Plants and Ecology

Core Lesson 1	Option lesson 1a	Option lesson 1b	Option lesson 1c	Core Lesson 2	Option lesson 2a	Core Lesson 3
1 ¼ hours	40-50 minutes	30-40 minutes	40 – 50 minutes	1 hour	1 hour	1 – 1 ¼ hours
Life cycle of plants	What liquids do seeds germinate in	How do plants stop self fertilisation	What conditions cause germination	Plant growth	Hydroponics	Competition and co-operation
Biology Objectives Pupils develop their understanding of plant reproductive organs and of sex cells. They use a flow diagram of the basic cycle, and describe fertilisation as the fusion of the nucleus of a male sex cell to the nucleus of a female sex cell.	**Biology Objectives**	**Biology Objectives**	**Biology Objectives**	**Biology Objectives** Pupils develop the idea that all plants are made up of cells, tissues and organs and investigate some of the environmental factors that influence plant growth.	**Biology Objectives**	**Biology Objectives** Pupils learn about the factors that affect the size of populations in a food web, that organisms with better adaptations are more successful in competing for resources and survive longer to pass on these advantages, and the use of predators to control pest populations.
Key concepts and processes Pupils use microscopes to measure the length of pollen tubes at different stages of germination, and use their data to say when a pollen tube would reach the ovary of their plant.	**Key concepts and processes** Pupils plan and carry out a fair-testing enquiry to investigate the best liquid for seed germination, draw conclusions from graphs and relate the findings to predictions made from their preliminary research.	**Key concepts and processes** Pupils use a model flower they have made themselves to explain how having variation in stigma and style length helps prevent self fertilisation in flowers.	**Key concepts and processes** Pupils devise and carry out a method to find out the optimum conditions for germination of seeds and use scientific knowledge to draw conclusions from their evidence.	**Key concepts and processes** Pupils plan and carry out a fair-test enquiry into a particular factor that affects plant growth, plot line graphs and analyse findings. This investigation will need to run over 2-3 weeks.	**Key concepts and processes** Pupils devise a test to find out the best combination and strength of minerals for hydroponically growing plants. They explain the importance of this application of science.	**Key concepts and processes** A food web simulation is used to raise questions and test hypotheses in different contexts. The model allows pupils to rapidly plot data to help show patterns clearly.
PLTS - Support conclusions, using reasoned arguments and evidence, by using their observations and data to describe how fertilisation happens	**PLTS** - Work towards goals, showing initiative, commitment and perseverance by setting suitable question/s to pursue, deciding on an approach, following appropriate procedures and arriving at an outcome that meets their target/s	**PLTS** - Work towards goals, showing initiative, commitment and perseverance by choosing materials to design a model flower to describe and explain how self-fertilisation is prevented in plants	**PLTS** - Identify questions to answer and problems to resolve by planning and carrying out a test to find the optimum conditions for germinating seeds	**PLTS** - questions to answer and problems to resolve by choosing variables to frame a question for a plant growth enquiry	**PLTS** - Identify questions to answer and problems to resolve by planning and carrying out a test to find the optimum conditions for hydroponically growing plants	**PLTS** - Analyse and evaluate information, judging its relevance and value, by analysing data from a food web model, using it to support conclusions and recognising its limitations
Technician's notes depending on season: vegetable seeds, germinating plants and the fruit; flowers with large stamens and ovaries; same species flowers at different stages o maturity /pollen production; seedheads lily plants and prepared cavity slides with cover slips of lily pollen in 10% sugar solution to show pollen tube growth at 1-, 2- and 3-hour intervals, labelled with time since preparation, compound microscopes with eyepiece graticules, dividers (See also http://www.saps.ptantsci.cam.ac.uk/pollen/pollen2.htm for other pollen to use.)				**Technician's notes** Rapid-cycling brassicas have a life cycle of approximately 40 days. You will need a supply of germinated plants for the Explore and Extend phase of this lesson. Brassica seedlings, soil, light banks, data loggers for temperature, light, moisture, thermometers, seed trays or pots, clingfilm to cover seed trays (SAPS suggest a low-cost propagator at http://www-saps.pLantsci.cam.ac.uk/worksheets/activ/bri.htm)		**Technician's notes** Cardboard, sellotape, previously photocopied rabbit ears and fox head template (the rabbit ears need to be of assorted sizes so some pupils will receive smaller ears than others), computer access No running is involved: the fox looks at the rabbits and taps on the shoulder those with smaller ears.

Assessment: During each lesson each student should assess their own level using the pupil speak level ladders and show their partner where the evidence is for that level. They should record this in the grid at the front of the book. The member of staff should then assess the level of a maximum of 2 students work each lesson. At the end of each lesson there will be an end of topic test to check the content level.
Homework: For each topic there is a task booklet that students should use for homework.

Option lesson 3a	Option lesson 3b	Core Lesson 4	Option lesson 4a	Core Lesson 5	Option lesson 5a	Option lesson 5b
50 minutes	1 hour	1-2 hours	1 hour	1 ¼ hours	40-50 minutes	40-50 minutes
Biological control	Co-operative animal behaviour	Human impact on food chains	Is organic farming better for wildlife	Adsorbing nutrients	Digestion of Starch	Sports Drinks
Biology Objectives	**Biology Objectives**	**Biology Objectives** Pupils learn that maximising human food production has benefits but also drawbacks, with impacts on wildlife through habitat loss and the effect of pesticides and herbicides on organisms higher in the food chain.	**Biology Objectives**	**Biology Objectives** Pupils understand some nutrients are made of large molecules that need to be chemically broken into small molecules to enable them to be absorbed into the bloodstream. They describe the function of organs and cell structures in the digestive system in nutrition.	**Biology Objectives**	**Biology Objectives**
Key concepts and processes Pupils apply knowledge of food chains to biological pest control and communicate scientific information on the advantages and disadvantages, explaining why it is considered a natural alternative to chemical pesticides and the possible implications to the environment of importing nonnative organisms.	**Key concepts and processes** Pupils find out how simple co-operative behaviours among predators or prey can benefit survival of the species. They plan and carry out a research enquiry in an area of personal interest, selecting sources of scientific information and appreciating that different explanations of observed behaviour may arise from preconceived ideas about animal behaviour. They use scientific ideas to explain why the behaviour is beneficial to survival.	**Key concepts and processes** Pupils evaluate secondary evidence on the issue of decline of wildlife populations, deciding whether there is a causal link with herbicide and pesticide use. They use data and scientific ideas to support recommendations for managing a population.	**Key concepts and processes** Pupils plan and carry out a research enquiry on the principles of organic farming, selecting sources of reliable information and using scientific ideas to explain why it is beneficial to wildlife.	**Key concepts and processes** Pupils use models and analogies to describe how enzymes aid digestion and how partially permeable membranes allow absorption of molecules across the gut wall. They identify strengths and weaknesses of the model.	**Key concepts and processes** Pupils investigate temperature as a variable in digestion and look for a pattern in their results. They draw conclusions in terms of human body temperature and draw on abstract ideas to explain their conclusions in terms of a particle model and energy transfer.	**Key concepts and processes** Pupils investigate the claim that sports drinks are better than water for rehydration after exercise, by identifying scientific data that supports the claim. They select sources of information and use their knowledge of digestion and absorption to explain the conclusion drawn from the data.
PLTS - Explore issues, events or problems from different perspectives by finding out about biological methods of pest control vs pesticide use	**PLTS** - Analyse and evaluate information, judging its relevance and value, by carefully distinguishing between subjective and objective observations to explain how social behaviour aids survival	**PLTS** - Analyse and evaluate information, judging its relevance and value, by analysing information from a herbicide impact study, using it to support conclusions and suggest solutions	**PLTS** - Consider the influence of circumstances, beliefs and feelings on decisions and events by taking into account that not all farmers will wish to go organic because yields are less, or consumers find it too expensive	**PLTS** - Support conclusions, using reasoned arguments and evidence, by explaining how the model gut is an analogy of a real gut and where this analogy breaks down	**PLTS** - Analyse and evaluate information, judging its relevance and value by explaining how the model simulates the digestive process while recognizing where the model breaks down	**PLTS** - Identify questions to answer and problems to resolve by investigating the claim that sports drinks are better than water for rehydration after exercise
Technician's notes		**Technician's notes**		**Technician's notes** 1% starch solution, 1% amylase solution, Visking tubing tied at one end, cotton or thread, 100cm^3 beakers, 0.1M iodine solution in dropper bottle, spotting tile, dropping pipette, Benedict's solution (see CLEAPSS recipe card 18) or glucose dip sticks (Clinistix), 400cm^3 glass beakers for water bath, boiling tubes and rack, kettle to provide hot water, stopwatches.	**Technician's notes** As core lesson 1	

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Core lesson 6	Option lesson 6a	Option lesson 6b	Option lesson 6c
1 ½ hour	40-50 minutes	20-30 minutes	20-30 minutes
Specialised Organs	How is the small intestine specialized?	What is colour blindness?	How big is my blind spot?
Biology Objectives Pupils understand that groups of specialised cells form tissues, that tissues can form organs, and that groups of organs form organ systems. They learn that external stimuli are detected by particular cells and that these sensor cells are grouped into specialised tissues. They explain how the specialisation of cells supports life processes.	**Biology Objectives**	**Biology Objectives**	**Biology Objectives**
Key concepts and processes Pupils make a 3D anatomical model of the structures in the eye and use their model to produce a report or presentation explaining how the tissues and specialised cells help the eye perform its function	**Key concepts and processes** Pupils make an annotated diagram or model to describe and explain how the small intestine is specialised for absorption.	**Key concepts and processes** Pupils find out about colour blindness and produce a report to explain what it is, using scientific vocabulary about specialised cells. They report on some of the implications of the condition.	**Key concepts and processes** Pupils calculate the diameter of their blind spot by following a given method as a team.
PLTS - Connect their own and others' ideas and experiences in inventive ways by sharing ideas about realistic or appropriate materials for making their model	**PLTS** - Try out alternatives or new solutions and follow ideas through by making a diagram or a model of the small intestine to explain the processes of digestion and absorption	**PLTS** - Organise time and resources, prioritising actions by setting targets and managing time to complete a report explaining colour blindness	**PLTS** - Collaborate with others to work towards common goals by working together to accurately measure, record and explain the blind spot
Technician's notes Suggested materials for model eye (pupils could come up with their own ideas): paper, scissors, tape, glue, clingfilm, red and yellow wool, zipped plastic sandwich bag, bubble wrap with large bubbles. Digital cameras for pupils to record their model in their presentation. Optional Model eye demonstration with fluorescein in flask			**Technician's notes**

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