fortismere KS3 Science Curriculum Map 2020 - 21

Curriculum Intent

"If it disagrees with experiment, it is wrong. In that simple statement is the key to science.
It doesn't make any difference how beautiful your guess is, it doesn't matter how smart you are; who made the guess; or what his name is… if it disagrees with experiment, it's wrong.

That's all there is to it."

Richard Feynman (Nobel Laureate in Physics)

Our students will develop the skills and confidence to form ideas and theories of their own to resolve challenges, beyond life at Fortismere. Our alumni will evaluate the evidence and critically challenge the theories and preconceptions presented to them by the media and other sources both reliable and unreliable.

We aim to instil in our students the same passion for science that we as teachers have. Teaching materials are designed to both lay a firm foundation to a lifetime of scientific thinking and to enthuse this passion. We aim to integrate the key concepts in all of the sciences as well as the idea of 'working scientifically' to develop alumni who are: inquisitive; able to balance the strength of evidence and be confident in their scientific guesses.

The Key Stage 3 Science program of study is planned as a spiral curriculum that re-visits Big Ideas in Years 7 and 8: Energy; Forces; Electromagnets; Matter; Earth; Reactions; Organisms; Ecosystems; Genes. Our curriculum is based around these big conceptual ideas that provide an deepening understanding of the sciences; it helps students define the individual disciplines and supports them recognising and understanding their interconnectedness.
Each idea is divided into four smaller topics that are the building blocks of the Big Ideas. Within lessons we will teach knowledge and skills in the context of their application outside the laboratory and with reference to their impact on other subject areas of the school curriculum.

In seeking to transform lives, our curriculum has other aims: to understand and apply the nature of the scientific principle; develop the skills required to engage in scientific activity; appreciate the impact and relationship to other subjects in the curriculum (for example, engineering and mathematics); supporting our students' mastery of debate through the power of accurate scientific vocabulary and application of an evidence based approach.

<u>Scientific Enquiry:</u>
The teaching of Scientific Enquiry is integrated into the Big Ideas and sub-topic principles with identified 'key practicals' to ensure equality of opportunity for students. This is consolidated in a full investigation in Year 8 Summer Term 2: What affects the strength of an electromagnet? (TBC)

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Working scientifically is broadly categorised as:

Analyse	Communicate	Enquire	Solve
Analyse patterns	Communicate ideas	Collect data	Estimate risks
Discuss limitations	Construct explanations	Devise questions	Examine consequences
Draw conclusions	Critique claims	Plan variables	Review theories
Present data	Justify opinions	Test hypotheses	Interrogate sources

All aspects of scientific enquiry are studied throughout Year 7 & 8 but each half-term has a scientific enquiry theme where key concepts of that enquiry theme are revisited often.

Mastery of Ideas:
Mastery is the secure understanding of the Big Ideas. This is not only "Knowledge" of the skills and facts, but also the flexibility to "Apply" the knowledge across different contexts and situations. The power of fluency in scientific vocabulary is a knowledge/skill considered necessary for mastery.

Yr7 (KS3)	**Topic Area**	**Key knowledge/skills (what has to be learnt)**	**Examples of key compulsory practicals for students**	**Resources/support at home**
1	**Big Idea 3** **Energy 1** 3.1 Energy Costs (sub-topic 1) 3.2 Energy Transfer and Conservation of energy (sub-topic 2)	3.1 Calculating the costs (economic costs and health costs) of using the stored energy in food, fuels and natural resources. 3.2 The amount of energy in the Universe is the same but can be transferred from one energy store to another store in useful and unuseful ways.	**Practical: Food as fuel** Compare the energy content of different foods **Practical: Comparing efficiency of lamps** Measure the energy dissipated as heat of different household bulbs.	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
2	**Big Idea 8** **Organisms 1** 8.1 Movement	8.1 The levels of organisation in a human body and how our joints and muscles work	**Required enquiry skill AT2: Producing and recording a clearly focused image of an object** Examining plant and animal cells by mounting tissue on a slide and observing under a	Kerboodle suite:(online textbook and activities assigned by teacher)

	8.2 Cells	8.2 The function and structure of animal and plant cells. Comparing and explaining, using examples sampled and observed under microscope, the differences between specialised cells	microscope **Project: Model of Specialised Cell** Create a 3D model of a specialised cell. This should be in the style of a Science Museum display model including detailed explanations of the features and functions of a specialised cell.	BBC Bitesize KS3
3	**Big Idea 5** **Matter 1** 5.1 The Particle Model 5.2 Separating Mixtures	5.1 Understand why different substances can be categorised as solid, liquid or gas; explain the properties of each state of matter and what happens when substances change from one state to another using the ideas of particles and energy 5.2 How can substances be separated from their solutions; what affects the solubility of a substance	**Required enquiry skill AT 1: Heat a measured volume of water until almost boiling, having selected and used appropriate equipment** Making a prediction about diffusion and testing this prediction **Required enquiry skill AT 3: Find out at regular intervals** **the temperature of water being heated and tabulate** **observations to reveal the** **pattern** Which is the best temperature for making a cup of tea? **Required enquiry skill AT 4: Separate ingredients from mixtures using appropriate techniques such as evaporation, filtration, chromatography** Separate sea water using appropriate separation techniques **Practical**: **Distillation** Separate ink and water by distillation **Practical**: **Chromatography analysis of different colour inks** Determine by chromatography which inks are solutes	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
4	B**ig Idea 7 Earth 1**	7.1		Kerboodle suite:(online

	7.1 Rocks 7.2 The Universe	How we classify rocks How materials are recycled in the rock cycle 7.2 Understanding the scale and size of our Solar System and galaxy; understanding how the movement of the Earth and Moon explains the seasons and the observations we make of the Sun and the night sky; understanding why it is hotter in August than in December in Britain but the other way around in Australia; Understanding that ideas about the Universe have changed based on new evidence.		textbook and activities assigned by teacher) BBC Bitesize KS3
5	**Big Idea 9 Ecosystems 1** 9.1 Interdependence 9.2 Plant Reproduction	9.1 Understand competition for resources that occurs within the organisation of an ecosystem; understand how small changes, such as infection or human interference with the environment, can affect the populations of the ecosystem 9.2 Understand how wind and insect pollinated flowers reproduce by studying the steps of reproduction from pollination to fertilisation	**Practical: Flower dissection** Follow instructions to dissect a flower and examine the reproductive organs and features of a plant.	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
6	**Forces 1** 1.1 Speed 1.2 Gravity	1.1 Understand that the change in movement of an object requires force and that this force can be contact or non-contact; Calculate the resultant force on objects and predict the determine the motion of the object; explain how to tell the story of the motion of an object using the average speed equation and distance-time graphs 1.2 Understand that the gravitational force of weight acting on our bodies is the same force that acts on all the bodies in the Solar System and know how to calculate the weight of any object with mass	**Practical: Measuring force** **Required enquiry skill AT 5: Measure the speed of a moving object using appropriate equipment** Investigating the average speed of a trolley on a ramp	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
7	**Big Idea 4 Waves 1** 4.1 Sound	4.1 How do instruments create sounds? How do we hear those sounds? Understand how the frequency	4.2.2; 4.2.3 Drawing Wave diagrams (reflection/refraction)	Kerboodle suite:(online textbook and activities

	4.2 Light	and wavelength are linked mathematically and apply the knowledge of skills of describing sound waves to explain how our ears distinguish between sounds by their pitch and volume. 4.2 Why does the lightning arrive before the thunder? Understand how we see luminous and non-luminous objects of different colours and how shadows cause eclipses; Understand that the wave model explains the behaviour of light when it is reflected by surfaces and refracted through transparent materials; understand how lenses can correct imperfect vision	**Practical:** Investigating Reflection **Practical:** Investigating Refraction **Practical:** Modelling the Eye and the Camera	assigned by teacher) BBC Bitesize KS3
8	**Big Idea 6 Reactions 1** 6.1 Acids and Alkalis 6.2 Metals and Non-metals	6.1 Understand the difference between physical (change of state) and chemical changes (reactions); understand how to test and compare acids and alkalis (bases) and name some typical household examples; explain how salts can be formed during useful neutralisation reactions 6.2 Understand how bases and salts can be formed during the reactions of metals and non-metals; use established observed trends and the relative position in the reactivity series to predict whether reactions will take place and the likely products	**Required enquiry skill AT 6: Measure changes in the pH of solutions using indicators** 6.1.3 Measuring pH changes **Required enquiry skill AT 7: Observe and investigate a range of chemical reactions using equipment appropriately** 6.2.6 Interpreting chemical reactions	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
9	**Big Idea 2 Electromagnets** 2.1Potential Difference and Resistance 2.2 Current	2.1 Understand that potential difference tells you about the force on the charges in a circuit and about how energy is transferred; state that current flows when there is a potential difference across a conductor; measure the potential difference and calculate the resistance of components in a variety of circuits, identifying patterns 2.2 Understand that current is a rate of flow of charged objects and happens because of a potential	**Required enquiry skill AT 8: Build electrical circuits using various components and measure current and voltage using an ammeter and voltmeter** Investigating the resistance of conducting dough **Required enquiry skill AT 9: Represent and interpret a range of simple circuit diagrams using appropriate symbols**	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3

		difference; be able to determine the current in a circuit using the resistance equation and measurement; understand how insulators become charged and how the discharge current can be hazardous	Should be a component of every electrical circuits practical in Years 7&8. **Practical**: charging and discharging insulators and using a model to explain the observations.	
10	**Big Idea 10 Genes 1** 1.1 Variation 1.2 Human reproduction	1.1 Observe categorise and analyse variation in populations and suggest how variations can be considered adaptations to the environment in an ecosystem	Collecting variation data (Tabulating, Recording, graph drawing)	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
Yr8 (KS3)	**Topic Area**	**Key recovery knowledge/skills (what <u>has</u> to be learnt)**	**Examples of key compulsory practicals for students**	**Resources/support at home**
1	**Big Idea 3 Energy 2** 3.3 Work 3.4 Heating and Cooling	3.1 Use work done = force x distance to compare the work done by different machines; explain using the application of W=fd and the conservation of energy how levers and pulleys can make a physical job easier. 3.2 Describe the ways that energy can be transferred using particle and wave models; explain how each energy transfer can be insulated and the importance of tis in our home.	**Class practical:** Students measure the time for their body heat to raise the temperature of a thermometer using choice of 3 different conduction materials (aluminium; cotton; polyester; wool) **Class practical:** IR radiation absorption and boiling tubes painted silver/black	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
2	**Big Idea 5 Matter 2** 5.3 Elements 5.4 Periodic Table	5.3 Understand how substances are made of atoms and describe the difference between elements and compounds; describe the structure of polymers and their uses; know the relationship between the chemical formula of a substance and composition/ratio of atoms of the substance 5.4 Understand how the periodic table was created and the relationship between the position of the element and its properties; describe and explain the patterns of reactivity in key Groups (1, 7 and 0) and predict the products of reactions of those elements.	**Teacher Demo:** Group 1 reactions (alkali metals) **Class practical:** Identify trends and make predictions based on the some Group 7 (halogens) reactions.	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
3	**Big Idea 8 Organisms 2**	8.3 Understand the mechanisms for breathing and	**Required enquiry skill AT 10: Carry out**	Kerboodle suite:(online

	8.3 Breathing 8.4 Digestion	gas exchange; understand the effects of recreational drugs, alcohol and smoking on the human body 8.4 Test common foods to identify the main food types and discuss what constitutes a healthy or unhealthy diet; understand the physical and chemical processes that take place in the digestive system of the human body that provide reactants for reactions such as respiration	**practical procedures using instructions without guidance and in a calm fashion with due regard to the safety of others:** Testing foods for nutrients	textbook and activities assigned by teacher) BBC Bitesize KS3
4	**Big Idea 7 Earth 2** 7.3 Climate 7.4 Earth resources	7.3 Understand what global warming is and how the changing levels of greenhouse gases alongside humanity's disruption of the Carbon Cycle, affects the temperature of the Earth's atmosphere within a year and over the last 200 years; know the evidence and arguments used to link climate change to global warming and human behaviour 7.4 Understand the methods that extract useful, sometimes rare, elements are from ores and be able to explain the importance of recycling methods.	**Class practical:** Thermal decomposition of carbonates **Class practical:** exothermic and endo thermic reactions	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
5	**Big Idea 1 Forces 2** 1.3 Contact and non-contact forces 1.4 Pressure	1.3 Understand how friction and drag affect s resultant forces and motion, and how to reduce it when it is not useful; understand reaction forces and describe how forces can deform objects and determine based on experimental results whether objects obey Hooke's Law; use the principle of moments to explain why objects fall over and calculate the moment of forces on a lever or children's see-saw. 1.4 Be able to describe the cause of pressure in fluids and how atmospheric pressure varies with altitude; understand how liquids can transmit pressure in a useful way; understand that pressure increase with depth and that this causes upthrust; explain what is meant by stress and how footwear or vehicles are adapted to minimise stress on surfaces	**Required enquiry skill AT 10: Carry out practical procedures using instructions without guidance and in a calm fashion with due regard to the safety of others:** 1.3.1 Investigating non-contact forces	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3

		Both: Using pressure equations to fluid pressure on surfaces and stress pressure on solid surfaces		
6	**Big Idea 9 Ecosystems 2** 9.3 Interdependence 9.4 Photosynthesis	9.3 Describe the processes aerobic and anaerobic respiration transfer energy from food to be used for growth, movement and repair; understand how different exercises/activities will involve aerobic and anaerobic respiration; describe how the fermentation processes of making bread, beer and wine 9.4 Describe how plants produce food by photosynthesis and how the structure of a leaf is adapted for photosynthesis; investigate the limiting factors of photosynthesis and how farmers can maximise plant growth		Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
7	**Big Idea 4 Waves 2** 4.3 Wave effects 4.4 Wave properties	4.3 describe how waves can transfer energy and how microphones detect sound waves; state what ultrasound is and how it is used in medicine and industries; describe the electromagnetic spectrum and relate uses and dangers to the energy of the wave 4.4 Use the wave model to: compare transverse and longitudinal waves; describe what happens when waves reach a surface or boundary and when superimpose.		Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
8	**Big Idea 10 Genes 2** 10.3 Variation 10.4 Human reproduction	10.3 With reference to examples such as the peppered moth and Darwin's finches, describe the theory of natural selection and evaluate the evidence for natural selection the process of evolution; explain how extinction can occur and describe humanity's interference in ecosystems has endangered some species and how we can preserve biodiversity in other endangered species. 10.4 Describe the relationship between genes,		Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3

		chromosomes and DNA and how DNA structure was discovered; explain how characteristics are inherited and predict the probability of specific characteristics, such as eye colour, being inherited by offspring; describe, ising examples of plants and/or animals, how a product is genetically modified and the potential advantages.		
9	**Big Idea 6 Reactions 2** 6.3 Types of reaction 6.4 Chemical energy	6.3 Describing chemical reactions in terms of atomic models and predicting the products of reactions such as combustion and thermal decomposition; use the law of conservation of mass to explain observations and calculate the mass of reactants and products; write balanced symbol equations for chemical reactions 6.4 Explain exothermic and endothermic reactions with reference to bond energies and represent the reactions using energy level diagrams	**Practical**: Displacement reaction patterns nd trends	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
10	**Big Idea 2 Electromagnets 2** 2.3 Magnetism 2.4 Electromagnetism	2.3 Describe how magnets interact and use magnetic field models to explain strength of fields and observations about the Earth's magnetic field 2.4 Constructing and investigating the strength of electromagnets; describing how electromagnetic devices such as bells and loudspeakers work.	**Required enquiry skill AT 10: Carry out practical procedures using instructions without guidance and in a calm fashion with due regard to the safety of others:** All practicals in topic **Full investigation:** What affects the strength of an electromagnet?	Kerboodle suite:(online textbook and activities assigned by teacher) BBC Bitesize KS3
Yr9	**Topic Area**	**Key recovery knowledge/skills (what has to be learnt)**		**Resources/support at home**
See GCSE info for Bio/Chem/Phys				