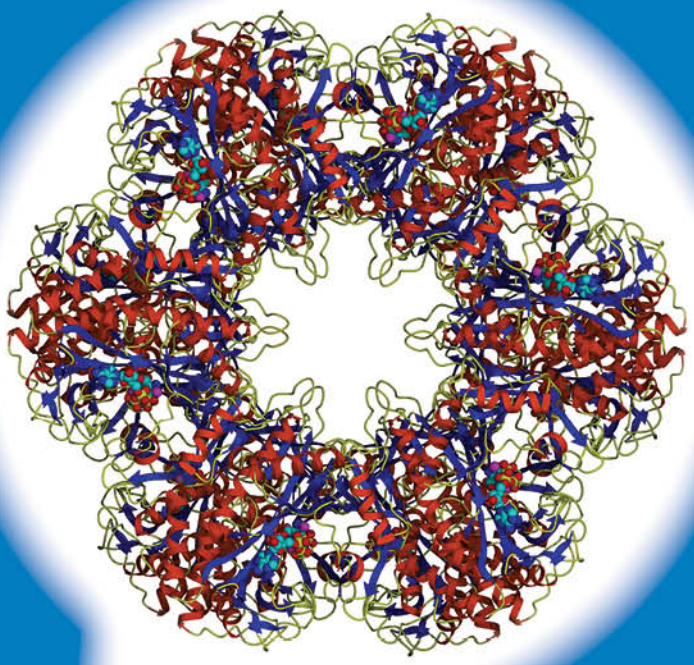
OCR
RECOGNISING ACHIEVEMENT

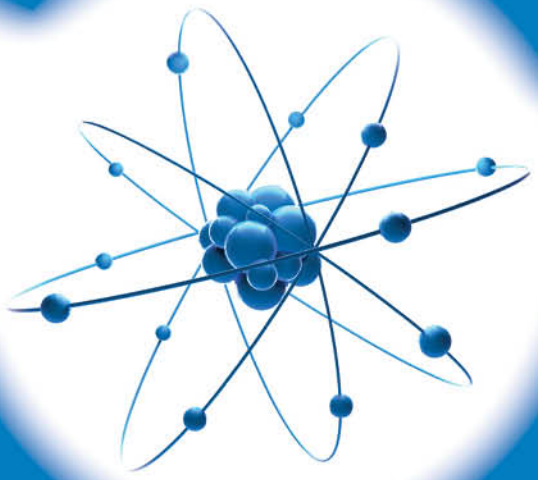


GATEWAY SCIENCE SUITE

SCHEMES OF WORK AND LESSON PLANS

P4: Radiation for life

VERSION 1 JUNE 2011



Topic: P4a Sparks

Suggested Teaching Time: 2 Hours

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
What is static electricity?	Show water being deflected by a charged polythene rod Class discussion what can you tell me about static electricity? • Demonstrate that when you rub a balloon it will attract hair • Demonstrate that when you rub a plastic comb it will attract small pieces of paper Class discussion: consider the observations and propose explanations. Develop the discussion to consider dust being attracted to charged objects and the use of charged dusting brushes. • Class experiment to investigate how a suspended rod with a positive charged behaves when a negatively charged rod is brought close to it and when a positively charged rod is brought close to it Discuss the observations and conclusion derived by pupils. Teacher to establish that the observations are as a result of electrostatic charge. Atoms have electrons. Electrons have a negative charge. Rubbing a material can add or remove electrons. More electrons give the object a negative charge. Less electrons results in a positive charge. Like charges repel and opposite charges attract. • Show BBC bitesize animation on electrostatics to illustrate the pupils observations: http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/electricity/static_act.shtml	Polythene rod, duster. Access to running water. Balloon, duster Plastic comb, duster Polythene rods, acetate rods, dusters, cotton, stands Details of alternative experiments using electrostatic charge can be found on the IOP website at: www.practicalphysics.org/go/collection_37.html?topic_id=8&collection_id=37	Students should be aware that objects, including themselves, become charged by friction. It can then be established that an insulator can be charged by rubbing it with another insulator before investigating the effect of a charged object on a light uncharged objects. Demonstrations could be carried out as class practicals. Detailed information about static electric experiments can be found on 'physicsclassroom' at: www.physicsclassroom.com/class/estatics/u8l1c.cfm Class experiment.

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
	• Show BBC bitesize pages about electrostatics to consolidate learning: http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway/radiation/electrostaticssparksrev2.shtml Homework: draw a picture / pictures to illustrate how rubbing a polythene rod with a duster alters the charge on the duster and rod.		
Why can static electricity be a nuisance?	Use Van de Graaff generator to demonstrate that like charges repel and unlike charges attract. Attach a student to the VDG and ask them to blow soap bubbles; put a paper cup containing Ricekrispies on top of the VDG and turn it on; put a tower (5) of small aluminium pie cases on top of the VDG and turn it on. Recall the structure of an atom. Use a model to show how a positive charge is created by loss of electrons and a negative charge is created by a gain of electrons. Introduce the term ion for charged atoms (or molecules). Discuss how static electricity can be a nuisance, for instance dust being attracted to TV screen or clothes clinging. Discuss how the effects can be reduced with for example anti-static sprays / cloths.	Van de Graaff generator, bubbles, Ricekrispies. Details of demonstrations using the Van de Graaff can be found on the IOP website at: http://www.practicalphysics.org/go/experiment_298.html?topic_id=8&collection_id=38 Model of an atom. Animations of atom structure can be found on the internet.	Safety: refer to CLEAPSS for advice on the safe use of a Van de Graaff generator. The IOP also has a guidance sheet see: http://www.practicalphysics.org/go/guidance_164.html?topic_id=8&guidance_id=1 A variety of good clips showing the Van de Graaff can be found on Youtube. • Higher tier students should be able to: – Describe static electricity in terms of the movement of electrons: – A positive charge due to lack of electrons – A negative charge due to an excess of electrons • Recognise that atoms or molecules that have become charged are ions.
Why can static electricity be dangerous?	Show film clip of petrol station fires caused by static charge Discuss where a static charge could be dangerous. Students to produce a visual model illustrating how an electrostatic charge is created during refuelling an aircraft. The model should show how the danger created by the charge can be prevented. Homework: explain how technicians who work on computers prevent the delicate electronics being damaged by static electric charge	Clips of petrol station fires caused by static charge can be found on Youtube.	Higher tier students should be able to explain that the chances of receiving an electric shock can be reduced by: • Correct earthling • Use of insulating mats • Using shoes with insulating soles • Bonding fuel tanker to aircraft Learning outcome: explain a scientific process using models.

Topic: P4b Uses of Electrostatics

Suggested Teaching Time: 2 Hours

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
What are the uses of electrostatics?	This initial activity is optional. Due to time constraints teachers may want to omit this: Show short clip about the invention of the photocopier from the how stuff works website: http://videos.howstuffworks.com/science/chemistry-of-innovations-videos-playlist.htm?page=2#video-40374 Discuss ways in which static electricity can be used. Groups of students to research and prepare a five minute presentation and wall chart to illustrate one of the following: • what an electrostatic precipitators is and how it works • how electrostatics are used in paint spraying • how electrostatics are used in crop spraying • how a photocopier uses electrostatics. Homework: use a diagram to explain how an air ioniser (air freshener) works.	Computers with internet access. Large sheets of paper; drawing equipment.	Due to the amount of material to get through teachers my want to omit this initial activity. Higher tier only: Explain how static electricity is used in electrostatic dust precipitators to remove smoke particles from chimneys: • High voltage metal grids put in chimney to produce a charge on the dust • Dust particles gain or lose electrons • Dust particles induce a charge on the earthed metal plate • Dust particles are attracted TP the plates Explain how static electricity is used in paint spraying, in terms of paint and car gaining and losing electrons and the resulting effects.
What is a defibrillator?	Show a clip of a defibrillator being used Show BBC clip of how to use a modern defibrillator. Discuss the apparent and actual danger that is associated with using a defibrillator Groups of students to correctly sequence cards containing the following comments (sequence shown is correct): • Paddles charged • Good electrical contact with patients chest • Charge passed through patient to make heart contract • Care taken not to shock operator. About ten years ago the government introduced defibrillators into public places. Students to use research to evaluate the impact these defibrillators have had on lives saved.	BBC video showing how to use a defibrillator www.bbc.co.uk/news/health-13037602 http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway/radiation/electrostaticsusesrev1.shtml Computers and internet access.	HSW: describe risk from new scientific technology HSW: identify how a scientific or technological development could affect different groups of people

Topic: P4c Safe electricals

Suggested Teaching Time: 3 Hours

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
What is an electrical circuit?	Students construct a simple circuit – power supply and bulb. Observe how breaking the circuit at any point results in the bulb going out. Incorporate a variable resistor in the circuit and observe its effect. Connect an ammeter to the circuit. Note how the current changes when the resistance changes. Class discussion of the effects observed. Develop discussion to incorporate use of terms voltage, resistance and current. Discuss the relationship between voltage, resistance and current. Homework: calculation of current using the formula: $I = \frac{V}{R}$	Power supplies – transformers or batteries Wires with crocodile clips Bulbs in bulb holders Variable resistors Circuit boards Ammeters Details of how to carry out class practical's with simple electrical circuits can be found on the IOP website at: www.practicalphysics.org/go/experiment_769.html?topic_id=8&collection_id=32	Basic circuits recall from KS3 Class practical activity Opportunity for mathematics: simple table of results; graph of results
How does the length and thickness of a wire affect its resistance?	Class practical to observe the effect of length and / or thickness of wire on its resistance. Students to carry out experiment and record current through the wires. Class discussion of the effects observed. Demonstrate how to calculate resistance from the results obtained. Describe the relationship between current, voltage (pd) and resistance. Use the equation: $\text{resistance} = \frac{\text{voltage}}{\text{current}}$ Homework: calculation of resistance using the formula above.	Power supply; crocodile clips; ammeters; resistance wire; wires of different thicknesses Details of how to carry out a practical to investigate the resistance of a wire can be found on the IOP website at: http://www.practicalphysics.org/go/experiment_276.html?topic_id=8&collection_id=33	Class practical activity Safety: the power supply should be a maximum of 6 volts. Warn students not to leave the power supply connected for more than the time taken to record the current. Not to touch the resistance wire as it may be hot. Mathematics: table of results; calculation of mean; calculation of resistance Homework for higher tier students: calculation of resistance, voltage and current using the equation (including change of subject): $\text{resistance} = \frac{\text{voltage}}{\text{current}}$

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
Domestic mains electricity	Groups of student given 10 minutes to research one of the following features of house wiring; Plugs (colour code). Fuses (types, size, function). Earth wire (function and why not needed by some appliances). Ring main (function of live, neutral and earth wires). RCDs. Teacher to reinforce key ideas about wire colour code, fuses, earth wires and ring main using input from each research group. Show BBC Bitesize animation to reinforce ideas from the activity above: www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/electricity/mainselecact.shtml Show the open plugs of appliances that are and are not double insulated. Compare the power rating and fuse size of each of these appliances. Explain that power = voltage x current. Use information panels from the range of electrical appliances to illustrate this. Demonstrate how a fuse works by passing a current through a thin resistance wire (steel wool can be used to give spectacular results). Discuss why it is important to have the correct sized fuse in a circuit. Homework: list five household appliances. Identify if they are double insulated or not; their power rating; their fuse rating. Alternative homework for HSW: explain how the developments of modern electrical devices (washing machines; vacuum cleaners etc) have affected our lives.	Internet access BBC animation: www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/electricity/mainselecact.shtml A range of electrical appliances (such as a water bath, kettle, soldering iron, transformer, lamp etc) with the plugs open for inspection. Power supply. Crocodile clips. Resistance wire. Steel wool. Details of how to demonstrate a fuse can be found on the IOP website at: www.practicalphysics.org/go/experiment_278.html?topic_id=8&collection_id=33	Higher tier: explain the reasons for the use of fuses and circuit breakers. Explain how the combination of a wire fuse and earthing protects people. Safety: instruct students not to plug the appliances in or saw off / put a bolt through the earth pin. Safety: the wire will become red hot and melt. The demonstration will probably result in the power supply's RCD tripping. Instruct students not to open plugs for homework exercise. Homework for higher tier: use the equation, including change of subject: power = voltage x current To select a suitable fuse for a range of appliances. HSW: identify how a scientific or technological development could affect different groups of people. HSW: describe risks from new scientific / technological advances.

Topic: P4d Ultrasound

Suggested Teaching Time: 3 Hours

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
What is sound?	Demonstration: put a vibrating tuning fork into a beaker of water to show the link between sound and vibration. Use a signal generator and loudspeaker with polystyrene balls on it to demonstrate that sound is a vibration. Describe the longitudinal sound wave in terms of compressions and rarefactions. Use a slinky to model a longitudinal wave. Use a signal generator and oscilloscope to: • demonstrate that sound has a range of frequencies. • investigate the hearing range of students in the class Discuss ultrasound as a frequency that is higher than the upper threshold of human hearing (20 000 hz). Dogs, bats and some other animals can hear sounds of a higher frequency than humans. Optional: demonstrate silent dog whistle. Discuss what an echo is. Develop the discussion to demonstrate that if we know the speed of a sound we can calculate distance by measuring the time taken for the sound to be reflected. This is used on boats to measure the depth of water and find shoals of fish. Homework: calculation of distance from given echo times.	Tuning fork. Beaker of water. Signal generator, loudspeaker, polystyrene balls 'Slinky spring' Signal generator, oscilloscope	Higher tier students should be able to compare the motion and arrangement of particles in longitudinal and transverse waves: • Wavelength • Frequency • Compression • Rarefaction • Amplitude. Opportunity for mathematics

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
How is ultrasound used?	Groups of students use the internet to investigate and produce a short PowerPoint presentation explaining one of the following features of ultrasound: • How ultrasound produces body scans • How kidney stones can be broken down by ultrasound • Why ultrasound is used to scan developing foetuses • Why using ultrasound is preferable to using x-rays Groups to deliver their PowerPoint presentation to the class. Homework: ultrasound scans of foetuses can reveal birth defects. Parents must decide whether to terminate the pregnancy. Discuss: does medical technology impose on us more than it empowers?	Computers/internet access.	Higher tier: explain how ultrasound is used in: • Body scans • Breaking down accumulations. Explain the reasons for using ultrasound. Rather than x – rays as being able to produce images of soft tissue and not damaging living cells. HSW: identify how a scientific or technological development could affect different groups of people.

Topic: P4e What is radioactivity?

Suggested Teaching Time: 3 Hours

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
What is ionisation?	Use a Geiger counter to demonstrate the presence of ionising radiation. Put a Geiger counter near various objects including a smoke detector and an old watch with luminous dial. Use radioactive sources and Geiger counter to observe the penetrating power of radioactive sources. Discuss why alpha particles are such good ionisers. Homework: research and write about the effects of radium dials on the people who painted them.	Geiger counter. Smoke detector. Old watch with luminous dial. Radioactive sources. Geiger counter. Aluminium sheet. Lead sheet.	Teachers unfamiliar with using radioactive sources can view teachers TV demonstrating physics – radioactivity at: www.tes.co.uk/teaching-resource/demonstrating-physics-radioactivity-6045739/ Practical advice for teachers on the handling and use of radioactive sources can be found at: http://www.practicalphysics.org/go/collection_80.html?topic_id=40&collection_id=80 Further experiment to demonstrate ionising radiation can be found at: http://www.practicalphysics.org/go/collection_72.html?topic_id=40&collection_id=72 Higher tier: explain why alpha particles are such good ionisers. HSW: describe risks from new scientific advances.
What is radioactivity?	Show BBC Bitesize animation introducing radioactivity: http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway/radiation/radioactiveact.shtml Discuss what radiation is and where it comes from. Groups of students to produce a poster that could be used to teach year 7 about one of the following: • Alpha radiation • Beta radiation • Gamma radiation. Students to present their poster to other groups for peer assessment. Homework: questions from past papers about alpha, beta and gamma radiation.	Information from the following websites provides a useful introduction: www.bbc.co.uk/schools/gcsebitesize/science/aqa/radiation/radiocativerev1.shtml http://www.furryelephant.com/content/radioactivity/understanding-radioactivity/ Poster paper; illustrating equipment Internet Library Science text books	Higher tier only: Describe what happens to a nucleus when an alpha particle is emitted Describe what happens to a nucleus when a beta particle is emitted Construct and balance nuclear equations in terms of mass numbers and atomic numbers to represent atomic decay. HSW: describe a simple scientific idea using a simple model

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
What is half life?	Students to model half life by: • Flipping coins. All that show heads are out • Rolling dice. All those that show six are out • Shaking a bag of cubes (that have one face a different colour to the rest) onto the desk and removing those with the coloured face. Demonstrate the half life of protactinium. Students to make a table of count rate against time and correct it for background count. Students plot a graph of count rate against time drawing a smooth curve through the points. Students to measure the half-life from the curve. Discuss the dangers of nuclear waste in terms of the long half lives of the materials used. Homework: students to use the periodic table to construct a graph of proton number against neutron number to show line of stability	Details of how to carry out these exercises can be found on the institute of physics website: http://www.practicalphysics.org/go/experiment_579.html?topic_id=40&collection_id=77 Details of where to purchase materials and how to set up and carry out the experiment can be found at: http://www.practicalphysics.org/go/experiment_577.html?topic_id=40&collection_id=77 A simulation showing how to calculate half life from a graph can be found at: http://www.darvill.clara.net/nucrad/hlife.htm	HSW: present data and identify trends. Process using simple methods. Safety: refer to CLEAPPS for handling of radioactive sources Higher tier: interpret graphical or numerical data of radioactive decay to include calculation of half life. Higher tier: construct and balance nuclear equations in terms of mass numbers and atomic numbers to represent alpha and beta decay.

Topic: P4f Use of radioisotopes

Suggested Teaching Time: 3 Hours

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
What are the levels of background radiation in the UK?	Use the internet to research levels of background radiation in different parts of the UK. Investigate the variation of background radiation with location and possible health risks. Identify sources of background radiation. Discuss how much radiation leaks from nuclear power stations. Debate the disposal of nuclear waste. Where is it dumped is this ethically acceptable? Discuss why some scientists/governments support nuclear power while others do not. Discus how the claims, opinions and evidence of scientists can be used in the nuclear debate. Homework: what do we do with nuclear waste? Explain ways nuclear waste is disposed of. Discus the relative safety of disposal methods.	Information about background radiation can be found on the BBC Bitesize website at: http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/radiation/backgroundradiationrev1.shtml The science museum website had discussion groups for school students. For example: http://antenna.sciencemuseum.org.uk/going-nuclear-the-uk%e2%80%99s-cheapest-option/	Higher tier only: evaluate the relative significance of sources of background radiation. HSW: distinguish between claims/opinions and scientific evidence in sources. HSW: recognise the importance of the peer review process in which scientists check each others work. HSW: describe risks from new scientific/technological advances.
How are radioisotopes used in industry?	Groups of students to investigate and produce a poster to illustrate one of the following uses of tracers: • To track dispersal of waste • To find leaks/blockages in underground pipes • To find the route of underground pipes. Groups to present their posters to the class for assessment. Homework: does your home have any smoke detectors? Is so how many, where are they and do they work?	Information about radioactive tracers can be found at: http://www.gcsescience.com/prad27-radioactive-tracer.htm	Higher tier: explain why gamma radiation is used as an industrial tracer.

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
How do smoke detectors work?	Show a smoke detector and ask how it might work. Describe how alpha radiation is used to detect smoke particles. Use a Geiger counter / solid state detector to demonstrate that smoke detectors give off radiation. Demonstrate a smoke detector operating. Identify the relevant parts of the smoke detector.	A picture showing the parts of a smoke detector and how it works can be found on the BBC Bitesize website at: http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway/radiation/radioisotopesrev2.shtml	Students should have an idea that a smoke detector contains a radioactive source from the demonstration of radioactivity in an earlier lesson (P4e).
How is radioactivity used to date rocks?	Discuss why radioactive carbon dating is only really useful for dating things up to 50 000 years. Explain that for geological dating of rocks we need to use an isotope with a longer half life. The decay of uranium to lead is commonly used. Homework: is it safe to throw your old smoke detector in the bin?	Picture of the shroud and information about carbon dating can be found on BBC Bitesize at: http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway/radiation/radioisotopesrev3.shtml For higher tier students further information is found at: http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway/radiation/radioisotopesrev4.shtml	This section has been visited at higher tier level in P4e: Explain how measurements of the activity of radioactive carbon can lead to an approximate age for different materials. The amount of carbon-14 in the air has not changed for thousands of years When an object dies (e.g a tree) gaseous exchange with air stops As the carbon-14 in the wood decays the activity of the sample decreases. The ratio of current activity from living matter to the activity of the sample is used to calculate the age within known limits.

Topic: P4g Treatment

Suggested Teaching Time: 3 Hours

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
How are x-rays produced?	Look at x-ray images. Discuss what an x-ray image is and how it is produced. Discuss why you should not be exposed to too many x-rays. Discuss how radiographers are protected from x-rays. Use information from the internet to produce a single page comparison of the similarities and differences between x-rays and gamma rays. Discuss why gamma rays are not used to produce images of the body. Homework: what is the difference between a radiographer and a radiologist?	Good x-ray images can be found at: http://www.e-radiography.net/schools/schools%20base.htm 0ther websites have good 'bizarre' images – check before using them with students as some can be inappropriate! The following website has comprehensive information about x-rays: http://www.e-radiography.net/ Information about x-rays and gamma rays can be found on BBC Bitesize at: http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/radiation/the_electromagnetic_spectrumrev3.shtml The IOP has a video showing gamma radiation penetration at: www.practicalphysics.org/go/experiment_589.html	HSW: describe risks from new scientific / technological advances. Higher tier: explain how: Gamma rays are given out from the nucleus of certain radioactive materials. X-rays are made by firing high speed electrons at metal targets. X-rays are easier to control than gamma rays.

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note

How is nuclear radiation used in medicine?	Demonstrate and model the idea of a tracer with a radioactive source hidden in the school skeleton.
	
	Groups of students to carry out Internet research to find out how radioactive sources are used in medicine:
	• As tracers
	• As treatment for cancers
	• To sterilise equipment.
	
	Explain why gamma and sometimes beta emitters can be used as tracers in the body.
	
	Explain why medical tracers should have short half lives.
	
	Explain how medical radioisotopes are produced.
	
	Homework; Research the shoe fitting Fluoroscope.
		Skeleton, radioactive source, Geiger counter.	Safety: Refer to CLEAPSS for safe handling of radioactive material.
			
			HSW: Identify how a scientific or technological development could affect different groups of people.
			
			Higher tier; explain how radioactive sources are used in medicine:
			• To treat cancer;
			  ○ Gamma rays focused on tumour
			  ○ Wide beam used
			  ○ Rotated round the patient with tumour at centre
			  ○ Limited damage to healthy tissue
			• As a tracer:
			  ○ Beta or gamma emitters with short half life
			  ○ Drunk/eaten/ingested/injected into body
			  ○ Allowed to spread through body
			  ○ Followed on outside by radiation detector.

Topic: P4h Fission and fusion

Suggested Teaching Time: 3 Hours

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
How do nuclear power stations work?	Describe a chain reaction. Describe a nuclear bomb as a chain reaction that has gone out of control. Show simulation of chain reactions and nuclear reactors. Show simulation to illustrate processes in a nuclear power station. Discuss how the chain reaction is controlled. Students to produce a flow diagram explaining the steps in electricity generation in a nuclear power station: Nuclear reaction – heat produced Heat turns water to steam Steam turns turbine Turbine turns generator Electricity produced. Recall discussion of the nuclear debate p4e. Emphasise that scientists' views about the wisdom of using nuclear power vary. Homework: should we be generating electricity from nuclear reactors? Give a qualified argument for or against the use of nuclear power stations.	Nuclear chain reaction applets available on the internet Many good simulation on youtube.com Lots of information and pictures can be found on the 'science museum' website at: Http://www.makingthemodernworld.org.uk/stories/defiant_modernism/04.st.02/?scene=1	Higher tier: Describe what happens to allow uranium to release energy: • Uranium nucleus hit by neutron. • Causes nucleus to split. • Energy released. • More neutrons released. Explain what is meant by a chain reaction. • When each uranium nucleus splits more than one neutron is given out. • These neutrons can cause further uranium nuclei to split. Explain how scientists stop nuclear reactions going out of control. • Rods placed in the reactor. • To absorb some of the neutrons. • Allowing enough neutrons to remain to keep the process operating. HSW: describe a simple scientific idea using a simple model. HSW: identify different views that might be held regarding a given scientific or technological development. HSW: describe risks from new scientific or technological advances.

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
What is nuclear fusion?	Discuss homework task: should we be generating electricity from nuclear reactors? Introduce fusion as a clean energy source. Show animation from the science museum website that explains the fusion reactor: Http://www.makingthemodernworld.org.uk/stories/defiant_modernism/04.st.02/?scene=6 Students to carry out internet research to investigate: • Potential benefits of nuclear fusion • The difficulties involved in developing fusion based reactors Students to use prepared information sheets to answer questions about the 'Coldfusion controversy' (Fleischmann-Pons claims). Examples of questions: • What evidence did Fleishmann-Pons have to show that cold fusion had taken place? • How could Fleishmann-Pons have strengthened their evidence? • Give one piece of evidence that supports the occurrence of cold fusion and one piece of evidence that refutes it. • Why do some scientists support the claims of Fleishmann-Pons while others don't? • How could the validity of the claims made by Fleishmann-Pons be strengthened?	Science museum website: http://www.makingthemodernworld.org.uk/stories/defiant_modernism/04.st.02/?scene=6 Further information about nuclear fusion can be found on the how stuff works website at: http://science.howstuffworks.com/fusion-reactor.htm Teachers will need to prepare information sheets about the cold fusion controversy. The depth and complexity of which will depend on the target audience. Information can be found on the internet. The following websites may be of use: http://news.bbc.co.uk/1/hi/sci/tech/1855672.stm http://en.wikipedia.org/wiki/cold_fusion http://encyclopedia2.thefreedictionary.com/arguments+in+the+cold+fusion+controversy http://science.howstuffworks.com/fusion-reactor6.htm	There is some material in a, probably long out of print, book, questions on everyday physics by Andrew Lambert that covers cold fusion Higher tier: Explain how different isotopes of hydrogen can undergo fusion to form helium Understand the conditions needed for fusion to take place, to include: • In stars, fusion happens under extremely high temperature and pressure • Fusion bombs are started with a fission reaction which creates exceptionally high temperatures • For power generation exceptionally high temperatures and / or pressures are required and this combination offers (to date) safety and practical challenges. Explain why 'cold fusion' is still not accepted as a realistic method of energy production. HSW: describe risks from new scientific or technological advances Question should allow students to show an understanding of fundamental scientific processes as outlined in item sa: how science works: • Recognise that scientific explanations are provisional but more convincing if there is more evidence to support them • Recognise the importance of the peer review process in which scientists check each others work

Topic outline	Suggested teaching and homework activities	Suggested resources	Points to note
			• Identify two different scientific views of explanations of scientific data • Identify different views that might be held regarding a given scientific or technological development • Recall that scientific explanations are used to: o Used to explain observations o Tested by collecting data / evidence. Explain how a conclusion is based on the scientific evidence which has been collected.

Item B4a: Sparks

OCR recognises that the teaching of this qualification above will vary greatly from school to school and from teacher to teacher. With that in mind this lesson plan is offered as a possible approach but will be subject to modifications by the individual teacher.

Lesson length is assumed to be **one hour**.

Learning Objectives for the Lesson

Objective 1	Recognise that when some materials are rubbed they attract other objects
Objective 2	Recognise that insulating materials can become charged when rubbed with another insulating material
Objective 3	Recognise that a charged material can attract or repel another charged material
Objective 4	State that there are two kinds of charge: positive and negative
Objective 5	Recognise that a positively charged material will attract a negatively charged material and repel a positively charged material: like charges repel; opposite charges attract.

Recap of Previous Experience and Prior Knowledge

From KS3: 3:1 Energy, electricity and forces students should recall that when their jumper and shirt rub together they get electrically charged, and then negative electric charges jump from one to the other. This makes sparks that crackle.

Time in mins	Learning activities		Resources	Assessment
	Teacher	Pupil		
Introduction/Starter				
5	Show water being deflected by a charged polythene rod	Give an explanation of how / why the stream of water is deflected by the polythene rod.	Polythene rod. Duster. Access to running water.	Question and answer
Main				
10	Demonstrate that when you rub a balloon it will attract hair Demonstrate that when you rub a plastic comb it will attract small pieces of paper Discuss why the balloon, comb etc need to be rubbed. What happens when you rub the balloon etc.	Pupils can be involved in carrying out the demonstrations	Balloons Plastic comb	Question and answer
25	Demonstrate how to set up an experiment to investigate forces due to electric charge: Support a charged acetate strip in a hanger suspended by fishing line from a retort stand. Charge a second acetate strip and bring it towards the suspended strip – observe what happens. Earth the acetate strip by touching it on the floor and bring it towards the suspended strip – observe what happens. Charge a polythene strip. Bring it towards the suspended acetate strip – observe what happens. Repeat with the polythene strip suspended. Teacher to discuss students' observations while repeating experiment to illustrate what happens. Teacher to establish that the observations are as a result of electrostatic charge. Atoms have electrons. Electrons have a negative charge. Rubbing a material can add or remove electrons. More electrons give the object a negative charge. Less electrons results in a positive charge. Like charges repel and opposite charges attract.	Pupils set up apparatus for investigation. Pupils carry out investigation making a note of observations. Pupils formulate a conclusion based on observations. Pupils to put forward ideas to explain observations	Retort stand; boss; clamp; sling for holding rods attached to fishing line. Solid strips / rods of acetate. Solid strips / rods of polythene. Dusters.	Practical aptitude Written observations Written conclusion

10	Show BBC Bitesize animation on electrostatics to illustrate the pupils observations: Clip1	Pupils may ask questions about the information shown. Higher tier pupils should be able to describe static electricity in terms of movement of electrons. A positive charge is due to a lack of electrons; a negative charge due to an excess of electrons.	Internet access	Question and answer
Consolidation				
10	Show BBC Bitesize pages about electrostatics to consolidate learning: Clip2	Pupils to ask/answer questions raised by the information shown	Interactive white board Internet access	Question and answer

Homework:

Draw a picture/pictures to illustrate how rubbing a polythene rod with a duster alters the charge on the duster and rod.

Clips:

Clip1: http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/electricity/static_act.shtml
Clip2: http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway/radiation/electrostaticssparksrev2.shtml

Key words:

Electrostatic, attract, repel, positive, negative, electron, charge.