# 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](http://www.medicaldaily.com/can-organ-transplant-change-recipients-personality-cell-memory-theory-affirms-yes-247498)

# 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)](https://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: B3: Organism Level Systems

## Suggested teaching time for chapter: 24 hours biology/12 hours combined science

### B3.1 Coordination and control - the nervous system

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 | B3.1a describe the structure of the nervous system to include: Central Nervous System, sensory and motor neurones and sensory receptors | Starter  How many senses are there? Get learners to list the senses. And list the sensory receptors that detect these stimuli.  The big 5:  hearing (audioception)  Sight (ophthalmoception)  smell (olfacoception or olfacception)  taste (gustaoception)  touch (tactioception)  others:  balance (equilibrioception)  kinesthetic sense (proprioception)  pain (nociception)  temperature (thermoception)  There are others but they are controversial.  A [short video](https://www.youtube.com/watch?v=KO_HaG8QIk4) about 'What If' some senses were lost.  Main  Define the difference between a nerve and a neurone. |  |
|  |  | Construct a model of a neurone. Learners should be given variety of materials (e.g. craft materials or recycled waste materials) and told to construct a labelled model of a neurone. Divide the class into 3 and give each group one of the neurones to construct: motor, relay and sensory neurone. Once the models have been created discuss the features of the neurone and how this feature allows the neurone to perform its function.  Plenary  Label a diagram of a neurone. During this activity the learners should be able to identify the major components of a neurone and also to recognise the structure of a motor, relay and sensory neurone from a diagram.  Homework |  |
| 2 | B3.1b explain how the components of the nervous system can produce a coordinated response to include: it goes to all parts of the body, has many links, has different sensory receptors and is able to coordinate responses | Starter  Demonstration (by video) of someone trying to do everyday tasks whilst being given mild electric  shocks (e.g. BBC Brainiac).  Main  Using a skeleton or diagram discuss the location and components of the central nervous system and also the location of the peripheral nervous system.  Investigate the density of touch receptors on the skin using the two-point discrimination test. There are a number of these on the web here are a couple:  <https://practicalbiology.org/control-and-communication/human-sensation-and-perception/assessing-skin-sensitivity-touch-discrimination>  <https://faculty.washington.edu/chudler/twopt.html>  and <http://www.exo.net/~pauld/workshops/zoom/Two%20Point%20Discriminate.pdf>  Plenary  Discuss the validity of the experiment. Why are some areas more sensitive than others? How could you improve this experiment?  Homework |  |
| 3 | B3.1c explain how the structure of a reflex arc is related to its function | Starter  Demonstration of reaction time by getting a learner to catch a falling £5 note.  Main  Investigating of reaction times by ruler drop.  Discuss that nerves need to work fast to often prevent danger. Discuss whether the brain needs to be involved in this reaction. What would happen if the brain got involved in a reaction (slow the reaction down as it may try to access a memory as to how it dealt with the situation last time and even evaluate the outcome and would this be an effective response)?  Using a card sort put the reflex arc in order.  Note that there are three neurones in the process and that the message needs to get across the gap.  Demonstrate how a synapse works: A kinaesthetic activity could be to model a synapse. Get learners to make two lines holding hands (e.g. a line of girls and a line of boys). Ensure that the gap between the end of the first line and the beginning of the second line is about 1 m. Get both lines to practice a Mexican wave. Tell the person at the start of the first line to hold out their hand. When you drop a penny into their hand he must start the Mexican wave. Secretly tell the person at the other end of the line that when he gets the signal he has to remove the lid from a perfume bottle. Tell the person at the beginning of the second line (closest to the first line) to start their Mexican wave when they get a ‘signal’. Get the people at the ends of the lines to close their eyes, but reassure them now that there will be no shocks or surprises. Discuss the model with the class.  Get learners to discuss different responses and determine if they are reflexes, e.g. catching a ball thrown at you vs. ducking a ball thrown at you; Dropping a hot plate vs. shaking a bug off you when you see it crossing your hand; blinking when you hear a loud bang vs. putting your fingers in your ears when you are told something will be loud. These are discussion points and learners may have to realise that some may be difficult to categorise.  Another approach is to use: <http://www.s-cool.co.uk/gcse/biology/nerves-and-hormones/revise-it/nervous-system>  Plenary  Can you turn off a reflex? Can the brain override a reflex arc?  Homework  Draw an arrow on a scrap piece of paper and look at it through a glass of water – write down the result. | Many people do a ruler drop as an example of a reflex – this is not a true reflex.  Reflexes are that they are there to stop harm. Some methods used to demonstrate reflexes come close to harm and should therefore be discouraged. Examples like pupil reflexes could be done but high intensity LED lights should not be used – using a medical pocket pen as a light source is ideal. The blink reflex is suitable as is the knee reflex. |
| 4 | B3.1d explain how the main structures of the eye are related to their functions to include: cornea, iris, pupil, lens, retina, optic nerve, ciliary body, suspensory ligaments | Starter  What happened with the arrow and the glass of water? Demonstration of the inversion of an image through a beaker full of water.  Main  Demonstration of the features of the human eye using a medical model or use a pin-hole camera as a model eye.  This [video](https://www.youtube.com/watch?v=9SGAicn9rXY) goes through the main structures of the eye and their functions.  Dissecting the eye is a good activity here. Get the learners to identify structures within the eye such as retina, optic nerve and lens. To demonstrate the magnifying effect of the lens place it on some text. Also look at pupil size experiment to demonstrate the effects of the iris muscles. Learners can research defects of the eye as a homework activity.  A good resource can be found here:  <https://www.exploratorium.edu/video/cows-eye-dissection>  Plenary  Label a diagram of an eye.  Homework  Find a good optical illusion and bring it into the next lesson. |  |
| 5 | B3.1e describe common defects of the  eye and explain how some of these problems may be overcome to include: colour blindness, short-sightedness and long-sightedness | Starter  Learners can ‘show-and-tell’ the optical illusions found for homework.  Point out that there is not a true normal eye. Everyone’s eyes are different there are a number of conditions that can affect the eye: colour blindness (8%), short-sightedness (50%), squint, long-sightedness, internal infections (e.g. congenital toxoplasmosis 1-3% caused by *Toxoplasma gondii*).  Main  Demonstrate that colour vision is only  Test for colour vision: <https://enchroma.co.uk/pages/colour-blind-test>  What does colour blindness look like?: [http://www.colourblindawareness.org/colour-blindness/colour-blindness-experience-it/](http://www.exo.net/~pauld/workshops/zoom/Two%20Point%20Discriminate.pdf)  What do long and short sight corrective lenses do. Glasses to correct short sight make the image smaller and glasses to correct long sight make the image larger. Investigate what the lens does to light by looking at the refraction of light through the lenses.  Demonstrate how sight can be tested by doing a rough sight test with a willing volunteer. [http://visionsource.com/site/assets/files/1192/free\_eye\_chart.pdf](http://www.s-cool.co.uk/gcse/biology/nerves-and-hormones/revise-it/nervous-system)  Plenary  Label the ray diagrams for lenses to correct short and long sightedness.  Homework  Learners should go into a dark room and write down a description of what they see. At low light intensities they should only see monochrome with the possible exception of very vibrant colours. Alternatively if the weather forecast is good they could look at a starry sky and see if they see more stars directly in front of them or do they see more stars outside their central area of focus. (peripheral visions). | Note the rate of colour blindness is about 8% so in a class of 30 learners you may have one colour blind male learner, possibly undiagnosed. |
| 6 | B3.1f describe the structure and function of the brain to include: cerebrum, cerebellum, medulla, hypothalamus, pituitary | Starter  Review the structure of the central nervous system and peripheral nervous system. Review reflex arc and that some reactions do not need the brain. Discuss: ‘So what is the brain for?’.  Most learners will suggest memory but there is increasing anecdotal evidence that memory can be stored outside the brain. This can be used to discuss how science works for transplant memory: <http://www.medicaldaily.com/can-organ-transplant-change-recipients-personality-cell-memory-theory-affirms-yes-247498>. Against: [http://bigthink.com/neurobonkers/dont-be-taken-in-by-the-bad-science-of-cell-memory-theory](http://www.colourblindawareness.org/colour-blindness/colour-blindness-experience-it/). This can be used to discuss the importance of the peer review system in science.  Main  Jigsaw a brain into its component parts. Then add to the brain what learners think that each part of the brain does.  The following may be used: <https://www.youtube.com/watch?v=5_vT_mnKomY>  A model of the brain or a suitable video can be used here (there are many on YouTube – please chose the one that is most suitable to your learners).  Plenary  Use the learner resource 1 (page 6) of the delivery guide to apply what learners have learned from this topic (<http://www.ocr.org.uk/Images/300024-organism-level-systems-delivery-guide.pdf>) | The brain and its structure is often an area that learners can feel quite squeamish about. |
| 7 | **B3.1g explain some of the difficulties of investigating brain function to include: the difficulty in obtaining and interpreting case studies and the consideration of ethical issues** | Starter  Discuss how head injuries have increased our understanding of the how the brain works.  A good example of this is the case of Phineas Gage.  Another area of interest may be the corpus callosum and ‘split brain’ – particularly how the brain handles recent damage to this area. Cutting the corpus callosum has now been used to treat focal epilepsy.  Discuss the main reasons for ‘damage’ e.g. trauma, stroke, infection, congenital/genetic ([https://www.newscientist.com/article/mg22329861-900-woman-of-24-found-to-have-no-cerebellum-in-her-brain/](https://www.newscientist.com/article/mg22329861-900-woman-of-24-found-to-have-no-cerebellum-in-her-brain)) etc.  Main  Research into a study of head injury and how this has led to an increase in knowledge of how that part of the brain works. Learners should focus on:   * Cerebrum * Cerebellum * Medulla * Hypothalamus * Pituitary.   Learners should work in groups to present their findings during the next lesson. Ensure that each area of the brain is covered by the class if possible.  Plenary  Discuss which area of the brain that each group had chosen and also why they have chosen that region. Discuss any findings.  Homework  Continue to research the brain injury and produce a suitable presentation. This could be a PowerPoint/lecture/paper/video etc.  Part of the presentation is to present their findings as a set of notes for the other learners in the class. |  |
| 8 | **B3.1g explain some of the difficulties of investigating brain function to include: the difficulty in obtaining and interpreting case studies and the consideration of ethical issues** | Starter  Give learners a short period of time to prepare their presentations.  Main  Learners to present their presentations. Learners should present their notes to the class.  Plenary  Discuss non-invasive methods of brain structure investigation (e.g.fMRI) have been used to investigate brain activity <http://www.radiologyinfo.org/en/info.cfm?pg=fmribrain>.  Homework  Find out about Guillain-Barré syndrome (<http://www.nhs.uk/conditions/Guillain-Barre-syndrome/Pages/Introduction.aspx>). |  |
| 9 | **B3.1h explain some of the limitations**  **in treating damage and disease in the brain and other parts of the nervous system to include: limited ability to repair nervous tissue, irreversible damage to the surrounding tissues, difficulties with accessing parts of the nervous system** | Starter  Discuss how during brain surgery areas of the brain can be electrically stimulated. The result of this stimulation has given us more information into brain activity (<http://www.wireheading.com/intracran/humourcentre.html>).  Main  Discuss the limitations in treating damage and disease in the brain and other parts of the nervous system to include: limited ability to repair nervous tissue, irreversible damage to the surrounding tissues, difficulties with accessing parts of the nervous system.  What could you do with the following conditions:   * Guillain-Barré syndrome * MS * Stroke * Concussion * Compression * Meningitis   Plenary  Discuss possible treatments for the conditions chosen. | Note some learners may have personal experience of the conditions chosen. If they are willing to discuss them this would be valuable. |

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| 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 | 3.1a & 3.1b | This is an [interactive resource](https://www.abpischools.org.uk/topic/nervoussystem/) about the nervous system, and contains information, glossaries, quick questions and animations. |
| 3 | 3.1c | This is an [online reaction time test](https://humanbenchmark.com/tests/reactiontime/) that students can carry out. They could be encouraged to collect data from others in their household and compare their results. It also links to PAG B6. |

### B3.2 Coordination and control –the endocrine system

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 | B3.2a describe the principles of hormonal coordination and control by the human endocrine system to include: use of chemical messengers, transport in blood, endocrine glands and receptors | Starter  Discuss the feelings that you have when you are nervous.   * Heart rate increases * Bladder relaxation * Tunnel vision * Shaking * Dilated pupils * Flushed face * Dry mouth * Changes in digestion (butterflies) * Hearing loss   What causes these? Although we call this nervous it is more an endocrine response.  Main  Label the main endocrine glands on a body image. This can be done on a worksheet or can be done on a model. Include the names of the hormones that the gland produces. Discuss the rudimentary function of the hormones (e.g. testosterone – secondary sexual characteristics).  Alternatively you can use: <https://www.youtube.com/watch?v=z-GXGR7AFpQ>  Discuss how the endocrine system works – ductless gland releases hormones directly into the blood stream and this delivers it to the target.  Plenary  Summarise lesson in a table or diagram.  Homework  Revise the position of the endocrine glands and the function of the hormones that they produce. |  |
| 2 | **B3.2b explain the roles of thyroxine and adrenaline in the body to include: thyroxine as an example of a negative feedback system** | Starter  Test the homework – e.g. by labelling a diagram of the endocrine system.  Main  Focus onto the roles of thyroxine and adrenaline.  Discuss fight or flight for adrenaline. What advantage does adrenaline serve? Discuss this with respect to the myotonic goat.  Alternatively use: <http://www.abpischools.org.uk/page/modules/hormones/horm8.cfm>  Discuss the difference between negative and positive feedback. Define negative feedback using thyroxine as an example.  Plenary |  |
| 3 | B3.2c describe the role of hormones in human reproduction including the control of the menstrual cycle to include: oestrogen, progesterone, FSH and testosterone | Starter  Which hormones are involved in secondary sexual characteristics?  Main  Label the diagram of the reproductive system included in the delivery guide (<http://www.ocr.org.uk/Images/300024-organism-level-systems-delivery-guide.pdf>) learner resource 2.  Plenary  Homework  Practical activity |  |
| 4 | **B3.2d explain the interactions of FSH, LH, oestrogen and progesterone in the control of the menstrual cycle** | Starter  Main  Use the resources available on ([http://www.ocr.org.uk/Images/300024-organism-level-systems-delivery-guide.pdf](http://www.nuffieldfoundation.org/practical-biology/assessing-skin-sensitivity-–-touch-discrimination)) learner resource 2.  Use the Excel file to assist with your teaching: $  Plenary  Learners could show their knowledge of menstruation by using the Yearly cycle activity on (<http://www.ocr.org.uk/Images/300024-organism-level-systems-delivery-guide.pdf>).  Homework  Produce a list of the different methods of contraception there are. |  |
| 5 | B3.2e explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception to include: relative effectiveness of the different forms of contraception | Starter  From the homework activity get the learners to work in groups and on blank cards to list the methods of contraception (one method per card)  Main  Get the learners to group the contraceptive methods into how they work (e.g. stop the sperm getting to the egg, fooling the body that it is already pregnant, stopping implantation, killing the sperm). Discuss the methods with the class and get the learners to write down their groups.  Get the learners to rank the methods based on their effectiveness. Discuss the learners results to the published results (<http://www.nhs.uk/conditions/contraception-guide/pages/how-effective-contraception.aspx> and/or <https://www.optionsforsexualhealth.org/birth-control-pregnancy/birth-control-options/effectiveness>)  Plenary  Discuss why methods of contraception may not be suitable for all.  Homework  Research into *Xenopus laevis* pregnancy testing to detect hCG by the stimulation of oogenesis.  Or  Research into hormonal treatments for infertility. |  |
| 6 | **B3.2f explain the use of hormones in modern reproductive technologies to treat infertility** | Starter  Introduce the learners to Louise Brown (<http://www.biography.com/people/louise-brown-9542072#profile>), Sir Robert Geoffrey Edwards, CBE, FRS and five million babies.  Main  Discuss what the major causes of infertility are. See section on infertility in: <https://www.nhs.uk/conditions/infertility/causes/>  Plenary  Discuss the pros and cons of fertility treatment. |  |
| 7 | B3.2g explain how plant hormones are  important in the control and  coordination of plant growth and  development, with reference to the  role of auxins in phototropisms and  gravitropisms to include: unequal distribution of auxin | Starter  Initiate a discussion by lighting a candle in the class. Discuss the shape of the candle flame and what causes it. Then discuss how the flame would be in microgravity  (<http://www.webexhibits.org/causesofcolor/3BB.html>).  Discuss how plants would grow in space. What do they do growing in microgravity?  The following link may be useful:  [http://www.nasa.gov/audience/foreducators/spacelife/topics/plants/#.V7V51UZv\_ft](http://www.nasa.gov/audience/foreducators/spacelife/topics/plants/" \l ".V7V51UZv_ft)  Main  Investigation of the effects of phototropism using seedlings.  Rather than using simply giving the learners all the equipment and a method it may be preferable to give the learners a variety of seeds and equipment and letting them design an experiment to answer the null hypothesis that light has no effect on the direction a plant grows.  Plenary  If available demonstrate a clinostat. If not available – 2D clinostat: <https://www.youtube.com/watch?v=cVlpqrAiVm4>  Discuss why this research is important.  Homework  Visit the NASA plants in space site <http://www.nasa.gov/audience/foreducators/spacelife/topics/plants/#.V7V4P0Zv_fs>  Watch the video and at least one associated link to answer the question set in the plenary. Write down at least one reason why we should study how plants grow in space. | PAG 6 |
| 8 | B3.2h describe some of the variety of  effects of plant hormones, relating to auxins, **gibberellins and ethane** to include: controlling growth, controlling germination, fruit ripening, flower opening and shedding of leaves | Starter  Collect the data from the tropism experiment and evaluate the results.  Main  Discuss what hormones do in humans (<http://www.endocrinesurgeon.co.uk/index.php/what-are-the-functions-of-the-different-types-of-hormone>). Can hormones be used as medicines? Use as an example human growth hormone.  Can hormones be used by humans to get plants to control plant development? Can we get plants to grow faster?  There are a number of investigations that can be used here to investigate plant hormones:   * Investigation/research into the question ‘does one bad banana spoil the fruit bowl?’ Investigate whether a ripe banana can be used to ripen other bananas or other fruit. * Can a ripe banana break dormancy in seeds? * Does hormone rooting powder work?   Plenary  Learners can write up the experiment they did paying particular attention to the equipment they used and how they controlled the variables in the experiment.  Homework  Research how hormones can be used as selective weed killers. | PAG 6 |
| 9 | **B3.2i describe some of the different ways in which people use plant hormones to control plant growth to include: selective herbicides, root cuttings, seedless fruit (parthenocarpic fruit development), altering dormancy** | Starter  Discuss how important plant hormones are worldwide.  <http://www.marketresearchstore.com/news/global-plant-growth-regulator-market-178>  Main  Research into the commercial used of plant hormones.  Give learners a list of the different hormones and their roles and in small groups learners are to devise potential commercial uses of hormones. Produce a business plan for the use of your hormone to be presented next lesson. This must include the hormone and the potential commercial benefit.  Plenary  Discuss how important plant hormones are worldwide.  <http://www.marketresearchstore.com/news/global-plant-growth-regulator-market-178>  Homework  Continue with the business plan.  Practical activity |  |
| 10 |  | Starter  Provide learners with a period of time to refine their business plan.  Main  Groups are to present their business plan to a panel of investors. These can be made up from learners that were absent from the previous lesson. The panel needs to look for novelty and potential benefits.  Plenary  Yes and no game. What are plant hormones used for. This can be done with white boards.  Fruit development  Shoots growing away from a light source  Cell elongation  Bolting  Preventing germination of seeds (dormancy)  Controlling germination of seeds  Promoting flowering  Promoting fruiting  Producing seedless fruit  Stimulating root growth |  |

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| 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 | B3.2a | This is an [interactive resource](https://www.abpischools.org.uk/topic/hormones/) about the endocrine system, with information, glossaries, questions and animations that pupils can work through.  This Oak National academy [remote lesson](https://teachers.thenational.academy/lessons/hormonal-responses-cgr3ed) can be used here or at B3.3a. It covers homeostasis and the human endocrine system, and contains a recap quiz, videos, and activities for students to work through. It could be used to introduce the topic, or could be used as consolidation at the end of the topic. |
| 3 & 4 | B3.2c & **B3.2d** | Students could work through part or all of this [powerpoint](https://www.tes.com/teaching-resource/gcse-igcse-menstrual-cycle-and-hormones-biology-12283275) about the menstrual cycle for independent learning or as a flipped learning task. |
| 5 & 6 | B3.2e & **B3.2f** | These Oak National academy remote lessons are about [contraception](https://classroom.thenational.academy/lessons/contraception-chh3ct) and [infertility & IVF](https://classroom.thenational.academy/lessons/artificial-control-of-fertility-higher-cgu6ac). It contains a recap quiz, videos and activities for students to work through. This [video](https://www.youtube.com/watch?v=kMY-v0F6bX0) covering hormonal and non-hormonal types of contraceptives can also be used for independent learning. |
| 7 & 8 | B3.2g & B3.2h | This [video](https://www.youtube.com/watch?v=U7U60HqsQs4) demonstrates the effect of light on the growth of seedlings, and relates to PAG B6. This is a [stop-motion video](https://www.youtube.com/watch?v=DhITXtENPrU) of phototropism in seedlings. |

### B3.3 Maintaining internal environments

| Lesson | Statements | Teaching activities | Notes |
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| 1 | B3.3a explain the importance of maintaining a constant internal environment in response to internal and external change to include: allowing metabolic reactions to proceed at appropriate rates | Starter  Get a set of burettes and burette stands around the class. Give the learners tape and get them to put the tape on the burette separated by as much distance as they want. Fill the burette with coloured water. Get the learners to turn the tap by as much as they want can be a flow or a drip. Then get the learners to maintain the liquid level in the burette between the tape marks. You will need to allow the learners to leave their seats to replenish the water as required. If the group’s water falls outside the lines then they are out. You can keep this activity going until all groups are out.  Main  Show the explosion at the Fukushima nuclear plant:  <https://www.youtube.com/watch?v=vbBk0Y6cQZQ>  Discuss the importance of maintain a constant internal environment in a nuclear power station. Too much heat may result in an explosion too little heat will result in not enough electricity being produced. Discuss what how the power station controls temperature – control rods and cooling water.  Discuss what the body has to maintain **and why**. Examples are water potential, temperature and blood sugar.  Plenary  Homework  Research into hypothermia and hyperthermia.  Practical activity |  |
| 2 | B3.3b describe the function of the skin in the control of body temperature to include: detection of external temperature, sweating, shivering, change to blood flow | Starter  Demonstration of the cooling effect of sweating  using alcohol based surgical wipes. Why does the hand feel cold? The alcohol evaporates and transfers energy away from the skin.  Main  Discuss the physiological responses to being too hot and too cold. Examples are:  *Too cold*   * Shivering * Skin looks pale * Goose bumps/hair stands up * Huddle * Migrate * Put on more clothing * Stand in sunlight   *Too hot*   * Sweating * Skin looks flushed/red * Hair lies flat * Find shade   Investigation into heat transfer by using microwaved plasticine shapes/model ‘animals’ by using a UV heat camera/LCD thermometers.  Or   * Design an experiment to determine why keeping a hat on keeps you warm * Design an experiment to see why penguins huddle. * Design an experiment to determine whether it is better to remove wet clothes after a rain shower or keep on the wet ones.   Plenary  Present learners with a cross section of skin and get them to label the diagram with how the skin can assist in maintain heat and heat loss (blue and red pens can be used to differentiate the two)  Homework  What is diabetes? |  |
| 3 | B3.3c explain how insulin controls blood sugar levels in the body | Starter  Define diabetes from the homework task.  Main  Look at/plot graphs showing the level of blood sugar during the day against insulin levels. Evaluate the data.  Inform the learners that insulin converts glucose to glycogen.  Inform the learners where the insulin is produced.  Show the structure of glucose and glycogen either full structure or as beads – what does the insulin do?  How does this help?  Investigations into the glucose content of artificial urine to diagnose diabetes, using e.g. Clinistix.  Or  Microscopic examination of pancreatic tissue to look for the Islets of Langerhan.  Plenary  Where is the best place to store glycogen (muscle and liver)?  Homework  Table of comparison between type 1 and type 2 diabetes.  Practical activity | PAG1 can be used here |
| 4 | **B3.3d explain how glucagon interacts with insulin to control blood sugar levels**  **in the body** | Starter  Review the role of insulin in bringing down the levels of blood sugar levels.  Main  Introduce the story of Claude Bernard (<https://www.encyclopedia.com/science-and-technology/chemistry/organic-chemistry/glycogen>)  What was the mysterious *matière glycogene*?  Storyboard the role of insulin and glucagon in the control of blood sugar levels. Discuss where the glucagon is produced  Plenary  Homework  Practical activity |  |
| 5 | B3.3e compare type 1 and type 2 diabetes and explain how they can be treated | Starter  People often find it difficult to remember which form of diabetes requires regular injections of insulin. Use the following or recreate the syringes then discuss with the class. Let the learners know that at the end of the lesson they will have to come up with a method of remembering the two types (e.g. rhyme or mnemonic)  Image of two syringes  Main  Divide the class into two and get them to produce one of two leaflets.  Produce a leaflet to inform a newly diagnosed type 1 diabetic what causes their treatment. This can be done to using a television/film character (e.g. Rod Flanders from the Simpsons is a type 1 diabetic).  Produce a leaflet to inform what type 2 diabetes is and what steps can be taken to prevent it. Again to prevent the personal element of this task it can be directed at a TV character (e.g. Homer Simpson)  Plenary  Learners can come up with their own method to remember how to remember type 1 and type two diabetes (see diagram above).  Homework  Finish off the leaflet |  |
| 6 | B3.3f explain the effect on cells of osmotic  changes in body fluids to include: higher, lower or equal water potentials leading to lysis or  shrinking (no mathematical use of water potentials required | Starter  What happen to blood cells in pure water:  <https://www.sciencephoto.com/media/676658/view/effects-of-osmosis-on-a-cell>  Main  What happens to cells if the water potential of body fluids change?  Demonstration/investigate of the different water potentials on different cells.  Set up the following experiment: <https://learning.cambridgeinternational.org/classroom/course/view.php?id=3903>  Plenary  Draw/label cell diagrams of cells in low water potential, high water potential and equal water potential cells | PAG8 |
| 7 | B3.3g describe the function of the kidneys  in maintaining the water balance of the body to include: varying the amount and concentration of urine and hence water excreted | Starter  In groups get learners to suggest ways the body can stop you losing water when dehydrated. Examples are: stop sweating, reduce toilet breaks – pee gets more concentrated, get thirsty, get cranky, do less, heart rate increase, dry mouth, dry skin etc.  Main  Investigation of the structure of the structure of a kidney by dissection and the application of H2O2 to visualise the nephrons.  Plenary  Label the gross structure of the kidney.  Homework |  |
| 8 | B3.3h describe the gross structure of the kidney and the structure of the kidney tubule | Starter  Main  Investigation of the structure of the structure of a kidney by dissection and the application of H2O2 to visualise the nephrons. Produce a table about what is absorbed where.  Plenary  Label the structure of the nephron.  Homework  Revise for the end of topic quiz. |  |
| 9 | **B3.3i describe the effect of ADH on the**  **permeability of the kidney tubules to include: amount of water reabsorbed and negative feedback** | Starter  What detects the amount of water in the blood? Liver, brain, heart or kidney – (brain hypothalamus).  Main  Introduce ‘nannies tea’ – some things make you urinate. These are called diuretics. These How can the brain signal to the kidneys to keep the water: nerves or hormones.  What can it do to the kidneys assist in water retention? Review structure of the nephron particularly the collecting duct.  Look at the gutter down pipe of a house and how we collect water for a water butt. Drill a hole into the down pipe and attach a water but deflector. How can we collect more – more holes and more water but deflectors. The collecting duct in the kidney is similar to the gutter down pipe. Anti-diuretic hormone (ADH) causes the collecting duct to have more holes in it and therefore to collect more water.  Investigation of the different sections of a nephron and the composition of mock filtrate  from each area.  Plenary  Produce a table of what is absorbed at each part of the nephron.  Homework  How do some people die after taking ecstasy? |  |
| 10 | **B3.3j explain the response of the body to different temperature and osmotic challenges to include: challenges to include high sweating and dehydration, excess water intake, high salt intake responses to include mechanism of kidney function, thirst** | Starter  Review how some people die after taking ecstasy.  Main  Investigate whether it is safe to constantly drink sports drinks without doing any associated exercise. How do they work? Look at sodium concentration e.g. Gatorade G2 has 45 mg of sodium per 100 g Cola/lemonade typically has 4 mg per 100 g.  Research into sports drinks and evaluation into which is best for athletes.  Plenary  Present the data on best sports drink – are they actually required for a 20-30 minute exercise?  Homework  Revise for end of topic quiz. |  |
| 11 |  | Starter  Provide the learners time to revise for the end of topic quiz.  Main  End of topic quiz  Plenary  Peer mark quiz |  |

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| 1 | B3.3a & B3.3b | This [resource](https://www.stem.org.uk/resources/elibrary/resource/29268/homeostasis-suitable-home-teaching) has a variety of audio clips, worksheets and a basic experiment idea to help students gain a better understanding of homeostasis and thermoregulation (linking to **B3.3j**) |
| 3 & 4 | B3.3c & **B3.3d** | This Oak National academy [remote lesson](https://classroom.thenational.academy/lessons/controlling-blood-sugar-levels-higher-71k32c) is about gluco-regulation. It contains a recap quiz, videos and activities for students to work through. |
| 5 | B3.3e | Students could use this [diabetes website](https://www.diabetes.org.uk/diabetes-the-basics) to learn about diabetes using the information and video provided. Alternatively, students can work through this [interactive website](https://www.abpischools.org.uk/topic/diabetes), which contains glossaries, questions and animations they can engage with. |
| 7, 8, 9 | B3.3g, B3.3h & **B3.3i** | here is this [interactive resource](https://www.abpischools.org.uk/topic/homeostasis-kidneys) about the kidneys and water balance, with information, glossaries, questions and animations that pupils can work through.  This [article](https://www.stem.org.uk/resources/elibrary/resource/27621/kidneys-suitable-home-teaching) focuses on the kidney and how it works, as well as what happens when the kidney goes wrong. It could be used as a reinforcement activity. |
|  |  | These [sample exam questions](https://www.bbc.co.uk/bitesize/guides/zgqcmsg/revision/1) have multiple choice and longer answer questions about B3 that students can work through individually. |



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