

***Isle of Wight Middle School  
programme for Science  
incorporating a two-year Key Stage 3  
in years 7 and 8***

## ***Introduction to the middle school programme in Science***

This proposed outline scheme for middle school science incorporates the *two-year Key Stage 3*. The success of the scheme will depend on a number of factors.

- There is an assumption that schools will need to adopt the approaches that are being promoted by the KS3 Strategy, both generally and within Science. In some cases this will require a re-examination of the style of teaching and learning that has previously taken place.
- Many colleagues are concerned about the amount of time available within a 2 year programme if we still are going to fulfil the demands of the National Curriculum. We have an opportunity in the current system of avoiding some of the problems associated with transfer at the end of year 6, which most schools face. We should therefore be able to capitalise on the previous learning in KS2 to make the transition to KS3 more successful.
- There will be a need for continued support for science teachers working in middle schools –this could be from LEA consultant(s) but also from peer-support between colleagues by means of network meetings and possibly through electronic communications e.g. School Box. It will be important for schools to be able to share their experiences so that developing good practice is quickly disseminated.
- This original draft document needs a critical examination, so that changes can be incorporated and we can get closer to a workable scheme before the starting date –it is expected that it will evolve over time. It does not imply any particular form of detailed scheme of work. Each school will still have to adapt their current detailed teaching schemes taking account of accommodation, staff expertise, resources etc.
- The Science curriculum specifically embodies a large content of factual knowledge. We need to get beyond this to look at the underlying Key Ideas and to promote activities which engage the pupils with these ideas. Also we need to encourage them to use the ideas in their *explanations* of both everyday phenomena and their experiences a school laboratory.

NOTE: Throughout this document, reference is made to **'the Framework'**. This is the file that launched the strategy in Science. [Full title: Key stage 3 National Strategy Framework for teaching science: Years 7,8 and 9 DfES 0136/2002 –all schools should already have at least one copy]

## ***Focusing on Pupil Achievement***

Although the National Curriculum for Science is defined largely by content and this informs the learning *objectives* in our lessons, we must be equally aware of the expected *outcomes* for the pupils. The QCA scheme of work gives guidance about what might be achieved in a lesson or group of lessons. This focus on what pupils have achieved and how they can make progress links clearly with the main messages from the Key Stage 3 Strategy.

The assumption is that most pupils will achieve their age-related expectations in terms of levels:

End of year	Expected attainment related to National Curriculum levels		
	Slower progress	Most pupils	Faster progress
4	2	3	4/5
5	2/3	3/4	5
6	3	4	5/6
7	3/4	4/5	6
8	4	5	6/7

At the end of year 8, after following a 2 year KS3, most pupils should be able to attain level 5 and should be challenged to reach level 6 (although they will not all reach this standard). The highest attaining pupils will be working at level 7.

In science, the level descriptions indicate the progression in the knowledge, understanding and skills set out in the four attainment targets of the programme of study: scientific enquiry, life processes and living things, materials and their properties and physical processes. The examples given in each level description are intended to indicate pitch and are not statutory.

The level descriptors below give an indication of the capability of most pupils on transfer to middle school from primary and also at the end of the 2 year Key Stage in Year 8.

Attainment target	At end of year 4 Level 3	By the end of year 8 Level 5
Science 1	<p>Pupils respond to suggestions and put forward their own ideas about how to find the answer to a question. They recognise why it is important to collect data to answer questions. They use simple texts to find information. They make relevant observations and measure quantities, such as length or mass, using a range of simple equipment. Where appropriate, they carry out a fair test with some help, recognising and explaining why it is fair. They record their observations in a variety of ways. They provide explanations for observations and for simple patterns in recorded measurements. They communicate in a scientific way what they have found out and suggest improvements in their work.</p>	<p>Pupils describe how experimental evidence and creative thinking have been combined to provide a scientific explanation <i>for example Lavoisier's work on burning at key stage 3</i>. When they try to answer a scientific question, they identify an appropriate approach. They select from a range of sources of information. When the investigation involves a fair test, they identify key factors to be considered. Where appropriate, they make predictions based on their scientific knowledge and understanding. They select apparatus for a range of tasks and plan to use it effectively. They make a series of observations, comparisons or measurements with precision appropriate to the task. They begin to repeat observations and measurements and to offer simple explanations for any differences they encounter. They record observations and measurements systematically and, where appropriate, present data as line graphs. They draw conclusions that are consistent with the evidence and begin to relate these to scientific knowledge and understanding. They make practical suggestions about how their working methods could be improved. They use appropriate scientific language and conventions to communicate quantitative and qualitative data.</p>
Science 2	<p>Pupils use their knowledge and understanding of basic life processes <i>for example, growth, reproduction</i> when they describe differences between living and non-living things. They provide simple explanations for changes in living things <i>for example, diet affecting the health of humans or other animals, lack of light or water altering plant growth</i>. They identify ways in which an animal is suited to its environment <i>for example, a fish having fins to help it swim</i>.</p>	<p>Pupils demonstrate an increasing knowledge and understanding of life processes and living things drawn from the key stage 3 programme of study. They describe the main functions of organs of the human body <i>for example, the stomach at key stage 3</i>, and of the plant <i>for example, root hairs at key stage 3</i>. They explain how these functions are essential to the organism. They describe the main stages of the life cycles of humans and flowering plants and point out similarities. They recognise that there is a great variety of living things and understand the importance of classification. They explain that different organisms are found in different habitats because of differences in environmental factors <i>for example, the availability of light or water</i>.</p>

Attainment target	At end of year 4 Level 3	By the end of year 8 Level 5
Science 3	Pupils use their knowledge and understanding of materials when they describe a variety of ways of sorting them into groups according to their properties. They explain simply why some materials are particularly suitable for specific purposes <i>for example, glass for windows, copper for electrical cables</i> . They recognise that some changes <i>for example, the freezing of water</i> can be reversed and some <i>for example, the baking of clay</i> cannot, and they classify changes in this way.	Pupils demonstrate an increasing knowledge and understanding of materials and their properties drawn from the key stage 3 programme of study. They describe some metallic properties <i>for example, good electrical conductivity</i> and use these properties to distinguish metals from other solids. They identify a range of contexts in which changes <i>for example, evaporation, condensation</i> take place. They use knowledge about how a specific mixture <i>for example, salt and water, sand and water</i> can be separated to suggest ways in which other similar mixtures might be separated.
Science 4	Pupils use their knowledge and understanding of physical phenomena to link cause and effect in simple explanations <i>for example, a bulb failing to light because of a break in an electrical circuit, the direction or speed of movement of an object changing because of a push or a pull</i> . They begin to make simple generalisations about physical phenomena <i>for example, explaining that sounds they hear become fainter the further they are from the source</i> .	Pupils demonstrate knowledge and understanding of physical processes drawn from the key stage 3 programme of study. They use ideas to explain how to make a range of changes <i>for example, altering the current in a circuit, altering the pitch or loudness of a sound</i> . They use some abstract ideas in descriptions of familiar phenomena <i>for example, forces are balanced when an object is stationary at key stage 3</i> . They use simple models to explain effects that are caused by the movement of the Earth <i>for example, the length of a day or year</i> .

## ***Levelness***

Perhaps more important than the specific descriptors above are that teachers (and pupils) have general ideas of 'levelness'. These can then be used in oral and written feedback to the pupils.

General features of levelness.

- Level 3      Simple explanation of what happens
- Level 4      Using correct terminology to describe what happens
- Level 5      Applying concrete ideas to less familiar situations and  
beginning to use abstract Key Ideas e.g. Particles
- Level 6      Using abstract ideas and models more confidently to explain why things happen
- Level 7      Linking Key ideas from different areas  
Using quantitative relationships

For key stage 3 the crucial progression is from Level 4 –related to concrete thinking and using the correct conventions and terminology –to Level 5 where concrete ideas are being applied in less familiar situations and pupils are beginning to use the Key ideas. Science materials will be available through local Key Stage 3 CPD training in the new academic year which support this progression and will help to focus teachers and pupils on moving to level 5.

## **Scientific Enquiry (Attainment target: Sc 1)**

**Years 5-8**

This part of the science curriculum is based more on the development of investigational skills and is independent of the 'content' of the programme of study. It is therefore possible to view the progression in this attainment target across the whole of the middle school from years 5 to 8. Science 1 is unlike the other 'content' based attainment targets which in some cases only introduce a concept explicitly for the first time in Key Stage 3\*. It is important to realise how this attainment target underpins the pupils' progression in science and provides an element of continuity from KS1 to KS4.

The expectation is that teachers will include aspects of Sc 1 within the context of the units that they are teaching and that they will look for opportunities to develop the skills exemplified in the teaching objectives. This does assume that practical work, like any other learning activity, needs to have a *purpose* if it is to be successful. This purpose may be the development or practise of a simple skill like measuring, or alternatively it could be achieving one of the teaching objectives like "use repeat measurements to reduce error..." Like other aspects of science we need to think in terms of 'curricular targets' for Sc 1 derived from the separate strands: ideas and evidence; planning; obtaining and presenting evidence; considering evidence; evaluating. Some experiments can be targeted at these separate strands while others may be carried out as complete investigations. There are two specific opportunities for carrying out longer term investigations, in the summer terms of year 6 and year 8, but this does not imply that Science 1 should be an added-on activity. It should be an integral part of our teaching and also a way of delivering some aspects of the other attainment targets.

\* e.g. Energy –we can see progression in Energy *across* Key Stage 3 but not between KS2 and KS3.

Progression in Science Attainment target 1 – Scientific Enquiry – yearly teaching objectives from year 5 →year 8

Sc 1 strand	Year 5	Year 6	Year 7	Year 8
<b>Ideas and evidence</b>	Consider how scientists have combined evidence from observation and measurement with creative thinking to suggest new ideas and explanations for phenomena.	Consider how scientists have combined evidence from observation and measurement with creative thinking to suggest new ideas and explanations for phenomena.	Consider early scientific ideas, including how experimental evidence and creative thinking have been combined to provide scientific explanations and how some early scientific ideas do not match present-day evidence. Describe how new creative thinking has been used to provide a scientific explanation.	Explain how scientific ideas have changed over time; describe some of the positive and negative effects of scientific and technological developments.
<b>Planning</b>	Make predictions of what will happen based on scientific knowledge and understanding, and suggest how to test these; to use knowledge and understanding to plan how to carry out a fair test or how to collect sufficient evidence to test an idea; and to identify factors that need to be taken into consideration in different contexts.	Decide how to turn ideas into a form that can be tested. Where appropriate, use scientific knowledge and understanding to make predictions. Identify factors relevant to a situation. Choose what evidence to collect to investigate a question, ensuring the evidence is sufficient. Choose what equipment to use.	Use scientific knowledge to decide how ideas and questions can be tested; make predictions of possible outcomes. Identify and control the key factors that are relevant to a particular situation. Identify more than one strategy for investigating questions and recognise that one enquiry might yield stronger evidence than another. Recognise that a range of sources of information or data is required. Carry out preliminary work such as trial runs to help refine predictions and to suggest improvements to the method.	Select and use a suitable strategy for solving a problem; identify strategies appropriate to different questions, including those in which variables cannot be easily controlled.

Progression in Science Attainment target 1 – Scientific Enquiry – yearly teaching objectives from year 5 → year 8

Sc 1 strand	Year 5	Year 6	Year 7	Year 8
<b>Obtaining and presenting evidence</b>	Make relevant observations; to consolidate measurements of volume, temperature, time and length; to measure pulse rate; to think about why observations and measurements need to be repeated; and to present results in bar charts and line graphs.	Make a variety of relevant observations and measurements using simple apparatus correctly. Decide when observations and measurements need to be checked by repeating to give more reliable data. Use tables, bar charts, line graphs and diagrams to present results. Make comparisons.	Select and use appropriate equipment, including ICT, to make observations and measurements correctly, e.g. 1 °C or 1 newton. Use repeat measurements to reduce error and check reliability. Present and interpret experimental results through the routine use of tables, bar charts and simple graphs, including line graphs.  Use a range of first-hand experience, secondary sources of information and ICT to collect, store and present information in different ways, including the generation of graphs.	Make sufficient systematic and repeated observations and measurements with precision, using an appropriate technique. Select and use appropriate methods for communicating qualitative and quantitative data.  Use appropriate range, precision and sampling when collecting data during a scientific enquiry, and explain why these and controlled experiments are important.
<b>Considering evidence</b>	Decide whether results support any prediction; to begin to evaluate repeated results; to recognise and make predictions from patterns in data and suggest explanations for these using scientific knowledge and understanding; to interpret data.	Identify patterns in results that do not appear to fit the pattern. Use results to draw conclusions and make further predictions.	Describe and explain what their results show when drawing conclusions; begin to relate conclusions to scientific knowledge and understanding.	Describe patterns in data; use scientific knowledge and understanding to interpret the patterns, make predictions and check reliability. Draw conclusions from their own data and describe how their conclusions are consistent with the evidence obtained, using scientific knowledge and understanding to explain them.
<b>Evaluating</b>	Think about whether it is sufficient to draw conclusions; and to draw conclusions indicating whether these match any prediction made.	Evaluate repeated results. Suggest and evaluate explanations for predictions using scientific knowledge and understanding. Say whether the evidence supports any prediction made	Evaluate the strength of evidence, e.g. in bar charts and graphs; indicate whether increasing the sample would have strengthened the conclusions.	Consider whether an enquiry could have been improved to yield stronger evidence (e.g. improving the accuracy or sufficiency of measurements or observations); explain any anomalous results. Describe how evidence or the quality of the product supports or does not support a conclusion in their own and others' enquiries; identify the limitations of data in conclusions.

## ***Years 5 and 6***

Although the intention is to create a coherent programme for the whole of the middle school range, this Science document is divided into years 5&6 and years 7&8 sections, which have slightly different formats.

This first section assumes that most teachers use the QCA scheme as their starting point. The years 7&8 section has been constructed using the Yearly Teaching Objectives from the Key Ideas in the Framework document. Unlike English and Maths which have a primary strategy, there is no corresponding document for KS2 Science but we do need to see the connections between KS2 and KS3. Therefore the QCA topics have been grouped using these Key Ideas to stress where the topic forms an important part of the foundation for later work.

It is not intended that any particular sequence or organisation of the curriculum is necessary provided that these important connections are emphasised but schools might like to look at their current grouping of topics and their timing to avoid too much repetition from year to year e.g. it might be preferable to avoid doing 6G circuits at the end of year 6 and then Energy 2 early in the next term.

This scheme assumes good communication between all science teachers e.g.  $KS2 \leftrightarrow KS3$  within the middle school. It also requires primary years 3 & 4 teachers to know how their topics form a foundation for later on in KS2 e.g. 3A Teeth and eating / 4A Moving and Growing; both support 5A keeping healthy.

## Outline scheme of work for Science in years 5 and 6

The following table makes explicit the connection between work in years 5 & 6 and the proposed 2 year KS3 programme. It relates the units in the QCA scheme to the Key Ideas (Cells, Energy, Forces, Interdependence, Particles) from the KS3 Science Framework document.

NC PoS reference	QCA unit from <b>KS2 SoW</b> –gives teaching activities and detailed list of objectives  [Links to earlier topics in square brackets]	Key teaching and learning objectives  [linked to the teaching objectives of the KS3 strategy and which support further learning]	Links to later <b>KS3</b> QCA units	Links to <b>Key idea</b> unit in <b>new KS3</b> programme (years 7 & 8)	Other comments e.g. how the Years 5 & 6 units provide an important foundation for later work at KS3
Sc2: 1a 2b 2c 2d 2e 2g 2h	<b>5A Keeping healthy</b> [3A, 4A]	<b>Cells:</b> begin to describe the role of nutrients and the importance of a balanced diet.  <b>Cells:</b> describe some aspects of health (related to drugs, exercise)  <b>Energy:</b> become familiar with the use of food as an energy source for living systems	8A (7A) 7I	Cells 2  Cells 3  Energy 1 end of year 6	Supports later development of ideas on cells, cell processes e.g. digestion, respiration, circulation  Later work focuses on explanations about health in terms of cell processes.  Although Energy is not specific at KS2 it is met in the context of food
Sc2: 1a,1b, 1f, 3a, 3b	<b>5B Life cycles</b> [3B]	<b>Cells:</b> describe plant fertilisation as the process of pollen (male), joining to ovum (female)  <b>Interdependence:</b> begin to develop an idea of the numbers of organisms resulting from reproduction.	7B  (7D)	Cells 1 Cells 5  Interdependence 2	Prepares for further ideas on specialised cells, human fertilisation, inheritance  Relates to development of ideas on competition, predation, pyramids of number.
Sc3: 1a,1e,2b	<b>5C Gases around us</b> [3D, 4D]	<b>Particles:</b> describe the differences between solid, liquids and gases	7G, 7H (7F)	Particles 1	Prepares for the introduction of the particle theory –start to answer <i>why</i> the three states are different
Sc3: 1e,2c,2d, 2e	<b>5D Change of State</b> [4D, 5C]	<b>Particles:</b> recognise (through the example of water) that there can be changes of state and link these to changes in temperature	7G, 7H  8I	Particles 1  Energy 3	Prepares for the introduction of the particle theory –start to answer <i>why</i> changes of state occur  Link from temperature change to Energy

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NC PoS reference	QCA unit from <b>KS2 SoW</b> –gives teaching activities and detailed list of objectives  [Links to earlier topics in square brackets]	Key teaching and learning objectives  [linked to the teaching objectives of the KS3 strategy and which support further learning]	Links to later <b>KS3</b> QCA units	Links to <b>Key idea</b> unit in <b>new KS3</b> programme (years 7 & 8)	Other comments e.g. how the Years 5 & 6 units provide an important foundation for later work at KS3
Sc4: 4a, 4b, 4c, 4d	<b>5E Earth, Sun and Moon</b> [3F]	Describe the effects of the rotation of the earth ('movement' of the sun, day /night)	7L	Energy 4?? Forces 5??	Not directly linked to development of a key idea except some aspects of Energy (light) and Forces (gravity)
Sc4: 3e,3f,3g	<b>5F Changing sounds</b>	<b>Energy:</b> recognize that sounds are produced from vibrations and that sounds can travel	8L	Energy 4	Link from vibrations to energy input and then transmission of energy.
Sc2: 1b,1c,3a, 3b,3c, 4a,5b,5c, 5d,5e	<b>6A Interdependence and Adaptation</b> [3B, 4B, 5A]	<b>Interdependence:</b> recognise the differences between animals and plants that can lead to classification; describe some adaptations of animals and plants; understand food chains and feeding relationships.  <b>Energy:</b> begin to understand that the sun is the ultimate source of energy.  <b>Cells:</b> appreciate the major factors in plant growth –light, 'air', water, nutrients.	7C, 7D  (7I)  (9C)	Interdependence 1  Energy 1  Cells 4	Interdependence is the main theme particularly food chains and adaptation  Prepares for energy transfer in food chains  Prepares for detailed knowledge of photosynthesis
Sc2: 2b,5f	<b>6B Microorganisms (short unit)</b> [3A, 6A]	<b>Cells:</b> describe how microorganisms can cause illness or decay	8C	Cells 2	Prepares for further detailed classification of microorganisms and how they relate to human health

## Outline scheme of work for Science in years 5 and 6

The following table makes explicit the connection between work in years 5 & 6 and the proposed 2 year KS3 programme. It relates the units in the QCA scheme to the Key Ideas (Cells, Energy, Forces, Interdependence, Particles) from the KS3 Science Framework document.

NC PoS reference	QCA unit from <b>KS2 SoW</b> – gives teaching activities and detailed list of objectives  [Links to earlier topics in square brackets]	Key teaching and learning objectives  [linked to the teaching objectives of the KS3 strategy and which support further learning]	Links to later <b>KS3</b> QCA units	Links to <b>Key idea</b> unit in <b>new KS3</b> programme (years 7 & 8)	Other comments e.g. how the Years 5 & 6 units provide an important foundation for later work at KS3
Sc3: 3a,3b,3c, 3d	<b>6C More about dissolving</b> [4D, 5C]	<b>Particles:</b> begin to appreciate that mass is conserved when solutions are formed; understand how evaporation can separate solutions; recognise that temperature changes can affect dissolving.	7H, 7G, 7E	Particles 1	Particle theory subsequently used to explain some of these phenomena; conservation of mass, relationship between temperature and dissolving, saturated solutions
Sc3 2a,2b,2f, 2g,3c,3d	<b>6D Reversible and irreversible changes</b> [5D, 65C]	<b>Particles:</b> begin to understand that irreversible changes are linked to the formation of new materials, and that these differ from reversible ones.	7E, 7F	Particles 2	Prepares for understanding of chemical reactions
Sc4: 2b,2c,2d, 2e	<b>6E Forces in Action</b> [4E]	<b>Forces:</b> describe the action of forces in terms of arrows, understand weight is a force, begin to develop ideas on air resistance and falling objects.	7K	Forces 1  Forces 2	Prepares for detailed knowledge of forces; introduces fluid friction; important for the development of ideas on balanced forces.
Sc4 3a,3b,3c, 3d	<b>6F How we see (short unit)</b> [3F, 5E]	<b>Energy:</b> recognize that light travels from a source, begin to understand some properties of light e.g. shadows, reflection.	7L, 8K	Energy 4	Prepares for linking of light specifically to energy and explanations of light properties in terms of energy.
Sc1: 1b,2a,2b, 2c,2e,2f, 2i,2l,2m	<b>5/6H</b> [e.g. 6A, 6G]	<b>Scientific enquiry:</b> explore investigation approach through environmental and technological contexts; carry out systematic investigations; use simple charts and graphs to identify patterns.	9M	Scientific enquiry	Develop skills in planning, fair testing, consideration of evidence etc..  Environment context links to Interdependence 1 –opportunities in summer term of year 6  [See last part of yr 5 & 6 programme]

## Outline scheme of work for Science in years 5 and 6

The following table makes explicit the connection between work in years 5 & 6 and the proposed 2 year KS3 programme. It relates the units in the QCA scheme to the Key Ideas (Cells, Energy, Forces, Interdependence, Particles) from the KS3 Science Framework document.

The last part of this document assumes that KS3 is started in the latter part of the **summer term** following the KS2 SATs (**using 6 weeks** of the available teaching time –this still allows for several weeks of extracurricular activities)

### Key stage 3 –end of year 6

Key idea	NC PoS reference	Teaching/learning objectives	QCA unit reference for activities	Other comments
Interdependence 1 Yr 6 summer term	Sc2 4b  5e 5c	<p>Explain that organisms can be grouped by their similarities and differences, and that a species is a group of very similar organisms.</p> <p>Identify some of the main taxonomic groups of animals, describing some common features.</p> <p>Explain how food chains within a habitat can be combined into food webs.</p> <p>Describe ways in which organisms are adapted to daily or seasonal changes in their environment and to their mode of feeding; use this idea to explain why some organisms can live more successfully than others in different habitats.</p>	7D  7D / 8D  7C  7C	<p>Fieldwork possibility here linking with Unit 6H (Scientific enquiry)</p> <p>Need to intro the idea of variation in prep for cells 5</p> <p><b>Adaptation</b> –key concept building on KS2</p>
Energy 1 Yr 6 Summer term	Sc2 2d Sc4 5a  5g	<p>Identify a range of fuels and explain:</p> <ul style="list-style-type: none"> <li>the uses of fuels (food) by living and non-living 'systems';</li> <li>their use as valuable resources;</li> <li>why conservation of fuels is important in the light of the Earth's diminishing energy resources.</li> </ul>	7I  7I 7I	<p>Ref: to Energy KS3 CPD unit - start with food.</p> <p>Needs quite a radical look</p> <p>Possibly Sc1 on solar/wind</p>

## Linking KS2 to KS3

The following table illustrates how earlier work from Key Stage 2 contributes to the development of the 5 Key Ideas in Science at Key Stage 3

Key Scientific Idea in KS3	What pupils will have experienced in this key idea by the <b>end of year 6</b>
Cells	Pupils will have some understanding of life processes, such as growth and reproduction, nutrition and movement. They will also have been taught about microorganisms and should have some idea that these are too small to be seen easily. Their understanding of just how small that might be is likely to be limited.
Energy	Energy is not introduced in the National Curriculum explicitly until KS3 but pupils' ideas about energy have developed gradually from early pre-school experiences. By year 6 they have a range of ideas about energy in everyday contexts. Many 11 year-olds associate energy with activity and use the term <i>energy</i> in speech, although they often state incorrectly that energy can be 'used up' or 'lost'. The challenge in KS3 is to establish energy as a key scientific idea with its own specific meaning in science.
Forces	From KS1 pupils have experimented with and can describe the effects of pushes and pulls on the state or motion of objects. They have met everyday meanings of the word 'force', probably in association with physical activity and muscular strength. In KS2 they have started to develop the idea of frictional force and weight, and to use the convention of arrows to illustrate the forces acting on familiar objects.
Interdependence	Most pupils have some understanding of the links between life processes in animals and plants and the environments in which they are found. They know that the wide variety of animals and plants can be grouped according to their similarities and difference. Pupils know that animals feed on plants or other animals and that feeding relationships can be described with simple food chains. They have been taught that animals and plants are often adapted to their environment through differences in their structure. They are aware of the need to care for other animals and plants, and for the whole environment and its sustainability. They have considered the cycling of materials in the context of the water cycle.
Particles	Pupils know that materials can be grouped into solids, liquids and gases and what causes simple substances such as water to change their physical state. They have been introduced to such terms as <i>evaporation</i> and <i>condensation</i> to describe these changes. They have sorted materials into groups according to simple physical properties and begun to explore chemical changes by observing and classifying reversible and irreversible changes.
Scientific Enquiry	Pupils can carry out systematic investigations working on their own and with others. They can use knowledge and understanding to plan how to carry out a fair test and can read accurately the data presented in simple tables and graphs. They use a wide range of references sources in their work including simple keys. Pupils can talk with confidence about their work and its significance and communicate ideas using scientific language, conventional diagrams, charts and graphs. They can identify simple patterns in results and point out results that do not appear to fit the pattern. Pupils draw conclusions which match the data they have collected and begin to use this evidence to support further predictions. They know that scientists have combined evidence from observation and measurement with creative thinking to suggest new ideas and explanations for phenomena.

## Years 7 and 8 (two year Key Stage 3)

The main table on the following pages shows how the teaching objectives from the KS3 strategy Framework document could be used to construct a scheme of work. The short table below gives a suggestion for sequencing the topics. In general, Cells 1 needs to come before Cells 2 etc. for reasons of progression but within each term the order doesn't usually matter. They are not all of equal length e.g. Particles 4 –long; Interdependence 2 –short.

	Autumn	Spring	Summer
Year 6			Interdependence 1/ Energy 1
Year 7	Cells 1 / Particles 1/ Forces 1/ Energy 2	Cells 2 / Particles 2 / Forces 2 / Energy 3	Cells 3 / Particles 3 / Forces 3 / Energy 4
Year 8	Cells 4 / Interdependence 2 / Particles 4 / Forces 4	Cells 5 / Interdependence 3 / Particles 5 / Forces 5 / Energy 5	Scientific Enquiry 9M

### Note:

- Care is needed over the introduction of year 9 units. These can be seen as the extension work as they are often targeting the higher levels –some pupils could use the time for reinforcement of the basic principles and maybe revisit but in a slightly different context.
- It is only necessary take to attempt work at the higher levels if it is appropriate for the pupils e.g. In 'Forces 1' all pupils would concentrate on the concept of speed but some may extend this into acceleration but then only qualitatively (relates to QCA unit 9K).

There is a need for good communication between all science teachers e.g. KS2→KS3. KS3 teachers need to be aware of exactly what experiences the pupils have had in KS2 so that they can effectively build on them. This is the major advantage of our middle school system. We need to remove KS2 content from KS3 SoW –there is no time for repetition. When we meet a topic already introduced at KS2 we need activities which demand the **use** of this knowledge not merely repeating what has been done.

Each of the Key ideas is supported by KS3 strategy CPD training materials that have been running this year. These will still be available on an in-school or Islandwide basis. Consultant support could be also used for converting overall teaching objectives into lesson objectives. Most teachers will be familiar with consulting the QCA units to refine their lesson planning in terms of learning objectives and **learning outcomes**. These units and various published schemes will provide the details that support this individual lesson planning.

## Outline scheme of work for Science in years 7 and 8

The following table shows a way of grouping the teaching objectives into units using the 5 Key Ideas (Cells, Energy, Forces, Interdependence, Particles) from the KS3 Science Framework document. These are cross-referenced to the units from the QCA scheme of work.

Key idea + sequencing	NC PoS reference	Teaching/learning objectives	QCA unit reference for activities	Other comments
Interdependence 1 Yr 6 Summer term	Sc2 4b 5e 5c	<p>Explain that organisms can be grouped by their similarities and differences, and that a species is a group of very similar organisms. Identify some of the main taxonomic groups of animals, describing some common features.</p> <p>Explain how food chains within a habitat can be combined into food webs. Describe ways in which organisms are adapted to daily or seasonal changes in their environment and to their mode of feeding; use this idea to explain why some organisms can live more successfully than others in different habitats.</p>	7D 7D / 8D 7C 7C	<p>Fieldwork possibility here linking with Unit 6H (Scientific enquiry)</p> <p>Need to intro the idea of variation in prep for cells 5</p> <p>Adaptation key concept building on KS2</p>
Energy 1 Yr 6 Summer term	Sc2 2d Sc4 5a 5g	<p>Identify a range of fuels and explain:</p> <ul style="list-style-type: none"> <li>the uses of fuels (food) by living and non-living 'systems';</li> <li>their use as valuable resources;</li> <li>why conservation of fuels is important in the light of the Earth's diminishing energy resources.</li> </ul>	7I 7I 7I	<p>Ref to Energy cpd unit - start with food</p> <p>Needs quite a radical look</p> <p>Possibly Sc1 on solar/wind</p>
Cells 1 Year 7 Autumn term	Sc2 1a 1b 1c 1a 1c 1d	<p>Describe a simple model for cells that recognises those features all cells have in common and the differences between animal and plant cells. Explain that some living organisms are only one cell but that others are multi-celled.</p> <p>Explain that growth means an increase in the size and number of cells. Explain that in multi-celled organisms certain cells may become specialised, e.g. sperm and egg cells.</p> <p>Explain that similar specialised cells can be grouped together to form tissues, that tissues can form organs, and that these do not all develop and grow at the same time; use this to explain why and how some organisms care for and protect their offspring.</p> <p>Describe fertilisation as the joining of the nucleus of a male sex cell (e.g. sperm) to the nucleus of a female sex cell (e.g. egg) and use this knowledge to explain that the resulting offspring are always similar to their parents but never identical.</p> <p>[Menstrual cycle, placenta]</p>	7A 7A 7A 7A / 7B 7A 7B 7B 9A	<p>Microscopes important +Sc1 exercise choice and focus on essential work</p> <p>Mention chloroplasts, cell walls etc</p> <p>NC specifically mentions cilia, sperm, ovum, root hair</p> <p>Implications for PSHE and timing??? e.g. Don't forget menstrual cycle ie be aware of NC PoS but not in YTOs</p>



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Key idea + sequencing	NC PoS reference	Teaching/learning objectives	QCA unit reference for activities	Other comments
Energy 2 Year 7 Autumn term	Sc4 5b  5e 1b 1c  1c 1a	<p>Use a simple model of energy transfer to explain:</p> <ul style="list-style-type: none"> <li>• that the Sun is the ultimate source of energy;</li> <li>• how non-living things can change or move and describe these events;</li> <li>• the transfer stages in a range of living and non-living systems;</li> <li>• the purpose of cells in an electric circuit;</li> <li>• that electric current carries energy to components in an electric circuit;</li> <li>• that in an electric circuit energy is transferred to the components;</li> <li>• that the electric current is the same at all points in a series circuit and divides along the branches of a parallel circuit.</li> </ul> <p>[measuring voltage / current]</p>	7I ?? ?? 7J 7J 7J 7J / 9I	Needs amplification of ideas in 7I opportunity to look at some energy transformations
Cells 2 Year 7 Spring term	Sc21e / 2a  2b  2c  2d  2n  2n	<p>Describe the role of the main nutrients in the body; explain why all cells need them and the importance of a balanced diet.</p> <p>Explain why some nutrients have to be broken down before the body can use them, and use models and analogies to describe how enzymes break down large molecules during digestion.</p> <p>Use the simple particle model to explain movement of substances through cell membranes by assuming particles are of different sizes;</p> <p>Describe the digestive system using knowledge of enzymes to explain how it works, and the role of the circulation system in transporting the products of digestion to cells.</p> <p>Classify bacteria and fungi as cellular micro-organisms and viruses as micro-organisms that are smaller than a cell; explain that some micro-organisms are useful to humans and some are harmful.</p> <p>Describe some of the systems in the human body for fighting infecting micro-organisms and immunisation as a way of improving immunity; use knowledge of cells, tissues and organs to explain how these systems work.</p>	8A  8A  7G / 8A  8A  8C  8C	Balanced diet 5A    Needs particles 1 first

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Particles 2 Year 7 Spring term	Sc3  1c  1c 1d  1e 1g	Describe a more sophisticated particle model for matter, recognising: <ul style="list-style-type: none"> <li>the atom is the basic building block of matter;</li> <li>there is a relatively small number of different atoms;</li> <li>elements consist of only one type of atom; [Properties of elements]</li> <li>compounds consist of (fixed combinations) of different types of atoms <u>that cannot be easily separated</u>; [Mixtures]</li> </ul>	8E 8E 8E 8E  8F	<u>Fixed combinations</u> revisited in more detail Particles 4
Forces 2 Year 7 Spring term	Sc4 2d  2d	Describe some ways of reducing friction between an object and a solid surface and some situations in which friction is useful. Use friction in liquids and gases to explore how resistance to an object moving through changes with the object's speed and shape; explain how streamlining reduces an object's resistance to air and water.	7K  9K	
Energy 3 Year 7 Spring term	5d 5d  5f    5f 5f 5f	Describe energy transfer as the result of temperature difference and use this to explain that: <ul style="list-style-type: none"> <li>heating is a process where energy is transferred;</li> <li>temperature change is the response of the material to the energy transfer;</li> <li>radiation is a means of energy transfer which does not directly depend on the movement of particles.</li> </ul> <p><i>Energy and particles</i> Use the particle model of solids, liquids and gases and energy transfer to explain:</p> <ul style="list-style-type: none"> <li><u>why</u> changes of state occur</li> <li>the processes of conduction, convection and evaporation;</li> <li>what happens when substances change state;</li> <li>the performance of thermal conductors and insulators.</li> </ul>	8I 8I  8I    8I..... ..... 8I 8I	Particles 1 must be done first   See Particles 1 (change of state)

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Cells 3 Year 7 Summer term	Sc2 2j, 2k  1e  2l  2i 2m  2i (smoking)	Use a word and/or symbol equation to describe respiration and explain similarities with burning of fuels. Explain that cells obtain energy through respiration, which often requires oxygen (aerobic respiration); use this to explain why tissues need a good blood supply; identify similarities in aerobic respiration in animals and plants. [Lung Structure] Explain that multi-celled organisms survive well only if all their parts work well together; use this to explain how smoking, alcohol, some drugs and exercise affect parts of the human body.	8B  8B  9B	Connects to Energy 1 food=fuel=energy source  Repeats some ideas on diet draws together ideas from 8A & B in context of good health
Particles 3 Year 7 Summer term	Sc3 3d, 3f 2d,2e 2f  2e,2f	[ Acids and alkalis] [Rocks and weathering] Use the simple particle model to explain how crystals form and that slow cooling results in the formation of larger crystals from molten material and solutions. [Rock cycle]	7E 8G  8H	In square brackets are parts of the programme of study that are not in the KS3 Framework – these still need to be covered
Forces 3 Year 7 Summer term	Sc4  1d  1e, 1f	Identify magnetic materials and their properties, including forces of attraction and repulsion. Use the idea of force to describe the patterns of magnetic fields produced by permanent magnets and electromagnets. Predict how the magnetic field pattern changes when the strength of an electromagnet increases.	8J  8J  8J	
Energy 4 Year 7 Summer term	Sc 4  3a 3b 3d, 3e, 3f  3j,3k 3g, 3h 3i	Recognise that when light travels from a source it is transferring energy; use this idea to: <ul style="list-style-type: none"> <li>describe the nature and propagation of light;</li> <li>explain the behaviour of light, including reflection and absorption.</li> </ul> [ refraction, colour, dispersion] Recognise that when sound travels by vibrations from the source it is transferring energy; use this idea to: <ul style="list-style-type: none"> <li>describe amplitude and frequency;</li> <li>explain the transmission, production and reception of sound.</li> </ul> [ Comparative speeds of light and sound]	8K 8K  8L 8L	

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Key idea + sequencing	NC PoS reference	Teaching/learning objectives	QCA unit reference for activities	Other comments
Cells 4 Year 8 Autumn term	Sc 2 3a  3c  3d 3c 3b, 3e	Describe photosynthesis and the requirement of chlorophyll, light, carbon dioxide and water; know that plant nutrition involves photosynthesis and other nutrients obtained from the soil; use this to explain: <ul style="list-style-type: none"> <li>photosynthesis as a source of biomass;</li> <li>that these other nutrients, used to produce proteins and other substances, can be supplied by fertilisers;</li> <li>how leaves and roots are adapted to their functions;</li> <li>conditions in which plants grow well.</li> </ul> Distinguish between photosynthesis and respiration in plants, including the use of word equations.	9C  9C 9C / 9D  9C 9C 8B / 9C	Early autumn term? Plant expts  Mention <u>nitrogen</u>
Interdependence 2 Year 8 Autumn term	Sc2  5b  5e	<i>Interdependence and energy</i> Explain that energy is transferred between organisms in food chains and webs; use this to: <ul style="list-style-type: none"> <li>relate the abundance and distribution of organisms to the resources available within a habitat;</li> <li>begin representation of this using pyramids of numbers and explain how pyramids of numbers represent feeding relationships in a habitat.</li> </ul>	9D  8D  8D	Revisit fieldwork? Do cells 4 first  Relate to 7D and what has already been done; main idea=populations
Particles 4 Year 8 Autumn term  (Continued on next page .....	Sc3	Describe a more sophisticated particle model for matter, recognising: <ul style="list-style-type: none"> <li>compounds consist of <u>fixed combinations</u> of different types of atoms that cannot be easily separated;</li> <li>atoms and combinations of atoms can be represented by symbols and formulae.</li> </ul> Use the more sophisticated particle model to explain how chemical reactions take place. Identify evidence which indicates that a chemical reaction has taken place, such as the association of energy transfer with chemical change. Recognise that chemical reactions can be modelled by assuming that atoms can rearrange themselves, and that this can happen in only a limited number of ways, for example, $A + B \rightarrow AB$ , $AB + CD \rightarrow AD + CB$ . Use the particle rearrangement model to:	8F (8E)  8F (8E)  8F (8E)  9H, 8F (8E)	Needs comprehensive revision of chemistry topics Much of the year 7 work F&E is taken further in year 8F and then into 9E and F

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.....continued) Particles 4 Year 8 Autumn term	3h 2g 3e, 3f  2i?	<ul style="list-style-type: none"> <li>predict the names and formulae for products that might be formed from given reactants;</li> <li>write word and symbol equations for some simple reactions;</li> <li>explain why mass is conserved in chemical reactions;</li> <li>explain how acids react with bases and neutralisation occurs</li> </ul> <p>[Fuels &amp; burning]</p>	9H, 9E (8E)  9E, 9H, 7F 9H 9E, 7E, 7F  7F/ 9H (9G)	9G is a problem but can do some burning here and also pick up in Interdependence 3??
Forces 4 Year 8 Autumn term	Sc4 2e 2f Sc2 - 2e  Sc4 - 2g	<p>Recognise how the turning effect of a force (moment) is related to the size of the force and the distance the force is from the pivot; use moments to explain how a simple object can be balanced. [Levers in the skeleton]</p> <p>Recognise how the effect of a force depends upon the area to which it is applied and that the force acting per unit area is called pressure; use the relationship to explain:</p> <ul style="list-style-type: none"> <li>the pressure exerted by solids;</li> <li>pressure within liquids and gases.</li> </ul>	9L  9L 9L / 7G	Gas pressure=particles colliding
Cells 5 Year 8 Spring term	Sc2 4a  4c	<p>Explain that the nucleus in a cell contains genes that control all the characteristics of the organism; use this to explain:</p> <ul style="list-style-type: none"> <li>fertilisation, where genes from one parent join with genes from the other to produce a new set of genes;</li> <li>how selective breeding, either by nature or by humans, can increase the chance of certain genes passing from parent to offspring.</li> </ul>	9A  9A  9A	Refer back to 7D where variation/inherited/environment first occur needs to be made specific And to 7B reproduction

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Interdependence 3 Year 8 Spring term	Sc2  5b  5d   5a	<p><i>Interdependence and energy</i> Explain that energy is transferred between organisms in food chains and webs and describe relationships of organisms in a food web and use these to explain:</p> <ul style="list-style-type: none"> <li>• why photosynthesis is important to humans;</li> <li>• why maximising human food production can significantly affect other animals and plants;</li> <li>• how the abundance and distribution of organisms may be affected by pesticides, weedkillers and the accumulation of toxins;</li> </ul> <p>Recognise the idea of energy conservation as a useful scientific accounting system when energy is transferred; use this to explain energy efficiency and energy dissipation (in food chains)</p> <p>Explain that habitats change in response to changes in physical, chemical and biological factors.</p> <p>Begin to describe a model for the whole environment that recognises how the materials that make up all living organisms are recycled, and that energy from sunlight flows through the system; use this to explain the need for sustainable development.</p>	9D  9D 9D  9D, 9G  9D	Emphasise <u>Energy</u> and link to Interd.2      Opportunity to relate to environment
Particles 5 Year 8 Spring term	Sc3	<p>Describe how metals react with:</p> <ul style="list-style-type: none"> <li>• oxygen, water, acids and oxides;</li> <li>• solutions of salts of other metals.</li> </ul> <p>Identify differences in reactivity of metals to construct a reactivity series; use this to explain uses of metals and make predictions about the reactions of metals.</p>	7F, 9E, 9F 9F 9F 9F	Opportunity to revisit some of particles 4, e.g. equations

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Forces 5 Year 8 Spring term	Sc 4: 4a 4b, 4d, 3b,  2b 4c, 4e, 4b  2b  4e	[Movement of the earth / apparent movement of sun and stars] [Relative position of earth, sun and planets in solar system] [Sun and stars are light sources / planets etc seen by reflected light]  Distinguish between mass and weight, giving examples Recognise that gravity is a force of attraction between objects, that this force is greater for large objects like the Earth but gets less the further an object moves away from the Earth's surface; use these ideas to explain: <ul style="list-style-type: none"> <li>• how weight is different on different planets;</li> <li>• how stars, planets, and natural and artificial satellites are kept in position in relation to one another.</li> </ul>	7L  7K  9J  9J 9J	7L links to Light luminosity, new idea =seasons
Energy 5 Year 8 Spring term	Sc4   5c  5g	Develop, from a simple model of energy transfer in electrical circuits, the idea of potential difference in electrical circuits. Use the model of energy conservation to explain how: <ul style="list-style-type: none"> <li>• the potential difference measured across cells or components shows how much energy is transferred from the cells to the current and from the current to the components;</li> <li>• electrical energy can be generated using fuels, including the energy transfers involved; recognise possible environmental effects of this.</li> </ul> Recognise the idea of energy conservation as a useful scientific accounting system when energy is transferred; use this to explain energy transfers in familiar situations, energy efficiency and energy dissipation.	9I  9I  9I 9G  9I	
Scientific enquiry 'Investigations' Year 8 Summer term (post-SATs)	Sc1 2a-2p	Investigating a question scientifically, planning, carrying out and obtaining evidence , considering the evidence and evaluating the investigation	9M	Opportunity to do some longer term investigational work to support/ finalise the teacher assessment (deadline is end of June)

This is intended to be a working draft document and I would welcome further comments / corrections before it becomes adopted as an Isle of Wight scheme. You can contact me at Thompson House (phone:529790 or preferably by e-mail [graham.burgess@iow.gov.uk](mailto:graham.burgess@iow.gov.uk) )

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Graham Burgess  
KS3 Science Consultant  
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