Waves, Light and the Electromagnetic Spectrum

Opportunities for Breadth and Challenge: Snell's Law, discovery of IR and UV (disciplinary), ultrasound in jewellery cleaning & cracks in metal detection			
Links to Sequencing for Learning: This unit links to previous work on light and sound in Y7 This unit prepares pupils for work in radioactivity (gamma) in topic 6 (radioactivity) and topic TS (astronomy)			
Section	What we are learning (key knowledge)	Key words	Assessment
1	Describing Waves • What do waves transfer? • How can we describe waves? • What is the difference between a longitudinal wave and a transverse wave?	Wavelength, Longitudinal, Transverse, Amplitude, Velocity, Period, Electromagnetic Waves.	Retrieval Qs of keywords
2a	Wave Speeds • How can we calculate the speed (or velocity) of a wave? • How can we measure the speed of sound in air? • How can we measure the speed of waves on water?	Wave speed, Distance, Frequency, Wavelength	Use of $v = f\lambda$ and $d = vt$
2b	Wave Investigations **Core practical:** *Investigate the suitability of equipment to measure the speed, frequency and wavelength of a wave in a solid and a fluid.*	Ripple Tank, Frequency, Wave Speed	MUM- Ripple Tank investigation, wave speed in vibrating string, wave speed in steel/air with oscilloscope
3a	Refraction • What happens when waves refract? • When does refraction occur? • How does a change in the speed of a wave affect its direction? **Core practical:** investigate refraction in rectangular blocks	Refraction, Interface, Normal, Absorption, Transmission, Reflection, Density, Speed	Refraction in water demo. Application of soldier/car model for towards/away from normal with light.
3b	Investigating refraction • How can you use ray diagrams to show reflection and refraction? • *Investigate refraction in rectangular glass blocks in terms of the interaction of electromagnetic waves with matter.*	Refraction, Ray diagrams, incident angle, refracted angle	Accuracy of angle measurements
4 TS only	Human hearing range and how the ear works • State the frequency associated with ultrasound and infrasound • Explain how the human ear works	Ultrasound, infrasound, cochlea, eardrum, frequency	Questioning

5 TS only	Uses of ultrasound • Describe how sonar is used to detect a shoal of fish • Describe how ultrasound scanning is used in pregnancy • Describe how bats use ultrasound • Calculate depth or distance from wave speed and velocity	Boundary, density, partial reflection	Use of d = vt including 'halving'/'doubling' Analysis of time-pulse graphs for (e.g.) metal scanning
6 TS only	Infrasound & Seismic Waves • State some animals that use infrasound for communication • Explain what p and s waves tell us about the internal structure of the Earth	P waves, s waves, transverse, longitudinal, seismograph, seismometer, mantle, crust, outer core, inner core	
7 TS only	Revision for unit 4 End of Unit Test 4 Test 4 Feedback		Class assessment sheet booklet EUT Test feedback sheet
8 TS only	Total Internal Reflection • Use words and diagrams to state the law of reflection • State and draw what is meant by the 'critical angle' • Describe what total internal reflection is and how it is used in communications and endoscopes	TIR, critical angle, endoscope, fibre optics / optical fibre	Accurate drawing of angles in L of R Qs or endoscope
9 TS only	Colour • Explain the difference between specular and diffuse reflection • Explain how light absorption at surfaces causes us to see different colours • Explain how filters affect what colours we see	Specular, diffuse, filter, absorbed, reflected	
10 TS only	Lenses • Use ray diagrams to show how light is refracted in converging and diverging lenses • Explain the difference between real and virtual images	Converge, diverge, real, virtual	Ray diagrams
11a	Electromagnetic spectrum – Examples and Uses • List the waves in the electromagnetic spectrum in order of increasing frequency (decreasing wavelength) • What do all electromagnetic waves have in common? • Which electromagnetic waves can our eyes detect? • What are the uses of each wave?	Frequencies, wavelengths, Transverse, Vacuum.	Mnemonic
11b	Electromagnetic spectrum – Hazards • What are the dangers of electromagnetic radiation? • How is the danger associated with an electromagnetic radiation? • How is electromagnetic radiation linked to changes in atoms and their nuclei?	Ionizing, gamma	Homework- Poster on the electromagnetic spectrum, uses and dangers.
12 TS only	Temperature and emitted radiation • Explain the link between emitted radiation, absorbed radiation and the temperature of an object	Emit, absorb, power, rate, greenhouse effect	

	• Apply this concept to the Earth **Core practical –** investigate how the surface of a body effects thermal energy radiated or absorbed (black and silver cans / Leslie's cube)		
13 TS only	Generation of radio waves • Recall that radio waves can be produced by oscillations in electrical circuits • Compare this with radiation produced by changes in atoms or nuclei (partially covered later in radioactivity topic)	Aerial, oscillation	
14	Revision for unit 5 End of Unit Test 5 Test 5 Feedback		Class assessment sheet booklet EUT Test feedback sheet

Lacon Childe School Science Department – Physics Scheme of Work – Year 10 TS - Topic 6

Radioactivity

Opportunities for Breadth and Challenge: Half-life modelling simulation			
Links to Sequencing for Learning: Multiple links to chemistry regarding atomic structure This unit links to previous work on gamma radiation as paper of the electromagnetic spectrum This unit prepares pupils for work in electric circuits (limited as fairly self-contained unit)			
Section	What we are learning (key knowledge)	Key words	Assessment
1	Atomic Models • What particles make up atoms? • How big are atoms? • How has our model of the atom changed over time?	atoms, elements, charge, sub atomic particles, electrons	Prior knowledge
2	Inside Atoms • What are the relative masses and charges of the particles that make up atoms? • What are the isotopes of an element? • How can isotopes be represented using symbols?	Isotope, nucleons, relative mass, protons, electrons, mass number, atomic number	Retrieval Qs of keywords
3	Electrons and Orbits • How are electrons arranged in an atom? • What happens to atoms when they absorb or emit electromagnetic radiation? • How do atoms become ionised?	Ionisation, spectrum, absorption spectrum, visible light, electronic configuration	

4	Background radiation • What is meant by background radiation? • What are the sources of background radiation? • How is radioactivity detected and measured?	Count rate, dose, Geiger muller tube	
5	Types of radiation • What are alpha particles, beta particles and gamma radiation? • How do the different kinds of radiation compare in their ability to penetrate materials? • How do the different kinds of radiation compare in their ability to ionise atoms?	Penetrate, alpha, beta, gamma,	
6	Radioactive decay • How does beta decay occur? • How are atomic and mass numbers affected by different kinds of decay? • How can radioactive decays be represented decays be represented in nuclear equations?	Nuclear equation, beta, decay	
7	Half Life • How does the activity of a substance change over time? • What does the half-life of a radioactive substance describe? • How can the half-life be used to work out how much of a substance decays?	Half life, becquerels, activity	
8	Dangers of radioactivity • What are the dangers of ionising radiation? • What precautions should be taken to protect people using radiation? • What is the difference between contamination and irradiation effects? NB plus link to half life for TS	Contamination, iradiation, mutation	
9 TS only	Uses of radioactivity • household fire (smoke) alarms • irradiating food • sterilisation of equipment • tracing and gauging thicknesses • diagnosis and treatment of cancer (including PET scanners and tracers)	PET scan, radiotherapy	
10 TS only	Fission and nuclear power stations • Describe the process of nuclear fission and chain reactions • Explain how these are utilised in nuclear power stations, including the use of control rods and moderators and a description of the energy transfers involved in the process	Chain reaction, moderator, control rods	Exam Qs
11 TS only	Nuclear fusion • Describe nuclear fusion as the creation of larger nuclei resulting in a loss of mass from smaller nuclei, accompanied by a release of energy, and recognise fusion as the energy source for stars • Explain the difference between nuclear fusion and nuclear fission	Chain reaction, moderator, control rods	

	• Explain why nuclear fusion does not happen at low temperatures and pressures, due to electrostatic repulsion of protons		
12	Revision End of unit test Test review and feedback		

Lacon Childe School Science Department – Physics Scheme of Work – Year 10 TS - Topic 7

Astronomy (TS only)

Opportunities for Breadth and Challenge: Many opportunities for metaphysical discussion of ideas such as parallel universes, oscillating universe etc			
Links to Sequencing for Learning: This unit links to previous work on Space in Y8 This unit prepares pupils for work in … NA (self-contained unit)			
Section	What we are learning (key knowledge)	Key words	Assessment
1 TS only	Solar System • Recall that our Solar System consists of the Sun (our star), eight planets and their natural satellites (such as our Moon); dwarf planets; asteroids and comets • Name the planets in order of distance from the sun • Describe how these ideas have changed over time	Geocentric, heliocentric, Ptolemy, Copernicus	
2 TS only	Mass & Weight • Describe the difference between mass and weight • State units for each • Use W=mg to calculate weight, mass or GFS	Gravitational field strength	
3 TS only	Orbits and circular motion • Describe the orbits of moons, planets, comets and artificial satellites • Explain for circular orbits how the force of gravity can lead to changing velocity of a planet but unchanged speed • Explain how, for a stable orbit, the radius must change if orbital speed changes (qualitative only)		
4 TS only	Doppler Effect and Redshift		

	• Describe that if a wave source is moving relative to an observer there will be a change in the observed frequency and wavelength • Describe the red-shift in light received from galaxies at different distances away from the Earth • Explain why the red-shift of galaxies provides evidence for the Universe expanding		
5 TS only	Theories of the Universe • Compare the Steady State and Big Bang theories • Describe evidence supporting the Big Bang theory, limited to red-shift and the cosmic microwave background (CMB) radiation • Explain how the discovery of the CMB radiation led to the Big Bang theory becoming the currently accepted model		
6 TS only	Life Cycle of Stars • Describe the evolution of stars of similar mass to the Sun through the following stages: a nebula b star (main sequence) c red giant d white dwarf • Explain how the balance between thermal expansion and gravity affects the life cycle of stars • Describe the evolution of stars with a mass larger than the Sun		
7 TS only	Telescopes • Describe how methods of observing the Universe have changed over time including why some telescopes are located outside the Earth's atmosphere		
8 TS only	Revision End of unit test Test review and feedback		

Lacon Childe School Science Department – Physics Scheme of Work – Year 10 TS - Topic 8 and 9

Energy, Forces Doing Work & Forces and their Effects

Opportunities for Breadth and Challenge:
Links to Sequencing for Learning: This unit links to previous work on This unit prepares pupils for work in

Section	What we are learning (key knowledge)	Key words	Assessment
1	Energy Stores & Transfers • Describe typical energy transfers in terms of energy stores	Kinetic, gravitational potential, elastic potential, chemical potential, electrical, thermal, light	
2	Work done • E = Fd	Work done = energy transferred, joules	
3	Gravitational Potential Energy • Use and application of ΔGPE = m× g ×Δh		
4	Kinetic Energy • Use and application of KE = × m × v^2		
5	Conservation of Energy & Efficiency • State and use the principle of energy conservation • Describe energy losses from mechanical processes in terms of dissipation and heat • Use Efficiency = useful energy / total energy • Explain ways of reducing unwanted energy transfer through lubrication	Closed system	
6	Power revision and investigation • Use of P = E/t (recap from earlier unit) • Investigate power by moving up the stairs, step-ups onto a low platform or lifting objects of different weights	1W = 1J/s	
7	Types of Force & (Simple) Force Diagrams • Describe examples of forces that act 'at a distance', when objects are 'in contact' • Describe examples of forces that act when objects are 'in contact' • Describe forces that act in pairs (Newton's third law)	Vector, scalar, gravitational, electrostatic, magnetic, normal contact, friction	
8	Free Body and Vector Diagrams • Draw and use free body force diagrams • Use vector diagrams to illustrate resolution of forces, a net force, and equilibrium situations • State the effect of a zero and non-zero resultant on an object's motion	Balanced, accelerate, constant speed/velocity	
9 TS only	Rotational Forces and Moments • Describe situations where forces can cause rotation • Calculate moments using force (newton, N) × distance normal to the direction of the force (metre, m) • Use the principle of moments (the sum of clockwise moments = the sum of anti-clockwise moments)	Equilibrium, pivot/fulcrum, lever, gear	

	• Explain how levers and gears transmit the rotational effects of forces		
10	Revision End of unit test Test review and feedback		