Basic Skils (suitable for primary / junior forms)

M3002 Gel Loading Practice MiniLab
M2025 Practice Pipette Cards
M2023 Laminated Gel Annotation and Photo Template
M3017R Pipette Pointillism Junior MiniLab
M3017 Pipette Pointillism MiniLab
M3009 Candy Color Electrophoresis MiniLab
M3007 Colorful Dye Electrophoresis MiniLab
M3001 Electrophoresis 101 MiniLab
NGSS-Aligned Color Dyes and Gel Electrophoresis MiniLab

Bk 1A Ch 1 Introducing biology

Section	Learning target	Practical
1.1 What is biology?	• To know what biology is • To know the common characteristics of organisms • To know the importance of studying biology	
1.2 How can we study biology?	• To know the basic steps of the scientific method • To learn the skills needed to design investigations	**1.1** Design an investigation of the effect of fresh pineapple on the setting of jelly *Practical Workbook* p.1-1
1.3 Nature of science	• To know what nature of science is	

Bk 1A Ch 2 The cell as the basic unit of life

Section	Learning target	Practical
2.1 Chemicals of life	• To identify the inorganic and organic chemical constituents of organisms	M3014 Taking Macromolecules to Micro!
2.2 Discovery and early studies of cells	• To understand the technological development of microscopes • To be able to state the cell theory and use microscopes to examine cell details	
2.3 Microscopes: tools for studying cells	• To know the types of microscopes commonly used today • To be able to calculate the total magnification of a compound microscope • To differentiate between observations at low-power and high-power magnifications	**2.1** Observation with a light microscope *Practical Workbook* p.2-1
2.4 Structure of cells	• To differentiate between animal cells and plant cells • To describe the functions of different sub-cellular structures in cells • To differentiate between prokaryotic cells and eukaryotic cells	**2.2** Preparation of temporary mounts and observation of animal cells *Practical Workbook* p.2-7 **2.3** Preparation of temporary mounts and observation of plant cells *Practical Workbook* p.2-10
2.5 Levels of body organization	• To understand how cells are organized in multicellular organisms	

Bk 1A Ch 3 Movement of substances across cell membrane

Section	Learning target	Practical
3.1 Structure of the cell membrane	• To recognize the structure of cell membrane • To appreciate the development of the cell membrane model	
3.2 Relationship between the structure, properties and functions of the cell membrane	• To understand how the structure of cell membrane is related to its properties and functions	**3.1** Effects of temperature and organic solvents on the permeability of cell membrane *Practical Workbook* p.3-1
3.3 Movement of substances across membranes	• To compare respective states of cells in solutions of different water potentials • To compare different processes of substance movement across cell membrane	**3.2** Demonstration of osmosis using dialysis tubing *Practical Workbook* p.3-7 **3.3** Study of osmosis at cellular level *Practical Workbook* p.3-11 **3.4** Study of osmosis at tissue level *Practical Workbook* p.3-14

Bk 1A Ch 4 Enzymes and metabolism

Section	Learning target	Practical
4.1 Enzymes and metabolism	• To identify catabolism, anabolism and metabolism • To be able to state the role of enzymes in metabolism	**4.1** Demonstration of the action of enzymes *Practical Workbook* p.4-1
4.2 Actions and properties of enzymes	• To understand how enzymes work • To understand why enzyme actions are specific • To know the properties of enzymes	
4.3 Factors affecting enzyme activity	• To understand how temperature, pH and inhibitors affect the rate of enzymatic reactions	**4.2** Investigation of the effect of temperature on enzyme activity *Practical Workbook* p.4-4 **4.3** Design an investigation of the effect of pH on enzyme activity *Practical Workbook* p.4-8 **4.4** Investigation of the effect of inhibitors on enzyme activity *Practical Workbook* p.4-13
4.4 Applications of enzymes	• To know the applications of enzymes	**4.5** Investigation of the effectiveness of different biological washing powders *Practical Workbook* p.4-16 **4.6** Design an investigation of protease activity in different fruit juices *Practical Workbook* p.4-20

Bk 1A Ch 5 Food and humans

Section	Learning target	Practical
5.1 The food requirements of humans	• To identify the functions and food sources of different food substances • To be aware of the corresponding deficiency diseases • To test for the presence of different food substances using appropriate food tests	**5.1** Detection of food substances by food tests *Practical Workbook* p.5-1 **5.2** Investigation of the food substances in common foodstuffs *Practical Workbook* p.5-8 **5.3** Design an investigation to compare the amount of vitamin C in different fruits and vegetables *Practical Workbook* p.5-12 **5.4** Design an investigation to study the effect of boiling on the amount of vitamin C in vegetables *Practical Workbook* p.5-18
5.2 Balanced diet	• To understand what a balanced diet is • To understand the factors that affect our dietary requirements	

Bk 1A Ch 6 Nutrition in humans

Section	Learning target	Practical
6.1 Modes of nutrition	• To know the modes of nutrition	
6.2 Process of human nutrition	• To identify the main processes of nutrition in humans • To identify different parts of the digestive system	**6.1** Examination of the mammalian digestive system *Practical Workbook* p.6-1
6.3 Ingestion	• To state the functions of different types of teeth • To know what dentition is and be able to identify the two sets of teeth in humans • To be able to describe the structure of a tooth	
6.4 Digestion	• To be able to compare physical and chemical digestion • To understand the importance of peristalsis • To identify the actions of different digestive juices	**6.2** Investigation of the action of pepsin *Practical Workbook* p.6-4 **6.3** Demonstration of the effect of bile salts on oil *Practical Workbook* p.6-8 **6.4** Investigation of the action of lipase *Practical Workbook* p.6-10
6.5 Absorption	• To know the adaptation of the small intestine for food absorption • To trace the route of absorption of various food substances	**6.5** Simulation of digestion and absorption in the small intestine using dialysis tubing *Practical Workbook* p.6-13
6.6 Assimilation	• To know how absorbed food molecules are transported to other parts of the body • To know the fates of the absorbed food • To state the roles of the liver	
6.7 egestion	• To understand what egestion is	

Bk 1B Ch 7 Gas exchange in humans

Section	Learning target	Practical
7.1 Human breathing system	• To be able to recognize the main parts of the human breathing system • To know how incoming air is kept clean, moist and warm in the respiratory tract	**7.1** Examination of the mammalian breathing system *Practical Workbook* p.7-1 **7.2** Examination of the pig lungs *Practical Workbook* p.7-4
7.2 Gas exchange in the air sacs	• To learn how gas exchange takes place in the air sacs • To know the adaptive features of air sacs for gas exchange • To know the differences between the composition of inhaled and exhaled air	**7.3** Examination of the mammalian air sacs *Practical Workbook* p.7-8 **7.4** Comparison of the oxygen content of inhaled air and exhaled air *Practical Workbook* p.7-10 **7.5** Comparison of the carbon dioxide content of inhaled air and exhaled air *Practical Workbook* p.7-12
7.3 Transport of respiratory gases	• To identify the adaptive features of red blood cells for carrying oxygen • To know how oxygen and carbon dioxide are transported	
7.4 Ventilation	• To know how ventilation is brought about	

Bk 1B Ch 8 Transport in humans

Section	Learning target	Practical
8.1 Need for transport system	• To understand the need for a transport system in humans	
8.2 Human circulatory system	• To be able to recognize the main parts of human transport system • To know the different components of the human circulatory system • To identify the composition of blood and the corresponding functions • To identify the differences between arteries and veins • To know what capillaries are and their function • To know how blood pressure changes along blood vessels • To identify different structures of the heart • To identify blood vessels related to the heart	**8.1** Examination of blood smears *Practical Workbook* p.8-1 **8.2** Examination of transverse sections of an artery and a vein *Practical Workbook* p.8-5 **8.3** Examination of the capillary flow in a fish tail fin *Practical Workbook* p.8-8 **8.4** Dissection and examination of a pig heart *Practical Workbook* p.8-11
8.3 Blood circulation	• To know how blood is circulated in the pulmonary and systemic circulation • To know how materials are exchanged between blood and body cells • To know how capillaries are adapted to their function • To be able to describe the formation of tissue fluid	
8.4 Human lymphatic system	• To know the different components of the lymphatic system • To know how lymph moves inside lymph vessels • To identify the functions of the lymphatic system	

Bk 1B Ch 9 Nutrition and gas exchange in plants

Section	Learning target	Practical
9.1 Nutrition in plants	• To know how plants obtain food • To understand why plants are important • To know the importance of minerals to plants	**9.1** Investigation of the effects of different minerals on plant growth *Practical Workbook* p.9-1
9.2 Gas exchange in plants	• To know where gas exchange takes place in plants • To know how leaves are adapted to gas exchange	**9.2** Investigation of the effect of light intensity on gas exchange in plants using hydrogencarbonate indicator *Practical Workbook* p.9-5 **9.3** Design an investigation of the effect of light intensity on gas exchange in plants using a data logger *Practical Workbook* p.9-8

Bk 1B Ch 10 Transpiration, transport and support in plants

Section	Learning target	Practical
10.1 Transpiration	• To know what transpiration is and where it takes place • To know how transpiration takes place through stomata • To know how transpiration pull is created • To understand why transpiration is important • To describe the features of leaves to prevent excessive water loss • To identify factors affecting the rate of transpiration	**10.1** Demonstration of the occurrence of transpiration *Practical Workbook* p.10-1 **10.2** Comparing the abundance of stomata on the upper and lower surfaces of a terrestrial dicotyledonous leaf *Practical Workbook* p.10-3 **10.3** Design an investigation to study the relative abundance of stomata on both sides of a leaf of different types of plants *Practical Workbook* p.10-6 **10.4** Investigation of the stomatal density on the epidermis of a leaf *Practical Workbook* p.10-11 **10.5** Measurement of the rate of transpiration using a bubble potometer *Practical Workbook* p.10-15 **10.6** Measurement of the amount of water absorbed and lost by a plant using a weight potometer *Practical Workbook* p.10-18 **10.7** Design an investigation of the effects of environmental factors on the rate of transpiration *Practical Workbook* p.10-21
10.2 Absorption of water and minerals by roots	• To identify adaptive features of roots for absorption • To know how water and minerals are absorbed by roots	
10.3 Transport in plants	• To know where and how transport takes place in flowering plants • To know the adaptive features of xylem vessels for transport of water and minerals • To know the adaptive features of phloem for transport of organic nutrients	**10.8** Examination of the vascular tissues of a young dicotyledonous plant *Practical Workbook* p.10-27 **10.9** Identifying the vascular tissue in the stem responsible for water transport *Practical Workbook* p.10-33
10.4 Support in plants	• To know how plants are supported	
10.5 Comparison of transport in humans and flowering plants	• To be able to compare transport in humans and flowering plants	

Bk 2 Ch 11 Cell cycle and division

Section	Learning target	Practical
11.1 Chromosomes	• To be able to describe the structure of a chromosome • To be able to contrast diploid and haploid cells	
11.2 The cell cycle and mitotic cell division	• To know that cell cycle consists of interphase and mitotic cell division • To identify different stages of mitotic cell division • To state the importance of mitotic cell division	**11.1** Examination of different stages of the cell cycle *Practical Workbook* p.11-1 **11.2** Investigation of the relative time spent in each stage of the cell cycle *Practical Workbook* p.11-6
11.3 Meiotic cell division	• To identify different stages of meiotic cell division • To state the importance of meiotic cell division	**11.3** Examination of meiotic cell division *Practical Workbook* p.11-10
11.4 Comparing mitotic and meiotic cell divisions	• To be able to compare mitotic and meiotic cell divisions	

Bk 2 Ch 12 Reproduction in flowering plants

Section	Learning target	Practical
12.1 Types of reproduction	• To contrast asexual and sexual reproduction	
12.2 Asexual reproduction	• To know what binary fission is • To know what vegetative propagation is • To identify storage organs involved in vegetative propagation • To know what cutting is	
12.3 Sexual reproduction in flowering plants	• To identify structures and functions of various parts of a flower • To state the characteristics of insect-pollinated and wind-pollinated flowers • To distinguish between self-pollination and cross-pollination • To be able to describe the process of fertilization in flowers • To know the significance of seed and fruit dispersal	**12.1** Dissection of a flower *Practical Workbook* p.12-1 **12.2** Examination of an insect-pollinated flower and a wind-pollinated flower *Practical Workbook* p.12-7
12.4 Significance of asexual and sexual reproduction	• To know the advantages and disadvantages of asexual and sexual reproduction in flowering plants	

Bk 2 Ch 13 Reproduction in humans

Section	Learning target	Practical
13.1 Human reproductive system	• To identify the structures and functions of male and female reproductive systems	**13.1** Examination of mammalian reproductive systems *Practical Workbook* p.13-1
13.2 Human gametes	• To identify the differences between sperms and ova • To know what ovulation is	
13.3 Secondary sexual characteristics in humans	• To be able to describe the secondary sexual characteristics in boys and girls	

Section	Learning target	Practical
13.4 Menstrual cycle	• To realize events that happen during the human menstrual cycle • To know what fertile period is	
13.5 Fertilization	• To know how sperms are transferred from a male into a female body • To be able to describe the process of fertilization	
13.6 Pregnancy	• To know the events leading to implantation • To know the functions of amnion and placenta • To understand how identical twins and fraternal twins are formed	
13.7 Birth process	• To be able to outline the main stages of labour	
13.8 Parental care	• To understand the importance of parental care to humans • To know the advantages of breast-feeding	
13.9 Birth control	• To understand the biological basis and reliability of various contraceptive methods	
13.10 Comparison between sexual reproduction in humans and flowering plants	• To be able to compare sexual reproduction in humans and flowering plants	

Bk 2 Ch 14 Growth and development

Section	Learning target	Practical
14.1 Concepts of growth and development	• To know what growth and development are and how they occur	
14.2 Measurement of growth	• To state the advantages and disadvantages of the parameters for measuring growth	
14.3 Seed germination	• To know the structure of a seed • To identify the conditions for seed germination • To know what happens when a seed germinates	**14.1** Investigation of the need for oxygen in seed germination *Practical Workbook* p.14-1 **14.2** Design an investigation of other conditions necessary for seed germination *Practical Workbook* p.14-4
14.4 Growth and development in plants	• To identify primary and secondary growth • To know what happens to cells in different regions of the root and shoot tips during growth and development • To identify the stages of growth in annual plants	**14.3** Investigation of the growth of the main roots of young seedlings *Practical Workbook* p.14-9
14.5 Growth and development in humans	• To identify the stages of growth in humans	

Bk 2 Ch 15 Detecting the environment

Section	Learning target	Practical
15.1 Irritability	• To know what irritability is • To know how a response is produced upon detecting a stimulus	
15.2 Human eye	• To identify functions of various parts of the human eye • To understand how we see • To differentiate between rod and cone cells • To understand how the eye controls the amount of light entering it • To know what eye accommodation is • To understand how the eye focuses on near and distant objects • To know the causes and corrections of short sight, long sight and colour blindness	**15.1** Dissection of ox eye *Practical Workbook* p.15-1
15.3 Human ear	• To identify functions of various parts of the human ear • To understand how we hear	
15.4 Phototropism of plants	• To identify the responses of shoots and roots to light • To identify where auxins are produced and their effects • To know how auxins cause phototropic responses in plants	**15.2** Investigation of the phototrophic responses of shoots and roots *Practical Workbook* p.15-6

Bk 2 Ch 16 Coordination in humans

Section	Learning target	Practical
16.1 General plan of nervous system	• To be able to identify different parts of the human nervous system	
16.2 Neurones	• To differentiate between different types of neurones • To know how nerve impulses are transmitted across a synapse • To know the significance of synapses	
16.3 Spinal cord	• To identify the structure and functions of the spinal cord	
16.4 Reflex action	• To be able to trace the reflex arc • To know the significance of reflex actions	
16.5 Brain	• To know the main parts of the brain and their functions	
16.6 Voluntary action	• To know how the nervous system brings about voluntary actions • To contrast reflex and voluntary actions	
16.7 Human endocrine system	• To know how hormones are transported to all parts of the body • To know the general function of hormones • To contrast hormonal and nervous coordination	

Bk 2 Ch 17 Movement in humans

Section	Learning target	Practical
17.1 Components of our skeleton	• To know what the human skeleton is made up of	
17.2 Organization and functions of the human skeleton	• To know the general plan of the human skeleton • To know the functions of the human skeleton	
17.3 Joints	• To identify functions of various parts of a movable joint • To differentiate between hinge joints and ball-and-socket joints	
17.4 Skeletal muscles	• To know what skeletal muscles are made up of and how they are attached to bones	
17.5 How the body moves	• To be able to identify opposing muscles • To know how muscles and bones work together to bring about movement	
17.6 Initiation of muscle contraction	• To know how muscle contraction is initiated	**17.1** Observation of the contraction of teased muscle from the leg of a pithed frog *Practical Workbook* p.17-1 **17.2** Electrical stimulation of a nerve in leg muscle of a pithed frog *Practical Workbook* p.17-4

Bk 2 Ch 18 Homeostasis

Section	Learning target	Practical
18.1 Importance of homeostasis	• To know what homeostasis is • To know the major parameters of the internal environment of our body and the importance of keeping them stable	
18.2 Mechanism of homeostasis	• To know how homeostasis is brought about • To know how blood glucose level is regulated and why this is important	

Bk 3 Ch 19 Ecosystems

Section	Learning target	Practical
19.1 Basic concept of ecology	• To be aware of the levels of organization in ecological studies • To be aware of the self-supporting, stable and dynamic nature of an ecosystem • To know the major types of ecosystems in Hong Kong	
19.2 Component of an ecosystem: the abiotic factors	• To identify some common abiotic factors in an ecosystem	
19.3 Component of an ecosystem: the biotic community	• To differentiate between the habitat and niche of an organism • To understand what species diversity and dominant species are • To know the modes of interactions among organisms in a community • To differentiate between primary succession and secondary succession	
19.4 Energy flow in an ecosystem	• To know how energy flows within an ecosystem • To be able to define a food chain and a food web • To know the roles of producers and consumers in the energy flow of an ecosystem • To know how energy is lost from one trophic level to another • To distinguish between pyramid of numbers and pyramid of biomass	
19.5 Material cycling in an ecosystem	• To know how carbon and nitrogen are cycled in an ecosystem • To know the roles of producers, consumers and decomposers in energy flow and material cycling	
19.6 Conservation of ecosystems	• To be aware of the impact of human activities on ecosystems • To know how to conserve ecosystems	M3016TAE What's in the Trunk? An Elephant Ivory Expedition
19.7 Ecological study	• To know the use of quadrats, line transects and belt transects in an ecological study • To know how to measure abiotic factors in an ecological study	**19.1** Conducting an ecological study of a local habitat *Practical Workbook* p.19-1

Bk 3 Ch 20 Photosynthesis

Section	Learning target	Practical
20.1 Roles of photosynthesis in ecosystems	• To know what photosynthesis is • To know the significance of photosynthesis	

Section	Learning target	Practical
20.2 Requirements for photosynthesis	• To be aware of the need of destarching a plant before conducting experiments • To know the requirements for photosynthesis	**20.1** Detection of oxygen produced in photosynthesis *Practical Workbook* p.20-1 **20.2** Detection of starch produced in photosynthesis by iodine test *Practical Workbook* p.20-3 **20.3** Investigation of the need for light in photosynthesis *Practical Workbook* p.20-7 **20.4** Investigation of the need for carbon dioxide in photosynthesis *Practical Workbook* p.20-10 **20.5** Investigation of the need for chlorophyll in photosynthesis *Practical Workbook* p.20-13
20.3 Site of photosynthesis	• To know the adaptive features of a leaf for photosynthesis • To know the adaptive features of a chloroplast for photosynthesis	
20.4 Process of photosynthesis	• To understand the major steps of photochemical reactions • To understand the major steps of the Calvin cycle • To know the relationship between photochemical reactions and the Calvin cycle	
20.5 Fate of photosynthetic products	• To know the fate of photosynthetic products	
20.6 Factors affecting the rate of photosynthesis	• To know the effect of light intensity and carbon dioxide concentration on the rate of photosynthesis • To know how the rate of photosynthesis is regulated in a greenhouse	**20.6** Investigation of the effect of light intensity on the rate of photosynthesis *Practical Workbook* p.20-17 **20.7** Design an investigation of the effect of carbon dioxide concentration on the rate of photosynthesis using a data logger *Practical Workbook* p.20-22

Bk 3 Ch 21 Respiration

Section	Learning target	Practical
21.1 Significance of respiration	• To know what respiration is • To know the role of ATP in cellular metabolism • To know the relationship between respiration and photosynthesis and their roles in the ecosystem	
21.2 Site of respiration	• To know where respiration takes place in a cell	
21.3 Aerobic respiration	• To understand the major steps of aerobic respiration • To contrast between aerobic respiration and photosynthesis	**21.1** Investigation of oxygen consumption in a grasshopper *Practical Workbook* p.21-1 **21.2** Investigation of carbon dioxide production in germinating seeds *Practical Workbook* p.21-4 **21.3** Investigation of carbon dioxide production in a living mouse *Practical Workbook* p.21-7 **21.4** Investigation of heat production in germinating seeds *Practical Workbook* p.21-11 **21.5** Investigation of heat production in a living mouse *Practical Workbook* p.21-14 **21.6** Investigation of the rate of respiration in a living mouse by measuring the rate of carbon dioxide production *Practical Workbook* p.21-17 **21.7** Investigation of the rate of respiration in germinating seeds by measuring the rate of oxygen consumption *Practical Workbook* p.21-22
21.4 Anaerobic respiration	• To know how anaerobic respiration occurs in yeast and skeletal muscles • To know the importance of anaerobic respiration • To know what oxygen debt is • To state the applications of anaerobic respiration	**21.8** Design an investigation of alcoholic fermentation in yeast *Practical Workbook* p.21-25
21.5 Comparison of aerobic and anaerobic respiration	• To contrast between aerobic and anaerobic respiration	

Bk 3 Ch 22 Non-infectious diseases

Section	Learning target	Practical
22.1 Health and diseases	• To recognize the meaning of health • To recognize the meaning of a disease • To identify the major difference between infectious and non-infectious diseases	
22.2 Non-infectious diseases	• To know some examples of non-infectious diseases, their treatment, risk factors and ways of prevention	

Bk 3 Ch 23 Infectious diseases and disease prevention

Section	Learning target	Practical
23.1 Pathogens of infectious diseases	• To know what pathogens are and how they cause diseases	
23.2 Transmission and prevention of infectious diseases	• To know how infectious diseases are transmitted and the preventive measures to reduce the spread of these diseases	M3006 Foodborne Outbreak Investigation MiniLab M6030 Who Has the Flu? Tracing Transmission with ELISA and PCR MiniLab
23.3 Treatment of infectious diseases	• To know how antibiotics kill or inhibit bacterial growth • To know the consequences of indiscriminate use of antibiotics • To know how to slow down the development of antibiotic resistance in bacteria • To know what sulpha drugs are and their functions	
23.4 Disease prevention	• To know what immunization is • To know how immunization programmes contribute to disease prevention • To be aware of personal responsibility in preventing disease transmission • To be aware of the importance of community health	

Bk 3 Ch 24 Body defence mechanisms

Section	Learning target	Practical
24.1 Non-specific defence mechanisms	• To know the characteristics of non-specific defence mechanisms • To know the first line of defence and be able to give examples of physical and chemical barriers • To know how phagocytosis provides body defence • To know what happens in an inflammatory response	**24.1** Identifying features of the mammalian skin that are related to body defence *Practical Workbook* p.24-1
24.2 Specific defence mechanisms	• To recognize the actions of B cells and T cells in immune response • To know how antibodies act against pathogens or their toxins • To be able to distinguish between primary and secondary responses • To understand the principle of vaccination • To distinguish between active and passive immunity	
24.3 Difference between non-specific and specific defence mechanisms	• To be able to compare non-specific and specific defence mechanisms	

Bk 4 Ch 25 Basic genetics

Section	Learning target	Practical
25.1 Mendel's laws of inheritance	• To know what monohybrid inheritance is • To know the structural relationship between a chromosome, DNA and a gene • To be able to state the Law of Segregation • To know the ways to determine the genotype of an organism with a dominant character • To know what dihybrid inheritance is • To be able to state the Law of Independent Assortment	**25.1** Study inheritance using maize cobs with grains of different colours *Practical Workbook* p.25-1 M3001 Determining the Genetics of a CaSH Cow MiniLab M3003 PTC Genetics MiniLab M3050 Sickle Cell MiniLab M3051 Hyperchelesterolemia MiniLab M3012 PTC Inheritance and Graphical Analysis MiniLan M3010 Hunting the Inheritance of Huntington's Disease MiniLab M6010 A Taste of Genetics MiniLab: Extract and Amplify the PTC Gene
25.2 Inheritance in humans	• To know how blood groups and sex are determined in humans • To know what sex-linked genes are	
25.3 Variations in organisms	• To contrast continuous and discontinuous variations • To know why variations occur • To know how genetic variations are brought about	**25.2** Observation and analysis of variations in humans *Practical Workbook* p.25-3
25.4 DNA – the carrier of genetic information	• To compare the composition of DNA and that of RNA • To describe the Watson-Crick model of DNA • To know how genes determine an organism's body characteristics • To know why DNA is suited to its function as a genetic material	**25.3** Extraction of DNA *Practical Workbook* p.25-10 M3015 DNA Extraction Toolbox

Bk 4 Ch 26 Molecular genetics

Section	Learning target	Practical
26.1 From DNA to proteins	• To be able to state the features of the genetic code • To identify the two main stages of protein synthesis • To identify the characteristics of transcription and translation	
26.2 Mutations	• To distinguish between gene mutations and chromosome mutations • To distinguish between spontaneous mutations and induced mutations • To be able to give examples of mutagens	M3050 Sickle Cell MiniLab

Bk 4 Ch 27 Biotechnology

Section	Learning target	Practical
27.1 Recombinant DNA technology	• To know the major steps and applications of recombinant DNA technology	
27.2 DNA fingerprinting	• To know the major steps, basic principle and applications of DNA fingerprinting	**27.1** Separation of DNA fragments using gel electrophoresis *Practical Workbook* p.27-1 M3004 DNA Fingerprinting MiniLab M3005 CSI Forensics MiniLab M3053 Analyzing a Crime Scene with DNA M3018TAE Molecular Ladder to Freedon – DNA Exoneration M3052 DNA Detectives Reagent Pack
27.3 Human Genome Project	• To know the goals, benefits and limitations of the Human Genome Project • To appreciate the joint efforts of scientists in international genomics projects	

Bk 3 Ch 28 Biodiversity

Section	Learning target	Practical
28.1 Diversity of life forms	• To understand what biodiversity is	
28.2 Classification	• To know how organisms are classified and named	
28.3 Development of the classification system	• To know the modern classification of organisms	
28.4 The six kingdoms	• To know the characteristics of the six kingdoms • To contrast archaebacteria and bacteria • To know how plants and animals are classified	
28.5 Dichotomous key	• To know the use of a dichotomous key	**28.1** Using a key to identify animals from a local habitat *Practical Workbook* p.28-1 **28.2** Constructing a dichotomous key for plants *Practical Workbook* p.28-4

Bk 4 Ch 29 Evolution I

Section	Learning target	Practical
29.1 The origin of life	• To know how life originated	
29.2 Evolution	• To know how the diversified life forms on earth today were formed • To understand how fossils provide evidence for evolution • To know the limitations of using fossil records as evidence for evolution • To know other evidence that supports the theory of evolution	

Bk 4 Ch 30 Evolution II

Section	Learning target	Practical
30.1 Mechanism of evolution	• To know the development of evolutionary thoughts • To outline the mechanism of evolution • To state the differences between Lamarck's theory and Darwin's theory • To know some examples of natural selection in action • To understand how insecticide-resistant insect pests and antibiotic-resistant bacteria develop	
30.2 Speciation	• To know what speciation is • To know how speciation occurs	

Bk E1 Ch 1 Regulation of water content

Section	Learning target	Practical
1.1 Importance of regulation of water content	• To realize the importance of osmoregulation • To identify the major organs involved in osmoregulation	
1.2 Human urinary system	• To identify the major parts of the urinary system and their functions • To know the structure of a nephron	**1.1** Examination of the mammalian urinary system *Textbook* p.157 **1.2** Examination of the mammalian kidney *Textbook* p.160
1.3 Process of urine formation	• To know how ultrafiltration takes place in a nephron • To know how substances in the glomerular filtrate are reabsorbed into the blood • To know the adaptive features of the first coiled tubule for reabsorption	
1.4 Main functions of kidneys	• To know the actions of ADH in keeping the water potential of the blood stable • To understand the role of kidneys in excretion	
1.5 Kidney failure	• To know what happens if a person's kidneys do not function properly • To understand how the dialysis machine helps clean the blood	

Bk E1 Ch 2 Regulation of body temperature

Section	Learning target	Practical
2.1 Importance of regulation of body temperature	• To state the importance of keeping body temperature stable • To know the major ways of heat exchange between the body and the environment	
2.2 The human skin	• To know the roles of various structures of the skin in body temperature regulation	**2.1** Identifying features of the mammalian skin that are related to temperature regulation *Textbook* p.163
2.3 Mechanism of body temperature regulation	• To know the role of the hypothalamus in detecting changes in internal and external temperatures • To know the actions of the thermoregulatory centre when there are changes in skin or blood temperature • To state the changes of the body under cold and hot conditions	
2.4 Heat- and cold-related illnesses	• To know what heat- and cold-related illnesses are	

Bk E1 Ch 3 Regulation of gas content in blood

Section	Learning target	Practical
3.1 Importance of regulation of gas content in blood	• To be aware of the importance of regulating gas content in blood	

Section	Learning target	Practical
3.2 Control of breathing	• To be able to explain how the respiratory centre brings about the basic rhythm of breathing • To be able to explain the effects of carbon dioxide content in blood on the rate and depth of breathing	
3.3 Control of heart beat	• To be able to explain how the heart beat is initiated • To know what happens at different times in a cardiac cycle • To know what heart rate, stroke volume and cardiac output are • To understand how cardiac output is controlled	
3.4 Effect of exercise on breathing and heart beat	• To be able to explain how exercise affects the rate and depth of breathing and cardiac output • To be aware of the significance of changes in rate and depth of breathing and the cardiac output	**3.1** Study of the changes in the rate and depth of breathing before and after exercise using a breath volume kit *Textbook* p.165 **3.2** Study of the changes in the rate and depth of breathing before and after exercise using a data logger *Textbook* p.168 **3.3** Study of the changes in heart rate before and after exercise using a data logger *Textbook* p.171

Bk E1 Ch 4 Hormonal control of reproductive cycle

Section	Learning target	Practical
4.1 Major events in menstrual cycle	• To recall events that happen during the human menstrual cycle	
4.2 Hormonal control of menstrual cycle	• To be able to state the major hormones involved in the menstrual cycle and their functions • To understand how follicle stimulating hormone, luteinising hormone, oestrogen and progesterone interact to bring about changes in the menstrual cycle • To know the significance of hormonal control of menstrual cycle	
4.3 Use of hormones as contraceptives	• To understand how hormones are used as contraceptives	
4.4 Use of hormones in infertility treatment	• To understand how synthetic hormones are used in the treatment of infertility	

Bk E2 Ch 1 Human impact on the environment

Section	Learning target	Practical
1.1 Human population growth and use of natural resources	• To know the impact of rapid human population growth on the environment and possible ways to reduce the impact • To differentiate between renewable and non-renewable resources	
1.2 Environmental impact of malpractices in fisheries	• To know the environmental impact of malpractices in fisheries	
1.3 Environmental impact of malpractices in agriculture	• To know the environmental impact of malpractices in agriculture • To understand bioaccumulation and biomagnification of pesticides in organisms • To understand the causes of eutrophication	
1.4 Environmental impact of industrialization and urbanization	• To know the environmental impact of land clearance and reclamation • To be able to state the sources of air pollution and water pollution, and their effects on human health	**1.1** Design an investigation on air pollution in different locations using lichen distribution as the indicator *Textbook* p.121 **1.2** Investigation of the air quality in different locations *Textbook* p.127 **1.3** Comparison of the oxygen content of clean and polluted water using a data logger *Textbook* p.133 **1.4** Design an investigation to study the types, sources and effects of pollutants in a freshwater stream or a shore habitat *Textbook* p.136
1.5 Global environmental issues	• To understand the causes and consequences of global warming, acid rain and algal bloom	

Bk E2 Ch 2 Human responsibilities for the environment

Section	Learning target	Practical
2.1 Sustainable development	• To know what sustainable development is • To be able to state the measures taken to promote sustainable fisheries and agriculture in Hong Kong	
2.2 Pollution control	• To identify the 4 Rs in environmental protection • To be able to state the measures taken to control air pollution and water pollution in Hong Kong • To be able to state the measures taken to manage solid waste in Hong Kong • To identify the roles of microorganisms in sewage treatment	

2.3 Conservation	• To realize the need for conservation • To realize the importance of preserving biodiversity • To know what endangered species are • To be able to state the measures for protecting endangered species • To identify some conservation areas in Hong Kong • To be aware of some ecological restoration projects and habitat creation projects in Hong Kong • To know what individuals can do in conservation	M3016TAE What's in the Trunk? An Elephant Ivory Expedition

Bk E3 Ch 1 Basic microbiology

Section	Learning target	Practical
1.1 What are microorganisms?	• To know what microorganisms are	
1.2 Viruses	• To know the structure of viruses • To understand how viruses multiply • To understand what happens when viruses enter a latent period	
1.3 Diversity of microorganisms	• To recognize the three main groups of microorganisms • To identify the general features of different groups of microorganisms	
1.4 Growing microorganisms	• To be able to state the growth requirements of microorganisms • To understand the purposes of carrying out aseptic techniques • To be able to state what aseptic techniques involve	1. Culture of yeast using aseptic techniques *Textbook* p.131 M6300 Let it Glow Bacterial Transformation MiniLab
1.5 Microbial growth	• To recognize the stages of microbial growth • To understand how to measure the growth of microorganisms	2. Design an investigation to study the growth of microorganisms *Textbook* p.141 M3013 The Dilution Solution MiniLab

Bk E3 Ch 2 Use of microorganisms

Section	Learning target	Practical
2.1 Using microorganisms for commercial purposes	• To understand why microorganisms are widely used for making commercial products • To understand how microorganisms are cultured on a large scale	
2.2 Food processing	• To understand how microorganisms are used in beer-brewing, wine-brewing, bread-making, making of yoghurt and making of cheese	**2.1** Production of alcoholic drinks and bread by fermentation *Textbook* p.147 **2.2** Design an investigation of the optimal conditions for fermentation by yeast *Textbook* p.153 **2.3** Production of yoghurt by fermentation *Textbook* p.159
2.3 Pharmaceutical industry	• To identify the roles of microorganisms in antibiotic and vaccine production	
2.4 Industrial enzyme production	• To identify the roles of microorganisms in producing enzymes in biological washing powder • To identify the roles of microorganisms in producing enzymes used in the production of fruit juice • To know some examples of enzymes that are microbial in origin	
2.5 Sewage treatment	• To identify the roles of microorganisms in sewage treatment	
2.6 Biogas production	• To identify the roles of microorganisms in biogas production	
2.7 Genetically modified microorganisms	• To realize the significance and potential hazards of using GM microorganisms	

Bk E3 Ch 3 Harmful effects of microorganisms

Section	Learning target	Practical
3.1 How do pathogens cause diseases in humans?	• To understand how microorganisms cause diseases in humans • To know what lethal $dose_{50}$ is	
3.2 Food-borne infection and food poisoning	• To differentiate between food-borne infection and food poisoning • To be able to state the common factors contributing to food-borne infection and food poisoning • To understand how to prevent food-borne infection and food poisoning	M3006 Foodborne Outbreak Investigation MiniLab
3.3 Microbial deterioration	• To understand how microorganisms cause deterioration of food and useful material	
3.4 Control of microbial growth	• To state the physical and chemical methods for controlling microbial growth	

Bk E4 Ch 1 Techniques in modern biotechnology

Section	Learning target	Practical
1.1 Introduction to biotechnology	• To know what modern biotechnology is	
1.2 Recombinant DNA technology	• To be able to describe the major steps in recombinant DNA technology • To understand how human insulin is produced using recombinant plasmids • To be able to state the advantages of using recombinant DNA technology in the production of human insulin	M6050 Restriction Digest Basics MiniLab M6053 Restriction Analysis of DNA MiniLab
1.3 Genetically modified organisms	• To be able to describe how GMOs are produced • To be able to state the benefits and potential hazards of producing GMOs	M6300 Let it Glow Bacterial Transformation MiniLab
1.4 Plant and animal cloning	• To be able to outline the major steps in cloning plants by tissue culture • To be able to state the applications of plant cloning • To know that animals have been cloned by embryo splitting and nuclear transfer • To be able to outline the major steps involved in nuclear transfer • To be able to state the applications of animal cloning • To state the advantages and disadvantages of plant and animal cloning • To be able to state issues related to animal cloning and human cloning	
1.5 Polymerase chain reaction	• To understand the basic principle of polymerase chain reaction • To be able to state the applications of polymerase chain reaction	1. Using polymerase chain reaction to amplify DNA fragments *Textbook* p.115 M6001 PCR 101 MiniLab M6005 PCR Cycle Number Analysis MiniLab M6030 Who Has the Flu? Tracing Transmission with ELISA and PCR MiniLab
1.6 DNA fingerprinting	• To understand the major steps in DNA fingerprinting • To be able to state the applications of DNA fingerprinting	All the electrophoresis minilabs

Bk E4 Ch 2 Applications in biotechnology

Section	Learning target	Practical
2.1 Production of pharmaceutical products	• To give examples of pharmaceutical products produced using biotechnology • To understand the roles of bacteria in the production of pharmaceutical products • To understand why plasmids are used as vectors • To understand why bacteria are used as host cells	
2.2 Gene therapy	• To know what gene therapy is • To know the potential benefits and hazards of gene therapy • To be able to state issues related to gene therapy	
2.3 Stem cell therapy	• To give examples of potential applications of stem cells in medicine • To be able to state issues related to stem cell therapy	
2.4 Transgenic plants and animals	• To understand the uses of transgenic plants and animals in agriculture and scientific research • To give examples of desirable characters introduced into plants and animals • To be able to state issues related to GM food	

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