1. Chemistry of Life

Weeks 1–3

生命的化学

They should be able to

1. Explain how the properties of water that result from its polarity and hydrogen bonding affect its biological function.
2. Describe the composition of macromolecules required by living organisms.
3. Describe the chemical reactions that build and break biological macromolecules.
4. Describe the structure and function of carbohydrates.
5. Describe the structure and function of lipids.
6. Describe the structure and function of DNA and RNA.
7. Describe the structure and function of proteins.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 01 (10 questions, answers on sheet 2)	
Teach the new content	Handout 01 Slide deck 01 Vocabulary list 01	
Practice guided then independent	Exercise sheets 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7 Past-paper sheets 1.4, 1.6, 1.7	
Check before they leave	Unit test 1 (with mark scheme)	
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	

2. Cell Structure and Function

Weeks 4–6

细胞结构与功能

They should be able to

1. Explain how the structure and function of subcellular components and organelles contribute to the function of cells.
2. Explain the effect of surface area-to-volume ratios on the exchange of materials between cells or organisms and the environment.
3. Describe the roles of each of the components of the cell membrane in maintaining the internal environment of the cell.
4. Describe the fluid mosaic model of cell membranes.
5. Explain how the structure of biological membranes influences selective permeability.
6. Describe the role of the cell wall in maintaining cell structure and function.
7. Describe the mechanisms that organisms use to maintain solute and water balance.
8. Describe the mechanisms that organisms use to transport large molecules across the plasma membrane.
9. Explain how the structure of a molecule affects its ability to pass through the plasma membrane.
10. Explain how concentration gradients affect the movement of molecules across membranes.
11. Explain how osmoregulatory mechanisms contribute to the health and survival of organisms.
12. Describe the processes that allow ions and other molecules to move across membranes.
13. Describe the membrane-bound structures of the eukaryotic cell.
14. Explain how internal membranes and membrane-bound organelles contribute to compartmentalization of eukaryotic cell functions.
15. Describe similarities and/or differences in compartmentalization between prokaryotic and eukaryotic cells.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 02 (10 questions, answers on sheet 2)	
Teach the new content	Handout 02 Slide deck 02 Vocabulary list 02	
Practice guided then independent	Exercise sheets 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10 Past-paper sheets 2.3, 2.4, 2.6, 2.7, 2.8, 2.9, 2.10	
Check before they leave	Unit test 2 (with mark scheme)	
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	

3. Cellular Energetics

Weeks 7–10

细胞能量学

They should be able to

1. Explain how enzymes affect the rate of biological reactions.
2. Explain how changes to the structure of an enzyme may affect its function.
3. Explain how the cellular environment affects enzyme activity.
4. Describe the role of energy in living organisms.
5. Explain how shared, conserved, and fundamental processes and features support the concept of common ancestry for all organisms.
6. Describe the photosynthetic processes and structural features of the chloroplast that allow organisms to capture and store energy.
7. Explain how cells capture energy from light and transfer it to biological molecules for storage and use.
8. Describe the processes and structural features of mitochondria that allow organisms to use energy stored in biological macromolecules.
9. Explain how cells obtain energy from biological macromolecules in order to power cellular functions.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 03 (10 questions, answers on sheet 2)	
Teach the new content	Handout 03 Slide deck 03 Vocabulary list 03	
Practice guided then independent	Exercise sheets 3.1, 3.2, 3.3, 3.4, 3.5 Past-paper sheets 3.1, 3.2, 3.3, 3.4, 3.5	
Check before they leave	Unit test 3 (with mark scheme)	
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	

4. Cell Communication and Cell Cycle

Weeks 11–13

细胞通讯与细胞周期

They should be able to

1. Describe the ways that cells can communicate with one another.
2. Explain how cells communicate with one another over short and long distances.
3. Describe the components of a signal transduction pathway.
4. Describe the role of components of a signal transduction pathway in producing a cellular response.
5. Describe the different types of cellular responses elicited by a signal transduction pathway.
6. Explain how a change in the structure of any signaling molecule affects the activity of the signaling pathway.
7. Explain how positive and negative feedback helps maintain homeostasis.
8. Describe the events that occur in the cell cycle.
9. Explain how mitosis results in the transmission of chromosomes from one generation of cells to the next.
10. Describe the role of checkpoints in regulating the cell cycle.
11. Describe the effects of disruptions to the cell cycle on the cell or organism.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 04 (10 questions, answers on sheet 2)	
Teach the new content	Handout 04 Slide deck 04 Vocabulary list 04	
Practice guided then independent	Exercise sheets 4.1, 4.2, 4.3, 4.4, 4.5, 4.6 Past-paper sheets 4.1, 4.2, 4.3, 4.4, 4.5, 4.6	
Check before they leave	Unit test 4 (with mark scheme)	
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	

5. Heredity

Weeks 14–16

遗传

They should be able to

1. Explain how meiosis results in the transmission of chromosomes from one generation to the next.
2. Describe similarities and differences between the phases and outcomes of mitosis and meiosis.
3. Explain how the process of meiosis generates genetic diversity.
4. Explain the inheritance of genes and traits as described by Mendel's laws.
5. Explain deviations from Mendel's model of the inheritance of traits.
6. Explain how the same genotype can result in multiple phenotypes under different environmental conditions.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 05 (10 questions, answers on sheet 2)	
Teach the new content	Handout 05 Slide deck 05 Vocabulary list 05	
Practice guided then independent	Exercise sheets 5.1, 5.2, 5.3, 5.4, 5.5 Past-paper sheets 5.1, 5.2, 5.3, 5.4, 5.5	
Check before they leave	Unit test 5 (with mark scheme)	
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	

6. Gene Expression and Regulation

Weeks 17–21

基因表达与调控

They should be able to

1. Describe the structures involved in passing hereditary information from one generation to the next.
2. Describe the characteristics of DNA that allow it to be used as hereditary material.
3. Describe the mechanisms by which genetic information is copied for transmission between generations.
4. Describe the mechanisms by which genetic information flows from DNA to RNA to protein.
5. Explain how the phenotype of an organism is determined by its genotype.
6. Describe the types of interactions that regulate gene expression.
7. Explain how the location of regulatory sequences relates to their function.
8. Explain how the binding of transcription factors to promoter regions affects gene expression and the phenotype of the organism.
9. Explain the connection between the regulation of gene expression and phenotypic differences in cells and organisms.
10. Describe the various types of mutation.
11. Explain how changes in genotype may result in changes in phenotype.
12. Explain how alterations in DNA sequences contribute to variation that can be subject to natural selection.
13. Explain the use of genetic engineering techniques in analyzing or manipulating DNA.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 06 (10 questions, answers on sheet 2)	
Teach the new content	Handout 06 Slide deck 06 Vocabulary list 06	
Practice guided then independent	Exercise sheets 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8 Past-paper sheets 6.1, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8	
Check before they leave	Unit test 6 (with mark scheme)	
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	

7. Natural Selection

Weeks 22–25

自然选择

They should be able to

1. Describe the causes of natural selection.
2. Explain how natural selection affects populations.
3. Describe the importance of phenotypic variation in a population.
4. Explain how variation in molecules within cells connects to the fitness of an organism.
5. Explain how humans can affect diversity within a population.
6. Explain how random occurrences affect the genetic makeup of a population.
7. Describe the role of random processes in the evolution of specific populations.
8. Describe the change in the genetic makeup of a population over time.
9. Describe the conditions under which allele and genotype frequencies will change in populations.
10. Describe the types of data that provide evidence for evolution.
11. Explain how morphological, biochemical, and geological data provide evidence that organisms have changed over time.
12. Describe structural and functional evidence on cellular and molecular levels that provides evidence for the common ancestry of all eukaryotes.
13. Explain how evolution is an ongoing process in all living organisms.
14. Describe the types of evidence that can be used to infer an evolutionary relationship.
15. Explain how phylogenetic trees and cladograms can be used to infer evolutionary relatedness.
16. Describe the conditions under which new species may arise.
17. Describe the rate of evolution and speciation under different ecological conditions.
18. Explain the processes and mechanisms that drive speciation.
19. Explain how the genetic diversity of a species or population affects its ability to withstand environmental pressures.
20. Describe the scientific evidence that supports models of the origin of life on Earth.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 07 (10 questions, answers on sheet 2)	
Teach the new content	Handout 07 Slide deck 07 Vocabulary list 07	
Practice guided then independent	Exercise sheets 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.11, 7.12 Past-paper sheets 7.1, 7.2, 7.3, 7.4, 7.6, 7.7, 7.9, 7.10, 7.11, 7.12	
Check before they leave	Unit test 7 (with mark scheme)	
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	

8. Ecology

Weeks 26–30

生态学

They should be able to

1. Explain how the behavioral and physiological response of an organism is related to changes in internal or external environment.
2. Explain how the behavioral responses of organisms affect their overall fitness and may contribute to the success of a population.
3. Describe the strategies organisms use to acquire and use energy.
4. Explain how energy flows and matter cycles through trophic levels.
5. Explain how changes in energy availability affect populations, communities, and ecosystems.
6. Explain how the activities of autotrophs and heterotrophs enable the flow of energy within an ecosystem.
7. Describe factors that influence growth dynamics of populations.
8. Explain how the density of a population affects and is determined by resource availability in the environment.
9. Describe the structure of a community according to its species composition and diversity.
10. Explain how interactions within and among populations influence community structure.
11. Describe the relationship between ecosystem diversity and its resilience to changes in the environment.
12. Explain how the addition or removal of any component of an ecosystem will affect its overall short-term and long-term structure.
13. Explain the interaction between the environment and random or preexisting variations in populations.
14. Explain how invasive species affect ecosystem dynamics.
15. Describe human activities that lead to changes in ecosystem structure and dynamics.
16. Explain how geological and meteorological activity leads to changes in ecosystem structure and dynamics.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 08 (10 questions, answers on sheet 2)	
Teach the new content	Handout 08 Slide deck 08 Vocabulary list 08	
Practice guided then independent	Exercise sheets 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7 Past-paper sheets 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7	
Check before they leave	Unit test 8 (with mark scheme)	
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	