

GCSE (9–1)

Delivery Guide

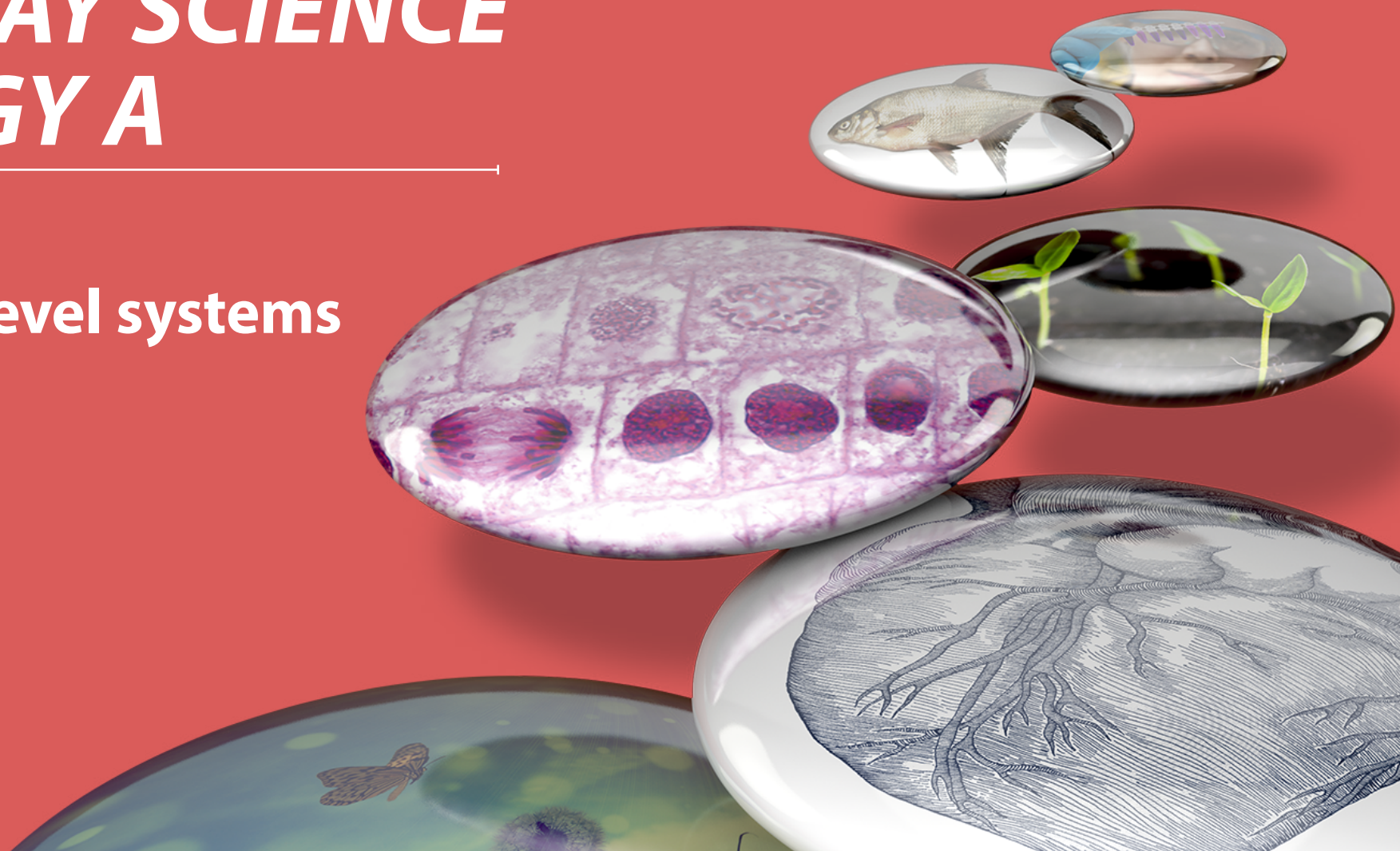
GATEWAY SCIENCE BIOLOGY A

J247

For first teaching in 2016

Organism level systems

Version 1



GCSE (9–1) **BIOLOGY A (GATEWAY SCIENCE)**

Delivery guides are designed to represent a body of knowledge about teaching a particular topic and contain:

- Content: A clear outline of the content covered by the delivery guide;
- Thinking Conceptually: Expert guidance on the key concepts involved, common difficulties students may have, approaches to teaching that can help students understand these concepts and how this topic links conceptually to other areas of the subject;
- Thinking Contextually: A range of suggested teaching activities using a variety of themes so that different activities can be selected which best suit particular classes, learning styles or teaching approaches.

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Subtopic 1 – B3.1 Coordination and control – the nervous system

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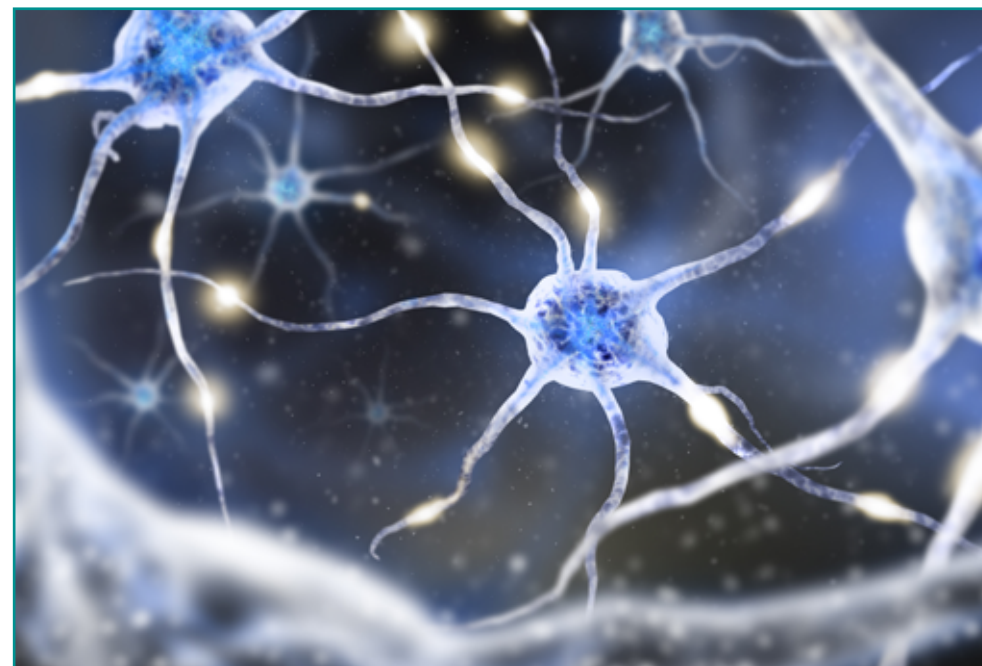
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BM3.1i	extract and interpret data from graphs, charts and tables
B3.1a	describe the structure of the nervous system, to include: central nervous system, sensory and motor neurones and sensory receptors.
B3.1b	explain how the components of the nervous 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
B3.1c	explain how the structure of a reflex arc is related to its function
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
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
B3.1f	describe the structure and function of the brain, to include: cerebrum, cerebellum, medulla, hypothalamus, pituitary
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
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



An illustration of neurons

General approaches:

A way to introduce the nervous system or even the endocrine system is to show it working well and to discuss what happens when it does not work well. Show learners a video from YouTube, which has something, which will unexpectedly scare them. Question learners why they reacted the way they did and what they think might be happening in their bodies for them to react the way they did. This can then lead to the explanation of the coordinated response (B3.1 a,b,c).

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.

An approach to the eye (B3.1 d,e) is to provide learners with an unlabeled diagram of the eye and get them to label it in pairs. Provide learners with functions of each part of the eye and see if they change their labels. Then provide learners with correct labels.

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.

The use of optical illusions here is always a good starter – especially when you want to discuss the brain's interpretation of the signal from the eye.

Common misconceptions or difficulties learners may have:

Learners may find it difficult to distinguish between voluntary and involuntary actions. Get learners in pairs and provide them with a list of actions, which they must distinguish as voluntary or involuntary. When getting results from learners use it as an opportunity for class discussion.

Learners struggle to understand how the ciliary muscles and suspensory ligaments change the shape of the lens. Giving learners clear explanations and extra time will help them. The following video focuses on just this to help learners.

http://www.bbc.co.uk/schools/gcsebitesize/science/triple_aqa/medical_applications_physics/the_eye/revision/2/

Learners may find it difficult to remember the structure of the brain. Get them in to groups of 4 and get them to come up to see a labelled picture. The first person of the group has a minute then take it back to the group to draw their own diagram. The next team member goes up for 45 seconds then 30 and finally 15. Each member completes the picture. A good diagram can be found on the following link.

<http://www.macmillan.org.uk/information-and-support/brain-tumours/understanding-cancer/the-brain.html>

Click on 'show more' to see diagram.

Conceptual links to other areas of the specification – useful ways to approach this topic to set learners up for topics later in the course:

The knowledge and understanding of 'The nervous system' is ideal before beginning topics such as 'The endocrine system' and 'Maintaining internal environments'. All the processes within the topics are not possible without the brain, which focuses on statements B3.1 f,g,h.

Approaches to teaching the content

Almost 2 million people in the UK live with sight loss and this number is just increasing. The learners can take the opportunity to explore the medical field and look into certain illnesses related to the nervous system/eyes. Learners may wish to take the role as GPs and follow the three situations in learner resource 1.

You could demonstrate that the position where the optic nerve joins the retina lacks photoreceptors by demonstrating the 'blind spot'. You could discuss why we do not have a gap in our vision because of this.

You could also demonstrate that the fovea has the most colour photoreceptors (cones) and that the peripheral retina is mainly composed of rods, which are more sensitive but monochrome. There are two easy experiments to demonstrate this. The first one is to get the learners to look into a dark room and see whether they see colour of black and white. The room will be black and white as the cones need a high light intensity to work effectively. Another experiment to use is to get a volunteer to face forward and focus on a point on a wall. Then bring two colour pencils into their field of view one in front of the other (red and green work well - but do not tell them the colours). The learner must shout stop when they can see the pencils. Then ask them which one is at the front. Although the learners can see the pencils they will not see them in colour.



Macro image of a human eye

Activity 1

Accommodation

BBC bitesize

http://www.bbc.co.uk/schools/gcsebitesize/science/triple_aqa/medical_applications_physics/the_eye/revision/2/

A clear video, which explains how the suspensory ligaments and ciliary muscles work together.

Activity 2

GP care

N/A

[Learner resource 1](#)

The task allows learners to apply what they have learned from the topic and apply it to a context of patient care. Each patient report requires analysis of a specific organ.

Activity 3

All

Kahoot

<https://getkahoot.com>

An exciting and new way of teaching many topics. Contains many quizzes, which makes the learning more fun at the same time. Interactive and very engaging.

Activity 4

Skin sensitivity

Society of Biology

<http://www.nuffieldfoundation.org/practical-biology/assessing-skin-sensitivity---touch-discrimination>

A variety of class practicals and demonstrations that can be undertaken within the classroom. Method and worksheet questions are provided.

Activity 5

The eye

Kscience

<http://www.kscience.co.uk/animations/eye.swf>

An excellent animation that allows learners to take control when observing how the light enters the eye. They can focus on certain parts of the eye and pause and reply as they wish.

Activity 6

Areas of the brain

YouTube

https://www.youtube.com/watch?v=5_vT_mnKomY

If learners are still having difficulty working out what ions are in ionic compounds then try this puzzle. It can easily be adapted into a card sort or matching activity for those learners who need it.

Activity 7

Synapse

S-cool

<http://www.s-cool.co.uk/gcse/biology/nerves-and-hormones/revise-it/nervous-system>

Provides learners with a description of the nervous system along with animations. At the end there is a quiz for learners to attempt.

BM3.2i	extract and interpret data from graphs, charts and tables
BM3.2ii	translate information between numerical and graphical forms
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
B3.2b	explain the roles of thyroxine and adrenaline in the body as examples of negative feedback systems, to include: thyroxine as an example of a negative feedback system
B3.2c	describe the role of hormones in human reproduction including the control of the menstrual cycle, to include: oestrogen, progesterone, FSH and testosterone
B3.2d	explain the interactions of FSH, LH, oestrogen and progesterone in the control of the menstrual cycle
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
B3.2f	explain the use of hormones in modern reproductive technologies to treat infertility
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
B3.2h	describe some of the variety of effects of plant hormones, relating to auxins, gibberellins and ethene , to include: controlling growth, controlling germination, fruit ripening, flower opening and shedding of leaves
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



Plant propagation

General approaches:

To introduce the endocrine system show learners the following video: <https://www.youtube.com/watch?v=z-GXGR7AFpQ>

When complete provide learners with a human body outline and get them to fill in as many glands as possible from the video. After discussing the glands as a class show the video a second time to allow learners to complete the remaining glands.

The menstrual cycle is difficult for learners to grasp. The menstrual cycle activity will hopefully make it easier for learners to understand the role of each hormone in the menstrual cycle. Teachers are to place the sequence of days around the room to get the learners to bring the pieces together. At the end as a group go over the cycle.

When teaching plant hormones the lesson element 'shoots and roots, exploring the action of auxins on the growth of roots and shoots' is an excellent starting point that allows learners to work independently and makes it more visual for learners to grasp the concepts.

To make it more visual a paper activity to show how cell elongation leads to bending. Give out 8 pieces of A5 paper. Lay them landscape in two rows (2x4). Tell the learner to rotate the 4 pieces on one side by 90 degrees but that all pieces in the row and two columns have to touch. This will show the effect of elongation on one side and will illustrate how the bend is achieved.

Common misconceptions or difficulties learners may have:

Learners find it difficult to refer to each stage of the menstrual cycle and the role each hormones play. The activity makes it easier for learners to grasp the idea. Also because hormones may not be seen it is useful to use modelling techniques to allow them to visualise it.

A common misconception involves auxins and its behaviour in the shoots and roots. Learners find it difficult to understand that the auxins in the roots and shoots are the same but their behaviour is different. In the roots the auxins prohibit growth and prevent growth in the where the auxin accumulates. However In the shoots auxins stimulate growth on the regions they are accumulate. The shoots and roots lesson element enables learners to model the auxin behaviour and distribution by using beads. Also there is much discussion in science as to whether auxins, 'move' to the dark side of the stem or whether they are broken down by light (or a combination of both). The use of accumulates on the dark side can overcome this.

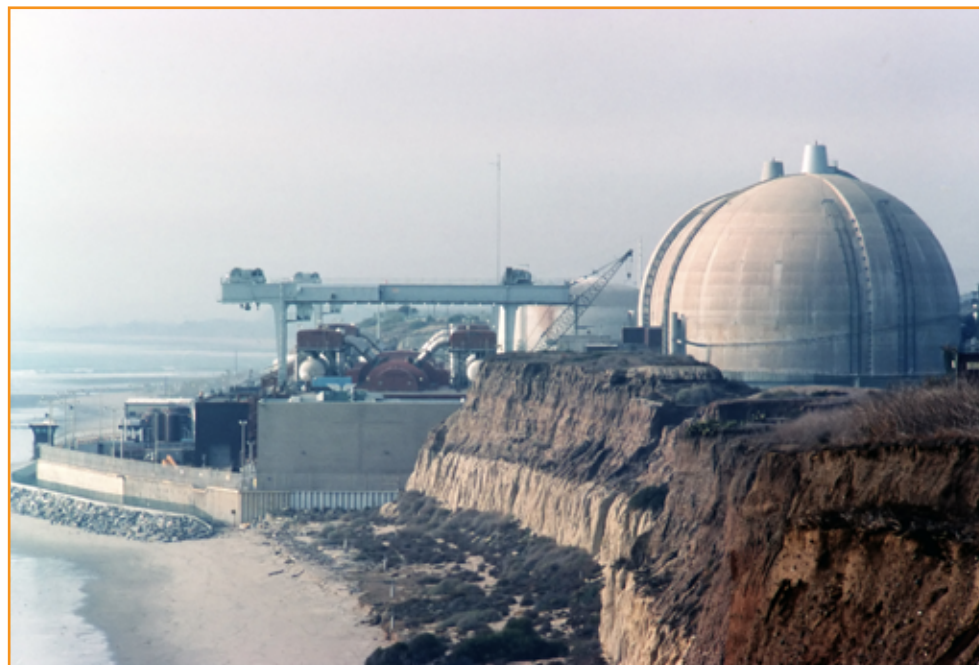
Conceptual links to other areas of the specification – useful ways to approach this topic to set learners up for topics later in the course:

The knowledge and understanding of 'The endocrine system' is ideal before beginning topics such as 'Maintaining internal environments'. There is little in terms of linking this topic to other topics in the specification.

Approaches to teaching the content

Learners are to get into small groups and produce a two-minute presentation on what Learners could look into how farmers/horticulturists use hormones to achieve the results they want. They could focus on the possibilities/outcomes rather than learning which hormone does what.

The importance of negative feedback can be given a contextual component by comparing the negative feedback done in organisms to the control of a nuclear power station. If the reaction is too vigorous and the temperature gets too high then it can cause the reactor to fail. The temperature can be brought back to normal by inserting control rods into the reactor core. These slow the reaction and bring the temperature back down. Too cold and the water may not boil and may not turn the turbines to generate electricity. Similar to the body any change needs to be reversed. If it is not maintained then the consequences can be devastating. If the body gets too hot then action is taken to bring the temperature down. If the body gets too cold then action is taken to warm the body up.



Nuclear power station

Activity 1

The endocrine system

YouTube

<https://www.youtube.com/watch?v=z-GXGR7AFpQ>

A clear video, which explains the endocrine system and its function. It focuses on the main glands and the hormones they release. A good starting point.

Activity 2

The menstrual cycle

N/A

[Learner resource 2](#)

Learners to move around the classroom and get information about each stage of the menstrual cycle. After completing each stage the learners then draw a diagram of the whole menstrual cycle.

Activity 3

The endocrine system quiz

Love biology

<http://lovebiology.co.uk/gcse-quizzes/The-Endocrine-System.php>

The quiz focuses on the menstrual cycle and the glands. It has a time limit and is a good revision tool or starting point to see what they already know.

Activity 4

Auxins

Kscience

<http://www.kscience.co.uk/animations/auxin.htm>

A very good animation on plant growth. The animations focus on response to environment and hormones. There is a section to test learners.

Activity 5

Adrenaline

abpi

<http://www.abpischools.org.uk/page/modules/hormones/horm8.cfm>

A teaching animation, which shows the effects of adrenaline on the body. The modes can be changed from normal to fight or flight.

Activity 6

Plant hormones auxin

TES

<https://www.tes.com/teaching-resource/aqa-b1-biology-plant-hormones-auxins-6301491>

A good worksheet on auxin, which will identify if learners understand plant hormones.

Activity 7

Menstrual cycle

Science-cochrane

<https://science-cochrane.wikispaces.com/file/view/menstrual+and+fertility.ppt>

A good teaching PowerPoint, which covers endocrine system fertility and menstrual cycle.

BM3.3i	extract and interpret data from graphs, charts and tables
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
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
B3.3c	explain how insulin controls blood sugar levels in the body
B3.3d	explain how glucagon interacts with insulin to control blood sugar levels in the body
B3.3e	compare type 1 and type 2 diabetes and explain how they can be treated
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)
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
B3.3h	describe the gross structure of the kidney and the structure of the kidney tubule
B3.3i	describe the effect of ADH on the permeability of the kidney tubules, to include: amount of water reabsorbed and negative feedback
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



Blood glucose meter

General approaches:

A way to introduce B3.3 a,b is to provide learners with a beaker of water, a Bunsen burner and some ice. Ask learners to maintain the temperature of the water at 37°C for as long as possible. Explain to learners how the body maintains this every moment for our entire life.

When looking at sweating it is possible to use medical wipes to illustrate how sweating keeps you cool.

When focussing on B3.3 c,d,e show learners a blood glucose testing meter and a Clinistix and get them to write what they measure blood sugar levels. Get learners to evaluate the advantages and disadvantages of both methods and compare them to a Benedict's test. Learners could identify the problems of using a Benedict's test for looking at blood sugar levels. Allow learners to practice Clinistix on some premade sugar samples.

Common misconceptions or difficulties learners may have:

Learners commonly describe vasodilation and vasoconstriction back to front.

When teaching kidneys (B3.3 g,h,i) it can be difficult for learners to imagine a microscopic sized nephron. Using the kidney structure task it can help learners to visualise it better when broken down. Learners get into groups of threes. Each member of the group is to go to one of the three stations and find out how the nephron works. After three to five minutes they will return to their group and share their information. Using the three separate bits of information each individual use the space at the bottom to draw the nephron and exactly how it works.

A misconception learners have is that insulin raises blood sugar levels. When explaining to class ensure keywords are clearly defined and time is taken to explain process. Learners could be provided with a premade cartoon strip (mat) which shows what happens as insulin enters the blood. Don't explain to learners what each part is showing but try to get them to pair up and figure out what each part might represent. Then go over as a class.

Conceptual links to other areas of the specification – useful ways to approach this topic to set learners up for topics later in the course:

The knowledge and understanding of 'Maintaining internal environments' is ideal after focussing on B3.1 and 2. Learners should have a good understanding of hormones and how they function along with the human body structure.

Approaches to teaching the content

In England alone there are almost 3 million sufferers of diabetes. With the increase of sugar intake it is only becoming a bigger problem in the UK. Diabetes is becoming a very serious problem. Learners can take the role of a developer who is tasked with producing a diabetic awareness leaflet for both type 1 and 2.

Learners are to take the role of a nephrologist who has been invited to deliver a speech about the kidney.



Surgeon displaying a kidney

Activity 1

Controlling blood sugar levels

TES

<https://www.tes.com/teaching-resource/controlling-blood-glucose-levels-6088062>

A good resource, which promotes independent learning and enables group work whereby learners learn how glucose levels are controlled by interpreting a storyboard.

Activity 2

Structure of kidney

N/A

[Learner resource 3](#)

Group activity where each member is to go to one of the three stations and find information about nephrons. After 5 minutes they will return and share the information. Using the 3 separate bits of information, each individual uses the space at the bottom to draw the nephron.

Activity 3

Sweating and temperature

Society of Biology

<http://www.nuffieldfoundation.org/practical-biology/interpreting-information-about-sweating-and-temperature>

A resource, which provides learners with data, they are to interpret about sweating and temperature.

Activity 4

Blood sugar regulation in diabetes

Human Anatomy

http://highered.mheducation.com/sites/0072495855/student_view0/chapter20/animation_blood_sugar_regulation_in_diabetics.html

A clear animation, which looks at sugar levels and treatments of type 1 and 2 diabetes. It uses a graph, which is good practice for exam questions. A quiz at the end.

Activity 5

Homeostasis

YouTube

<https://www.youtube.com/watch?v=62e8IV-WT8c>

A very clear video, which explains how homeostasis works and focuses on temperature, water and sugar levels.

Activity 6

ADH and control of water balance

abpi

http://www.abpischools.org.uk/page/modules/homeostasis_kidneys/kidneys6.cfm?coSiteNavigation_allTopic=1

A teaching animation, which shows the effects of too much or too little water and the role of ADH. The modes can be changed from normal, too much water and too little water.

Activity 7

Thermoregulation

Education Quizzes

<http://www.educationquizzes.com/gcse/biology/unit-3-thermoregulation/>

A quiz which learners can use a revision tool or a quick classroom activity. Focuses on temperature control.

Activity 8

The kidney

Learners are to take the role of a nephrologist who has been invited to deliver a speech about the kidney. Learners to pair up and produce a 2 minute speech which focuses on the following points:

- Structure of the kidney
- Function of the kidney
- What ADH is?
- How does ADH affect the kidney?
- What alternatives are there if the kidney fails?

Activity 9

Diabetic awareness leaflet

Learners could produce a diabetic awareness leaflet for both type 1 and 2.

- What causes each type?
- Does body still produce insulin?
- Treatments

How does the lifestyle change?



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