# Scheme of work

## Combined Science: Trilogy - Foundation

## Biology – Homeostasis and response

This resource provides guidance for teaching the Homeostasis and response topic from our new GCSE in Combined Science; Trilogy (Biology) 8464. It has been updated from the draft version to reflect the changes made in the accredited specification.

Some minor changes have been made to the specification in sections 4.5.1 Homeostasis, 4.5.2, The human nervous system, 4.5.3.2 Control of blood sugar concentration, and 4.5.3.3 Hormones in human reproduction. These alterations have not required changes to the scheme of work.

The scheme of work is designed to be a flexible medium term plan for teaching content and development of the skills that will be assessed.

It is provided in Word format to help you create your own teaching plan – you can edit and customise it according to your needs. This scheme of work is not exhaustive; it only suggests activities and resources you could find useful in your teaching.

### 4.5 Homeostasis and response

### 4.5.1 Homeostasis

| **Spec ref.** | **Summary of the specification content** | **Learning outcomes**  *What most candidates should be able to do* | **Suggested timing (hours)** | **Opportunities to develop scientific communication skills** | **Opportunities to develop and apply practical and enquiry skills** | **Self/peer assessment opportunities and resources**  *Reference to past questions that indicate success* |
| --- | --- | --- | --- | --- | --- | --- |
| 4.5.1 | Importance of homeostasis | Homeostasis is the regulation of the internal conditions of a cell or organism to maintain optimum conditions for function in response to internal and external changes.  Students should be able to explain the importance of homeostasis in maintaining optimal conditions for enzyme action and all cell functions.  In the human body, these include control of:   * blood glucose concentration * body temperature * water levels. | 1 | Define homeostasis.  Recall the ideal temperature that human enzymes work at and discuss what happens to enzymes when they get too hot.  Discuss how a fever affects microbial infection and how students feel when they have a temperature.  Describe the changes that occur in blood vessel diameter, skin colour and position of hairs when the core body temperature changes.  Describe how the brain monitors temperature of the blood (and how what you feel does not necessarily reflect the blood temperature). | Students can investigate the difference in sensation of tepid water after one hand has been in hot water and one hand has been in ice cold water.  Examine thermal images of different objects (including reptiles and mammals)   * [BBC: 10 wildlife secrets revealed by thermal cameras](http://www.bbc.co.uk/nature/24269057) * [Veterinary Thermal Imaging Ltd: Veterinary thermal imaging gallery](http://www.veterinary-thermal-imaging.com/thermography/thermal-imaging-gallery) * [PASS: six amazing things you didn't know about thermal cameras](http://www.tester.co.uk/blog/thermography/6-amazing-things-you-didnt-know-about-thermal-cameras) | [Exampro user guide PowerPoint](http://filestore.aqa.org.uk/resources/science/AQA-GCSE-SCIENCE-EXAMPRO-UG.PPTX) | |
| 4.5.1 | Control systems | These automatic control systems may involve nervous responses or chemical responses.  All control systems include:   * cells called receptors, which detect stimuli (changes in the environment) * coordination centres (such as the brain, spinal cord and pancreas) that receive and process information from receptors * effectors, muscles or glands, which bring about responses which restore optimum levels. | 1 | Define receptors, coordinators and effectors.  Describe the processes that occur without thinking in the body, including breathing rate and pupil size reaction.  Describe how the brain monitors blood carbon dioxide levels and link this to how CPR works to raise CO2 levels and initiate the breathing response. | Investigate the responses that occur when students hold their breath.  Investigate how the pupil changes size in different light levels. |  | |

### 4.5.2 The human nervous system

| **Spec ref.** | **Summary of the specification content** | **Learning outcomes**  *What most candidates should be able to do* | **Suggested timing (hours)** | **Opportunities to develop scientific communication skills** | **Opportunities to develop and apply practical and enquiry skills** | **Self/peer assessment opportunities and resources**  *Reference to past questions that indicate success* |
| --- | --- | --- | --- | --- | --- | --- |
| 4.5.2 | Structure and function | The structure of the nervous system is adapted to its functions.  The nervous system enables humans to react to their surroundings and to coordinate their behaviour.  Information from receptors passes along cells (neurones) as electrical impulses to the central nervous system (CNS). The CNS is the brain and spinal cord. The CNS coordinates the response of effectors which may be muscles contracting or glands secreting hormones. | 1 | Label a diagram of the human nervous system.  Label a diagram of a sensory and a motor neurone.  Colour in various sections of a diagram of a brain to reflect what the different parts do.  The events leading to a non-reflex response go in the following order:   * stimulus * receptor * coordinator * effector * response.   Examine MRI images of brains with tumours or disease to identify what the person may struggle to do. | Students can use hair grips or bent wire to investigate where they have many touch receptors on the skin surface.  Students can alternate between touching one and two prongs on the hand of a blindfolded pupil. |  |
| 4.5.2 | The reflex arc  **Required practical: Reflexes**  Plan and carry out an investigation into the effect of a factor on human reaction time.  AT skills covered by this practical activity: biology AT 1, 3 and 4. | Students should be able to explain how the various structures in a reflex arc relate to their function and understand why reflex actions are important.  Reflex actions are automatic and rapid; they do not involve the conscious part of the brain.  Students should understand the following points about a simple reflex action such as a pain withdrawal reflex:   * impulses from a receptor pass along a sensory neurone to the CNS * at a junction (synapse) between a sensory neurone and a relay neurone in the CNS, a chemical is released that causes an impulse to be sent along a relay neurone * a chemical is then released at the synapse between a relay neurone and motor neurone in the CNS, causing impulses to be sent along a motor neurone to the effector * the effector is usually a muscle, in this case to withdraw the limb from the source of pain. | 1 | Describe reflex actions and how they work to protect the body.  Label a flow diagram of a reflex arc.  Describe the method used to test reaction times and how they might be affected by different drugs or situations.  Label a diagram of a synapse and describe how neurotransmitters work.  Discuss how certain drugs and poisons inhibit or overstimulate the synaptic response. | Demonstrate different reflexes:   * the salivary response to peeling an orange * the knee jerk reflex * an insect or ball flying towards the eye causing the blink response * a flinch when a ruler is slapped loudly on a desk.   Synaptic tag  In the playground or a large space, draw a chalk diagram of the ends of an axon and dendrite.  Some students can be neurotransmitters trying to cross the gap between axons and dendrites without being caught and sent back to the axon by enzymes (the catchers) in the gap.  Use reaction rulers to investigate the difference between visual, auditory and tactile cues (pupil to catch the ruler when they see it released; then blindfolded and catch it when they hear the word release, and finally catch it as their shoulder is touched for its release). This is very similar to the activity in Physics unit 6.1.4.3.1 on Stopping distances. |  |

### 4.5.3 Hormonal coordination in humans

| **Spec ref.** | **Summary of the specification content** | **Learning outcomes**  *What most candidates should be able to do* | **Suggested timing (hours)** | **Opportunities to develop scientific communication skills** | **Opportunities to develop and apply practical and enquiry skills** | **Self/peer assessment opportunities and resources**  *Reference to past questions that indicate success* |
| --- | --- | --- | --- | --- | --- | --- |
| 4.5.3.1 | Human endocrine system | The endocrine system is composed of glands which secrete hormones directly into the blood stream. Hormones are large chemical molecules. The blood carries the hormone to a target organ where it produces an effect.  Compared to the nervous system the effects are slower but act for longer.  The pituitary gland in the brain is a ‘master gland’ which secretes several hormones into the blood in response to body conditions.  These hormones in turn act on other glands to stimulate other hormones to be released to bring about effects.  Students should be able to identify the position of the following on a diagram of the human body:   * pituitary gland * pancreas * thyroid * adrenal gland * ovary * testes. | 1 | Define the words secrete, gland, hormone and excrete.  Label a diagram of the endocrine system.  Link hormones with the responses they bring about.  Compare and contrast the endocrine and nervous system. | Demonstrate how glands work using water squeezed from a sponge. The porous parts of the sponge are the ducts of a gland (like sweat glands).  Students role play being hormones travelling in the body to correct receptor.  Use ‘puzzle pairs’ and ask students to find the correct partner for their hormone/response.  Receptors remain still and hormones travel through the class looking for their match.  Once they have found their match, they must perform the action written across the back of both puzzle pieces. |  |
| 4.5.3.2 | Control of blood glucose concentration | Blood glucose concentration is monitored and controlled by the pancreas. If the blood glucose concentration is too high, the pancreas produces the hormone insulin that causes glucose to move from the blood into the cells. In liver and muscle cells excess glucose is converted to glycogen for storage.  Students should be able to explain how insulin controls blood glucose (sugar) levels in the body.  Type 1 diabetes is a disorder in which the pancreas fails to produce sufficient insulin. It is characterised by uncontrolled high blood glucose levels and is normally treated with insulin injections.  In Type 2 diabetes the body cells no longer respond to insulin produced by the pancreas. A carbohydrate controlled diet and an exercise regime are common treatments. Obesity is a risk factor for Type 2 diabetes. Students should be able to compare Type 1 and Type 2 diabetes and explain how they can be treated. | 1 | Recall the need for glucose in respiration.  Draw a flow diagram to show how blood glucose is controlled in the pancreas.  Describe diabetes and what happens when blood sugar is no longer regulated by insulin.  Draw graphs to compare how glucose is regulated in a diabetic compared to a non-diabetic person.  Describe Type 1 and Type 2 diabetes and compare the disorders and how they are treated.  Examine graphs to show the rise of diabetes and the relationship with obesity. Describe ways to reduce the risk of diabetes.  Students make a visual display to present the information they have found out about sugar in foods and its links to a risk of diabetes, including a comparison of the two types of diabetes. | Give students cards with the names of the hormones, glucose and glycogen. In pairs, students can ‘respond’ to different scenarios of high or low glucose levels by showing which hormone is released and the resulting levels of blood glucose.  Examine food and drink labels commonly consumed by students to identify the amount of sugar in different foods.  Students measure out the amount of sugar found in two different foods into beakers and put into a class display. |  |
| 4.5.3.3 | Hormones in human reproduction | Students should be able to describe the roles of hormones in human reproduction, including the menstrual cycle.  During puberty reproductive hormones cause secondary sex characteristics to develop.  Testosterone is the main male reproductive hormone produced by the testes and it stimulates sperm production. | 1 | Label diagrams of male and female changes at puberty (links with PHSE).  Label the male reproductive tract.  Describe the main reproductive hormones in males and females, where they are secreted from and what they do. |  |  |
| 4.5.3.3 | Female reproductive hormones | Oestrogen is the main female reproductive hormone produced in the ovary. At puberty eggs begin to mature and one is released approximately every 28 days. This is called ovulation.  Several hormones are involved in the menstrual cycle of a woman.   * Follicle stimulating hormone (FSH) causes maturation of an egg in the ovary * Luteinising hormone (LH) stimulates the release of the egg * Oestrogen and progesterone are involved in maintaining the uterus lining. | 1 | Label a female reproductive tract.  Define menstruation, menstrual cycle, ovulation.  Describe the actions of the different female hormones.  Label a flow diagram to show what happens to the female reproductive system during the menstrual month as different hormones are secreted.  Interpret a graph of different hormones and their effects on each other. Use the graph to indicate when during the 28 days, a girl could get pregnant or menstruation starts. |  |  |
| 4.5.3.4 | Contraception | Students should be able to evaluate the different hormonal and non-hormonal methods of contraception.  Fertility can be controlled by a variety of hormonal and non-hormonal methods of contraception.  These include:   * oral contraceptives that contain hormones to inhibit FSH production so that no eggs mature * injection, implant or skin patch of slow release progesterone to inhibit the maturation and release of eggs for a number of months or years * barrier methods such as condoms and diaphragms which prevent the sperm reaching an egg * intrauterine devices which prevent the implantation of an embryo or release a hormone * spermicidal agents which kill or disable sperm * abstaining from intercourse when an egg may be in the oviduct * surgical methods of male and female sterilisation. | 1 | Define fertilisation.  Describe different methods of contraception and how they prevent fertilisation.  Examine data on the reliability of the different forms of contraception ie:  [NHS – How effective is contraception at preventing pregnancy?](http://www.nhs.uk/conditions/contraception-guide/pages/how-effective-contraception.aspx)  [Center for Young Women's Health – Success and failure rates of contraceptives](http://youngwomenshealth.org/2009/11/03/success-and-failure-rates-of-contraceptives/)  Discuss why people might use or not use different forms of contraception, and why issues around contraception cannot be answered by science alone. |  |  |