PROGRESS TRACKER

TOPIC 1: THE NATURE & VARIETY OF LIVING ORGANISMS	Covered	Revised	Exam Ready
(a) Characteristics of living organisms			
1.1 - Understand how living organisms share the following characteristics:			
• Need for nutrition			
• Respiration			
• Excretion of waste			
• Response to surroundings			
• Movement			
• Homeostasis (internal condition control)			
• Reproduction			
• Growth and development			
(b) Variety of living organisms			
1.2 - Describe the common features shown by eukaryotic organisms: plants, animals, fungi and protoctists:			
• **Plants**: Multicellular, chloroplasts for photosynthesis, cellulose cell walls, store carbohydrates as starch or sucrose; examples include flowering plants & legumes			

TOPIC 1: THE NATURE & VARIETY OF LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
• **Animals**: Multicellular, no chloroplasts or cell walls, nervous coordination, store carbohydrates as glycogen; examples include mammals & insects			
• **Fungi**: No photosynthesis, hyphal structure, some are single-celled, cell walls made of chitin, saprotrophic nutrition, store carbohydrates as glycogen; examples include *Mucor* & yeast			
• **Protoctists**: Microscopic, single-celled, features similar to either plant or animal cells; examples include Amoeba, Chlorella, Plasmodium			
1.3 - Describe the common features shown by prokaryotic organisms such as bacteria:			
• Single-celled, cell wall, no nucleus, sometimes photosynthetic, often feed on organic matter; examples include *Lactobacillus*, *Pneumococcus*			
1.4 - Understand the term pathogen and know that pathogens may include fungi, bacteria, protoctists or viruses:			
• Define the term pathogen; examples include fungi, bacteria, protoctists, and viruses			
• **Viruses**: Non-living, parasitic (can reproduce only inside living cells), protein coat, DNA or RNA; examples include tobacco mosaic virus, influenza, HIV			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS	Covered	Revised	Exam Ready
(a) Level of organisation			
2.1 - Describe levels of organization in organisms:			
• Organelles, cells, tissues, organs, systems			
(b) Cell structure			
2.2 - Describe cell structures:			
• Nucleus, cytoplasm, cell membrane, cell wall, mitochondria, chloroplasts, ribosomes, vacuole			
2.3 - Describe the functions of cell structures:			
• **Nucleus**: Genetic control center			
• **Cytoplasm**: Site of chemical reactions			
• **Cell membrane**: Regulates entry/exit of substances			
• **Cell wall**: Structural support in plant cells			
• **Mitochondria**: Site of respiration and energy production			
• **Chloroplasts**: Site of photosynthesis in plant cells			
• **Ribosomes**: Protein synthesis			
• **Vacuole**: Storage of substances, maintaining cell pressure			
2.4 - Know similarities and differences between plant and animal cells:			
• **Plant cells**: Cell wall, chloroplasts, large vacuole • **Animal cells**: No cell wall, no chloroplasts, smaller or no vacuole			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.5B - Understand the term cell differentiation			
• Explain the importance of cell differentiation in development of specialized cells			
2.6B - Understand the advantages and disadvantages of using stem cells in medicine:			
• **Advantages**: Potential for regenerative medicine, treating diseases • **Disadvantages**: Ethical concerns, risk of tumor formation			
(c) Biological molecules			
2.7 - Identify chemical elements present in biological molecules:			
• Carbohydrates, proteins, lipids (fats and oils): all contain carbon, hydrogen, oxygen; proteins also contain nitrogen			
2.8 - Describe the structure of biological molecules:			
• **Carbohydrates**: Simple sugars (e.g., glucose) form starch and glycogen			
• **Proteins**: Amino acids form polypeptides			
• **Lipids**: Fatty acids and glycerol form fats/oils			
2.9 - Practical: Food Samples			
• *Investigate food samples for presence of glucose, starch, protein, and fat*			
2.10 - Understand the role of enzymes:			
• Biological catalysts speeding up metabolic reactions			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.11 - Understand how temperature affects enzyme function:			
• Temperature changes can alter enzyme activity, including changes to active site shape			
2.12 - Practical: Enzyme Activity - Temperature			
• *Investigate effect of temperature on enzyme activity*			
2.13 - Understand how pH affects enzyme function:			
• Changes in pH can alter the active site of enzymes			
2.14B - Practical: Enzyme Activity - pH			
• *Investigate effect of pH on enzyme activity*			
(d) Movement of substances into and out of cells			
2.15 - Understand processes of substance movement:			
• Diffusion, osmosis, active transport			
2.16 - Understand factors affecting the rate of substance movement:			
• Surface area to volume ratio, distance, temperature, concentration gradient			
2.17 - Practical: Diffusion & Osmosis			
• *Investigate diffusion and osmosis using living and non-living systems*			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
(e) Nutrition			
Flowering Plants			
2.18 - Understand the process of photosynthesis and its importance:			
• Conversion of light energy to chemical energy for plant growth			
2.19 - Know the equations for photosynthesis:			
• **Word equation**: Carbon dioxide + water → glucose + oxygen (in presence of light and chlorophyll) • **Balanced chemical symbol equation**: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$			
2.20 - Understand how varying factors affect the rate of photosynthesis:			
• Carbon dioxide concentration, light intensity, temperature			
2.21 - Describe leaf structure and explain adaptations for photosynthesis:			
• Large surface area, thin structure, chloroplasts in palisade cells, stomata for gas exchange, veins for water/nutrient transport			
2.22 - Understand plants require mineral ions for growth:			
• Magnesium ions for chlorophyll • Nitrate ions for amino acids			
2.23 - Practical: Investigate photosynthesis:			
• *Demonstrate oxygen evolution, starch production, and requirements of light, carbon dioxide, and chlorophyll*			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
Humans			
2.24 - Understand components of a balanced diet:			
• Appropriate proportions of carbohydrate, protein, lipid, vitamins, minerals, water, dietary fibre			
2.25 - Identify sources and functions of dietary components:			
• **Carbohydrates**: Energy source (e.g., bread, pasta)			
• **Proteins**: Growth and repair (e.g., meat, fish)			
• **Lipids**: Energy storage and insulation (e.g., oils, butter)			
• **Vitamin A**: Vision (e.g., carrots)			
• **Vitamin C**: Skin and immune system (e.g., citrus fruits)			
• **Vitamin D**: Bone health (e.g., dairy products, sunlight)			
• **Calcium**: Bone and teeth strength (e.g., milk)			
• **Iron**: Red blood cell production (e.g., spinach, red meat)			
• **Water**: Hydration			
• **Dietary fibre**: Digestion (e.g., whole grains, vegetables)			
2.26 - Understand how energy requirements vary:			
• Based on activity levels, age, pregnancy			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.27 - Describe the structure and function of the human alimentary canal:			
• **Mouth**: Ingestion and digestion begins			
• **Oesophagus**: Transports food to stomach			
• **Stomach**: Protein digestion begins, acidic environment			
• **Small intestine (duodenum and ileum)**: Absorption of nutrients			
• **Large intestine (colon and rectum)**: Water absorption, waste formation			
• **Pancreas**: Secretes digestive enzymes			
2.28 - Understand food movement through the gut by peristalsis:			
• Waves of muscular contractions push food along digestive tract			
2.29 - Understand the role of digestive enzymes:			
• **Amylase and maltase**: Break down starch to glucose			
• **Proteases**: Break down proteins to amino acids			
• **Lipases**: Break down lipids to fatty acids and glycerol			
2.30 - Understand bile production and storage:			
• Bile produced by the liver, stored in the gall bladder			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.31 - Understand the role of bile:			
• Neutralizes stomach acid, emulsifies lipids for easier digestion			
2.32 - Understand how the small intestine is adapted for absorption:			
• Villi increase surface area, thin walls for diffusion, rich blood supply for transport of absorbed nutrients			
2.33B - Practical: Investigate the energy content in a food sample:			
• *Measure the energy content in various food samples by burning them and calculating the energy released in the form of heat*			
(f) Respiration			
2.34 - Understand how the process of respiration produces ATP in living organisms:			
• Energy released from glucose breakdown is used to produce ATP in cells			
2.35 - Know that ATP provides energy for cells:			
• ATP (Adenosine Triphosphate) is the main energy currency in cells, used to drive metabolic processes			
2.36 - Describe the differences between aerobic and anaerobic respiration:			
• **Aerobic respiration**: Requires oxygen, produces more energy • **Anaerobic respiration**: Occurs without oxygen, produces less energy and leads to the formation of lactic acid (in animals) or ethanol and carbon dioxide (in plants)			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.37 - Know the word equation and the balanced chemical symbol equation for aerobic respiration in living organisms:			
• **Word equation:** Glucose + Oxygen → Carbon dioxide + Water + Energy (ATP) • **Balanced chemical symbol equation:** $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + Energy (ATP)			
2.38 - Know the word equation for anaerobic respiration in plants and animals:			
• **Animals**: Glucose → Lactic acid + Energy (ATP) • **Plants**: Glucose → Ethanol + Carbon dioxide + Energy (ATP)			
2.39 - Practical: Investigate the evolution of carbon dioxide and heat from respiring seeds or other suitable living organisms:			
• *Use seeds or organisms to measure carbon dioxide and heat production during respiration*			
(g) Gas exchange			
Flowering Plants			
2.40B - Understand the role of diffusion in gas exchange:			
• Gas exchange in plants occurs through diffusion, moving gases from high to low concentration			
2.41B - Understand gas exchange (of carbon dioxide and oxygen) in relation to respiration and photosynthesis:			
• **Respiration** takes in O_2 and releases CO_2 • **Photosynthesis** takes in CO_2 and releases O_2			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.42B - Understand how the structure of the leaf is adapted for gas exchange:			
• Large surface area, thin structure, and air spaces within the leaf facilitate efficient gas exchange			
2.43B - Describe the role of stomata in gas exchange:			
• Stomata are pores on the leaf surface that allow gas exchange by opening and closing			
2.44B - Understand how respiration continues during the day and night, but that the net exchange of carbon dioxide and oxygen depends on the intensity of light:			
• Respiration occurs continuously, but the rate of photosynthesis (and thus net gas exchange) depends on light intensity			
2.45B - Practical: Investigate the effect of light on net gas exchange from a leaf, using hydrogen-carbonate indicator:			
• *Experiment to assess how light affects the exchange of gases in plants, indicated by changes in a hydrogen-carbonate indicator*			
Humans			
2.46 - Describe the structure of the thorax, including the ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli, and pleural membranes:			
• Thoracic cavity contains lungs protected by ribs, connected to trachea, bronchi, and bronchioles leading to alveoli where gas exchange occurs			
2.47 - Understand the role of the intercostal muscles and the diaphragm in ventilation:			
• Intercostal muscles and diaphragm contract and relax to facilitate breathing (inhalation and exhalation)			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.48 - Explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries:			
• Alveoli have a large surface area, thin walls, and are surrounded by capillaries to facilitate efficient diffusion of gases			
2.49 - Understand the biological consequences of smoking in relation to the lungs and the circulatory system, including coronary heart disease:			
• Smoking damages the alveoli, reduces lung function, and increases the risk of lung cancer and coronary heart disease			
2.50 - Practical: Investigate breathing in humans, including the release of carbon dioxide and the effect of exercise:			
• *Measure breathing rate, carbon dioxide production, and assess the impact of exercise on respiratory function*			
(h) Transport			
2.51 - Understand why simple, unicellular organisms can rely on diffusion for the movement of substances in and out of the cell:			
• Diffusion is sufficient for unicellular organisms due to their small size and large surface area relative to volume			
2.52 - Understand the need for a transport system in multicellular organisms:			
• Multicellular organisms require transport systems to efficiently move substances across different regions of the body due to their larger size and lower surface area-to-volume ratio			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
Flowering Plants			
2.53 - Describe the role of phloem in transporting sucrose and amino acids between the leaves and other parts of the plant:			
• Phloem transports food substances like sucrose and amino acids from the leaves (where they are produced by photosynthesis) to other parts of the plant			
2.54 - Describe the role of xylem in transporting water and mineral ions from the roots to other parts of the plant:			
• Xylem transports water and dissolved mineral ions absorbed by the roots up to the stems, leaves, and other parts of the plant			
2.55B - Understand how water is absorbed by root hair cells:			
• Root hair cells absorb water by osmosis due to the higher concentration of water in the soil compared to the plant's cells			
2.56B - Understand that transpiration is the evaporation of water from the surface of a plant:			
• Transpiration is the process of water evaporating from the stomata in the leaves, which helps pull water up through the plant from the roots			
2.57B - Understand how the rate of transpiration is affected by changes in humidity, wind speed, temperature, and light intensity:			
• Transpiration increases with higher temperatures, stronger wind speeds, and greater light intensity, but decreases with higher humidity			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
• *2.58B - Practical: Investigate the role of environmental factors in determining the rate of transpiration from a leafy shoot:*			
• *Conduct experiments to explore how different environmental factors (light, temperature, wind, humidity) impact transpiration rates in plants*			
Humans			
2.59 - Describe the composition of the blood: red blood cells, white blood cells, platelets, and plasma:			
• Blood consists of red blood cells (carry oxygen), white blood cells (immune response), platelets (clotting), and plasma (transporting dissolved substances)			
2.60 - Understand the role of plasma in the transport of carbon dioxide, digested food, urea, hormones, and heat energy:			
• Plasma carries carbon dioxide to the lungs, digested food to cells, urea to the kidneys, hormones to target organs, and distributes heat energy throughout the body			
2.61 - Understand how adaptations of red blood cells make them suitable for the transport of oxygen, including shape, the absence of a nucleus, and the presence of haemoglobin:			
• Red blood cells are biconcave (increase surface area), lack a nucleus (more space for haemoglobin), and contain haemoglobin for efficient oxygen transport			
2.62 - Understand how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to the pathogen:			
• Phagocytes engulf and digest pathogens, while lymphocytes produce antibodies to neutralize specific pathogens			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.63B - Understand how vaccination results in the manufacture of memory cells, which enable future antibody production to the pathogen to occur sooner, faster, and in greater quantity:			
• Vaccinations stimulate the production of memory cells, allowing the immune system to respond more rapidly and effectively if the same pathogen is encountered again			
2.64B - Understand how platelets are involved in blood clotting, which prevents blood loss and the entry of micro-organisms:			
• Platelets help form clots at the site of a wound, sealing it to prevent blood loss and reduce the risk of infection			
2.65 - Describe the structure of the heart and how it functions:			
• The heart has four chambers (two atria, two ventricles) and functions as a pump to circulate blood through the body, using valves to prevent backflow			
2.66 - Explain how the heart rate changes during exercise and under the influence of adrenaline:			
• During exercise, heart rate increases to supply more oxygen to muscles; adrenaline also increases heart rate in response to stress or danger			
2.67 - Understand how factors may increase the risk of developing coronary heart disease:			
• Risk factors for coronary heart disease include smoking, high-fat diets, lack of exercise, and genetic predisposition			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.68 - Understand how the structure of arteries, veins, and capillaries relate to their function:			
• Arteries have thick walls for high-pressure blood flow; veins have valves to prevent backflow; capillaries have thin walls for efficient diffusion of gases and nutrients			
2.69 - Understand the general structure of the circulation system, including the blood vessels to and from the heart and lungs, liver, and kidneys:			
• The circulation system includes the pulmonary circulation (to/from lungs) and systemic circulation (to/from the rest of the body), with arteries, veins, and capillaries facilitating the flow of blood to and from key organs like the heart, liver, and kidneys			
(i) Excretion			
Flowering Plants			
2.70 - Understand the origin of carbon dioxide and oxygen as waste products of metabolism and their loss from the stomata of a leaf:			
• Carbon dioxide is produced during respiration, and oxygen is produced during photosynthesis. Both gases are released through the stomata of the leaf			
Humans			
2.71 - Know the excretory products of the lungs, kidneys, and skin (organs of excretion):			
• The lungs excrete carbon dioxide; the kidneys excrete urea, water, and salts in urine; the skin excretes sweat (water, salts, and urea)			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.72B - Understand how the kidney carries out its roles of excretion and osmoregulation:			
• The kidney removes waste products from the blood and regulates water balance (osmoregulation) by adjusting the amount of water excreted in urine			
2.73B - Describe the structure of the urinary system, including the kidneys, ureters, bladder, and urethra:			
• The urinary system includes two kidneys (filter blood), ureters (carry urine to the bladder), bladder (stores urine), and urethra (releases urine)			
2.74B - Describe the structure of a nephron, including the Bowman's capsule and glomerulus, convoluted tubules, loop of Henle, and collecting duct:			
• The nephron is the functional unit of the kidney, with the Bowman's capsule filtering blood, the tubules reabsorbing useful substances, and the loop of Henle concentrating urine			
2.75B - Describe ultrafiltration in the Bowman's capsule and the composition of the glomerular filtrate:			
• Blood pressure forces water, salts, glucose, and urea out of the blood into the Bowman's capsule, forming glomerular filtrate			
2.76B - Understand how water is reabsorbed into the blood from the collecting duct:			
• Water is reabsorbed from the collecting duct into the blood to regulate water balance, depending on the body's needs			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.77B - Understand why selective reabsorption of glucose occurs at the proximal convoluted tubule:			
• Glucose is selectively reabsorbed in the proximal convoluted tubule because it is an important source of energy for the body			
2.78B - Describe the role of ADH in regulating the water content of the blood:			
• ADH (antidiuretic hormone) increases water reabsorption in the kidneys when the body needs to conserve water			
2.79B - Understand that urine contains water, urea, and ions:			
• Urine is composed of water, urea (a waste product from the breakdown of proteins), and dissolved ions (salts)			
(j) Co-ordination and response			
2.80 - Understand how organisms are able to respond to changes in their environment:			
• Organisms detect and respond to environmental stimuli through coordinated actions of the nervous and hormonal systems			
2.81 - Understand that homeostasis is the maintenance of a constant internal environment, and that body water content and body temperature are both examples of homeostasis:			
• Homeostasis ensures stable conditions in the body, such as maintaining constant water content and temperature			
2.82 - Understand that a coordinated response requires a stimulus, a receptor, and an effector:			
• A stimulus (change in environment) is detected by receptors, which trigger effectors (muscles or glands) to respond			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
Flowering Plants			
2.83 - Understand that plants respond to stimuli:			
• Plants react to environmental stimuli like light and gravity by adjusting growth and movement			
2.84 - Describe the geotropic and phototropic responses of roots and stems:			
• Roots show positive geotropism (growth toward gravity), while stems show positive phototropism (growth toward light)			
2.85 - Understand the role of auxin in the phototropic response of stems:			
• Auxin is a plant hormone that causes cells on the shaded side of the stem to elongate, bending the plant toward the light			
Humans			
2.86 - Describe how nervous and hormonal communication control responses and understand the differences between the two systems:			
• The nervous system sends rapid electrical signals, while the hormonal system sends slower chemical messages via the blood			
2.87 - Understand that the central nervous system consists of the brain and spinal cord and is linked to sense organs by nerves:			
• The brain and spinal cord coordinate responses, receiving information from sense organs through nerves			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.88 - Understand that stimulation of receptors in the sense organs sends electrical impulses along nerves into and out of the central nervous system, resulting in rapid responses:			
• Sense organs detect stimuli and send electrical impulses to the CNS, which coordinates a rapid response			
2.89 - Understand the role of neurotransmitters at synapses:			
• Neurotransmitters are chemicals that transmit signals across synapses between neurons			
2.90 - Describe the structure and functioning of a simple reflex arc illustrated by the withdrawal of a finger from a hot object:			
• A reflex arc involves sensory neurons, relay neurons in the spinal cord, and motor neurons, leading to an automatic response			
2.91 - Describe the structure and function of the eye as a receptor:			
• The eye detects light using photoreceptors in the retina, sending signals to the brain to form images			
2.92 - Understand the function of the eye in focusing on near and distant objects, and in responding to changes in light intensity:			
• The eye adjusts the shape of the lens for focusing and the size of the pupil for regulating light entry			
2.93 - Describe the role of the skin in temperature regulation, with reference to sweating, vasoconstriction, and vasodilation:			
• The skin regulates temperature by sweating (cooling), vasodilation (heat loss), and vasoconstriction (heat conservation)			

TOPIC 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS contd.	Covered	Revised	Exam Ready
2.94 - Understand the sources, roles, and effects of the following hormones: adrenaline, insulin, testosterone, progesterone, and oestrogen:			
• **Adrenaline** - fight or flight response • **Insulin** - blood sugar regulation • **Testosterone** - male traits • **Progesterone and Oestrogen** - female traits			
2.95B - Understand the sources, roles, and effects of the following hormones: ADH, FSH, and LH.			
• **ADH** - regulates water balance • **FSH** - stimulates egg development in ovaries • **LH** triggers ovulation			

TOPIC 3: REPRODUCTION AND INHERITANCE	Covered	Revised	Exam Ready
(a) Reproduction			
3.1 - Understand the differences between sexual and asexual reproduction:			
• **Sexual reproduction**: Involves fusion of male and female gametes, resulting in genetic variation • **Asexual reproduction**: No fusion of gametes, offspring are genetically identical to the parent			
3.2 - Understand the process of fertilisation:			
• Fusion of male and female gamete produces a zygote • The zygote undergoes cell division and develops into an embryo			
Flowering Plants			
3.3 - Describe the structures and adaptations for pollination:			
• **Insect-pollinated flowers**: Bright petals, scent, nectar, sticky pollen • **Wind-pollinated flowers**: Small or no petals, no scent, light pollen			
3.4 - Understand how fertilisation in plants leads to seed and fruit formation:			
• Growth of pollen tube from stigma to ovule • Fertilisation results in seed and fruit formation			
3.5 - Practical: Investigate the conditions needed for seed germination:			
• *Experiment to determine factors such as water, oxygen, and temperature necessary for germination*			

TOPIC 3: REPRODUCTION AND INHERITANCE contd.	Covered	Revised	Exam Ready
3.6 - Understand how germinating seeds utilise food reserves:			
• Seeds use stored food reserves to grow until they can perform photosynthesis			
3.7 - Understand asexual reproduction in plants:			
• Natural methods: **Runners** (e.g., strawberry plants) • Artificial methods: **Cuttings** (e.g., cloning plants)			
Humans			
3.8 - Understand the structure and functions of the male and female reproductive systems:			
• Male: Testes, sperm production • Female: Ovaries, egg production, nurturing of fertilised egg			
3.9 - Understand the roles of oestrogen and progesterone in the menstrual cycle:			
• **Oestrogen**: Stimulates development of the uterine lining • **Progesterone**: Maintains the uterine lining			
3.10B - Understand the roles of FSH and LH in the menstrual cycle:			
• **FSH (Follicle Stimulating Hormone)**: Stimulates egg development and oestrogen production • **LH (Luteinising Hormone)**: Triggers ovulation and the release of the egg			
3.11 - Describe the role of the placenta in embryo nutrition:			
• Placenta facilitates the exchange of nutrients, gases, and wastes between mother and embryo			

TOPIC 3: REPRODUCTION AND INHERITANCE contd.	Covered	Revised	Exam Ready
3.12 - Understand how the embryo is protected by amniotic fluid:			
• Amniotic fluid cushions the developing embryo and provides a stable environment			
3.13 - Understand the roles of oestrogen and testosterone in the development of secondary sexual characteristics:			
• **Oestrogen**: Development of female secondary sexual characteristics (e.g., breast development) • **Testosterone**: Development of male secondary sexual characteristics (e.g., facial hair growth)			
(b) Inheritance			
3.14 - Understand the genome and genes:			
• The genome is the entire DNA of an organism • A gene is a section of DNA that codes for a specific protein			
3.15 - Understand the role of chromosomes:			
• Chromosomes in the nucleus carry genes			
3.16B - Describe the structure of a DNA molecule:			
• DNA is two strands coiled into a double helix • Strands are linked by paired bases: adenine (A) with thymine (T), cytosine (C) with guanine (G)			
3.17B - Understand the structure of an RNA molecule:			
• RNA is single-stranded and contains uracil (U) instead of thymine (T)			

TOPIC 3: REPRODUCTION AND INHERITANCE contd.	Covered	Revised	Exam Ready
3.18B - Describe protein synthesis:			
• Transcription and translation involve mRNA, ribosomes, tRNA, codons, and anticodons			
3.19 - Understand alleles and their role in inheritance:			
• Genes have alternative forms called alleles that lead to differences in inherited characteristics			
3.20 - Understand key genetic terms:			
• Dominant, recessive, homozygous, heterozygous, phenotype, and genotype			
3.21B - Understand the meaning of the term codominance			
• Both alleles contribute to the phenotype when they are present			
3.22 - Understand polygenic inheritance:			
• Most phenotypic traits are controlled by multiple genes (polygenic inheritance)			
3.23 - Describe monohybrid inheritance using genetic diagrams:			
• Use genetic diagrams to explain the inheritance of a single trait			
3.24 - Understand how to interpret family pedigrees:			
• Use pedigrees to trace inherited traits through generations			

TOPIC 3: REPRODUCTION AND INHERITANCE contd.	Covered	Revised	Exam Ready
3.25 - Predict probabilities of outcomes from monohybrid crosses:			
• Calculate the probabilities of inheritance outcomes from monohybrid crosses			
3.26 - Understand how sex is controlled by chromosomes:			
• XX in females and XY in males			
3.27 - Describe the determination of the sex of offspring:			
• Use genetic diagrams to show how sex is determined during fertilisation			
3.28 - Understand mitosis and its role:			
• Mitosis produces two genetically identical diploid cells			
3.29 - Understand the importance of mitosis:			
• Mitosis occurs during growth, repair, cloning, and asexual reproduction			
3.30 - Understand meiosis and its role:			
• Meiosis produces four genetically different haploid cells			
3.31 - Understand how random fertilisation contributes to variation:			
• Random fertilisation leads to genetic variation in offspring			
3.32 - Understand the chromosome numbers in human cells:			
• **Diploid** number - 46 chromosomes • **Haploid** number: 23 chromosomes			

TOPIC 3: REPRODUCTION AND INHERITANCE contd.	Covered	Revised	Exam Ready
3.33 - Understand the sources of variation within a species:			
• Variation can be genetic, environmental, or a combination of both			
3.34 - Understand the concept of mutation:			
• A mutation is a rare, random, inheritable change in genetic material			
3.35B - Understand how DNA mutations affect phenotype:			
• Changes in DNA can alter the sequence of amino acids in a protein, affecting the phenotype			
3.36B - Understand the effects of genetic mutations:			
• Most mutations have no effect, some have minor effects, and few have significant effects			
3.37B - Understand factors that increase mutation rates:			
• Ionising radiation (e.g., gamma rays, x-rays, UV rays) and chemical mutagens (e.g., tobacco chemicals) increase mutation rates			
3.38 - Explain Darwin's theory of evolution by natural selection:			
• Evolution occurs as advantageous traits are naturally selected over generations			
3.39 - Understand antibiotic resistance in bacteria:			
• Bacterial populations can develop resistance to antibiotics, making infections harder to treat			

TOPIC 4: ECOLOGY AND THE ENVIRONMENT	Covered	Revised	Exam Ready
(a) The Organism in the environment			
4.1 - Understand key ecological terms:			
• **Population** - Group of individuals of the same species living in a particular area			
• **Community** - All the populations of different species living and interacting in a habitat			
• **Habitat** - The natural environment where an organism lives			
• **Ecosystem** - A community of organisms and their physical environment interacting as a system			
4.2 - Practical Investigation: Population Size			
• *Investigate population size of an organism in two different areas using quadrats*			
4.3B - Understand the term biodiversity:			
• Biodiversity - The variety of life in a particular habitat or ecosystem, including the number of species, genetic variation, and ecosystem variety			
4.4B - Practical Investigation: Distribution and Biodiversity			
• *Investigate organism distribution and measure biodiversity using quadrats*			
4.5 - Understand how abiotic and biotic factors affect organisms:			
• Explain how non-living (abiotic) and living (biotic) factors influence population size and distribution			

TOPIC 4: ECOLOGY AND THE ENVIRONMENT contd.	Covered	Revised	Exam Ready
(b) Feeding relationships			
4.6 - Understand trophic levels:			
• Define trophic levels, including producers, consumers (primary, secondary, tertiary), and decomposers			
4.7 - Understand feeding relationships:			
• Explain food chains, food webs, and the different types of pyramids (number, biomass, energy transfer)			
4.8 - Understand the transfer of substances and energy along a food chain:			
• Substances - Include nutrients and organic matter passed along as organisms are consumed • Energy transfer - Energy is passed from one organism to another through feeding, with some energy lost as heat			
4.9 - Understand energy loss between trophic levels:			
• 10% energy transfer rule - Only about 10% of the energy at one trophic level is passed to the next; the rest is lost as heat, waste, or used for metabolic processes			
(c) Cycles within ecosystems			
4.10 - Describe the stages of the carbon cycle:			
• Outline the roles of respiration, photosynthesis, decomposition, and combustion in the carbon cycle			
4.11B - Describe the stages of the nitrogen cycle:			
• Outline the roles of nitrogen-fixing bacteria, decomposers, nitrifying bacteria, and denitrifying bacteria (specific names not required)			

TOPIC 4: ECOLOGY AND THE ENVIRONMENT contd.	Covered	Revised	Exam Ready
(d) Human influences on the environment			
4.12 - Understand the biological consequences of air pollution:			
• Explain the effects of sulfur dioxide (acid rain) and carbon monoxide (poisonous gas) pollution on organisms and ecosystems			
4.13 - Understand the role of greenhouse gases:			
• Identify water vapor, carbon dioxide, nitrous oxide, methane, and CFCs as greenhouse gases			
4.14 - Understand human contributions to greenhouse gases:			
• Describe how human activities, such as burning fossil fuels, agriculture, and deforestation, increase greenhouse gas levels			
4.15 - Understand the effects of increased greenhouse gases:			
• Enhanced greenhouse effect - Increase in trapped heat due to higher concentrations of greenhouse gases, leading to global warming • Consequences - Rising temperatures, sea level rise, melting ice caps, and changes in weather patterns			
4.16 - Understand the biological consequences of water pollution by sewage:			
• Sewage pollution - Leads to oxygen depletion in water bodies, affecting aquatic life • Pathogens - Can enter water systems, posing health risks to humans and animals			

TOPIC 4: ECOLOGY AND THE ENVIRONMENT contd.	Covered	Revised	Exam Ready
4.17 - Understand the biological consequences of eutrophication:			
• Describe how eutrophication is caused by leaching of minerals from fertilizers, leading to overgrowth of algae and depletion of oxygen in water bodies			
4.18B - Understand the effects of deforestation:			
• Explain the consequences of deforestation, including leaching, soil erosion, disruption of evapotranspiration, effects on the carbon cycle, and imbalances in atmospheric gases			

TOPIC 5: USE OF BIOLOGICAL RESOURCES	Covered	Revised	Exam Ready
(a) Food production			
Crop Plants			
5.1 - Understand how glasshouses and polythene tunnels increase crop yield:			
• Glasshouses & polythene tunnels - Provide controlled environments that protect crops from pests and weather			
5.2 - Understand the effects of increased CO_2 and temperature on crop yield in glasshouses:			
• **CO_2 increase** - Boosts the rate of photosynthesis, leading to faster plant growth and higher yields • **Temperature increase** - Warmer conditions can enhance enzyme activity in plants, promoting growth and development			
5.3 - Understand how fertilizers increase crop yield:			
• Fertilizers provide essential nutrients (e.g., nitrogen, phosphorus, potassium) that plants need for growth			
5.4 - Understand the reasons for pest control and the pros and cons of pesticides and biological control:			
• **Pesticides** - Chemicals that kill pests but may cause environmental damage and resistance in pests • **Biological control** - Use of natural predators to control pests, with fewer environmental risks but potentially slower results			
Micro-organisms			
5.5 - Understand the role of yeast in food production:			
• Yeast - Microorganisms that ferment sugars to produce carbon dioxide, causing dough to rise in bread-making			

TOPIC 5: USE OF BIOLOGICAL RESOURCES contd.	Covered	Revised	Exam Ready
5.6 - Practical Investigation: Anaerobic Respiration			
• *Investigate the role of anaerobic respiration by yeast under different conditions*			
5.7 - Understand the role of bacteria in yoghurt production:			
• Explain the role of Lactobacillus bacteria in converting lactose into lactic acid during yoghurt production			
5.8 - Understand the use of industrial fermenters:			
• Describe how fermenters are used in industrial processes and explain the need for controlling aseptic conditions, nutrients, temperature, pH, oxygen, and agitation to optimize microbial growth			
Fish Farming			
5.9B - Understand the methods used in fish farming to produce large quantities of protein:			
• Explain methods to farm fish for protein, including controlling water quality, predation, disease, waste removal, feeding, and selective breeding			
(b) Selective Breeding			
5.10 - Understand how selective breeding develops plants with desired characteristics:			
• Explain how selective breeding can develop plants with desired traits such as disease resistance and higher yield			
5.11 - Understand how selective breeding develops animals with desired characteristics:			
• Describe how selective breeding can produce animals with preferred characteristics such as higher milk production, faster growth, or better disease resistance			

TOPIC 5: USE OF BIOLOGICAL RESOURCES contd.	Covered	Revised	Exam Ready
(c) Genetic Modification (Genetic Engineering)			
5.12 - Understand the use of restriction enzymes and ligase in genetic modification:			
• **Restriction enzymes** - cut DNA at specific sites • **Ligase enzymes** - join pieces of DNA together			
5.13 - Understand how plasmids and viruses act as vectors for recombinant DNA:			
• Plasmids and viruses - Serve as carriers (vectors) that transport recombinant DNA into cells, enabling genetic modification			
5.14 - Understand how genetically modified bacteria are used to produce human insulin:			
• Explain how genetically modified bacteria grown in fermenters are used to produce large amounts of human insulin			
5.15 - Understand how genetically modified plants improve food production:			
• GM plants - Engineered to be more resistant to pests, diseases, or harsh environmental conditions, increasing crop yields and reducing the need for chemical inputs			
5.16 - Understand the term transgenic:			
• Define transgenic as the transfer of genetic material from one species to another			

TOPIC 5: USE OF BIOLOGICAL RESOURCES contd.	Covered	Revised	Exam Ready
(d) Cloning			
5.17B - describe the process of micropropagation (tissue culture) in which explants are grown in vitro:			
• Micropropagation - A technique where small pieces of plants (explants) are grown in sterile conditions on a nutrient medium, producing clones of the original plant			
5.18B - Understand the commercial use of micropropagation to produce identical plants:			
• Commercial quantities - Allows for the rapid production of large numbers of genetically identical plants with desirable traits (e.g., disease resistance)			
5.19B - Describe the process of cloning mammals, illustrated by Dolly the sheep:			
• Cloning mammals - Involves transferring the nucleus from a diploid cell of an adult animal into an enucleated egg cell (egg without a nucleus), followed by stimulation to divide and develop into a clone			
5.20B - Understand how cloned transgenic animals can be used to produce human proteins:			
• Cloned transgenic animals - Engineered to produce human proteins (e.g., clotting factors, antibodies) in their milk or other tissues for medical treatments			