



<p>Fusion 2: B1.1 – Body Systems</p> <p>National Curriculum Link up •2.1a, b, c. 2.2a, b. 2.3a. 3.3a.</p>		
<p>Learning Objectives Pupils should learn: That cells are organised into tissues, organs and body systems. The structure and functions of body organs. The organisation and functions of body systems.</p>	<p>Teaching / Learning activities Lesson structure Starter -Organ word search Ask the pupils to complete a word search with the names of the major organs of the body in it. Put a time limit on it or award a small prize for the pupil who completes it first. (5–10 mins) Main Let the pupils do the activity 'Drawing organs', working in pairs or in groups. One pupil in each group should lie on top of a piece of lining paper, or several pieces of paper joined together, or the back of a large poster placed on the floor. With a felt tip marker, they draw around the outline of the pupil's body. Give the pupils in each group a list of body organs which they must draw within their outline. They should aim to get the organ in the correct location and also try to get the size right, labelling each organ with its name and function. Pin the outlines up around the room and score each group for location and approximate size of the organs. Illustrate the specialisation of cells using a PowerPoint presentation of the different types of cells in a section of the small intestine or a blood vessel such as an artery or a vein. Give the pupils a worksheet so that they have a record of the cells and their functions. Discuss which cells are the most highly specialised and the functions that they carry out. Draw out that the most highly specialised cells have fewer functions than those that are the least specialised. Extend the activity above by allocating an organ to each group of pupils and allow them to research, using any sources available, which types of cell are involved and what their functions are. Gather the results together in a table which the pupils can copy into their notebooks. Plenary - OK! Name them In this activity, groups of pupils bid against each other to see which group can name the greatest number of specialised cells, the most body organs or organ systems. This game can be made more exacting by ensuring that the correct terminology is used, e.g. not just blood cells, but red cells, white cells and so on. (5–10 mins)</p>	<p>Teaching suggestions • Learning styles. <i>Visual:</i> Observing the PowerPoint presentation. <i>Auditory:</i> Listening to the explanations. <i>Kinaesthetic:</i> Taking part in the body parts activity. <i>Interpersonal:</i> Working in pairs or groups on the body parts activity. <i>Intrapersonal:</i> Completing the word search. • Special needs. Pupils can be supplied with pictures of the body organs to place in the correct positions on an outline of the human body. • Extension. Design a game, based on 'Happy families', where participants collect the parts of a body system. • Homework. Pupils could choose a specialised cell, e.g. a muscle cell or a nerve cell, and write a paragraph about how it is modified to carry out its function. Ask pupils to complete the copying of tables into their notebooks.</p>
<p>Learning Outcomes <i>All pupils should be able to understand that cells are organised into tissues, organs and body systems.</i> <i>Most pupils should be able to describe the structure and functions of the body organs and body systems.</i> <i>Some pupils should also be able to describe the relationship between different body systems.</i></p>	<p>Additional teachers notes Equipment and materials required Large pieces of paper (lining paper or pieces of paper stuck together or backs of posters) and felt tip pens.</p>	



<p>Fusion 2: B1.2 – The Digestive System.</p> <p>National Curriculum Link up •3.3a.</p>		
<p>Learning Objectives Pupils should learn: About the parts of the digestive system. The different parts of the digestive system and describe their structure. The functions of the different parts of the digestive system.</p>	<p>Teaching / Learning activities Lesson structure Starter - Where is food needed and how does it get there? Pose this question and give the pupils the task of reporting their ideas on a large piece of paper in whatever manner they choose. Display the results and share the responses with other groups. (10–15 mins) Main Using a human model torso or PowerPoint diagrams, take the pupils through the main parts of the digestive system. It could be useful to give each pupil a blank outline diagram to fill in as the parts are named. Illustrate the role of teeth in providing extra surface area by getting the pupils to consider how they eat a chocolate bar. Suggest that using teeth also make things easier to swallow. To introduce the oesophagus and the idea of peristalsis, show the Simpson's clip featuring Itchy and Scratchy in 'Oesophagus now' (season 7, episode 3F03). The functions of the stomach can be illustrated by reference to the story of Alexis St Martin, who had lumps of meat dangled inside him. The functions of the small intestine in absorption can be illustrated by using pieces of rolled up carpet to convey the idea of the villi increasing the surface area. A model villus can be made from the finger of a rubber glove and felt tip pens. This can either be done as a demonstration or the pupils could make their own. Now is a good time to do the activity from the pupil book: 'A model intestine'. The standard tests for a reducing sugar and starch need to be demonstrated to the pupils so that they can test for the results. Plenary - Digestion mnemonics or 'Te-To-Tum' Pupils should make up a mnemonic to help them remember the sequence of parts of the digestive system. (5–10 mins)</p>	<p>Teaching suggestions</p> <ul style="list-style-type: none"> • Special needs. Use a cloth intestine tabard to illustrate the parts of the digestive system. • Extension. Using the chocolate bar illustration from the starter, suggest to the pupils that they calculate how the surface area of an 8 cm cube sweet bar increases each time it is divided, i.e. untouched, cut into 2,4,8,16,32. Pupils could graph these out and try to come up with an equation linking the two. • Learning styles. <i>Visual:</i> Observing PowerPoint presentation. <i>Auditory:</i> Listening to the explanations. <i>Interpersonal:</i> Working in groups in the starter activity. <i>Intrapersonal:</i> Composing mnemonic or song. • Homework. Give the pupils a list of the key words and ask them to write a paragraph about the digestive system in their notebooks. Ask them to finish their mnemonic or song if time is short at the end of the lesson.
<p>Learning Outcomes <i>All pupils should be able to</i> state that food needs to be broken down so that it can be absorbed. <i>Most pupils should be able to</i> label the main parts of a digestive system diagram. <i>Some pupils should also be able to</i> give detailed and alternative names and functions of the parts of the digestive system.</p>	<p>Additional teachers notes Equipment and materials required per group: Visking or dialysis tubing, dropping pipettes, elastic bands, starch and enzyme solutions (the strength of the solutions should be adjusted to give results in a lesson session), water baths, beakers, Bunsen burner, 2 test tubes and a stand, 1 test tube of warm water, iodine solution, Benedict's solution, eye protection. Safety. Iodine: CLEAPSS Hazcard 54B. Benedict's solution is harmful: CLEAPSS Hazcards 27C and 95A. Eye protection.</p>	



Fusion 2: B1.3 – Digesting Food		
National Curriculum Link up •3.3a.		
Learning Objectives Pupils should learn: How digestion occurs. That starch, protein and fat have to be digested before they can be absorbed. How these large molecules are broken down by enzymes.	Teaching / Learning activities Lesson structure Starter - Squeezy fists Get the pupils to put their hands into the air and squeeze their fists. Ask them how they are doing that and keep questioning about where the energy comes from to enable them to keep doing it. (5–10 mins) Main Explain that enzymes are proteins, biological catalysts, which speed up reactions in living organisms but are not themselves used up. Explain that enzymes are specific, i.e. that one enzyme will only speed up the rate of one reaction and another reaction will require a different enzyme. Give each group of pupils a set of six identical Lego bricks (or laminated cards with Velcro patches) with the letters 'S', 'T', 'A', 'R', 'C' and 'H' written on the front of them. On the back of each brick write the word 'sugar' (or 'glucose' if you prefer). Ask the pupils to assemble the bricks into a block and then to separate them using a plastic knife labelled 'amylase'. Use the experiment 'Digesting starch' described in the pupil book either as a class demonstration or in groups. The process of digestion of a meal can be demonstrated by placing some food into a blender and liquidising it. Pour the liquidised food into the leg of a pair of tights and squeeze. The liquid part will come through the gaps. Emphasise that this is going into the blood and not the body cavity and that for most food, digestive enzymes are needed to make the food small enough to go through the gaps. Plenary - Digestion rags to riches Carry out a 'Who wants to be a millionaire?' style rags to riches game constructed using a set of Java tools such as Quia (www.quia.com). (5–10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Pupils could look at simple digestion animations on the intranet. • Extension. Ask pupils to research the consequences of cystic fibrosis (which blocks the pancreatic duct) in terms of enzymes and digestion, then report their findings. • Learning styles. <i>Visual:</i> Observing the results of the experiment. <i>Auditory:</i> Listening to the exposition on enzymes. <i>Kinaesthetic:</i> Carrying out the Lego bricks exercise. <i>Interpersonal:</i> Taking part in 'Squeezy fists'. • Homework. Having explained that enzyme names end in '-ase', ask pupils to find as many different names for enzymes as they can.
Learning Outcomes <i>All pupils should be able to</i> recognise that large molecules cannot be absorbed but smaller ones can. <i>Most pupils should be able to</i> match the food types to their component parts. <i>Some pupils should also be able to</i> give a detailed description of the digestion of the major food types including enzyme names. How Science Works Describe how the use of a model or analogy supports an explanation (1.1a1).	Additional teachers notes Equipment and materials required Starch solution, glass beaker, water bath at 37°C, amylase solution (or saliva), iodine solution (less than 1 mol/dm ³). Liquidised food and a pair of tights. Safety Amylase solution is an irritant: CLEAPSS Hazcard 33, Recipe card 23. Iodine solution: CLEAPSS Hazcard 54B. Eye protection.	



Fusion 2: B1.4 – Food and a Balanced Diet		
National Curriculum Link up •3.3a.		
Learning Objectives Pupils should learn: The food types needed in a balanced diet. How the body uses the different nutrients contained in foods. To use chemical tests to identify carbohydrate, protein and fat.	Teaching / Learning activities Lesson structure Starter - Shopping sort out Show the pupils a large bag with shopping items in. Ask the pupils to sort them into groups according to the food type. (10–15 mins) Main Go over the main food types according to scientific understanding. Give the pupils a worksheet with a table of food types, examples and uses and ask them to fill in the appropriate bits. Demonstrate the main standard food tests: iodine solution for starch, Benedict's reagent for, Biuret for protein (sodium hydroxide solution and copper sulfate solution) and either the emulsion test (shaking with alcohol) or the grease mark test on translucent paper for fats. Give the pupils a variety of simple foods to test. Give them a sheet with the foods tabulated and spaces to fill in the results of the tests they do on each one. Plenary - Food tri-ominoes Pupils play a game like dominoes but with triangular playing pieces. Each piece has one food type, one example and one use on it. The different categories are colour-coded. The object is to match one face of the tri-omino with a matching face of one already lying on the table. (10–15 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Pupils could use a 'cut and stick' exercise to sort food items on to appropriate shelves drawn on a pantry sheet. Check, that then pupils glue cut-out food into their exercise books. • Extension. Continue the exercise on occupation and appropriate diet to include more detailed information on the changes in the food requirements of an individual at different stages of their life. Do they change? Why might they need to change? • Learning styles. <i>Visual:</i> Matching tri-ominoes in the plenary. <i>Kinaesthetic:</i> Carrying out the food tests. <i>Interpersonal:</i> Working together on food tests. • Homework. Complete the 'food types' booklet. Ask the pupils to take a photograph using their mobile phones (or find an appropriate picture from a magazine) of an example of a food which is representative of each one of the food types. This can be peer-assessed as part of an assessment of learning session.
Learning Outcomes <i>All pupils should be able to name the six major food types with aid.</i> <i>Most pupils should be able to list the major food types, giving examples, and describe the tests for them.</i> <i>Some pupils should also be able to give detailed descriptions of the types of foodstuffs and how they are used by the body.</i> How Science Works Explain how the observation and recordings methods are appropriate to the task (1.2d).	Additional teachers notes Equipment and materials required per group: small pieces of foods such as apple, potato, bread, egg albumen, test tubes, test tube rack, water bath, dropping pipettes, watch glasses or white tiles, iodine solution (starch), Benedict's reagent (sugars), Biuret reagent (proteins) and translucent paper (fats). Starch test: Add a drop of iodine solution to the food to be tested. Benedict's test: A small piece of food should be placed in a test tube and about 3 cm ³ of Benedict's solution added. Heat in a water bath. Biuret test: Add a small quantity of Biuret reagent to the food in a test tube and observe the colour change. Fat test: Rub the food to be tested on to a piece of paper. Safety. Eye protection. Care with water baths. Iodine solution: CLEAPSS Hazcard 54B; Benedict's solution: CLEAPSS Hazcard 27C and 95A; Biuret reagent: CLEAPSS Recipe card 13; 0.1 mol/dm ³ sodium hydroxide solution: CLEAPSS Hazcard 91 and 27C (Copper Sulfate). Also useful: CLEAPSS Student Safety Sheet 4 Food Testing (1).	



Fusion 2: B1.5 – Breathing National Curriculum Link up •3.3a.		
Learning Objectives Pupils should learn: The basic structure of the lungs. How our lungs work. How we breathe in and out.	Teaching / Learning activities Lesson structure Starter -Breathing line up Give each pupil a card with one of the following words on it: mouth, epiglottis, larynx, trachea, bronchus, bronchioles, air sacs and alveoli. Show the students an anatomical diagram of the respiratory system and get the pupils to line up in sets in the correct order that inhaled air would meet them. Ask them to call out their part names in order. (5–10 mins) Main Set up a demonstration model of how an epiglottis works by having a Y-junction section from a domestic waste pipe cut in two, lengthways. Arrange a hinged sprung flap of plastic, so that as a ball rolls down one tube it shuts the other one off so that it can't go down it. How we breathe activity: use the classic bell jar with a pair of balloons in it as a breathing model. Demonstrate how the model works by pulling down the 'diaphragm' and then letting go. Get the pupils to describe and explain what is happening. Carry out the activity 'Lung capacity' as described in the pupil book. The data can be used to see if there are any interesting correlations. Plenary - Passengers will kindly remember to breathe In pairs, write and rehearse a spoof version of the familiar airline safety announcements given at the start of flights. Their version should, in a humorous yet accurate way, tell the passengers how to breathe. (5–10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Give the pupils the key words for the topic, but with either all the vowels or all the consonants missing and ask them to fill in the missing letters. • Extension. Pupils could produce a poster to show how the Heimlich manoeuvre is carried out and explain how it works. • Learning styles. <i>Kinaesthetic:</i> Lining up to show the movement of inhaled air. <i>Interpersonal:</i> Discussing the results of the experiments. • Homework. Pupils should write up the results of the 'Lung capacity' activity or peak flow meter activities, making a table of results and commenting on any difficulties with the experiment, differences in results from different groups (age, gender, etc.) and conclusions that can be drawn from the results.
Learning Outcomes <i>All pupils should be able to describe the basic structure of the lungs.</i> <i>Most pupils should be able to describe how the breathing process occurs.</i> <i>Some pupils should also be able to explain the effects of breathing in and breathing out on the different parts of the thorax.</i>	Additional teachers notes Demonstration of epiglottis equipment and materials required Plumbers' Y-piece and valve, ball to fit, hinged sprung flap of plastic. How we breathe equipment and materials required For the class demonstration breathing model: bell jar with a cork in the top, sheet of rubber, two balloons, Y-shaped glass tube inserted through the cork at the top of the bell jar. Lung capacity equipment and materials required Large plastic container (five-litre fruit juice container) marked with litres and half litres, large bowl, rubber tubing.	



Fusion 2: B1.6 – Lungs		
National Curriculum Link up •3.3a.		
Learning Objectives Pupils should learn: How the lungs are adapted for gaseous exchange. The structure of the lungs and associated organs. How our lungs are kept clean.	Teaching / Learning activities Lesson structure Starter - Chest parts word search Ask the pupils to complete a word search with the key words in it. Gear the difficulty of this to the ability of the pupils. (5–10 mins) Main Show the pupils a PowerPoint, or a video, on the process of breathing and how it takes place. Carry out a dissection of a set of pigs' lungs. [Check pupil sensitivities and/or religious objections.] If you ask at a good butcher for a pigs pluck, you should get a set. Get them as fresh as you can and keep them refrigerated. Either use them straight away or freeze them straight away. Do not re-freeze once thawed out. The lungs can be inflated by introducing a piece of Bunsen hose, attached to a foot pump or cycle pump for inflating, into an airway leading into an intact lobe. Show photographs of the structure of the different parts of the lungs, particularly of the alveoli. A microscope slide of alveoli, emphasising the nature of the thin walls and the close proximity to the blood vessels should link the gross structure to the gas exchange surface. Refer the pupils back to the dissection and the pink colour of the lungs. Ask: 'Why were they so pink?' Get the pupils to carry out a sequencing exercise on the stages in breathing. Once the sequence has been established, the pupils should make notes in their exercise books summarising the process. Plenary - Structure to function mind map Ask the pupils to complete a mind map showing the parts of the respiratory system, relating them to their functions. (5–10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Provide cards with the stages of breathing on them and ask the pupils to put them in the correct order. Using a large poster of the lungs and associated structures, ask pupils to label the key structures or provide labels for them to put in the correct places. • Extension. Ask the pupils to find out how you can breathe for someone who is unconscious and not breathing. Link to PSHE and remind them of what happens on programmes such as <i>Casualty</i>. If possible, let them investigate the models used to teach CPR. Emphasise that this should never be done on a conscious person or if a conscious person is breathing unaided. • Learning styles. <i>Visual:</i> Observing PowerPoint or video presentations. <i>Kinaesthetic:</i> Sequencing the stages in breathing. <i>Interpersonal:</i> Working in pairs to carry out the starter and/or plenary activities. <i>Intrapersonal:</i> Making own notes on the sequence of breathing. • Homework. Pupils should finish writing up their notes on the sequence of breathing. Get pupils to count and record how many breaths per minute they take when carrying out different activities. Ask: 'Are there changes in chest volume associated with the number of breaths?'
Learning Outcomes <i>All pupils should be able to</i> label windpipe, voice box, bronchi and air sacs. <i>Most pupils should be able to</i> label larynx, trachea, bronchi, bronchioles, alveoli, ribs and diaphragm, and be able to describe how the lungs are adapted for gaseous exchange. <i>Some pupils should also be able to</i> link structure and function for all the above parts and give explanations of how the lungs are kept clean.	Additional teachers notes Equipment and materials required Pig's lungs (pluck), dissecting tools, a piece of rubber hose, a foot pump or cycle pump. Safety Place pig's lungs in a large, clear plastic bag when inflating: CLEAPSS handbook/CD-Rom section 14.7.2. Pupils to wash hands thoroughly after touching the pig's lungs.	



Fusion 2: B1.7 – Inhaled and Exhaled Air		
National Curriculum Link up •3.3a.		
Learning Objectives Pupils should learn: That respiration releases energy from food. The differences between inhaled and exhaled air. That the differences between inhaled and exhaled air are related to the release of energy.	Teaching / Learning activities Lesson structure Starter -Watch the birdy Show the pupils the painting 'Experiment on a bird in the air pump' by Joseph Wright. Discuss what is going on and what will happen to the bird if it is left inside the pump and why. (10–15 mins) Main - For each group of pupils, set up two gas jars filled with water, inverted over water. Give each pair within the four a stubby candle on a float and a stop-watch. One pair is to allow the jar to fill with ordinary air by letting the water out. The other pair breathe out through a rubber hose to expel the water. Keep the mouth of this jar beneath the water surface to keep the exhaled air trapped. Seal each jar by sliding a lid covered with Vaseline over the mouth. Light the candles, take the lids off the jars and invert the jars over the candles. Start the stop-watches. Record when each candle goes out. Repeat the procedure. Get the pupils to compare their results and discuss. As a comparison, you could demonstrate what happens when you use a jar of pure oxygen and what happens when you use a jar of pure carbon dioxide. Use the experiment 'Comparing carbon dioxide' described in the pupil book as a demonstration. Carry out the 'Comparing water vapour' activity as described in the pupil book. Plenary - Respiration modelling: O₂ in, CO₂ out Give some pupils cards to hold with the names of the parts of the respiratory system written on them. Give one pupil a card with 'O ₂ ' written on it. Ask them to pass down the system in the correct sequence. (5–10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. The 'Respiration modelling' plenary could be extended for these pupils. • Extension. Pupils could produce a balanced equation for respiration. To extend further, ask: 'if a person inhales and exhales 3 litres of air, assuming the inhaled air has 0.04% carbon dioxide and exhaled has 4%, how much more would the exhaled breath weigh than the inhaled one?' • Learning styles. <i>Visual:</i> Observing the Joseph Wright picture. <i>Auditory:</i> Listening to discussions and the views of others. <i>Kinaesthetic:</i> Carrying out the practical experiment. <i>Interpersonal:</i> Working in a group in the 'Respiration modelling' plenary. <i>Intrapersonal:</i> Reflecting on their own views about the Joseph Wright picture. • Functional skills link-up. ICT Enter, develop and organise numerical information that is fit for purpose (level 2). • Homework. Pupils could imagine they are one of the people in the picture by Joseph Wright and write a short account of what they saw, giving a scientific explanation of what was happening.
Learning Outcomes <i>All pupils should be able to state that inhaled air has more oxygen and less carbon dioxide than exhaled air.</i> <i>Most pupils should be able to state that inhaled air has more oxygen and less carbon dioxide than exhaled air and give the percentages.</i> <i>Some pupils should also be able to give a balanced equation for respiration.</i>	Additional teachers notes Equipment and materials required Drinking straws, test tubes, limewater, candles, gas jars, Vaseline, cover slips, fl oats, stop-watches, rubber hose, cobalt chloride paper, thermometer (0–110°C), matches. Apparatus as shown in the pupil book for the 'Comparing carbon dioxide' experiment. Safety. Eye protection should be worn. Limewater is an irritant: CLEAPSS Hazcard 18. Cobalt chloride paper should be handled as little as possible, wash hands afterwards and avoid skin contact: CLEAPSS Hazcard 25. Warn about the use of matches.	



Fusion 2: B1.8 – The Heart and Circulation		
National Curriculum Link up •3.3a.		
Learning Objectives Pupils should learn: That the heart pumps blood around the body. That the blood is carried to and from body organs in blood vessels. The structure and functions of the different types of blood vessel.	Teaching / Learning activities Lesson structure Starter - All change Give the pupils a cloze passage to complete on the basic knowledge gained last lesson on the gas exchanges which happen in the lungs. This can then be peer marked. (5–10 mins) Main - Get the pupils to describe the flow of blood in a rhythmical manner, chanting with you that it goes 'from the body to the heart, to the lungs to the heart, to the body to the heart, to the lungs to the heart' reinforcing this by actions, moving your fist in appropriate semicircles coming to rest over the heart each time. Ask the pupils to label a blank diagram of the heart and use coloured pencils to colour in the left side red and the right side purple. Carry out the activity 'Taking your pulse' as described in the pupil book. Working in pairs, pupils should practise taking someone else's pulse. Gather up the results for the class and determine a mean rate. Carry out the activity 'Beating muscle' as described in the pupil book. Each pupil should count how many times they can clench and unclench their hand in five minutes. Again, the class results could be recorded and any differences (age, gender, fitness, etc.) discussed. Plenary - Cute cuticles Draw cells on a cardboard tube from a roll of kitchen paper and pass around to show what capillary structure is like. Put some moving eyes on it and suggest that it looks like a caterpillar. Choose a volunteer, cover the nail cuticle in clove oil and focus carefully down a binocular microscope. Capillary loops with curved heads towards the nail should be visible under high magnification. (5–10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Give the pupils name cards to place in the correct positions on a large heart diagram. Also provide some arrows so that the passage of blood through the heart can be indicated. • Extension. Get the pupils to do some more research on Galen or William Harvey and to make a poster for the classroom, summarising their ideas and contrasting them with the knowledge we have today. • Learning styles. Auditory: Describing the double circulation. Kinaesthetic: Taking pulse rates. Interpersonal: Taking part in the 'double circulation' chanting. Intrapersonal: Making their own diagrams of the circulatory system. • Homework. Ask the pupils to imagine that they are red blood cells and get them to describe how they circulate around the body, picking up oxygen and delivering it to the cells. To make it more exciting, they could be told to think of it as a motor rally circuit or a Grand Prix race track, where there are different hazards and they may travel at different speeds.
Learning Outcomes <i>All pupils should be able to state that the heart pumps blood around the body and the names of the different types of blood vessel.</i> <i>Most pupils should be able to describe how the heart works and the differences between arteries, veins and capillaries.</i> <i>Some pupils should also be able to give detailed descriptions of the tissues and anatomical features involved linked to their functions.</i>	Additional teachers notes Taking your pulse and Beating muscle equipment and materials required Stop-watches or stop-clocks. Plenary: Cute cuticles equipment and materials required Kitchen roll tube, felt-tipped pens, moving eyes, clove oil, binocular microscope.	



Fusion 2: B1.9 – Supplying the Cells National Curriculum Link up •3.3a.		
Learning Objectives Pupils should learn: How ideas about the circulation of the blood have developed over time. That oxygen, carbon dioxide, dissolved food and waste are carried in the blood. How different substances are carried to the tissues and organs.	Teaching / Learning activities Lesson structure Starter - True or false? Give the pupils a list of questions based on the previous lesson. They have to write down whether they are 'true' or 'false' in the back of their books. They self-mark this exercise. (5–10 mins) Main – Go over the history of thought on the human circulation, from Galen's ideas through Ibn al-Nafi s's work on pulmonary circulation to that of William Harvey. Ask the pupils to make a timeline using a till roll. Using a scale of 20 cm per 100 years, start at CE Year 0. If possible get a supply of fresh blood from an abattoir. Put a little sodium citrate solution into the bottom of the collecting flask as an anti-coagulating agent. Using an oxygen cylinder or generator (manganese dioxide and hydrogen peroxide will do this), bubble some oxygen through the blood to observe the colour change. Working in pairs, get the pupils to look at the inside of each other's lower lip or under the tongue to see both oxygenated and deoxygenated blood within the arterioles and venules. Relate this to why blood is always bright red when you cut yourself, but is purple/blue when you have a blood sample taken from a vein. Plenary - Blood dominoes Carry out a floor dominoes game relating the parts of the blood and their functions. (5–10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Pupils could make Plasticine models of red blood cells to fit the capillary tubes made in the previous lesson. They could use red Plasticine for oxygenated and purple for deoxygenated. • Extension. Ask: 'Are all vertebrate red blood cells the same?' Get pupils to find out how the blood of other animals differs from human blood. This leads to a discussion of the importance of forensic science in the investigation of blood stains at the scene of a crime. • Learning styles. <i>Visual:</i> Observing each other's arterioles and venules. <i>Kinaesthetic:</i> Making a timeline. <i>Interpersonal:</i> Taking part in the floor dominoes plenary. • Homework. Ask pupils to write a short passage or a poem about the duties of a red blood cell.
Learning Outcomes <i>All pupils should be able to state that the red cells carry oxygen.</i> <i>Most pupils should be able to state that the red cells carry oxygen and that the plasma carries carbon dioxide, dissolved food and waste.</i> <i>Some pupils should also be able to do the above in detail and describe how the different substances reach the tissues and organs.</i> How Science Works Describe how scientific evidence from different sources carries different weight in supporting or disproving theories (1.1a3).	Additional teachers notes Making a timeline equipment and materials required Till roll or long strips of paper. Colour of oxygenated blood equipment and materials required Fresh blood from abattoir, sodium citrate and a source of oxygen. Safety. Care with the handling of the fresh blood and risk assess hydrogen peroxide if generating oxygen. Looking at arterioles and venules safety. Make sure pupils hands are clean when examining each other's mouths and tongues.	



Fusion 2: B1.10 – Exercise		
National Curriculum Link up •3.3a.		
Learning Objectives Pupils should learn: That heart rate increases when we exercise. What happens to our breathing rate when we exercise. What happens when we cannot get enough oxygen to our muscles.	Teaching / Learning activities Lesson structure Starter - Why does that happen? Show the pupils a video clip from a cartoon chase, such as <i>Road Runner</i> , where a character is shown with a pounding heart following vigorous exercise. Working in small groups, ask the pupils to say why this happens in as much detail as possible. (10–15 mins) Main - Show the pupils how to take their own pulse and that of a partner. Get the pupils to count the beats in 15 seconds and then, by multiplying by four with a calculator, get the heart rate or pulse rate in beats per minute (BPM). Show the pupils how to use data-loggers with heart rate monitors connected. Use the practical 'The effects of exercise' as described in the pupil book. Let the pupils work in pairs, one as exerciser and one as timer and recorder. Take an initial reading when the pupil is seated and resting. Record this result. Have them carry out safe, sensible but vigorous exercise for two minutes. Get the pupils to take a pulse reading immediately after exercise, then one, two and three minutes after the exercise has finished. Pupils should record their results in a suitable table. Repeat the whole exercise, reversing roles. Pupils can plot their results on a graph and compare their individual results with their partner. Discuss the results and draw out by questioning the reasons behind the increase in rate. Plenary - Why did that happen again? Repeat the <i>Road Runner</i> clip used at the start. Put up on the board the key words for the unit so far. Ask pupils to repeat their explanations for the increase in heart rate during exercise, gaining a point for each in-context key word they use. (5–10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Pupils should be able to participate in the practical activities with assistance. Using pictures cut out from newspapers and magazines, pupils could make a poster showing examples of aerobic exercise. • Extension. Pupils could devise a training programme for an athlete who wishes to compete in a marathon. The programme should include reasons for the training and suitable diets, both during training and on the day before the marathon. • Learning styles. <i>Visual:</i> Recording pulse rates. <i>Auditory:</i> Listening to explanations. <i>Kinaesthetic:</i> Carrying out practical activities. <i>Interpersonal:</i> Working in pairs on pulse rate activity. <i>Intrapersonal:</i> Displaying personal results on graphs.
Learning Outcomes <i>All pupils should be able to relate heart rate to exercise.</i> <i>Most pupils should be able to explain why heart rate increases with exercise.</i> <i>Some pupils should also be able to predict accurately the effects of increased exercise on the rate of return to the resting heart rate.</i> How Science Works Describe and suggest, with reasons, how planning and implementation could be improved (1.2e).	Additional teachers notes Equipment and materials required Stop-watches or a clock with a second hand to time pulse rates. If available, examples of data-loggers with heart rate monitors/pulse monitors such as used in athletic training. Safety Check exercises suggested for suitability and safety.	



Fusion 2: B1.11 – Excretion and Homeostatis		
National Curriculum Link up •3.3a.		
Learning Objectives Pupils should learn: How the temperature and water content of the body is controlled. The functions of the kidney in the removal of toxins and the control of the water content of our bodies.	Teaching / Learning activities Lesson structure Starter - What is a thermostat? Pose this question to the pupils and gauge responses. If possible, display a thermostat in action – a mini-fridge used for camping may be an appropriate prop. (5–10 mins) Main - Show a video clip of a boxing match or other sporting event with plenty of sweat flowing. Discuss situations where we get sweaty, concentrating on drawing out the reason why we get sweaty. Use the activity suggested in the pupil book, 'Does sweating actually cool us down?'. Each group of pupils could be given the same set of apparatus and asked to consider how they can make it a fair test and reliable test. Show a video clip of the effect of cold on the human body. A suitable video clip could be from <i>The Mighty Boosh</i> , in the episode where they visit the North Pole in search of a precious stone and meet an ice monster. Comment on the processes involved in trying to keep itself at the correct temperature. Get the pupils to summarise these processes in a table. Ask for a volunteer to act out being very cold and discuss with the class the importance of shivering. Ask why the face would be pale. Draw the discussion to a close by getting the pupils to summarise the effects of excessive heat and cold on the human body. Plenary - Steady as she goes Ask pupils to devise homeostatic mechanisms for 'Bender' the robot from <i>Futurama</i> – a suitable clip would be useful here. Ask: 'What sort of sensors would he need and how would they respond to the environment?' Use a background track for this activity 'Steady as she goes' by The Raconteurs. (10–15 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Supply pupils with two outlines of the human body, one labelled 'Too hot' and the other 'Too cold'. Pupils can label and illustrate how each is feeling or what is happening. For example, the hot person could have a red face and drops of sweat and the cold person could look pale and be shivering. • Extension. These pupils could be given pigs' kidneys to dissect. Supply an instruction sheet and a set of flag labels so that they can label the parts for the rest of the class as a demonstration. [Be aware of pupils' sensitivities and/ or religious objections.] Safety: Wear eye protection and wash hands after experiment. Care with scalpels. • Learning styles. <i>Visual:</i> Watching videos clips and demonstrations. <i>Auditory:</i> Listening to the responses to discussions. <i>Kinaesthetic:</i> Carrying out practical activities. <i>Interpersonal:</i> Working in a group to design an investigation. • Homework. Pupils could design the investigation suggested in the pupil book, showing how the apparatus could be set up, how to make it a fair test and how to ensure the results are reliable. This could then be used during a practical session.
Learning Outcomes <i>All pupils should be able to state that the temperature and water content of the body are controlled and that the kidneys clean the blood.</i> <i>Most pupils should be able to describe how temperature and water content are controlled and how toxins are removed from the body by the kidneys.</i> <i>Some pupils should also be able to explain in greater detail how these homeostatic mechanisms work.</i>	Additional teachers notes Does sweating actually cool us down? Equipment and materials required Boiling tubes, stand, thermometers, paper towels, hot water. Safety Care needed with hot water and the handling of thermometers.	



Fusion 2: B1.12 – The Nervous System		
National Curriculum Link up •3.3a.		
Learning Objectives Pupils should learn: That reflex actions protect us because they are fast and automatic. How a reflex action works. The ways in which the skin is sensitive to different types of stimuli.	Teaching / Learning activities Lesson structure Starter - Nervous 'Rex' Get the class settled into a very quiet mode and then unexpectedly explode a hydrogen/oxygen balloon. Get the pupils to gauge their responses (increased heart rate, rapid breathing, dilated eyes, paler skin, blinking and other involuntary movements) and to attempt to describe which sense organs are involved, what has happened and why. (10–15 mins) Main - Ask the pupils to identify their sense organs and discuss why we need sense organs. Let them imagine that they lost each one. Get them to arrange a set of cards in the order in which they would prefer to have their senses. Discuss this and draw group conclusions. Show a PowerPoint presentation on the reflex pathway. Provide the pupils with a worksheet that they fill in as the pathway is explained. Introduce the relevant terms, if appropriate, and ensure that the flow of nerve impulses from receptor to effector in the pathway is clearly shown. The activity 'Measuring reaction time' can be carried out as described in the pupil book. The activity 'Sensitive skin' can be carried out as described in the pupil book. Variations could include testing other parts of the body, such as the leg or the back. Map out the results from various parts of the body. Plenary - Sixth sense Ask the pupils to imagine another sense that they would like to have. Ask: 'How would it work? What would it enable you to do?' Share with the rest of the class. (5–10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Pupils should be able to take part in the practical activities with assistance. Provide the pupils with a set of cards with the components of a reflex pathway on them. Pupils can then put them into the correct order. • Extension. Pupils could complete a worksheet summarising the flow of nerve impulse from receptor to effector. Pupils could find out if practising the stick-drop test improves reaction times. They could try the test out on younger pupils and older people. Ask: 'Do the times vary significantly? Is there a difference between the times for boys and those for girls?' • Learning styles. <i>Visual:</i> Observing PowerPoint presentation on reflex action. <i>Auditory:</i> Listening to explanations. <i>Kinaesthetic:</i> Carrying out practical activities. <i>Interpersonal:</i> Working in groups at the practical activities. <i>Intrapersonal:</i> Responding to 'Nervous Rex' starter. • Homework. There are several opportunities here to follow up the practical activities: writing up the method, making a table of results, comparison of results etc.
Learning Outcomes All pupils should be able to name a reflex action. Most pupils should be able to name a reflex action and describe how it works. Some pupils should also be able to describe the details of a named reflex action. How Science Works Describe ways in which the presentation of experimental results through the routine use of tables, chart and line graphs makes it easier to see patterns and trends (1.2d).	Additional teachers notes Hydrogen/air balloon CLEAPSS Hazard 48. Measuring reaction time equipment and materials required Metre ruler, pre-printed sheets to fill in. Sensitive skin equipment and materials required Small pieces of blunt wire (hair pins, unbent paper clip, blunt tapestry needles) mounted in pieces of cork. If two wires are used, they should be about 1 cm apart. Safety. Avoid the use of sharp needles or pieces of wire.	