



Fusion 2: HSW – Carrying out Project Work		
National Curriculum Link up •2.1a, b, c. 2.3a, b. 4.a, b.		
Learning Objectives Pupils should learn: How to carry out extended project work effectively	Teaching / Learning activities Lesson structure Starter - What, where, why, when, how? Ask pupils to write five scientific questions about a topic, for example the Sun, starting with each of the words in the title of the starter. Share questions with the whole group. (5 mins) Main Pupils can use this opportunity to go over the wide variety of methods that scientists use to gather data to answer questions. Stress the creativity involved in problem solving in science – not all investigations are merely a fair test. Reinforce different forms of presentation available for sharing the results of their project work. Discuss advantages and disadvantages of different methods. Go over the essentials of carrying out effective research before asking pupils to generate some possible questions to investigate in the activity 'Interesting projects'. Keep the outcomes of this activity as a basis for future project work (which might be an individual or group work project). Weed out the questions that you feel will be unsuitable or unproductive. The pupils will feel ownership of the project if they know the options you give them to investigate were originally their own ideas. Plenary - 'No 'I' in TEAM' Form groups to review their answers to the in-text question a) 'What are the benefits of working as a group in project work?' Decide on the three most important benefits. (5 mins)	Teaching suggestions • Learning styles. <i>Auditory:</i> Discussing questions. <i>Interpersonal:</i> Working in groups. <i>Intrapersonal:</i> Reflecting on the nature of scientific enquiry and how to find the answers to scientific questions. • SEN. Model how to fill in a research help sheet using a specific example. •Extension. Take one question and classify the different modes of working required to conduct an extended enquiry to answer that question. • Functional Skills – English Write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively (level 2). Make a range of contributions to discussions and make effective presentations in a wide range of contexts (level 2).
Learning Outcomes <i>All pupils should be able to</i> frame a variety of scientific questions. <i>Most pupils should be able to</i> plan the major steps needed in project work. <i>Some pupils should also be able to</i> identify opportunities and plan in detail how to tackle a scientific project. How Science Works Adapt the stylistic conventions of a range of genres for different audiences and purposes in scientific writing (1.1c). Describe an appropriate approach to answer a scientific question using sources of evidence and, where appropriate, making relevant observations or measurements using appropriate apparatus (1.2a). Recognise that the selection, ordering or rejection of secondary data could lead to different conclusions (1.2f).	Additional teachers notes Discuss the need for extended enquiries, i.e. what we tend to call 'projects' in schools. Encourage pupils to talk about projects they have done which were memorable or enjoyable, as well as ones they have not got much out of. Why? From the discussion draw out some key points for a successful project, for example, achievable objectives defined and agreed roles for members of a team in group work, checkpoints, and clear vision of end product.	



Fusion 2: HSW – Communicating New Science		
National Curriculum Link up •1.2a. 4.c, h.		
Learning Objectives Pupils should learn: How scientists add to the body of scientific knowledge by communicating through journals. How scientific papers are subjected to peer review and that occasionally this can be abused.	Teaching / Learning activities Lesson structure Starter - Application of science Ask pupils to come up with a list of inventions that have been introduced in their lifetimes. (5 mins) Main Pupils can be asked how they think scientists communicate their new findings to each other (and hence to the media). Go over the case of Dr Schon outlined in the pupil book. Discuss the pressures there might be on young scientists to falsify evidence. The research activity 'Great inventions' can be undertaken after a complete discussion of the peer review system or after introducing the work of Dr Schon as a research scientist at Bell Laboratories. Plenary - Peer review In pairs ask pupils to swap exercise books with somebody they do not normally work with and choose an experiment to review for their new partner. They should each ask three questions related to the data gathered in the experiment. (10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. Help can be provided for pupils in producing the radio item in 'Great inventions' by providing information, for example on the first mobile phones, so they can concentrate on making the recording. • Extension. Pupils can find out about nanotechnology or transistors and report back to the class. • Learning styles. <i>Visual:</i> Looking at complex data in a scientific journal. <i>Auditory:</i> Listening to a partner reviewing a piece of their practical work. <i>Interpersonal:</i> Discussing peer review. <i>Intrapersonal:</i> Reflecting on the ethics of why a scientist might falsify data.
Learning Outcomes <i>All pupils should be able to</i> list some important scientific inventions. <i>Most pupils should be able to</i> describe how science makes an important contribution to everyday life and how new scientific papers undergo peer review. <i>Some pupils should also be able to</i> explain why a particular scientist might falsify data in a scientific paper. How Science Works Recognise that science is a communal, and therefore fallible, human activity and that different explanations can arrive from individual bias (1.1a2). Describe how scientific evidence from different sources carries different weight in supporting or disproving theories (1.1a3).	Additional teachers notes Have some copies of scientific journals for pupils to look at. Show some from the web if possible. Choose an article with experimental data in it. Discuss the 'peer review' system used to vet scientific papers before publication. Ask pupils to consider the complex experimental data in a paper. Why would it be difficult for a reviewer to check all the data? What things might make a reviewer suspicious of a set of data?	



Fusion 2: HSW – The Application of Science		
National Curriculum Link up •1.2a, b, 4c, f.		
Learning Objectives Pupils should learn: How new discoveries are made and exploited, changing people's lives.	Teaching / Learning activities Lesson structure Starter - Where do plastics come from? Gather pupils' ideas on where they think plastics come from. What is the raw material? [Mainly crude oil at present.] (5 mins) Main Pupils should be aware of the role science can play in developing new materials and generating wealth, as well as improving the quality of people's lives, in this case using the plastics industry as an example. The 'Plastics research' activity can be used to show the ethical and moral dilemmas that arise from exploiting plastics. Point out the role of scientists in trying to solve the problems associated with plastic waste. In discussing the examples of Bakelite, PTFE and Kevlar explore the business implications for the discoveries made by the scientists. [Baekeland was an entrepreneur and made his own company to exploit his new plastic. Plunkett and Kwolek both worked for the giant US company, Du Pont.] When going over the discoveries, look at the role of hard work, luck, the ability to recognise an opportunity in the initial breakthrough and its subsequent applications. Any of these discoveries can be extended by further research. By dividing the class into three, more information on each plastic could be gathered, then shared. Plenary - Design a plastic Explain to pupils how we now have polymers that can conduct electricity and can change colour in different conditions. Ask pupils to design plastic that could be used to advertise a designer's label on clothing. (10 mins)	Teaching suggestions <ul style="list-style-type: none"> • Special needs. You may wish to provide beads to make chains, and then show how the chains get tangled up when polymers form plastics. • Extension. Pupils can research the latest developments in plastics, e.g. smart polymers. • Learning styles. <i>Visual:</i> Observing the joining of beads to model polymer formation. <i>Auditory:</i> Listening to feedback on research into plastics. <i>Interpersonal:</i> Working in groups to carry out research. <i>Intrapersonal:</i> Reflecting on the future of the plastics industry. • Functional Skills – English Writing documents, including extended writing pieces, communicating information, ideas and opinions effectively and persuasively (level 2).
Learning Outcomes All pupils should be able to list two important discoveries in the field of plastics. Most pupils should be able to describe how the discovery of a plastic has affected people's lives. Some pupils should also be able to explain how creativity and innovation play a vital role in new discoveries and their application, and the effects on society. How Science Works Explain some issues, benefits and drawbacks of scientific developments with which they are familiar (1.1b).	Additional teachers notes	