

## Specification checklist

**How to use:** tick one box for each of the 539 spec points as you revise. Go back to the “Not yet” rows first, and keep going until every row is “Confident”.

The numbers are IB's own spec references, and each note title links to its note on clockitwithsci.com. **HL only** additional Higher Level content, only for HL students. SL students can skip it.

### A1 Molecules (Unity and diversity)

#### Water **Spec A1.1**

| Spec   | What to know (the note)                                         | Not yet                  | Nearly                   | Confident                |
|--------|-----------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| A1.1.1 | Water as the medium for life and hydrogen bonding               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.1.2 | Water as the medium for life and hydrogen bonding               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.1.3 | Cohesion and adhesion                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.1.4 | Cohesion and adhesion                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.1.5 | Solvent properties of water                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.1.6 | Physical properties of water and aquatic animals                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.1.7 | Origin of water on Earth and the search for life <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.1.8 | Origin of water on Earth and the search for life <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

#### Nucleic acids **Spec A1.2**

| Spec    | What to know (the note)                                     | Not yet                  | Nearly                   | Confident                |
|---------|-------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| A1.2.1  | DNA as the genetic material and nucleotides                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.2  | DNA as the genetic material and nucleotides                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.3  | DNA as the genetic material and nucleotides                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.4  | DNA as the genetic material and nucleotides                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.5  | RNA polymers and the DNA double helix                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.6  | RNA polymers and the DNA double helix                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.7  | Differences between DNA and RNA                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.8  | Base pairing, information storage and the genetic code      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.9  | Base pairing, information storage and the genetic code      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.10 | Base pairing, information storage and the genetic code      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.11 | Directionality and purine–pyrimidine pairing <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.12 | Directionality and purine–pyrimidine pairing <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.13 | Structure of a nucleosome <b>HL only</b>                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.14 | Hershey–Chase experiment and Chargaff's data <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A1.2.15 | Hershey–Chase experiment and Chargaff's data <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### A2 Cells (Unity and diversity)

#### Origins of cells **Spec A2.1**

| Spec   | What to know (the note)                                   | Not yet                  | Nearly                   | Confident                |
|--------|-----------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| A2.1.1 | Early Earth and the first carbon compounds <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec   | What to know (the note)                                                    | Not yet                  | Nearly                   | Confident                |
|--------|----------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| A2.1.2 | Living and non-living, and the challenge of the first cells <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.1.3 | Living and non-living, and the challenge of the first cells <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.1.4 | Early Earth and the first carbon compounds <b>HL only</b>                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.1.5 | Vesicles and RNA as the first genetic material <b>HL only</b>              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.1.6 | Vesicles and RNA as the first genetic material <b>HL only</b>              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.1.7 | The last universal common ancestor <b>HL only</b>                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.1.8 | The last universal common ancestor <b>HL only</b>                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.1.9 | The last universal common ancestor <b>HL only</b>                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Cell structure **Spec A2.2**

| Spec    | What to know (the note)                                                   | Not yet                  | Nearly                   | Confident                |
|---------|---------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| A2.2.1  | Cell theory and structures common to all cells                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.2  | Microscopy skills                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.3  | Developments in microscopy                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.4  | Cell theory and structures common to all cells                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.5  | Prokaryote and eukaryote cell structure                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.6  | Prokaryote and eukaryote cell structure                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.7  | Processes of life in unicellular organisms                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.8  | Animal, fungal and plant cells, and atypical cells                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.9  | Animal, fungal and plant cells, and atypical cells                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.10 | Micrographs, drawing and annotation                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.11 | Micrographs, drawing and annotation                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.12 | Origin of eukaryotic cells by endosymbiosis <b>HL only</b>                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.13 | Cell differentiation and the evolution of multicellularity <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.2.14 | Cell differentiation and the evolution of multicellularity <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Viruses **Spec A2.3**

| Spec   | What to know (the note)                               | Not yet                  | Nearly                   | Confident                |
|--------|-------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| A2.3.1 | Structure and diversity of viruses <b>HL only</b>     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.3.2 | Structure and diversity of viruses <b>HL only</b>     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.3.3 | Lytic and lysogenic cycles <b>HL only</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.3.4 | Lytic and lysogenic cycles <b>HL only</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.3.5 | Origins and rapid evolution of viruses <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A2.3.6 | Origins and rapid evolution of viruses <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## A3 Organisms (Unity and diversity)

### Diversity of organisms **Spec A3.1**

| Spec   | What to know (the note)                       | Not yet                  | Nearly                   | Confident                |
|--------|-----------------------------------------------|--------------------------|--------------------------|--------------------------|
| A3.1.1 | Variation, species and binomial names         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.2 | Variation, species and binomial names         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.3 | Variation, species and binomial names         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.4 | The biological species concept and speciation | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.5 | The biological species concept and speciation | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.6 | Chromosome numbers and karyograms             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec    | What to know (the note)                                 | Not yet                  | Nearly                   | Confident                |
|---------|---------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| A3.1.7  | Chromosome numbers and karyograms                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.8  | Unity and diversity of genomes                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.9  | Unity and diversity of genomes                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.10 | Unity and diversity of genomes                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.11 | Whole genome sequencing                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.12 | Limits of the biological species concept <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.13 | Limits of the biological species concept <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.14 | Dichotomous keys and environmental DNA <b>HL only</b>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.1.15 | Dichotomous keys and environmental DNA <b>HL only</b>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Classification and cladistics **Spec A3.2**

| Spec   | What to know (the note)                                                  | Not yet                  | Nearly                   | Confident                |
|--------|--------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| A3.2.1 | Why classify, and problems with the traditional hierarchy <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.2.2 | Why classify, and problems with the traditional hierarchy <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.2.3 | Why classify, and problems with the traditional hierarchy <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.2.4 | Clades and the molecular clock <b>HL only</b>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.2.5 | Clades and the molecular clock <b>HL only</b>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.2.6 | Constructing and analysing cladograms <b>HL only</b>                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.2.7 | Constructing and analysing cladograms <b>HL only</b>                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.2.8 | Testing classifications and the three domains <b>HL only</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A3.2.9 | Testing classifications and the three domains <b>HL only</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## **A4 Ecosystems (Unity and diversity)**

### Evolution and speciation **Spec A4.1**

| Spec    | What to know (the note)                                                      | Not yet                  | Nearly                   | Confident                |
|---------|------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| A4.1.1  | Evolution as change in heritable characteristics                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.1.2  | Evidence from sequences and selective breeding                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.1.3  | Evidence from sequences and selective breeding                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.1.4  | Homologous and analogous structures                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.1.5  | Homologous and analogous structures                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.1.6  | Speciation, reproductive isolation and differential selection                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.1.7  | Speciation, reproductive isolation and differential selection                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.1.8  | Allopatric and sympatric speciation, and adaptive radiation <b>HL only</b>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.1.9  | Allopatric and sympatric speciation, and adaptive radiation <b>HL only</b>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.1.10 | Barriers to hybridization and abrupt speciation by polyploidy <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.1.11 | Barriers to hybridization and abrupt speciation by polyploidy <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Conservation of biodiversity **Spec A4.2**

| Spec   | What to know (the note)                             | Not yet                  | Nearly                   | Confident                |
|--------|-----------------------------------------------------|--------------------------|--------------------------|--------------------------|
| A4.2.1 | Biodiversity and the number of species              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.2.2 | Biodiversity and the number of species              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.2.3 | Anthropogenic species extinction and ecosystem loss | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.2.4 | Anthropogenic species extinction and ecosystem loss | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.2.5 | Evidence for and causes of the biodiversity crisis  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec   | What to know (the note)                                        | Not yet                  | Nearly                   | Confident                |
|--------|----------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| A4.2.6 | Evidence for and causes of the biodiversity crisis             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.2.7 | Approaches to conservation and the EDGE of Existence programme | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A4.2.8 | Approaches to conservation and the EDGE of Existence programme | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## B1 Molecules (Form and function)

### Carbohydrates and lipids Spec B1.1

| Spec    | What to know (the note)                                         | Not yet                  | Nearly                   | Confident                |
|---------|-----------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| B1.1.1  | Carbon atoms and the diversity of carbon compounds              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.2  | Condensation and hydrolysis reactions                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.3  | Condensation and hydrolysis reactions                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.4  | Monosaccharides: form and function                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.5  | Starch, glycogen and cellulose                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.6  | Starch, glycogen and cellulose                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.7  | Glycoproteins and cell-cell recognition                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.8  | Lipids: hydrophobic properties, triglycerides and phospholipids | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.9  | Lipids: hydrophobic properties, triglycerides and phospholipids | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.10 | Fatty acids, energy storage and insulation                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.11 | Fatty acids, energy storage and insulation                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.12 | Phospholipid bilayers and steroids                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.1.13 | Phospholipid bilayers and steroids                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Proteins Spec B1.2

| Spec    | What to know (the note)                                                             | Not yet                  | Nearly                   | Confident                |
|---------|-------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| B1.2.1  | Amino acids and peptide bonds                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.2.2  | Amino acids and peptide bonds                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.2.3  | Dietary amino acids and the variety of peptide chains                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.2.4  | Dietary amino acids and the variety of peptide chains                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.2.5  | Effect of pH and temperature on protein structure                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.2.6  | R-groups and primary structure <b>HL only</b>                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.2.7  | R-groups and primary structure <b>HL only</b>                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.2.8  | Secondary structure: alpha helices and beta-pleated sheets <b>HL only</b>           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.2.9  | Tertiary structure and the effect of polar and non-polar amino acids <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.2.10 | Tertiary structure and the effect of polar and non-polar amino acids <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.2.11 | Quaternary structure: non-conjugated and conjugated proteins <b>HL only</b>         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B1.2.12 | Form and function in globular and fibrous proteins <b>HL only</b>                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## B2 Cells (Form and function)

### Membranes and membrane transport Spec B2.1

| Spec          | What to know (the note)                                     | Not yet                  | Nearly                   | Confident                |
|---------------|-------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| B2.1.1-B2.1.3 | Lipid bilayers, barriers and simple diffusion               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B2.1.4        | Membrane proteins, glycoproteins and the fluid mosaic model | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B2.1.5-B2.1.8 | Osmosis, channel proteins and pump proteins                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B2.1.9        | Membrane proteins, glycoproteins and the fluid mosaic model | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec                   | What to know (the note)                                                    | Not yet                  | Nearly                   | Confident                |
|------------------------|----------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>B2.1.10</b>         | Membrane proteins, glycoproteins and the fluid mosaic model                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.1.11-B2.1.13</b> | Membrane fluidity, cholesterol and vesicles <b>HL only</b>                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.1.14-B2.1.16</b> | Channel proteins, sodium-potassium pumps and cotransporters <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.1.17</b>         | Adhesion of cells to form tissues <b>HL only</b>                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Organelles and compartmentalization **Spec B2.2**

| Spec                 | What to know (the note)                                     | Not yet                  | Nearly                   | Confident                |
|----------------------|-------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>B2.2.1-B2.2.3</b> | Organelles, the nucleus and compartments                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.2.4</b>        | Adaptations of mitochondria and chloroplasts <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.2.5</b>        | Adaptations of mitochondria and chloroplasts <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.2.6</b>        | The nucleus, free ribosomes and rough ER <b>HL only</b>     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.2.7</b>        | The nucleus, free ribosomes and rough ER <b>HL only</b>     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.2.8</b>        | The Golgi apparatus and vesicles <b>HL only</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.2.9</b>        | The Golgi apparatus and vesicles <b>HL only</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Cell specialization **Spec B2.3**

| Spec                 | What to know (the note)                                        | Not yet                  | Nearly                   | Confident                |
|----------------------|----------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>B2.3.1-B2.3.4</b> | Differentiation and stem cells                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.3.5</b>        | Cell size and surface area-to-volume ratio                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.3.6</b>        | Cell size and surface area-to-volume ratio                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.3.7</b>        | Surface area adaptations and pneumocytes <b>HL only</b>        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.3.8</b>        | Surface area adaptations and pneumocytes <b>HL only</b>        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.3.9</b>        | Cardiac muscle cells and striated muscle fibres <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B2.3.10</b>       | Adaptations of sperm and egg cells <b>HL only</b>              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## **B3** Organisms (Form and function)

### Gas exchange **Spec B3.1**

| Spec           | What to know (the note)                                                   | Not yet                  | Nearly                   | Confident                |
|----------------|---------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>B3.1.1</b>  | Gas exchange and exchange surfaces                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.2</b>  | Gas exchange and exchange surfaces                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.3</b>  | Gas exchange and exchange surfaces                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.4</b>  | Adaptations of mammalian lungs                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.5</b>  | Ventilation and lung volumes                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.6</b>  | Ventilation and lung volumes                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.7</b>  | Gas exchange in leaves                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.8</b>  | Gas exchange in leaves                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.9</b>  | Transpiration and stomatal density                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.10</b> | Transpiration and stomatal density                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.11</b> | Haemoglobin, the Bohr shift and oxygen dissociation curves <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.12</b> | Haemoglobin, the Bohr shift and oxygen dissociation curves <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>B3.1.13</b> | Haemoglobin, the Bohr shift and oxygen dissociation curves <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Transport **Spec B3.2**

| Spec          | What to know (the note)    | Not yet                  | Nearly                   | Confident                |
|---------------|----------------------------|--------------------------|--------------------------|--------------------------|
| <b>B3.2.1</b> | Adaptations of capillaries | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec    | What to know (the note)                                              | Not yet                  | Nearly                   | Confident                |
|---------|----------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| B3.2.2  | Structure and adaptations of arteries and veins                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.3  | Structure and adaptations of arteries and veins                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.4  | Pulse rates and occlusion of the coronary arteries                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.5  | Structure and adaptations of arteries and veins                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.6  | Pulse rates and occlusion of the coronary arteries                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.7  | Water transport in xylem                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.8  | Water transport in xylem                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.9  | Tissues in dicotyledonous stems and roots                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.10 | Tissues in dicotyledonous stems and roots                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.11 | Tissue fluid and lymph <b>HL only</b>                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.12 | Tissue fluid and lymph <b>HL only</b>                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.13 | Tissue fluid and lymph <b>HL only</b>                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.14 | Single and double circulation and the mammalian heart <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.15 | Single and double circulation and the mammalian heart <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.16 | Stages in the cardiac cycle <b>HL only</b>                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.17 | Root pressure and phloem transport <b>HL only</b>                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.2.18 | Root pressure and phloem transport <b>HL only</b>                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Muscle and motility **Spec B3.3**

| Spec    | What to know (the note)                                                | Not yet                  | Nearly                   | Confident                |
|---------|------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| B3.3.1  | Movement and reasons for locomotion <b>HL only</b>                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.3.2  | Sliding filament model of muscle contraction <b>HL only</b>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.3.3  | Titin, antagonistic muscles and the intercostal muscles <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.3.4  | Motor units in skeletal muscle <b>HL only</b>                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.3.5  | Skeletons, the hip joint and range of motion <b>HL only</b>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.3.6  | Skeletons, the hip joint and range of motion <b>HL only</b>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.3.7  | Skeletons, the hip joint and range of motion <b>HL only</b>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.3.8  | Titin, antagonistic muscles and the intercostal muscles <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.3.9  | Movement and reasons for locomotion <b>HL only</b>                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3.3.10 | Adaptations for swimming in marine mammals <b>HL only</b>              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## **B4 Ecosystems (Form and function)**

### Adaptation to environment **Spec B4.1**

| Spec   | What to know (the note)                             | Not yet                  | Nearly                   | Confident                |
|--------|-----------------------------------------------------|--------------------------|--------------------------|--------------------------|
| B4.1.1 | Habitats and adaptations to the abiotic environment | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.1.2 | Habitats and adaptations to the abiotic environment | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.1.3 | Abiotic variables and range of tolerance            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.1.4 | Abiotic variables and range of tolerance            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.1.5 | Conditions required for coral reef formation        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.1.6 | Terrestrial biomes                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.1.7 | Terrestrial biomes                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.1.8 | Adaptations to hot deserts and tropical rainforest  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Ecological niches** Spec B4.2

| Spec    | What to know (the note)                                    | Not yet                  | Nearly                   | Confident                |
|---------|------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| B4.2.1  | Ecological niche and tolerance of oxygen                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.2  | Ecological niche and tolerance of oxygen                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.3  | Photosynthesis and mixotrophic nutrition                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.4  | Holozoic and saprotrophic nutrition, and archaea           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.5  | Photosynthesis and mixotrophic nutrition                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.6  | Holozoic and saprotrophic nutrition, and archaea           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.7  | Holozoic and saprotrophic nutrition, and archaea           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.8  | Dentition and diet in the Hominidae                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.9  | Adaptations for herbivory and predation                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.10 | Adaptations for herbivory and predation                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.11 | Adaptations of plant form for harvesting light             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.12 | Fundamental and realized niches, and competitive exclusion | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4.2.13 | Fundamental and realized niches, and competitive exclusion | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**C1 Molecules (Interaction and interdependence)****Enzymes and metabolism** Spec C1.1

| Spec    | What to know (the note)                                                           | Not yet                  | Nearly                   | Confident                |
|---------|-----------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| C1.1.1  | Enzymes as catalysts and their role in metabolism                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.2  | Enzymes as catalysts and their role in metabolism                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.3  | Enzymes as catalysts and their role in metabolism                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.4  | Active sites, induced fit, collisions and denaturation                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.5  | Active sites, induced fit, collisions and denaturation                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.6  | Active sites, induced fit, collisions and denaturation                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.7  | Active sites, induced fit, collisions and denaturation                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.8  | Effects of temperature, pH and substrate concentration                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.9  | Effects of temperature, pH and substrate concentration                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.10 | Effect of enzymes on activation energy                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.11 | Intracellular and extracellular reactions, heat and metabolic pathways<br>HL only | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.12 | Intracellular and extracellular reactions, heat and metabolic pathways<br>HL only | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.13 | Intracellular and extracellular reactions, heat and metabolic pathways<br>HL only | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.14 | Non-competitive and competitive inhibition HL only                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.15 | Non-competitive and competitive inhibition HL only                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.16 | Feedback inhibition and mechanism-based inhibition HL only                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.1.17 | Feedback inhibition and mechanism-based inhibition HL only                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Cell respiration** Spec C1.2

| Spec   | What to know (the note)                   | Not yet                  | Nearly                   | Confident                |
|--------|-------------------------------------------|--------------------------|--------------------------|--------------------------|
| C1.2.1 | ATP: the molecule that distributes energy | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.2.2 | ATP: the molecule that distributes energy | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.2.3 | ATP: the molecule that distributes energy | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C1.2.4 | Cell respiration: aerobic and anaerobic   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec           | What to know (the note)                                           | Not yet                  | Nearly                   | Confident                |
|----------------|-------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>C1.2.5</b>  | Cell respiration: aerobic and anaerobic                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.6</b>  | Variables affecting the rate of cell respiration                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.7</b>  | NAD, oxidation and glycolysis <b>HL only</b>                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.8</b>  | NAD, oxidation and glycolysis <b>HL only</b>                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.9</b>  | Anaerobic respiration: lactate and yeast <b>HL only</b>           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.10</b> | Anaerobic respiration: lactate and yeast <b>HL only</b>           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.11</b> | The link reaction and the Krebs cycle <b>HL only</b>              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.12</b> | The link reaction and the Krebs cycle <b>HL only</b>              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.13</b> | Electron transport chain, chemiosmosis and oxygen <b>HL only</b>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.14</b> | Electron transport chain, chemiosmosis and oxygen <b>HL only</b>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.15</b> | Electron transport chain, chemiosmosis and oxygen <b>HL only</b>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.16</b> | Electron transport chain, chemiosmosis and oxygen <b>HL only</b>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.2.17</b> | Lipids and carbohydrates as respiratory substrates <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## Photosynthesis **Spec C1.3**

| Spec           | What to know (the note)                                                           | Not yet                  | Nearly                   | Confident                |
|----------------|-----------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>C1.3.1</b>  | Photosynthesis: energy, carbon dioxide, water and oxygen                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.2</b>  | Photosynthesis: energy, carbon dioxide, water and oxygen                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.3</b>  | Photosynthesis: energy, carbon dioxide, water and oxygen                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.4</b>  | Separating photosynthetic pigments by chromatography                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.5</b>  | Absorption of light, absorption spectra and action spectra                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.6</b>  | Absorption of light, absorption spectra and action spectra                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.7</b>  | Investigating limiting factors on photosynthesis                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.8</b>  | Carbon dioxide enrichment experiments                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.9</b>  | Photosystems and the photolysis of water <b>HL only</b>                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.10</b> | Photosystems and the photolysis of water <b>HL only</b>                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.11</b> | Photosystems and the photolysis of water <b>HL only</b>                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.12</b> | Chemiosmosis, reduction of NADP and thylakoids <b>HL only</b>                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.13</b> | Chemiosmosis, reduction of NADP and thylakoids <b>HL only</b>                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.14</b> | Chemiosmosis, reduction of NADP and thylakoids <b>HL only</b>                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.15</b> | The Calvin cycle: carbon fixation, triose phosphate and RuBP <b>HL only</b>       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.16</b> | The Calvin cycle: carbon fixation, triose phosphate and RuBP <b>HL only</b>       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.17</b> | The Calvin cycle: carbon fixation, triose phosphate and RuBP <b>HL only</b>       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.18</b> | Making other carbon compounds and interdependence of the reactions <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C1.3.19</b> | Making other carbon compounds and interdependence of the reactions <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## **c2** Cells (Interaction and interdependence)

### Chemical signalling **Spec C2.1**

| Spec          | What to know (the note)                              | Not yet                  | Nearly                   | Confident                |
|---------------|------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>C2.1.1</b> | Receptors, ligands and quorum sensing <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.2</b> | Receptors, ligands and quorum sensing <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.3</b> | Types of signalling chemicals <b>HL only</b>         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec           | What to know (the note)                                              | Not yet                  | Nearly                   | Confident                |
|----------------|----------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>C2.1.4</b>  | Types of signalling chemicals <b>HL only</b>                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.5</b>  | Types of signalling chemicals <b>HL only</b>                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.6</b>  | Transmembrane and intracellular receptors <b>HL only</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.7</b>  | Transmembrane and intracellular receptors <b>HL only</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.8</b>  | Ion channel receptors and G protein-coupled receptors <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.9</b>  | Ion channel receptors and G protein-coupled receptors <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.10</b> | Ion channel receptors and G protein-coupled receptors <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.11</b> | Tyrosine kinase receptors: insulin <b>HL only</b>                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.12</b> | Intracellular receptors and steroid hormones <b>HL only</b>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.13</b> | Intracellular receptors and steroid hormones <b>HL only</b>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.1.14</b> | Positive and negative feedback in cell signalling <b>HL only</b>     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Neural signalling **Spec C2.2**

| Spec           | What to know (the note)                                               | Not yet                  | Nearly                   | Confident                |
|----------------|-----------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>C2.2.1</b>  | Neurons and the resting potential                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.2</b>  | Neurons and the resting potential                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.3</b>  | Nerve impulses as action potentials                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.4</b>  | Speed of nerve impulses                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.5</b>  | Synapses and excitatory postsynaptic potentials                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.6</b>  | Synapses and excitatory postsynaptic potentials                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.7</b>  | Synapses and excitatory postsynaptic potentials                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.8</b>  | Depolarization, repolarization and oscilloscope traces <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.9</b>  | Depolarization, repolarization and oscilloscope traces <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.10</b> | Depolarization, repolarization and oscilloscope traces <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.11</b> | Speed of nerve impulses                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.12</b> | Exogenous chemicals, inhibition and summation <b>HL only</b>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.13</b> | Exogenous chemicals, inhibition and summation <b>HL only</b>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.14</b> | Exogenous chemicals, inhibition and summation <b>HL only</b>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.15</b> | Pain perception and consciousness <b>HL only</b>                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C2.2.16</b> | Pain perception and consciousness <b>HL only</b>                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## **C3** Organisms (Interaction and interdependence)

### Integration of body systems **Spec C3.1**

| Spec          | What to know (the note)                            | Not yet                  | Nearly                   | Confident                |
|---------------|----------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>C3.1.1</b> | System integration and the hierarchy of subsystems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.2</b> | System integration and the hierarchy of subsystems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.3</b> | System integration and the hierarchy of subsystems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.4</b> | The brain, spinal cord, neurons and nerves         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.5</b> | The brain, spinal cord, neurons and nerves         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.6</b> | The brain, spinal cord, neurons and nerves         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.7</b> | The brain, spinal cord, neurons and nerves         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.8</b> | The brain, spinal cord, neurons and nerves         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.9</b> | Pain reflex arcs and the cerebellum                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec           | What to know (the note)                                                         | Not yet                  | Nearly                   | Confident                |
|----------------|---------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>C3.1.10</b> | Pain reflex arcs and the cerebellum                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.11</b> | Melatonin, epinephrine and control by the hypothalamus and pituitary            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.12</b> | Melatonin, epinephrine and control by the hypothalamus and pituitary            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.13</b> | Melatonin, epinephrine and control by the hypothalamus and pituitary            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.14</b> | Feedback control of heart rate and ventilation rate                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.15</b> | Feedback control of heart rate and ventilation rate                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.16</b> | Control of peristalsis by the CNS and enteric nervous system                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.17</b> | Tropic responses in seedlings and positive phototropism <b>HL only</b>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.18</b> | Tropic responses in seedlings and positive phototropism <b>HL only</b>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.19</b> | Phytohormones, auxin efflux carriers and cell growth <b>HL only</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.20</b> | Phytohormones, auxin efflux carriers and cell growth <b>HL only</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.21</b> | Phytohormones, auxin efflux carriers and cell growth <b>HL only</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.22</b> | Auxin and cytokinin interactions, and ethylene in fruit ripening <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.1.23</b> | Auxin and cytokinin interactions, and ethylene in fruit ripening <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Defence against disease **Spec C3.2**

| Spec           | What to know (the note)                       | Not yet                  | Nearly                   | Confident                |
|----------------|-----------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>C3.2.1</b>  | Pathogens as the cause of infectious diseases | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.2</b>  | Skin, mucous membranes and blood clotting     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.3</b>  | Skin, mucous membranes and blood clotting     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.4</b>  | Innate and adaptive immunity, and phagocytes  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.5</b>  | Innate and adaptive immunity, and phagocytes  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.6</b>  | Lymphocytes, antigens and antibody production | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.7</b>  | Lymphocytes, antigens and antibody production | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.8</b>  | Lymphocytes, antigens and antibody production | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.9</b>  | Lymphocytes, antigens and antibody production | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.10</b> | Immunity, vaccines and herd immunity          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.11</b> | HIV transmission and AIDS                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.12</b> | HIV transmission and AIDS                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.13</b> | Antibiotics and antibiotic resistance         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.14</b> | Antibiotics and antibiotic resistance         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.15</b> | Zoonoses and evaluating COVID-19 data         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.16</b> | Immunity, vaccines and herd immunity          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.17</b> | Immunity, vaccines and herd immunity          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C3.2.18</b> | Zoonoses and evaluating COVID-19 data         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## **C4 Ecosystems (Interaction and interdependence)**

### Populations and communities **Spec C4.1**

| Spec          | What to know (the note)                              | Not yet                  | Nearly                   | Confident                |
|---------------|------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>C4.1.1</b> | Populations and random sampling                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.2</b> | Populations and random sampling                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.3</b> | Populations and random sampling                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.4</b> | Capture-mark-release-recapture and the Lincoln index | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec           | What to know (the note)                                | Not yet                  | Nearly                   | Confident                |
|----------------|--------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>C4.1.5</b>  | Carrying capacity and density-dependent factors        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.6</b>  | Carrying capacity and density-dependent factors        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.7</b>  | Population growth curves                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.8</b>  | Population growth curves                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.9</b>  | Intraspecific and interspecific relationships          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.10</b> | Intraspecific and interspecific relationships          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.11</b> | Intraspecific and interspecific relationships          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.12</b> | Mutualism                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.13</b> | Invasive species and testing for competition           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.14</b> | Invasive species and testing for competition           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.15</b> | Invasive species and testing for competition           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.16</b> | Predator-prey relationships and control of populations | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.17</b> | Predator-prey relationships and control of populations | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.1.18</b> | Allelopathy and secretion of antibiotics               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Transfers of energy and matter Spec C4.2

| Spec           | What to know (the note)                                                  | Not yet                  | Nearly                   | Confident                |
|----------------|--------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| <b>C4.2.1</b>  | Ecosystems as open systems and the source of energy                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.2</b>  | Ecosystems as open systems and the source of energy                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.3</b>  | Food chains, food webs and decomposers                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.4</b>  | Food chains, food webs and decomposers                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.5</b>  | Food chains, food webs and decomposers                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.6</b>  | Autotrophs and heterotrophs                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.7</b>  | Autotrophs and heterotrophs                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.8</b>  | Autotrophs and heterotrophs                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.9</b>  | Autotrophs and heterotrophs                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.10</b> | Trophic levels and energy pyramids                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.11</b> | Trophic levels and energy pyramids                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.12</b> | Energy losses between trophic levels                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.13</b> | Energy losses between trophic levels                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.14</b> | Energy losses between trophic levels                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.15</b> | Primary and secondary production                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.16</b> | Primary and secondary production                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.17</b> | The carbon cycle, carbon sinks and combustion                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.18</b> | The carbon cycle, carbon sinks and combustion                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.19</b> | The carbon cycle, carbon sinks and combustion                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.20</b> | The Keeling Curve                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.21</b> | Interdependence of autotrophs and heterotrophs and recycling of elements | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>C4.2.22</b> | Interdependence of autotrophs and heterotrophs and recycling of elements | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## D1 Molecules (Continuity and change)

### DNA replication Spec D1.1

| Spec   | What to know (the note)                                          | Not yet                  | Nearly                   | Confident                |
|--------|------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D1.1.1 | Exact copies by semi-conservative replication                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.1.2 | Exact copies by semi-conservative replication                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.1.3 | Roles of helicase and DNA polymerase                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.1.4 | PCR and gel electrophoresis                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.1.5 | Applications of PCR and gel electrophoresis                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.1.6 | Directionality: leading and lagging strands <span>HL only</span> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.1.7 | Directionality: leading and lagging strands <span>HL only</span> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.1.8 | Replication enzymes and DNA proofreading <span>HL only</span>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.1.9 | Replication enzymes and DNA proofreading <span>HL only</span>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Protein synthesis Spec D1.2

| Spec    | What to know (the note)                                                       | Not yet                  | Nearly                   | Confident                |
|---------|-------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D1.2.1  | Transcription and gene expression                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.2  | Transcription and gene expression                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.3  | Transcription and gene expression                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.4  | Transcription and gene expression                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.5  | Translation at the ribosome                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.6  | Translation at the ribosome                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.7  | Translation at the ribosome                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.8  | The genetic code                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.9  | The genetic code                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.10 | Translation at the ribosome                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.11 | Mutations that change protein structure                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.12 | Directionality and initiation at the promoter <span>HL only</span>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.13 | Directionality and initiation at the promoter <span>HL only</span>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.14 | Non-coding DNA, mRNA processing and alternative splicing <span>HL only</span> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.15 | Non-coding DNA, mRNA processing and alternative splicing <span>HL only</span> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.16 | Non-coding DNA, mRNA processing and alternative splicing <span>HL only</span> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.17 | Initiation of translation and the A, P and E sites <span>HL only</span>       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.18 | Modification of polypeptides and proteasomes <span>HL only</span>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.2.19 | Modification of polypeptides and proteasomes <span>HL only</span>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Mutation and gene editing Spec D1.3

| Spec   | What to know (the note)                                       | Not yet                  | Nearly                   | Confident                |
|--------|---------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D1.3.1 | Substitutions, insertions and deletions                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.3.2 | Substitutions, insertions and deletions                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.3.3 | Substitutions, insertions and deletions                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.3.4 | Causes of mutation and randomness                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.3.5 | Causes of mutation and randomness                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.3.6 | Germ and somatic cells, and mutation as a source of variation | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.3.7 | Germ and somatic cells, and mutation as a source of variation | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.3.8 | Gene knockout <span>HL only</span>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec    | What to know (the note)                                 | Not yet                  | Nearly                   | Confident                |
|---------|---------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D1.3.9  | CRISPR-Cas9 gene editing <b>HL only</b>                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D1.3.10 | Conserved and highly conserved sequences <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## D2 Cells (Continuity and change)

### Cell and nuclear division **Spec D2.1**

| Spec    | What to know (the note)                                 | Not yet                  | Nearly                   | Confident                |
|---------|---------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D2.1.1  | Cell division and cytokinesis                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.2  | Cell division and cytokinesis                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.3  | Cell division and cytokinesis                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.4  | Mitosis, meiosis and chromosome movement                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.5  | Mitosis, meiosis and chromosome movement                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.6  | Mitosis, meiosis and chromosome movement                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.7  | Phases of mitosis                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.8  | Phases of mitosis                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.9  | Meiosis, non-disjunction and variation                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.10 | Meiosis, non-disjunction and variation                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.11 | Meiosis, non-disjunction and variation                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.12 | Cell proliferation and the cell cycle <b>HL only</b>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.13 | Cell proliferation and the cell cycle <b>HL only</b>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.14 | Cell proliferation and the cell cycle <b>HL only</b>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.15 | Cell proliferation and the cell cycle <b>HL only</b>    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.16 | Mutations, tumours and the mitotic index <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.1.17 | Mutations, tumours and the mitotic index <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Gene expression **Spec D2.2**

| Spec    | What to know (the note)                                          | Not yet                  | Nearly                   | Confident                |
|---------|------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D2.2.1  | Gene expression and its regulation <b>HL only</b>                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.2.2  | Gene expression and its regulation <b>HL only</b>                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.2.3  | Gene expression and its regulation <b>HL only</b>                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.2.4  | Epigenesis, the transcriptome and epigenetic tags <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.2.5  | Epigenesis, the transcriptome and epigenetic tags <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.2.6  | Epigenesis, the transcriptome and epigenetic tags <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.2.7  | Epigenetic inheritance and the environment <b>HL only</b>        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.2.8  | Epigenetic inheritance and the environment <b>HL only</b>        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.2.9  | Epigenetic inheritance and the environment <b>HL only</b>        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.2.10 | Epigenetic inheritance and the environment <b>HL only</b>        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.2.11 | External factors and gene expression <b>HL only</b>              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Water potential **Spec D2.3**

| Spec   | What to know (the note)                | Not yet                  | Nearly                   | Confident                |
|--------|----------------------------------------|--------------------------|--------------------------|--------------------------|
| D2.3.1 | Solvation and osmosis                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.3.2 | Solvation and osmosis                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.3.3 | Solvation and osmosis                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.3.4 | Osmosis in plant tissue: the practical | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec    | What to know (the note)                        | Not yet                  | Nearly                   | Confident                |
|---------|------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D2.3.5  | Water movement in cells with and without walls | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.3.6  | Water movement in cells with and without walls | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.3.7  | Water movement in cells with and without walls | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.3.8  | Water potential <b>HL only</b>                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.3.9  | Water potential <b>HL only</b>                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.3.10 | Water potential <b>HL only</b>                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D2.3.11 | Water potential <b>HL only</b>                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## D3 Organisms (Continuity and change)

### Reproduction **Spec D3.1**

| Spec    | What to know (the note)                                               | Not yet                  | Nearly                   | Confident                |
|---------|-----------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D3.1.1  | Sexual and asexual reproduction                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.2  | Sexual and asexual reproduction                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.3  | Male and female sexes and human reproductive systems                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.4  | Male and female sexes and human reproductive systems                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.5  | Ovarian and uterine cycles and their hormones                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.6  | Fertilization in humans and hormones in IVF                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.7  | Fertilization in humans and hormones in IVF                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.8  | Sexual reproduction in flowering plants and insect-pollinated flowers | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.9  | Sexual reproduction in flowering plants and insect-pollinated flowers | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.10 | Cross-pollination and self-incompatibility                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.11 | Cross-pollination and self-incompatibility                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.12 | Seed dispersal and germination                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.13 | Puberty, spermatogenesis and oogenesis <b>HL only</b>                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.14 | Puberty, spermatogenesis and oogenesis <b>HL only</b>                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.15 | Preventing polyspermy, the blastocyst and implantation <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.16 | Preventing polyspermy, the blastocyst and implantation <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.17 | Pregnancy testing and the placenta <b>HL only</b>                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.18 | Pregnancy testing and the placenta <b>HL only</b>                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.19 | Hormones in pregnancy and childbirth, and HRT <b>HL only</b>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.1.20 | Hormones in pregnancy and childbirth, and HRT <b>HL only</b>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Inheritance **Spec D3.2**

| Spec   | What to know (the note)                                        | Not yet                  | Nearly                   | Confident                |
|--------|----------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D3.2.1 | Haploid gametes, diploid zygotes and genetic crosses in plants | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.2 | Haploid gametes, diploid zygotes and genetic crosses in plants | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.3 | Genotype, phenotype, dominance and phenotypic plasticity       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.4 | Genotype, phenotype, dominance and phenotypic plasticity       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.5 | Genotype, phenotype, dominance and phenotypic plasticity       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.6 | Genotype, phenotype, dominance and phenotypic plasticity       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.7 | Phenylketonuria, SNPs, multiple alleles and ABO blood groups   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.8 | Phenylketonuria, SNPs, multiple alleles and ABO blood groups   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.9 | Phenylketonuria, SNPs, multiple alleles and ABO blood groups   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec    | What to know (the note)                                                 | Not yet                  | Nearly                   | Confident                |
|---------|-------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D3.2.10 | Incomplete dominance and codominance                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.11 | Sex determination, sex linkage and haemophilia                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.12 | Sex determination, sex linkage and haemophilia                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.13 | Pedigree charts                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.14 | Continuous variation and box-and-whisker plots                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.15 | Continuous variation and box-and-whisker plots                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.16 | Segregation, independent assortment and dihybrid crosses <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.17 | Segregation, independent assortment and dihybrid crosses <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.18 | Gene loci, autosomal linkage and recombinants <b>HL only</b>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.19 | Gene loci, autosomal linkage and recombinants <b>HL only</b>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.20 | Gene loci, autosomal linkage and recombinants <b>HL only</b>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.2.21 | Chi-squared test on dihybrid cross data <b>HL only</b>                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## Homeostasis **Spec D3.3**

| Spec    | What to know (the note)                                                 | Not yet                  | Nearly                   | Confident                |
|---------|-------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D3.3.1  | Homeostasis and negative feedback                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.3.2  | Homeostasis and negative feedback                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.3.3  | Regulation of blood glucose                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.3.4  | Type 1 and type 2 diabetes                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.3.5  | Thermoregulation                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.3.6  | Thermoregulation                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.3.7  | The kidney: excretion, ultrafiltration and reabsorption <b>HL only</b>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.3.8  | The kidney: excretion, ultrafiltration and reabsorption <b>HL only</b>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.3.9  | Loop of Henle and osmoregulation in the collecting ducts <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.3.10 | Loop of Henle and osmoregulation in the collecting ducts <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D3.3.11 | Changes in blood supply to organs with activity <b>HL only</b>          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## **D4** Ecosystems (Continuity and change)

### Natural selection **Spec D4.1**

| Spec    | What to know (the note)                                                                | Not yet                  | Nearly                   | Confident                |
|---------|----------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D4.1.1  | Natural selection as the mechanism of evolution                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.2  | Mutation and sexual reproduction as sources of variation                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.3  | Overproduction, competition and selection pressures                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.4  | Overproduction, competition and selection pressures                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.5  | Overproduction, competition and selection pressures                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.6  | Natural selection as the mechanism of evolution                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.7  | Sexual selection and Endler's guppies                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.8  | Sexual selection and Endler's guppies                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.9  | Gene pools and allele frequencies <b>HL only</b>                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.10 | Gene pools and allele frequencies <b>HL only</b>                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.11 | Gene pools and allele frequencies <b>HL only</b>                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.12 | Directional, disruptive and stabilizing selection; artificial selection <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.13 | The Hardy-Weinberg equation and its conditions <b>HL only</b>                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Spec    | What to know (the note)                                                                | Not yet                  | Nearly                   | Confident                |
|---------|----------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D4.1.14 | The Hardy-Weinberg equation and its conditions <b>HL only</b>                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.1.15 | Directional, disruptive and stabilizing selection; artificial selection <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Stability and change **Spec D4.2**

| Spec    | What to know (the note)                                                        | Not yet                  | Nearly                   | Confident                |
|---------|--------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D4.2.1  | Stability of natural ecosystems                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.2  | Stability of natural ecosystems                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.3  | Amazon deforestation as a possible tipping point                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.4  | Mesocosms and keystone species                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.5  | Mesocosms and keystone species                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.6  | Sustainable harvesting and agriculture                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.7  | Sustainable harvesting and agriculture                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.8  | Eutrophication                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.9  | Biomagnification of pollutants                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.10 | Microplastic and macroplastic pollution of the oceans                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.11 | Rewilding                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.12 | Ecological succession and primary succession <b>HL only</b>                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.13 | Ecological succession and primary succession <b>HL only</b>                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.14 | Cyclical succession, climax communities and arrested succession <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.2.15 | Cyclical succession, climax communities and arrested succession <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Climate change **Spec D4.3**

| Spec    | What to know (the note)                                               | Not yet                  | Nearly                   | Confident                |
|---------|-----------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|
| D4.3.1  | Anthropogenic causes and positive feedback                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.3.2  | Anthropogenic causes and positive feedback                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.3.3  | Boreal forest tipping point and polar habitat change                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.3.4  | Boreal forest tipping point and polar habitat change                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.3.5  | Nutrient upwelling and threats to coral reefs                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.3.6  | Poleward and upslope range shifts                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.3.7  | Nutrient upwelling and threats to coral reefs                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.3.8  | Afforestation, forest regeneration and peatland restoration           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.3.9  | Phenology and disrupted synchrony <b>HL only</b>                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.3.10 | Phenology and disrupted synchrony <b>HL only</b>                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.3.11 | Insect life cycles and evolution due to climate change <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| D4.3.12 | Insect life cycles and evolution due to climate change <b>HL only</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |