



<b>Fusion 3: B1.1 – Health</b>		
<b>National Curriculum Link up</b> •3.3c		
<b>Learning Objectives</b> <b>Pupils should learn:</b> that our health is affected by: - The amount and types of food we eat. - The amount of exercise we take. - Drugs. - Alcohol and tobacco. - Microbes.	<b>Teaching / Learning activities</b> <b>Lesson structure</b> <b>Starter – Health for sale</b> Provide the pupils with a pile of newspapers or magazines, which contain a lot of adverts for 'healthy' products (supermarket magazines are a good source). Get the pupils to cut out the adverts and, for each one, identify what the product is and how it is supposed to keep you healthy. Make sure the magazines do not contain inappropriate material. (5–10 mins) <b>Main</b> Start with an investigation of what the class already knows about being 'healthy'. In small groups of three or four, ask the pupils to discuss the topic of how to stay healthy. Each one should put down their ideas onto a sheet of paper and stick these collectively onto a large piece of sugar paper. The sheets can then be circulated among the groups before a member of each group reports on their ideas. Collect and collate the ideas from the groups onto a board at the front entitled 'Our ideas on health'. From the health-related issues identified using the strategy outlined above, select 'diet' and 'exercise' to focus on in more detail. A short video clip, or PowerPoint presentation, suitably summarising the six major food types will be useful at this point. Bring out a bag of groceries and get the pupils to discuss what food types are present. <b>Testing foods:</b> Using demonstrations, remind the pupils of the food tests for starch, glucose, protein and fats. If time allows, pupils could perform the tests on one of the items from the bag of groceries. <b>Food labels:</b> Either collect labels from food packaging (pupils could be asked to collect and bring in labels from home), or use a pre-printed set of labels, and ask the pupils to carry out an analysis of the content of a range of foodstuffs. You could include some extreme examples of unusual foodstuffs, such as those found on the BBC CBBC Newsround Web Pages for interest and motivation, guessing what their nutritional makeup would be. Use the questions in the pupil book to help guide the pupils with their analysis. Give each pupil a slip of paper with a 24-hour timeline on it. Ask them to annotate this with all the activities they carry out during the day. Open up a discussion on the importance of exercise. <b>Plenary - Which food type</b> You could carry out a 'drag and drop' style exercise, in which a number of common food objects have to be dragged to the most appropriate food type box. Have boxes labelled 'carbohydrates', 'proteins', 'fats', 'vitamins', 'minerals' and 'fibre'. (5–10 mins)	<b>Teaching suggestions</b> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Provide pupils with pre-printed labels for the major food types (carbohydrates, proteins, fats etc.) and ask them to put these on to the items from the bag of groceries.</li> <li>• <b>Extension.</b> Packaged food is often taken on expeditions as it is easy to carry, does not go bad and can be converted into a meal fairly quickly. Ask the pupils to select a range of packaged foods they would consider taking on a weekend expedition to the mountains.</li> <li>• <b>Learning styles.</b>  <i>Visual:</i> Sorting out pictures of healthy products from the magazines.  <i>Auditory:</i> Listening to other pupils' opinions.  <i>Kinaesthetic:</i> Completing the timeline of activities.  <i>Interpersonal:</i> Working in a small group discussing ideas on how to stay healthy.</li> <li>• <b>Homework.</b> Ask pupils to write a short paragraph in their notebooks entitled 'Why I think I have/do not have a healthy diet.'</li> </ul>
<b>Learning Outcomes</b> <i>All pupils should be able to describe the factors that affect our health.</i> <i>Most pupils should be able to explain how these factors, especially diet and exercise, affect our health.</i> <i>Some pupils should also be able to understand the need for different nutrients in a healthy diet.</i>	<b>Additional teachers notes</b> <b>Equipment and materials required.</b> Each group will need: iodine solution, Benedict's solution, sodium hydroxide and copper sulphate solution, filter paper, test tubes, racks, spatulas, white tiles, Bunsen burners and water baths. <b>Safety.</b> Wear eye protection and take care with reagents, especially sodium hydroxide. Iodine solution: CLEAPSS Hazcard 54B. Benedict's solution: CLEAPSS Recipe card 8. Sodium hydroxide: CLEAPSS Hazcard 91.	



<b>Fusion 3: B1.2 – Balanced diet</b>		
<b>National Curriculum Link up</b> •3.3c		
<b>Learning Objectives</b> <b>Pupils should learn:</b> Which nutrients are needed in a healthy, balanced diet?  Which foods are used as a source of energy?  Why our bodies need protein.  How to evaluate an investigation.	<b>Teaching / Learning activities</b> <b>Lesson structure</b> <b>Starter - Starvation symptoms</b> Let the pupils imagine that a situation at school has become so extreme that they have decided to barricade themselves in the gym and go on hunger strike. Ask them to describe what would happen to them over time and to list the reasons why. You may choose to let the pupils do this as a piece of drama, in which case they could break up into groups of four or five. Build up a list of why we need food and what happens if we do not get any. (10–15 mins) <b>Main</b> Remind the pupils that the unit for energy is joules (symbol J) and that 1000 joules makes a kilojoule (kJ). As energy values on packaged foods and many diets still use ‘calories’, it might be worth explaining here about the calorie and its relationship to the joule (1 calorie = 4.186 J). Using the data in the pupil book, draw a bar chart of the information describing what your body needs energy for. You may choose to use a graphing programme to draw out projected images of the bar chart produced. Discuss why a bar chart is used rather than a line graph (How Science Works). Discuss the energy requirements of people from different age groups carrying out a range of activities. Measuring the energy in food: Ask the pupils to suggest how the energy in food can be measured. If time permits, the pupils could carry out this practical activity in small groups. Provide them with a range of foodstuffs. Provide the pupils with pre-printed results tables (see pupil book) that they can stick in their notebooks. Discuss the layout of the table and how to display the results graphically, followed by the conclusion. Finally stress the evaluation. <b>Plenary - Superfoods</b> Ask the pupils what the term ‘superfoods’ means to them. Have they heard of it? If so, what foods have they heard of which come into this category. Build up a list on the board and try to draw out from the pupils whether they think the claims are justified. (5–10 mins)	<b>Teaching suggestions</b> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Pupils could be provided with appropriately sized strips to enable them to build up a bar chart on a large grid of the daily energy needs as shown in the pupil book.</li> <li>• <b>Extension.</b> Pupils could research the structure, function and source of omega-3 fatty acids, using the internet and any available textbooks.</li> <li>• <b>Learning styles</b>  <b>Visual:</b> Reading temperatures on the thermometers in the practical activities and observing the photographs in the PowerPoint presentations.  <b>Auditory:</b> Listening to the opinions of others in the discussions.  <b>Kinaesthetic:</b> Taking part in the practical activity.  <b>Interpersonal:</b> Working in groups during the practical.  <b>Intrapersonal:</b> Writing up the evaluation of the practical work.</li> <li>• <b>Homework.</b> If the pupils carry out the practical activity to measure the energy content of foods, they could complete their results tables and answer the questions printed in the pupil book.</li> </ul>
<b>Learning Outcomes</b> <i>All pupils should be able to describe the functions of the nutrients needed in a healthy, balanced diet.</i> <i>Most pupils should be able to explain why our bodies need sources of energy and protein.</i> <i>Some pupils should also be able to explain why a balanced diet changes with age and occupation.</i> <b>How Science Works</b> Explain how improvements to the planning and implementation would have led to the collection of more valid and reliable evidence and a more secure conclusion (1.2e)	<b>Additional teachers notes</b> <b>Equipment and materials required</b> A range of suitable foods, such as bread, biscuits etc., boiling tubes, racks, thermometers, Bunsen burners, suitable receptacles for the burning food. <b>Safety</b> Wear eye protection. Check for allergies if considering using nuts.	



<b>Fusion 3: B1.3 - Malnutrition</b> <b>National Curriculum Link up</b> •3.3c		
<b>Learning Objectives</b> <b>Pupils should learn:</b> The meaning of the term 'malnutrition'.  What causes malnutrition?  How malnutrition is associated with problems such as obesity and heart disease.	<b>Teaching / Learning activities</b> <b>Lesson structure</b> <b>Starter - Eat yourself ill competition</b> Imagine a TV show where you had to make yourself as ill as could be in order to win a prize. Some pupils may have seen the TV programme where someone ate junk food for a fortnight and other programmes where participants have swapped diets. What options for bad diet plans could you have? Break the class into groups and ask each group to come up with a specific diet plan to win the competition. Be aware of any potential eating disorders that may be present among pupils in the class. Get the groups to report to the rest of the class. (10-15 mins) <b>Main</b> Begin with a general revision discussion on healthy diets, collecting appropriate suggestions on the board, organising them into groups as they emerge. Then give the pupils a concise briefing on the topic of malnutrition through exposition, board work and selected PowerPoint and video clips. Break the pupils into small groups and allocate to each a topic from the following list: famine, kwashiorkor, anorexia, obesity, atheroma, coronary thrombosis, stroke, arthritis, diabetes, salt, importance of fibre. You will need to be careful with health issues within the class, especially with respect to anorexia and obesity. The pupils are asked to investigate their selected topic and prepare to report back their findings to the whole class. They may decide to make a written report or present it as a radio article or a PowerPoint presentation. You will need to work out the timings, so that there is time for them to assemble their material and time for each group's presentation. The resources for this will need to be organised well in advance. Give the pupils a chance to peer assess the various offerings. Balancing diets: The pupils should be asked to keep records of what they eat and what their activities were over a 24-hour period, and to bring these with them to the lesson. Discuss the value of such an exercise by asking pupils to show their results and compare with each other. Is it a fair assessment of their life-style? Was the day they kept the records a typical day? How would their intake and expenditure vary from day to day? From week to week? Or at different times of the year? <b>Plenary - Diet diamond nines</b> Arrange the pupils into small groups and give each group a set of nine statements concerning diet and health, written on small square cards. Ask each group to arrange the cards into a diamond pattern, with the most important ones at the top and the least important at the bottom. (10 mins)	<b>Teaching suggestions</b> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Prepare some sentences into which pupils can place the key words (on laminated cards) of the topic.</li> <li>• <b>Extension.</b> Ask the pupils to find out what is meant by 'good' cholesterol and 'bad' cholesterol.</li> <li>• <b>Learning styles</b>  <b>Visual:</b> Recognising the signs of malnutrition from pictures.  <b>Auditory:</b> Learning the pronunciation and derivation of the term 'malnutrition'.  <b>Kinaesthetic:</b> Preparing the presentation of the topic.  <b>Interpersonal:</b> Working together on the project.  <b>Intrapersonal:</b> Working out a personal energy intake and energy expenditure balance sheet.</li> <li>• <b>Homework.</b> Ask pupils to write a paragraph on why malnutrition can be a condition associated with affluence as well as poverty.</li> </ul>
<b>Learning Outcomes</b> <i>All pupils should be able to describe some causes and effects of a poor diet.</i> <i>Most pupils should be able to explain how malnutrition can be caused by too much as well as not enough food.</i> <i>Some pupils should also be able to give more detailed explanations of the effects of malnutrition.</i> <b>How Science Works</b> Use and apply qualitative and quantitative methods to obtain and record sufficient data systematically (1.2d)	<b>Additional teachers notes</b> <b>Equipment and materials required</b> <b>Safety</b>	



<b>Fusion 3: B1.4 – Vitamins and minerals</b>		
<b>National Curriculum Link up</b> •3.3c		
<b>Learning Objectives</b> <b>Pupils should learn:</b> Why we need vitamins and minerals in our diet.  Which foods are good sources of vitamins and minerals?  How the importance of vitamins were discovered.	<b>Teaching / Learning activities</b> <b>Lesson structure</b> <b>Starter - Funky stuff!</b> Introduce the origin of the word 'vitamins' through the story of the biologist, Casimir Funk, who tried to find a cure for the disease beriberi (show some slides of victims). Discuss his discovery of what he considered to be 'vital amines' (tie in that amines are chemically related to amino acids). (5–10 mins) <b>Main</b> Through discussion and board work, find out the current state of the pupils' knowledge regarding vitamins and minerals. There are some good video clips available on the deficiency disease scurvy, including a cartoon version from the TV series 'Scientific Eye', which is in common use. Show some grizzly photographs, and go through the material in the pupil book. Carry out the practical 'Testing foods for vitamin C' described in the pupil book, using DCPIP to detect levels of the vitamin in a variety of juices. It would be useful to have a solution of vitamin C of known concentration (say 1%) to use as a standard. Pupils could find out how much vitamin C solution is required to decolourise 1 cm <sup>3</sup> of DCPIP before trying out the juices. Alternatively, they could be provided with this information. If time is short, then this can be done as a demonstration; or show a video of the experiments, providing a worksheet for the pupils to follow. A general discussion of how minerals are supplied in diets could follow this. For example, the use of iron cooking pots in the developed world and the practice, in the developing world, of putting a piece of iron in the bottom of a cooking pot to avoid anaemia. The presence of iron particles in Kellogg's Special K breakfast cereal can be demonstrated. Grind up some of the breakfast cereal and extract the metal particles using a magnetic stirrer in a beaker. Great debates: Within this topic, there is an opportunity to discuss the ethics of animal experimentation. A cross-curricular link may be possible with PSHE, ethics or RE lessons. Ensure a balanced and rational approach prevails, such as in an organised formal debate where each side can present a case before discussion. <b>Plenary - Symptom snap</b> Make up sets of cards that show the six vitamins and minerals mentioned in the pupil book, along with cards showing the symptoms of their deficiency. In pairs, the pupils are to play 'Snap', where the vitamin or mineral must be followed, or preceded, by its deficiency symptoms. (5–10 mins)	<b>Teaching suggestions</b> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Pupils could use the snap cards to do a matching exercise with the nutrients and the deficiency diseases. This could be extended by making additional sets of cards to include uses in the body and sources of the nutrients.</li> <li>• <b>Extension.</b> Pupils could investigate the recommended daily amounts (RDA) of the major vitamins and minerals and find out which foods are best to supply these.</li> <li>• <b>Learning styles</b>  <b>Visual:</b> Recognising the symptoms of the various deficiency diseases.  <b>Auditory:</b> Listening to the opinions of others in the discussions.  <b>Kinaesthetic:</b> Carrying out the practical activity on determining vitamin C content.  <b>Interpersonal:</b> Working in groups in any of the described activities.  <b>Intrapersonal:</b> Forming own opinions on the ethical issues.</li> <li>• <b>Homework.</b> Pupils could write up the experiment on testing foods for vitamin C.</li> </ul>
<b>Learning Outcomes</b> <i>All pupils should be able to name and suggest a source of the major vitamins and minerals needed in the diet.</i> <i>Most pupils should be able to describe how the major vitamins and minerals are used in the body and some of the symptoms caused</i> <i>Some pupils should also be able to explain the links between the functions of a vitamin and the deficiency disease caused by a lack of that vitamin in the diet.</i> <b>How Science Works</b> Use and apply qualitative and quantitative methods to obtain and record sufficient data systematically (1.2d)	<b>Additional teachers notes</b> <b>Equipment and materials required</b> DCPIP solution, a selection of fruit juices and/or vegetable juices, test tubes; racks, plastic syringes, a solution of vitamin C of known concentration (glass pipette, burette, stand). <b>Safety</b> Make sure pupils behave with plastic syringes.	



Fusion 3: B1.5 - Smoking		
National Curriculum Link up •3.3c		
<p><b>Learning Objectives</b> <b>Pupils should learn:</b> What tobacco smoke contains.</p> <p>How the substances in tobacco smoke affect our bodies.</p> <p>How the harmful effects of smoking were discovered.</p>	<p><b>Teaching / Learning activities</b> <b>Lesson structure</b> <b>Starter - Word association</b> Divide the class into small groups and give each group a sheet of A3 paper. Ask them to write, in large letters, the word 'smoking' in the centre of the paper. Emphasise that the lesson is about smoking tobacco, not other substances, and give them a short time to take turns and suggest a word that they associate with smoking. The words suggested should be written around the sheet of paper. Collate the results from all the groups and lead into the discussion at the start of the main lesson. (10 mins)</p> <p><b>Main</b> Hold a short, open discussion on tobacco, following on from the starter activity. Establish the range of attitudes towards tobacco-use. Emphasise that the core of the lesson is to do with clarifying facts, and that people will then be well-informed with regard to their choice of whether to smoke or not. Revise respiratory tract structure briefly. Show the structure of cilia on a diagram and, if available, show their motion through a video clip of cilia in action. Describe the function of the cilia in terms of moving mucus up the airways. <b>Investigating cigarette smoke:</b> This demonstration must be carried out in a fume cupboard. Consult your departmental and county safety policies. Discuss why the temperature, the colour of the limewater and the appearance of the glass wool are observed before and after the cigarette is in the machine. Establish the toxic contents of the cigarette smoke. Show video footage or PowerPoint slides of sufferers from lung cancer (including a dissected smoker's lung complete with tumour), emphysema (an interview with a sufferer may be effective), bronchitis, smoker's cough and low birth weight. Also inform the pupils that smoking reduces circulation, which can lead to amputations of various extremities and, as it affects blood pressure, it can be a contributory factor in impotence. Get the pupils to use calculators to find out how much an average '20 per day' smoker spends on their habit per week, per year and in a lifetime (say 40 smoking years). Discuss how links were made between smoking and ill health. There is a BBC timeline available on smoking and disease. It documents the events from the first paper published in 1951 by Richard Doll et al. to the introduction of the ban on smoking in public places.</p> <p><b>Plenary - Future history</b> Write an article from a history book from AD 2200 on the rise and fall of the recreational use of tobacco. This could be completed as homework. (10–15 mins)</p>	<p><b>Teaching suggestions</b></p> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Supply pupils with a large diagram of the respiratory tract and some labelled Post-it notes, so that they can show where the cilia are, the passage of the smoke and where the chemicals from an inhaled cigarette end up.</li> <li>• <b>Extension.</b> Pupils to do an internet search to find out why nicotine is addictive and what effects it has.</li> <li>• <b>Learning styles</b> <b>Visual:</b> Viewing the images and video footage of the action of cilia and the effects of smoking. <b>Auditory:</b> Listening to other pupils' opinions on the use of tobacco. <b>Kinaesthetic:</b> Taking part in the cilia demonstration. <b>Interpersonal:</b> Working in a group with the word association activity. <b>Intrapersonal:</b> Writing the article about the recreational uses of tobacco.</li> <li>• <b>Homework.</b> Finish the article from the history book of AD 2200, suggested in the plenary.</li> </ul>
<p><b>Learning Outcomes</b> <i>All pupils should be able to list the harmful constituents of tobacco smoke and know why smoking is bad for us.</i> <i>Most pupils should be able to explain why smoking causes a number of diseases and health problems.</i> <i>Some pupils should also be able to explain in detail how the links between smoking and health problems have been made.</i></p> <p><b>How Science Works</b> Explain whether the collection and manipulation of secondary evidence is sufficient or insufficient to support the conclusion or interpretation made (1.2f)</p>	<p><b>Additional teachers notes</b> <b>Equipment and materials required</b> The smoking machine apparatus needs to be set up, with thermometer, limewater, glass wool, hand pump.</p> <p><b>Safety</b> School and LEA regulations on safety. Must be carried out in a fume cupboard. Follow CLEAPSS guidance in Guide L195 and Hazcard 03. Avoid skin contact with tars.</p>	



<b>Fusion 3: B1.6 - Alcohol</b>		
<b>National Curriculum Link up</b> •3.3c		
<b>Learning Objectives</b> <b>Pupils should learn:</b> How alcohol affects the body.  How alcohol affects behaviour.  What constitutes a 'unit' of alcohol?	<b>Teaching / Learning activities</b> <b>Lesson structure</b> <b>Starter - Human bar chart</b> This activity needs a good bit of space and can work well outside. Draw five lines in chalk on the ground and label them 1–5. Read out to the class a series of statements about alcohol, and for each statement ask the pupils to move onto one of the lines. Explain that you move onto line 1 if you strongly agree with the statement, down to line 5 if you strongly disagree with it, and onto one of the lines in between if your feeling is in-between these extremes. Appoint a pair of pupils to record the numbers on each line for each statement. Use the results as a starting point for discussion. (10–15 mins) <b>Main</b> Hold a general discussion on why people drink alcohol, summarising the points made on the board. Compile a list of synonyms for alcohol and for being drunk (Caution, as this could lead to swearing). Tell the pupils that the more interest a society has in a subject, the more words they invest in it. The classic example of this being the Inuit people with their many names for different types of snow. Compile PowerPoint slides showing some statistics about alcohol: 2.9 million people in the UK are dependent on alcohol; that is 1 in 13 of the adult population, two or three in the average secondary school class; averaging one per second, day and night, seven days a week, it would take you over 34 days to count them all. Six thousand deaths a year are directly alcohol-related. Reaction time: There are many internet-based reaction timers available. Browse until you find a suitable one and then try out the timer with the pupils. Let them keep their individual scores and also find an average (mean) value for the class. Add 33% to the figures to allow for the effects of alcohol on reaction times. Run the internet software again, but this time add 33% to each figure achieved, setting an accident threshold at the original average level. See how many pupils fail and cause accidents. Following a study of the pupil text and teacher exposition, get the pupils to produce a piece of artwork summarising the major effects of alcohol on the human body. This can be done in groups or individually and the results pinned around the room for peer review. <b>Plenary - One for the road ... or the morning after the night before</b> Remind the pupils that the average human body metabolises alcohol at 1 unit (1/3 pint of beer) per hour. Get the pupils to imagine that it is someone's birthday party. Write up a list of (hypothetical) names on the board and alongside each name write the number of drinks they had and at what times. Get the pupils to calculate at what time it would be safe for each one of the people in the scenario to drive again without being over the limit. Remind pupils that this is just a guideline for the 'average' human, some people would still not be safe after this time. (5–10 mins)	<b>Teaching suggestions</b> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Adapt the exercise described in the pupil book on the 'Effects of alcohol'. Pupils could be given pre-printed labels to place on the picture in the appropriate places.</li> <li>• <b>Extension.</b> How much alcohol is there in a unit? What is the safe limit for driving? Pupils to find out what 'over the limit' means in terms of blood alcohol levels.</li> <li>• <b>Learning styles</b>  <b>Visual:</b> Creating the piece of artwork.  <b>Auditory:</b> Listening to the comments on the 'Boozy T-shirts'.  <b>Kinaesthetic:</b> Using the reaction timers in the activity on how alcohol affects reaction times.  <b>Interpersonal:</b> Working together to produce a human bar chart.  <b>Intrapersonal:</b> Writing the letter to a friend.</li> <li>• <b>Homework.</b> Pupils could write a letter to a friend, persuading them that drinking too much alcohol is not good for them, by pointing out the harmful effects that alcohol has on the body.</li> </ul>
<b>Learning Outcomes</b> <i>All pupils should be able to describe some of the effects of alcohol on the body and its effects on behaviour.</i> <i>Most pupils should be able to understand and explain the effects of alcohol on the body.</i> <i>Some pupils should also be able to explain in detail the effects of alcohol on different organs of the body.</i>	<b>Additional teachers notes</b> <b>Equipment and materials required</b> <b>Safety</b>	



Fusion 3: B1.7 - Drugs		
National Curriculum Link up		
•3.3c		
<p><b>Learning Objectives</b>  <b>Pupils should learn:</b>            What is meant by the term 'drug'?</p> <p>The ways in which drugs are used.</p> <p>How drugs affect the body.</p> <p>To plan an investigation into the effect of caffeine on reaction time.</p>	<p><b>Teaching / Learning activities</b>  <b>Lesson structure</b>  <b>Starter - Drug or no drug?</b>            Show the pupils a series of PowerPoint slides, some of which are obviously drugs such as smoking a spliff, injecting heroin with a hypodermic needle and snorting white powder, some which are ambiguous and some which are not of drugs at all. Get the pupils to record whether they think each one is a drug or not. Use the responses from the exercise as a stimulus to spark off a discussion as to what is and is not a drug. (10–15 mins)</p> <p><b>Main</b>            Starting with a dictionary definition of 'drug', summarise the different categories into which we put drugs: prescription (therapeutic), recreational, socially acceptable, addictive. Point out to the pupils that a drug can be put into more than one category. It would also be beneficial here to flag up the hazards of some, especially the over-the-counter therapeutic drugs such as paracetamol (liver toxicity and can easily kill in overdose after a period of apparent recovery) and aspirin (stomach complications).  <b>Caffeine and reaction time:</b> This activity can be done as a demonstration or the class can work in pairs or small groups and design their own investigation as described in the pupil book. Reaction times can be measured by the 'stick drop test' or by using a reaction timer from the internet, as described in the previous spread. As an alternative, the link between caffeine and heart rate level can be demonstrated, using a heart rate monitor. Failing that, use the simple method of recording the pulse rate. Give a pupil a piece of chocolate or a sugary drink containing caffeine and show that the heart rate increases. This could be done as a class activity if time and the conditions permit.            Create four stations around the room (or eight, with two duplicates, if the class is large) labelled 'depressants', 'stimulants', 'hallucinogens' and 'analgesics'. Next to each station, display material about the drug type and a set of questions to be answered. Pupils are to circulate around the stations and fill in the question sheets.</p> <p><b>Plenary - Holiday destinations</b>            Show some attractive slides of America and ask the class if anyone has already been there. Ask the rest of the class who would like to go there and what they would like to see. Show some slides of attractive professions: lawyers, doctors, actors, etc. Emphasise to the pupils that a conviction of any kind, including possession of small amounts of cannabis for personal use, may result in you being denied entry to the USA and many other countries. In addition, it might severely limit your employment prospects. Discuss as a group. (10 mins)</p>	<p><b>Teaching suggestions</b></p> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Ask pupils to write down the names of all the drugs they can think of. Then they have to show their list to their group and score points for which ones no-one else in the group has got.</li> <li>• <b>Extension.</b> Carry out an internet survey of drug advice. A good site to start at is <a href="http://www.talktofrank.com">www.talktofrank.com</a>. Produce a summary of succinct advice to younger pupils.</li> <li>• <b>Learning styles</b>  <b>Visual:</b> Recognising drugs from pictures and watching the demonstrations.  <b>Auditory:</b> Listening to explanations about drugs.  <b>Kinaesthetic:</b> Taking part in the activities to determine the effect of caffeine on reaction times.  <b>Interpersonal:</b> Working together in the reaction times activity.  <b>Intrapersonal:</b> Writing their own notes on the details of the drugs.  <b>Homework.</b> As a follow-up to the plenary, ask the pupils to write down their feelings as if they had to explain to their children why they cannot take them on holiday to Disneyland Florida.</li> </ul>
<p><b>Learning Outcomes</b>  <i>All pupils should be able to understand what is meant by the term 'drug' and to distinguish between therapeutic and recreational drugs.</i>  <i>Most pupils should be able to describe the ways in which drugs are used and some of the effects they have on the body.</i>  <i>Some pupils should also be able to explain the effects of drugs on the body.</i></p> <p><b>How Science Works</b>            Use and apply independent and dependent variables in an investigation by choosing an appropriate range, number and value for each one. (1.2b)</p>	<p><b>Additional teachers notes</b>  <b>Equipment and materials required</b>            Caffeine containing substance (drink or chocolate), heart rate monitor or stop-watch.  <b>Safety</b>            Not to be done in the laboratory; use a food technology room. See CLEAPSS Handbook/CD-Rom section 11.8.1.</p>	



<b>Fusion 3: B1.8 – Healthy living</b>		
<b>National Curriculum Link up</b> •3.3c		
<b>Learning Objectives</b> <b>Pupils should learn:</b> How exercise can improve health.  How exercise can help to develop muscles.  That inappropriate exercise can cause damage to the body.	<b>Teaching / Learning activities</b> <b>Lesson structure</b> <b>Starter - My exercise week</b> Give each pupil a blank sheet with the days of the week broken down into hourly slots. Give them highlighters and get them to colour in the times at which they carried out exercise of some sort, colour coding the types and giving a key. Let them show the results to each other in small groups of about four. Discuss the different opportunities for exercise within the school framework and as leisure activities in the area. (10 mins) <b>Main</b> Get a volunteer to carry out some exercise at the front of the room, such as stepping on and off a bench or box [beware of slipping]. Get the class to observe carefully the changes which take place in the volunteer. Most classes will come up with: increased breathing rate, increased heart rate, raised temperature, flushed skin colour and sweating. Draw these out on to the board and ask the class to explain them in as much depth as they can. For each change in turn, carry out a questioning session to try to draw out the underlying reasons why these changes take place [just stating 'because she is exercising' is not sufficient!]. Use questioning strategies to unpick their thinking. Ask what would happen if the volunteer carried out the exercise for a long time without eating, drawing out suggestions of weight loss. Ask why the volunteer would lose weight and where the weight would leave the body– how would the mass get out? Follow this with drawing out the equation for respiration. Divide the class into groups and provide each group with a set of cards which, when assembled correctly, will give the equation for respiration. Let the pupils practise putting this together correctly, timing with stop-watches. <b>Exercise for health</b> activity. Carry out the practical described in the pupil book to design exercise programmes for fitness. It is probably best to let the pupils work in groups, allocating one of the exercise programmes per group so that all are covered. If necessary, add some more categories, such as a retired person. <b>Plenary - Aerobic benefits</b> Using the pupil book and the lesson content as sources, produce a slogan for use as a jingle on the radio to promote the health giving benefits of aerobic exercise. Pick on some pupils to read out examples or share them with the class in other ways. (10–15 mins)	<b>Teaching suggestions</b> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Pupils can be given the parts of the equation for respiration to put together.</li> <li>• <b>Extension.</b> Pupils could investigate the differences between training programmes for sprinters and those for long-distance runners.</li> <li>• <b>Learning styles</b>  <b>Visual:</b> Putting together the equation for respiration.  <b>Auditory:</b> Listening to class discussion and explanations as to how energy is lost from the body.  <b>Kinaesthetic:</b> Carrying out the practical activity on designing exercise programmes.  <b>Interpersonal:</b> Working in groups at the activities.  <b>Intrapersonal:</b> Sorting out their own exercise week.</li> <li>• <b>Homework.</b> Ask pupils to write a paragraph on 'Keeping healthy', using the knowledge gained so far in this topic. Indicate to them that they should include reference to smoking, alcohol, drugs, good diet and the benefits of exercise.</li> </ul>
<b>Learning Outcomes</b> <i>All pupils should be able to describe some of the benefits of exercise to health.</i> <i>Most pupils should be able to explain how exercise can help to develop muscles and benefit health.</i> <i>Some pupils should also be able to explain the dangers of inappropriate exercise.</i> <b>How Science Works</b> Adapt the stylistic conventions of a wider range of genres for different audiences and purposes in scientific writing. (1.1c)	<b>Additional teachers notes</b> <b>Equipment and materials required</b> Sets of cards with parts of the respiration equation written on them. Sheets of A3 paper. <b>Safety</b>	



<b>Fusion 3: B1.9 – Too small to see</b>		
<b>National Curriculum Link up</b> •3.3c		
<b>Learning Objectives</b> <b>Pupils should learn:</b> The different types of microbe.  How microbes can be useful.  How microbes can be grown.	<b>Teaching / Learning activities</b> <b>Lesson structure</b> <b>Starter - Microbes I have known</b> Briefly discuss what microbes are in terms of being organisms too small to see with the naked eye. Break into small groups and collectively compile a list of all the microbes you know. Discuss the findings, separating names of diseases and names of the microbes themselves. Have a small reward for groups which work particularly well, not necessarily just for the one which names the most microbes. (10–15 mins) <b>Main</b> Show the pupils a PowerPoint summary of the main types of microbe. Discuss each type, asking questions to maintain attention and check understanding. Video footage, if available, is valuable to emphasise the different forms and their various uses in the food industry and in breaking down sewage. Set up demonstrations of mouldy pieces of bread, rotting strawberries or other fruit (mouldy lemons with blue-green mould are good) in deep Petri dishes or similar. <b>Water bacteria:</b> Carry out this activity according to the instructions given in the pupil book. You will need to allow time in another lesson to count the colonies. Alternatively, inoculate agar plates a few days before the lesson and give each group of pupils a set to count. Collate the class results and find a mean. Show the pupils a still photograph of some rod-shaped bacteria. Note that they are not all the same size and that some of the smaller ones appear to be joined in pairs. Ask the pupils to come up with reasons for this. Show the pupils a short video clip of binary fission taking place and then get them to write up how this happens. Consider whether viruses are alive or not. <b>Plenary - Do the flashcard flip</b> Use an internet-based Java game generation programme, such as Quia or Hot Potatoes, to generate a set of interactive flappable flashcards with words and phrases related to the lesson content. Pupils may use these individually, if a class set of laptops or a computer suite is available, or collectively when projected to the front of the class. (10–15 mins)	<b>Teaching suggestions</b> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Give the pupils a set of diagrams of the stages of binary fission in a mixed up order. Get the pupils to number them in the correct order.</li> <li>• <b>Extension.</b> Provide the pupils with the list of microbes compiled at the beginning of the lesson and ask them to find out the sizes of the organisms. They can draw up a chart, showing the ranges of the sizes of the different types of microbe, and include a human body cell for comparison.</li> <li>• <b>Learning styles</b>  <b>Visual:</b> Distinguishing between the different types of microbe.  <b>Auditory:</b> Listening to discussions about whether viruses are alive.  <b>Kinaesthetic:</b> Carrying out practical.  <b>Interpersonal:</b> Working in a group at the practical activities.  <b>Intrapersonal:</b> Creating their mind-map.</li> <li>• <b>Homework.</b> The 'mind-map' summary in the pupil book would enable pupils to consolidate the knowledge gained on this topic and prepare them for next lesson.</li> </ul>
<b>Learning Outcomes</b> <i>All pupils should be able to name the different types of microbe and describe some ways in which they are useful to us.</i> <i>Most pupils should be able to describe and distinguish between the different types of microbe and their uses.</i> <i>Some pupils should also be able to explain how microbes grow and reproduce.</i> <b>How Science Works</b> Explain how approaches to practical work were adapted to control risk. (1.2c)	<b>Additional teachers notes</b> <b>Equipment and materials required (Main lesson: Decaying food)</b> Mouldy bread, decaying fruit, deep dishes, Clingfilm, <b>Safety</b> Refer to regulations for the disposal of decaying material. Do not uncover mouldy items. <b>Equipment and materials required (Water bacteria practical)</b> Agar plates, water samples, 1 cm <sup>3</sup> pipette, sterile spreader, Sellotape, incubator. <b>Safety</b> Strict observance of sterile procedures. Do not seal dishes. Do not remove lids after incubation. Refer to CLEAPSS handbook/CD-Rom section 15.2. Refer to regulations for the temperature of the incubator and the sealing and disposal of any microorganisms.	



<b>Fusion 3: B1.10 – Microbes and diseases</b>		
<b>National Curriculum Link up</b> •3.3c		
<b>Learning Objectives</b> <b>Pupils should learn:</b> Which diseases are caused by different types of microbe.  How microbes are spread from person to person.	<b>Teaching / Learning activities</b> <b>Lesson structure</b> <b>Starter - Causal organisms quiz</b> Show the pupils a PowerPoint presentation of the different types of microbe and some examples of the diseases they cause. Give the pupils a short list of other diseases and the organisms that cause them, either to stick in or to copy down. Get the pupils to close their books, erase any lists on the board or AV and mute the projector. Read out a list of diseases that have been covered (mix them up so that you do not get all the viral ones together) and get the pupils to write onto 'Show me' boards the initial letter of the type of microbe causing the disease. (10–15 mins) <b>Main</b> Go over the methods of transmission. A short video on the methods of transmission, if available, would be useful here, or a PowerPoint summary based on the table in the pupil book. Show a short video, cartoon or PowerPoint presentation of the work of John Snow in combating cholera. There is a good cross-curricular link here with a History topic 'The History of Medicine'. Carry out a short written exercise summarising John Snow's work. Discuss the spread of disease from faeces contaminating water supplies. Link this to why it is important to wash your hands after going to the toilet. Also link the contamination of water supplies with the problems facing communities after major disasters such as earthquakes. <b>Does soap remove bacteria?</b> Carry out this practical as outlined in the pupil book. In order to make it clear that anything that grows on the agar plates has come from washed or unwashed hands and not from the air or their clothes, instruct the pupils in the correct method of opening their Petri dishes just slightly. As a control, expose one agar plate to the air in the room and incubate with the rest, so that a comparison can be made. The agar plates should be incubated at no more than 25°C. They should be sealed, but not airtight, not opened by the pupils and disposed of appropriately. <b>Plenary - Transmission charades</b> Get a volunteer pupil to choose a method of transmission from a list (do not include sexual transmission). The volunteer should not tell the class what the method is but should mime it. When pupils think they know what the method is, they should put up their hands and the person miming can choose who answers. If they get it right, they become the next one to choose another method; if not the mimer continues until a right answer emerges. (5–10 mins)	<b>Teaching suggestions</b> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Pupils could choose a disease and make a poster illustrating the symptoms and the method of transmission.</li> <li>• <b>Extension.</b> Pupils could use books and the internet to research the life cycle of the mosquito and find out about the relationship between it and the malarial parasite.</li> <li>• <b>Learning styles</b>  <b>Visual:</b> Recognising the organisms that cause diseases or watching the mimes in the plenary.  <b>Auditory:</b> Listening to the explanations of the methods of transmission.  <b>Kinaesthetic:</b> Carrying out the practical activity.  <b>Interpersonal:</b> Working in a group in practical work.  <b>Intrapersonal:</b> Writing own account of the work of John Snow.  <ul style="list-style-type: none"> <li>• <b>Homework.</b> Pupils could write up the method and results of the practical 'Does soap remove bacteria?'</li> </ul> </li> </ul>
<b>Learning Outcomes</b> <i>All pupils should be able to give some examples of diseases caused by microbes and to name the major methods of transmission of diseases from person to person.</i> <i>Most pupils should be able to relate common diseases to their causative organisms and to explain how transmission occurs from person to person.</i> <i>Some pupils should also be able to use their knowledge of the methods of transmission to suggest how some diseases can be avoided.</i> <b>How Science Works</b> Describe how bias, a lack of evidence or misconceptions can give rise to inappropriate theories and the role of scientists in questioning these. (1.1a2) The role of John Snow in fighting cholera.	<b>Additional teachers notes</b> <b>Equipment and materials required</b> Petri dishes containing nutrient agar, markers for labelling dishes, soap, water, paper towels, Sellotape, incubator. <b>Safety</b> Temperature of incubator must be less than 25°C. Ensure proper sealing of Petri dishes and appropriate disposal, see CLEAPSS handbook/CD-Rom section 15.2.	



<b>Fusion 3: B1.11 - Keeping microbes out</b>		
<b>National Curriculum Link up</b> •3.3b		
<b>Learning Objectives</b> <b>Pupils should learn:</b> How microbes can be kept out of the body.  How we develop immunity to diseases.	<b>Teaching / Learning activities</b> <b>Lesson structure</b> <b>Starter - Jabs – What immunisations have I had?</b> Discuss the injections pupils have had over their lives and what age they were when they had them. Get some volunteers to recount their experiences and build up a list on the board. Distinguish between those that most children are given and those that are needed for visiting special areas of the world. The parents or grandparents of some pupils may have scars from inoculations in their childhood. Ask what pupils think is injected into the body in 'jabs' and what purpose it serves. Get them to discuss this in pairs and write down a response. (10–15 mins) <b>Main</b> Show the pupils some pictures of smallpox victims. Discuss the disease and its effects on the victims. Show a video, animation or PowerPoint presentation of the work of Edward Jenner, linking to the 'Jabs' starter if it was used. Using exposition, go over the immune system. A video clip of phagocytosis would be useful during the explanation. Ask the class to devise a role play in which pupils (with suitable props) play the parts of lymphocytes, some as phagocytes and lots as different types of microbe. If time try out their ideas. Ask what would happen if an antigen got into the body but there was no matching antibody. Link to the Spanish invasion of South America and the drastic disease consequences for the natives. Get a pupil to draw on the computer an antibody card to go with the new antigen. When done, get the pupil to quickly use copy and paste to produce many more. Draw out this analogy to link to the collection of antibodies we build up over the years and which can be replicated quickly because we have the originals. Carry out written work to summarise the process as appropriate to the pupils' ability (differentiated worksheets through to independent prose). <b>Plenary - MMR highlights</b> Give the pupils an appropriate summary of the MMR controversy, such as that on CBBC News Round. Get them to highlight the terms used in the lesson and be prepared to read appropriate sections out loud. (5–10 mins)	<b>Teaching suggestions</b> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Pupils could play a matching game with the antigen–antibody cards.</li> <li>• <b>Extension.</b> Following some research on the internet and information gained during the lesson, pupils could write a letter to a friend about the merits of allowing their children to be given the MMR vaccine.</li> <li>• <b>Learning styles</b>  <b>Visual:</b> Viewing pictures of smallpox victims and presentation on Edward Jenner.  <b>Auditory:</b> Listening to exposition of the immune system.  <b>Kinaesthetic:</b> Taking part in the class activity on the immune system.  <b>Interpersonal:</b> Working with a partner on the 'Jabs' starter.  <b>Intrapersonal:</b> Writing the piece about James Phipps for homework.</li> <li>• <b>Homework.</b> Using the story of Edward Jenner and his experiments with cowpox and James Phipps, pupils could write an article for the local paper about what happened, with appropriate headlines. The article could feature the milkmaid, Sarah Nelmes, the experiences of James himself, or the reactions of his parents.</li> </ul>
<b>Learning Outcomes</b> <i>All pupils should be able to describe the ways in which microbes are kept out of the body.</i> <i>Most pupils should be able to describe the functions of the immune system and the roles of the white blood cells.</i> <i>Some pupils should also be able to explain how immunisation helps to prevent diseases.</i>		<b>Additional teachers notes</b> <b>Equipment and materials required</b> <b>Safety</b>



<p><b>Fusion 3: B1.12 – Helping the immune system</b></p> <p><b>National Curriculum Link up</b> •3.3c</p>		
<p><b>Learning Objectives</b> <b>Pupils should learn:</b></p> <p>The differences between antiseptics and disinfectants.</p> <p>The meaning of the term 'antibiotic' and how antibiotics were discovered.</p> <p>How the effectiveness of antimicrobial substances can be tested.</p>	<p><b>Teaching / Learning activities</b> <b>Lesson structure</b> <b>Starter - Bacteria killing scramble</b></p> <p>Give the pupils the three main key words for the lesson 'antiseptic', 'disinfectant' and 'antibiotic'. In small groups, get them to see how many different words they can make from each one. Give points for the total number of words, for words no one else has got and for the longest word. Allow this to lead into a discussion of what the given key words might mean and what the differences are between them. (5–10 mins)</p> <p><b>Main</b></p> <p>Introduce the three key words 'antiseptic', 'disinfectant' and 'antibiotic' carefully and distinctly, as pupils often find them confusing. Emphasise that the first two can cause damage to living cells.</p> <p>Antiseptics: Show them a packet of antiseptic wipes, a bottle of Listerine mouthwash and a cake of carbolic soap (if available). Discuss what a septic wound would look like (show a slide if possible), and what it might smell like. Talk over the situation in hospitals in the 1800s when many people died of sepsis. Link with wars, such as the Crimean War, where so many soldiers died because of infected wounds.</p> <p>Disinfectants: Show a TV advertisement for a type of bleach or other disinfectant (the sort you put down the toilet). Emphasise that you would not put undiluted bleach on or in your body, because it would damage you. This makes it very different from antiseptics. Show a slide or photocopies of a label, from a disinfectant product, listing the contents and the warnings on it.</p> <p>Antibiotics: Show a video, if available, or alternatively a series of PowerPoint slides on the work of Alexander Fleming and Florey and Chain. Summarise the work on the discovery of penicillin.</p> <p><b>Testing antibiotics:</b> Carry out the practical described in the pupil book. The pupils will be provided with Petri dishes filled with agar that has had bacteria mixed with it. The plates will probably look cloudy. The paper discs containing bacteria should be labelled A, B, C etc. The usual precautions should be taken.</p> <p><b>Plenary - Drag and drop in the pharmacy</b></p> <p>Get the pupils to carry out a 'drag and drop' exercise, either individually on laptops, collectively on an interactive whiteboard or on a projected PC. This would consist of three bins labelled 'Antiseptics', 'Disinfectants' and 'Antibiotics'. Products, descriptions and phrases are to be dragged to the correct box as they appear. (5–10 mins)</p>	<p><b>Teaching suggestions</b></p> <ul style="list-style-type: none"> <li>• <b>Special needs.</b> Provide pictures of a number of anti-microbial products and get pupils to sort them out into the various categories under the headings 'antiseptics', 'disinfectants' and 'antibiotics'.</li> <li>• <b>Extension.</b> Research, using texts and the internet, the difference between the terms 'bactericidal' and 'bacteriostatic'.</li> <li>• <b>Learning styles</b></li> </ul> <p><b>Visual:</b> Carrying out the 'drag and drop' exercise.</p> <p><b>Auditory:</b> Listening to the explanations of the three key words..</p> <p><b>Kinaesthetic:</b> Carrying out the practical activity.</p> <p><b>Interpersonal:</b> Working together in the practical activity.</p> <p><b>Intrapersonal:</b> Writing the account of discovery of penicillin.</p> <p><b>Homework.</b> Pupils could write up an account of the practical activity, taking care to mention all the safety precautions, leaving space, if necessary, to record the results and draw some conclusions about the action of the antibiotics.</p>
<p><b>Learning Outcomes</b></p> <p><i>All pupils should be able to distinguish between antiseptics, disinfectants and antibiotics.</i></p> <p><i>Most pupils should be able to describe the properties of an antibiotic and how antibiotics were discovered.</i></p> <p><i>Some pupils should also be able to explain the differences between broad spectrum and narrow spectrum anti-microbial substances.</i></p> <p><b>How Science Works</b></p> <p>Describe how bias, a lack of evidence or misconceptions can give rise to inappropriate theories and the role of scientists in questioning these. (1.1a2)</p>	<p><b>Additional teachers notes</b></p> <p><b>Equipment and materials required</b></p> <p>Petri dishes filled with agar containing bacteria (check for right species to use), paper discs impregnated with antibiotics, tweezers, sterile paper discs, markers, Sellotape, incubator set at 25°C.</p> <p><b>Safety.</b> Temperature of incubator must be less than 25°C. Ensure proper sealing of Petri dishes and appropriate disposal. See CLEAPSS handbook/CD-Rom section 15.2.</p>	