Convenio M.E.C./British Council

Orientaciones pedagógicas para el desarrollo del Currículo Integrado en el nivel de Educación Secundaria (3º E.S.O.): Ciencias Naturales : Biología y Geología

Guidelines for the development of the Integrated Curriculum in Secondary Education (3º E.S.O.): Biology and Geology

Table of Contents

Introduction to the Biology / Geology Curriculum

This Integrated Biology / Geology Curriculum for E.S.O. 3º is based on the current Spanish and British curricula.

The order of teaching topics may be changed to allow the pupils to use an English textbook and to work within topic areas. The QCA (Quality Control Agency, Department for Education and Skills –DfES) has recently published a programme of study and science criteria for Key Stage 4 including preparation for the GCSE science exams. These documents, available from the QCA website (see appendix) may prove useful to teachers when planning units of work.

Methodology

- A major aim of this Integrated Curriculum is to encourage an imaginative approach to the teaching of Biology and Geology. Not only do our pupils need to learn scientific facts but also, increasingly, they need to be able to use and apply their scientific knowledge.
- Pupils need to be encouraged or challenged to reflect upon scientific interpretations: Where did the information come from? How do we know it is true? How can I check on it? They also need to understand how scientific ideas are developed, they need to be able to plan and carry out scientific investigations to test out ideas experimentally. In doing this they will be developing their practical skills, learning how to solve problems, learning how to evaluate their results and so to be able to evaluate the scientific information which they will be coming in to contact with on a daily basis throughout their lives. Current concerns which could affect all of us include diet, dangers of antibiotics, mad cows, HIV, IVF, SARS, cloning, genetic testing, environmental pollution, global warming. Pupils need to be able to evaluate the importance and relevance of these complex, science-based topics for themselves. So this curriculum aims to give the pupils experience of many types of scientific enquiry such as:
    - recognising patterns and correlations
    - using first hand and second hand sources of information including ICT
    - identification and classification techniques
    - how to use and evaluate some scientific techniques or applications
    - the need for fair tests involving controls
    - using experimental models and analogies

The use of practical work
As well as teaching Biology and Geology, the course also specifies which science skills should be taught. Teaching science skills is as important as teaching the contents.

- Practical skills work can be used for a number of reasons such as:
  - To back up theory work
  - To give the pupils first hand experiences
  - To learn how to carry out a scientific investigation
  - To develop science skills
  - To stimulate the pupils' interest

- Teachers will use a variety of different approaches to practical work with their pupils which might include the following if appropriate:

  - ✓ Starting a topic with an investigation to allow the pupils to find out some of the key concepts through their own work. In practice this cannot be used too often as it can be time consuming and it must be carefully structured to allow the pupils to be led in the right direction.
  - ✓ Using practical work to illustrate a concept. The teacher will have already introduced the main points and questioned the pupils to assess their basic understanding then the structured practical work will be used to reinforce the theory.
  - ✓ Practical demonstrations by the teacher so that the results can be discussed at the time.
  - ✓ Small practical activities during a theory lesson to break it up and to introduce new ideas and points for discussion.

- Practical work need not use a lot of equipment nor a lot of time and it may vary from:
  - Full investigations such as:
    - a biology field trip lasting a whole day
    - carrying out investigations to demonstrate the effect of exercise on the pulse rate
  - Shorter practical investigations such as:
    - an investigation to compare minocular and binocular vision, e.g: threading a needle, ring throwing, shooting
  - Or quick activities such as:
    - demonstrating muscle fatigue, e.: measurement of repeated hand grip
    - measuring reaction times in pairs, by, e.g: dropping and catching objects

Different approaches to teaching and learning

All pupils do not learn in the same way so it is important to give them a range of different kinds of experiences to give them the opportunity to develop. The range of types of experience can be summarised as:

Examples of possible activities		
Type of experience	**Used by pupils**	**Used in teaching**
Visual	PowerPoint slides, making videos, making a poster, use colour codes for revision, mind maps, making graphs, key diagrams, computer based learning	PowerPoint slides Posters on the walls Video Internet searches Practical demonstrations Visits to museums and planetariums
Audio and linguistic	Word puzzles, writing a magazine article, crosswords, discussion, debates, comprehension tests, library search, presentations from/to the class Listening to a news/documentary report	Word walls Setting library or newspaper search investigations Internet/TV news/documentaries/reports School magazine Entering national science competitions
Kinaesthetic, physical	Model making, practical tasks, role-play, making flash cards and posters. Movement.	Hands-on practical lessons Using role-play to act out ethical dilemmas.
Mathematical	Organising tasks into steps, listing key points, making tables and graphs of information, making timelines, creating flow charts	Preparing quantitative practical lessons to generate data Using flow charts to sequence an activity Using Excel for dealing with data tables and graphs.

These types of experiences above should be taken into account when preparing the scheme of work to ensure a good range of different activities.

This does not mean that there is no place for the normal class where the teacher stands at the front and delivers a lesson. On the contrary, the teacher has an even more central role in ensuring that all the pupils are given the best opportunity possible to understand the concepts and take an active part in their own learning. Rather than lecturing to the pupils, the teacher has to be looking for feedback and response, by questioning the pupils, testing them to see if they understand.

When carrying out practical activities pupils will usually be working in groups. This is an important part of learning how to work together and supporting each other within the team.

Assessment of practical work
The teacher will assess different aspects of practical work. The main areas are:

Area	Skills to be taught	*Examples of opportunities for teaching the skills*
Ideas and Evidence	Making predictions, looking at how scientists worked in the past, considering evidence and scientific explanations	Microbes and disease. Changes and development in the transmission of infectious diseases. Research how scientists work together to investigate and reduce the transmission of diseases.
Planning investigations	Making a plan to answer a particular question, identifying key variables, making a fair test, selecting appropriate apparatus.	Obtain and analyse information on the effects of exercise and recovery rates in athletes and non-athletes. Investigate different types of micro organisms, e.g. bacteria, viruses or fungi. Describe the features of each of these.
Obtaining and presenting information	Collecting data, using tables, bar charts and graphs, using ICT formats of presentation to include written summaries, extended writing and short talks using power-point presentations.	Making charts, tables, graphs to compare investigation results. Making calculations including: percentages, averages, ratios etc. Classifying, e.g: bacteria or fungi on a chart. Naming some of the disease these cause. Describing some of the defences the body has against disease. Describing immunisation and its effects.
Considering results	Drawing conclusions, explaining using scientific knowledge and understanding Considering the power and limitations of science in addressing industrial, social and environmental questions, including the kind of questions science cannot answer. Looking at uncertainties in scientific knowledge and the ethical questions involved.	Recognising that antibiotics are effective against bacteria but not against viruses. Commenting on the purpose, approach and suitability of a given experiment. Commenting on the limitations of the set up, apparatus, suggested measurements or observations, limitations of equipment and appropriateness of controls. Studying different cloning techniques and considering the benefits and drawbacks of each technique.

Evaluating results	Accuracy of the results, how investigations can be improved These aspects of evaluation should be kept in mind when planning a scheme of work.	Commenting on sources and causes of error. Suggesting possible improvements in method.

Text books

This course is designed so that teachers can choose text books in English as appropriate for their pupils. As the Integrated Curriculum is designed to cover the Spanish and English objectives, there is no “ideal” textbook. However, given the methodological approach, many teachers may find an English textbook to be more appropriate.

The British system has 5 years of secondary education from year 7 to year 11; the equivalents of these in the Spanish system are:

Y7	6º Primaria	Key Stage 3
Y8	1º ESO	Key Stage 3
Y9	2º ESO	Key Stage 3
Y10	3º ESO	Key Stage 4
Y11	4º ESO	Key Stage 4

Y10 to Y11 are called Key Stage 4 and are taught in secondary schools aiming towards the preparation of GSCE examinations

In the Integrated Curriculum at this level, Biology and Geology are taught in English. The topic order is flexible to correspond with the chosen textbooks and the supplementary material available.

Suggested textbooks for teaching the curriculum for 3º ESO are :

Science Plus+ (Collins) Book 1 : ISBN 0-00-721648-3
Book 2 : ISBN 0-00-721649-1
Teachers guide and CDROM ISBN 0-00-721650-5
Homework and assessment on-line ISBN 0-00-721645-9
Further information available at : www.collinseducation.com
N.B: This text is a general science course, including all of the biology topics and with some useful material connected to the geology topics. It is useful both for students intending to work towards the GCSE exam and those who do not intend to take the exam.

BIOLOGY first (OUP) ISBN 0-19-914731-0
Further information available at : www.oup.com
N.B: This text is a specific Biology course and is considered particularly useful for students who intend to work towards the Biology GCSE exam.

Other useful books for teacher reference :

Collins Absolute Science, 1,2,3
N.B : Especially book 2 Rocks and weathering, and the Rock Cycle : ISBN 0-007-13588-2
And book 3 Environmental chemistry, Inheritance and selection, and Fit and healthy : ISBN 0-00-713587-4Also with Teachers Guide, CDROM and online support
Further information available at : www.collinseducation.com

For detailed background knowledge at a higher level and summaries of the different syllabuses of different British examination boards :

***Letts* Revise AS and A2** : ISBN 1-84315-474-9 www.letts-education.com

Collins GCSE Revision Guide series: Biology 0-00-719058-1

References to some of these texts has been made in the resource column of the units of work where appropriate in order to give teachers some ideas of how the content fits into the various topics included in the Integrated Curriculum.

THE SCIENCE CURRICULUM

The curriculum for 3º ESO is divided into two main areas :

- Biology
- Geology

This is not necessarily a teaching sequence, and each teacher should decide on this according to pupils' needs, available time, resources etc. Each of the sections is split up into a suggested teaching sequence which should be followed as some concepts need to be introduced before others.

The introduction to each section includes the titles of the section and the areas to be covered. There is also a section on assumed knowledge, which summarises the sections of the syllabus already covered in previous years. This could be used to introduce the section to the pupils by finding out what they already know. It could be done using a quick quiz. It is important to realize that the pupils will already have a great deal of scientific knowledge and understanding; we have to find out how much and then build on this foundation.

h The suggested time of the lesson or lessons, usually 1 or 2 hours.
In the same column there is also information as to the importance of the lesson:

- **Core** means it is an essential part of this Integrated Curriculum
- **Revision** means that the if necessary, it may be included before proceeding with the topic.
- **Extension** means if you have time you might like to do it but it is included to provide more practice in or depth to a topic.
- **Investigation** means a practical activity, which may form part of the core.

Lesson outline This is not a lesson plan but there are suggestions for activities to be carried out in the lesson.

Assessment activities These are suggestions for assessment opportunities that may come up in each lesson., as well as activities which may be used in each lesson. Teachers are advised to select those they consider most appropriate to their needs and the needs of their students.

Lesson outcomes An outline of the learning expectations for pupils from that lesson

Resources Suggestions for useful resources which are needed or would be useful for that lesson. These include both references to the suggested texts and websites.

N.B: Suggestions have also been made where appropriate of how teachers can link to other curricular areas. These are indicated using the following key :

LL : Literacy link (some of the activities which involve report writing etc, could be carried out in a literacy class.)
GL : Geography link (some of the content may also be covered, from a different perspective, in the Geography curriculum.)
CL : Chemistry link (some of the content may also be relevant to areas of Chemistry.
HL : History link (some of the content may also be connected with work covered in a History lesson)

Biology

Topic: Humans as multicellular organisms:- Causes, cures and prevention of infectious diseases.

Assumed knowledge from previous years:
The basic structure and function of an animal cell
Complex organisms have specialised organ systems
The common features of all living things, e.g. nutrition, respiration, reproduction, etc
The five kingdoms of living organisms include bacteria, protozoa, fungi, some of which are beneficial to humans and others are harmful and pathogenic.

Content :
1. That humans are multicellular organisms, organised into tissues, organs and systems which mutually support the health of the whole organism
2. That some micro-organisms can cause disease and that micro-organisms enter the body by a range of mechanisms
3. That the body can defend itself against infections and ailments.
4. That humans have developed means of enhancing the natural defence mechanisms
5. That these defence systems have an effect on organ transplants

H	Lesson outline	Assessment activities	Lesson outcomes	Resources
1 Core	Revise the organisation of the human being: Summarise what a cell / tissue/ organ/ system is and relate to previous work. Revise the processes common to life, animals, and mammals as a schematic on an OHP. Discuss what else links all living organisms? The need to keep all these systems healthy in the face of the risk of disease. Start the students thinking of factors affecting health, including ailments and diseases and ask them to bring in information and ideas for the next lessons.		Have an overview of some factors promoting health and others that cause sickness, infirmity, ailments or diseases.	Biology First pages 8-12 Cell form and function diagrams revision and test http://www.bbc.co.uk/schools/gcsebitesize/biology/cellprocesses/1cellfunctionsrev4.shtml Schematic on OHP

1 Core	**Content: The principal causes of sickness.** Ask pupils what illnesses they know about. Classify them according to whether they were infections or have other causes. Be aware if some have had experiences of serious illness and are likely to be distressed; relate to general information in the media rather than personal cases. Pupils sometimes find it hard to distinguish between infectious illnesses and other forms of illness, *eg dietary induced.* Ask pupils how colds pass from person to person in a class. Use their answers to explain the term 'infectious' and introduce them to viruses as a form of pathogen. Discuss other infectious diseases and how they are transmitted. Provide pupils with reference sources with which to construct a table of methods of transmission, with examples of diseases and causative agents. Discuss practical personal hygiene steps which would reduce the risk of infection •Help pupils to generate a list of ways to avoid infections and then use their ideas to write a leaflet for travellers to a long-haul destination on how to avoid infection by local diseases, *E.g. water-borne intestinal infections, malaria*.	**LL** Read account of outbreak of infection, e.g. gastro-enteritis in a hospital or school and identify causes, responses, consequences Quick quiz on how personal hygiene can reduce spread of infections **LL** Evaluate presentations of leaflets.	recognise that micro-organisms can cause infections, *eg food poisoning, TB, colds, tetanus, malaria, meningitis, athlete's foot* •describe a range of mechanisms by which micro-organisms enter the body, *eg food- and water-borne, droplet/air-borne, vectors, blood-borne passage across the placenta and via breastfeeding* •produce a leaflet giving advice on avoiding infection	Information on diseases and their causative agents or pathogens from textbooks and other sources, e.g. common cold, measles, food poisoning, etc. See sources below Oxford Biology first Chp. 2 page 57 Microbes and disease Collins Science plus 2 Chp. 27 Body wars pages 34-39 Information on foreign travel; http://www.bbc.co.uk/health/healthy_living/travel_health/index.shtml for contacts for world health and travel, advice http://www.bbc.co.uk/health/healthy_living/travel_health/usefulcontacts_index.shtml

1 Extension	**How people have fought disease in the past.** Relate to the pupils instances of people preventing the spread of disease when the role of micro-organisms was not known, *e.g. the residents of Eyam in Derbyshire restricting the spread of the plague, the work of Dr John Snow identifying wells as the source of cholera infections* Establish differences between some of the stories, *eg John Snow's actions were based on evidence about the distribution of cases of cholera, while the actions of others were not based on observed data*. Provide pupils with information about a modern outbreak of a disease, *eg Ebola, cholera, E. coli,* and ask pupils to identify the range of people involved in containing the spread of infection. Help them to present findings, *eg as a poster, flow chart*.	Read accounts of these events. Relate to the lifestyle and knowledge of the period. **LL** and **HL** Evaluate the poster or flow chart; encourage pupils to consider for themselves if they have identified all the people or other factors affecting the spread of the disease	Present information about a method of avoiding infection •relate the methods to knowledge about micro-organisms and evaluate their effects •describe the contributions of different scientists in dealing with an outbreak of disease	Accounts of the historical events. Dr John Snow and the cholera outbreak http://www.makingthemodernworld.org.uk/learning_modules/geography/05.TU.01/?section=2 Information leaflets about disease containment, e.g. foot and mouth Provide pupils with information about a modern outbreak of a disease, *eg Ebola, cholera, E. coli, salmonella* Collins Science plus 2 chp 27 Body wars.

1 - 2 Core	**How we protect ourselves against infectious diseases.** Explore pupils' ideas of why people are seldom ill despite surroundings rich in potentially harmful micro-organisms by asking them to complete a concept map using a variety of terms, *eg bacteria, virus, hygiene, immunity, vaccination, skin.* Relate the size of bacteria to a football field and a virus to a tennis ball in it. Use pupils' ideas to explain natural barriers to infection, and help pupils to annotate a diagram of the body with natural defence mechanisms. Ask pupils why young children are sometimes less resistant to infections than older children and why breast-feeding can help. Explain that the body has specialised cells in the blood as part of the defence systems. Explain that some white blood cells engulf pathogens and other white blood cells make matching antibodies that identify and hinder specific microbial activity. Use the presence of antibodies in, *eg blood*, to link with the previous activity. Point out that all kinds of micro-organisms can cause disease and that each type of micro-organism needs a different set of antibody-making cells. Ask pupils to write a short passage about how blood cells defend against disease.	Evaluate responses and ideas on concept map Evaluate passage explaining how blood cells defend against disease.	Identify natural barriers against infection, *eg dry skin, lysozyme, enzymes etc. in tears and sweat* •recognise that each type of micro-organism provokes a different set of antibodies •describe how white blood cells defend the body against disease, *eg engulfing micro-organisms, making antibodies* •describe antibody action, *eg marking infecting micro-organisms, entangling micro-organisms* •explain how blood cells defend against disease	Biology First page 57 Microbes and disease Collins Absolute Science 2 Chapter 7 Microbes and disease, and associated activities in teachers CDROM notes Concept map layout (individual copies or OHT) Diagram of body for annotation http://pathmicro.med.sc.edu/mhunt/vir-size.jpg shows a good comparative size picture of virus and bacterium. Use video clips, ICT, slides or illustrations to show the action of white blood cells engulfing micro-organisms. www.biotopics.co.uk/circuln/anphag.html

1-2 Core	**Vaccination and disease prevention.** Ask pupils if they have received vaccinations and which infections they are now protected against. Explain that a vaccination provokes the body into producing antibodies to that disease. Look at information about the levels of immunisation in the world or specific countries and data about the incidence of specific infectious diseases. Can the pupils see any relationships? What might happen if a country no longer carried out a programme of vaccination? Point out that vaccination programmes in developed countries are the result of careful planning to prevent the spread of communicable diseases *OR* Look at the story of Jenner and the prevention of Smallpox. *OR* Discuss the public response to health scares and the role of the media, which has led to a loss of community protection. This could lead on to an update on avian 'flu (the bird 'flu scare). *OR* Help the pupils prepare posters or leaflets promoting vaccination as a means to protect young people from meningitis or other infections	OR Extension **LL** Discuss the account of Jenner's work in the light of modern restrictions on experimenting on human beings. OR **LL** Consider if the reports in the media have caused anxiety in the students or made them better informed. OR **LL** Leaflets are factually accurate and appealing.	Pupils show understanding of the relationship between vaccination and incidence of disease. Most students will be able to understand the importance of the vaccination programme to community health in preventing the spread of communicable diseases. Some can explain how a vaccination works and explain the difference between live and dead vaccines.	OHP of the usual vaccination programme for children and adolescents in Spain Biology First page 120 vaccines and antibiotics Charts and graphs of incidence of diseases such as measles, small pox, Account of the work of Edward Jenner For the effects of reduced uptake of vaccination see http://briandeer.com/mmr/lancet-deer-1.htm but there are many more web references. The effect of the MMR scare was to reduce vaccination below the desired threshold target.

1 Core	**Treatment of diseases and infections by antibiotics**. Compare accounts of the discovery of Penicillin. Explain that antibiotics attack the infecting bacteria. Discuss why doctors do not prescribe antibiotics for virus infections and why we need to take the complete course of antibiotics.	Answer simple quiz about the differences in treatment between viral and bacterial infections	Can relate the treatment to the form of infection	Accounts of the discovery of penicillin from textbooks, internet, history books, etc. Biology First page 120 vaccines and antibiotics Collins Absolute Science Chp 7 Fleming and the discovery of penicillin text and photo http://www.sciencepages.co.uk/keystage3/year8/module15/fleming.pdf
1 Core	**Transplants and transfusions.** Revise which organ systems or tissues are essential for life, what happens if they become diseased or fail? Can these be replaced and if so how? Remind the students about the body's defence against invading bacteria and viruses. Ask what effect this might have if organs and tissues such as blood, corneas or kidneys are transferred from one person to another. What are the problems that have to be overcome? Which organs can be kept longest before they cannot be used? How are replacement organs obtained? How can doctors ensure that the donor is willing? Let the students debate issues of approaching relatives or carrying donor cards or growing artificial organs.	**LL** Students may prepare a debate or a publicity leaflet or compare existing leaflets to consider the type of persuasive language used.	Some organs/tissues are essential to life. After death they can be transplanted to a new host. Some cannot be preserved as long as others. There are ethical issues about obtaining organs which are affected by advances in medical technology	Collins Science plus Chp 1 Dead or Alive Accounts in news about successes or failures of transplants Publicity campaigns about giving blood or donating organs after death. Reports of family members giving kidneys to close relatives

1 Extension	**Preventing the spread of disease by food preparation processes.** Study an account of the work of Pasteur and pasteurisation, compare to Ultra Heat Treated milk (UHT) in preventing Tuberculosis			Relates to Nutrition and Health
1 Extension	Extension: pupils could be asked to find out about the work of Carlos Juan Finlay on yellow fever in Cuba and how his theories were only accepted once it was known that mosquitoes are carriers of malaria.			Carlos Juan Finlay and yellow fever in Cuba and in USA http://www.patient.co.uk/showdoc/40025124/

Topic: Nutrition and Health

Assumed knowledge from previous years:
Organ systems in humans and animals; Position and functions of organs; Characteristics of biomolecules: glucids, lipids, proteins.

Content:

1 Nutrients and Food
2 Balanced diet
3 Effects of an unhealthy diet
4 Conservation, manipulation and marketing of the food
5 People and the food consumption. Genetically-modified food

h	Lesson outline	Assessment Activities	Lesson outcomes	Resources
1 -2 Core	Ask pupils to use the nutritional information panel from cereal packets to identify the main nutrients contained in food, and establish that carbohydrates, proteins, fats, fibre and water form the bulk of food. Discuss with pupils the importance of water in our diet, what the sources of water are and whether it should or should not be counted as a nutrient.	Use a true/false quiz to assess and revise pupils' knowledge and understanding of food and diet. Name the most important nutrients and functions	Identify foods which are rich in particular nutrients Identify the main role of proteins, carbohydrates and fats in our diet	A collection of food packaging, including cereal packets showing nutritional contents Games and activities about nutrition: http://www.nutritionexplorations.com/kids/activities-main.asp Biology First, Oxford (pages 30 – 31) Collins Science Plus (page 36)

h	Lesson outline	Assessment Activities	Lesson outcomes	Resources
Core Investigation	Demonstrate food tests to identify protein, starch, sugars, fats, and water, ensuring that pupils are aware of the health and safety requirements for these tests.	To present results to highlight significant points	Use chemical tests to identify proteins, carbohydrates and fats Work safely with chemicals	About food tests: http://www.bbc.co.uk/schools/gcsebitesize/biology/humansasorganisms/0nutritiondigestionrev8.shtml Biology First, Oxford (page 35)
Extension	Ask pupils to produce a report of their findings and conclusions in an interesting and appropriate format, eg display work, an advisory leaflet for a particular target group, a class debate, a radio interview script.	Represent information in a format appropriate to the audience	Indicate where knowledge is not sufficient to draw a firm conclusion	Media reports, magazine, newspaper and television advertisements relating to food and diet

1-2 Core	Extend pupils' understanding of a balanced diet by providing software on diet containing information about the nutritional content of a range of foods. Describe, e.g. in an information leaflet, good sources of one nutrient and the importance of that nutrient in the diet	Ask pupils to produce a quiz sheet to test knowledge and understanding about food and diet and exchange with other pupils Generate questions about nutrients and diet	Use data to show that vitamins and minerals are present in foods in smaller amounts than other nutrients Explain that a healthy diet contains a balance of six groups of chemicals (proteins, carbohydrates, fats, vitamins, minerals, fibre) and water	Biology First, Oxford (page 30 – 31) Diet software, CD-ROMs, dietary information leaflets, other literature, which may include articles from magazines Collins Science Plus (page 29 – 30) Posters or drawings of nutrients that can be used as examples
Extension	Help groups of pupils to use the results of their investigations to produce a summary leaflet about one type of food constituent, including information about foods that are a good source of it and the role of this food constituent in the diet.	Bring together all the leaflets as a class booklet and establish the main role of each type of food in the diet	Select relevant information	Use food packaging, advertising claims, media reports, or recorded television advertisements as a stimulus to raise questions

1 – 2 Core	Discuss the effect of the shortage of a particular dietary component and some of the overall consequences, eg children succumb more easily to waterborne infections and measles, developmental delay, effects of low-energy foods in the diet, lack of calcium in bones and teeth. Provide pupils with secondary sources, including ICT, to identify the consequences of specific nutrient deficiencies. Consider investigations into the effects of specific nutrient deficiencies, eg the work of Magendie and Gowland Hopkins, the role of folic acid in development, the recognition of kwashiorkor (protein deficiency). Ask pupils about other ways in which a diet may be unhealthy and talk about ways in which overeating can affect health and lifestyle.	Help pupils make a summary of the nutrients needed for a healthy diet and some of the consequences of an inadequate or inappropriate diet. Use and interpret ICT-generated graphs	Describe the effects of deficiencies in diet, eg of calcium, iron, protein Describe some effects of an unhealthy diet, eg obesity, rickets, scurvy Describe evidence linking nutrition and health, and how evidence has been used	Use the internet to find information and advice on food and diet, eg www.nutrition.org.uk Visit a supermarket to find out more about foods Look at menus and labels in fast-food outlets Read articles in magazines and newspapers about issues relating to food and diet, eg for athletes, pregnant women, very young children About healthy diet: http://www.bbc.co.uk/health/healthy_living/nutrition/

1 Core	Explain to pupils that the consumer is the final element of the food chain. Food that has been perfectly safe at the point of purchase needs to be handled carefully to avoid contamination at home. To ensure that eating remains an enjoyable experience and is not spoiled by the risks or fear of falling ill, a number of measures can be taken	Compare different conservation strategies Check the "Use-By" date or "Best before" date marking on packaged foods.	Understanding of food properties, processing, preparation, marketing, conservation...	About food safety: http://www.eufic.org/en/quickfacts/food_safety.htm#14 leaflets, articles, magazines, etc about food marketing, conservation...
1 Core	Use quick oral questions to review pupils' knowledge of food consumption - Do we need genetically-modified food? - What are the effects on human health of eating it? - Should GM crops be subjected to clinical trials?	Ask pupils to list some names of foods that they dislike so much that they refuse to eat them. Ask them to estimate how long it has been since they last tried these foods Write advantages and disadvantages of genetically-modified food	Knowing the importance of an appropriate consumption and the consequences of an inappropriate one Knowing what is a genetically-modified food.	About nutrition and consumption: http://www.bbc.co.uk/food/food_matters/salt.shtml About genetically-modified food: http://news.bbc.co.uk/1/hi/special_report/1999/02/99/food_under_the_microscope/278490.stm#need Information leaflets, video clips of TV advertisements, other literature, which may include articles from magazines

Topic: Organs and Systems that support Nutrition; Processes within the Digestive system; Healthy Habits and Common Ailments

Assumed knowledge from previous years:
The major human organs, and their positions in the body
Some knowledge of why food is important and that food consists of different substances, which are required by the rest of the body.
Some knowledge that cells require nutrition and respire to live

Content :
The digestive system
What happens within the digestive system
Maintenance of healthy functioning of the system.
Common ailments

H	Lesson outline	Assessment activities	Lesson outcomes	Resources
	Content: the digestive system as a tube through which food passes through 5 stages of digestion and use a model gut to demonstrate how this works. Revise the digestive system and its organs from ESO 1 by quiz/ chain game of terms and definitions/ pupils devising questions for others to answer/ finally labelling diagram with correct terms and definitions Ask pupils for their ideas about what happens to food once it has been eaten. Build up a sequence of events commencing with feeding, followed by absorption and ending with elimination of faeces. Develop the idea that food enters a tube running through the body, and that what happens to food inside this tube can be explored using a model, *e.g. a model gut made filled with a 'starch meal'; a software simulation*	Observe which terms are not recalled, or definitions not understood and accuracy with which diagram is labelled	Can describe how food passes along a digestive tube which runs through the body Can offer suggestions about what happens to food as it passes through this tube Can make links between the model gut and the digestive system Can describe how food passes along a digestive tube which runs through the body	Cards for chain game or prepared game Large unlabelled poster or OHP/individual copies Or outline body and outline organs to assemble digestive system Possibly enlarged label cards and definition cards Biology First (OUP) pages 32 - 36 Collins Science plus 1 page 31 General process of digestion and flow chart Collins Science plus Teachers CDROM has worksheets to back up topic of digestion (chapter 5) Hodder Science Gold B, Chapter 1, Activity pack pages 108,112 Collins Absolute Science2 page 42 Food and Digestion

1-2 Core	Revise how they tested for starch in their nutrition studies and help them to test the contents of the 'gut' and the surrounding water for starch. Ask pupils to explain their observations and to consider the implications of nutrients from food entering the body. Ask pupils to interpret their findings in the light of their previous assumptions.	Observe whether pupils are able to suggest scientific explanations for observations	Use scientific knowledge to explain observations	Model gut made from porous "visking" tubing filled with a 'starch meal'; This lesson follows on from the analysis of food for its components. If not carried out earlier the test for starch needs to be demonstrated here. reagents for starch test e.g. iodine *see* Collins Science plus Teachers handbook and CDRom (or Collins Absolute Science2 page 40 for tests) Software simulation. This site has the microscopic structure of the small intestine and other interesting simulations http://www.vivo.colostate.edu/hbooks/pathphys/digestion/smallgut/anatomy.html

1 Core	Check pupils' understanding of the relationship between size of food molecules and ease of absorption, *e.g. by showing them models representing molecules of starch, protein, fat, sugars, vitamins and minerals*. Ask pupils which of these make up most of the foods they eat and challenge them to suggest what must happen to the large molecules. Ask them to predict which will be absorbed most easily, with reasons. Establish that digestion involves breaking larger molecules into smaller ones. Introduce the idea that digestion involves enzymes which act on large, insoluble molecules to break them down into smaller, soluble molecules. Help pupils to set up the model gut with saliva, or commercial preparation of amylase, and starch, and to test the contents of the water for sugar and the contents of the model gut for starch		State that small molecules can easily pass through the wall of the small intestine Explain that starch, protein and fat molecules are too large to be absorbed Explain that specific vitamins and minerals are generally smaller and can be absorbed by the body Produce a sequence of diagrams to illustrate that larger molecules are broken down to form smaller molecules in the gut	•Interlocking bead models can be used to represent large and small molecules and to model the process of breakdown of molecules, such as starch into sugar molecules. Although such models do not accurately represent the structure of fats, they do help to get across the idea of complexity. Starch, visking tubing, amylase or saliva, reagents for testing for sugars, e.g. glucose **Safety** – ensure pupils use their own saliva and that used test tubes are placed in disinfectant. Staff who clean apparatus should use gloves

1-2 Core	Remind pupils of the range of food types with large molecules and explain that in addition to enzymes the conditions inside the gut assist the breakdown of large molecules, *e.g. body temperature*. Ask pupils what substances are found in the stomach. Ensure pupils know that the lining of the stomach produces hydrochloric acid and this activates the enzyme pepsin. It also provides the right conditions for other protein-digesting enzymes Ask pupils to suggest what might affect how well the enzyme digests the food, *e.g. pH*, *temperature*, and help them to plan an investigation, identifying what they are going to measure and which variables they will need to control. If possible allow them to try one of the extension experiments below and ask pupils to produce an account of their investigation, relating what they found out to the conditions in the gut	Account shows relationships between ideas	Can suggest relevant variables, *e.g. pH, temperature* Can identify ways to keep variables, *e.g. temperature*, constant Can relate the conditions under which digestion occurs, *e.g. at a temperature of 37ºC*, to their results	**Safety** – pupils' plans must be checked for health and safety before practical work begins. Remind pupils how to safely heat test tubes of acid and other substances

1 Core	Remind pupils about the way in which the body uses food, *e.g. for energy*, *for growth,* and ask them how the products of digestion reach other parts of the body. Use secondary sources, *e.g. video clips, ICT simulations,* to show how simple molecules, *e.g. glucose molecules,* are transported to cells, *e.g.* in the muscles, through the circulatory system Ask pupils which of the food types they hadn't considered during the work on the products of digestion. Establish that fibre and undigested food is passed through the gut and egested in faeces	Evaluate understanding through discussion, planning and carrying out of processes	Can state that the blood transports products of digestion to every cell in the body Can use models to describe how smaller molecules are transported in the blood Able to state that some food material cannot be digested and is passed out of the body as faeces	http://www.vivo.colostate.edu/hbooks/pathphys/digestion/smallgut/lifecycle.html http://www.vivo.colostate.edu/hbooks/pathphys/digestion/smallgut/anatomy.html A simple animation of glucose absorption is found at the bottom of this webpage. Click "step" and an explanatory note describes what is happening. http://www.vivo.colostate.edu/hbooks/pathphys/digestion/smallgut/absorb_sugars.html
Part of 2h core above Extension	Extension: Provide them with an opportunity to investigate the action of a particular enzyme, *e.g. trypsin acting on the gelatine of exposed and developed black-and-white photographic film; protease acting on albumen*.			Dried egg albumen (sterilised) Old black and white film, gelatine spread on glass plate, droppers, flasks Commercial trypsin
Part of 2h core above Extension	Extension: pupils could find out which is the best washing powder for an egg yolk stain, *e.g. biological or non-biological*. Be aware that some pupils may be allergic to biological washing powders.			Fabric stained with egg-yolk biological washing powders, liquid soap, detergent e.g. Fairy

1 Core	Ask the pupils to discuss amongst themselves a display of patent remedies and decide what part of the digestive system they are designed to affect, and possibly what common ailments they treat. Enter the information on an OHP chart. Decide through discussion which products are preventative and which treat symptoms. Extend the pupils knowledge of other common ailments such as stomach ulcers and relate to the causes. Discuss whether people should treat the symptoms themselves first or visit their doctor. Relate to their studies of nutrition and health and ask them to make a presentation on how healthy habits of diet and hygiene can prevent one/more than one of these ailments: e.g. high fibre diets and probiotic yogurts can prevent indigestion and promote regular bowel movements and have positive effects on cholesterol levels.	Observe any misconceptions about any of the products, safety issues or inappropriate use for very young children Select groups to make their presentation and observe their understanding of their topic and the questions raised by the rest of the class		Display or PowerPoint presentation of: Packets and bottles of patent remedies for indigestion, stopping diarrhoea, toothpaste with and without fluoride and mouth wash, labels from lactose free milk, bifidus yogurts, health advice from high fibre cereal packets. Collins48-51, acids and alkalis, indigestion Invite a health/diet specialist in to talk about healthy diets, digestive system problems e.g. bowel cancer, or if appropriate bulimia and anorexia
1 Extension	Present information about food poisoning such as salmonella or gastro-enteritis and/or intestinal diseases such as cholera, dysentery and make case studies of how they are transmitted and how they can be prevented or treated.		**LL**	Dr John Snow and the cholera outbreak in Victorian London. http://www.makingthemodernworld.org.uk/learning_modules/geography/05.TU.01/?section=2

Review of work carried out

To relate knowledge and understanding of food types to the processes of digestion and consequences of poor diet and unhealthy eating practices.	Provide pupils with an appropriate selection of terms related to food, digestion and health and ask them to use these to make a concept map. Discuss pupils' maps with them, asking them to identify areas of difficulty and challenging them to make and explain new connections.	Identify appropriate connections between ideas in this unit and explain their reasoning	A concept map can show connections between different ideas in a particular topic. Pupils may have made concept maps previously.

Log on to www.CollinsEducation.com/absolutescience/ to see:
• Web-links for each chapter for Year 9 material
• Extra teaching notes and worksheets to supplement the printed resources
• Regularly updated Science Summaries which provide a digest of Science in the news

www.biotopics.co.uk/ for content for KS3 and 4, and GCSE by Dr Stearn, designed for use by pupils with revision notes, some animations

Gondar Design Biology
http://www.purchon.com/biology/index.html
Site for students linked to teachers pages in the UK.
Concentrated revision notes and diagrams covering key stage 4 biology. The level of detail is high and authoritative making the pages very suitable for students studying the single subject at GCSE. Ideal for final examination revision.

Digestive system histology and animated enzyme
http://www.tvdsb.on.ca/westmin/science/sbi3a1/digest/digest.htm

Also covers digestion but mainly information for a teacher
http://digestive.niddk.nih.gov/ddiseases/pubs/yrdd/index.htm

Absorbption of sugars
http://www.vivo.colostate.edu/hbooks/pathphys/digestion/smallgut/absorb_sugars.html

Topic: Respiratory System

Assumed knowledge

1 Major human organs
2 Experiments showing that air has weight
3 Respiration in plant and animal cells
4 Respiration and Excretion

Content:

1 Good health involves social, mental and physical aspects
2 How the respiratory system contributes to the body's nutrition
3 Description of anatomy of the apparatus involved in respiration
4 Keeping our lungs healthy
5 Common respiratory illnesses

h	Lesson outline	Assessment criteria	Lesson outcomes	Resources
1 Core	**The Health Triangle** Give pupils a selection of newspaper / magazine cuttings related to health. Discuss the articles with the class and ask them to relate them to the three aspects of health – social, mental and physical. Ask pupils to make posters of the Health Triangle. Place articles in order or write examples of (a) social (b) mental and (c) physical well-being. Discuss the meaning of health The importance of a healthy lifestyle. Ask pupils to define function of nutrition. Explain that it does not only involve feeding. Get the pupils to complete a table outlining the main functions carried out by the digestive, respiratory, circulatory and excretory systems. Santillana Book ·3 page 63 Use the headings Apparatus / Function / Principal Organs / Function of the Organs.	Poster of the Health Triangle Table showing apparatus / function / principal organs and function of organs	Know that good health includes social, mental and physical aspects Correctly define what we mean by nutrition Know apparatus involved in the function of nutrition in human beings. The digestive, circulatory, respiratory and excretory apparatus	Newspaper / magazine / internet articles on health Santillana Biology Geology Teacher's book 3 (2003) chapter 4 page 32

1 Core	Explain to the pupils that during the next few lessons they will be focusing on the respiratory system. Label diagram of human respiratory apparatus. Look at CD's or computer animations showing ventilation to bring about gas exchange. Show illustrations, models or animated pictures of the fine structure of the lungs and ask pupils to suggest why the alveoli have so many blood vessels around them. Provide information about carbon dioxide and oxygen concentrations in the blood. Ask pupils to predict what happens in the alveolus. Help pupils to annotate diagrams with arrows to show the direction of movement of oxygen and carbon dioxide and describe gas exchange in terms of a supply of oxygen to the blood and removal of carbon dioxide from the blood. Ask students to make models of human respiratory apparatus. Take notes from page 30 – 35 of AQA GCSE Biology book. Complete questions from book.	Labelling activity Assess diagrams showing movement of oxygen and carbon dioxide Model lungs	Mechanism of breathing in lungs Function of cilia, cartilage and mucus in trachea and bronchi Gas exchange between the air sacs and the surrounding blood vessels Features which make lungs efficient gas exchange structures : large surface area, a moist surface, a very thin membrane, a rich capillary network	AQA GCSE Biology Chapter 2.4 pages 30 – 35 Enchanted Learning lung diagram can be found in the anatomy section:http://www.enchantedlearning.com/sample/ Multi-media CD ROMS on breathing Gas exchange http://www.schoolscience.co.uk/content/4/biology/abpi/asthma/asth2.html Franklin Institute On-line Oxygen Delivery system The Respiratory System : A Review The Human Body :http://www.bbc.co.uk/science/humanbody/ Model lungs lesson plan- http://www.adprima.com/sci-respsystem.htm BBC site:http://www.bbc.co.uk/schools/gcsebitesize/pe/anatomy/respiratoryrev1.shtml

1 2 Core	Remind pupils of earlier work in 2º ESO on respiration and review their understanding of the reaction in the cells between oxygen and glucose. Ask them to think about what happens if the blood cannot supply enough oxygen for the cell's needs e.g. during intense physical activity, Ask them about their own experiences and illustrate, *eg with video clips of athletics.* Ask pupils about the meaning of the word 'aerobic' and why aerobics in relation to exercise is so called. This could be extended to other situations where there may be a reduced oxygen supply, *eg through illness, mountaineering.* Reinforce the idea that carbon dioxide and water, as well as energy, are released from aerobic respiration and that carbon dioxide is removed from the cells in the bloodstream Explain oxygen debt and build up of lactic acid in muscles Complete activities from chapter 4 of Hodder Science B	Respiration quiz from Hodder Science chapter 4 Written activities from Hodder B textbook	How respiration makes energy Difference between aerobic / anaerobic respiration Word equation for aerobic / anaerobic respiration Muscle fatigue, lactic acid and oxygen debt	AQA Biology GCSE Chapter 2 Humans as organisms pages 30-35 Video clips of athletics Hodder Science B Teacher 's File - Respiration chapter 4 Hodder Science Pupil's Book B – Activities pages 40-50

2 Core	Produce a leaflet to give to younger children on respiratory illnesses such as bronchitis, tuberculosis, emphysema or asthma. Research information about their causes, treatments & prevention and draw up table demonstrating findings. Show illustrations of damaged lungs from emphysema or dust damage. Ask pupils to describe the differences and predict what effects this damage might have on gas exchange.	Leaflet / table of respiratory illnesses	Know some of the causes of the more common respiratory illnesses Be aware of treatment given to sufferers Know how you can keep your lungs healthy	AQA GCSE Biology Chapter 9 Controlling Disease Hodder Science Pupils Book – chapter on Respiration " Getting Enough Oxygen," Chapter 4.5 page 48 second edition. Canadian lung association- http://www.lung.ca/children/ Breathing and asthma http://www.schoolscience.co.uk/content/4/biology/abpi/asthma/index.htm Photos of damaged lungs: http://www.quitsmokinghelp.net/smokers_lungs.html

1 Core	**Smoking** – Challenge pupils to give ideas why people find it difficult to give up smoking Explain how link between smoking tobacco and lung cancer gradually became accepted (Sir Richard Doll) Evaluate pros and cons of different ways to give up smoking Discuss links between cannabis and addiction to hard drugs Effects of nicotine, carcinogens and carbon monoxide in tobacco smoke Demonstration of smoking machine – Compare high / medium / low tar brands of cigarette	Project work on link between smoking /lung cancer	Know how the link between smoking and lung cancer gradually became accepted Nicotine is the addictive substance in tobacco smoke Tobacco smoke contains carcinogens Effects of tobacco on pregnant women and their children Evaluate claims made about the effects of cannabis on health and the link between cannabis and the addiction to hard drugs	AQA GCSE Biology Chapter 3.6 pages 60-63 www.teachernet.gov.uk/wholeschool/healthyliving/behaviours/smoking www.nida.gov www.dare.uk.com www.drugs.gov.uk bbc.co.uk/science/hottopics/cannabis cannabis.net talkto frank.com Hodder Science Book C Capter 4.3 and related worksheets

1 Extension	Carry out measurement of the lungs Tidal volume, Vital capacity and peak flow depend on the size, age, sex and fitness of a person. Peak flow can be used in diagnosis and management of asthma. Carry out experiment to demonstrate the effects of exercise on breathing rate. Describe how recovery time can be used as an indication of physical fitness. Class debate – Are we healthier than our grandparents?	Measurement and analysis of tidal volume, vital capacity and peak flow rates using charts / graphs	Tidal volume is the air breathed in or out of the lungs in one normal breath Vital capacity is the maximum volume of air which can be breathed out in one breath after a maximum inspiration Peak flow is the maximum rate at which air can be forced from the lungs	Consult QCA Website for project work on “are we fitter than our grandparents: http://www.standards.dfes.gov.uk/schemes2/secondary_science/sci09b/09bq8?view=get

Topic: The Circulatory System. Healthy habits. Frequent Illnesses.

Assumed knowledge:
1 Introduction to cells. Different cells have different functions. Specialised cells (blood cells).
2 Cells make up tissues which make up organs which make up organ systems.
3 Cellular respiration.
4 Function of blood to transport products of digestion and oxygen to body cells.

Content:
1 The circulatory system as a vital system involved in nutrition
2 Description of the anatomy of the circulatory system
3 Keeping a healthy heart
4 Common illnesses related to the circulatory system

NB - This topic provides an excellent opportunity for cross-curricular work with the Physical Education Department in your school. Before starting, you may wish to plan some of the activities with the PE staff. Reference may also be made to the importance of this topic for those people interested in a career in sport science (e.g. trainers, coaches, personal fitness trainers).

h	Lesson outline	Assessment criteria	Lesson outcomes	Resources
1 Core	**Introduce the circulatory system as a vital system involved in nutrition** Remind pupils of the heart's structure and function using e.g. illustrations, video-clips, models, mammalian hearts, CD-ROMS. Discuss the heart's pumping action as a double pump, one side supplying the lungs, the other side supplying the other body organs. Provide opportunities for pupils to discuss in groups and then annotate diagrams of the heart using arrows to show the direction of blood flow. Ask pupils to think about and predict the consequences of the heart not working efficiently in terms of blood supply. List reasons why we need a circulatory system and single-celled organisms do not. Label diagram of the heart. Explain structure and function. Complete quiz on the heart from Hodder Science Teacher's Pack. Use resources available to write a fact-file on the heart.	Hodder Science Teachers Resource Quick Quiz Chapter 4 from Teachers Resource Pack Annotated diagram of blood - flow through the heart Write fact-file on the heart	Why the circulatory system is necessary : transport of substances, temperature regulation, defence against disease Know constituent parts of the heart (including the four chambers, pulmonary vein, vena cava, aorta, pulmonary artery, tricuspid and mitral valves) and their function Explain why tissues, including the lungs, need a good blood supply	AQA GCSE Biology Chapter 2 – Humans as organisms CD - ROMS video clips on heart/ circulatory system Hodder science starter and plenary cd rom chapter 4 Diagram of heart /blood flow BBC Webpage:http://www.bbc.co.uk/schools/gcsebitesize/biology/humansasorganisms/1circulationrev2.shtml Worksheet labelling heart & marking direction of blood flow :Hodder Science B Teacher's Resource File Homework Activity 4.3 The BBC has produced a heart fact-file in it's Science and Nature web page:http://www.bbc.co.uk/science/humanbody/body/factfiles/heart/heart.shtml Oxford Biology First pages 41-42 Some useful web-pages on the heart and circulation can be found at :http://www.schoolscience.co.uk/content/4/biology/abpi/heart/index.html Labelling activity :http://www.schoolscience.co.uk/teachers/sep/downloads/4/biology/abpi/heart.pdf

1 Core	Draw a table with diagrams of the three main blood vessels :arteries, veins and capillaries and describe their functions.	Table showing functions of main blood vessels	Arteries carry blood away from the heart. Veins carry blood to the heart. Capillaries link arteries with veins. The structural adaptations of arteries, veins and capillaries related to their function	Hodder Science B Pupil's Book Chapter 4.2 & 4.3 BBC GCSE physical education webpage has a useful section :http://www.bbc.co.uk/schools/gcsebitesize/pe/anatomy/circulatoryrev1.shtm Worksheet: http://www.schoolscience.co.uk/teachers/sep/downloads/4/biology/abpi/heart.pdf

1 - 2 Core	**Blood** List the cells and substances in blood. Draw a table of red cells, white cells and platelets containing information on each. Quiz / Crossword activities on circulatory system. Describe the function of red blood cells and plasma in the transport of respiratory gases and food. Describe the features of a capillary network which allow efficient gas exchange. Explain diffusion of gases in lungs. Use air freshener to demonstrate diffusion of gases. Time how long it takes to pass from one end of room to other. Carry out discussion of diffusion in air and in liquids. In what ways are they the same? Explain how substances in blood diffuse from areas of high concentration to areas of lower concentration. Complete experiment on diffusion From Hodder Science B 4.2 measuring time taken for food-colouring to pass through ice, cold water, warm water and filter paper	Assess collection of data and presentation Precision in carrying out experiments Drawing conclusions from their own data and using evidence to back them up Can students use their scientific knowledge to explain their findings?	Know that blood consists of red cells, white cells and platelets and the function of each Liquid part of blood is called plasma Function of the haemoglobin in the transport of oxygen. Some of the chemicals that move around our body move in and out of our cells by a process called diffusion The reactants and products of respiration are transported throughout the body in the blood stream	Hodder Science Pupil's Book B Chapter 4 Respiration Worksheet 4.1, 4.2, 4.3 and 4.4 of Teachers Resource Book Crossword activity - t3.pacific.edu/teams/M007305/**circulatorysystem**.html - 15k Experiments on diffusion from Hodder Science B Teacher's Pack Activity sheet 4.2 Quizzes can be found at: http://www.schoolscience.co.uk/content/4/biology/abpi/heart/index.htm

2 Core	Write a definition of health and sickness and try to establish relationship between them Importance of a healthy lifestyle List main habits which contribute to keeping a person healthy Write a letter to your heart telling it how to keep healthy Research internet, encyclopaedias and textbooks for illnesses relating to the circulatory system (arteriosclerosis, thrombosis, angina and heart attacks). Prepare a leaflet for the local health centre outlining causes / prevention / treatment.	Letter writing **L** Assess leaflet / projects	Know a definition for illness Know different types of illnesses (infectious, congenital, hereditary, deficit and chronic) Importance of eating appropriate range of foods, taking regular exercise, regular relaxation and avoiding unnecessary health risks with tobacco, alcohol, drugs	Santillana Book 3 Topic 8 Health & Illness The NHS England website is an excellent source of information for this topic. The Health Encyclopaedia contains an extensive range of information on the different illnesses: http://www.nhsdirect.nhs.uk/articles/alphaindex.aspx Information on heart attacks, angina, atherosclerosis and their treatment can be found at : http://www.schoolscience.co.uk/content/4/biology/abpi/heart/heart6.html
Extension	Carry out investigations to demonstrate the effect of exercise on pulse rate. Obtain and analyse information on the effects of exercise and on the recovery rates in athletes and non-athletes. Describe how recovery time can be used as an indication of physical fitness. Resting pulse rate and recovery time can be reduced by taking regular exercise.	Evaluation of investigations	With exercise pulse rate (and breathing rate) and lactic acid level rise less in an athlete than in an untrained person Recovery time is time taken to return to normal level of pulse rate, breathing rate and lactic acid	Stethoscope, pulsimeter, stop watch, heart-rate monitor. Measure blood pressure using digital sphygmomanometer

1 Extension	Complete a small project on blood analysis as a means of diagnosing a persons health : anaemia, diabetes and leukaemia. Blood pressure. Class survey on blood transfusions. Project work on the pioneers of heart surgery. Make a model heart. Research into your blood group. Class survey. Present information on a chart using spreadsheets.	Project work Blood groups (A,B;O Rhesus)	In blood, presence of antibodies can indicate an infection, a low iron count can indicate anaemia and a high sugar level can indicate diabetes. An abnormal white blood cell count can indicate leukaemia.	William Harvey's demonstration of emptying of veins in the arm http://www.accessexcellence.org/AE/AEC/CC/heart_background.html Hodder Science Teachers Resource Pack Homework Sheet 4.5 (Asthma) Pioneers of heart: surgery : Cut to the Heart surgery:http://www.pbs.org/wgbh/nova/heart/pioneers.html QCA document :http://www.standards.dfes.gov.uk/schemes2/secondary_science/sci08b/08bq2b?view=get Hodder Science B:Make a model heart Activity sheet 4.3

Topic : The Excretory System

Assumed knowledge from previous years
All animals produce waste materials and that these need to be eliminated or excreted from the body.
Human beings have a circulatory system which carries waste materials away from the tissues where the waste materials are produced.
The main organs for removing waste from the bloodstream are the kidneys and the location of these organs is in the abdomen.

Contents:
1. The role of the kidney in osmo-regulation and homeostasis of the body in filtering waste and extra fluid from the blood.
2. The process of filtration of the blood and the consequences if it fails.
3. Common ailments of the kidneys and related tissues, e.g. kidney failure, urinary tract infections, kidney stones.

H	Lesson outline	Assessment activities	Lesson outcomes	Resources
1 Core	Use a quick fire quiz to create a brainstorm diagram to revise what is known about the circulatory system: which organs are involved in circulating the blood, heart, arteries, and veins. Revise what the blood transports (oxygen, carbon dioxide, nutrients) Revise which organs receive a blood supply and why: e.g. muscles need oxygen and a source of energy (glucose), digestive system needs oxygen and a means to transport the products of digestion to other parts of the body, etc. Establish that the kidneys also have a blood supply and that this is related to their studies of respiration and nutrition in cells Provide unlabelled diagrams of the excretory organs and secondary sources of information about the excretory system. Challenge the pupils to label the basic parts; kidney, urethra, ureter bladder, vein and artery, correctly,.	Group brainstorm of organs and purposes Fill in outlines before discussion and amend as discussion takes place	Can describe the circulation in terms of which organs carry out the circulatory process and which main organs receive a blood supply Can give reasons for the blood supply to different organs Can name the constituent parts of the human excretory system.	Model human torso with organs or large clear coloured posters of the different systems, or transparencies. Collins Science plus 1 p36-7 Teachers Guide worksheets Unlabelled outlines of body or kidney for pupils Explore the excretory system at http://www.innerbody.com/image/urinov.html or information at http://www.bbc.co.uk/science/humanbody/body/factfiles/kidneys/kidneys.shtml Interact with a diagram of the parts of a kidney at http://www.purchon.com/biology/kidney.htm#regions

1-2 Core	Relate the function of the kidneys to earlier work in ESO1 on solutions and filtration of mixtures; Show how a solution will pass through a fine filter. Ask how we can show that the same compounds are present before and after filtering. Ask how solids can be separated from a liquid. Demonstrate or use a simulation or video to show that the kidneys act as if they were filtering the blood retaining large molecules such as proteins and blood cells. Explain that urea is produced from the use of proteins in the cells and this is soluble and is filtered out by the kidneys to form urine, which is stored in the bladder, until it can be released in the toilet. Explain that a healthy kidney reabsorbs all the glucose excreted and returns it to the blood stream Practical work: obtain some Clinistiks for testing urine from a local pharmacy, or from a nursing home. Organize groups of pupils to share the sticks to test tubes of water plus a single dose of dissolved substance. e.g. egg white (protein), glucose (sugar), vitamin C, caffeine, table salt, alcohol etc. Number the containers! A little paella colour/caramel gives an authentic note! Ask them to use the Clinistiks to detect these substances and carry out research using other sources to 'diagnose' possible health related problems.**	Monitor the carrying out of the tests and interpretation of colour changes which can be very subtle. Observe the completion of the "analysis" sheets	Explain what is meant by excretion Can describe how to test for substances in the urine	Flasks and containers, funnels and papers for filtering; salt water, coloured water, small beads, etc as available. Very clear simple PowerPoint presentation with diagrams at http://smartweed.olemiss.edu/nmgk12/curriculum/middleschool/seventh/EXCRETORY/Excretory%20System.PPT **Sample activity from www.questacon.edu.au Teaching ideas for all parts of body Clinistiks or similar test materials Test tubes, numbered solutions of e.g. egg white (protein), glucose (sugar), vitamin C, caffeine, table salt, alcohol etc Report sheets resembling hospital/analysis reports Secondary sources about urine tests and diseases detected by testing urine. Invite a clinician or nurse in to demonstrate the tests / make a presentation about urine analysis

1 Core	The functions of the kidney osmoregulation: Explain how the body contains approximately 75 % water and the kidneys help to control this. Use a simple flow chart to show how more water consumed leads to increased flow of urine and reduced consumption or loss by sweating leads to reduced flow. Conversely, less water drunk or cold conditions lead to the opposite effects. Discuss how much water the pupils think is needed for normal healthy digestion and metabolism and where this comes from in our daily diet. Discuss what might happen if the kidneys do not work as well as usual. Explain that one healthy kidney is sufficient for a normal life but the loss of function in both (kidney failure) would necessitate dialysis or a kidney transplant. Explain the principles behind kidney dialysis		Understand the part played by the kidney in osmo-regulation	http://www.punchon.com/biology/kidney.htm:- gives detailed information and allows pupils to interact with some pages, virtual microscope for some cells, language is informal and humorous at times. Provides revision activities. Biology First page 37 explains hormonal control Collins Science plus 1 pages 36-7 Explains osmoregulation P54 Collins Science plus 2 explains dialysis
1 Core	Explain that kidneys sometime develop hard deposits of minerals or cholesterol. Describe with the help of diagrams how these can be removed. Describe a scenario where a young person develops the symptoms of cystitis. Discuss how (s)he can find out what is happening and how to treat the problem. Ask the students in pairs to design an information leaflet about the condition. Review some examples if possible and decide if they are easy to understand and effective in explaining to our example person.	**LL** Preparation of information leaflet		Text for use in class/literacy and links to health and ailments. http://kidney.niddk.nih.gov/kudiseases/pubs/yoururinary/index.htm contains American English spellings and measures of quantity e.g. quarts Information on cystitis - printable http://www.nhsdirect.nhs.uk/articles/article.aspx?printPage=1&articleId=119

1 Extension	Observe a dissection of a kidney live or a simulation on line. Relate what is seen to a diagram, which can be labelled. Develop an understanding of the structures of nephrons, glomeruli, renal pyramids, and label diagrams.		Be able to label a diagram of the kidney; Explain how a nephron works	A very good, not too gory dissection of a pig's kidney, watch out for the animated urine! http://www.whitman.edu/biology/vpd/excretory.html Biology First (OUP) page 37 Letts Revise AS/A2 page 72 - 75
1 Extension	Find out how desert animals such as the kangaroo rat or camel limit their loss of water by adaptation of their physical features, physiology and behaviour			Letts Revise AS/A2 page 76

Topic: Interaction and co-ordination

Assumed knowledge :

1 Muscles in movement
2 Specialised cells (nerve cells)
3 Animal senses
4 Light

Content:

1 How the different parts of the nervous system work together to co-ordinate the body's responses to stimuli
2 Voluntary and reflex responses
3 The endocrine system
4 Internal control systems of the body - homeostasis
5 Glands and main hormones
6 Frequent illnesses associated with the nervous system

h	Lesson outline	Assessment criteria	Lesson outcomes	Resources
1Core	Brainstorm previous work on structure and function of human nervous system including five senses. Diagrams or models can be used to illustrate the position of the brain, spinal cord and peripheral nerves of human body. Teachers should make sure that there is no confusion between the spinal cord and vertebral column. Lamb chops often have a small piece of spinal cord on them lying in the groove of the vertebra, this can be used to show students what the cord looks like and how it is protected by surrounding vertebrae. Use pictures or flow diagrams to show how the different parts of the nervous system work together to co-ordinate our response to external stimuli. The teacher could, for example, demonstrate the response to a pin prick on the finger in diagrammatic form using flow diagrams. A list of responses may be written on the board and students could be asked to explain how the body responds to each one (catching a ball, knee jerk reaction, light / dark pupil response etc.) Students could think of a situation of when a response is required. In pairs, they swap situations and draw a flow diagram explaining how the body responds to the situation they have suggested. They can then exchange flow diagrams and assess each others work.	Teacher or pupil assessment of flow diagrams and their explanations Written explanations of body responses	Human nervous system is made up of the central nervous system (brain & spinal cord) and many nerves which carry messages from receptors to effectors Know that the nervous system includes receptors (to light, sound, changes in position, chemicals, touch, pressure, pain and temperature), the spinal cord and effectors Pupils will be able to give a variety of examples of stimuli and responses and be able to explain these in detail. They will know that these responses may increase the chances of an organism's survival. I	AQA GCSE Biology Chapter 3 AQA GCSE Science Core Foundation pupils textbook and Teacher's Guide Chapter one Oxford Biology First pages 50-53 The BBC Bitesize GCSE website contains a very useful chapter on the nervous system http://www.bbc.co.uk/schools/gcsebitesize/biology/humansasorganisms/4nervoussystemrev1.shtml Another website from the BBC which contains interactive games related to the nervous system is : The Human Body & Mind http://www.bbc.co.uk/science/humanbody/body/index.shtml?skeleton A more simple site useful for an introduction may be :http://yucky.kids.discovery.com/flash/body/pg000136.html A more detailed website : Neuroscience for Kids http://faculty.washington.edu/chudler/introb.html

1 Core	Students can study how nerves are formed from neurones and how they are linked by synapses. Ask pupils to describe how the sound of their voice travels to a friend when they phone them on a land line. Challenge them to match each stage to a stage in a nervous response Look at diagrams showing the structure of effector neurones and receptor neurones and demonstrate how neurones form nerves. Ask the pupils to think of an analogy for nerves (bundles of straws or spaghetti). Introduce the idea of synapses. Mention could be made of Ramon y Cajal, the Spanish Nobel prize-winner, and his contribution to our understanding of synapses Pupils could make a model of a neuron for display purposes using beads, rope, pipe cleaners etc. Pupils can carry out an experiment to investigate the density of touch receptors in various parts of the skin using two blunted cocktail sticks held together by a piece of plasticine about 1cm apart. They can touch their blindfolded friend's skin with the two points simultaneously. They record how many points their blindfolded friends feel. The results can be recorded with the cocktail sticks at different distances apart e.g. 2cm then 3cm. Repeat on different parts of the body e.g. back of neck, finger tips, sole of foot, forearm.	**HL**	Sensory (receptor) nerves contain neurones that carry nerve impulses from receptors to the CNS. Effector (motor) nerves contain neurones that carry nerve impulses from the CNS to effectors. Mixed nerves contain both receptor and effector neurones Understand the role of synapses in the nervous system Understand function of effector and receptor neurones. Know function of their constituent parts (dendrites, cytoplasm, nucleus, membrane surrounding axon, axon, myelin sheath)	Diagram of neurone from internet :http://www.bbc.co.uk/schools/gcsebitesize/biology/humansasorganisms/4nervoussystemrev3.shtml Gondar Design Biology :http://www.purchon.com/biology/index.ht Making neurones: Neuroscience for kids http://faculty.washington.edu/chudler/chmodel.html Santillana Teacher's book 2003 Chapter 6 p55

1 - 2 Core	Look at difference between voluntary and reflex responses Pupils could brainstorm a range of voluntary and reflex responses separating them into two columns <u>Voluntary</u> e.g. picking up a pen, taking a CD off a shelf, turning around when someone calls your name) <u>Reflex</u> e.g. blinking when someone kicks dust at you, sneezing when pepper goes up your nose, pulling your finger away when you touch a hot iron. Discuss why reflex responses need to take place so quickly. Class practical – Students investigate reaction time in pairs: one drops a metre ruler between the finger and thumb the other student catches it. Compare where the ruler is caught under different conditions. Discuss the effects of alcohol on reaction time Look at diagram of reflex arc. Ask pupils to draw diagrams / flow charts of simple reflex arc Crossword / Quiz activities using new vocabulary - nerves, synapses, voluntary actions reflex actions, neurones, electrical impulses, dendrites etc	Making a table of voluntary / reflex actions Writing up experiment. Evaluating results	Understand that voluntary responses are co-ordinated by the brain Reflex arc as a receptor, sensory neurone, relay fibre, motor neurone and effector. It's function is to facilitate instantaneous and involuntary responses automatically Reaction times can be affected by drugs, alcohol and excitement. Practise can reduce reaction time	www.S-Cool has an interesting chapter on nerves and hormones Reflex arc AQA GCSE Biology page 40 Voluntary /Reflex actions :http://www.bbc.co.uk/schools/gcsebitesize/biology/humansasorganisms/4nervoussystemrev4.shtml Eclipse crossword is a useful website where you can make up your own crosswords www.eclipsecrossword .com Many other crosswordscan be found at: http://faculty.washington.edu/chudler/cross.html

2 Core	Pupils could be asked to do some internet research on the different illnesses related to the nervous system. Research how developments have provided opportunities to enhance treatment of various illnesses. Pupils prepare short five or ten minute talks, using power point presentations. In pairs they could research encyclopaedias such as Encarta to find out about Alzheimer's disease, Parkinson's, brain tumours, strokes, epilepsy, illnesses of the sensory organs, otitis, conjunctivitis, glaucoma, retinal-detachment, cataracts etc. Talks could be presented to the class the following week. Use diagrams to describe the structure and function of the eye. Sets of cards could be prepared for students to match the different parts of the eye to their function.	Pupil presentations could be assessed by teacher or by peers Label diagram of eye with explanation of function of each part	Pupils should appreciate that scientists are still finding out new things. By developing our scientific knowledge, scientists have helped us to answer many questions. But science cannot answer all the questions. Some questions are outside the boundaries of science Pupils should know the effects of Multiple Sclerosis, Alzheimer's and Parkinson's disease. They should be aware of some of the recent developments in the treatments of these illnesses Pupils should be able to describe the structure and function of the eye, including accommodation and pupil reflex Distinguish between rods and cones, in terms of function and distribution	Information on most illnesses can be found on the NHS site health encyclopaedia Alzheimer's disease http://www.nhsdirect.nhs.uk/articles/article.aspx?articleId=14 Parkinson's disease http://www.nhsdirect.nhs.uk/articles/article.aspx?articleId=278&sectionId=10316 Multiple Sclerosis :www.mstrust.org.uk www.mult-sclerosis.org Diagram of eye: http://www.bbc.co.uk/schools/gcsebitesize/biology/humansasorganisms/4nervoussystemrev3.shtml Collins Science Plus Book 1 chapter 19 and chapter 23

	Hormones Ask students to brainstorm names of hormones that they have heard of and what they think they do. In groups, they can pool together their ideas and write a list of hormones and their functions. Ask for feedback from each group. Discuss some of the examples suggested by the class. Use these to highlight the fact that hormones are made in one part of the body (gland), transported around the body in the bloodstream and have an effect on another part of the body (target organ). Students can then research, using a range of texts or the internet, a range of hormones and draw up a table showing: hormone, gland, target organ and effect Students could make a table highlighting similarities and differences between nervous system and hormonal system Look at diagram showing thyroid, adrenal glands, testes, ovaries, pituitary and pancreas and discuss their function **Homeostasis** Complete a set of notes from the AQA Biology book on pages 48 -55 This could be done in table format or as a mind-map activity Write the facts they know about diabetes Ask pupils to prepare an information sheet giving advice to sufferers of diabetes Write a newspaper article explaining the risks of hypothermia to old people and suggesting how they can protect themselves against it Describe the effects of smoking, alcohol and drugs Research personal and social problems arising from drug abuse	Complete chart of hormones and their functions Write account of similarities / differences between nervous system and hormonal system Label diagram of human body to show hormonal system Written accounts **LL**	Students should appreciate that many of the processes in the body are co-ordinated by chemicals called hormones Understand that chemical hormones are involved in controlling conditions inside the body. Know that hormones are secreted by glands and transported by the bloodstream to a target organ Define homeostasis as the maintenance of a constant internal environment. Know that homeostasis includes control of water balance in blood, blood sugar level, body temperature and blood urea level Describe temperature regulation and explain the effects of sweating, vasodilation and vasoconstriction Understand the control of blood sugar Function of insulin and	Schoolscience.co have a very useful site called "Hormones – The Chemical Messeengers" :http://www.schoolscience.co.uk/teachers/sep/notes/4/biology/abpi/hormones.html Neuroscience for kids :http://faculty.washington.edu/chudler/introb.html Digitalbrain.com has some information on hormones and also contains links to other web-sites: http://www.digitalbrain.com/digitalbrain/web/subjects/2.%20secondary/ks4sci/su2/mod2/mod2kl.db_psc?verb=view The BBC GCSE bitesize biology website has some useful information on homeostasis :http://www.bbc.co.uk/schools/gcsebitesize/biology/humansasorganisms/ AQA GCSE Biology pages 48 -55

1 Core	Use source material and internet to research the effects of a range of drugs including alcohol, cocaine and heroin		glucagon	AQA GCSE Biology page 62-65
1 Extension	Look at the structure and function of brain. Explain how discrete areas of the brain are related to their sensory / motor function		Know location and function in simple terms of cerebrum, cerebellum, medulla and hypothalamus Cerebrum as the site of conscious responses and higher centres, cerebellum as the centre of balance and co-ordination of movement, medulla as the site of the vital centres such as breathing and heart rate, hypothalamus as the centre for regulation of water balance and temperature	Brain map interactive activities http://www.bbc.co.uk/science/humanbody/body/interactives/organs/brainmap/index.shtml http://www.purchon.com/biology/brain.htm

Topic: Human Reproduction, (see also cells ESO1); Links to Humans as multicellular organisms; the organisation of the body into tissues and organs with specialised functions

Assumed knowledge:

The basic structure of cells, nucleus, cytoplasm, membrane and organelles (ESO1 Cells)
Some cells are specialised to carry out special functions
Tissues are made of similar cells with similar functions
An organ is made of different tissues that combine to carry out a specialised role in the body
Describption the human life cycle in terms of infancy, childhood, adolescence, maturity and ageing

Content of this module:

1 Identification and naming the parts of the reproductive system of humans
2 The function of the reproductive apparatus
3 Fertilisation as the fusion of egg and sperm cells
4 The stages of foetal development
5 Contraception and fertility, transmission of disease

In addition there is the possibility of extending the pupils knowledge to show:

1 that the nucleus contains chromosomes that carry the genes
2 how cells divide by mitosis during growth, and by meiosis to produce gametes
3 how this mechanism leads to variation and inheritance
4 how this mechanism leads to new varieties [for example, how genetic engineering is a modern form of selective breeding].

H	Lesson outline	Assessment activities	Lesson outcomes	Resources
1 Core	Revise different parts of cells, nucleus, cytoplasm, cell membrane, and extend to mitochondria, golgi body, etc. Look at how different cells have different functions within tissues, e.g. muscle or nerve, but still maintain the same life processes, e.g. respiration, growing, replication, compare the different outward appearances of different specialised cells.	Labelled diagrams. Descriptive accounts.	Know the main parts of the cell Can explain respiration as a word equation and relate this to a basic function in all cells. Can relate the different forms of cells to their function in a tissue of like cells or in interaction with a different tissue, e.g. nerve fibre serving a muscle fibre	Biology first (OUP) pages 10 - 13 Collins Science plus1. Chp 1 life processes, cellular respiration, different cells. http://www.bbc.co.uk/schools/gcsebitesize/biology/cellprocesses/1cellfunctionsrev4.shtml Cell form and function, diagrams, revision and test http://www.cellsalive.com/cells/cell_model.htm the parts of a cell, interactive, with text explanations and sound effects. http://www.kidshealth.org, general information on all human reproductive mechanisms.
1 Extension	Role of the nucleus in more depth, chromosomes, genes, how cells divide to form new cells or gametes. Use online animations of cells division. Make labelled diagrams. How characteristics are inherited through the genes on the chromosomes. How sex is determined; explain that male and female nuclei contain the genetic information that determines sex.		Can identify the function of nuclei in inheritance and sex determination Explain how egg and sperm cells are specialised, and describe how they carry the information for development of a new life	To see animated cell division and labelled organelles. http://www.cellsalive.com/cam0.htm http://www.cellsalive.com/meiosis.htm Meiosis, animated with sound effects Hodder Gold C Inheritance and selection p2 nucleus and chromosomes Collins Science plus 2 page 26-33 My Genes, page 29 sex chromosomes

1 Extension	**Inheritance and Selection**: Pupils should be taught how variation arises from genetic causes, (e.g. blood group), or environmental causes, (e.g. sunburn), and a combination of both e.g. height, and that some diseases are inherited (e.g. haemophilia). Explain with the help of diagrams or video clips how new generations inherit features from their parents. Look at photographs of familial members and identify inherited features such as eye colour, and non-inherited such as piercings. Enacting a family whose members inherit eye colour. Learn how to predict probable inheritance of genes using a Punnet diagram Explain the basic principles of cloning, selective breeding and genetic engineering	Prepare a debate about whether or not cloning animals is acceptable or if cloning of humans should be permitted. **LL**	Can distinguish between characteristics which are inherited and those caused by environmental factors. Can explain how individuals can inherit characteristics and apply their knowledge [for example, in relation to selective breeding].	Collins Science plus 2 Chp 26 My Genes, page 28 How to work out patterns of inheritance with a Punnet square page 30 Photographs of family members, celebrity families, Historical families e.g. Hapsburgs Collins Science plus 2 Chp24 Growing, page 18-19, Page 21 Selective breeding and cloning, page 31 Genetic engineering Hodder Gold C p 4-7 Selective breeding Collins Absolute Science3 page 81 selective breeding. p85 Dolly the sheep

2 Core	Form and function of reproductive apparatus: Use video clips, models, photographs, software simulations and ultrasound scans to illustrate the human reproductive organs. Help pupils to identify, name and describe the functions of the mature human reproductive organs. Ask pupils to annotate diagrams of male and female reproductive organs. , *e.g. ovary, testis, oviduct, uterus, etc. introduce synonyms e.g. womb/uterus, birth canal/vagina,* which may be encountered in literature. The effects of sex hormones: changes at *puberty* and in *adolescence*. Secondary sexual characteristics, menstruation. Explain that hormones control the stages in the menstrual cycle. Watch video clips or an animation of the menstrual cycle, e.g. from the Kidshealth site. Help the pupils to construct a diagram of the cycle, or use a prepared chart, marking menstruation and ovulation and when the uterus lining is thickening. Discuss with pupils the variation in cycle length and practise calculating when a woman might ovulate and when her period is due. Explain that the menstrual cycle also prepares the uterus for a fertilised egg and identify the time in the cycle when fertilisation is most likely.	Annotated diagram **LL** QCA yr9 booster kit section 2 lesson plan 3 as it involves listening to text and drawing a life cycle, sequencing pictures and preparing a presentation **LL** Pairs of pupils can prepare a short description of the menstrual cycle using links of time and reason, referring to the diagram prepared earlier.	Can name, locate and describe the functions of the reproductive structures, *e.g. ovary, oviduct, uterus, vagina, penis, testis, sperm duct* Can sequence the stages in menstruation and early stages of pregnancy Pupils learn and use the vocabulary in context: male, female, mature, puberty, adolescence, Menstrual cycle and pregnancy: specialised terms, e.g. *ovary, ovulation, fallopian tubes, uterus, menstrual cycle, menstruation, sperm, pregnant, pregnancy, fertilisation, placenta, mammary glands, gestation, birth or parturition*	Collins Science plus 1 Chp 2 Babies Teachers guide Organs of reproduction: http://www.innerbody.com/htm/body.html http://www.innerbody.com/image/repo04.html QCA lesson plan http://www.standards.dfes.gov.uk/keystage3/respub/sc_y9boost0001702_s2103human.doc video clips, models, photographs, software simulations and ultrasound scans illustrating the human reproductive organs e.g. Female reproductive system, text description and pronunciations http://www.kidshealth.org/teen/sexual_health/changing_body/female_repro.html Video animation of female organs, menstruation and ovulation, with commentary and text, needs Macromedia flash player, (big file); also available in Spanish. http://www.kidshealth.org/misc/movie/bodybasics_female_repro.html Biology *First* (OUP) p 44 - 49 Human reproduction: simple account

1 Extension	Show photographs or diagrams of sperm and egg cells. Ask pupils to compare them and suggest how they are specially adapted for their functions. Ask pupils to draw and describe or annotate drawings of egg and sperm cells, identifying their main features. Explain fertilisation in terms of the fusion of nuclei of sperm and egg. Watch video clips or software simulations to illustrate fertilisation. Discussion of the adaptations of cells could be extended to the ciliated cells in the oviduct.		Can describe how sperm and egg cells are adapted for their functions. *e.g. a tail that pushes a sperm along; streamlining, by reduction in size through having less cytoplasm; a specially strengthened head that contains enzymes to penetrate and break down the outer layers of the egg or the egg cell has an enlarged cell with food reserves* Describe fertilisation as the fusion of two cell nuclei;	Video clips or software simulations to illustrate, e.g. fertilisation. e.g.www.kidshealth.org

2 Core	Foetal development Discuss with pupils, illustrating with, *e.g. video clips, photographs, simulations*, how the fertilised egg divides into 2, 4, 8, etc cells as it passes down the oviduct. Ask pupils to draw, or label, and sequence pictures or diagrams illustrating ovulation, fertilisation, cell division and implantation. Provide information about the development of the foetus in size and complexity and fill in gaps in a prepared table containing some information. Use video clips, models, photographs, software simulations and ultrasound scans to illustrate gestation, development of the foetus, birth. Discuss related topics in nutrition and healthy lifestyles which could affect the survival or health of the foetus, e.g. the use of drugs, alcohol, poor nutrition, or the effect of infectious agents, e.g. rubella, on the foetus and the most critical times for these effects.	**LL** Y9 booster kit section 2 lesson plan 3 Human Growth and Reproduction, can also be used as a literacy link - it uses diagrams and sequencing	Can sequence the stages in menstruation and early stages of pregnancy Pupils can use vocabulary in context and know some common English synonyms:- *foetus, baby, male nucleus, female nucleus, cell, fertilised, fertilisation/ conception, amniotic fluid/ waters, umbilical cord, placenta/ after-birth, birth/ parturition* Pupils can explain how the foetus obtains the materials it needs for growth	Video clips, models, photographs, software simulations and ultrasound scans illustrating gestation, foetus, birth Biology for You (Nelson Thornes) p 160 - 1 Reproduction - Foetal development Biology *First* (OUP) p 44 - 49 Human reproduction: simple account QCA Y9 booster kit section 2 lesson plan 3 www.qca.org.uk/printable.html or http://www.standards.dfes.gov.uk/keystage3/respub/sc_y9boost0001702_s2103human.doc http://www.visembryo.com -interactive but demanding language Secondary sources providing information about the effects of alcohol, tobacco and other drugs, and rubella on the developing foetus

1 Core	Contraception and infertility treatment:- Medical uses of hormones in the control and promotion of fertility: Refer to the earlier work on the reproductive organs and discuss how infertility may arise, *e.g. from low sperm counts, blocked oviducts or infrequent ovulation*, the technological solutions available and some of the ethical and social issues that may arise. Discuss with the pupils why people may wish to control when they will reproduce and where the responsibility should lay. Discuss some of the current methods and compare to life in the past. Explore some of the ethical and social issues that can arise and where or how people can obtain advice on different solutions to the problems/ issues		The pupils show awareness that the social and moral issues are different for different groups of people and that different views can be held to their own. They understand that scientific knowledge can help to solve dilemmas but cannot provide final answers. They understand that reaching agreed solutions between couples should be by negotiation and may or may not involve advice from others.	Biology *first* Contraceptives page 49 Biology for You (Nelson Thornes) p 164 - 5 Human reproduction - contraception P167 - 8 infertility treatment.

1 Core	Remind the pupils about infectious diseases and which organisms can infect humans, e.g. viruses, bacteria, protozoa (malaria) and fungi. Revise pathways into the body and natural barriers, e.g. skin, mouth, airways, etc. Explain that sharing needles can spread infections from blood to blood. Explain that sexually active people can also contract infections. See if the pupils have any knowledge of possible infections (They will probably know about HIV and AIDS but not know the more common ones. Having already studied issues of contraception they may suggest that using condoms or abstinence may offer protection. However, develop their knowledge of other infections, such as pubic lice (which do not need full sexual contact to be transmitted) and thrush or candidiasis, which can arise naturally as a result of antibiotic treatment. Explain that even if they believe they have not had sexual contact any unusual symptoms should be brought to the attention of a nurse or doctor, or a family member.		Pupils are aware that sexually transmitted diseases can occur from a variety of causes and that the symptoms are not always immediately apparent. That some symptoms are not necessarily a cause for anxiety but should be diagnosed promptly. That there are methods of reducing the risk of infection and that lifestyle has a great influence on the likelihood of infection	A health professional may be able to talk to the students and provide leaflets and further guidance. Information on sexually transmitted diseases at http://www.kidshealth.org/teen/sexual_health/ Biology first (OUP) page 49 Sexually transmitted diseases

1 Extension	Foetal development Establish that humans usually have one offspring at a time and that the human reproductive system is designed to make sure that this survives. Discuss related topics in nutrition and healthy lifestyles which could affect the survival or health of the foetus, e.g. the use of drugs, alcohol, poor nutrition, or the effect of infectious agents, e.g. rubella, on the foetus and the most critical times for these effects. Make an advice leaflet for young women who may become pregnant. Provide information about height/weight/growth of human offspring in the past and compare these with expected ranges now.	**LL** Assess advice leaflet for young women who may become pregnant	Can use what they know about nutrition and healthy lifestyles and information provided to prepare advice in a leaflet for mothers-to-be.	Secondary sources providing information about height/weight/growth of human offspring in the past and expected ranges now
1 Core	Control and prevention of sexually transmitted diseases Remind the pupils of the previous work on infectious diseases and how they enter the body. Remind them about the different types of infectious organisms or microbes, bacteria, viruses, fungi, unicellular, e.g. malarial parasites. Explore what they know of infections transmitted sexually. Develop their knowledge of different names, and be prepared for questions about symptoms. Point out that if they follow simple rules of hygiene they should have no cause for anxiety but they should not let any unexplained symptoms go unchecked.			Urinary infections and sexually transmitted diseases. http://www.kidshealth.org Biology First: page 49. Sexually-Transmitted Diseases

1 Extension	Pupils could: • find out about reproduction of, and breeding in, domestic pets • read newspaper and magazine articles about cloning • find out about life-support systems for premature babies and children with prenatal developmental problems • find out about social, ethical and technological issues when offspring are born as the result of assisted conception, such as ‘test-tube’ babies and fertility drugs			

Geology

Topic: Rocks

Assumed knowledge:

1 Rock cycle
2 Effects of weathering
3 Volcanoes
4 Making sedimentary rock
5 Structure of earth's layers
6 Transport in rivers, wind and glaciers
7 Fossils
8 Earthquakes
9 Acids & alkalis

Content:

1 Definition of rocks and minerals
2 The three fundamental types of rocks
3 Process of the formation of igneous, sedimentary and metamorphic rocks
4 The rock cycle

h	Lesson outline	• ssessment criteria	Lesson outcomes	Resources
1 Core	Brief revision of previous work on rocks. Look at cross sectional view of earth showing students inner core, outer core, mantel and crust. Explain that the crust is relatively thin in comparison to the other layers. It consists of continental and oceanic plates of rock moving slowly in relation to each other.	Drawing / Labelling Activity of cross sectional view of earth	The Earth is made up of distinctive layers, the inner core, outer core, mantel and crust. The different layers have different conditions of pressure and temperature	Cross–sectional diagram of earth: http://www.bbc.co.uk/schools/gcsebitesize/geography/platetectonics/platetectonicsrev2.shtml
1 Core	Ask pupils to write down a definition of the word “rock.” and explain in their own words the difference between a rock and a mineral. Give definition and explain	Written definition	Minerals have a crystalline chemical composition and structure which are always the same. Rocks are formed by one or more minerals and they are not uniform	Santillana Science Book 3 Chapter 2 Rocks

1 1 1-2 Core	<u>Sedimentary Rocks</u> Ask pupils what they know about different rocks, weather and sedimentation. Use photographs and suitable specimens. Establish key points, eg the physical and chemical causes of weathering, that rocks consist of grains that fit together, and that over time layers of sediment accumulate. Demonstration or class activity of showing the effect of squashing wet sand and asking them to observe the loss of water. Show pictures of deep layers of sedimentary rock and ask them to think about the pressure at the bottom of a cliff. Look at some damp sand and some sandstone with a hand- lens, or under a microscope and look for clues as to what is holding the grains together. Remind pupils that rocks are mixtures and establish that the “glue” comes from minerals in the sediment that have dissolved and been left as the water evaporated. Show pupils samples of other sedimentary rocks, eg chalk, limestone, shale and identify some common characteristics. Show students examples of different limestones. Establish that limestones are carbonate rich rocks, but may contain other components . Remind them how carbonates react with acids and help them to find a way of comparing the carbonate content of two different samples of limestone e.g. by weighing both samples before and after reacting with acid, measuring volume of acid needed to completely react with the carbonate.	Write up class activity and relate it to the formation of sedimentary rock Written work based on research from internet. Worksheets Write up experiment. Assess whether pupils are capable of identifying more than one strategy to answer questions Can students draw conclusions from their own data and are their conclusions consistent with evidence they have collected? Can they suggest any improvements to their experiment?	Sedimentary rock can be formed by pressure from layers of sediment resulting in the compactation and cementation of grains. Remains of dead organisms are transformed over time and their shelly material can accumulate to form sediments Fossils can be used as evidence in rock layers to suggest a sequence of events over time Students should learn some examples of sedimentary rocks, eg sandstone, chalk and some of the characteristic features of sedimentary rocks, eg non-interlocking textures, porous, contain fossils Students should know where different types of sedimentary rocks are formed e.g. Sandstone, limestone, shale	How rocks are formed http://www.fi.edu/fellows/fellow1/oct98/create/ BBC web-pages on sedimentary rocks:http://www.bbc.co.uk/schools/gcsebitesize/chemistry/changestoearthandatmosphere/0rocksrev2.shtm Internet Geography has some information on limestone : http://www.geography.learnontheinternet.co.uk/index.html Santillana Science 3 Chapter 2 There are a number of useful resouces on the teachernet website. If you enter into http://www.teachernet.gov.uk/ and do a search on “rocks” you will find a list of suitable ideas for lessons Hodder Science B Teacher's Resource File Chapters 8 and 11 contain some useful activities and there are some pupil activities in the corresponding pupil's book

2 Core	Metamorphic Rocks Explain with illustrations, theories about the formation of metamorphic rocks, and ask pupils to examine samples of metamorphic rock and compare them with the sedimentary rocks from which they were formed, eg limestone and chalk with marble, sandstone with quartzite, shale with slate. Using slides or photographs, show pupils illustrations of the alignment of grains eg in slate. Ask pupils to choose one pair of sedimentary and metamorphic rock, describe the difference between them and describe how the metamorphic rock was formed. It may be useful to present the processes in writing on some cards for bi-lingual pupils and ask the children to arrange them in the correct order. Label tectonic plate diagram to distinguish the different places where metamorphism takes place.	Written descriptions Labelling activity	That increasing temperature and pressure can cause some rocks to change in the solid state That metamorphic rocks are formed from pre-existing rocks during metamorphism, as a result of high pressure and / or high temperature Name some metamorphic rocks. Pupils should know the high pressure and high temperature effects on different types of rock Describe how metamorphic rocks differ from sedimentary rocks eg the crystals may be aligned, they may be less porous, fossils may or may not be distorted, no grains may be visible, the rock may be harder Distinguish the different places where metamorphism takes place	Santillana Science 3 Chapter 2 Detailed lesson plans and many useful ideas can be found in the Teachernet website. http://www.teachernet.gov.uk/ If you enter the homepage of teachernet and do a search for “rocks”you will find a list of suitable resources :http://www.english-nature.org.uk/science/nature_for_schools/secondary_8.asp

	<u>Igneous Rocks</u> Show pupils a videoclip of a volcanic eruption, asking them to observe that magma can flow out as lava or be blasted out as ash, and compare the resulting rocks. Ask them to suggest the origin of the magma. Remind pupils that they have considered two types of rock, sedimentary and metamorphic. Explain that there is a third type , *igneous rock*. Provide pupils with a variety of rock samples and ask them to classify them into types of rock, igneous and non-igneous, and then to sub-divide them into rapid and slow-cooling types, and/or suggesting where they were formed, eg obsidian (glasslike, very fast cooling on surface) pumice (gas bubbles, fast cooling on surface) basalt (small crystals, moderate cooling near surface) gabbro/granite (large crystals, slow cooling in the earth) <u>The rock cycle</u> – Review pupil's knowledge of the three kinds of rock through asking questions about processes and asking pupils to match descriptions with rock types. Remind them of how sedimentary rocks are formed and how these can be changed into metamorphic rock. Pose a question about where igneous rock comes from and describe the process whereby existing rocks melt under high pressure and at a high temperature to form magma. Lay out labels of the products of the rock cycle, eg sediments, metamorphic rocks, magma, rocks at the Earth's surface, and ask pupils to place labels for processes, eg deposition, metamorphism, melting, and examples of the products eg sand, limestone, slate, a photograph of a volcano, a photograph of a mountain, in the	Make table with descriptions Assess poster work Labelling diagrams of rock cycle processes	Igneous rock crystallises from magma The rate of cooling and crystallisation determines the grain size in an igneous rock That the rock cycle links the processes of rock formation. How the rock cycle provides a continuous supply and transfomation of Earth materials	Santillana Science 3 Chapter 2 Volcanoes http://www.bbc.co.uk/science/hottopics/naturaldisasters/volcanoes.shtml Volcanoes enchantedlearning.com There are a number of useful resources on the teachernet website. If you do a search on “rocks” you will find a list of suitable ideas for lessons http://www.teachernet.gov.uk/ There is a useful section from the BBC chemistry revisewise site on the rock cycle: http://www.bbc.co.uk/schools/gcsebitesize/chemistry/changestoearthandatmosphere/0rocksrev1.shtml

1 Core	right places. Alternatively, children could present the rock cycle, showing each of the processes and products, on a poster or as a class mural			
1 Extension	Elaborate a file of rocks with photographs or drawings or diagrams, including the name, type and description of each sample. <u>How do we use rocks?</u> Project work on uses of rocks. Students may wish to do project work on the Petroleum industry or the mining industry. <u>Project on coalmines</u> Pupils could look at maps of Spain to identify distribution of coal mines. Identify the areas on the map where coal mines have been closed and identify the relevant human processes responsible for the changes. List uses of coal. Look at effects on community where mines have closed down. Compare situation in Spain with that in Britain using internet sources, eg with mining areas in Yorkshire, Nottingham, Glasgow. Write a page comparing situation in Spain with that in Britain. Arrange class visit with a local coal-miner. Visit to local coal mining museum if possible. Discuss positive / negative aspects of pit closures Write article for local mining newspaper. Prepare a talk for a radio programme describing how one community has been affected by the changes to the industry.	Assess rock files Written work comparing effect of coal mine closures in Spain with Britain Project work on the different uses of rocks in different places **LL** Record and assess radio programmes	Using maps. Presenting accurate information on maps Analysing similarities and differences between two communities Considering how and why (because of human processes) the distribution of Spanish and British coalfields has changed and is changing	School science .com has interesting web pages on “Exploring for Oil”- http://www.schoolscience.co.uk/content/4/chemistry/findoils/index.html Details of project work on mining can be found on The Standards Site :http://www.standards.dfes.gov.uk/schemes2/secondary_geography/geo22/22q8?view=ge National Coalmining Museum for England has some photocopiable resources: http://www.ncm.org.uk/supportimages/KS3%20Worksheet.pdf

Topic: Minerals

Assumed knowledge from previous years:
Differences between rocks and minerals
Principal properties of minerals
Identification of most common minerals.

Contents:
1 Characteristics of minerals
2 Crystallography
3 Chemical composition of minerals
4 Practical uses and exploitation of minerals

h	Lesson outline	Assessment criteria	Lesson outcomes	Resources
1 Core Revision	**What is a mineral?** Brainstorm the main differences between rocks and minerals to remind students of work covered previously. Present these on the board. Using examples of some common minerals, or photographs and slides (examples available on mentioned website), ask students to identify them, explaining how they can identify each one. List their answers on a table or chart. Remind them of where minerals can be found and how they are formed, referring to maps, video footage etc.	Fill in a chart showing the main differences between rocks and minerals. Complete a cloze text on the definition of a mineral. (LL) Match pictures and names of minerals on a table.	Explain the difference between rocks and minerals. Identify some of the most common minerals and explain their characteristics.	Collection of some common minerals (or slides and photographs of these). Hodder Gold Pupil's Book B, pp 92-93 http://www.webmineral.com/ Maps of mineral deposits. Video or photographs of mineral deposits, examples of mining.

2 Core	**Crystallography:** Using photographs and geometric diagrams, (see website), explain how minerals belong to various different crystal groups and classes. Giving various examples, demonstrate the symmetrical structure of minerals, (the mentioned website has a large variety of interactive diagrams and illustrations). Ask students to observe carefully examples of CRYSTALLOGRAPHIC AXES and list on the board, in chart form, a variety of examples, relating these to some common minerals already familiar to the students. Take one as an example, and using the website, demonstrate in detail for the students to observe.	On a chart or table, match some common minerals with geometric diagrams. Complete a chart of information on the symmetrical structure of common minerals. Using the interactive diagrams on the website, explore and write a short report on the crystal formation of a chosen mineral.(LL)	Understand how minerals can be classified according to their crystallography. Identify the crystal formations of some of the most common minerals. Understand and give examples of the crystallographic axes of common minerals.	http://www.webmineral.com/crystall.shtml Photographs and diagrams of minerals and their crystal formations. http://www.rockhounds.com/rockshop/xtal/part1.html

1 -2 Core	Chemical composition of minerals: Using a variety of examples, explain how minerals can be grouped and classified according to their chemical composition. Using a chart or table, ask students to observe and comment on a range of examples, helping with relevant vocabulary as necessary. With students in pairs or small groups, hand out vocabulary cards with the names of various minerals, and definitions of these according to their chemical composition. Ask them to match correctly. Once they have completed the activity, correct and re-explain as necessary, referring to the chart.	Place a variety of common minerals on a chart according to their chemical composition.(CL) Prepare a word wall or vocabulary chart to describe the chemical composition of minerals. (LL)	Understand how minerals can be classified and grouped according to their chemical composition. Identify a range of common minerals according to their chemical composition.	http://www.webmineral.com/chemical.shtml http://www.amonline.net.au/geoscience/minerals/crystallography.htm Chart or table of minerals grouped by chemical composition. Vocabulary and definition cards to describe various minerals.

2 Core	Use and exploitation of important minerals : Quickly revise where minerals can be found and how they are formed, referring to maps, video footage etc. Brainstorm some ideas of how we use minerals in our everyday lives, writing some suggestions on the board. Outline the most important uses of minerals : - Industrial -Energy resources -Jewellery Give a range of examples, and ask students to suggest more. Referring to a world map, point out some important mineral deposits and invite the students to suggest the effect these have on each country or region. List ideas on labels to accompany the map.	Write a short report on one of the ways in which minerals are used in our everyday lives. (LL) Complete a blank map of Spain or one region, indicating the major mineral deposits to be found.	Recognise some major mineral deposits in own country and regions. Understand and explain the main uses of minerals, how they are exploited and how they affect a country's economy. Understand the risks and dangers of over-exploitation of mineral deposits	Maps, video or photographs of mineral deposits, examples of mining. http://www.uni-wuerzburg.de/mineralogie/links/ore/ore.html (links to information on mineral deposits.)
1 Extension	Briefly revise information gathered in the previous lesson, drawing students' attention to the maps used. Compare maps of Spain and Great Britain, showing the principal mineral deposits in each country. Point these out and ask students to comment on similarities and differences. Referring students (in pairs) to the website, ask them to gather information on one region of Great Britain and report their findings to the class.	Using the internet, research information on minerals in Great Britain and prepare a short oral presentation. (LL)	Recognise the similarities and differences of mineral deposits in Spain and those in Great Britain.	Maps of Spain and the United Kingdom, showing the most important mineral deposits. http://www.rock-site.co.uk/ (information on minerals in Great Britain)

Bands of attainment

The bands of attainment described below are for ESO 3.

- **Band 1 30% pupils will not have made so much progress and will have reached or may be struggling at this level.**
- **Band 2 60% pupils will have reached this level.**
- **Band 3 10 % pupils will have progressed further and will have reached this level.**

Band 1 :
Students recall a limited range of information. For example, they state the main functions of organs of the human body and describe some defence mechanisms of the body. They use and apply knowledge and understanding in some specific everyday contexts and are able to make some use of scientific and technical vocabulary and make simple generalisations from information. They relate scientific explanations to some experimental evidence and describe simple examples of benefits and drawbacks of scientific development. They devise fair tests in contexts which involve only a few factors. They use simple apparatus to make measurements appropriate to the task and record observations and measurements in tables and graphs. They obtain information from simple tables, charts and graphs and identify simple patterns in information and observations. They offer explanations consistent with the evidence obtained.

Band 2 :

Students recall a range of scientific information from all areas. For example, they describe how some organ systems in living things carry out life processes. They use and apply scientific knowledge and understanding in some general contexts, for example they describe how a cell is adapted to its functions. They describe links between related phenomena in different contexts, use diagrams, charts and graphs to support arguments, use appropriate scientific and technical vocabulary in a range of contexts. They describe how evidence is used to test predictions made from scientific theories, and how different people may have different views on some aspects of science. They use scientific knowledge and understanding to identify an approach to a question. They use a range of apparatus to make careful and precise measurements and systematic observations and recognise when it is necessary to repeat measurements and observations. They present data systematically, in graphs where appropriate. They identify and explain patterns within data and draw conclusions consistent with the evidence. They explain these conclusions using scientific knowledge and understanding and evaluate how strongly their evidence supports the conclusions.

Band 3 :

Students recall a wide range of knowledge from all areas. They use detailed scientific knowledge and understanding in a range of applications relating to scientific systems or phenomena. For example, they explain how temperature or water content is regulated in humans. They draw together and communicate knowledge from more than one area, use routinely scientific or mathematical conventions in support of arguments, use a wide range of scientific and technical vocabulary throughout their work. They explain how scientific theories can be changed by new evidence and identify some areas of uncertainty in science. They use scientific knowledge and understanding to select an appropriate strategy for a task, identifying the key factors to be considered. They make systematic observations in qualitative work and decide which observations are relevant to the task in hand. When making measurements they decide the level of precision needed and use a range of apparatus with precision and skill to make appropriately precise measurements. They select a method of presenting data appropriate to the task; they use information from a range of sources where it is appropriate to do so. They identify and explain anomalous observations and measurements and the salient features of graphs. They use scientific knowledge and understanding to identify and explain patterns and draw conclusions from the evidence by combining data of more than one kind or from more than one source. They identify shortcomings in the evidence, use scientific knowledge and understanding to draw conclusions from their evidence and suggest improvements to the methods that would enable them to collect more reliable evidence.

Development of Scientific ways of thinking

It is possible to give an outline of how we expect the pupils to develop scientifically throughout the course, although they will not all develop at the same rate. It is important for teachers to be aware that there will be a mixture of levels in any class and to try to ensure that their questions and the work set is differentiated to encompass this variety:

Lower levels of attainment

Pupils will be able to recall information, use some basic scientific vocabulary, describe what happens and answer basic questions about why something happened.

For example they may know that plants need light and carbon dioxide to carry out photosynthesis.

Middle levels of attainment

Pupils will begin to use abstract ideas and models in their answers: energy, forces, particles and cells.

They will be able to explain their observations: This happens because...

Plants need carbon dioxide and water because they are made into carbohydrates for food.

Light energy is needed to make carbohydrates.

For example they will be able to say that photosynthesis takes place in green plant cells because they contain chlorophyll which traps the light energy and converts it into chemical energy.

Higher levels of attainment

They will be able to apply abstract ideas, models and theories to explain phenomena.

They will be able to find patterns in their observations and begin to explain their conclusions in a logical and reasoned way.

For example, if they are at this level they will be able to see photosynthesis in terms of particles, energy and cells. They will begin to appreciate the role of photosynthesis in ecology as the basis of all food chains and to use quantitative relationships in explanations, evaluate practical work and to make predictions based on their knowledge. They will understand that certain environmental conditions limit the rate of photosynthesis and apply this to how the green house effect might affect plant growth.

This mental development is probably more important than the simple acquisition of scientific facts or content. Any pupil can learn facts parrot fashion but they need to be at an appropriate level of understanding or maturity to be able to truly understand what they are learning. It is of little use to teach an ESO1 pupil about detailed atomic structure with protons, neutrons and electron shells; they will be able to learn it but they will not be able to have a reasonable true understanding of the significance of the model until they are 14 or 15 years old, perhaps never. But they will be able to grasp the idea of particles making up solids, liquids and gases and be able to understand that these particles may be atoms. It is the teacher's job to advance their pupils' learning in careful steps in keeping with their level of understanding, rather than fill them up with scientific facts to be regurgitated in an exam.

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Science Plus+ (Collins) : Book 1 : ISBN 0-00-721648-3
Book 2 : ISBN 0-00-721649-1
Teachers guide and CDROM ISBN 0-00-721650-5
Homework and assessment on-line ISBN 0-00-721645-9

BIOLOGY first (OUP) ISBN 0-19-914731-0
N.B: This text is a specific Biology course and is considered particularly useful for students who intend to work towards the Biology GCSE exam.

Collins Absolute Science, 1,2,3
N.B : Especially Book 2 : ISBN 0-007-13588-2
Book 3 : ISBN 0-00-713587

***Letts* Revise AS and A2** : ISBN 1-84315-474-9
Useful for revising and testing.

Collins GCSE Revision Guide series: Biology 0-00-719058-1
Useful for summaries of topics, testing and revision.

Santillana Science : Book 3
Covers all areas of science.

Useful Websites and Internet Resources

General Reference :

www.scienceacross.org

http://www.standards.dfes.gov.uk/schemes2/secondary_science/?view=get
Part of the official government site for the National Curriculum, this site includes schemes of work and resource links for all the topics at all levels of secondary science. Very useful reference guide.

http://www.qca.org.uk/12265.html
The official site of the QCA (Qualifications and Curriculum Authority), with information about science teaching at Key Stage 4

Biology :

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Well laid out site with lots of information on cells.

http://www.makingthemodernworld.org.uk/learning_modules/geography/05.TU.01/?section=2
Site with information on the geography of health.

http://www.biotopics.co.uk/
Specific educational site, with lots of diagrams etc on various aspects of biology, including viruses etc.

http://www.bbc.co.uk/schools/gcsebitesize/biology/humansasorganisms/0nutritiondigestionrev8.shtml
Useful information on food and nutrition, presented in an easy to follow format for students.

www.nutrition.org.uk
Information on nutrition, useful for both teachers' reference and students' activities.

http://www.eufic.org/web/index.asp?cust=1&lng=en#14
A site on food safety, particularly useful for teachers.

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Site includes information on various aspects of human biology.

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Information on the digestive system.

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Useful reference site for teachers on the digestive system.

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A lesson plan on the respiratory system.

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Information on the cardiovascular system.

http://www.schoolscience.co.uk/content/4/biology/abpi/heart/index.html
Information, quizzes and activities related to the circulatory system.

http://www.nhsdirect.nhs.uk/articles/alphaindex.aspx
A health encyclopaedia with a list of terms, including illnesses etc. Very useful reference for teachers.

http://www.bbc.co.uk/schools/gcsebitesize/biology/humansasorganisms/4nervoussystemrev1.shtml
Easy to follow information, including illustrations, on the nervous system. Suitable for students' use.

http://www.bbc.co.uk/science/humanbody/
A site with lots of information, interactive activities etc on the human body and mind.

http://www.cellsalive.com/cam0.htm
Information, including a useful glossary of terms, on cells.

http://www.kidshealth.org,
Information on human reproduction for children and teenagers.

http://www.visembryo.com/
Interactive site on human reproduction and development.

Geology :

http://www.webmineral.com/
A very complete site, including definitions, photographs of minerals. Useful both for teachers' reference and for students to investigate and revise the topic.

http://www.earth.ox.ac.uk/~davewa/minerals.html
Includes a list of links to a variety of sites on rocks and minerals.

http://www.rockhounds.com/rockshop/
Includes information and explanations of rocks and minerals, as well as a variety of links to other useful sites.

http://geology.csupomona.edu/alert/mineral/minerals.htm
User-friendly information and interactive activities on rocks and minerals, including identification and classification.

http://www.amonline.net.au/geoscience/minerals/crystallography.htm
Particularly useful site for teachers' reference, with information on physical and chemical properties of minerals.

http://www.proteacher.com/110073.shtml
A list of links to lesson plans etc. on rocks and minerals. Various levels, some very simple.

http://www.rock-site.co.uk/
A site with information on mineral deposits in Great Britain.

Literacy Support

Writing across the curriculum – frames to support learning. Maureen/David Wray. University Reading