# Scheme of work

## Combined Science: Trilogy - Foundation

## Biology – Infection and response

This resource provides guidance for teaching the Infection 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 4.3.1.1 Communicable diseases, 4.3.1.6 Human defence system and 4.3.1.9 Discovery and development of drugs. 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.

### 4.3 Infection and response

### 4.3.1 Communicable diseases

| **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* |
| --- | --- | --- | --- | --- | --- | --- |
| 4.3.1.1 | Communicable (infectious) diseases | Students should be able to explain how diseases caused by viruses, bacteria, protists and fungi are spread in animals and plants.  Pathogens are microorganisms that cause infectious disease. Pathogens may be viruses, bacteria, protists or fungi. They may infect plants or animals and can be spread by direct contact, by water or by air.  Bacteria and viruses may reproduce rapidly inside the body. | 1 | Define pathogen.  Describe the different kinds of pathogen and give examples of the diseases they cause. | Use plasticine and pipe cleaners to make models of a bacteria, virus, protist and fungus.  Set up agar plates to investigate the action of hand sanitizer and antiseptic on the growth of microorganisms found around the lab. These will be used in lesson 4.3.1.3 Bacterial diseases below. | [Exampro user guide Powerpoint](http://filestore.aqa.org.uk/resources/science/AQA-GCSE-SCIENCE-EXAMPRO-UG.PPTX) |
| 4.3.1.1 | Preventing the spread of disease | The spread of diseases can be reduced or prevented by:   * simple hygiene measures * destroying vectors * isolation of infected individuals * vaccination. | 1 | Describe the ways that disease can be transmitted.  Describe the methods that infections can be prevented. | Students can model the transmission of disease through direct contact (quietly put glitter on two students’ hands at the start of the lesson) – by the end of the lesson anyone with glitter on them is infected.  Model airborne disease by using a bubble maker – anyone touched by a bubble over the course of the lesson has been infected. |  |
| 4.3.1.2 | Viral diseases | Viruses live and reproduce inside cells, causing cell damage.  Symptoms, complications and cures/ prevention of measles, HIV, tobacco mosaic virus (TMV). | 1 | Draw a flow diagram to illustrate how viruses reproduce inside cells.  Describe the symptoms, complications and cures/ prevention of measles, HIV, tobacco mosaic virus. | Students can compare the relative sizes of viruses and bacteria by looking at scale diagrams. |  |
| 4.3.1.3 | Bacterial diseases | Bacteria may produce poisons (toxins) that damage tissues and make us feel ill.  Symptoms, complications and cures/ prevention of Salmonella and Gonorrhoea. | 1 | Draw a flow diagram to illustrate how bacteria reproduce to cause disease.  Ask students to compare bacterial and viral diseases and their effects on cells in the body.  Describe the symptoms, complications and cures/ prevention of Salmonella and Gonorrhoea. | Examine the bacteria growth on agar plate set up in previous lesson (4.3.1.1 – Communicable (infectious) diseases). |  |
| 4.3.1.4 | Fungal diseases | Symptoms, complications and cures/ prevention of rose black spot. | 1 | Describe the symptoms, complications and cures/ prevention of rose black spot. | Examine yeast budding under the light microscope.  Examine bread mould using a hand lens. |  |
| 4.3.1.5 | Protist diseases | Malaria, including protist lifecycle and prevention. | 1 | Students put the lifecycle of the protist into order.  Describe methods of prevention. | Students can produce a table to consolidate viral/ bacterial/ fungal/ protest diseases by comparing and contrasting in a table comparing scales/ how it spreads/ example diseases and preventions. |  |
| 4.3.1.6 | Human defence systems – non-specific | Students should be able to explain the nonspecific defence systems of the human body against pathogens.  The human body defends itself against the entry of pathogens:   * The skin is a barrier and produces antimicrobial secretions. * The nose traps particles which may contain pathogens. * The trachea and bronchi secrete mucus which traps pathogens and cilia waft the mucus to the back of the throat where it is swallowed. * The stomach produces acid which kills the majority of pathogens which enter via the mouth. | 1 | Label a diagram of the human body with the nonspecific defence systems, including the structure of goblet and ciliated cells. | Use a bubble machine to simulate infections.  Students can arm themselves with a variety of materials to prevent bubbles touching them:   * cling film – skin * paper fans – cilia * pins – acid * paper towels – mucus. |  |
| 4.3.1.6 | Human defence systems – specific | Students should be able to explain the role of the immune system in the defence against disease.  If a pathogen enters the body the immune system tries to destroy the pathogen.  White blood cells help to defend against pathogens by:  • phagocytosis  • antibody production  • antitoxin production. | 1 | Draw a cartoon strip to illustrate the immune response in the body highlighting the points in the learning outcomes about white blood cells. | Students can model the immune response by placing a cling film covered magnet (antibody) into mixtures of salt (human cells) and iron filings (pathogens).  The iron will stick onto the antibodies. Adding more magnets represent the immune response if the disease has been encountered before.  Ask students to describe what is good and less good about the model. Ask students to come up with their own ideas for modelling the immune system. |  |
| 4.3.1.7 | Vaccination | Vaccination involves introducing small quantities of dead or inactive forms of a pathogen into the body to stimulate the white blood cells to produce antibodies. If the same pathogen re-enters the body the white blood cells respond quickly to produce the correct antibodies, preventing infection.  Students do not need to know details of vaccination schedules and side effects associated with specific vaccines.  If a large proportion of the population is immune to a pathogen, the spread of the pathogen is very much reduced. | 2 | Describe how a vaccination works.  Draw a flow diagram to show the changes in the immune system. Revisit the cartoon strip drawn in Human defence systems – specific 4.3.1.6 and add extra frame to illustrate the action of vaccination on an alternate version of the story.  Students describe the effect that vaccination has on the overall population. | Role play the effect that vaccination has by distributing 2 red counters (infected by measles), several blue (unvaccinated) and green counters (vaccinated) to the students.  Give the blue counter students post it notes to describe why they have not been vaccinated.  Red students should throw paper balls at the torsos of other students. Vaccinated students can deflect the infection, non-vaccinated cannot and become infected.  All infected sit down and throw paper balls, non-infected remain standing. Highly infectious disease like measles will get 15 paper balls to throw.  Herd immunity can be modelled by then getting the vaccinated students to surround the unvaccinated students and protect them from the disease throwing students. |  |
| 4.3.1.8 | Antibiotics and painkillers | Students should be able to explain the use of antibiotics and other medicines in treating disease.  Antibiotics, such as penicillin, are medicines that help to cure bacterial disease by killing infective bacteria inside the body. It is important that specific bacteria should be treated by specific antibiotics.  The use of antibiotics has greatly reduced deaths from infectious bacterial diseases. However, the emergence of strains resistant to antibiotics is of great concern.  Antibiotics cannot kill viral pathogens.  Painkillers and other medicines are used to treat the symptoms of disease but do not kill pathogens.  It is difficult to develop drugs that kill viruses without also damaging the body’s tissues. | 1 | Describe the action of antibiotics.  Explain how antibiotics and painkillers are used to treat disease.  Examine data, ie [CDC – Control of Infectious Diseases](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4829a1.htm) on how the use of antibiotics has reduced infectious diseases and summarise the information.  Describe the problems of antibiotic resistance and how it can be reduced.  Calculate how many bacteria there will be in 10 hours if they double in number every 30 minutes. Describe what would happen to the population of bacteria if antibiotics were taken. | Demonstrate how antibiotic resistant strains can survive antibiotics by using balloons of one colour to represent normal bacteria, and a balloon of a different colour to represent the resistant strain.  Demonstrate the action of antibiotics (a pin) on the normal balloons.  Demonstrate a virus using a ball that cannot be popped with the pin.  Demonstrate painkillers using a marker pen – bacteria can be affected by it, but cannot be destroyed by them.  Students can investigate how not completing the course of antibiotics can allow reinfection to occur. Add a set number of drops of vinegar (the antibiotics course) into a test tube of water and phenolphthalein (bacteria) until it turns yellow (healthy). |  |
|  |  |  |  |  | Note that if the course is not finished (add less drops), some bacteria survives. |  |
| 4.3.1.9 | Discovery and development of drugs | Traditionally drugs were extracted from plants and microorganisms.   * The heart drug digitalis originates from foxgloves. * The painkiller aspirin originates from willow. * Penicillin was discovered by Alexander Fleming from the Penicillium mould.   Most new drugs are synthesised by chemists in the pharmaceutical industry. However, the starting point may still be a chemical extracted from a plant. | 1 | Describe the plant origins of some drugs.  Summary the story of Alexander Fleming’s discovery into a cartoon strip. | Examine the mould growing on bread set up in 4.3.1.4 – Fungal disease lesson. |  |
| 4.3.1.9 | Medical testing | New medical drugs have to be tested and trialled before being used to check that they are safe and effective.  New drugs are extensively tested for toxicity, efficacy and dose.  Preclinical testing is done in a laboratory using cells, tissues and live animals.  Clinical trials use healthy volunteers and patients.   * Very low doses of the drug are given at the start of the clinical trial. * If the drug is found to be safe, further clinical trials are carried out to find the optimum dose for the drug. * In double blind trials, some patients are given a placebo, which does not contain the drug. * Patients are allocated randomly to groups so that neither the doctors nor the patients know who has received a placebo and who has received the drug until the trial is complete. | 1 | Describe why drugs should be tested.  Define placebo and double blind.  Describe how students would investigate whether caffeine/ sugar affects heart rate.  Complete a flow diagram to show the stages in medical testing.  Design the content for a website to encourage people to become involved in drug testing – the process, the benefits, and why the risks are low. Describe why sometimes only men can test certain drugs, rather than both men and women. | Students can investigate the effect of sugar/caffeine on their heart using normal cola and diet/caffeine free cola. Use pulse meters to test heart rate. Test after drinking the cola. Complete a double blind test (where teacher does not know which cola is which). Compare results to see if the different ingredients make a difference to heart rate.  The heart rate of water Daphnia can also be investigated using a light microscope and caffeine solutions. |  |