



Science KS4

Science Curriculum Intent

The science curriculum at The Palmer Catholic Academy is designed to develop skilled, knowledgeable, independent practical scientists.

The curriculum will allow all students across the academy to become successful scientists. All students will be supported to develop their understanding, motivated to secure their knowledge, and challenged to exceed expectations and maximise their potential in science. A broad range of science topics, balanced across the three main disciplines of Biology, Chemistry and Physics, will provide students with the awe, wonder and intrigue to develop their knowledge of the “Big Ideas” in science.

Embedding the Catholic Ethos in the Science Curriculum

“The son is the image of the invisible God, the firstborn over all creation. For in him all things were created: things in heaven and on Earth, visible and invisible, thrones or powers or rules or authorities; all things have been created through him and for him.”

Colossians 1:15-16

Science by its nature offers many opportunities for links with the Catholic Ethos of the school. All lessons in Science, like other lessons in school, start with the academy prayer. Science Labs which are also form rooms display information shared by the chaplaincy team.

The Science curriculum focuses on teaching the skills linked to the “Scientific Method” including investigative skills, analytical skills and problem solving. Science education must also address the mechanics, reasoning, and explanation behind observations of the universe and development of new technology.

These can at times be at odds with some religious beliefs and where this occurs science teaching should focus on the “scientific facts” but acknowledge the relevant religious teaching.

Science and its study allows students to engage with their own religious or moral beliefs, while consider the believes of others and the scientific explanations. These can be addressed through links to the gospel values by considering:

- Awe and wonder of the universe and its creation.
- The miracle of life, both of humankind and the living kingdoms.
- Care for our self’s and the bodies God have given us.
- Service (Medicine, Veterinary, etc)
- Stewardship and care for the planet God gave us.
- Ethical and moral discussions.



Science KS4

**Content listed in italics is covered by students studying separate GCSE Sciences only.*

		Autumn Term	Spring Term	Summer Term
Year 10 Implementation	Biology Cell Division (3 Lessons) Revision of cell structures and functions, mitosis, the cell cycle, cell differentiation, stems cells, moral and ethical issues with stem cells. Organisation and Digestion (5 Lessons) Organisation in animals and plants; including cells, tissues, organs and organ systems. The digestive system, food groups and enzymes. Organising Plants and Animals (5 Lessons) The circulatory system including the blood, blood vessels, the heart, and gas exchange in animals. Plant tissues and organs, transport in plants, and transpiration.	Biology Communicable Disease (5 Lessons) Infections, pathogens, health problems, bacteria, viruses, spread of disease, preventing infection, fungi and protists, defence response, immune system, <i>aseptic techniques, preventing bacterial growth, plant disease and response.</i> Preventing & Treating disease (4 Lessons) Vaccination, herd immunity, antibiotics and painkillers, discovering and developing drugs, <i>monoclonal antibodies.</i> Non-Communicable Disease (3 Lessons) Correlation vs causation, risk factors, tumours, benign vs malignant, causes and treatment of cancer, smoking, diet and exercise. Effects of alcohol and ionising radiation	Biology Photosynthesis (3 Lessons) Photosynthesis, leaf adaptations, investigating photosynthesis, rate of photosynthesis (effects of light, temperature, carbon dioxide concentration and chlorophyll), uses of glucose, controlling photosynthesis. Respiration (3 Lessons) Aerobic respiration, mitochondria, need for respiration, response to exercise, anaerobic respiration, oxygen debt, fermentation, metabolism and the liver, Homeostasis (4 Lessons) Principles of homeostasis; receptors, coordination centres and effectors. Controlling body temperature, water content and blood glucose concentration. The nervous system; neurones, nerves, central nervous system. Reflex arc: sensory, relay and motor neurones, synapses. <i>The brain; cerebral cortex, cerebellum, medulla. The eye, myopia and hyperopia, correcting vision.</i> Organising an Ecosystem (3 Lessons) Food chains, producers, and consumers. Predators and Prey. Material cycling; carbon cycle, decay cycle, water cycle. <i>Rates of decomposition.</i>	
	Chemistry The Periodic Table (4 Lessons) Revision of the atom, the formation of the periodic table, trends in the periodic table. Group 1, 7 & 0 elements and their reactions, <i>transition elements.</i> Structure and Bonding (7 Lessons) States of matter, ions, ionic bonding and structures, covalent bonding, simple molecules, giant covalent structures, fullerenes, graphene, bonding in metal, metallic structures, <i>nanoparticles,</i> Electrolysis (3 Lessons) Electrolysis, electrolytes, changes at electrodes, half equations, electrolysis of water, extraction of aluminium, electrolysis of solutions,	Chemistry Relative Masses and Moles (6 Lessons) Relative atomic mass, relative formula mass, the mole, equations and calculations, balanced equations, <i>yield, atom economy, concentration, titrations, volume of gases.</i> Chemical Changes (6 Lessons) The reactivity series, reactions of metals, displacement reactions, redox reactions, half and ionic equations, extracting metals, reduction with carbon and hydrogen, making salts, reactions of metals and acids, acids and insoluble bases, acids and alkalis, acids and carbonates, Neutralisation and the pH Scale, strong and weak acids,	Chemistry Energy Changes (4 Lessons) Exothermic and endothermic relations, investigating temperature changes, using energy transfers from reactions, reaction profiles, activation energy, bond breaking and making, bond energy calculations, <i>chemical cells and batteries, Fuel cells,</i> Rates of Reaction (6 Lessons) Rate of reaction, measuring rates, collision theory and surface area, effect of temperature, effect of concentration and pressure, effect of catalysts, reversible reactions, dynamic equilibrium, altering conditions,	



Science KS4

Year 10 Implementation	<p>Physics Energy Transfer by Heating (3 Lessons) Revision of energy stores and transfers, conduction and insulation, <i>infra-red radiation</i>, specific heat capacity, insulating buildings</p> <p>Energy Resources (3 Lessons) Energy demands, power stations, fuels, biofuel, wind power, wave power, HEP, Tidal, solar power, geothermal, environment issues, supply and demand.</p> <p>Circuits (5 Lessons) Static electricity, charges, charging by friction, electrostatic forces, electric fields, circuit symbols, current, potential difference, resistance, components, series and parallel circuits,</p> <p>Electricity in the Home (3 Lessons) Alternating Current, oscilloscopes, The National Grid, plugs, sockets and cables, the three-pin plug, short circuits, electrical power, choosing fuses, resistance heating, calculating charge, energy transfers in circuits, electrical efficiency,</p>	<p>Physics Molecules and Matter (5 Lessons) Density, changes of state, conservation of mass, kinetic theory, melting and freezing points, latent heat, internal energy, gas pressure, Brownian motion, <i>Boyle's Law</i>.</p> <p>Radioactivity (7 Lessons) Atoms and radiation, the plum pudding model, Bohr's model of the atom (energy levels and EM radiation), the nuclear model. Atomic structure, alpha, beta and gamma emission, Neutron emission, penetrating power, irradiation and contamination, uses of radiation, activity and half-life, <i>nuclear radiation in medicine</i>, Nuclear fission, <i>fission reactors</i>, Nuclear fusion, <i>stars and fusion reactors</i>, nuclear issues, background radiation, nuclear waste, nuclear accidents.</p>	<p>Physics Wave Properties (5 Lessons) Nature of waves, transvers and longitudinal waves, properties of waves, amplitude, wavelength, frequency period, wave speed, the wave equation, reflection and refraction, ripple tanks, investigating waves, sound waves, <i>the ear</i>, <i>echo location</i>, <i>ultrasound</i>, <i>seismic waves</i>.</p> <p>Electromagnetic Waves (4 Lessons) The electromagnetic spectrum. Light, infrared, microwaves, and radio waves. Communications. UV, X-rays and gamma rays. X-rays in medicine.</p>
Impact	<p>Each topic includes the following assessments:</p> <ul style="list-style-type: none"> • Online Homework • Extended Writing Task • End of Topic Knowledge Checker. <p>End of Term Synoptic assessment assesses all content from this term.</p>	<p>Each topic includes the following assessments:</p> <ul style="list-style-type: none"> • Online Homework • Extended Writing Task • End of Topic Knowledge Checker. <p>End of Term Synoptic assessment assesses all content from this term plus content from the Autumn Term.</p>	<p>Each topic includes the following assessments:</p> <ul style="list-style-type: none"> • Online Homework • Extended Writing Task • End of Topic Knowledge Checker. <p>End of Year Synoptic assessment assesses all content from Year 10.</p>



Science KS4

	Autumn Term	Spring Term	Summer Term
Year 11 Implementation	<p>Biology</p> <p>Hormonal Coordination (7 Lessons) Hormonal control, the endocrine system, controlling blood glucose insulin, glucagon and glycogen, diabetes. treating diabetes, negative feedback, thyroxine, adrenaline. Human reproduction, oestrogen, testosterone, puberty, and fertility. The menstrual cycle, FSH, LH, progesterone. Contraception, Infertility treatment. <i>Plant hormones, tropism, auxins, gibberellins.</i></p> <p>Homeostasis in Action (3 Lessons) Controlling body temperature, vasoconstriction, and vasodilation. Removing waste products, the kidneys, dialysis, kidney transplants.</p> <p>Reproduction (6 Lessons) Asexual and sexual reproduction, meiosis, fertilisation, variation. <i>Reproduction in fungi, plants and malaria parasites.</i> DNA and the Human Genome. <i>Protein synthesis. Gene expression, and mutations.</i> Inheritance, homozygous and heterozygous, genotype and phenotype. Genetic diagrams. Sex determination. Inherited disorders; polydactyly, and cystic fibrosis. Screening genetic disorders.</p>	<p>Biology</p> <p>Variation & Evolution (4 Lessons) Nature vs Nurture; genetic vs environmental variation. Natural selection; mutations and genetic variation. Survival of the fittest. Selective breeding. Genetic engineering. <i>Cloning plants and animals.</i> Ethic of genetic technology.</p> <p>Genetics & Evolution (6 Lessons) <i>Mendel, monohybrid inheritance. Discovery of DNA. Theories of evolution; Lamarck, Darwin, origin of species. Darwinism. Speciation.</i> Evidence of Evolution; fossil record. Extinction. Antibiotic resistant bacteria. Classification; kingdoms, species, binomial system, three domains, evolutionary trees.</p> <p>Adaptations, Interdependence and Competition (5 Lessons) Communities, interdependence, biotic and abiotic factors. Distribution, abundance. Investigation populations: quadrats, transects, random sampling. Competition in animals: for food, for territory, for mates. Competition in plants. Seed dispersal. Adaptations in plants and animals.</p> <p>Biodiversity and Ecosystems (5 Lessons) Human population growth, land, and resources, managing waste. Land, Water, and air pollution. Deforestation and peat destruction. Global warming. <i>Impact of change, maintaining biodiversity. Trophic levels, pyramids of biomass. Biomass transfers, Food production and security.</i></p>	<p>Completion of any outstanding content.</p> <p>Revision of all content covered in year 10 and 11.</p> <p>Walking talking mocks and other past paper practice.</p>
Year 11 Implementation	<p>Chemistry</p> <p>Crude Oil (3 Lessons) Hydrocarbons, alkanes, properties of alkanes, fractional distillation, complete and incomplete combustion, cracking, saturated and unsaturated hydrocarbons.</p> <p>Organic Reactions (3 Lessons) <i>Reactions of alkanes, Structures of alcohols, carboxylic acids, and esters. Reactions of alcohols, carboxylic acids, and esters.</i></p> <p>Polymers (3 Lessons) <i>Monomers and Polymers, addition polymerisations, condensation polymerisation. Natural polymers; polysaccharides, polypeptides, proteins and amino acids, DNA</i></p> <p>Chemical Analysis (4 Lessons) Pure substance, mixtures, and formulations. Chromatograms. Gas tests: hydrogen, oxygen, carbon dioxide and chlorine. <i>Testing of ions; flame tests, precipitates, carbonates, halides, sulfates. Instrumental Analysis.</i></p>	<p>Chemistry</p> <p>The Earth's Atmosphere (4 Lessons) The early atmosphere, oxygen in the atmosphere, locked in carbon, ammonia, and methane. The atmosphere today. Greenhouse gases, climate change, atmospheric pollutants.</p> <p>The Earth's Resources (4 Lessons) Finite and renewable resources, Potable water, water purification. Sewage treatment. Extracting metals from ores. Life Cycle Assessments. Reduce, reuse, recycle.</p> <p>Using Resources (5 Lessons) <i>Resting, Alloys, Using polymers. Glass, ceramics, and composites. The Haber Process. Making fertilisers</i></p>	



Science KS4

<p>Physics Forces in Action (5 Lessons) Vectors and Scalars, Newton's third law of motion, friction in action, Newton's first law of motion, balanced and unbalanced forces. Free-body force diagrams. <i>Moments, levers, gears, centre of mass. Moments and equilibrium.</i> Parallelogram of forces. Resolution of forces. Motion (3 Lessons) Speed, distance, and time. Distance-time graphs. Velocity and acceleration. Velocity-time graphs. Forces and Acceleration (5 Lessons) Newton's second law, investigating force and acceleration, inertia. Weight and terminal velocity. Forces and braking, thinking, braking and stopping distance. Momentum, <i>conservation of momentum, collisions, impact forces, car safety.</i> Forces and Elasticity. Pressure and Surfaces (3 Lessons) <i>Pressure, force and area. Pressure in liquids. Atmospheric Pressure. Upthrust and Flotation.</i></p>	<p>Physics Light (4 Lessons) <i>Reflection, refraction, real and virtual images, light and colour, lenses, ray diagrams.</i> Electromagnetism (4 Lessons) Magnetic fields, permanent and induced magnetism. Magnetic fields around electric currents; solenoids and electromagnets. <i>Electromagnetic devices.</i> The Motor Effect. <i>The Generator Effect, alternators, dynamos and moving coil devices. Transformers.</i> Space (3 Lessons) <i>The Solar system, birth of stars, life cycle of stars. Planets, satellites and orbits. Red shift, the expanding universe, the big bang theory, CMBR, the future of the universe. Dark matter and dark energy.</i></p>	
<p>Each topic includes the following assessments:</p> <ul style="list-style-type: none"> Extended Writing Task End of Topic Knowledge Checker. 	<p>Each topic includes the following assessments:</p> <ul style="list-style-type: none"> Extended Writing Task End of Topic Knowledge Checker. <p>Mock Exams will take place at the start of the Spring Term.</p>	<p>GCSE Exams will start in may. 2 x Biology Papers 2 x Chemistry Papers 2 x Physics Papers.</p>