions.

- Thick waxy cuticle reduces evaporation.
- Rolled leaves trap humid air.
- Sunken stomata reduce air movement.
- Hairy leaves trap water vapour.
- Reduced leaf area lowers transpiration.
- Extensive roots absorb more water.

Transpiration

- Transpiration = loss of water vapour from plant.
- Water moves from roots to leaves through xylem.
- Evaporation from mesophyll lowers water potential.
- Cohesion between water molecules maintains water column.
- Transpiration pull draws water upwards.
- High temperature increases kinetic energy and evaporation.
- Wind removes humid air increasing gradient.
- Low humidity increases water loss.
- Light causes stomata to open.

Important Definitions to Memorise

Term	Definition
Transpiration	Loss of water vapour from aerial parts of plant.
Diffusion	Net movement of particles from high to low concentration.
V _{max}	Maximum rate of enzyme reaction.
K _m	Substrate concentration at half V _{max} .
Mitosis	Nuclear division producing genetically identical nuclei.
Bohr Shift	Reduced affinity of haemoglobin for oxygen at high CO ₂ .
Ventilation	Movement of air into and out of lungs.

Exam Tips for Paper 2

- Always mention concentration gradient in diffusion questions.
- Use correct biological terminology.
- State adaptation and explain its advantage.
- In enzyme questions mention active site and enzyme-substrate complex.
- For graph questions describe trend first then explain.
- For immunity questions mention antigen specificity.
- Use PMAT order for mitosis.