# Planning Support Booklet

**J247, J250**

**For first teaching in 2016**

This support material booklet is designed to accompany the OCR GCSE (9-1) specification in Biology A and Combined Science A (Gateway Science).

***DISCLAIMER***

This resource was designed using the most up to date information from the specification at the time it was published. Specifications are updated over time, which means there may be contradictions between the resource and the specification, therefore please use the information on the latest specification at all times.If you do notice a discrepancy please contact us on the following email address: [resources.feedback@ocr.org.uk](mailto:resources.feedback@ocr.org.uk)

# Introduction

This support material is designed to accompany the OCR GCSE (9-1) specification for first teaching from September 2016 for:

* [Biology A (Gateway Science – J247)](http://www.ocr.org.uk/Images/234594-specification-accredited-gcse-gateway-science-suite-biology-a-j247.pdf)
* [Combined Science A (Gateway Science – J250)](http://www.ocr.org.uk/Images/234596-specification-accredited-gcse-gateway-science-suite-combined-science-a-j250.pdf)

The Planning Guidance table on the following pages sets out suggested teaching times for the topics within the specification. Note that we always recommend that individual centres plan their schemes of work according to their individual needs. Actual teaching times for topics will depend on the amount of practical work done within each topic and the emphasis placed on development of practical skills in various areas, as well as use of contexts, case studies and other work to support depth of understanding and application of knowledge and understanding. It will also depend on the level of prior knowledge and understanding that learners bring to the course.

The table follows the order of the topics in the specification. It is not implied that centres teach the specification topics in the order shown, centres are free to teach the specification in the order that suites them.

## Delivery guides

The column ‘Delivery guides’ refers to individual teacher guides available from the [GCSE (9–1) Biology A](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-biology-a-j247-from-2016/) and [Combined Science A](http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-combined-science-a-j250-from-2016/) qualification pages.

These Delivery guides provide further guidance and suggestions for teaching of individual topics, including links to a range of activities that may be used and guidance on resolving common misconceptions.

## Practical work

Specification topic p7 (Practical skills) is not included explicitly in the Planning Guidance table. The expectation is that the practical skills are developed throughout the course and in support of conceptual understanding.

Suggestions for where the PAG techniques can be are included throughout the table. This is by no means and exhaustive list of potential practical activities.

| Topic | Teaching hours Separate / Combined | Delivery guides | PAG opportunities |
| --- | --- | --- | --- |
| **Topic 1: Cell level systems** | | | |
| B1.1 Cell structures | 3.0 / 3.0 | Cell level systems – delivery guide | PAG B1: Microscopy – investigation of a range of cells  PAG B6: Physiology, responses respiration – Investigation of cytoplasmic streaming in Elodea spp.  PAG B7: Microbiological techniques – Preparation of cheek cell slides |
| B1.2 What happens in cells (and what do cells need)? | 6.5 / 4.0 | Cell level systems – delivery guide | PAG B1: Microscopy – observation of mitosis in root tip cells  PAG B2: Testing for biological molecules – Investigation of DNA extraction from a living organism  PAG B2: Testing for biological molecules – Investigations of enzyme activity  PAG B2: Testing for biological molecules – Investigation into the effect of amylase on a baby rice paste  PAG B4: Rates of enzyme controlled reactions – Investigation into the effect of amylase  on a baby rice paste  PAG B4: Rates of enzyme controlled reactions including numerical analysis of data and graphical representation of results |
| B1.3 Respiration | 5.5 / 5.0 | Cell level systems – delivery guide | PAG B2: Testing for biological molecules – Investigation into respiration  PAG B6: Physiology, responses respiration – research into whether plants respire  PAG B6: Physiology, responses respiration – investigation into aerobic and anaerobic respiration using fungi |
| B1.4 Photosynthesis | 6.0 / 5.0 | Cell level systems – delivery guide | PAG B2: Testing for biological molecules – Investigation into photosynthesis  PAG B5: Photosynthesis – Investigation of photosynthesis in algae using alginate beads  PAG B5: Photosynthesis – Investigation of photosynthesis e.g. the Priestley experiment using Cabomba to collect oxygen or the Ingenhousz experiment to show mass gain  PAG B5: Photosynthesis – Experiments to show the consequences of light exclusion on photosynthesising plants  PAG B5: Photosynthesis – Investigation of photosynthesis in algae using alginate beads to immobilize the algae |
| **Total for topic 1 = 21.0 / 17 hours** | | | |
| **Topic B2: Scaling up** | | | |
| B2.1 Supplying the cell | 6.0 / 5.0 | Scaling up – delivery guide | PAG B6: Physiology, responses respiration – Investigation of ‘creaming yeast’ to show osmosis  PAG B6: Physiology, responses respiration – Investigation into changes in mass of vegetable chips when placed in sucrose/salt concentrations of varying concentrations  PAG B8: Transport in and out of cells – Investigation into changes in mass of vegetable chips when placed in sucrose/salt concentrations of varying concentrations |
| B2.2 The challenges of size | 9.0 / 9.0 | Scaling up – delivery guide | PAG B1: Microscopy – investigation of a blood smear/blood vessels  PAG B1: Microscopy – Examination of root hair cells  PAG B1: Microscopy – Measurement of plant stomatal density  PAG B1: Microscopy – Investigation of the position of the xylem/phloem in root, stem and leaf tissues  PAG B6: Physiology, responses respiration – Measurement of plant stomatal density and opening  PAG B6: Physiology, responses respiration – investigations into environmental factors that affect water uptake in plants |
| **Total for topic 2 = 15.0 / 14.0 hours** | | | |
| **Topic B3: Organism level systems** | | | |
| B3.1 Coordination and control – the nervous system | 7.0 / 3.0 | Organism level – delivery guide systems | PAG B6: Physiology, responses respiration – Research into reflexes/reaction times |
| B3.2 Coordination and control – the endocrine system | 8.0 / 5.0 | Organism level systems – delivery guide | PAG B6: Physiology, responses respiration – Investigation of the effects of phototropism using seedlings |
| B3.3 Maintaining internal environments | 9.0 / 4.0 | Organism level systems – delivery guide | PAG B8: Transport in and out of cells – Demonstration of the different water potentials on different cells |
| **Total for topic 3 = 24.0 / 12.0 hours** | | | |
| **Topic B4: Community level systems** | | | |
| B4.1 Ecosystems | 9.0 / 5.0 | Community level systems – delivery guide | PAG B1: – Examination of the roots of a leguminous plant  PAG B3: Sampling techniques – Investigation of the holly leaf miner or the horse-chestnut leaf miner (Cameraria ohridella)  PAG B3: Sampling techniques – Identification of the biotic factors in an ecosystem using sampling techniques  PAG B4: Rates of enzyme controlled reactions – Investigation of the most favourable conditions for composting  PAG B7: Microbiological techniques – Investigation of the most favourable conditions for composting |
| **Total for topic 4 = 9.0 / 5.0 hours** | | | |
| **Topic B5: Genes, inheritance and selection** | | | |
| B5.1 Inheritance | 12.0 / 9.0 | Genes, inheritance and selection – delivery guide |  |
| B5.2 Natural selection and evolution | 6.0 / 4.0 | Genes, inheritance and selection – delivery guide |  |
| **Total for topic 5 = 18.0 / 13.0 hours** | | | |
| **Topic 6 Global challenges** | | | |
| B6.1 Monitoring and maintaining the environment | 5.0 / 4.0 | Monitoring and maintaining the environment – topic exploration pack | PAG B3: Sampling techniques – Investigation into the effects of lichen distribution against pollution  PAG B3: Sampling techniques – Investigation into the effectiveness of germination in different strengths of acid rain  PAG B3: Sampling techniques – Investigation of ecological sampling methods |
| B6.2 Feeding the human race | 6.0 / 3.0 | Feeding the human race – topic exploration pack |  |
| B6.3 Monitoring and maintaining health | 22.0 / 16.0 | Monitoring and maintaining health – topic exploration pack | PAG B7: Microbiological techniques – Investigation into growth bacterial cultures using aseptic techniques |
| **Total for topic 6 = 33.0 / 23.0 hours** | | | |

**Total teaching hours = 120 hours / 84 hours**

# Outline Scheme of Work: B4: Community level systems

## Suggested teaching time for chapter: 9 hours biology/5 hours combined science

## B4.1 Ecosystems

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 | B4.1a Recall that many different materials cycle through the abiotic and biotic components of an ecosystem to include examples of cycled materials e.g. nitrogen and carbon.  B4.1b Explain the role of microorganisms in the cycling of materials through an ecosystem the role of microorganisms in decomposition. | **Starter**  The video clip for the 'Circle of life' song at the start of the Disney film 'The Lion King'. This can be played as learners arrive at the classroom and settle at their desks.  <https://www.youtube.com/watch?v=GibiNy4d4gc>  List what is recycled in nature students could be asked different questions and told to come up with an answer e.g. what happens to a buried human, where do the leaves go after autumn, with all these animals egesting why are we not knee deep faeces, why do plants like lightning, what do fungi do.  **Main**  Learn the nitrogen cycle. There are a number of methods to do this. <http://www.windows2universe.org/teacher_resources/nitrogen_main.html> works well.  One problem with the nitrogen cycle is that there is no standard nitrogen cycle. There are numerous ones on the web, within text books and even between years from an exam board. One activity could be to present students with a number of different examples and give the learners time to come up with a standard version. They can then present this to the class and justify their attempt.  Another approach is to get students into groups and have a nitrogen cycle outside the class. Give the learners one minute each to look at the diagram then return back to the team and copy the diagram. Every member of the group needs to go up.  There are a number of resources on the website for this e.g. The nitrogen cycle student activity.  **Additional resources:**  Lesson plan covering the stages of the nitrogen cycle. Learners role play being atoms of nitrogen gas moving around the nitrogen cycle dependent on the roll of a die. <https://scied.ucar.edu/activity/nitrogen-cycle-game>  Learners culture a free-living nitrogen-fixing bacterium from the soil on nitrogen rich and nitrogen free agar. Technician and teacher information included in addition to a learner worksheet containing instructions and questions. <https://practicalbiology.org/environment/nitrogen-cycle>  A very clear animation showing the different stages of the nitrogen cycle. <https://www.pbslearningmedia.org/resource/lsps07.sci.life.eco.nitrogen/the-nitrogen-cycle/> |  |

| Lesson | Statements | Teaching activities | | Notes |
| --- | --- | --- | --- | --- |
|  |  | | **Plenary**  Give the students a nitrogen cycle diagram with the processes removed and get them to label the processes and associated microbes.  **Homework**  Research into the range of ecosystems and examples of micro-organisms that act as decomposers within them.  Get students to get 2l fizzy drink bottles for lesson 2. |  |

| Lesson | Statements | Teaching activities | Notes | |
| --- | --- | --- | --- | --- |
| 2 | B4.1c Explain the importance of the carbon cycle and the water cycle to living organisms to include: maintaining habitats, fresh water flow of nutrients. | **Starter**  Using one of the nitrogen cycles generated from lesson 1 cover some of the features and get the learners to identify the blanks.  **Main**  Obtain 2l fizzy drinks bottles and learners can use them to start their own brine shrimp (Artemia) bottle biosphere. A suitable example practical can be found here: <https://www.brineshrimpdirect.com/about-us/articles/brine-shrimp-hatching-instructions-equipment/>  Live brine shrimps can be purchased from aquatic shops and used to produce a demo bottle. This bottle should be sealed and can be used to discuss that algae photosynthesise to produce oxygen and food for the shrimp. The shrimp produce faeces and carbon dioxide for the algae.  Learners could use the demo bottle to produce a carbon cycle. This, behind a sealed system, students can suggest what happen to the levels of carbon dioxide in the bottle.  Discuss fossil fuel combustion and what that is doing to the levels of CO2 in the biosphere.  **Alternative**:  Lesson plan including background information about the cycling of carbon and a practical activity releasing carbon dioxide can be found here: <https://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_carbon/cub_carbon_lesson01_activity1.xml>  1. Learners read through the ‘Student background reading sheet' and highlight the key points.  2. Carry out the practical activity and complete the worksheet.  3. Using the ‘Student background reading sheet' learners draw a cartoon strip of a carbon atom moving through the ecosystem. Lower ability learners draw the route through the fern, fossil fuel and combustion. Higher ability learners draw the route through the fern, dinosaur, ocean, marine animal shell, chalk cliffs etc.  In pairs learners explain their cartoon to each other.  4. Answer the questions in pairs at the end of the worksheet.  **Plenary**  Design a carbon cycle  **Homework**  Research into the water cycle and its importance in maintaining freshwater habitats. A suitable starting web site which gives a link to a simple animation of the water cycle and to instructions on how to make a very quick and simple mini water cycle with just a bowl, cup, elastic band, cling film and water. Very good for lower ability learners is: <https://thewaterproject.org/resources/the_water_cycle> | * Experiments with brine shrimps can be done for example learners can investigate the hatching of shrimp eggs at different salt concentrations. Using different strength salt concentrations (either side of the optimum) 20 eggs could be added into each solution and the hatching rate calculated. This can be used to prove the skill Safe and ethical use of living organisms (plants or animals) to measure physiological functions and responses to the environment |
|  |  |  |  |
| Lesson | Statements | Teaching activities | Notes |
| 3 | B4.1dExplain the effect of factors such as temperature, water content, and oxygen availability on rate of decomposition to include: the terms aerobic and anaerobic. | **Starter**  Get learners into groups and to list the biological uses of water – list all that they can think of ideas could be habitat (fish), frozen water floats and can be a habitat (polar bears), needed for hydrolysis, produced during condensation reaction, hydration, major component of the body etc.  **Main**  Get students to research a definition for decomposition and senescence. Point out that senescence is done by the organism and that decomposition is done to the organism.  Design an experiment to investigate what can speed up slow down the process of decomposition ensuring that the item decomposing is not senescing.  Set up the experiment.  **Alternative:**  Lesson plan giving instruction on how learners can plan and carry out a practical to find the effect different factors such as temperature, light and water content have on the decomposition of a piece of carrot. <https://www.teachengineering.org/view_activity.php?url=collection/duk_/activities/duk_decomposers_mary_act/duk_decomposers_mary_act.xml>  **Plenary**  How is food preserved and how does the method prevent the decomposition?  **Homework**  Define the terms biotic and abiotic. | * Maths skills M1c, M2c, M4a, M4c * Working scientifically WS1.1b, WS1.1h, WS1.2b, WS1.2c, WS1.2e, WS1.3a, WS1.3b, WS1.3c, WS1.3d, WS1.3e, WS1.3f, WS1.3g, WS2a, WS2b, WS2c, WS2d |

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 4 | B4.1e Describe different levels of organisation in an ecosystem from individual organisms to the whole ecosystem.  B4.1f Explain how abiotic and biotic factors can affect communities to include temperature, light intensity, moisture level, pH of soil, predators, food. | Lesson 4 image**Starter**  Show a news report where they talk about a local community – was the newscaster correct to use the word community or is there a better word to describe a collection of the same species. Get students to define community and population.  **Main**  You could relate the organisation in an ecosystem to the following diagram:  Give the students a biome each and get them to prepare a presentation and to the particular challenges of that biome paying attention to the biotic and abiotic factors that can affect the community.  Pay attention to where the organisms are in the ecosystem and pay attention to their niche.  **Alternative resources:**  An animated video to introduce ecosystems and abiotic and biotic factors that affect them. <http://studyjams.scholastic.com/studyjams/jams/science/ecosystems/ecosystems.htm>  A [PowerPoint presentation](http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=8&cad=rja&uact=8&ved=0ahUKEwiC2t_9oYbLAhWFfywKHaZtByAQFgg_MAc&url=http%3A%2F%2Fwww.pdst.ie%2Fsites%2Fdefault%2Ffiles%2FLesson%2520on%2520Biotic%2520and%2520Abiotic%2520Factors.pptx&usg=AFQjCNGMV6VHOsvyQRcaQ7Op-ufaPzo3mA&sig2=ny_qg6CcHIFKEfQ9z0Uo8w) about how abiotic and biotic factors affect communities including information, short activities and questions for learners.  **Plenary**  Students should present their work.  **Homework** | * Maths skills M3a * Working scientifically WS1.3a, WS1.3b,WS1.3e WS1.3h, WS2a, WS2b, WS2c, WS2d WS1.4a, WS2a, WS2b, WS2c, WS2d |

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 5 | B4.1g Describe the importance of interdependence and competition in a community interdependence relating to predation, mutualism and parasitism. | **Starter**  What do humans compete for? Students should determine where humans compete e.g. for resources, mate, land etc.  **Main**  Identify examples of predation, mutualism and parasitism. Examples can be practically investigated for example Examination of the roots of a leguminous plant e.g. clover to observe the root nodules. Investigation of the holly leaf miner or the horse-chestnut leaf miner (*Cameraria ohridella*).  The predator/prey relationship can be studied using the predator-prey activity on the OCR web site.  These can be investigated microscopically using a microscope or hand lens.  **Alternative resources:**  A fox and rabbit predator prey game where learners drop 'fox' cards onto a table 'meadow' to catch 'rabbits'. Results are recorded over numerous 'years' and the population sizes are plotted on a graph. <http://serc.carleton.edu/sp/mnstep/activities/26886.html>  A video clip from David Attenborough's 'The Hunt' that are great to show the class as an introduction to the relationship between predators and prey. (Teachers may want to warn learners that the videos contain an animal be hunted and caught by another before showing the clips). <https://www.youtube.com/watch?v=0mgnf6t9VEc>  or  <https://www.youtube.com/watch?v=CsfJL-IIVz4>  **Plenary**  Think of examples where humans have a predator/prey relationship – mutualistic relationship and are a parasite or are parasitised.  **Homework**  Evaluate which is the best food source for humans (e.g. ‘wheat vs. meat’). |  |

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 6 | B4.1h Describe the differences between the trophic levels of organisms within an ecosystem to include: use of the terms producer and consumer.  B4.1i Describe pyramids of biomass and explain, with examples, how biomass is lost between the different trophic levels to include: loss of biomass related to egestion, excretion, respiration.  B4.1j Calculate the efficiency of biomass transfers between trophic levels and explain how this affects the number of trophic levels in a food chain. | **Starter**  Investigation of the trophic levels within a children’s story (e.g. *The Gruffalo*).  **Main**  Learners need to be able to draw a scale pyramid of numbers biomass and energy. Students need to suggest why with a pyramid of energy why each trophic level the energy available falls. They also need to know the advantages and disadvantages of each pyramid.  Using a pyramid of biomass/energy or given values the learners need to work out the efficiency of transfers between the trophic levels. This will typically be as a percentage.  **Plenary**  **Homework**  Revise for end of topic quiz. | * Maths skills M1c M4a * Working scientifically WS1.3c, WS1.3e |
| 7 | End of topic quiz | End of topic quiz |  |

|  |  |  |
| --- | --- | --- |
| Additional remote learning opportunities ***As a response to the Covid-19 outbreak, additional online learning opportunities were identified for each topic in June 2020.*** | | |
| **Lesson** | **Statement** | **Teaching activities** |
| 1, 2, 3 | B4.1a – B4.1d | There are a pair of videos about the carbon cycle. [Part 1](https://www.youtube.com/watch?v=zrD3tMNPjXU) is about the carbon cycle itself, and [part 2](https://www.youtube.com/watch?v=oe2kPpmhLuc) looks at how humans have had an influence on the carbon cycle (linking to content in B6.1 also). These [revision pages](https://www.bbc.co.uk/bitesize/guides/zydbqhv/revision/1) can be used by students to review their learning, along with the interactive test at the end of the revision. |
| 6 & 7 | B4.1h – B4.1j | This Amoeba sisters [video](https://www.youtube.com/watch?v=-oVavgmveyY) can be used to review and reinforce learning about food webs and pyramids. This [video](https://www.youtube.com/watch?v=mOsHEkTixk8) can be used by students to review how to calculate the efficiency of biomass transfers, as well as understanding how biomass is lost at different trophic levels. These [virtual labs](http://glencoe.mheducation.com/sites/0078695104/student_view0/unit1/chapter2/virtual_labs.html) allow students to model interdependence in ecosystems and how energy flows through an ecosystem. |



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