Paper 1:

Topic 1 – Cell Biology Retrieval Starters

4.1.1.1 Eukaryotes and Prokaryotes

1. Eukaryotic cells have a nucleus and membrane-bound organelles. Prokaryotic cells do not.
2. Eukaryotic cells.
3. It contains extra small rings of DNA that can carry useful genes, such as antibiotic resistance.
4. Cell membrane and cytoplasm.
5. They have no nucleus, so their genetic material is free in the cytoplasm.
6. Plant cells have a nucleus, mitochondria, a cell wall and chloroplasts, whereas bacterial cells have no nucleus or chloroplasts.

4.1.1.2 Animal and Plant Cells

1. Nucleus, cell membrane, cytoplasm, mitochondria and ribosomes.
2. Cell wall, chloroplasts and permanent vacuole.
3. Controls the activities of the cell and contains the genetic material (DNA).
4. Site of aerobic respiration where energy is released.
5. Plant cells photosynthesise, so they need chloroplasts containing chlorophyll. Animals do not photosynthesise.
6. It strengthens and supports the cell and maintains its shape.

Required Practical 1: Using a Light Microscope

1. A light microscope.
2. Onion epidermal cells and human cheek cells.
3. A title and magnification (or scale).
4. To make structures easier to see by increasing contrast.
5. It makes it easier to find and focus the specimen before increasing magnification.
6. To produce an accurate scientific drawing that clearly shows the structures.

4.1.1.3 Cell Specialisation

1. A cell adapted to carry out a particular function.
2. A long tail (flagellum) to swim to the egg.

3. A long axon to carry electrical impulses over long distances.
4. A large surface area for absorbing water and mineral ions.
5. Muscle cells contain many mitochondria to provide energy for contraction.
6. Xylem cells are hollow with no end walls, allowing water to flow through them.

4.1.1.4 Cell Differentiation

1. The process by which a cell changes to become specialised for a particular function.
2. At an early stage of development.
3. They contain meristems where cells continue to divide and differentiate.
4. Most cells have already differentiated, so cell division is mainly for growth, repair and replacement.
5. Different genes are switched on and off, producing cells with different structures and functions.
6. Different specialised cells require different structures to carry out their functions efficiently.

4.1.1.5 Microscopy

1. An electron microscope.
2. An electron microscope.
3. The ability to distinguish between two points that are close together.
4. Magnification = Image size ÷ Real size
5. They have much greater magnification and resolution, allowing smaller cell structures to be seen.
6. Magnification = Image size ÷ Real size = 20 mm ÷ 0.02 mm = 1000

4.1.2.1 Chromosomes

1. In the nucleus.
2. DNA.
3. A section of DNA that codes for a protein.
4. In 23 pairs.
5. They contain the genetic information needed to control cell activities and inheritance.
6. Chromosomes are made of DNA, and genes are sections of DNA found on chromosomes.

4.1.2.2 Mitosis and the Cell Cycle

1. A type of cell division that produces two genetically identical daughter cells.
2. It is copied so there are two copies of each chromosome.

3. Two.
4. To prepare the new cells so they can make proteins and release energy.
5. It produces identical cells needed for growth and replacing damaged or worn-out cells.
6. DNA is replicated → Cell grows and increases sub-cellular structures → Mitosis and cell division produce two identical daughter cells.

4.1.2.3 Stem Cells

1. An undifferentiated cell that can divide and differentiate into different types of specialised cells.
2. In embryos.
3. In bone marrow.
4. They can produce clones of plants quickly and cheaply with desired characteristics.
5. They can replace damaged cells, for example treating leukaemia using bone marrow stem cells.
6. Destroying embryos to obtain stem cells raises ethical concerns because some believe embryos are potential human life.

4.1.3.1 Diffusion

1. The net movement of particles from an area of higher concentration to an area of lower concentration.
2. Down a concentration gradient (from high to low concentration).
3. Concentration gradient, temperature and surface area.
4. They have a large surface area to volume ratio, so diffusion is fast enough.
5. They have a small surface area to volume ratio and diffusion alone is too slow.
6. The lungs have a large surface area, thin walls and a good blood supply.

4.1.3.2 Osmosis

1. The net movement of water molecules through a partially permeable membrane from a dilute solution to a more concentrated solution.
2. A partially permeable membrane.
3. From a dilute solution (high water concentration) to a concentrated solution (low water concentration).
4. Water enters the cell by osmosis and it becomes turgid.
5. Water leaves the cell by osmosis and it becomes flaccid (or plasmolysed if enough water is lost).
6. Diffusion is the movement of any particles. Osmosis is the movement of water molecules only through a partially permeable membrane.

Required Practical 2: Osmosis

1. Potato tissue.
2. The concentration of the sugar solution.
3. The mass of the potato cylinders.
4. To ensure it is a fair test because they all have the same surface area to volume ratio.
5. Water moves into or out of the potato cells by osmosis depending on the concentration of the solution.
6. The concentration where there is no change in mass is the estimated concentration of the potato cells.

4.1.3.3 Active Transport

1. The movement of substances from a low concentration to a high concentration against the concentration gradient using energy from respiration.
2. From low concentration to high concentration.
3. Because substances are moved against the concentration gradient.
4. Absorption of mineral ions by root hair cells.
5. Absorption of glucose in the small intestine.
6. Diffusion moves substances down the concentration gradient and does not require energy. Active transport moves substances against the concentration gradient and requires energy.

Topic 2 – Retrieval Starters

4.2.1 Principles of Organisation

1. A cell is the basic unit of structure and function in living organisms.
2. A tissue is a group of similar cells working together to carry out a particular function.
3. An organ is a group of different tissues working together to perform a particular function.
4. An organ system is a group of organs working together to perform a particular function.
5. Cell → Tissue → Organ → Organ system → Organism.
6. Similar cells form tissues, tissues form organs, organs work together in organ systems, and organ systems make up an organism.

4.2.2.1 The Human Digestive System

1. To break down food into small soluble molecules that can be absorbed into the blood.
2. The mouth.
3. The small intestine.
4. Completes digestion and absorbs soluble products of digestion into the bloodstream.
5. Small soluble molecules can pass through the walls of the small intestine into the blood.
6. The digestive system breaks food into soluble molecules, which the circulatory system transports to cells throughout the body.

Enzymes and Metabolism

1. Proteins.
2. To act as biological catalysts that speed up chemical reactions.
3. The part of the enzyme where the substrate binds.
4. Each enzyme has an active site with a specific shape that only fits one substrate.
5. The substrate has a complementary shape to the enzyme's active site.
6. High temperatures change the shape of the active site (denature the enzyme), reducing or stopping enzyme activity.

Digestive Enzymes

1. Amylase.
2. Protease.
3. Lipase.
4. Amino acids.
5. Fatty acids and glycerol.
6. They are small and soluble, so they can pass through the wall of the small intestine into the bloodstream.

Bile

1. The liver.
2. The gall bladder.
3. Neutralises stomach acid and emulsifies fats.
4. To provide the optimum alkaline pH for enzymes in the small intestine.
5. It breaks large fat droplets into smaller droplets, increasing the surface area for lipase.

6. Emulsification increases the surface area, allowing lipase to digest fats more quickly.

Required Practical – Food Tests

1. Benedict's solution.
2. Add Benedict's solution to the food sample and heat in a water bath. A positive result changes from blue to green, yellow, orange or brick-red depending on the amount of reducing sugar present.
3. Iodine solution. A positive result changes from orange-brown to blue-black.
4. Biuret reagent. A positive result changes from blue to lilac/purple.
5. Add ethanol to the food sample and shake. Pour the mixture into water. A positive result is a cloudy white (milky) emulsion.
6. To ensure a fair test by preventing contamination and allowing valid comparisons between samples.

4.2.2.2 The Heart and Blood Vessels

1. To pump blood around the body.
2. A double circulatory system.
3. The right side.
4. The left side.
5. Aorta, vena cava, pulmonary artery, pulmonary vein and coronary arteries.
6. Blood passes through the heart twice during one complete circulation of the body.

Structure of the Heart

1. The heart.
2. To pump blood out of the heart.
3. To receive blood returning to the heart.
4. It pumps blood at higher pressure around the whole body.
5. The heart muscle needs oxygen and glucose for aerobic respiration.
6. It generates electrical impulses that control the heart rate and is found in the right atrium of the heart.

The Lungs and Gas Exchange

1. Oxygen.
2. Carbon dioxide.
3. Alveoli.
4. Capillaries.
5. Large surface area, moist surface, thin walls (one cell thick) and a good blood supply.
6. It maintains a steep concentration gradient for rapid diffusion.

Blood Vessels

1. Arteries, veins and capillaries.
2. Arteries.
3. Veins.
4. To withstand the high pressure of blood pumped from the heart.
5. To provide a short diffusion distance for substances.
6. Arteries have thick muscular, elastic walls and a small lumen; veins have thinner walls, a large lumen and valves; capillaries have walls one cell thick for efficient exchange.

4.2.2.3 Blood

1. Plasma is the liquid part of the blood that transports cells and dissolved substances.
2. To transport oxygen.
3. To defend the body against pathogens.
4. To help blood clot.
5. They contain haemoglobin, have no nucleus and have a biconcave shape, giving a large surface area for oxygen transport.
6. It is made up of different specialised cells working together to carry out a function.

4.2.2.4 Coronary Heart Disease

1. Fatty deposits build up in the coronary arteries, reducing blood flow to the heart muscle.
2. The heart muscle receives less oxygen, increasing the risk of a heart attack.
3. To keep a narrowed coronary artery open.
4. They reduce blood cholesterol levels.
5. Biological valves are made from animal or human tissue and usually do not require lifelong anticoagulants. Mechanical valves are artificial, last longer but require lifelong anticoagulants.
6. Heart transplants can greatly improve quality of life but there is a shortage of donors and risk of rejection. Artificial hearts can keep patients alive while waiting for a transplant but can increase the risk of blood clots and infection.

4.2.2.5 Health Issues

1. Health is the state of physical and mental wellbeing.
2. Communicable diseases are caused by pathogens and can spread between organisms. Non-communicable diseases cannot be spread.
3. Diet, stress, life situation or exercise (any two).

4. It makes a person more likely to develop infectious diseases.
5. Some viruses damage DNA in cells, increasing the risk of uncontrolled cell division and cancer.
6. One disease can trigger another or make it more likely, for example a weakened immune system increasing susceptibility to infectious diseases.

4.2.2.6 Effect of Lifestyle on Non-Communicable Diseases

1. A risk factor is something that increases the chance of developing a disease.
2. Smoking damages the lungs and can cause lung disease and lung cancer.
3. Alcohol can damage liver cells, causing cirrhosis.
4. Obesity increases insulin resistance, increasing the risk of Type 2 diabetes.
5. It increases the risk of premature birth, low birth weight and developmental problems.
6. Most non-communicable diseases result from a combination of lifestyle, environmental and genetic risk factors.

4.2.2.7 Cancer

1. A tumour is a mass of abnormal cells formed by uncontrolled cell division.
2. A benign tumour is contained in one place and does not spread.
3. A malignant tumour invades surrounding tissues and spreads to other parts of the body.
4. Through the blood or lymphatic system.
5. Smoking.
6. Benign tumours remain in one place and are usually not cancerous, whereas malignant tumours spread around the body and are cancerous.

4.2.3.1 Plant Tissues

1. Epidermal tissue covers and protects the plant.
2. To carry out photosynthesis.
3. It allows gases to diffuse through air spaces.
4. To transport water and mineral ions from the roots to the leaves and provide support.
5. To transport dissolved sugars produced by photosynthesis.
6. Meristem tissue contains unspecialised cells that divide and differentiate, allowing the plant to grow.

4.2.3.2 Plant Organ System

1. The loss of water vapour from the leaves.
2. The transport of dissolved sugars around the plant.

3. They have a large surface area, thin walls and many mitochondria for active transport.
4. Xylem vessels are dead, hollow cells joined end to end with no end walls and strengthened with lignin.
5. Guard cells open and close the stomata to control gas exchange and water loss.
6. Higher temperature, higher light intensity and higher wind speed increase transpiration. Higher humidity decreases transpiration.

Topic 3 – Infection and Response Retrieval Starters

4.3.1.1 Communicable Diseases

1. A disease caused by a pathogen that can be passed from one organism to another.
2. Bacteria, viruses, fungi and protists.
3. Air, water and direct contact. (Also acceptable: contaminated food.)
4. They produce toxins that damage tissues and make us ill.
5. They reproduce inside living cells, damaging or destroying the cells.
6. Good hygiene, isolating infected individuals, destroying vectors and vaccination.

4.3.1.2 Viral Diseases

1. A virus.
2. By droplets from coughs and sneezes.
3. To develop immunity and prevent the spread of the disease.
4. Through sexual contact or exchange of body fluids, including infected blood.
5. It attacks and damages the immune system.
6. It causes discolouration of leaves, reducing photosynthesis and stunting growth.

4.3.1.3 Bacterial Diseases

1. Bacteria.
2. By eating contaminated food.
3. Fever, stomach cramps, vomiting or diarrhoea. (Any two.)
4. Poultry are vaccinated against salmonella.
5. Through sexual contact.
6. Some bacteria have become antibiotic resistant.

4.3.1.4 Fungal Diseases

1. Rose black spot fungus.
2. Purple or black spots on leaves and early leaf loss.
3. By spores carried in the wind or water.
4. Less photosynthesis occurs because leaves are damaged or lost.
5. Using fungicides and removing infected leaves.
6. It reduces the spread of fungal spores to healthy plants.

4.3.1.5 Protist Diseases

1. A protist.
2. The mosquito.
3. Fever. (Also acceptable: chills or flu-like symptoms.)
4. It carries the pathogen from one host to another.
5. They prevent mosquito bites.
6. Use insecticides and remove mosquito breeding sites/use mosquito nets.

4.3.1.6 Human Defence Systems

1. The skin acts as a physical barrier and secretes antimicrobial substances.
2. The nose contains hairs and mucus that trap pathogens.
3. Mucus traps pathogens and cilia move the mucus to the throat where it is swallowed.
4. Hydrochloric acid kills many pathogens that enter the stomach.
5. Phagocytosis, producing antibodies and producing antitoxins.
6. Phagocytes engulf and digest pathogens, antibodies bind to specific pathogens to destroy them, and antitoxins neutralise toxins released by bacteria.

4.3.1.7 Vaccination

1. A way of protecting people against disease by stimulating the immune system.
2. Dead or inactive pathogens, or parts of pathogens (antigens).
3. So the body develops immunity before infection occurs.
4. They produce specific antibodies and memory cells.
5. Memory cells remain in the body and produce antibodies quickly if the pathogen enters again.
6. It reduces the number of people who can catch and spread the disease, reducing transmission (herd immunity).

4.3.1.8 Antibiotics and Painkillers

1. Bacterial diseases.
2. Penicillin.
3. Viruses reproduce inside body cells, so antibiotics cannot destroy them.
4. They relieve symptoms such as pain but do not kill pathogens.
5. When bacteria are no longer killed by antibiotics.
6. Infections become harder to treat, increasing the risk of illness and death.

4.3.1.9 Discovery and Development of Drugs

1. Willow.
2. Foxglove.
3. Alexander Fleming.
4. Toxicity, efficacy and dosage are tested using cells, tissues and live animals.
5. To reduce bias and produce valid, reliable results.
6. To ensure the drug is safe, works effectively and the correct dose is identified before it is licensed.

Topic 4 – Bioenergetics Retrieval Starters

4.4.1.1 Photosynthetic Reaction

1. Photosynthesis is the process by which plants use light energy to produce glucose from carbon dioxide and water.
2. Carbon dioxide and water.
3. Glucose and oxygen.
4. Chloroplasts.
5. Because it absorbs energy from light.

6. Carbon dioxide + water → glucose + oxygen (light energy and chlorophyll required).

4.4.1.2 Rate of Photosynthesis

1. Light intensity, carbon dioxide concentration, temperature and chlorophyll concentration.
2. A factor that is in shortest supply and therefore limits the rate of photosynthesis.
3. The rate increases until another factor becomes limiting.
4. The rate increases until another factor becomes limiting.
5. Increasing temperature increases the rate up to the optimum temperature; above this, enzymes denature and the rate decreases.
6. They increase light intensity, carbon dioxide concentration and temperature to maximise the rate of photosynthesis and crop yield.

4.4.1.3 Uses of Glucose from Photosynthesis

1. Respiration.
2. Starch is insoluble, so it can be stored.
3. It is converted into cellulose to make cell walls.
4. It is converted into lipids for energy storage.
5. Nitrate ions.
6. Respiration, making starch, making cellulose, making amino acids (with nitrate ions) and making fats and oils.

4.4.2.1 Aerobic and Anaerobic Respiration

1. Respiration is the process that transfers energy from glucose.
2. An exothermic reaction.
3. Glucose + oxygen → carbon dioxide + water.
4. Glucose → lactic acid.
5. Ethanol and carbon dioxide.
6. Aerobic respiration requires oxygen, releases more energy and produces carbon dioxide and water. Anaerobic respiration does not require oxygen, releases less energy and produces lactic acid in animals or ethanol and carbon dioxide in yeast.

4.4.2.2 Response to Exercise

1. It increases.
2. It increases.
3. The muscles cannot receive enough oxygen for aerobic respiration.
4. Lactic acid builds up in the muscles.

5. The extra oxygen needed to react with the lactic acid produced during anaerobic respiration.
6. Lactic acid is carried by the blood to the liver, where it is broken down using oxygen.

4.4.2.3 Metabolism

1. Metabolism is the sum of all the chemical reactions that take place in a cell or the body.
2. Respiration.
3. Glycogen.
4. Starch.
5. Amino acids are used to make proteins.
6. Metabolism includes:

- The conversion of glucose to starch, glycogen and cellulose.
- The formation of lipids from glycerol and fatty acids.
- The use of glucose and nitrate ions to make amino acids, which are then used to make proteins.
- Respiration, where glucose is broken down to transfer energy.
- The breakdown of excess proteins to form urea for excretion.

Paper 2:

Topic 5 – Homeostasis and Response Retrieval Starters

4.5.1 Homeostasis

1. The regulation of the internal conditions of a cell or organism to maintain optimum conditions for function in response to internal and external changes.
2. Body temperature, blood glucose concentration and water content.
3. A cell or group of cells that detect a stimulus.
4. A muscle or gland that brings about a response.
5. The brain, spinal cord and pancreas.
6. Receptors detect a stimulus, coordination centres process the information, and effectors produce a response to restore optimum conditions.

4.5.2 The Human Nervous System

1. To detect stimuli and coordinate the body's responses.
2. Central Nervous System.
3. The brain and spinal cord.
4. Stimulus → Receptor → Coordinator → Effector → Response.
5. A rapid, automatic response to a stimulus that does not involve conscious thought.
6. A stimulus is detected by receptors, impulses travel along sensory neurones to the CNS, then along motor neurones to an effector, which produces a rapid response.

4.5.3.1 Human Endocrine System

1. A chemical messenger produced by a gland and carried in the blood.
2. A system of glands that produce and release hormones.
3. In the bloodstream.
4. It releases hormones that control other endocrine glands.
5. Hormones act more slowly but have longer-lasting effects than nerve impulses.
6. Hormonal coordination is slower, carried in the blood and longer lasting, whereas nervous coordination is rapid, carried by neurones and usually has short-lived effects.

4.5.3.2 Control of Blood Glucose Concentration

1. The pancreas.
2. Insulin.
3. A stored form of glucose.
4. The pancreas produces little or no insulin.
5. By a carbohydrate-controlled diet, exercise and weight loss (sometimes medication).
6. Type 1 diabetes is caused by little or no insulin production and requires insulin therapy. Type 2 diabetes is linked to lifestyle and insulin resistance and is often managed with diet, exercise and medication.

4.5.3.3 Hormones in Human Reproduction

1. Oestrogen.
2. Testosterone.
3. The release of an egg from an ovary.
4. FSH stimulates the maturation of an egg in an ovary.
5. LH stimulates ovulation.

6. FSH stimulates egg maturation, oestrogen inhibits FSH and stimulates LH, LH triggers ovulation, and progesterone maintains the lining of the uterus and inhibits FSH and LH.

4.5.3.4 Contraception

1. The prevention of pregnancy.
2. The contraceptive pill. (Also acceptable: contraceptive patch, implant or injection.)
3. Condoms. (Also acceptable: diaphragm or abstinence.)
4. It contains hormones that inhibit FSH so no egg matures, and/or prevent ovulation.
5. They act as a barrier to stop sperm reaching the egg.
6. Hormonal methods use hormones to prevent ovulation or fertilisation and are usually highly effective but may have side effects. Non-hormonal methods do not use hormones and include barrier methods such as condoms, which also reduce the spread of STIs.

4.5.3.5 The Use of Hormones to Treat Infertility (HT)

1. The inability to conceive naturally after regular unprotected intercourse.
2. FSH and LH.
3. In Vitro Fertilisation.
4. FSH stimulates egg maturation and LH triggers ovulation.
5. FSH and LH are given to mature eggs, eggs are collected from the ovaries, sperm are used to fertilise the eggs in a laboratory, and one or two embryos are transferred into the uterus.
6. Advantages: can help infertile couples have children. Disadvantages: expensive, emotionally stressful, success rates are not guaranteed and there is an increased chance of multiple births.

4.5.3.6 Feedback Systems (HT)

1. The adrenal glands.
2. The thyroid gland.
3. It prepares the body for a "fight or flight" response by increasing heart rate and blood flow to muscles.
4. It controls the body's metabolic rate.
5. A control mechanism that reverses a change to keep internal conditions stable.
6. If thyroxine levels are too low, the pituitary releases more TSH to stimulate the thyroid. If thyroxine levels are too high, less TSH is released, reducing thyroxine production.

Topic 6 – Inheritance, Variation and Evolution Retrieval Starters

4.6.1.1 Sexual and Asexual Reproduction

1. Reproduction involving the fusion of male and female gametes.
2. Reproduction involving only one parent with no fusion of gametes.
3. Meiosis.
4. Mitosis.
5. Offspring inherit a mixture of alleles from both parents, creating genetic variation.
6. Sexual reproduction produces genetically varied offspring and involves two parents. Asexual reproduction produces genetically identical offspring (clones) and involves one parent.

4.6.1.2 Meiosis

1. Cell division that produces gametes.
2. In the reproductive organs (ovaries and testes).
3. Four.
4. Because chromosomes are mixed and separated randomly.
5. Meiosis halves the chromosome number to 23; fertilisation restores it to 46.
6. Meiosis produces genetically different gametes, and fertilisation combines genes from two parents, producing variation.

4.6.1.3 DNA and the Genome

1. Deoxyribonucleic acid.
2. A long molecule of DNA containing many genes.
3. A section of DNA that codes for a protein.
4. The entire genetic material of an organism.
5. A specific sequence of amino acids to make a protein.
6. Identify genes linked to disease, understand inherited disorders and develop new treatments.

4.6.1.4 Genetic Inheritance

1. An alternative version of a gene.
2. A dominant allele is expressed if present; a recessive allele is only expressed if two copies are present.
3. Having two identical alleles.
4. Having two different alleles.
5. Genotype is the genetic makeup; phenotype is the observable characteristics.

6. Use the parental alleles to complete the Punnett square, determine the possible offspring genotypes and phenotypes, and calculate the probabilities.

4.6.1.5 Inherited Disorders

1. A disorder caused by inheriting one or more faulty alleles from parents.
2. Polydactyly.
3. Cystic fibrosis.
4. An inherited disorder in which a person is born with extra fingers or toes.
5. An inherited disorder that causes thick, sticky mucus to build up in the lungs and digestive system.
6. Embryo screening can prevent serious inherited disorders, but some people believe it is unethical because embryos may be destroyed and it could be used to select preferred characteristics rather than prevent disease.

4.6.1.6 Sex Determination

1. 23 pairs (46 chromosomes).
2. XX.
3. XY.
4. The father, because sperm carry either an X or a Y chromosome.
5. 50% (1 in 2).
6. The mother always passes on an X chromosome. The father passes on either an X or a Y chromosome. XX produces a female and XY produces a male, giving a 50% chance of each.

4.6.2.1 Variation

1. Differences between individuals of the same species.
2. Genetic factors (inherited alleles) and environmental factors.
3. A random change in the DNA sequence of a gene.
4. No, most mutations have little or no effect on the phenotype.
5. Environmental factors such as diet, climate and lifestyle can influence characteristics.
6. Mutations create new alleles. If a mutation gives an advantage, individuals are more likely to survive and reproduce, passing the allele on through natural selection.

4.6.2.2 Evolution

1. The gradual change in the inherited characteristics of a population over time.

2. The process where organisms with advantageous characteristics are more likely to survive and reproduce.
3. Because they have advantageous adaptations that make them better suited to their environment.
4. When populations become isolated and evolve differently until they can no longer interbreed.
5. Individuals with advantageous characteristics are more likely to survive, reproduce and pass on their alleles.
6. Variation exists within a population. Individuals with advantageous characteristics are more likely to survive and reproduce, passing on their alleles. Over many generations these alleles become more common, causing the population to evolve.

4.6.2.3 Selective Breeding

1. The process of breeding plants or animals with desirable characteristics to produce offspring with those characteristics.
2. To produce organisms with useful characteristics such as disease resistance, higher yield or a good temperament.
3. Breeding dairy cattle to produce more milk.
4. Select parents with the desired characteristic, breed them, then select offspring with the characteristic and repeat over many generations.
5. It reduces genetic variation, making populations more vulnerable to disease or environmental change.
6. Selective breeding can increase food production and improve desirable traits, but it reduces genetic variation and may increase the chance of inherited health problems.

4.6.2.4 Genetic Engineering

1. Changing the genetic material of an organism by inserting a gene from another organism.
2. A crop that has had its genes altered using genetic engineering.
3. Producing human insulin using genetically modified bacteria.
4. Producing crops that are resistant to insects or herbicides.
5. Advantage: Higher crop yields or reduced pesticide use. Disadvantage: Concerns about environmental impacts and the spread of modified genes.
6. Genetic engineering can produce medicines such as insulin and improve crops by increasing yield, disease resistance or nutritional value, although there are ethical and environmental concerns.

4.6.3.1 Evidence for Evolution

1. Charles Darwin.
2. Fossils and antibiotic-resistant bacteria.

3. Fossils show how organisms have changed over millions of years and provide evidence of extinct species.
4. Bacteria evolve resistance through natural selection, showing evolution can occur over short timescales.
5. Because there is now extensive evidence from fossils, genetics and observations of evolution.
6. Fossils, DNA evidence and observations such as antibiotic resistance all support Darwin's theory that species evolve over time by natural selection.

4.6.3.2 Fossils

1. The preserved remains or traces of ancient organisms.
2. When hard parts do not decay because they are replaced by minerals over millions of years.
3. Many early organisms were soft-bodied and decayed before fossilising, and geological activity has destroyed some fossils.
4. They can learn what extinct organisms looked like, how they lived and how species have changed over time.
5. Soft tissues usually decay before fossilisation can occur.
6. Fossils provide evidence of organisms that lived in the past and show how species have evolved over time.

4.6.3.3 Extinction

1. The permanent loss of a species when no individuals remain alive.
2. It means every member of the species has died.
3. Environmental change.
4. Rapid environmental changes may prevent species from adapting quickly enough to survive.
5. Better-adapted species may outcompete others for food, space or mates, causing their numbers to fall.
6. Species become extinct because of factors such as environmental change, new diseases, competition, new predators or catastrophic events, preventing them from surviving and reproducing.

4.6.3.4 Resistant Bacteria

1. The ability of bacteria to survive treatment with antibiotics.
2. Because they reproduce rapidly and mutations can occur frequently.
3. A type of bacteria that is resistant to many common antibiotics (Methicillin-resistant *Staphylococcus aureus*).
4. Because antibiotics do not kill viruses and are ineffective against viral infections.

5. To ensure all bacteria are killed and reduce the chance of resistant bacteria surviving and reproducing.
6. Mutations make some bacteria resistant to an antibiotic. These bacteria survive treatment, reproduce and pass on the resistance gene. Over time, the resistant strain becomes more common through natural selection.

4.6.4 Classification of Living Organisms

1. Carl Linnaeus.
2. The system of giving each organism a two-part Latin name consisting of its genus and species.
3. Kingdom, Phylum, Class, Order, Family, Genus, Species.
4. Carl Woese.
5. Archaea, Bacteria and Eukaryota.
6. Classification systems have changed because new evidence, including DNA analysis and improved technology, has shown that some organisms are more or less closely related than previously thought.

Topic 7 – Ecology Recall Questions

4.7.1.1 Communities

1. An ecosystem is the interaction of a community of organisms with the non-living parts of their environment.
2. All the populations of different species living together in a habitat.
3. Organism → Population → Community → Ecosystem.
4. Organisms depend on each other for food, shelter, pollination, seed dispersal and other resources.
5. Light, space, water and mineral ions.
6. Removing one species can disrupt food chains and interdependence, affecting the survival of other organisms in the community.

4.7.1.2 Abiotic Factors

1. A non-living factor that affects organisms in an ecosystem.
2. Light intensity, temperature, moisture levels and soil pH.
3. Higher light intensity generally increases the rate of photosynthesis and plant growth.
4. Soil pH affects the availability of mineral ions needed for healthy plant growth.
5. Aquatic animals need dissolved oxygen for aerobic respiration.
6. Changes in abiotic factors can affect the survival and distribution of organisms, changing population sizes and the whole community.

4.7.1.3 Biotic Factors

1. A living factor that affects organisms in an ecosystem.
2. Competition, predation, disease and food availability.
3. More food generally increases population size, while less food causes populations to decrease.
4. It can reduce the population of prey species and affect the whole food web.
5. The less successful species may decrease in number or be forced out of the habitat.
6. Changes in biotic factors affect survival and reproduction, altering population sizes and ecosystem balance.

4.7.1.4 Adaptations

1. A feature that helps an organism survive and reproduce in its environment.
2. Structural, behavioural and functional.
3. A physical feature that helps an organism survive.
4. A way an organism acts that helps it survive.
5. A process inside an organism's body that helps it survive.
6. Extremophiles have adaptations that allow their enzymes and cells to function in extreme conditions such as very high temperatures, high salt concentrations or high pressures.

4.7.2.1 Levels of Organisation

1. An organism that makes its own food, usually by photosynthesis.
2. An organism that eats producers.
3. An animal that hunts and eats other animals.
4. An animal that is hunted and eaten by another animal.
5. Quadrats and transects.
6. As prey numbers increase, predator numbers increase because there is more food. More predators then reduce the prey population, causing predator numbers to fall. This cycle then repeats.

4.7.2.2 How Materials are Cycled

1. The carbon cycle and the water cycle.
2. Because materials are needed continuously by living organisms and are present in limited amounts.
3. Respiration.
4. Photosynthesis.
5. They act as decomposers, breaking down dead organisms and waste, releasing carbon dioxide through respiration.

6. The carbon cycle recycles carbon needed to make carbohydrates, proteins and fats, while the water cycle continually supplies fresh water needed for life.

4.7.3.1 Biodiversity

1. The variety of all the different species of organisms on Earth or within an ecosystem.
2. It helps maintain stable ecosystems and provides resources such as food and medicines.
3. Deforestation.
4. A greater variety of species makes ecosystems more stable because organisms depend on each other.
5. It provides food, medicines, raw materials and helps maintain stable ecosystems.
6. Human activities such as deforestation, pollution, peat extraction and global warming destroy habitats and reduce the variety of species.

4.7.3.2 Waste Management

1. Air pollution, water pollution and land pollution.
2. It releases harmful microorganisms and chemicals into rivers and lakes.
3. Burning fossil fuels and releasing smoke or harmful gases.
4. Landfill uses land, can pollute soil and water, and produces methane gas.
5. Pollution damages habitats, kills organisms and reduces the variety of species.
6. A growing population produces more waste, increases pollution and destroys more habitats, reducing biodiversity.

4.7.3.3 Land Use

1. Building, farming, quarrying and landfill.
2. A wetland where dead plant material builds up to form peat.
3. They provide unique habitats and store large amounts of carbon.
4. Carbon dioxide is released into the atmosphere.
5. Habitats are destroyed and stored carbon is released, contributing to climate change.
6. Using peat provides compost for gardening, but destroying peat bogs damages habitats, reduces biodiversity and releases carbon dioxide, so conservation is generally more sustainable.

4.7.3.4 Deforestation

1. The clearing of forests.
2. To provide land for cattle farming and to grow crops such as biofuels.
3. To create grazing land for cattle.

4. To produce crops that can be used as renewable fuels.
5. It destroys habitats, reduces food sources and can lead to species becoming extinct.
6. Deforestation destroys habitats, reduces biodiversity, increases carbon dioxide levels in the atmosphere and contributes to global warming.

4.7.3.5 Global Warming

1. Carbon dioxide and methane.
2. The long-term increase in the Earth's average temperature caused by increased greenhouse gases.
3. Carbon dioxide absorbs infrared radiation, trapping heat in the atmosphere.
4. Changes in the distribution of species.
5. Species may move to cooler areas or become extinct if they cannot adapt.
6. Increased greenhouse gases raise global temperatures, causing habitat loss, changes in species distribution, reduced biodiversity and disruption of ecosystems.

4.7.3.6 Maintaining Biodiversity

1. A programme where endangered species are bred in captivity to increase their population.
2. To conserve biodiversity and prevent species from becoming extinct.
3. They provide habitats, food and shelter for wildlife.
4. It reduces the need for landfill and the use of raw materials, helping to protect habitats.
5. It preserves habitats and prevents species from losing their homes.
6. Humans can maintain biodiversity by protecting habitats, reducing deforestation, running breeding programmes, recycling resources, reducing pollution, creating field margins and hedgerows, and reducing greenhouse gas emissions.