Science Long Term Plan

Long term plan for KS3, KS4 combined, & KS4 separate

Contents Page:

Click the home icon on any page to return here.

Key Pages:

KS3

Long term plan: Topic overview KS3

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year seven					
C1 C2 C3 C4	B1 B2 B3 B4	P1 P2 P3 M1			
Year eight					
P4 P5 P6 P7	C5a C6 C7 C8 C9 C5b	B5 B6 B7 B8 B9			
Year nine					
B10 B11 B12 B13	C10 C11 C12 C13	P8 P9 P10 P11			

Year 7 Long term plan: Physics

Brief overview
Year 7 Physics begins by studying two of our most important core concepts – force and energy. The unit starts by checking KS2 knoweldge and distinguishing force from other concepts related to motion. The early lessons on force are designed to displace commons around force and motion. This is done by exploring equilibrium situations between weight and the normal contact force before studying the effect of friction in some depth. The second half of P1 develops students concept of energy as the "cost" of getting things done before exploring the different energy stores and simple transfers qualitatively. P2 gives students a deeper understanding of two "waves" (term not introduced) that they will have encountered at KS2 – sound and light. The unit explores how both transmit information from source to observer and dissipate (spread out) with distance from a source. Our final unit of Y7 looks at temperature through students knowledge of the particle model (from C1) and use it to explain the idea of heating and thermal stores of energy.

Unit	P1	P2	P3
Unit title	Force and energy	Sound and Light	Heating and cooling
Big question/ core concept	Why do things move and change? Core concepts: force and energy	How does information and energy spread? Core concept: waves (term not introduced in unit)	What is matter? Core concept(s): matter and energy
Relevant end points	• Objects at "equilibrium" the forces on it are balanced • Unbalanced forces cause a change in motion • Friction is a force that acts against motion • Energy stores can be used to predict how much a system can change	• Sound and light transfer information from source to observer • Both sound and light radiate from a source and become more spread out with distance.	• (Particle model of) temperature • (Particle model of) Thermal stores of energy
Core substantive knowledge	• Forces are represented with arrows and measured in newtons • Difference between force and (momentum) • Weight is a force that is pulling down • The normal contact force keeps objects in equilibrium if they are resting on a solid surface. • An object at equilibrium can be moving or stationary • The force of friction acts against motion • Fuels are "used up" but energy is transferred • Key energy stores and describing transfers	• Vibrating sources produce sound • Sound travels through a medium as vibrations • Sound travels best through mediums in their solid or liquid states • Light can reflect or "scatter" off surfaces. • The passive eye model of sight • Sun light as "white light" and how colours of light combine • Why objects appear coloured under different sources of light	• What temperature is • Thermal expansion (and how a thermometer works) • Heating as an energy transfer • Dissipation of heat • Thermal conduction • Insulators
Core disciplinary knowledge	• Representation in physics (force diagrams) • **Investigations**: controlling variables • **Analysis** of data to draw conclusions • Physics uses **mathematical** models to explain changes • Forces are an explanation which applies to a very wide range of situations • Energy is a **model** not an explanation	• **Measurement**: using a prism to observe the spectrum of light (evidence of "white" light) • **Procedures:** how to use a ray box to investigate light • **Measurement:** observations of objects under different colours as evidence of how we perceive colour using information from light	• How a thermometer **measures** temperature • **Measurement**: how to measure temperature • **Analysis**: and interpretation of line graphs

Year 7 Long term plan: Biology

Brief overview
Year 7 biology begins by revisiting students knoweldge of organisms as "living things" which show the "characteristics of living organisms" before using extensive microscope work to establish a more meaningful criteria for life – being made of cells. Students look at classification of animal cells and plant cells (including why this can be challenging) and the basic structures of these cell types. They idea of the cytoplasm and cell membrane are developed by linking to students knoweldge of the particle model to build an explanation for diffusion into and out of cells. Unit B3 develops these ideas to look at how organ systems in the human body work together to provide the substances needed for respiration to every cell. Units B2 uses the family to build a concept of genetic inheritance and the genome, including how genetics and the environment shape similarities and differences in the family. B4 looks are variation within species and how species has changed over time – including how biologists gather and interpret evidence. B4 includes students first longer form investigation at KS3.

Unit	B1	B2	B3	B4
Unit title	Cells the unit of life	Inheritance and the genome	From cells to organ systems	Variation through time
Big question/ core concept	What are organisms made of Core concept: cells	How do organisms grow and reproduce? Core concept: inheritance	What are organisms made of? Core concept: cells	Why are organisms so diverse? Core concept: evolution
Relevant end points	• All life is made of cells • Microscopes can be used to observe cells • Cells are dynamic and exchange substances with their surroundings	• All organisms in a species show variation • Variation can be caused by genetic information, the environment or both • Our genome is inherited from our parents (50% from each)	• Multicellular organisms contain organ systems • Organ systems have a specific function • Organ systems work together to maintain the conditions of life for all cells	• Members of a species can reproduce fertile young • Genetic inheritance only occurs across generations within a species • Species have gradually changed over billions of years
Core substantive knowledge	• Seven characteristics of living organisms • Typical structures of animal and plant cells • Basic functions of sub-cellular structures • Cytoplasm is a dynamic fluid (particle model) • Diffusion – particle model explanation • Structure of cell membrane enables transport of small molecules.	• Genome is all the genetic information in an organism • Role of environment and genetic inheritance in explaining similarity and difference in families • Genome is stored on DNA in the nucleus of (most) body cells • DNA is organised into chromosomes • DNA is a class of chemical and can be extracted	• Levels of organisation in animals and plants • Mechanism of breathing and adaptions for gas exchange • Structure of digestive system and function of small intestine • Role of enzymes in producing small nutrients which can be absorbed • Role of circulatory system • Role of muscular skeletal system	• Variation can be continuous or discrete • Definition of a species • Scientists use fossil evidence to study the past • Most fossils are mineralised remains of hard body parts • The fossil record is incomplete
Core disciplinary knowledge	• **Procedures** for preparing and viewing tissue slides • **classification** into animal and plant cells • **Models** can be used to explain processes (diffusion) • Biologists study life at the level of cells and biological molecules	• **Investigation:** how to follow a written method • How evidence was used to establish a **model** of DNA • There is a cross over between the study of chemistry and biology when looking at biological molecules	• Dissection provides **qualitative** evidence of the internal structure of organisms • **Models** can help us explain the functioning of biological systems • Biologists have to source organisms for dissection **ethnically** • Biologists can study live at different levels of organisation	• Collection of large-scale **quantitative** data for **analysis.** • Difference between correlation and cause • **Analysis:** Conventions for producing scatter graphs. • Collection of data (fossils) to look for **qualitative** changes

Year 7 Long term plan: Chemistry

Brief overview
Year 7 begins by giving students a observable characteristic used to identify a substance (melting point behaviour) and an experience of observing the difference between a substance and a mixture. This distinction is built up by working through separation techniques first encountered in KS2. Students will learn that substances (not materials) can exist in all three states of matter and how this relates to the particle model. Once students have built a sense of concept for "substance" we look at some different ways substances are classified by their structure and properties. C2 also introduces the representation of substances using formula. C3 develops the idea that substances have distinct properties by looking at solubility and introducing students to how properties can be quantified and represented on graphs to explore trends and make predictions. C4 builds up students concept of "chemical change" giving students experience of thinking using the chemistry "triplet" – observations, representations and sub microscopic models.

Unit	C1	C2	C3	C4
Unit title	Substances and mixtures	Substances	Solubility	Introducing chemical change
Big question/ core concept	What are substances? Core concept: Substance	What are substances? Core concept: substance What gives substances their properties? Core concept: Bonding (holding power)	What are substances? Core concept; substance What gives substances their properties? Core concept: bonding (holding power)	What is chemical change? Core concept: chemical change
Relevant end points	• Most materials are mixtures • Materials made of single substance start and finish melting at the same temperature • Every substance has a melting point	• Substances can be classified into different groups by their properties and structure • Substances are made of atoms • Substances melting points depend on their sub-microscopic structure	• Every substance has a measurable solubility in water. (This is distinct property of a substance)	• Atoms are rearranged to form new substances • New substances formed in a chemical change have new properties
Core substantive knowledge	• Substances can exist in three states of matter • Mixtures can be separated into substances • Different techniques separate different types of mixture • Solutions are clear mixtures of a solvent and solute • Particle model for liquids solids and gases • Brownian motion	• Substances are made of atoms • Elements can be metals of non-metals • Metals have giant substances so have high melting points • Non metals have molecular structures so have low mpts • Substances can be compounds or elements • Chemical reactions can rearrange atoms to form new substances	• Properties can be measured and given numerical values • Solubility of a substance depends on temperature • Dissolving happens without stirring • Dissolving is the result of the intrinsic motion of particles in the liquid state	• Word equations • Symbol equations • Particle representations of symbol equations • Multipliers (molecular substances) • State symbols • Conservation of atoms/mass in a chemical change • Precipitation (if insoluble products formed)
Core disciplinary knowledge	• Simple procedural processes for separation **techniques** • Particle **model** (as model of the sub macroscopic) • **Investigation:** Brownian motion as observational evidence of particle model	• Chemicals use symbols and formula to **represent** substances • Chemists **classify** substances into groups based on properties and structure • Chemists **classify** changes as physical or chemical	• Chemists quantify solubility **mathematically** to show trends • Graphs are used to analyse trends mathematically and make predictions • How to interpret and **analyse** graphs • That chemists make use measurement **techniques**	• Chemists link the representational, sub microscopic model and observations Reinforcing: • **Representational** • Sub microscopic **Models** • **Observations (**qualitative)

Year 7 Long term plan: “Materials science”

Brief overview
After their end of year 7 exams students study a short unit on materials science. This aims to reinforce students knoweldge of our big question “what are substances” by using the concept of “substance” to inform students understanding of what a “material” is. Studying material science provides an opportunity to discuss the technological products of scientific knoweldge.

Unit	M1
Unit title	Substances and mixtures
Big question/ core concept	What are substances? Core concept: Substance
Relevant end points	• Most materials are mixtures • Materials made of single substance start and finish melting at the same temperature • Substances rather than materials have clearly defined “states of matter”
Core substantive knowledge	• Materials are classified based on their properties • Materials are usually made of more than one substance • Composite materials are made of more than one material • Properties of ceramics, metals and polymers • Gels and pastes are a mixture of substances in solid and liquid states
Core disciplinary knowledge	• Materials science is an “inter-disciplinary” field of science • Chemists' **classification** of states of matter applies to substances rather than materials • Materials scientists have their own forms of **classification** based on what they are studying

Long term plan: Year 7 breakdown by lesson

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
L1. Introduction to science L2. KS2 Chemistry prior knoweldge test. (optional formative) **Topic C1: What are substances and mixtures** L1. What is a chemical substance? L2 Are all materials pure substances? L3. Do substances disappear when they dissolve? L4. Can we prove if an ink is a mixture? L5. What is melting? L6. What is boiling? L7. How does a filter work? L8. Can we prove gases are made of moving particles? L9. Can we separate salt from the sea? L10. Can we separate a mixture of liquids? L11. Can we separate the cherry from cherry coke? (optional) L12. End of topic test C1 L13 Master and feedback **Topic C2: What are substances?** L1. What are elements? L2. Why do metals have high melting points? L3. Why are there so many substances? L4. How are compounds and mixtures different? L5. How do chemists represent substances?	***C2 continued*** L6. What do chemical formulas represent? L7. What is the difference between chemical and physical change? L8. How do chemical changes form new substances? L9. EOTT What are substances. L10. Feedback and mastery **Topic C3: Solubility** L1. Why do some substances dissolve L2. How can we increase the solubility of a substance? L3. How do we use graphs of solubility (optional) **Topic C4: What are chemical reactions?** L1. How do we represent chemical change? L2. How can equations help us observe reactions? L3. What do symbol equations represent? L4. What happens to mass in a chemical reaction? (optional) L5. How does the solubility effect our observations of reactions? L6. What happens to mass in a reaction (Pt2 if complete optional lesson). L7. EOTT C4 L8. Feedback and mastery **Topic B1: Cells – the unit of life** L1. What makes something alive L2. What are all living things made of? L3. What are animals made of? L4. What are plants made of? L5. Why can we not see cells with out eyes?	Mid year OCL assessment **B1 cont.** L6. How many types of cell are there? L7. How does a cell get what it needs to stay alive? L8. How do substances move in and out of a cell? **Topic B2: Inheritance and the genome** L1. What makes us all unique? L2. What characteristics can be inherited L3. Where is our genome stored? L4. Can we 'extract DNA? L5. EOTT B1 & B2 L6. Mastery and feedback **Topic B3: From cells to organ systems** L1. What are we made of? L2. What are other organisms made of? L3. How do our lungs work? L4. Why do we need to breathe? L5. How does our digestive system work? L6. How does our digestive system keep us alive? L7. How do substances get around our body?	**Topic B3 continued.** L8. Why do we need a circulatory system? L9 Are our bones made of cells? L10 How do we move? L11 (Optional) Rat dissection L11. EOTT B3 L12. Mastery and feedback **Topic B4: variation.** L1. What makes individuals in a species different? L2. How can we investigate variation? L3. How can we represent variation? L4. What are fossils? L5 What can the fossil record show us? L6. EOTT Variation L7. Mastery and feedback **Topic P1: Forces & energy** L1. What are forces? L2. How do we represent forces? L3. How can we stop things falling? L4. Why does the motion of objects change? L5. Can we predict how an objects motion will change?	***P1 continued*** L6. How does friction affect motion? L7. Can we reduce friction? L8. Which lubricant is the most effective (Investigating friction Pt 1) L9 – Which lubricant is the most effective (Investigating friction Pt 2) L10. What is the cost of moving an object? L11. What are the different stores of energy? L12. When is energy transferred L13. Why do moving objects heat up? L14. How do we describe energy transfers (optional) L15. EOTT P1 L16. Mastery and feedback **Topic P2: Sound and light** L1. How is sound produced? L2. How does sound travel? L3. Why do we get shadows? L4. How does light fill a room? L5. Why are some objects reflective? L6. How do we "see" objects	End of year OCL assessment ***P2 continued*** L7. How do we get different colours of light? L8. What colour is sun light? L9. Why do some objects appear black or white? L10. Why do some objects appear coloured? L11. EOTT Sound and Light L12 Mastery & feedback **Topic P3: Heating and cooling** L1. What is temperature? L2. How do thermometers work? L3. Why do hot objects cool down?? L4. Why are some materials good conductors? L5. What is a thermal store of energy? L6. Why are some materials better at storing energy? (optional) **Topic: Material science** L1. What is the difference between substances and mixtures? (optional) L2. Why might two materials be combined? L3. How can materials be classified? ~~L4 Gels and paste (optional)~~ L5 Do all plastics have the same properties? (optional) L6 Do all polymers have the same properties pt2 (optional)

Year 8 Long term plan: Physics

Brief overview				
We start by introducing one of our big questions (space) that students will not have covered since KS3. This first topic uses prerequisite knowledge of forces and radiation to build a sense of where we are in the universe and how the motion of bodies in space shapes our perspective. The remaining topics develop big questions that were first encountered in Y7. "Why do things move and change" l being covered in both P5 and P7. P5 looking first at ideas around motion and distance time graphs before P7 looks at explaining common scenarios using force such a surface supporting a weight; extension of a springy material and levers. Unit P6 returns to the idea of the ray model of light deepening students understanding of how light radiates and exploring the different ways "images" can be produced. Students also learn how to use ray boxes and lasers to investigate images, reflection and refraction.				
Unit	**P4**	**P5**	**P6**	**P7**
Unit title	Where are we in space?	Force and motion	How do we make images?	More on Forces
Big question/ core concept	Where are we in space? Core concepts: Space	Why do things move and change? Core concepts: force and energy	How does information and energy spread? Core concept: waves	Why do things move and change? Core concepts: force and energy
Relevant end points	• The Earth is a sphere, and we live on its surface • Gravity exerts a pulling force towards the centre of an object and is dependent on its mass • The orbits of planets are caused by gravity	• Distance = speed x time • Distance time graphs can be used to represent the motion of an object • Acceleration is a how quickly the speed of an object is changing	• Light rays are imaginary lines which show the path and direction light can travel along • Light can produce 'images' of real objects in different ways	• Weight (N) = mass x strength of gravity • Simple machines (levers) can increase the turning effect of a force • The extension of a spring is proportional to the force exerted on it
Core substantive knowledge	• Stars are nuclear stores of energy that radiate light • Night and day are caused by the rotation of the earth • Seasons are caused by changes to the "tilt" of the earth as it orbits the sun • The solar system is a tiny part of a much larger galaxy • The universe is all of space and everything in it	• A horizontal line on a D-T graph shows an object is stationary • A straight-line sloping shows an object moving at a constant speed • A curved line shows an object that is accelerating • Drag is the result of particles exerting a pushing force on an object	• Why a pin hole camera (or eye) produces images which are upside down and back to front • The law of reflection (angle of incidence = angle of reflection • Light refracts (changes direction) • Lenses can refract light and produce an image	• Mass is a measure of the "amount" of matter in a material. Units: Kg • The force needed to support an object is equal to its weight • Turning force = force x distance from pivot • Elastic objects can return to its original size and shape after being distorted. • Surfaces produce a "contact force" because they become squashed at a microscopic level
Core disciplinary knowledge	• Gravity is an example of a powerful physics **explanation** in that applies in all known situations everywhere in the universe	• **Mathematical formulation**: many ides in physics can be expressed as mathematical equations • **Analysis:** the conventions for representing and interpreting movement using DT graphs	• Light rays are a way of **modelling** the behaviour of light • **Mathematical formulation**: many ideas in physics can be expressed as mathematical equations • **Procedures:** How to use lasers and ray boxes to investigate light • Independent and dependent variables in investigations & **reproducible experiments**	Graphs allow us to spot patterns and **analyse** data • A straight line on a graph shows the change in the dependent variable is proportional to the change in the independent variable • A curved line shows the change in the dependent variable is not proportional to the change in the independent variable

Year 8 Long term plan: Chemistry

Brief overview`
Year 8 develops the fundamentals established in Y7 to explore how chemistry shapes our planet. We start and finish with unit C5 (part A and B) which begins with looking the structure of the earth (or geosphere) and how it has changed over geological time scales (dynamic earth). Students look at minerals as an example of substances with a "giant" crystal forming structure. This unit is broken into two sections which bookend Y8 chemistry. Between parts A and B of unit C5 students revisit chemical change to look at types of chemical reaction – including neutralisation and other reactions of acids in C9. We then introduce two other important parts of the earth, its hydrosphere (liquid water) and atmosphere, before concluding by looking at physical weathering, the role of acid rain in chemical weathering and sedimentary rocks. C8 revisits Y7 work on energy transfers in the context of chemical reactions.

Unit	C5 (Parts a & b)	C6	C7	C8	C9
Unit title	How is our planet changing?	What types of chemical reaction are there?	What are the atmosphere and hydrosphere?	How is energy transferred in chemical reactions?	How do acids react?
Big question/ core concept	What is the Earth made of and how is it changing? Core concepts: Dynamic Earth	What is chemical change? Core concepts: chemical change	How does chemistry effect our world Core concept: Chemical earth	What is chemical change? Core concept: chemical change	What is chemical change? Core concepts: chemical change
Relevant end points	• The geosphere is made of different minerals • Rocks are a mixture of minerals • The surface of the earth is slowly changing as a result of physical and chemical processes	• Mass is conserved in all chemical reactions • That reactions can be classified into different types	• That the atmosphere is the mixture of gases surrounding the earth • The hydrosphere is all the water on earth • How water cycles the earth	• That energy is transferred to and from the surroundings during chemical change	• Acids can react with alkalis and metals • That solutions can be acidic or alkaline • The acidity / alkalinity of a solution is measured by the pH scale
Core substantive knowledge	• Earth's internal structure. • How the main three types of rocks are classified • How the three main rock types are formed • Difference between chemical & physical weathering • Earth's surface is made of slow-moving tectonic plates	• The characteristic features of the following "types" of reaction - Combustion - Oxidation - displacement - Thermal decomposition • That mass is conserved during thermal decomposition reactions	• Why water evaporates and clouds form. • The hydrosphere includes salt water; fresh water (surface or ground); and water vapour • The composition of today's atmosphere • .Human activity adds visible and invisible pollutants into the atmosphere	• That energy is transferred from the internal (chemical) store to the surroundings in an exothermic change • That energy is transferred form the surroundings to the internal (chemical) store of the products during an endothermic change	• A salt and water are formed in a neutralisation reaction • A salt and hydrogen are formed when an acid reacts with an alkali • Pollution can form acid rain which reacts with rocks and damages wildlife
Core disciplinary knowledge	• Earth scientists classify rocks according to their structure • The term "mineral" has a specific meaning in the earth sciences community	• Chemists classify chemical reactions into different types. • Diagrams of the sub-microscopic can be used to **model** reactions • Reactions can be **represented** in different ways	• That scientific **conclusions** are based on experimental evidence that can be reproduced by other teams	• `Chemical investigation involves careful **measurement** and recording • To measure a change in temperature you must measure before and after	• Chemical **techniques** can be used to **identify** a substance or the properties of a mixture • Diagrams of the sub-microscopic can be used to **model** reactions • Reactions can be **represented**

Year 8 Long term plan: Biology

Brief overview
Y8 biology starts by exploring the concepts of health and disease in students first exploration of the big question "What keeps organisms healthy?". Other units start students journeys into other big questions. "How organisms grow and reproduce?" is studied in unit's B6. Y8 ends with "Why do organisms depend on each other and their environment?" with students being introduced to a basic understanding of the concept of "interdependence" ahead of a more detailed journey into ecology in Y9. Our short unit on "biochemistry" consciously follows our Y8 units on chemical change enabling students to appreciate the links between disciplines. This looks at a few of the key chemical reaction in cells – drawing students attention to the sub-microscopic world of substances within cells now their chemical schema is more developed.

Unit	B5	B6	B7	B8	B9
Unit title	What keeps us healthy?	How do organisms grow and reproduce?	How do we classify living things?	What is the chemistry of living things?	What are ecosystems?
Big question/ core concept	What keeps organisms healthy? Core concepts: Health	How do organisms grow and reproduce? Core concepts: inheritance	Why are organisms so diverse Core concept: Evolution	What are organisms made of? Core concept: The cellular basis of life	Why do organisms depend on each other and their environment Core concept: interdependence
Relevant end points	• Health is defined as physical and mental well being • .Disease can be caused by pathogens, environment, our genome or lifestyles • Only diseases caused by pathogens can be infectious	• Multicellular organisms primarily grow by cell division • All new cells are produced from existing cells dividing • Growth & development are part of an organisms life cycle • Organism reproduce sexually or asexually	• Organisms are classified based on observable characteristics and cell structure • Organisms are classified into five kingdoms • Humans are part of the kingdom "animalia"	• Producers make glucose by photosynthesis • All cells transfer energy by respiration for their life processes	• Biomass and energy are passed along food webs. • All ecosystems depend on producers • Decomposers recycle materials in an ecosystem
Core substantive knowledge	• Asthma is a disfunction of our lungs • The percentage of carbohydrate, lipid and protein in a balanced diet • Cause of obesity & deficiency diseases • How fitness contributes to good health • Food is a source of energy (a chemical store)	• Parts of human male and female reproductive systems. • Role of the menstrual cycle • What fertilisation is • How the body supports foetal development during pregnancy • How plants can reproduce sexually or asexually	• Organisms are classified hierarchically into groups • The distinction between scientific and common names	• Word equation for photosynthesis • Word equation for aerobic respiration • Why anaerobic respiration (in humans) is less efficient • Where respiration and photosynthesis happen in a cell	• Producers make all the biomass in an ecosystem. • Many plants rely on animals for pollination or seed dispersal • Population sizes of different organisms are dependent on each other
Core disciplinary knowledge	• How to measure resting heart rate and lung volume • How to measure the energy in food by simple calorimetry • Biologists **communicate** their research to improve human health	• Biology is studied as at different **levels** including the organism, interactions between organisms and organ systems	• Biologists use systems to **classify** all organisms • Use of keys in **classification** • A continuous **cycle** of collecting and analysing data constantly improves classification systems	• Biology is studied as at different **levels** including the chemistry of living things	• Biology is studied as at different **levels** including how different organisms interact in an ecosystem • Simple means of investigating seed dispersal

Long term plan: Year 8 breakdown by lesson

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
P04 Where are we in space L0 Introduction to space (**optional**) L1, What are days, months and years? L2. What is gravity? L3 How does Gravity affect the solar system? L4 Why does the night sky change? (**optional**) L5 How big is space? L6 Why do we get seasons? L7 Why it is hotter in summer? (investigation) (**optional**) L8 EOTT L9 Mastery and feedback **P05 Moving by force** L1 What is speed? L2. How do we describe speed? L3 What do distance -time graphs tell us? L4 How does force affect motion? (**optional**) L5 What is acceleration? L6 What causes drag? L7 How do parachutes work? L8 Investigating drag in different fluids (Pt 1) L9 Investigating drag in different fluids (Pt 2) L10 What is relative motion? L11 Moving by Force EOTT L12 Mastery and feedback	**P06 Making images** L1 How do pin hole cameras work? L2 Using pin hole cameras (**optional**) L3 What are reflections? L4 What is the "law" of reflection? L5 What is "refraction"? L6 How do we investigate refraction? (**optional**) L7 What are lenses? L8 How does the eye work? (**optional**) L9 EOTT Making images IL0 Mastery and feedback **P07 More on forces** L1 What causes weight? L2 How do we calculate weight? L3 How does a bridge supports an objects weight? L4 Investigating bridges (**optional**) L5 How does a floor support a weight? L6 How does force affect a spring? L7 How does a wire support an objects weight? (**optional**) L8 How do levers work? L9 Investigating moments of a force (**optional**) L10 EOTT More on forces L11 Mastery and feedback **C5 (part a) How is our planet changing?** L1. Wha is rock? L2 What are minerals? L3 What is the geosphere made of? L4 How is the surface of the earth changing?	**Mid year OCL assessment** L5 Why do tectonic plates move (**optional**) L6 How are igneous rocks formed? L7 Can rocks be transformed? **C6 What types of chemical reaction are there?** L1 What are chemical reactions (**optional**) L2 What is combustion? L3 What are oxidation reactions? L4 Why does oxidation increase mass? (**optional**) L5 What is a displacement reaction? L6 Why does displacement not effect mass? (**optional**) L7 What is thermal decomposition? L8 How does thermal decomposition effect mass? L9 EOTT What types of chemical reaction are there? L10 Mastery and feedback **C7 What are the atmosphere and hydrosphere?** L1 What gases make up our atmosphere? L2 How are we polluting our atmosphere? L3 Why does water evaporate? L6 Why does water evaporate faster on a hot day? (**optional**) L7 What are clouds? L8 What is the hydrosphere? L9 How do rocks store ground water (investigation) (**optional**) L10 How do humans contaminate ground water? (**optional**)	L11 How does water cycle the planet? L12 EOTT What are the atmosphere and hydrosphere? L13 Mastery and feedback **C8 How is energy transferred in chemical reactions?** L1 Energy stores and transfers (**optional recap**) L2 What is an exothermic reaction? L3 How do we measure an exothermic change? L4 What is an endothermic change? L5 Measuring an endothermic change (**optional**) **C9 How do acids react?** L1 How can we identify acidic and alkaline solutions? L2 What is the pH scale? L3 What are neutralisation reactions? L4 How can we show an acid is neutralised (practical) (**optional**) L5 How is acid rain formed? L6 Investigation: what rocks does acid rain react with? (**optional**) L7 How do acids react with metals? L8 EOTT How do acids react L9 Feedback and mastery **C5 (part b) How is our planet changing?** L1 How does rain weather rocks? L2 What is the difference between weathering and erosion? L3 How are sedimentary rocks formed?	L4 Why are fossil fuels found in rocks? L5 EOTT How is our planet changing L6 Mastery and feedback **B5 What keeps us healthy?** L1 What is "good health"? L2 What causes disease? L3 What is asthma? L4 What is Covid-19? (**optional**) L5 How do we get the nutrients we need? L6 What is malnutrition? L7 How much energy is in food? L8 Investigating energy in food L9 What is fitness? L10 Investigating fitness (**optional**) L11 EOTT: What keeps us healthy L12 Feedback and mastery **B6 How do organisms grown and reproduce?** L1 How do multicellular organisms grow? L2 Do animals have similar life cycles? L3 Do flowering plants have similar life cycles? L4 How does the male reproductive system work?	**End of year OCL assessment** L5 How is the female reproductive system work? L6 How does a baby develop? L7 How do plants reproduce? L8 What is in a seed (Seed dissection) (**optional**) L9 EOTT growth and reproduction L10 Mastery and feedback **B7 How do we classify living things** L1 How do biologists classify organisms L2 How does the classification system work? L3 Where do humans fit in the classification system? **B8 What is the chemistry of living things?** L1 How do producers make glucose? L2 Where does photosynthesis happen in a leaf? (**optional**) L3 How do cells transfer energy? L4 What reactions happen in plant cells? L5 Can our cells respire without oxygen? **B9 What is an ecosystem?** L1 What are food webs? L2 How do food webs affect populations? L3 Why does an ecosystem depend on producers? L4 How are flowers pollinated, and seeds dispersed? L5 What happens to dead organisms? L6 How can we estimate population size pt1 (**optional**) L7 How can we estimate population size pt2 (**optional**)

Year 9 Long term plan: Biology

Brief overview				
Our journey through biology in year nine is held together through a focus on micro-organisms. We begin by returning to the study of cells and looking at how technological advance has enabled biological understanding to develop. We look at three classes of organisms for the first time: protists, Eubacteria and archaea. This supports our second unit looking at pathogens and examples the diseases they cause. B12 and B13 fit together – first looking a the vast biodiversity on Earth then studying how it has evolved over huge time scales.				
Unit	**B10**	**B11**	**B12**	**B13**
Unit title	What are micro-organisms?	What causes disease?	Why do organisms depend on their environment?	How do species evolve?
Big question/ core concept	What are organisms? Core concept: cellular basis of life	What keeps organisms healthy? Core concept: Health	Why do organisms depend on each other and their environment? Core concept: interdependence	Why are organisms so diverse? Core concept: Evolution
Relevant end points	• Cells are eukaryotic or prokaryotic • Prokaryotic organisms are unicellular and have no true nucleus • Water moves in and out of cells by osmosis. • Classification of: Fungi, prokaryotes (true bacteria and archaea), protist by their cellular structure	• Pathogens are micro-organisms (bacteria, fungi protists or viruses) that cause disease • Viruses cause disease by reproducing rapidly in the body destroying cells • Bacteria cause disease by reproducing rapidly in the body and releasing toxins	• Biodiversity is the variety of all living species • Populations change in response to environmental changes • Human activities can increase or decrease biodiversity • Conservation protects biodiversity	• Natural selection causes advantageous traits to become more common over time • Evolution takes place over generations • Scientists explain the observed evidence of evolution using the theory of natural selection
Core substantive knowledge	• Development of microscopes • Relative resolution and magnification of electron microscopes • Magnification calculation • Electron microscopes resolution • Role of ribosomes • Role of Enzymes in cells • Yeast as a fungi • Aerobic and anaerobic respiration in yeast • Differences between bacteria and archaea	• Factors effecting human health • Effect of alcohol and tobacco misuse on health • Bacteria are important in digestion. • Examples of human and plant diseases caused by pathogens • The role of contraception in preventing STI's • Antibiotics only target bacterial infections & painkillers only treat symptoms • Role of immune system + chemical and physical barriers to infection	• Abiotic and biotic factors • Ecosystem organisation (population, community and ecosystem) • Organisms are adapted to their environments and effect their environments • Interdependence of organisms within an ecosystem • Populations can only adapt slowly to environmental change.	• Organisms can be classified based on their sub cellular structures into kingdoms and domains • Organisms within populations compete for resources • Populations show genetic variation which can be inherited • Some organisms have characteristics that enable them to compete for resources more effectively • Organisms that are better able to survive are more likely to reproduce. • Humans' evolutionary history
Core disciplinary knowledge	• The **procedure** for using a light microscope • How to **categorise** organisms into bacteria and protists • The significance of the microscope in developing the discipline of biology	• **Analysis** of graphs showing population data related to health and disease.	• Biologists have different **levels of study** including studying changes in populations • **Analysis** of graphs showing population changes within an ecosystem	• Biology works in **continuous cycles** of collecting evidence and improving classification systems. • Our understanding of evolutionary history is constantly improved by continuous cycles of collecting evidence and improving theories.

Year 9 Long term plan: Chemistry

Brief overview`
Y9 chemistry develops students' knowledge of our three core chemistry big questions. We start by returning to the idea of separating mixtures first encountered in students first Y7 science unit. Students develop their depth of knowledge of the particle model to explain state changes and focus other procedural steps behind key separation techniques. We then develop our knowledge of the periodic table for the first time – exploring how it arranges atoms by both chemical and physical properties before introducing the information it holds on atomic structure. We then focus in on the chemical properties of metals to focus in on the concepts of "reactivity" and rate of reaction before returning to the idea of atomic structure to develop the concept of "chemical bonding" from earlier ideas about "holds between particles." In year nine knowledge of bonding is limited to metallic bonding (group 1) and bonding in covalent molecules (group 7). This builds students link between the "sub molecular" structure and bonding and macro properties of key periodic groups.

Unit	C10	C11	C12	C13
Unit title	How do chemists' separate mixtures?	How is the periodic table arranged?	Which metals are the most reactive?	Why does electron configuration matter?
Big question/ core concept	What are substance? Core concept: substance	What are substances? Core concept: substance	What is chemical change?	What gives substances their properties?
Relevant end points	• State changes can be explained using the particle model. • Different separation techniques are used to separate different types of mixture. • Distillation separates substances by their boiling point • Chromatography can be used to identify the substances in a mixture	• All elements are represented on the periodic table. • There are trends in the physical properties of groups of elements. • Elements are arranged by atomic number and chemical properties. • Structure of an atom in terms of protons, neutrons and electrons.	• Metals react with acids to produce hydrogen and a salt. • Metals can be ranked by reactivity based on how quickly they react. • Rate of reaction measures the amount of product produced per unit time. • Different factors can affect the rate of a reaction.	• Atoms of different elements have different electronic configurations • Metals form positive ions • Metals have high melting points because they have giant metallic structures. • Halogens have low melting points because of the weak forces between molecules
Core substantive knowledge	• Detailed knowledge of separation technique procedures including • Fractional distillation of crude oil separates different fractions by their boiling points. • A change of state is shown by a horizontal line (temperature stays constant) on a cooling curve. • Calculating solubility in grams per dm^3 • Calculation of Rf values from chromatograms	• Elements are organised on the periodic table by their characteristic properties. • Atoms are arranged by atomic number • Atomic and mass number can be used to calculate the number of subatomic particles in an atom of an element • Chemical properties of groups 1, 7 & 0	• Reactivity of group 1 elements with water increases down the group • More reactive metals can displace less reactive metals • Displacement can be used to extract some metals form their ores • increasing surface area increases the rate of a reaction • Catalysts increase the rate of a reaction by providing an alternative path with a lower E_a.	• Metals lose electrons when they react and form positive ions. • Reactivity down group one increases as the outer electron is further from the nucleus.. • Metals have giant structures with strong attractions between positive ions and delocalised electrons. • Halogens are molecular substances made of two atoms joined by a covalent bond.
Core disciplinary knowledge	• Knowledge of apparatus and techniques relevant to the core separation techniques (not including fractional distillation or use of fractionating columns)	• The periodic table became accepted as it enabled predictions to be made that were verified by later discoveries. • The periodic table was developed as new scientific discoveries were made	• The classification of metals into a group enables chemists to collect data and identify trends. • Knowledge of metals reactivity enables humans to extract useful metals from rock	• Chemists use models of the sub-microscopic structure and bonding in substances to explain their macro (observable) properties)

Year 9 Long term plan: Physics

Brief overview
Year 9 is when we develop two of our more challenging core concepts – waves and electricity. We cover electricity later in KS3 as students are more experienced in practical work and better prepared to work with electrical equipment. We use a simple "hoop" model to support students making sense of the relationship between potential difference, current and resistance. Students have ample opportunity to explore these concepts in simple circuits before returning to look at parallel circuits. Students also look at "waves" having looked at light rays and "sound" in year 7 & 8. The topic focuses on mechanical waves leaving electromagnetic waves to KS4. We support students in relating particle vibrations to wave terminology and representation. Y9 finishes by developing the concept of "electromagnetism" before concluding with a short unit on forces.

Unit	P8	P9	P10	P11	P12
Unit title	How do electrical circuits work?	What are mechanical waves?	What are parallel circuits?	What are magnetic fields?	Why do objects sink or float?
Big question/ core concept	What is electricity and magnetism Core concept: electromagnetism	How does energy and information spread? Core concept: waves	What is electricity and magnetism? Core concept: electromagnetism	What is electricity and magnetism? Core concept: electromagnetism	Why do things move and change Core concept: forces
Relevant end points	• Current is the rate of flow of electric charge • Increasing potential difference increases current • Increasing resistance decreases current • Circuits transfer energy from a source to components	• Mechanical waves can be transverse or longitudinal • Mechanical waves transfer energy and information not matter • Mechanical wave transfer through particle vibrations	• Circuits can be parallel or series • Parallel circuits have more than one loop of charge • Potential difference is measured in parallel • Rules for describing potential difference and current in parallel circuits	• Magnetic objects are surrounded by magnetic fields • A second magnet will experience a non-contact force if placed in a magnetic field • Current generates a magnetic field (electromagnetism)	• Objects sink if they are heavy for their size • Upthrust is the force produced by a fluid on a submerged object. • Air pressure causes a force at 90^{O} to a surface. • Pressure is explained by the particle model
Core substantive knowledge	• Current = charge / time • Potential difference = current x resistance • How to use component symbols to draw circuit diagrams of series circuits • Static electricity is caused by the interaction between electric charges	• Waves on water and ropes are transverse • Sound waves are longitudinal • Definition of wavelength and amplitude • Wave speed = distance / time • Definition of frequency • Wave speed = frequency x wavelength	• The voltage across each branch on a parallel circuit is equal to the voltage of the source of potential difference. • The sum of the currents pushed through each branch is equal to the current through the battery	• Magnets have a permeant magnetic field • The shape of a field around a bar magnet, wire and solenoid • Magnetic materials generate a magnetic field when near a magnet • N and N and S and S poles repel • N and S poles attract • Electromagnets are made of a solenoid and an iron core.	• The pressure experienced by a surface = force / area • Buoyancy is caused by the force of upthrust on an object • Objects sink if their weight is larger than the upthrust from a fluid • Air pressure is caused by particle collisions • Pressure increases with depth
Core disciplinary knowledge	• Circuit diagrams are representations which show some elements of circuits at the expense of others. • Circuit diagrams follow strict conventions so they can convey information accurately	• Experience of using ripple tanks to explore water waves • Waves are represented as wave forms or wave front diagrams	• Physicists take measurements more than once and calculate an average to minimise the effect of random error • We take measurements to describe what is happening in electrical circuits	• Measuring and recording independent and dependent variables	The particle model is a powerful explanation which applies in many scenarios

Long term plan: Year 9 breakdown by lesson

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
B10 – What are microorganisms? L1 – How do we use a light microscope? L2 – Observing plant cells. (optional) L3 – What is osmosis? L4 – Why do plant cells need a cell wall? (optional) L5 – What are fungi? L6 – Why is yeast useful? L7 – How have microscopes improved? L8 – Why do cells need ribosomes? L9 – What lives in moss? (optional) L10 – What are protists? L11 – How can we calculate the size of micro-organisms? L12 – What are bacteria? L13 – How are Prokaryotes adapted to their environments? L14 – How are prokaryotes and eukaryotes different? L15 – EOTT L16 - Mastery **B11 – what causes disease** L1 – What is good health? (optional) L2 – How does smoking cause disease? L3 – How does alcohol cause disease? L4 – What are pathogens? L5 – How does the body prevent infection? L6 – What diseases do virus cause? L7 - How can we reduce STD's? L8 – What diseases do bacteria cause? L9 – How do we prevent and treat disease? L10 – What causes malaria? L11 – How does the immune system work? L12 – How do plants prevent infection? L13 – EOTT L14 - Mastery	**B12 – Why do organisms depend on their environments?** L1 – What is an ecosystem? L2 – What factors effect ecosystems? L3 – What environments exist within ecosystems? (optional) L4 – How are organisms adapted to their environments? L5 – How do organisms effect their environment? L6 – How does environment effect population size? L7 – How can wolves maintain an ecosystem? (optional) L8 – What is biodiversity? L9 – Why is biodiversity in crisis? L10 – What is conservation? L11 – EOTT L12 – Mastery **B13 – How do species evolve?** L1 – How do we classify organisms? L2 – Do classification systems change? L3 – What are species? L4 – What variation can organisms inherit? L5 – Why are some organisms more likely to survive? L6 – What is natural selection? L7 – What is evolution by natural selection? L8 – Where did homo-sapiens come from? (optional) L9 – EOTT L10 – mastery **C10 – How do chemists' separate mixtures?** 01 – How do we explain state changes? 02 – What is a cooling curve 03 – How do we identify single substances? 04 – How do we calculate the solubility of a solution? 05 – How can a solute be separated from a solution? 06 – How do we interpret chromatograms?	Mid point assessments **C10 – How do chemists' separate mixtures?** 07 – Do leaves contain different pigments (optional) 08 – What is simple distillation? 09 – Distillation of water and ink 10 – What are miscible and immiscible mixtures? (optional) 11 – What is fractional distillation 12 – How do we separate crude oil into different fuels? 13 – EOTT 14 – Mastery **C11 – How is the periodic table arranged?** L01 – What are elements on the left of the periodic table like? L02- Are there patterns on the periodic table? L03 – How can we use the trends in group 0 to make predictions? L04 – Why do group 1 have higher mpts than group 7? (optional) L05 – How is the periodic table arranged L06 – What are the properties of group 1? L07 – What are the properties of group 7 L08 – Practice balancing equations (optional) L09 – How did the periodic table develop? L10 – What is the structure of an atom? L11 – Why are atoms neutral? L12 – EOTT L13 – feedback and mastery	**C12 – Which metals are the most reactive?** L01 – How do we compare the reactivity of metals? L02 – How do group one metals react with water? L03 – What is the reactivity series? L04 – How can displacement reactions provide evidence of reactivity? L05 – How do we extract metals from the earth? L06 – How do we measure the rate of a reaction? L07 – How does surface area affect rate ? L08 – What are catalysts? L09 – EOTT L10 - Mastery **C13 – Why does electron configuration matter?** 01 – Electronic configuration of atoms? 02 – The periodic table and electron configuration? 03 – Why are group one metals reactive? 04 – Why do metals form positive ions? (optional) 05 – Why do metals have high melting points? 06 – What gives metals their properties? 07 – Why do group 7 have low melting points? 08 – EOTT 09 – mastery **P08 – How do electrical circuits work?** L01 – What are circuits? L02 – How do circuit diagrams represent circuits? L03 – What is current?	**P08 – How do electrical circuits work?** L04 – What materials are conducting? L05 – How do we calculate current? L06 – What is voltage? L07 – Why do devices have voltage ratings (optional) L08 – Investigating the effect of voltage on current (optional) L09 – What is electrical resistance? L10 – How do voltage and resistance affect current? L11 – How does a battery store energy? L12 – What is static electricity? L13 – EOTT L14 – Mastery **P09 – What are mechanical waves?** L01 – What are water waves? L02 – investigating water waves (optional) L03 – What is a sound wave? L04 – Comparing mechanical waves L05 – How can we represent transverse waves? L06 – How can we represent sound waves? L07 – How can we calculate wave speed? L08 – What is frequency? L09 – What is the wave equation? L10 – EOTT L11 – Mastery	End of year exams **P10 – What are parallel circuits?** L01 – What are parallel circuits? L02 – What are the rules for potential difference in parallel circuits? L03 – Investigating: rules for p.d in series and parallel circuits (optional) L04 – How does current flow in parallel circuits L05 – Investigating current in parallel circuits (optional) L06 –How is energy transferred in parallel circuits? L07 – Describing electricity in parallel circuits (optional) L08 – EOTT (self-marked) L09 – Mastery **P11 – What are magnetic fields?** L01 – What materials are magnetic? L02 – What is a magnetic field? L03 – What is electromagnetism? L04 – Comparing magnetic fields (optional). L05 – What is an electromagnet L06 – EOTT L07 – Mastery **P12 – Why do objects sink or float?** L01 – Why do some objects float? L02 – What property affects whether an object floats? L03 – What causes air pressure? L04 – How do we calculate the effect of pressure? (optional) L05 – What is convection?

KS4

Combined science

Long term plan: Topic overview combined science

Autumn 1			Autumn 2			Spring 1		Spring 2			Summer 1			Summer 2	
Year ten															
B14	B15	C14	C15	P13	P14	B16	B17	C16	C17	C18	P15	P16 & P17	P18	C19	C20 & C21	B18
Year eleven															
B19	C22	P19	mocks	B20		C23	P20	REVISION							

Year 10 Long term plan: Biology (combined)

Brief overview					
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.					
Unit	**B14**	**B15**	**B16**	**B17**	**B18**
Unit title	What are organisms made of?	Why are organ systems vital for life?	How does medicine keep us healthy?	What is bioenergetics?	How do changes impact ecosystems?
Big question/ core concept	What are organisms made of? Core concept: cellular basis of life	What are organisms made of? Core concept: Cellular basis of life	What keeps organisms healthy? Core concept: health	What are organisms made of? Core concept: cellular basis of life	Why do organisms depend on each other and their environment? interdependence
Relevant end points	• Multicellular organisms have specialised exchange surfaces so they can absorb all the substances they need by diffusion. • Three stages of the cell cycle • Specialised cells developed from stem cells by differentiation	• Enzymes activity can be explained using the “lock and key” model. • Defects in the heat can be treated using a range of surgical and nonsurgical techniques • How transpiration and translocation transport substances in pants	• How vaccination increases the response time of the immune system preventing illness • New drugs must pass preclinical and clinical trials testing for toxicity, efficacy and dose before being approved for use.	• Metabolism is all the reactions in a cell or organism. • How light intensity affects the rate of photosynthesis	• Sampling techniques are used to investigate population size and distribution
Core substantive knowledge	• Cells absorb substances and excrete remove by diffusion • How active transport moves substances against a concentration gradient. • Organisms with large SA : V ratios can absorb all they need by diffusion • Differences between adult, embryonic and meri stems cells • Therapeutic cloning • Advantages and disadvantages of using stem cells in medicine	• The role of amylase, lipase and proteases in digestion • Blood is a tissue comprised of specialist cells adapted to their function. • The names, roles and adaptations of the four main blood vessels connected to the heart. • The role of valves in the circulatory system • The risk factors and triggers for cancer. • Difference between benign and malignant tumours	• Vaccination reduces the spread of pathogens once a critical mass of the population is vaccinated. • Digitalis originates from foxgloves and aspirin from willow bark • Use of double-blind trials and placebos. • Stages of preclinical and clinical trials	• How temperature, CO_2 concentration and amount of chlorophyll affect the rate of photosynthesis • Interactions of factors affecting photosynthesis (HT) • Uses of glucose in plants • Inverse square law (HT) • How exercise creates an oxygen debt	• Abiotic and biotic factors can affect the population size and distribution of a species. • How carbon cycles through the biosphere, atmosphere and soil. • How the destruction of peat bog impacts biodiversity
Core disciplinary knowledge	• How to measure percentage increase in mass due to osmosis. • Biological research is shaped by ethical debates which inform the limits on research set down by governments.	• How continuous monitoring can be used to investigate the effect of pH on the action of amylase. • The positive tests for lipids, proteins and carbohydrates in food	• How peer review by scientific journals helps prevent false claims. • How double-blind trials provide a control group in drug testing	• How to investigate the effect of light intensity on the rate of photosynthesis	• How to estimate abundance using random sampling • How to use a belt transect to investigate distribution

Year 10 Long term plan: Chemistry (combined)

Brief overview
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.

Unit	C14	C15	C16	C17
Unit title	How do chemists use the periodic table?	What is chemical bonding	How do we calculate the "amount" of a substance?	How do we measure energy changes in chemical reactions?
Big question/ core concept	What are substances? Substances	What gives substances their properties? Bonding	What are substances? Substances (are measured in moles)	What is chemical change? Chemical change
Relevant end points	• The discovery of subatomic particles changed chemists' model of the atom • Differences between the plum pudding and nuclear model of the atom	• Ionic substances form crystals with high melting points bonded by strong electrostatic attractions between oppositely charged ions. • Non-metal atoms can be bonded by sharing electrons (covalent bonds) forming molecules or giant molecular structures. • Molecular substances have low melting points due to the weak forces between molecules.	• (HT only) the mole us the unit used to compare the amount of different substances • Mr of a substance can be calculated from the RAM of the atoms in its formula • (uncertainty included in C17)	• Energy changes in a reaction can be represented by reaction profiles • The energy change in a reaction can be compared by measuring the change in temperature • Bond enthalpies can be used to calculate the energy change in a reaction (HT)
Core substantive knowledge	• Discovery of electrons lead to JJ Thompsons plum pudding model • Rutherford's alpha particle scattering experiment led to the nuclear model • Atomic scale is measured in nm • Isotopes are atoms with the same number of protons but a different number of neutrons • Discovery of isotopes explained why Mendeleev has to switch the order of some elements when ordered by weight • RAM is an average that takes into account the abundance of different isotopes.	• Covalent bonds are a shared pair of electrons • Molecules can be represented by dot and cross diagrams • That polymers are very large molecules with higher melting points. • Properties of diamond and graphite • Properties of graphene and fullerenes • That molecular substances do not conduct, and ionic substances only conduct when molten or aq. • Ionic bonds can form via electron transfer • Group zero elements are unreactive as they have a full outer shell so do not easily share or transfer electrons	• Mass is always conserved in chemical reactions. • Mass can appear to change if one, or more, reactants or products is in its gaseous state. • Calculations of moles can be used to balance a chemical equation. • The (theoretical) mass of a product can be calculated using the ratios of a balanced equation if the moles of one substance is known. • A reactant that is completely used up in a reaction is a "limiting reactant" and controls the amount of product that can be produced	• Combustion, neutralisation are exothermic reactions • Thermal decomposition and citric acid and sodium hydrogen carbonate are examples of exothermic reactions. • Profiles can show the activation energy of a reaction and whether it transfers energy to or from the surroundings • All reactions conserve energy
Core disciplinary knowledge	• Experimental evidence of subatomic particles lead to the model of the atom being changed and replaced • How to represent nm in standard form as x 10^{-9}	• Bonding can be represented in different ways all models highlight some features at the expense of other features	• Moles (mol) is a chemical	• Measurement of a change in temperature by recording the temperature before and after. • Controlling variables

Year 10 Long term plan: Chemistry (combined)

Brief overview
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.

Unit	C18	C19	C20	C21
Unit title	What are chemical changes?	How do we use crude oil?	Why is our atmosphere changing?	What is chemical analysis?
Big question/ core concept	What is chemical change? Chemical change	How does chemistry affect our world? Chemical earth	How does chemistry affect our world? Chemical Earth	What are substances? Substances
Relevant end points	• Metals lose electrons when they react with oxygen to form ionic metal oxides • (HT) half equations can show whether an element is oxidised or reduced • Electrolysis can be used to split a substance into its elements using direct current	• Crude oil produces fuels and chemical feedstocks • Alkanes are used as fuels which can undergo complete or incomplete combustion. • Properties of alkanes depend on chain length • Alkenes are reactive hydrocarbons.	• The proportions of gases in our atmosphere have remained largely unchanged for 200 millions years • The role of volcanoes, cooling and photosynthesis in the formation of the atmosphere • The role of the green house effect in driving climate change	• Pure substances are made of a single substance represented by a chemical formula • Formulations are mixtures of substances designed to be useful products • Rf values can be used to identify substance in a mixture
Core substantive knowledge	• Neutralisation reactions can be represented by the equation $H^+ + OH^- \rightarrow H_2O$ • Ions in acidic and alkaline solutions • (HT) strong acids completely dissociate in solution. • Molten ionic substances can undergo electrolysis to produce a non-metal at the positive electrode and a metal at the negative electrode • Process for molten and aq electrolysis • Rules for determining the products of (aq) electrolysis. • (HT only) half equations	• The chain length of hydrocarbons affects their flammability, viscosity and boiling point. • Long chain hydrocarbons can be cracked to produce short hydrocarbons and alkenes • Shorter chain hydrocarbons are in higher demand for fuels. • Cracking can be done at high temperature or using a catalyst. • Alkenes turn bromine water colourless • Alkenes are used to produce polymers and as starting materials for many other chemicals	• Volcanoes release carbon dioxide and small amounts of nitrogen. • Cooling caused oceans to condense which dissolved CO_2 and precipitated carbonate sediments • Photosynthesis removed CO2 and released oxygen • Todays atmosphere is 80% nitrogen, 20 oxygen and trace amounts of CO2, water and noble gases. • Methane, water vapour and CO2 are green house gases • So2 and NOX are acidic gases produced during combustion. They cause acid rain and respiratory issues • Carbon monoxide is a toxic gas and soot causes global dimming and asthma	• Formulations are made by mixing substances in fixed proportions. • Examples of formulations are alloys, fertilizers, medicines, cleaning products and paints • Hydrogen, carbon dioxide, oxygen and chlorine gas tests.
Core disciplinary knowledge	• Procedure for producing a soluble salt from an acid and excess of an insoluble base • Procedure for conducting the electrolysis of a (aq) solution	• Carbon compounds are so important to society they have their own branch of chemistry “organic chemistry” • The petrochemical industry is a major driving force behind organic chemistry	• Peer reviewed evidence for the human contribution to climate change is overwhelming • Climate systems are complex and hard to model which creates uncertainties	• Procedure for producing and analysing chromatograms of ink formulations

Year 10 Long term plan: Physics (combined)

Brief overview
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.

Unit	P13	P14	P15
Unit title	How do we analyse energy changes?	How do we use electricity?	How do we explain the properties of matter?
Big question/ core concept	How do things move and change? Core concept: Force and energy	What is electricity and magnetism? Core concept: electromagnetism	What is matter? Core concept: matter
Relevant end points	• Energy is always conserved in a change • During any change, some energy is dissipated to smaller less useful stores in the surroundings by heating. • We can calculate the extent of any possible change using energy calculations • The sources of energy used to power society can be classified as renewable or non-renewable. • We can calculate the power and efficiency of an energy change.	• Resistance of a circuit can be increased by adding resistors in parallel and decreased by adding them in series • Diodes, bulbs and resistors have different IV characteristics. • The national grid uses transformed to transfer electricity over long distances with a high voltage to minimise energy lost by the heating effect of resistance.	• State changes conserve mass but change density as changes in the arrangement of particles change the volume of a material. • A pure substance will remain at the same temperature while is changing state as energy is transferred to or from its internal store.
Core substantive knowledge	• Energy can be transferred by forces, electric current or heating • Efficiency of energy transfers can be increased by lubrication and insulation. • Recognise and use the calculations calculating the energy in a gravitational, Elastic potential, kinetic, thermal store. • The procedure for completing two step energy transfer calculations when assuming a transfer is 100% efficient. • Calculation of the specific heat capacity of a solid material. • To know coal, oil, natural gas and nuclear sources of energy are finite. • Fossil fuels and nuclear power are reliable sources of power that can work day and night. They transfer large amounts of energy • To evaluate the use of renewable energy sources.	• The total resistance is equal to the sum of the resistances added in series. • The total resistance of a circuit is lower then the resistance of any one resistor connected in parallel. • Longer wires have a higher resistance then shorter wires. • To know how thermistors and LDR's can affect the current in a circuit • Step up transformers increase the voltage in overhead power lines. • Step down transformers decrease the voltage so it can be supplied safely to homes. • To recognise and use the equation for the heating effect of current working against resistance • The mains electricity supplied to homes is an alternating current with a voltage of 230V, a frequency of 50 Hz • To know the safety features of UK plugs • To calculate the power and efficiency of electrical devices	• If heating a substance increases the kinetic energy of particles it's temperature will increase. • If heating a substance changes its state the energy is transferred to the potential store of the particles and the temperature does not change • Recognise and use the specific latent heat equation to calculate energy changes when a substance changes state. • Identify points on a cooling curve where a material is changing state
Core disciplinary knowledge	• Procedure for determining the specific heat capacity of a metal block.	• To know how to set up circuits to test I/V characteristics • To know the procedure for investigating effect of the length of a wire on resistance.	• Using a eureka can to calculate the density of irregular objects. • Using suitable appropriate apparatus

Year 10 Long term plan: Physics (combined)

Brief overview			
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.			
Unit	**P16**	**P17**	**P18**
Unit title	What is nuclear radiation?	What is electromagnetism?	What are electromagnetic waves?
Big question/ core concept	What is matter? Core concept: matter	What are electricity and magnetism? Core concept: electromagnetism	How does energy and information spread? Core concept waves (and energy)
Relevant end points	• Nuclear radiation is produced by the random decay of unstable atomic nuclei • Alpha, beta and gamma radiation are different types of radiation with different penetrating and ionising powers. • The decrease in radioactivity of a sample can be predicted using its half life	• To be able to represent the field lines when a) the field around two like poles interact b) two opposite poles interact • (HT only) The magnetic field around a wire will interact with a magnetic field to produce a force (the motor effect)	• EM waves are transverse waves that transfer energy and information from source to an absorber • All mater emits EM waves • The EM spectrum is continuous and all travels at the same speed in a given medium. • Waves in the EM spectrum are grouped by wavelength and frequency. • Lower frequency waves transmit less energy
Core substantive knowledge	• Activity is the rate unstable nuclear decay and is measured in (bq) • Structure, penetrating power and distance travelled in air of alpha, beta and gamma • Half life is the time for half the unstable nuclei in a sample to decay – it is constant for a given nuclei • Nuclear equations can be used to represent the changes in the nucleus during radioactive decay • Compare hazards from nuclear contamination and irradiation.	• To be able to represent a strong, uniform magnetic field. • To describe the field inside a solenoid as strong and uniform • (HT) To be able to predict the direction of a force on a wire caused by the motor effect using Flemmings left hand rule. • (HT) increasing the size of a current on length of wire in a magnetic field increases the strength of the force experienced by a wire • (HT) to recognise and use the magnetic flux density equation to calculate the force on a wire • (HT) to explain how the forces on opposite sides of a coil of wire (in a magnetic field) have a rotational effect	• The order (by frequency) of the EM spectrum wave types • The colours of the visible spectrum of light • (HT) different substances absorb, transmit or reflect different frequencies of EM waves • To construct wave diagrams to show refraction. (HT only - use wave front diagrams to explain in terms of changes to wave speed). • To know the dangers and uses of each type of EM radiation. • (HT) describe transmission of information via production and absorption of radio waves
Core disciplinary knowledge	• Geiger muller counters are used to measure radioactivity • Findings on the effects of radiation on humans should be published in journals and subject to peer review.	• Conventions for representing fields using arrows to indicate the direction of the force applied to an object.	• Use a signal generator to measure the wavelength, frequency of a wave on a string. • Use a ripple tank to measure the frequency, wavelength and speed of water waves • To investigate how different surface radiate heat using a Leslie cube

Long term plan: Year 10 (combined) by lesson

Autumn 1	Autumn 2	Spring 1	Spring 2
B14 – What are organisms made of? L1 – What is transported in and out of body cells L2 – How do unicellular organisms exchange what they need (SA:V) L3 – How are animals adapted for exchange? L4 – How can we measure water uptake in plant tissues (RP) L5 – RP results analysis L6 – How do cells transport substances from dilute solutions? L7 – How do multicellular organisms grow and develop L8 – How do organisms produce specialised cells? L9 – What are stem cells? L10 – How do scientists use stem cells? L11 – EOTT L12 - mastery **B15 – Why are organ systems vital for life?** L1 – How does the digestive system work L2 – How do we test for different nutrients (RP 3) L3 – How do enzymes work L4 – Investigating the effect of pH on the activity of amylase (Rp Pt 1) L5 - Investigating the effect of pH on the activity of amylase (Rp Pt 2) L6 – What is the role of blood in the body? L7 – What us the structure of the human circulatory system L8 – How can we repair damage to the heart L9 – What causes cancer L10 – How do leaf tissues work together? L11 – How are substances transported in plants L12 – What is translocation? L13 EOTT L14 – mastery **C14 – How do chemists use the periodic table?** L1 – Why has our model of the atom changed? L2 – What are isotopes (and ions)?	**C15 – What is chemical bonding?** L1 – What gives salts get their properties? L2 – How can we represent ionic bonding? L3 – What gives molecular substances their properties? L4 – How can we represent molecules? L5 – What are polymers L6 – What do diamond and “pencil lead” have in common? L7 – What are graphene and fullerenes? L8 - C14 & 15 EOTT L9 - mastery **P13 – How do we analyse energy changes?** L1 – Gravitational and kinetic energy L2 – Gravitational and elastic potential energy L3 – Calculating changes in thermal energy L4 – Investigating heat capacity (RP Pt 1) L5 – Investigating heat capacity (RP pt 2) L6 – Power & efficiency L7 – Non renewable & renewable energy resources **P14 – How do we use electricity?** L1 – Resistors in series and parallel L2 – Investigating resistors (RP15a) L3 – How the length of a wire affects resistance (RP15 b) L4 – I-V characteristics L5 – Investigating I-V characteristics (RP16) L6 – How do thermistors and LDR’s affect circuits? L7 - What is mains electricity? L8 – How does the national grid supply electricity? L9 – How do we calculate the energy supplied by circuits? L10 – Energy and electricity topic assessment L11 – mastery	**B16 – How does medicine keep us healthy?** L1 – Communicable diseases (recap) L2 – How does vaccination prevent disease? L3 – How do we develop new drugs? **B17 – What is bioenergetics?** L1 – How does photosynthesis support a plants metabolism? L2- What affects the rate of photosynthesis? L3 – What is the inverse square law? (HT only) L4 – Photosynthesis RP (pt a) L5 – Photosynthesis RP (pt b) L6 – What is our metabolism? L7 – How does the body respond to exercise? L8 – EOTT (B16 & B17) L9 – mastery **C16 – How do we calculate the “amount” of a substance?** L1 – Why do some reactions appear to involve a change in mass? L2 – What is a mole? (HT) / What is relative formula mass? (FT) L3 – Using moles to balance equations (HT) / Percentage mass (FT) L4 – How can we calculate reacting masses? (HT) L5 – What is a limiting factor? (HT) *Sequence assumes one and a half weeks are taken for mid year assessments and preparation.*	**C17 – How do we measure energy changes in chemical reactions?** L1 – What are reaction profiles? L2 – Investigating temperature change (RP10 pt a) L3 – Investigating temperature change (RP10 pt b – Inc. uncertainty) L4 – Calculating energy transfers (HT only) L5 – EOTT (C16 & 17) L6 - mastery **C18 – What are chemical changes?** L1 – Oxidation of metals (FT) / How do metals react? (HT) L2 – Displacement reactions (FT / HT) L3 –Neutralisation reactions L4 - Producing a soluble salt (RP 8) L5 – pH scale & strong acids L6 – Molten electrolysis L7 – Electrolysis to produce aluminium L8 – Electrolysis in solution L9 – Electrolysis (RP 9) L10 – EOTT L11 – Mastery **P15 – How does the particle model explain the properties of matter?** L1 – Particle model and density L2 – Density RP L3 – Changes of state and specific latent heat L4 – Cooling curves

Long term plan: Year 10 (combined) by lesson

Summer 1	Summer 2
P16 – Radiation L1 – Radioactive decay L2 – How did we discover the structure of atoms? L3 - What are nuclear equations L4 – What is the half life of a sample L5 – Risks of nuclear radiation L6 – Assessment point (P14 &15) L7 - mastery **P17 – Magnetism** L1 – How do magnetic fields interact? L2 – Predicting the force produced by a current (HT) L3 – Explaining the motor effect (HT) **P18 – What are electromagnetic waves** L1 – RP 20 – waves on a string L2 – RP 20 – Ripple tank investigation L3 – Electromagnetic waves L4 – Uses and risks of EM waves L5 – Producing EM waves (HT only) L6 – Refraction L7 – RP 21 (Leslie cube) L8 – Assessment P16 & 17 L9 Mastery **C19 – How do we use crude oil?** L1 – What does crude oil contain? L2 – How do the properties of hydrocarbons vary? L3 – How are alkenes produced? *Sequence assumes three weeks are taken for EOY exams + one week is taken for work experience during summer term.*	**C20 – Why is our atmosphere changing?** L1 – How did our atmosphere develop? L2 – What is the greenhouse effect? L3 – How are humans driving climate change? L4 – How are we polluting our atmosphere? **C21 – What is chemical analysis?** L1 –What are formulations? L2 – How do we analyse chromatograms? L3 – RP 12 - chromatography L4 – How can chemists identify a gas? L5 – EOTT C19, C20 & C21 L6 – Mastery **B18 – How do changes impact ecosystems?** L1 – Factors affecting populations L2 – RP 7 (part a) L3 – RP 7 (part b) L4 – How does carbon cycle through an ecosystem? L5 – Impact of land use: Peat bogs

Year 11 Long term plan: Biology (combined)

Brief overview		
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.		
Unit	**B19**	**B20**
Unit title	How do organisms inherit characteristics?	How do we control our bodies?
Big question/ core concept	How do organisms grow and reproduce? Inheritance	What are organisms made of? Cellular basis of life
Relevant end points	• Meiosis is the production of gametes • Fertilization is the fusion of two gametes. • When gametes fuse, we inherit one allele of each parent. • Selective breeding is the process were humans breed animals and plants for characteristics • Genetic engineering adds a new gene to an organism's genome • Fossils and multiply resistant bacteria are evidence for evolution. • Mutations are the source of all genetic variation • Genetic model of inheritance (for characteristics controlled by a single gene)	• Homeostasis is the regulation of the bodies internal conditions to provide the optimal conditions for enzymes and cell processes • Homeostatic processes are controlled by our endocrine and nervous systems. • All control systems have receptors that detect stimuli, coordination centres and effectors. • Nervous responses are fast and short lived • Hormonal responses are slower and longer lasting
Core substantive knowledge	• Meiosis produces four genetically varied haploid cells • DNA is a polymer formed of two strands. It has a double helix shape • A gene is a small section of DNA that codes for a specific protein • Alleles are different versions of a gene and can be recessive or dominant. • Body cells have two copies of each gene and can be homozygous or heterozygous • Dominant alleles are always expressed • Mutations occur continuously. Most mutations have no effect on phenotype, but all genetic variation is caused by mutations. • Humans selective bread animals for increased milk or meat yield; dogs for a gentle nature; crops for disease resistance and garden plants for large or unusual flowers. • (HT) process of genetic engineering. • There are benefits, risks and ethical concerns around genetic engineering. • Fossils a	• The CNS consists of two coordination centres – the brain and the spinal cord • The structure of a reflex arc including synapses and that it bypasses the conscious parts of the brain. • How insulin and glycogen (HT only) regulate blood sugar levels. • Causes and treatments for type one and two diabetes. • How oestrogen, progesterone (LH and FSH – HT only) control the menstrual cycle. • Hormonal and barrier contraception • Hormonal fertility treatments (HT only)
Core disciplinary knowledge	• Biologists have to carefully consider how organisms are treated during research into genetic engineering. • Biologists must communicate about their work in a way that is accessible to audiences beyond the scientific community	• Investigation into whether caffeine affects reaction time. • Use of a placebo group in a double-blind trial

Year 11 Long term plan: Chemistry (combined)

Brief overview		
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.		
Unit	**C22**	**c23**
Unit title	How far and fast can reactions go?	How do we use the earths resources?
Big question/ core concept	What is chemical change? Core concept: Chemical change	How does chemistry affect our world? Chemical Earth
Relevant end points	• Increasing concentration or pressure increase rate of reaction as particles are closer together, so successful collisions are more frequent • Temperature increases the rate of a reaction as the particles move faster and have more energy so there are more frequent collisions and a higher percentage of collisions that are successful. • Some reactions are reversible. • Reversable reactions reach equilibrium in a closed system	• Potable water is safe to drink. It may contain some dissolved minerals • Pure water contains no dissolved minerals. It is used in chemical analysis • Waster water has to be treated before it can be released • Water is a renewable resource • Metal ores are a finite resource • Life cycle assessments can be used to evaluate the environmental impact of a product by accounting for: extraction and processing of raw materials, its manufacture, its use, its disposal
Core substantive knowledge	• Increasing temperature has a larger effect on rate than increasing surface area, pressure or concentration. • Collision theory is used as a model to explain changes to rate. • If a reversable reaction is exothermic in the forwards direction it is endothermic in the reverse direction. • Equilibrium will shift to counteract a change in concentration, pressure or temperature (HT only).	• Fresh water can be made potable by filtering, sterilising with chlorine • Salt water has to be desalinated by distillation or reverse osmosis. This requires lots of energy. • Wastewater is screened, sedimented (into effluent and sludge) then digested by anaerobic (sludge) and aerobic bacteria (effluent) • The carbon footprint of a product is the carbon dioxide and other greenhouse gases released over its lifetime. • Extraction of low-grade copper ore by phytomining and bioleaching (HT) • We can preserve limited resources by reducing use, reusing and recycling. • Metals and glass can be melted and reformed into products (recycled)
Core disciplinary knowledge	• Procedure and controls for measuring the rate of a reaction which produces a precipitate using a disappearing cross method. • Procedure and controls for measuring the rate of a reaction which produces a gas using an inverted measuring cylinder or gas syringe. • Procedure for measuring the rate of reaction using change in mass. • Calculation of average rate of reaction (1/t ; change in mass / t; change in volume / t)	• UI can be used to test if water has a potable pH • The mass of dissolved minerals in a sample can be calculated by evaporation then heating to constant mass. • Lab procedure for producing pure water by distillation.

Year 11 Long term plan: Physics (combined)

Brief overview		
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.		
Unit	**P19**	**P20**
Unit title	How do forces do work?	How do forces explain changes in motion?
Big question/ core concept	Why do objects move or change? Core concept: Force and energy	Why do objects move or change? Core concept: Force and energy
Relevant end points	• A resultant force will cause an object to change speed or direction • Describe and use the equation W = Fs to describe the mechanical work done by a force • To relate force applied to extension of a spring • Elastic distortion is directly proportional to the force applied	• Speed is a scaler quantity and velocity is a vector quantity • Acceleration is the change in velocity ÷ time taken • How to interpret velocity time graphs • Force = mass x acceleration • The force exerted by Object B on object A is equal in size but opposite in direction to the force exerted by A on B • (HT) momentum of an object = mass x velocity
Core substantive knowledge	• (HT) How to calculate a resultant force using vectors • (HT) How to draw free body diagrams • Weight can be considered to act from a single point. This is point is called the centre of mass of an object. • (Joules are derived from Nm's) 1 Joule = 1 Nm • Two forces are required to distort the shape of an object • The difference between elastic and inelastic distortion • That the limit of proportionality for an object represents the limit to which it can be extended elastically	• Vectors have size and direction. Scalers have size only • Distance is a scaler and displacement is a vector. • (HT only) area under a V-T graph is equal to the distance travelled. • Acceleration due to gravity (near the earths surface) is 9.8m/s2 • (HT) inertial mass = force / acceleration (= how difficult to accelerate) • Stopping distance = thinking distance + breaking distance • Factors that affect thinking and breaking distance • Typical human reactions times range from 0.2 to 0.9 seconds. • (HT) calculations showing conservation of linear momentum
Core disciplinary knowledge	• To know how to investigate the relationship between force applied and the extension of a spring • To know that taking repeat measurements and calculating an average reduces random error • Describing trends from graphs and tables.	• Investigating F = ma (effect of mass and acceleration) using dynamics trolleys and light gates • Evaluate measurements of reaction time

Long term plan: Year 11 (combined) by lesson

Autumn 1	Autumn 2	Spring 1
B19 – How do organisms Inherit characteristics? L1 – How are gametes produced? L2 – What determines sex? L3 – Understanding the human genome L4 – How are genes inherited? L5 – How are genetic disorders inherited? L6 – How do mutations drive evolution? L7 - What is our evidence for evolution? L8 – What is MRSA? L9 – What is selective breeding? L10 – What is genetic engineering (FT & HT versions) L11 – End of unit assessment L 12 – Mastery **C22 – How far and how fast do reactions go?** L1 –How can we calculate the rate of a reaction? (FT/HT versions) L2 – How do concentration, pressure and temperature affect rate? L3 – RP 11 – disappearing cross (part a) L4 – RP 11 – inverted measuring cylinder L5 – Reversible reactions & equilibrium L6 – How ds concentration and pressure effect equilibria? (HT only) L7 – How does changing temperature effect an equilibria? (HT only) **P19 – How do forces do work?** L1 – How do we determine a resultant force (HT/FT versions) L2 – How do forces "do work"? L3 – How do forces extend or compress a spring? L4 - RP 18 *Sequence assumes four weeks are taken for mock assessments across autumn 1 & 2.*	**B20 – How do we control our bodies?** L1 –What is homeostasis L2 – What is the endocrine system? (+ feedback systems) L3 – How do we control blood sugar levels? (FT/HT versions) L4 – How can we manage diabetes? L5 – How do hormones affect our sex? L6 – How do hormones control the menstrual cycle? (FT/HT versions) L7 – How can we control our fertility? (FT/HT versions) L8 – What is the role of the nervous system? L9 – Reflexes RP 6 L10 – End of unit assessment L11 – Mastery **C23 – How do we use the earths resources?** L1 – How do we produce potable water? L2 – How do we manage wastewater? L3 – Testing water samples: RP13 (pt a) L4 – Testing water samples (RP 13 (pt b) L5 - How can we reduce our use of resources?	**C23 – How do we use the earths resources?** L6 – How can we preserve metal ore supplies? (HT only) L7 – What is a LCA? L8 – EOTT C22-23 L9 – Mastery **P20 – How do forces explain changes in motion?** L1 – What is velocity? (HT: Inc. circular motion) L2 –Interpreting distance time graphs L3 – Calculating acceleration L4 – Interpreting velocity time graphs (pt 1) L5 – Newtons 1st and 2nd law L6 – RP 19 (part a) L8 – RP 19 (part b) L8 – Newtons third law L9 – Stopping: thinking distance & breaking distance L10 – Dangers of large decelerations L11 – Momentum (HT only) L12 – Unit assessment point (P19 & 20) L13 - mastery *Sequence assumes the last 1.5 weeks of spring one are taken by the paper two mock series.*

KS4

Separate science

Long term plan: Topic overview Separate science

Autumn 1			Autumn 2				Spring 1			Spring 2			Summer 1			Summer 2	
Year ten																	
B14	B15	C14	C15	P13	P14	C16	B16	B17	C17	C18	P15	P16	P17 & P18	C19	C20	C21	B18
Year eleven																	
B19	C22	P19	MOCKS	B20	C23	P20	P21	REVISION									

Year 10 Long term plan: Biology (separate)

Brief overview		
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.		
Unit	**B14**	**B15**
Unit title	What are organisms made of?	Why are organ systems vital for life?
Big question/ core concept	What are organisms made of? Core concept: cellular basis of life	What are organisms made of? Core concept: Cellular basis of life
Relevant end points	• Multicellular organisms have specialised exchange surfaces so they can absorb all the substances they need by diffusion. • Three stages of the cell cycle • Specialised cells developed from stem cells by differentiation	• Enzymes activity can be explained using the “lock and key” model. • Defects in the heat can be treated using a range of surgical and nonsurgical techniques • How transpiration and translocation transport substances in pants
Core substantive knowledge	• Cells absorb substances and excrete remove by diffusion • How active transport moves substances against a concentration gradient. • Organisms with large SA : V ratios can absorb all they need by diffusion • Bacteria multiply rapidly by simple cell division • Uncontaminated cultures can be grown in nutrient broth or on agar • Differences between adult, embryonic and meri stems cells • Therapeutic cloning • Advantages and disadvantages of using stem cells in medicine	• The role of amylase, lipase and proteases in digestion • Blood is a tissue comprised of specialist cells adapted to their function. • The names, roles and adaptations of the four main blood vessels connected to the heart. • The role of valves in the circulatory system • The risk factors and triggers for cancer. • Difference between benign and malignant tumours
Core disciplinary knowledge	• How to measure percentage increase in mass due to osmosis. • Calculation of cross-sectional areas for analysis • How to prepare cultures using an aseptic technique • Biological research is shaped by ethical debates which inform the limits on research set down by governments.	• How continuous monitoring can be used to investigate the effect of pH on the action of amylase. • The positive tests for lipids, proteins and carbohydrates in food

Year 10 Long term plan: Biology (separate)

Brief overview			
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.			
Unit	**B16**	**B17**	**B18**
Unit title	How does medicine keep us healthy?	What is bioenergetics?	How do changes impact ecosystems?
Big question/ core concept	What keeps organisms healthy? Core concept: health	What are organisms made of? Core concept: cellular basis of life	Why do organisms depend on each other and their environment? interdependence
Relevant end points	• How vaccination increases the response time of the immune system preventing illness • New drugs must pass preclinical and clinical trials testing for toxicity, efficacy and dose before being approved for use.	• Metabolism is all the reactions in a cell or organism. • How light intensity affects the rate of photosynthesis	• Sampling techniques are used to investigate population size and distribution • Food security is a growing concern due to changing biological factors
Core substantive knowledge	• Vaccination reduces the spread of pathogens once a critical mass of the population is vaccinated. • Use of double-blind trials and placebos. • Stages of preclinical and clinical trials • Monoclonal antibodies are produced from a single clone of cells and produce antibodies that are specific to one chemical or cell. • Plants have physical, chemical and mechanical defences	• How temperature, CO_2 concentration and amount of chlorophyll affect the rate of photosynthesis • Interactions of factors affecting photosynthesis (HT) • Uses of glucose in plants • Inverse square law (HT) • How exercise creates an oxygen debt	• Pyramids of biomass represent the total biomass at each trophic level • Abiotic and biotic factors can affect the population size and distribution of a species. • How carbon cycles through the biosphere, atmosphere and soil. • How the destruction of peat bog impacts biodiversity • Temperature, water and oxygen availability effect the rate of decomposition • Changes to farming and biotech can help to improve food security
Core disciplinary knowledge	• How peer review by scientific journals helps prevent false claims. • How double-blind trials provide a control group in drug testing • Evaluate the usefulness and problems with monoclonal antibodies	• How to investigate the effect of light intensity on the rate of photosynthesis	• How to estimate abundance using random sampling • How to use a belt transect to investigate distribution

Year 10 Long term plan: Chemistry (separate)

Brief overview				
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.				
Unit	**C14**	**C15**	**C16**	**C17**
Unit title	How do chemists use the periodic table?	What is chemical bonding	How do we calculate the "amount" of a substance?	How do we measure energy changes in chemical reactions?
Big question/ core concept	What are substances? Substances	What gives substances their properties? Bonding	What are substances? Substances (are measured in moles)	What is chemical change? Chemical change
Relevant end points	• The discovery of subatomic particles changed chemists' model of the atom • Differences between the plum pudding and nuclear model of the atom	• Ionic substances form crystals with high melting points bonded by strong electrostatic attractions between oppositely charged ions. • Non-metal atoms can be bonded by sharing electrons (covalent bonds) forming molecules or giant molecular structures. • Molecular substances have low melting points due to the weak forces between molecules.	• (HT only) the mole us the unit used to compare the amount of different substances • Mr of a substance can be calculated from the RAM of the atoms in its formula • (uncertainty included in C17)	• Energy changes in a reaction can be represented by reaction profiles • The energy change in a reaction can be compared by measuring the change in temperature • Bond enthalpies can be used to calculate the energy change in a reaction (HT)
Core substantive knowledge	• Discovery of electrons lead to JJ Thompsons plum pudding model • Rutherford's alpha particle scattering experiment led to the nuclear model • Atomic scale is measured in nm • Isotopes are atoms with the same number of protons but a different number of neutrons • Discovery of isotopes explained why Mendeleev has to switch the order of some elements when ordered by weight • RAM is an average that takes into account the abundance of different isotopes. Physical and chemical properties of transition metals.	• Covalent bonds are a shared pair of electrons • Molecules can be represented by dot and cross diagrams • That polymers are very large molecules with higher melting points. • Properties of diamond and graphite • Properties of graphene and fullerenes • That molecular substances do not conduct, and ionic substances only conduct when molten or aq. • Ionic bonds can form via electron transfer • Group zero elements are unreactive as they have a full outer shell so do not easily share or transfer electrons • Nanoparticles have large SA:V ratios which give them useful properties	• Mass is always conserved in chemical reactions. • Mass can appear to change if one, or more, reactants or products is in its gaseous state. • Calculations of moles can be used to balance a chemical equation. • The (theoretical) mass of a product can be calculated using the ratios of a balanced equation if the moles of one substance is known. • A reactant that is completely used up in a reaction is a "limiting reactant" and controls the amount of product that can be produced • Use of gas volume and concentration in amount of substance calculations	• Combustion, neutralisation are exothermic reactions • Thermal decomposition and citric acid and sodium hydrogen carbonate are examples of exothermic reactions. • Profiles can show the activation energy of a reaction and whether it transfers energy to or from the surroundings • All reactions conserve energy
Core disciplinary knowledge	• Experimental evidence of subatomic particles lead to the model of the atom being changed and replaced	• Bonding can be represented in different ways all models highlight some features at the expense of other features • How to represent nm in standard form as x 10^{-9}	• Moles (mol) is a chemical	• Measurement of a change in temperature by recording the temperature before and after. • Controlling variables

Year 10 Long term plan: Chemistry (separate)

Brief overview
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.

Unit	C18	C19	C20	C21
Unit title	What are chemical changes?	What is organic chemistry?	Why is our atmosphere changing?	What is chemical analysis?
Big question/ core concept	What is chemical change? Chemical change	How does chemistry affect our world? Chemical earth	How does chemistry affect our world? Chemical Earth	What are substances? Substances
Relevant end points	• Metals lose electrons when they react with oxygen to form ionic metal oxides • (HT) half equations can show whether an element is oxidised or reduced • Electrolysis can be used to split a substance into its elements using direct current	• Crude oil produces fuels and chemical feedstocks • Alkanes are used as fuels which can undergo complete or incomplete combustion. • Properties of alkanes depend on chain length • Alkenes are reactive hydrocarbons.	• The proportions of gases in our atmosphere have remained largely unchanged for 200 millions years • The role of volcanoes, cooling and photosynthesis in the formation of the atmosphere • The role of the green house effect in driving climate change	• Pure substances are made of a single substance represented by a chemical formula • Formulations are mixtures of substances designed to be useful products • Rf values can be used to identify substance in a mixture
Core substantive knowledge	• Neutralisation reactions can be represented by the equation $H^+ + OH^- \rightarrow H_2O$ • Ions in acidic and alkaline solutions • (HT) strong acids completely dissociate in solution. • Procedure and calculations for titrations • Molten ionic substances can undergo electrolysis to produce a non-metal at the positive electrode and a metal at the negative electrode • Process for molten and aq electrolysis • Rules for determining the products of (aq) electrolysis. • (HT only) half equations • Simple model of simple cells and fuel cells.	• The chain length of hydrocarbons affects their flammability, viscosity and boiling point. • Long chain hydrocarbons can be cracked to produce short hydrocarbons and alkenes • Shorter chain hydrocarbons are in higher demand for fuels. • Cracking can be done at high temperature or using a catalyst. • Alkenes turn bromine water colourless • Alkenes are used to produce polymers and as starting materials for many other chemicals • Chemical reactions of alkenes, alcohols and carboxylic acids • Structure and formation of addition and condensation polymers	• Volcanoes release carbon dioxide and small amounts of nitrogen. • Cooling caused oceans to condense which dissolved CO_2 and precipitated carbonate sediments • Photosynthesis removed CO2 and released oxygen • Today's atmosphere is 80% nitrogen, 20 oxygen and trace amounts of CO2, water and noble gases. • Methane, water vapour and CO2 are green house gases • So2 and NOX are acidic gases produced during combustion. They cause acid rain and respiratory issues • Carbon monoxide is a toxic gas, and soot causes global dimming and asthma	• Formulations are made by mixing substances in fixed proportions. • Examples of formulations are alloys, fertilizers, medicines, cleaning products and paints • Hydrogen, carbon dioxide, oxygen and chlorine gas tests. • Process for flame tests and interpretation of emission spectroscopy • Tests for positive and negative ions in solution • Instrumental methods of analysis require complex equipment but are accurate sensitive and rapid
Core disciplinary knowledge	• Procedure for producing a soluble salt from an acid and excess of an insoluble base • Procedure for conducting the electrolysis of a (aq) solution	• Carbon compounds are so important to society they have their own branch of chemistry “organic chemistry” • The petrochemical industry is a major driving force behind organic chemistry	• Peer reviewed evidence for the human contribution to climate change is overwhelming • Climate systems are complex and hard to model which creates uncertainties	• Procedure for producing and analysing chromatograms of ink formulations

Year 10 Long term plan: Physics (separate)

Brief overview
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.

Unit	P13	P14	P15
Unit title	How do we analyse energy changes?	How do we use electricity?	How do we explain the properties of matter?
Big question/ core concept	How do things move and change? Core concept: Force and energy	What is electricity and magnetism? Core concept: electromagnetism	What is matter? Core concept: matter
Relevant end points	• Energy is always conserved in a change • During any change, some energy is dissipated to smaller less useful stores in the surroundings by heating. • We can calculate the extent of any possible change using energy calculations • The sources of energy used to power society can be classified as renewable or non-renewable. • We can calculate the power and efficiency of an energy change.	• Resistance of a circuit can be increased by adding resistors in parallel and decreased by adding them in series • Diodes, bulbs and resistors have different IV characteristics. • The national grid uses transformed to transfer electricity over long distances with a high voltage to minimise energy lost by the heating effect of resistance.	• State changes conserve mass but change density as changes in the arrangement of particles change the volume of a material. • A pure substance will remain at the same temperature while is changing state as energy is transferred to or from its internal store.
Core substantive knowledge	• Energy can be transferred by forces, electric current or heating • Efficiency of energy transfers can be increased by lubrication and insulation. • Recognise and use the calculations calculating the energy in a gravitational, Elastic potential, kinetic, thermal store. • The procedure for completing two step energy transfer calculations when assuming a transfer is 100% efficient. • Calculation of the specific heat capacity of a solid material. • To know coal, oil, natural gas and nuclear sources of energy are finite. • Fossil fuels and nuclear power are reliable sources of power that can work day and night. They transfer large amounts of energy • To evaluate the use of renewable energy sources.	• The total resistance is equal to the sum of the resistances added in series. • The total resistance of a circuit is lower then the resistance of any one resistor connected in parallel. • Longer wires have a higher resistance then shorter wires. • To know how thermistors and LDR's can affect the current in a circuit • Step up transformers increase the voltage in overhead power lines. • Step down transformers decrease the voltage so it can be supplied safely to homes. • To recognise and use the equation for the heating effect of current working against resistance • The mains electricity supplied to homes is an alternating current with a voltage of 230V, a frequency of 50 Hz • To know the safety features of UK plugs • To calculate the power and efficiency of electrical devices • To draw and explain the field pattern for electric charges	• If heating a substance increases the kinetic energy of particles it's temperature will increase. • If heating a substance changes its state the energy is transferred to the potential store of the particles and the temperature does not change • Recognise and use the specific latent heat equation to calculate energy changes when a substance changes state. • Identify points on a cooling curve where a material is changing state • Gases can be compressed or expanded by pressure changes • Doing work on a gas changes its internal energy store
Core disciplinary knowledge	• Procedure for determining the specific heat capacity of a metal block.	• To know how to set up circuits to test I/V characteristics • To know the procedure for investigating effect of the length of a wire on resistance.	• Using a eureka can to calculate the density of irregular objects. • Using suitable appropriate apparatus

Year 10 Long term plan: Physics (separate)

Brief overview		
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.		
Unit	**P16**	**P17**
Unit title	What is nuclear radiation?	What is electromagnetism?
Big question/ core concept	What is matter? Core concept: matter	What are electricity and magnetism? Core concept: electromagnetism
Relevant end points	• Nuclear radiation is produced by the random decay of unstable atomic nuclei • Alpha, beta and gamma radiation are different types of radiation with different penetrating and ionising powers. • The decrease in radioactivity of a sample can be predicted using its half life	• To be able to represent the field lines when a) the field around two like poles interact b) two opposite poles interact • (HT only) The magnetic field around a wire will interact with a magnetic field to produce a force (the motor effect)
Core substantive knowledge	• Activity is the rate unstable nuclear decay and is measured in (bq) • Background radiation has many sources and is around us all the time • Structure, penetrating power and distance travelled in air of alpha, beta and gamma • Half life is the time for half the unstable nuclei in a sample to decay – it is constant for a given nuclei • Hazards associated with a nuclear material depend on its half life • Nuclear equations can be used to represent the changes in the nucleus during radioactive decay. • Nuclear radiations are used to explore internal organs and control or destroy unwanted tissues • Compare hazards from nuclear contamination and irradiation. • Process of nucleus fusion, fission and chain reactions	• To be able to represent a strong, uniform magnetic field. • To describe the field inside a solenoid as strong and uniform • (HT) To be able to predict the direction of a force on a wire caused by the motor effect using Flemmings left hand rule. • (HT) increasing the size of a current on length of wire in a magnetic field increases the strength of the force experienced by a wire • (HT) to recognise and use the magnetic flux density equation to calculate the force on a wire • (HT) to explain how the forces on opposite sides of a coil of wire (in a magnetic field) have a rotational effect • The generator effect and its use in alternators, dynamos and microphones • Use of transformer equation and explanation of how transformers work
Core disciplinary knowledge	• Geiger muller counters are used to measure radioactivity • Findings on the effects of radiation on humans should be published in journals and subject to peer review.	• Conventions for representing fields using arrows to indicate the direction of the force applied to an object.

Year 10 Long term plan: Physics (separate)

Brief overview
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.

Unit	P18
Unit title	What are electromagnetic waves?
Big question/ core concept	How does energy and information spread? Core concept waves (and energy)
Relevant end points	• EM waves are transverse waves that transfer energy and information from source to an absorber • All mater emits EM waves • The EM spectrum is continuous and all travels at the same speed in a given medium. • Waves in the EM spectrum are grouped by wavelength and frequency. • Lower frequency waves transmit less energy
Core substantive knowledge	• Explain how hearing is caused by the vibration of small solids in the air when absorbing sound waves between 20 Hz to 20 kHz • Explain the uses of sound waves in ultrasound, seismology and echolocation • The order (by frequency) of the EM spectrum wave types • The colours of the visible spectrum of light • (HT) different substances absorb, transmit or reflect different frequencies of EM waves • To construct wave diagrams to show refraction. (HT only - use wave front diagrams to explain in terms of changes to wave speed). • Construct eave diagrams for reflection • To know the dangers and uses of each type of EM radiation. • (HT) describe transmission of information via production and absorption of radio waves • Production of real and virtual mages by lenses • How colour is produced • Perfect black bodies absorbs all the
Core disciplinary knowledge	• Use a signal generator to measure the wavelength, frequency of a wave on a string. • Use a ripple tank to measure the frequency, wavelength and speed of water waves • To investigate how different surface radiate heat using a Leslie cube

Long term plan: Year 10 (separate) by lesson

Autumn 1		Autumn 2	
B14 – What are organisms made of? L1 – What is transported in and out of body cells L2 – How do unicellular organisms exchange what they need (SA:V) L3 – How are animals adapted for exchange? L4 – How can we measure water uptake in plant tissues (RP) L5 – RP results analysis L6 – How do cells transport substances from dilute solutions? L7 – How do bacteria multiply? L8 – How do we culture bacteria (RP) L9 – How do we investigate zones of inhibition (RP) L10 - How do multicellular organisms grow and develop L11 – How do organisms produce specialised cells? L12 – What are stem cells? L13 – How do scientists use stem cells? L14 – EOTT L15 - mastery **B15 – Why are organ systems vital for life** L1 – How does the digestive system work L2 – How do we test for different nutrients (RP 3) L3 – How do enzymes work L4 – Investigating the effect of pH on the activity of amylase (Rp Pt 1) L5 - Investigating the effect of pH on the activity of amylase (Rp Pt 2) L6 – What is the role of blood in the body? L7 – What us the structure of the human circulatory system L8 – How can we repair damage to the heart L9 – What causes cancer L10 – How do leaf tissues work together? L11 – How are substances transported in plants L12 – What is translocation? L13 EOTT L14 – mastery	**C14 – How do chemists use the periodic table?** L1 – Why has our model of the atom changed? L2 – What are isotopes (and ions)? L3 – How do alkali metals compare to transition metals? L4 – What is the chemistry of transition metals?	**C15 – What is chemical bonding?** L1 – What gives salts get their properties? L2 – How can we represent ionic bonding? L3 – What gives molecular substances their properties? L4 – How can we represent molecules? L5 – What are polymers L6 – What do diamond and pencil “lead” have in common? L7 – What are graphene and fullerenes? L8 – What are nanoparticles? L9 - C14 & 15 EOTT L10 - mastery **P13 – How do we analyse energy changes?** L1 – Gravitational and kinetic energy L2 – Gravitational and elastic potential energy L3 – Calculating changes in thermal energy L4 – Investigating heat capacity (RP Pt 1) L5 – Investigating heat capacity (RP pt 2) L6 – Power & efficiency L7 – Thermal conductivity investigation (RP) L8 – Non renewable & renewable energy resources **P14 – How do we use electricity?** L1 – Resistors in series and parallel L2 – Investigating resistors (RP15a) L3 – How the length of a wire affects resistance (RP15 b) L4 – I-V characteristics L5 – Investigating I-V characteristics (RP16) L6 – How do thermistors and LDR’s affect circuits? L7 - What is mains electricity? L8 – How does the national grid supply electricity? L9 – How do we calculate the energy supplied by circuits? L10 – What are electric fields? L11 – P12 & P13 unit assessment L12 – mastery	**C16 – How do we calculate the “amount” of a substance?** L1 – Why do some reactions appear to involve a change in mass? L2 – What is a mole? (HT) / What is relative formula mass? (FT) L3 – Using moles to balance equations? (HT) / Percentage mass (FT) L4 – How can we calculate reacting masses? (HT) L5 – What is a limiting factor? (HT) L6 – What are chemical yield and atom economy? L7 – Reacting concentrations? (HT) L8 – Reacting gases? (HT only) L9 – End of unit assessment L10 – Mastery

Long term plan: Year 10 (separate) by lesson

Spring 1	Spring 2
B16 – How does medicine keep us healthy? L1 – Communicable diseases (recap) L2 – How does vaccination support our immune system? L3 – How do we develop new drugs? L4 – What are monoclonal antibodies? L5 – How can we detect plant diseases? L6 – What defences against disease do plants have? **B17 – What is bioenergetics?** L1 – How does photosynthesis support a plants metabolism? L2- What affects the rate of Photosynthesis? L3 – What is the inverse square law? (HT only) L4 – Photosynthesis RP (pt a) L5 – Photosynthesis RP (pt b) L6 – What is our metabolism? L7 – How does the body respond to exercise? L8 – EOTT (B16 & B17) L9 – mastery **C17 – How do we measure energy changes in chemical reactions?** L1 – What are reaction profiles? L2 – Investigating temperature change (RP 10 pt a) L3 – Investigating temperature change (RP10 pt b – Inc. uncertainty) L4 – Calculating energy transfers (HT only) L5 – EOTT (C16 & 17) L6 – mastery *Sequence assumes one and a half weeks are taken by mid year assessments and preparation.*	**C18 – What are chemical changes?** L1 – How do metals react with oxygen (FT) / How do metals react? (HT) L2 - Displacement reactions (FT / HT) L3 – neutralisation reactions L4 – Producing a soluble salt (RP 8) L5 – pH scale & strong acids L6 – What is a titration (pt 1) L7 – What is a titration (pt 2) L8 – Molten electrolysis L9 – Electrolysis to produce aluminium L10 – Electrolysis in solution L11 – Electrolysis (RP 9) L12 – What are batteries and cells? L13 – What is a fuel cell? L14 – EOTT L15 – Mastery **P15 – How does the particle model explain the properties of matter?** L1 – Particle model and density L2 – Density RP L3 – Changes of state and specific latent heat L4 – Cooling curves L5 – How does changing volume affect gas pressure? **P16 – Radiation** L1 – Radioactive decay L2 – How did we discover the structure of atoms? L3 - changes in the atom L4 – Half life's L5 – What is background radiation? L6 – Risks of nuclear radiation L7 – Hazards and half-life L8 – What are nuclear fission and fusion? L9 – Assessment point (P14 &15) L10 - mastery

Long term plan: Year 10 (separate) by lesson

Summer 1		Summer 2	
P17 – Magnetism L1 – How do magnetic fields interact? L2 – Predicting the force produced by a current (HT) L3 – Explaining the motor effect (HT) L4 – How do loudspeakers work? (HT) L5 – What is the generator effect? (HT) L6 – How do we generate AC and DC? (HT) L7 – How do microphones work? (HT) L8 – How do transformers work? (HT) L9 – Unit assessment L10 - Mastery **P18 – What are electromagnetic waves?** L1 – How do we hear sound waves? L2 – How do we use waves to "see" hidden structures? L3 – RP 20 – waves on a string L4 – RP 20 – Ripple tank investigation L5 – Electromagnetic waves L6 – Uses and risks of EM waves L7 – Properties of EM waves L8 – Refraction L9 – refraction & reflection RP L10 – What are perfect black bodies L11 – RP (Leslie cube L12 – How do we see? L13 – How do lenses work? L14 – Unit assessment L15 - Mastery	**C19 – What is organic chemistry?** L1 – What does crude oil contain? L2 – How do the properties of hydrocarbons vary? L3 – How are alkenes produced? L4 - How do alkenes react? L5 – How are alcohols produced? L6 – How do alcohols react? L7 – How do carboxylic acids react? L8 – What is addition polymerisation? L9 – What is condensation polymerisation? L10 – How are biological polymers produced? **C20 – Why is our atmosphere changing?** L1 – How did our atmosphere develop? L2 – What is the green house effect? L3 – How are humans driving climate change? L4 – How are we polluting our atmosphere?	**C21 – What is chemical analysis?** L1 – What are formulations? L2 – How do we analyse chromatograms? L3 – RP 12 - chromatography L4 – How can chemists identify a gas? L5 – What is flame emission spectroscopy? L6 – How can we test for positive ions? L7 – How can we test for negative ions? L8 – Testing ions in solution (RP) L9 – EOTT C19, C20 & C21 L10 – Mastery **B18 – How do changes impact ecosystems?** L1 – What do pyramids of biomass show? L2 – Why are transfers of biomass not 100% efficient? L3 – Factors affecting populations L4 – RP 7 (part a) L5 – RP 7 (part b) L6 – How do we evaluate the impact of an environmental change (HT only) L7 – How does carbon cycle through an ecosystem? L8 – Why do things decompose? L9 – Investigating decomposition pt 1 (RP) L10 – Investigating decomposition pt 2 (RP) L11 - Impact of land use: Peat bogs L12 – What are the threats to food security? L13 – How do we produce food efficiently and sustainably? L14 – How can biotech help with food production? L15 – EOTT L16 – mastery *Sequence assumes three weeks for EOY exams + one week of work experience during summer term.*	

Year 11 Long term plan: Biology (separate)

Brief overview		
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.		
Unit	**B19**	**B20**
Unit title	How do organisms inherit characteristics?	How do we control our bodies?
Big question/ core concept	How do organisms grow and reproduce? Inheritance	What are organisms made of? Cellular basis of life
Relevant end points	• Meiosis is the production of gametes • Fertilization is the fusion of two gametes. • When gametes fuse we inherit one allele of each parent. • Selective breeding is the process were humans breed organisms for particular characteristics • Genetic engineering adds a new gene to an organism's genome • Fossils and multiply resistant bacteria are evidence for evolution. • Mutations are the source of all genetic variation • Alleles and the genetic model of inheritance	• Homeostasis is the regulation of the bodies internal conditions to provide the optimal conditions for enzymes and cell processes • Homeostatic processes are controlled by our endocrine and nervous systems. • All control systems have receptors that detect stimuli, coordination centres and effectors. • Nervous responses are fast and short lived • Hormonal responses are slower and longer lasting
Core substantive knowledge	• Meiosis produces four genetically varied haploid cells • Sexual reproduction produces variation which increases the survival advantage by natural selection • Asexual reproduction is faster, more energy efficient and can rapidly produce identical offspring in favourable conditions • DNA is a polymer made of four different nucleotides containing the bases A, C, G and T. It has a double helix shape • A gene is a small section of DNA that codes for a specific protein • A sequence of three bases is the code for a specific amino acid. • (HT) simple model of protein synthesis limited to the complementary base pairs, role of mRNA, tRNA and the ribosome as the site of synthesis. • How mutations in a gene can affect protein structure and phenotype • Alleles are different versions of a gene and can be recessive or dominant. • Body cells have two copies of each gene and can be homozygous or heterozygous • Dominant alleles are always expressed • Humans selective bread animals for increased milk or meat yield; dogs for a gentle nature; crops for disease resistance and garden plants for large or unusual flowers. • (HT) process of genetic engineering. • Cloning processes – tissue cultures, cuttings embryo transplants and adult cell cloning • There are benefits, risks and ethical concerns around genetic engineering.	• The CNS consists of two coordination centres – the brain and the spinal cord • The brain is made of billions of interconnected neurones and controls complex behaviour • The structure of a reflex arc including synapses and that it bypasses the conscious parts of the brain. • How the structures of the eye relate to their functions • How insulin and glycogen (HT only) regulate blood sugar levels. • Causes and treatments for type one and two diabetes. • How oestrogen, progesterone (LH and FSH – HT only) control the menstrual cycle. • Hormonal and barrier contraception • Hormonal fertility treatments (HT only) • Mechanism of thermoregulation in humans • Regulation of water and mineral ions (ADH on HT only) • The role of auxins, gibberellins and ethene in plants
Core disciplinary knowledge	• Biologists have to carefully consider how organisms are treated during research into genetic engineering. • Biologists have to communicate about their work in a way that is accessible to audiences beyond	• Investigation into whether caffeine affects reaction time. • Use of a placebo group in a double-blind trial • Procedures for investigating photo or gravotropism

Year 11 Long term plan: Chemistry (separate)

Brief overview		
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.		
Unit	**C22**	**c23**
Unit title	How far and fast can reactions go?	How do we use the earths resources?
Big question/ core concept	What is chemical change? Core concept: Chemical change	How does chemistry affect our world? Chemical Earth
Relevant end points	• Increasing concentration or pressure increase rate of reaction as particles are closer together, so successful collisions are more frequent • Temperature increases the rate of a reaction as the particles move faster and have more energy so there are more frequent collisions and a higher percentage of collisions that are successful. • Some reactions are reversible. • Reversable reactions reach equilibrium in a closed system	• Potable water is safe to drink. It may contain some dissolved minerals • Pure water contains no dissolved minerals. It is used in chemical analysis • Waster water has to be treated before it can be released • Water is a renewable resource • Metal ores are a finite resource • Life cycle assessments can be used to evaluate the environmental impact of a product by accounting for: extraction and processing of raw materials, its manufacture, its use, its disposal
Core substantive knowledge	• Increasing temperature has a larger effect on rate than increasing surface area, pressure or concentration. • Collision theory is used as a model to explain changes to rate. • If a reversable reaction is exothermic in the forwards direction it is endothermic in the reverse direction. • Equilibrium will shift to counteract a change in concentration, pressure or temperature (HT only).	• Fresh water can be made potable by filtering, sterilising with chlorine • Salt water has to be desalinated by distillation or reverse osmosis. This requires lots of energy. • Wastewater is screened, sedimented (into effluent and sludge) then digested by anaerobic (sludge) and aerobic bacteria (effluent) • The carbon footprint of a product is the carbon dioxide and other greenhouse gases released over its lifetime. • Extraction of low-grade copper ore by phytomining and bioleaching (HT) • How metal objects are protected from corrosion • Uses of common alloys • We can preserve limited resources by reducing use, reusing and recycling. • Metals and glass can be melted and reformed into products (recycled) • Production and use of ceramics and • Production and use of polyethene • How Nitrogen, phosphorous and potassium compounds are extracted for use in NPK fertilisers
Core disciplinary knowledge	• Procedure and controls for measuring the rate of a reaction which produces a precipitate using a disappearing cross method. • Procedure and controls for measuring the rate of a reaction which produces a gas using an inverted measuring cylinder or gas syringe. • Procedure for measuring the rate of reaction using change in mass.	• UI can be used to test if water has a potable pH • The mass of dissolved minerals in a sample can be calculated by evaporation then heating to constant mass. • Lab procedure for producing pure water by distillation.

Year 11 Long term plan: Physics (separate)

Brief overview			
Our KS4 units broadly match up with the main sections of the AQA combined science specification teaching paper one then paper two topics. We have taken the decision to broadly align with the specification sections, so OCL resources can be more easily integrated with other revision guides. Where sections of content has been moved into a different unit for sequencing purposes this is clearly flagged in the unit plans. Specification content is divided into PK (prior knowledge) from KS3 delivered via carousel and study packs & new knowledge delivered in KS4 lessons. Key prior knowledge is reactivated in lesson resources. Reactivations are designed to follow spaced independent study of prior knowledge via carousel quizzes.			
Unit	**P19**	**P20**	P21
Unit title	How do forces do work?	How do forces explain changes in motion?	How is the universe changing
Big question/ core concept	Why do objects move or change? Core concept: Force and energy	Why do objects move or change? Core concept: Force and energy	Where are we in space? Core concept : Space
Relevant end points	• A resultant force will cause an object to change speed or direction • Describe and use the equation W = Fs to describe the mechanical work done by a force • To relate force applied to extension of a spring • Elastic distortion is directly proportional to the force applied	• Speed is a scaler quantity and velocity is a vector quantity • Acceleration is the change in velocity ÷ time taken • How to interpret velocity time graphs • Force = mass x acceleration • The force exerted by Object B on object A is equal in size but opposite in direction to the force exerted by A on B • (HT) momentum of an object = mass x velocity	• How our sun and solar system were formed • How the lifecycle of a star is determined by its size • How redshift provides evidence that the universe is expanding
Core substantive knowledge	• (HT) How to calculate a resultant force using vectors • (HT) How to draw free body diagrams • Weight can be considered to act from a single point. This is point is called the centre of mass of an object. • (Joules are derived from Nm's) 1 Joule = 1 Nm • Two forces are required to distort the shape of an object • The difference between elastic and inelastic distortion • That the limit of proportionality for an object represents the limit to which it can be extended elastically • The size of a turning effect is defined by M = Fd • Levers and gears are examples of using moments of a force in simple machines • How atmospheric pressure produces forces	• Vectors have size and direction. Scalers have size only • Distance is a scaler and displacement is a vector. • (HT only) area under a V-T graph is equal to the distance travelled. • Acceleration due to gravity (near the earths surface) is 9.8m/s2 • (HT) inertial mass = force / acceleration (= how difficult to accelerate) • Stopping distance = thinking distance + breaking distance • Factors that affect thinking and breaking distance • Typical human reactions times range from 0.2 to 0.9 seconds. • (HT) calculations showing conservation of linear momentum • Calculating forces caused by changes in momentum	• Gravity holds all satellites, both natural and artificial, in orbit. • Moons are natural satellites • (HT) explain stable circular motion in terms of gravity and velocity
Core disciplinary knowledge	• To know how to investigate the relationship between force applied and the extension of a spring • To know that taking repeat measurements and calculating an average reduces random error • Describing trends from graphs and tables.	• Investigating F = ma (effect of mass and acceleration) using dynamics trolleys and light gates • Evaluate measurements of reaction time	• How evidence from observations support physicists to develop theories about the universe.

Long term plan: Year 11 (separate) by lesson

Autumn 1		Autumn 2	
B19 – How do organisms Inherit characteristics? L1 – How are gametes produced? L2 – What determines sex? L3 – What are the advantages of sexual and asexual reproduction? L4 – Understanding the human genome L5 – How do genes code for proteins? (FT/HT) L6 – How are genes inherited? L7 – How are genetic disorders inherited? L8 – How did our understanding of genetics develop? L9 – How do mutations dive evolution L10 – How did our understanding of evolution develop? L11 – What is the evidence for evolution? L12 – What is MRSA? L13 – What is selective breeding? L14 – What is genetic engineering (FT & HT versions) L15 – How do we clone organisms? L16 – End of unit assessment L17 – Mastery **C22 – How far and how fast do reactions go?** L1 –How can we calculate the rate of a reaction? (FT/HT versions) L2 – How do concentration, pressure and temperature affect rate? L3 – RP 11 – disappearing cross (part a) L4 – RP 11 – inverted measuring cylinder L5 – Reversible reactions & equilibrium L6 – How does concentration and pressure effect equilibria? (HT only) L7 – How does changing temperature effect an equilibria? (HT only)	**P19 – How do forces do work?** L1 – How do we determine a resultant force (HT/FT versions) L2 – How do forces "do work"? L3 – How do forces extend or compress a spring? L4 - RP 18 L5 – What is the moment of a force? L6 – What is atmospheric pressure? L7 – How does pressure cause forces? **B20 – How do we control our bodies?** L1 –What is homeostasis L2 – What is the endocrine system? (+ feedback systems) L3 – Do plants have hormones? (inc RP) L4 – How do we control blood sugar levels? (FT/HT versions) L5 – How can we manage diabetes? *Sequence assumes four weeks are taken for mock assessment, revision and feedback.*	**B20 – How do we control our bodies? (Continued)** L6 – How do hormones affect our sex? L7 – How do hormones control the menstrual cycle? (FT/HT versions) L8 – How can we control our fertility? (FT/HT versions) L9 – How do we regulate water levels? L10 – What is the role of ADH? (HT only) L11 – Investigating plant hormones (RP) L12 – What is the role of the nervous system? L13 – The Central nervous system L14 – Reflexes RP 6 L15 – How does the eye work? L16 – How can we correct eye defects? L17 – How do we control body temperature? L18 – End of unit assessment L19 – Mastery **C23 – How do we use the earths resources?** L1 – How do we produce potable water? L2 – How do we manage wastewater? L3 – Testing water samples: RP13 (pt a) L4 – Testing water samples (RP 13 (pt b) L5 - How can we reduce our use of resources? L6 – How can we preserve metal ore supplies? (HT only) L7 – How can we prevent corrosion? L8 – Why do we use alloys? L9 – How do we use plastics? L10 – How so we make ceramics and composites?	

Long term plan: Year 11 (separate) by lesson

Spring 1

C23 – How do we use the earths resources? (cont.)
L11 – What is a Life Cycle Assessment?
L12 – What is the Haber process?
L13 – How are NPK fertilisers made?
L14 – EOTT C22-23
L15 - Mastery

P20 – How do forces explain changes in motion?
L1 – What is velocity? (HT: inc circular motion)
L2 – Interpreting distance time graphs
L3 – Calculating acceleration
L4 – Interpreting velocity time graphs
L5 – Newtons 1st and 2nd law
L6 – RP 19 (part a)
L7 – RP 19 (part b)
L8 – Newtons third law
L9 – Stopping: thinking distance & breaking distance
L10 – Dangers of large decelerations
L11 – Momentum (HT only)
L12 – How do forces change an objects momentum? (HT only)
L13 – Unit assessment point (P19 & 20)
L14 – mastery

P21 – How is the universe changing?
L1 – How was our solar system formed?
L2 - What is the life cycle of stars?
L3 – How do we know the universe is expanding?

Sequence assumes the last 1.5 weeks of spring one are taken by the Paper two mock series.