YEAR 10		AUTUMN TERM				YEAR 10		SPRING TERM				YEAR 10		SUMMER TERM			
POWERFUL IDEAS	**Energy, Electricity and Particle Physics**	**CEIAG**	Working in energy generation, renewable energy, nuclear energy. Engineering (designing for energy efficiency) Civil engineering (creating energy efficient homes) Materials scientist (investigating insulation)	**Focused retrieval 6 topics**	Energy transfers, stores, conservation of energy, work done (Conceptually not the equation)	**POWERFUL IDEAS**	**Particle Physics and Forces**	**CEIAG**	Materials scientist, Mechanical engineer,Particle Physicist Radiation Protection Officer Nuclear Engineer , Electrical engineer, Engineering, Mechanic, Jobs in the manufacture of electric motors for electric cars, robotics.	**Focused retrieval 6 topics**	structure of the atom. radiation as a form of energy transfer.	**POWERFUL IDEA**	**Forces and Energy**	**CEIAG**	Engineering, Technology, architecture, product design. Sports science and physiology.	**Focused retrieval 6 topic**	Named forces, force diagrams and simple statements regarding the effects of balanced and unbalanced forces
TOPICS	**Substantial knowledge (KNOW)**	**Disciplinary Knowledge (KNOW HOW TO)**			**Literacy**	**TOPICS**	**Substantial knowledge (KNOW)**	**Disciplinary Knowledge (KNOW HOW TO)**			**Literacy**	**TOPICS**	**Substantial knowledge (KNOW)**	**Disciplinary Knowledge (KNOW HOW TO)**			**Literacy**
Energy	Energy Recap Calculating Gravitational Potential Calculating Kinetic Energy Calculating Elastic Potential Power Specific Heat Capacity RP: Specific Heat Capacity (Practical) RP: Specific Heat Capacity (Analysis) Efficiency Recap Energy Resources	Describe energy changes in stores and transfers. Apply equations to analyse energy, power and efficiency of a range systems. Carry out an investigation to the specific heat capacity of metals. Describe and evaluate energy resources types			Energy, Work Gravitational, Gravitational Field, Potential Kinetic Energy, Mass, Velocity Spring Constant, Potential, Elastic/Plastic Deformation. Power, Work, Energy Capacity, Heat, Temperature Joulemeter efficiency, thermal conductivity. Renewable, non-renewable, hydroelectricity, biofuel, geothermal	Particle Model of matter	RP: Density of Regular Shapes RP: Density of Irregular Shapes RP: Density (Write up) Changes of State Internal Energy Specific Latent Heat Specific Heat Capacity Gas Pressure Gas Pressure. Boyle's Law.	Carry out investigations to determin the density of regular and irregular shapes. Use the particle model of matter to describe changes of state. Define internal energy and describe changes in internal energy of an object under heating and cooling. Define latent heat of a substance and use it to explain observations of systems changing state Use the latent heat formula to solve problems Deifne the specific heat capacity of a substance and use it to explain obserations of systems undergoing heating and cooling Use the specific heat capacity to solve problems. Use the particle modle to describe and explain changes in the the pressure exerted by a gas. Use Boyle's Law to solve problem for changes in the pressure and volume of fixed mass of gas.		Solids, liquids, gases, models, density, volume, boiling, melting, condensing, evaporating, freezing, sublimation, Chemical potential, thermal store, kinetic energy, Latent Heat, Vaporization, Fusion, Thermal Energy, Specific Heat Capacity, Kinetic Theory, Pressure, constant	Forces and Their Interactions	Mass, Weight and Gravity Resultant Force (Newtons first law) Newtons 2nd Law Free Body Diagrams (HT Content) Car Safety (Stopping Distances) Work Done Work and Friction Stretching and Changing Shape Spring Equations RP: Hookes Law (Practical) RP: Hookes Law (Analysis)		Define and know the units of mass, weight and gravitational field strength (gfs) Apply the equation that links weigh, mass and gfs to solve problems. Define and determin the resultant force on an object. Recall Newton's first Law and use it to explain predict the behaviour of objects. Draw free body diagrams to anayises the forces on and object in 1 and 2 dimentions. Describe and explain factors affectig stoping distances. Define work done as energy transferred and use the equation to solve problems. Describe and explain the effect of frctional forces on a system. Decribe the effects of forces on the shape of objects and the work done, Use equations lined to forces and energy on the stretching of springs Investigate the relationship between the force applied and the exption of a spring		Weight, mass, gravitational field stregth, resultant force, component of a force, acceleration, proprtional, Work, Newton, elastic, inelastic and elastic limit, extention, spring constant,
Electricity	Static Electricity Electric Fields Electrical Power National Grid, Transformers and Power Circuits Recap (Circuit Rules) Graphs of Thermistors and LDR's RP: Resistors in Series and Parallel (Simulation) IV Characteristics (Resistor, Bulb and Diodes) RP: I-V Characteristics	Draw diagrams to represent electric fields around posistive and negative point charges. Use field diagram to explain the atractive and replusive forces between charges. Describe the production of static electricity, and sparking, Explain how the transfer of electrons between objects can explain the phenomena of static electricity. Define electrical power and apply equations to electric power problems. Decribe and explain the structure of the nationsal grid including the role of the transformer. Describe the functionof thermisters and light deopendandant resistors in everyday circuits. Describe the change in the resistanc of thermisters and LDR's under differencnt environmental conditions Inversitgate the current-voltage charateristics of electrical components.			Insulator, Conductor, Charge, Electrons Electric Field, electrostatic, : Power, Watts, National Grid, transmission, Parallel, Series, Circuit, Current, Resistance, Thermistor, Light Dependent Resistor, Filament lamp, diode, LDR, Resistance, Ohmic, Rheostat (Variable resistor)	Atomic Physics	Structure of an Atom History of the Atom (Models) Alpha Particle Scattering Experiment Radioactive Decay Different Types of Radiation Properties of Alpha, Beta and Gamma Decay Equations Half-life Half-life Calculations (HT only) Contamination and Irradiation (Background Radiation) Uses of Nuclear Radiation (HT Content) Fission (HT Content) Fusion (HT Content)	Describe the structure of an atoms and how the model of the atom and changed over time. Explain how models change over time based on scientific evidence. Know that the nucleus of some elements are unstable and decay. Know the structures of radioactive decay particles and link the observed properties to the structure. Know and apply the general decay equations for types of radioactive radiations. Define half life, determine it from graphs and calculate in a range of contexts inculding number of particles and count rates. Describe and explain uses of different types of radioactive radiations . know the difference between contamination and Radiation Descibe the process of Fusion and the condistions required for it to iccur. Descibe the process of Fission, including chain reations. Use general equations to show the process of fusion and fission..		Atoms, protons, neutrons, electrons, ions, isotopes, alpha, scattering experiment, pluim pudding modle, Becquerrel, ionising, radiation, alpa, beta, gamma, penetration, half-life, decay, contamination, irradiation, tracers, fusion, fission, daughter nuclei, reactor, control rods					
Particle Model of Matte	States of Matter (recap) Density, Theory and Calculations	Use the particle model of matter to describe the three sates of matter. Define desity and use the equation to solve problems.			Density, solids, liquids, gases, volume, mass	Forces and Their interactions	Vectors and Scalars Centre of Mass	Define vectors and scalars and describe the difference between the m. Give example of scalar and vectors. Define centre of mass and descibe methois to determin this for regular and irregular shapes			Scalar, Vector, Magnitude					

YEAR 11		AUTUMN TERM				YEAR 11		SPRING TERM				YEAR 11		SUMMER TERM			
POWERFUL IDEAS	**Forces, Energy and Waves**	**CEIAG**	Engineering, Technology, architecture, product design. Sports science and physiology.	**Focused retrieval 6 topics**	Vectors and Scalars, Centre of mass, Newtons laws (1&2), Free body diagrams, Car Safety, Work done, Friction, Spring, KS3: Waves: what is a wave, oscillations cause variations which cause waves, Light and Shadows, Reflection and Refraction, KS4: Energy transfer by waves is called radiation, all radiation does work.	**POWERFUL IDEAS**	**Forces, Waves, Electricity, particle Physics and Energy**	**CEIAG**	Sound Engineer, Seismologist, Sonographer, Radiographer, Lighting Engineer.	**Focused retrieval 6 topics**	KS3: Waves: what is a wave, oscillations cause variations which cause waves, Light and Shadows, Reflection and Refraction, KS4: Energy transfer by waves is called radiation, all radiation does work.	**POWERFUL IDEA**	**Forces, Waves, Electricity, Particle Physics and Energy**	**CEIAG**	Atmospheric Science and Meteorology, Astronomer / Physicist, Space Technologists / Aerospace Technician, Avionics technician, Satellite technician.	**Focused retrieval 6 topic**	Forces (KS4): Include questions on gravitational fields and weight. Atomic Structure: Pupils should be able to describe a fusion reaction. Waves: Em Waves, Light
TOPICS	**Substantial knowledge (KNOW)**		**Disciplinary Knowledge (KNOW HOW TO)**		**Literacy**	**TOPICS**	**Substantial knowledge (KNOW)**		**Disciplinary Knowledge (KNOW HOW TO)**		**Literacy**	**TOPICS**	**Substantial knowledge (KNOW)**		**Disciplinary Knowledge (KNOW HOW TO)**		**Literacy**
Forces and Motion	Inertial Mass and Momentum (HT only) Conservation of Momentum (HT only) Changes in Momentum (Physics only) Moments (Levers and Gears) (Physics only) Pressure in a Fluid (Physics only) Pressure at depth (Physics only) Pressure in a Gas (Phys only)		Describe mechanics systems with repect to interial mass and momentum Apply equations to analyse conseravtion of momentum in a closed system Describe and evaluate mechanics system with repect to moments and lever. Apply equations to closed systems wirht repect to moments levers and gears Describe and evaluate the behaviours and pressures of fluids		inertial, inertia, momentum	Waves Part 2	Reflection of Waves and Colour (Physics only) RP: Light and Reflection (Physics only) Lenses (Convex) (Physics only) Lenses (Concave) (Physics only) Black Body Radiation (Physics only)		Construct labelled ray diagrams to illustrate the reflection, refraction of a wave at a plain surface and for concave and convex lenses. State the law of reflection. Describe and explain the effect of a wave moving from one medium into another.Explain how the colour an object looks depends on the absorption, transmission and reflection of different wavelengths of light. Draw rays diagrams to illustrate specular reflection by a smooth surface and scattering of light by a rough surface. Explain how the colour of an opaque object is related to the wavelengths of light that are reflected and the wavelengths of light that are absorbed. Define transparent and translucent. Explain what is meant by black body radiation. Explain how the colour of an object is linked to the temperature of that object in terms of intensity of wavelengths emitted.	Reflection, refraction, disperion, convex, concave, transmit, absorb, emmit, normal, incident, specular	Space	The Solar System (Physics only) Satellites and Orbits (Physics only) Life Cycle of a Star (Physics only) Fusion within Stars (Physics only) Red-Shift (Physics only) Evidence for the Big Bang		Name objects found in the solar system, understand how our solar fits into the structure of the universe. Apply a qualitative approach to the description of the orbits, satellites and their applications. Describe an explain the life cycle of a star and link the ultimate fate of a star to it's mass. Describe the process of fusion in stars and how it leads to the formation of elements. Undertsand the process of spectral absorptuion in stars. Use absorption spectra and undertanding od red shift to qualitativly determine relative speeds of galaxies. Explain how the evidence from red shift and cosmic background radiation can be used to support the big bang model for the formation of the universe	Galaxy, asteroids, comets, polar orbit, geostationary orbit, super novae, equilibrium, neutron stars, protostars, main sequence, red giant, black hole
Waves part 1	Properties of Waves The Wave Equation (Physics Content) RP: Observing Waves (Practical) RP: Observing Waves (Analysis) Sound and Ultrasound (Physics only) P&S Waves and the Earths Structure (Physics only) Electromagnetic Spectrum UV, X-Rays and Gamma Rays Properties of Electromagnetic Waves (HT only) Uses of EM Radiation		Define a waves and there sub types of transvers and longitudinal. Idetify features of both types of waves. Apply equations to analyse period, frequency wavelength and wavespeeds Make measurementsmand calcualtions of progressive and standing waves Describe, explain and evaluate used on sound and ultra sound waves. Explain how the properties of Seizmic maves can be used to infer the structure of the Earth Recall the regions of the electromagnetic spectrum Recall and explain uses of the regions of the EM spectrum based on their properties		Transverse, Longitudinal, Parallel, Perpendicular, Oscillations. Amplitude, Wavelength, frequency, period. Ultrasound, Frequency, Sonographer	Magnetism and Electro Magnetism TRIP	Permanent and Induced Magnets (Magnetic Fields) Electromagnetism (Physics content) The Motor Effect (HT only) Electric Motors (HT only) Induction, Microphones & Speakers (Physics only) Generators – AC Alternators and DC Dynamos (Physics only) The Transformer Equation (Physics only)		Descrbe the difference between permentant and induced magnets. Draw diagrams to represent the magnet fields of a bar magnet, attractive and repulise magnetic forces and a solenoid. Describe an electromagnet and the factors affecting the strength of it's magntic field. Define and apply flemming's left hand rule. Decribe the motor effect and apply the associated equation to solve problems. Describe and explain the function of simple DC and AC motors. Use electromagnetic induction to describe and explain the function of microphones and speakers. Apply electromagntic induction to both AC and DC generators. Describe and explain the features of step and step down transformers. Apply the transfomer and power equations to solve problems.	Magnetic field, solennoid, poles, electromagnetic induction,Generators, Alternators, Generator Effect, Polarity, Dynamo	Forces DUAL	Mass, Weight and Gravity Resultant Force (Newtons first law) Newtons 2nd Law Free Body Diagrams (HT Content) Car Safety (Stopping Distances) Work Done Work and Friction Stretching and Changing Shape Spring Equations RP: Hookes Law (Practical) RP: Hookes Law (Analysis)		Define and know the units of mass, weight and gravitational field strength (gfs) Apply the equation that links weigh, mass and gfs to solve problems. Define and determin the resultant force on an object. Recall Newton's first Law and use it to explain predict the behaviour of objects. Draw free body diagrams to anaylses the forces on and object in 1 and 2 dimentions. Describe and explain factors affectig stoping distances. Define work done as energy transferred and use the equation to solve problems. Describe and explain the effect of frctional forces on a system. Decribe the effects of forces on the shape of objects and the work done, Use equations lined to forces and energy on the stretching of springs Investigate the relationship between the force applied and the exption of a spring	Weight, mass, gravitational field stregth, resultant force, component of a force, acceleration, proprtional, Work, Newton, elastic, inelastic and elastic limit, extention, spring constant,

Magnetism and Electromagnetism DUAL	Permanent and Induced Magnets (Magnetic Fields) Electromagnetism	Descrbe the difference between permentant and induced magents. Draw diagrams to represent the magnet fields of a bar magnet, attractive and repulise magnetic forces and a solenoid. Describe an electromagnet and the factors affecting the strength of it's magntic field	Magnetic field, solennoid, poles, induced,	Electricity Revision - DUAL	Static Electricity Electric Fields Electrical Power National Grid, Transformers and Power Circuits Recap (Circuit Rules) Graphs of Thermistors and LDR's RP: Resistors in Series and Parallel IV Characteristics (Resistor, Bulb and Diodes) RP: I-V Characteristics	Draw diagrams to represent electric fields around posistive and negative point charges. Use field diagram to explain the atractive and replusive forces between charges. Describe the production of static electricity, and sparking, Explain how the transfer of electrons between objects can explain the phenomena of static electricity. Define electrical power and apply equations to electric power problems. Decribe and explain the structure of the nationsal grid including the role of the transformer. Describe the functionof thermisters and light deopendandant resistors in everyday circuits. Describe the change in the resistanc of thermisters and LDR's under differencnt environmental conditions Inversitgate the current-voltage charateristics of electrical components.	Insulator, Conductor, Charge, Electrons Electric Field, electrostatic, : Power, Watts, National Grid, transmission, Parallel, Series, Circuit, Current, Resistance, Thermistor, Light Dependent Resistor, Filament lamp, diode, LDR, Resistance, Ohmic, Rheostat (Variable resistor)	Waves DUAL	Properties of Waves The Wave Equation (Physics Content) RP: Observing Waves (Practical) RP: Observing Waves (Analysis) Sound and Ultrasound (Physics only) P&S Waves and the Earths Structure (Physics only) Electromagnetic Spectrum UV, X-Rays and Gamma Rays Properties of Electromagnetic Waves (HT only) Uses of EM Radiation	Define a waves and there sub types of transvers and longitudinal. Idetify features of both types of waves. Apply equations to analyse period, frequency wavelength and wavespeeds Make measurementsmand calcualtions of progressive and standing waves Describe, explain and evaluate used on sound and ultra sound waves. Explain how the properties of Seizmic maves can be used to infer the structure of the Earth Recall the regions of the electromagnetic spectrum Recall and explain uses of the regions of the EM spectrum based on their properties	Transverse, Longitudinal, Parallel, Perpendicular, Oscillations. Amplitude, Wavelength, frequency, period. Ultrasound, Frequency, Sonographer
Electricity (TRIP)	Static Electricity Electric Fields	Draw diagrams to represent electric fields around posistive and negative point charges. Use field diagram to explain the atractive and replusive forces between charges. Describe the production of static electricity, and sparking, Explain how the transfer of electrons between objects can explain the phenomena of static electricity. .	Insulator, Conductor, Charge, Electrons Electric Field, electrostatic	Atomic Physics DUAL	Structure of an Atom History of the Atom (Models) Alpha Particle Scattering Experiment Radioactive Decay Different Types of Radiation Properties of Alpha, Beta and Gamma Decay Equations Half-life	Describe the structure of an atoms and how our model of the atom and changed over time. Explain how models change over time based on scientific evidence. Know that the nucleus of some electments are unstable and decay. Know the structures of radioactive decay particles and link the observed properties to the structure. Know and apply the general decay equations for types of radioactive radiations. Define half life and determine it from graphs Describe and explain uses of different types of radioactive radiations . know the difference between contamination and Radiation	Atoms, protons, neutrons, electrons, ions, isotopes, alpha, scattering experiment, pluim pudding modle, Becquerrel, ionising, radiation, alpa, beta, gamma, penetration, half-life, decay, contamination, irradiation	Forces and Motion	Inertial Mass and Momentum (HT only) Conservation of Momentum (HT only) Changes in Momentum (Physics only) Moments (Levers and Gears) (Physics only) Pressure in a Fluid (Physics only) Pressure at depth (Physics only) Pressure in a Gas (Phys only)	Describe mechanics systems with repect to interial mass and momentum Apply equations to analyse conseravtion of momentum in a closed system Describe and evaluate mechanics system with repect to moments and lever. Apply equations to closed systems wirht repect to moments levers and gears Describe and evaluate the behaviours and pressures of fluids	inertial, inertia, momentum, kinetic theory
Atomic Physics TRIP	Fission (HT Content) Fusion (HT Content)	Descibe the process of Fusion and the condistions required for it to iccur. Descibe the process of Fission and the condistions required for it to iccur, including chain reations. Use general equations to show the process of fusion and fission..	fusion, fission, daughter nuclei, reactor, control rods	Particle Model DUAL	RP: Density of Regular Shapes RP: Density of Irregular Shapes RP: Density (Write up) Changes of State Internal Energy Specific Latent Heat Specific Heat Capacity Gas Pressure Gas Pressure. Boyle's Law.	Carry out investigations to determin the density of regular and irregular shapes. Use the particle model of matter to describe changes of state. Define internal energy and describe changes in internal energy of an object under heating and cooling. Define latent heat of a substance and use it to explain observations of systems changing state Use the latent heat formula to solve problems Deifne the specific heat capacity of a substance and use it to explain obserations of systems undergoing heating and cooling Use the specific heat capacity to solve problems. Use the particle modle to describe and explain changes in the the pressure exerted by a gas. Use Boyle's Law to solve problem for changes in the pressure and volume of fixed mass of gas.	Solids, liquids, gases, models, density, volume, boiling, melting, condensing, evaporating, freezing, sublimation, Chemical potential, thermal store, kinetic energy, Latent Heat, Vaporization, Fusion, Thermal Energy, Specific Heat Capacity, Kinetic Theory, Pressure, constant	Magnetism and Electromagnetism DUAL	Permanent and Induced Magnets (Magnetic Fields) Electromagnetism	Descrbe the difference between permentant and induced magents. Draw diagrams to represent the magnet fields of a bar magnet, attractive and repulise magnetic forces and a solenoid. Describe an electromagnet and the factors affecting the strength of it's magntic field	Magnetic field, solennoid, poles, induced,

YEAR 12		AUTUMN TERM				YEAR 12		SPRING TERM				YEAR 12		SUMMER TERM			
POWERFUL IDEAS	**Energy, Waves and Particle Physics**	**CEIAG**	Particle Physics Fibre Optic Engineer	**Focused retrieval 6 topics**	KS4 Working Scientificaly, Waves and Atomic Physics	**POWERFUL IDEAS**	**Energy, Waves, Forces, Particle Physics and Electricity**	**CEIAG**	Civil engineering Aeronautical design engineer Acousitc modeller Electronic engineer	**Focused retrieval 6 topics**	KS4 Atomic Physics, waves and forces and electricity	**POWERFUL IDEA**	**Energy, Forces, and Particle Physics**	**CEIAG**	Material Scientist Civil Engineer	**Focused retrieval 6 topic**	
TOPICS	**Substantial knowledge (KNOW)**		**Disciplinary Knowledge (KNOW HOW TO)**		**Literacy**	**TOPICS**	**Substantial knowledge (KNOW)**		**Disciplinary Knowledge (KNOW HOW TO)**		**Literacy**	**TOPICS**	**Substantial knowledge (KNOW)**		**Disciplinary Knowledge (KNOW HOW TO)**		**Literacy**
Measurements and their errors	Use of SI units and their prefixes Limitation of physical measurements d Estimation of physical quantities		Apply the tools and techniques of the scientific process to the investigation and interrogation of physics laws and theories.		Accuracy, precise, uncertainty, random systematic,repeatable, reproducible	Particles and radiationr	The photo electric effect. Collisions of electrons with atoms. Energy levels and photon emission. Wave-particle duality.		Describe and explaion with reference to the concepts of quantum phenomena the behavioirs of photons when interacting with matter in a range of contexts. Explain the development of the theory wave partical duality with reference to the evdience as the the dual behaviors of photns, electrons and hense the extrapolation to other particles and matter		photons, photoelectric, diffraction, spectra, absobtion, emmision	Mechanics and materials	Bulk properties of solids, the Young modulus		Investigate, explain and evaluate material properties. Develop and apply algebraic solutions to material problems		modulus, stress, stain, deformation, malluable, ductile, brittle, yield point
Particles and radiation	Constituents of the atom, Stable and unstable nuclei, Particles, antiparticles and photons, Particle interactions, classification of particles, Quarks and anti quarks, application of conservation laws,		Describe and explain the structure of matter and the fundamental forces through knowledge of particle physics and quantum phenomena.		nucleons, hadrons, baryons, quarks, mesons,muons, kaons, specific, photons, bosons, photoelectric	Waves	Diffraction, Refraction at a plane surface		Interogate and evaluate the behavior of a waves under going diffraction in a range of contexts and scales. Use diffraction to explain the function of material anaylsis devices.		refraction, critial angle, optical fibres, absorption, modal and material dispersion, pulse broadening					
Waves	Progressive waves, Longitudinal and transverse waves, Principle of superposition of waves and formation of stationary waves Interference,.		Investigate, explain and evaluate the energy transfer and related observed phenomena of the interaction of waves with each other and matter. Develop and apply algebraic solutions to wave problems		progressive, stationary diffraction, superposition, interference, phase, polarisation, harmonics, coherence	Mechanics and materials	Scalars and vectors, moments, motion along a straight line, projectile motion, Newton's laws of motion, momentum, work, energy and power		Investigate, explain and evaluate the mechanical behaviours and material properties of closed and open systems Develop and apply algebraic solutions to Mechanics and problems		scalar, vector, component, resultant, resolving, freefall, projectile, parabolic, elastic and inelastic collisions, impulse, inertia, momentum, moments					
						Electricity	Basics of electricity, Current –voltage characteristics, Resistivity, circuits, Potential divider, electromotive force and internal resistance		Investigate and explain observed phenomena through electrical theory. Develop and apply algebraic solutions to electric circuit problems		potenttial, electromotive force, resistvity, conductivity, ohmic, diode, super conductors					

YEAR 13		AUTUMN TERM				YEAR 13		SPRING TERM				YEAR 13		SUMMER TERM			
POWERFUL IDEAS	Energy, Waves, Forces, and Particle Physics	CEIAG	Satellite Engineer Astronomer	Focused retrieval 6 topics	KS5: Mechanics KS4: forces, space, energy	POWERFUL IDEAS	Energy, Waves, Forces, Particle Physics and Electricity	CEIAG	Radiation Officer Radiologist National Grid Engineer Building Efficieny	Focused retrieval 6 topics	KS5: Particle Physics, mechanics, waves KS4: forces, waves. Space	POWERFUL IDEA	Energy, Waves, Forces, Particle Physics and Electricity	CEIAG	Cosmologist Electronic engineer	Focused retrieval 6 topic	KS5: Electric fields, electricity KS4: space, waves
TOPICS	Substantial knowledge (KNOW)		Disciplinary Knowledge (KNOW HOW TO)		Literacy	TOPICS	Substantial knowledge (KNOW)		Disciplinary Knowledge (KNOW HOW TO)		Literacy	TOPICS	Substantial knowledge (KNOW)		Disciplinary Knowledge (KNOW HOW TO)		Literacy
Further mechanics	Circular motion, Simple harmonic motion, simple harmonic systems Forces vibrations and resonance.		Invetigate, explain and evaluate circular motion, SHM systems and forced and free vibrations in a range of contexts. Develop and apply algebraic solutions to further mechanics problems.		Simple harmonic motion, centripetal, resonance, dampening	Fields and their Consequences	Gravitational potential, orbits of planets and satellites. Electric field strength, electric potential, Magnetic flux density Moving charges in a magnetic field, magnetic flux and flux linkage, Electromagnetic induction, Alternating currents, the transformer.		Investigate, explain and evaluate the behaviours of masses and charges in the presences of gravitational, electric and magnetic fields. Describe, explain, measure, and evaluated the properties of graviational , electric and electric fields. Develop and apply algebraic solutions to field problems.		geostationary, polar, flux density, flux linkage, induction, eddy currents, curcular, parabolic	Capacitors	capacitance, parallel plate capacitor, energy stored by a capacitor, capacitor charge and discharge.		Investigate, explain, measure and evaluate the behaviours of capacitors in a range of applications. Explain the factors affecting the material properties of capacitors.. Develop and apply algebraic solutions to capacitor problems.		time constant, diaelectric, permittivity, capacitance,
Astrophysics Telescopes	Refracting telescope - normal adjustment, refracting telescopes, single dish radio telescopes, advantages of large diameter telescopes.		Construct accurate ray digraoms for all reflecting and refracting telescope including the normal adjustment. Describe, explain and evaluate the uses of the full range of EM based telescopes.		refraction, reflection, converging, real, virtual, charged coupled device, resoulution, resolving, parallax, spherical abberation, chromatic abberation	Nuclear Physics	Rutherford scattering, alpha, beta and gamma radiation, radioactive decay, Nuclear instability, nuclear radius, mass and energy, induced fission, safety aspects of fission		Investigate, explain and evaluate the behaviours of radioactive radiations. Describe, explain nuclear instability radiations. Describe, explain and evaluted nuclear fission and fusion process including the design and function of a nuclear reactor. Develop and apply algebraic solutions to nuclear problems.		isotope, decay, exponential, inverse square law, nuclei, nucleons, activity, stability, mass defect, binding energy, moderator, control rods,shielding	Astrophysics Cosmology	Quasars, detection of exoplanets		Describe and explain the formation and properties of Quasars, and their application as standards candles. Describe and explain methods for the detection and interpretation fo data from exoplanets . Develop and apply algebraic solutions to Astrophysics problems.		exoplanet, quasar, transit, spectroscopic
Fields and their Consequences	Fields, newton's law, gravitational field strength, . Electric fields – coulombs law,		Interogate and evaluate the behavior of mass ands charges in th in a range of contexts and scales. .Develop and apply algebraic solutions to field problems.		potential, field strength, equipotential, radial, uniform,	Thermal Physics	Thermal energy transfer, ideal gases, molecular kinetic theory model		Investigate, describe and explain a range of thermal processes with detailed reference to energy transfers. Investigate and evaluate the ideal gas laws. Derive the kinetic theory formula from first priniciples. Develop and apply algebraic solutions to Thermal physics problems.		absolute zero, absolute temperature, internal energy, specific and latent heat, molar and molecular mass, root mean squared, kinetic						
						Astrophysics Cosmology	Classification by luminosity, absolute magnitude, classification by temperature, black body radiation, Principles of the use of stellar spectral classes, The Hertzsprung –Russel Diagram, Supernovae, neutron and black holes,Doppler effect, Hubble's law,		Recall and apply the spectral classification and the HR diagram of to a range of astophysics contexts. Desribe and explain the formation and properties of supernovae, neutron stars and black holes. Apply a range of process to determine distance in space in culding the use of standard candles. Develop and apply algebraic solutions to Astrophysics problems.		parsec, light year, apparent and absolut magbnitue, standard candle, doppler, spectra, main sequence, light curve, supernovae, red shift, binary star,						