Weekly topic area	**Learning objective**	**GCSE prior**	**Additional home tasks beyond weekly HW**	**Pre-Learning Reading**	**Independent Learning**
Week 1 **3.2.1 Particles** **3.2.1.1 Constituents of the atom**	Simple model of the atom, including the proton, neutron and electron. Charge and mass of the proton, neutron and electron in SI units and relative units. Specific charge of the proton and the electron, and of nuclei and ions. Proton number *Z*, nucleon number *A*, nuclide notation. Students should be familiar with the $^{A}_{Z}X$ notation. Meaning of isotopes and the use of isotopic data.	Prior knowledge: GCSE Dual Award Science; Simple atomic model, Isotopes.	Past exam paper materials: PHYA1 May 2013 Q1 PHYA1 January 2013 Q1(a) PHYA1 June 2012 Q2(a) PHYA1 June 2012 Q2(b) PHYA1 May 2014 Q2(a)(i), (ii) and (iii)	CGP text p19-22 http://phet.colorado.edu/en/simulation/build-an-atom **Rich questions:** Why was specific charge important in the discovery of the electron by J.J. Thomson?	• Describe a model of the atom including protons, neutrons and electrons. • Identify the charge and mass of the proton, neutron and electron in SI and relative units. • Define specific charge and calculate the specific charges of the proton and the electron and of nuclei and ions. • Identify the unit of specific charge. • Define proton number and nucleon number and recognise nuclear notation. • Explain the meaning of isotopes. • Analyse isotopic data.
Week 2 **RP0a resonance tubes**	Develop A-level investigation skills	GCSE practical skills	Read compendium section on experimental skills	CGP text p1 to 18	•
Week 3 **3.2.1.2 Stable and unstable nuclei**	The strong nuclear force; its role in keeping the nucleus stable; short-range attraction up to approximately 3 fm, very-short range repulsion closer than approximately 0.5 fm. Unstable nuclei; alpha and beta decay. Equations for alpha decay, β^{-} decay including the need for the neutrino. The existence of the neutrino was hypothesised to account for conservation of energy in beta decay.	Prior knowledge: GCSE Dual Award Science; unstable nuclei	Past exam paper materials: PHYA1 May 2013 Q2(b)(i) PHYA1 May 2013 Q2(a)(iv) PHYA1 May 2011 Q2 PHYA1 May 2010 Q2(b) and (c)	CGP text p23-30 http://www.walter-fendt.de/ph14e/decayseries.htm **Rich question**: Identify a radioactive decay series and analyse the types of decay taking place that lead to the series.	• Describe the strong nuclear force and its role in keeping the nucleus stable. • Recognise that the strong nuclear force has a short range attraction and a very short range repulsion. • Associate distance below 0.5 fm with repulsion and between 0.5 and 3.0 fm with attraction. • Describe alpha decay and beta decay. • Illustrate alpha beta decay using equations. • Deduce why the neutrino is necessary in beta decay.

Week 4 **3.2.1.3 Particles, antiparticles and photons**	For every type of particle, there is a corresponding antiparticle. Knowledge of particle antiparticle pairs and a comparison of their properties. The photon model of electromagnetic radiation. The energy of photons. The mechanisms of annihilation of matter and antimatter and pair production.		PHYA1 January 2013 Q2 PHYA1 May 2013 Q4(b)	CGP text p31-37 QED – Richard Feynman (softback book, easy reading) **Rich question:** How is annihilation of matter and antimatter used in forming a PET scan?	• Recall that every particle has a corresponding antiparticle. • Contrast the properties of particles and antiparticles. • Give examples of particle antiparticle pairs. • Describe the photon model of electromagnetic radiation. • Calculate the energy of photons from wavelength and frequency. • Describe the processes of annihilation and pair production.
Week 5 **RP 0b Planck's constant with LEDs** **3.2.1.4 Particle interactions**	Further familiarity with practical skills, LED Planck's constant experiment. The four fundamental interactions. The fundamental interactions in terms of exchange particles. The weak interaction. Diagrams to represent the fundamental interactions.	Knowledge of LEDs and circuits	PHYA1 June 2014 Q2(b) PHYA1 June 2013 Q2(a) and (b) •	CGP text p42-47 http://hyperphysics.phy-astr.gsu.edu/hbase/forces/funfor.html https://www.youtube.com/watch?v=3P-FGw5KUeo	• Name the four fundamental interactions. • Describe the fundamental interactions in terms of exchange particles. • Identify the virtual photon as the exchange particle in the electromagnetic interaction. • Distinguish between β^- and β^+ decay identifying them both as examples of the weak interaction. • Analyse electron capture and electron positron collisions as examples of the weak interaction and identify the appropriate exchange particle (W+ or W^-) in each case. Draw simple diagrams to represent interactions.
Week 6 **3.2.1.5 Classification of particles**	Hadrons are subject to the strong interaction. There are two classes of hadrons. Baryon number and its conservation. The proton as the only stable baryon. The pion as the exchange particle of the strong nuclear		PHYA1 May 2013 Q3(a) PHYA1 May 2014 Q1 PHYA1 May 2012 Q3	(CGP text p35-47)) http://www.particleadventure.org/quarks_leptons.html **Rich questions:** What is the Higg's boson and why is it so important to the standard model?	• Associate hadrons with the strong interaction. • Classify hadrons into baryons and mesons. • Differentiate between baryons and mesons in terms of baryon number and are able to demonstrate baryon number conservation in interactions. • Explain that the proton is the only stable hadron and that all other baryons eventually decay into protons. • Identify the pion as the exchange particle of the strong nuclear force. • Recognise and describe kaon decay.

	force. The decay of kaons into pions. Examples of leptons and their antiparticles. Lepton number and its conservation. The decay of muons into electrons. Strange particles and their production through the strong interaction and their decay through the weak interaction. Strangeness and its conservation in strong interactions. Strangeness does not have to be conserved in the weak interaction.				• Identify leptons and how they can interact through the weak interaction. • Identify the lepton numbers of electrons, muons and neutrinos and demonstrate lepton number conservation in examples of the weak interaction. • Describe the decay of muons into electrons. • Identify strange particles and describe their production and decay. • Demonstrate the conservation of strangeness in strong interactions. • Explain that strangeness does not have to be conserved in the weak interaction.
Week 7 3.2.1.6 Quarks and antiquarks weeks	Properties of quarks and antiquarks. Combinations of quarks and antiquarks required for baryons, antibaryons and mesons.		PHYA1 May 2014 Q1 PHYA1 May 2012 Q1(a) PHYA1 Jan 2013 Q3(a) •	(CGP text p38-47) http://sciencepark.etacude.com/particle/introduction.php http://hyperphysics.phy-astr.gsu.edu/hbase/particles/quark.html http://hyperphysics.phy-astr.gsu.edu/hbase/particles/meson.html	• Recognise charge, baryon number and strangeness as properties of quarks and antiquarks. Analyse the quark structure of protons, neutrons, antiprotons, antineutrons, pions and kaons.
Week 7 cont. 3.2.1.7	Change of quark nature in β^-	Prior	PHYA1 May 2014	http://hyperphysics	• Identify the change in quark character in β^-

Applications of conservation laws	and β^+ decay. Application of conservation laws for charge, baryon number, lepton number and strangeness for particle interactions. Conservation of energy and momentum in interactions.	knowledge: Conservation of energy	Q1(c) PHYA1 May 2012 Q1(b)	.phy-astr.gsu.edu/hbase/particles/parint.html	and β^+ decay. • Apply the conservation laws for charge, baryon number, lepton number and strangeness for particle interactions. Recall that momentum and energy are conserved in interactions.
3.2.2 Electromagnetic radiation and quantum phenomena					
Week 8 **3.2.2.1 The photoelectric effect**	Description of the photoelectric effect. Explanation of threshold frequency in terms of the photon model. Explanation of work function and stopping potential. The photoelectric equation.		PHYA1 May 2013 Q4 PHYA1 May 2012 Q4	CGP text p51-56 http://physics.info/photoelectric/ https://www.youtube.com/watch?v=0qKrOF-gJZ4 https://www.youtube.com/watch?v=kcSYV8bJox8	• Describe the photoelectric effect. • Recognise that the threshold frequency cannot be explained by the wave model of light and can deduce an explanation of threshold frequency in terms of the photon model. • Explain the terms work function and stopping potential. • Analyse the photoelectric effect using the photoelectric equation and calculate the maximum kinetic energy of emitted electrons. • Deduce that the emitted electrons have a range of kinetic energies up to the maximum value calculated using the photoelectric equation.
Week 9 **3.2.2.2 Collisions of electrons with atoms**	Ionisation and excitation. Application in the fluorescent tube. The electron volt.		PHYA1 May 2014 Q4 • PHYA1 Jan 2013 Q4	CGP text p56-59 http://astronomy.swin.edu.au/cosmos/S/Spectral+Line http://www.colorado.edu/physics/2000/quantumzone/ https://www.youtube.com/watch?v=Ql50GBUJ48s	• Describe the processes of excitation and ionisation • Explain how excitation and ionisation apply in the fluorescent tube. • Define the electron volt Convert energies from eV to J and vice versa.

				Rich questions: How are line spectra used to measure the rotational speeds of stars? How do line spectra provide evidence of the Big Bang?	
Week 9 cont 3.2.2.3 Energy levels and photon emission	Line spectra as evidence of discrete energy levels. Calculation of the frequency of emitted photons.		• PHYA1 May 2014 Q4	http://hyperphysics.phy-astr.gsu.edu/hbase/hyde.html - c2 http://physics.nist.gov/PhysRefData/ASD/lines_form.html	• Demonstrate how line spectra implies discrete energy levels in atoms. Calculate the frequencies of emitted photons using the energies associated with different discrete energy levels.
Week 10a 3.2.2.4 Wave-particle duality	Electron diffraction as a demonstration that particles possess wave properties. The photoelectric effect as a demonstration that electromagnetic waves have a particulate nature. The de Broglie wavelength.	Prior knowledge: The diffraction of waves.	• PHYA1 May 2014 Q3	CGP text p60-64 http://hyperphysics.phy-astr.gsu.edu/hbase/mod1.html - c1 **Rich questions:** Is there experimental evidence for the diffraction of protons or neutrons? Why do electron microscopes have a much better	• Identify that electron diffraction provides evidence of particles having wave properties. • Analyse the photoelectric effect and deduce that it demonstrates the particulate nature of electromagnetic waves. • Calculate the wavelength of a particle using the de Broglie equation. Explain how and why the amount of diffraction changes when the momentum of a particle is changed.

				resolving power than optical microscopes?	
Week 10b	Time set aside for PAZ 1				•
3.3.1 Progressive and stationary waves					
Week 11 **3.3.1.1 Progressive waves**	Define the terms amplitude, frequency, period, wavelength, phase and phase difference. Use the equation $c = f\lambda$	Prior knowledge: Wave properties such as frequency, wavelength and amplitude.	PHYA1 May 2013 Q6(d) • PHYA1 Jan 2012 Q7	CGP text p67-73 http://www.acs.psu.edu/drussell/demos/waves/wavemotion.html http://www.animations.physics.unsw.edu.au/waves-sound/	• Define the terms frequency, period, amplitude and wavelength of a wave. • Explain what is meant by phase and phase difference. Use the equation $c = f\lambda$ in calculations.
Week 12 **3.3.1.2 Longitudinal and transverse waves**	The nature of longitudinal and transverse waves. Electromagnetic waves as examples of transverse waves. Speed of electromagnetic waves. Polarisation as a feature of transverse waves. Applications of polarisers.	Prior knowledge: The difference between transverse and longitudinal waves.	PHYA1 May 2013 Q6 PHYA1 May 2014 Q7 PHYA1 May 2012 Q7 •	CGP text p74-78 http://science.hq.nasa.gov/kids/imagers/ems/waves2.html http://missionscience.nasa.gov/ems/02_anatomy.html http://hyperphysics.phy-astr.gsu.edu/hbase/waves/emwv.html http://www.cyberphysics.co.uk/topics/light/polarisation.htm **Rich questions:**	• Distinguish between longitudinal and transverse waves. • Recognise that electromagnetic waves are transverse and all examples of electromagnetic waves travel at the same speed in a vacuum. • Describe the polarisation of transverse waves. Describe applications of polarisers.

				How do we measure the speed of light?	
Week 13 3.3.1.3 Principle of superposition of waves and formation of stationary waves	Stationary waves on strings. The meaning of nodes and antinodes in relation to standing waves. The equation for the frequency of the first harmonic for first harmonic. The formation of a stationary wave by two waves of the same frequency travelling in opposite directions. Graphical explanation for the formation of stationary waves. Examples of stationary waves including those formed on strings and those produced using sound waves or microwaves.		PHYA1 May 2014 Q7(d) PHYA1 Jan 2013 Q6 PHYA1 May 2012 Q6 • PHYA1 Jan 2011 Q4	CGP text p79-85 http://phet.colorado.edu/en/simulation/wave-on-a-string https://www.youtube.com/watch?v=HpovwbPGEoo **Rich question:** How are standing waves used in musical instruments?	• Explain what is meant by a stationary wave. • Define the terms node and antinode. • Calculate the frequency of the first harmonic produced by a stationary wave on a string. • Describe the formation of a stationary wave by two waves of the same frequency travelling in opposite directions. • Use graphs to demonstrate the formation of standing waves. Describe the formation of standing waves produced by microwaves and sound waves.
WEEK 14	Rp1 Standing waves			CGP text p86-87	•

Week 15 **3.3.2 Refraction, diffraction and interference** **3.3.2.1 Interference**	Path difference and coherence. Demonstrate interference and diffraction using a laser as a source of monochromatic light. The Young's double slit experiment. The equation for fringe spacing. Fringe spacing: $w = \frac{\lambda D}{s}$ Production of interference. The interference pattern produced by white light. Interference patterns produced by sound and electromagnetic waves. Appreciation of how knowledge and understanding of the nature of electromagnetic radiation has changed over time.		PHYA1 Jan 2013 Q7 • PHYA1 May 2011 Q7	CGP text p79-85 http://www.physicsclassroom.com/class/light/Lesson-1/Two-Point-Source-Interference https://www.youtube.com/watch?v=G-R8LGy-OVs	• Explain the meaning of path difference and coherence. • Describe the Young's double slit experiment and calculate fringe spacing using data from the experiment. • Distinguish between the fringe patterns produced by monochromatic and white light. • Analyse different examples of the double slit experiment using both electromagnetic and sound waves. Explain how knowledge and understanding of the nature of electromagnetic radiation has changed over time.
Week 16 **3.3.2.2 Diffraction**	The appearance of the diffraction pattern from a single slit using monochromatic and white light. A qualitative treatment of the variation of the width of the central diffraction maximum and slit width. Using a plane diffraction grating with light at normal incidence. The derivation of the grating equation:		PHYA1 May 2014 Q6 PHYA1 May 2013 Q7 PHYA1 Jan 2012 Q5 • PHYA1 Jan 2011 Q3	CGP text p88-93, 96-101 http://hyperphysics.phy-astr.gsu.edu/hbase/phyopt/grating.html **Rich question:** How does the spectrum from a diffraction grating differ from that	• Describe the diffraction patterns produced using a single slit with monochromatic light and contrast this with the pattern produced by white light. • Discuss the effect on the width of the central maximum when the slit width is varied. • Describe the use of the plane diffraction grating. • Use the grating equation in calculations. Describe uses of the diffraction grating such as the analysis of spectra.

	$$d sin\theta = n\lambda$$ Applications of the diffraction grating.			produced by a prism?	
Week 17	RP2: Young's double slit expt and interference			CGP text p94-95	
Week 18 **3.3.2.3 Refraction at a plane surface**	Defining refractive index in terms of wave speed in different media. Snell's law of refraction at a boundary: $$n_1 \sin\theta_1 = n_2 \sin\theta_2$$ Total internal reflection $$\sin\theta_c = \frac{n_1}{n_2}$$ Step index optic fibres including the function of the cladding. Material and modal dispersion and the consequences of pulse broadening and absorption.	Prior knowledge: The refraction of light.	PHYA1 May 2014 Q5 PHYA1 May 2013 Q5 PHYA1 Jan 2013 Q5 PHYA1 May 2012 Q4 PHYA1 Jan 2012 Q6 • PHYA1 May 2011 Q5	CGP text p102-109 http://www.learnerstv.com/animation/animation.php?ani=102&cat=physics http://hyperphysics.phy-astr.gsu.edu/hbase/geoopt/refr.html https://www.youtube.com/watch?v=0MwMkBET_5I	• Define refractive index in terms wave speed in different media. • Recall that the refractive index of air is approximately 1. • Use Snell's law to calculate angles when light crosses a boundary between two media, • Describe total internal reflection and distinguish this from partial reflection. • Calculate critical angles using refractive indices. • Describe the step index optic fibre. Understand the principles and consequences of pulse broadening and absorption.

3.4.1 Forces, energy and momentum					
Week 19 **3.4.1.1 Scalars and vectors**	The nature of scalar and vector quantities. Addition of vectors by calculation or scale drawing. The resolution of vectors into two components. The conditions for equilibrium for two or three coplanar forces acting at a point.		PHYA1 Jan 2013 Q2 PHYA1 Jan 2012 Q1 PHYA1 May 2012 Q1	CGP text p113-119 http://ed.ted.com/lessons/football-physics-scalars-and-vectors-michelle-buchanan	• Students can distinguish between scalar and vector quantities including velocity/speed, mass, force/weight, acceleration, displacement/distance. • Students can add two vectors by constructing an appropriate scale drawing. • Calculate the sum of two vectors. • Resolve a vector into two perpendicular components. • Recognise the conditions for two or three coplanar forces acting at a point to be in equilibrium. • Apply the conditions for equilibrium in the context of an object at rest or moving at constant velocity.
Week 20 **3.4.1.2 Moments**	Definition of the moment of a force about a point. A couple as a pair of equal and opposite coplanar forces. The equation for the moment of a couple. The principle of moments. The centre of mass and its position in a uniform regular solid.		PHYA1 May 2014 Q3 PHYA1 Jan 2013 Q3 PHYA1 May 2012 Q3 PHYA1 Jan 2012 Q3 • PHYA1 May 2011 Q4	CGP text p120-124 http://www.schoolphysics.co.uk/age16-19/Mechanics/Statics/text/Equilibrium_/index.html	• Define and calculate the moment of a force. • Describe a couple and calculate the moment of a couple. • State the principle of moments. • Apply and use the principle to analyse the forces acting on a body in equilibrium. Explain what is meant by the centre of mass.
Weeks 21 **3.4.1.3 Motion along a straight line**	Definitions of displacement, speed, velocity, acceleration. Representation by graphical methods of uniform and non-uniform acceleration. Significance of areas of velocity – time and acceleration – time	Prior knowledge: Motion graphs, the acceleration due to gravity.	PHYA1 May 2013 Q2 and Q3 PHYA1 May 2012 Q2 PHYA1 Jan 2012 Q3(b) PHYA1 May 2011 Q1 and Q2 • PHYA1 Jan 2011	CGP text p125-138 http://hyperphysics.phy-astr.gsu.edu/hbase/mechanics/motgraph.html	• Define displacement, speed, velocity and acceleration. • Distinguish between velocity and speed. • Calculate velocities and accelerations. • Calculate both instantaneous and average velocities. • Draw graphs to represent motion. • Recognise the significance of the areas of velocity – time and acceleration – time

	graphs and gradients of displacement – time and velocity – time graphs. The equations for uniform acceleration. $v = u + at$ $s = \left(\frac{u+v}{t}\right)t$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$		Q5	http://www.grc.nasa.gov/WWW/k-12/airplane/mofall.html **Rich question:** What is the average velocity of a cyclist who cycles at a constant speed of 20 m s^{-1}, around a circular track of circumference 400 m when they are a quarter of the way around the track?	graphs. • Recognise the significance of the gradients of displacement – time and velocity – time graphs. • Recall the equations of uniform acceleration and can apply them in calculations. Involving motion in straight lines. Analyse experiments to determine the acceleration due to gravity using a graphical method
Time should fit, quick pract.	RP3: Determining the acceleration due to gravity, *g*.				

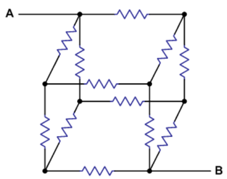
Week 22a 3.4.1.5 Newton's laws of motion	Knowledge and application of the three laws of motion. Use of the equation; $F = ma$	Prior knowledge: Force = mass × acceleration	PHYA1 May 2013 Q1 • PHYA1 May 2011 Q3	CGP text p139-140 http://hyperphysics.phy-astr.gsu.edu/hbase/newt.html **Rich question:** How is the equation, *F=ma*, modified when mass is changing?	• Recall the three laws of motion and apply them in appropriate situations. • Construct and use free-body diagrams. • Use the equation linking force and acceleration in calculations. Recognise that the equation can only be used in situations where the mass is constant.
Week 22b 3.4.1.4 Projectile motion	Independent effect of motion in horizontal and vertical directions of a uniform gravitational field.		PHYA1 May 2014 Q2 PHYA1 Jan 2011 Q2	CGP text p141-146 http://phet.colorado.edu/sims/projecti	• Explain how the motion of a projectile can be analysed by treating its horizontal and vertical motion independently. • Analyse the motion of a projectile by considering the effect of gravity on horizontal

	A qualitative treatment of friction. Qualitative treatments of lift and drag forces. A qualitative treatment of the effects of air resistance on the trajectory of a projectile. The factors affecting the maximum speed of a vehicle.			le-motion/projectile-motion_en.html http://www.nationalstemcentre.org.uk/elibrary/resource/2084/monkey-and-hunter http://www.instructables.com/id/MONKEY-HUNTER-PHYSICS/	and vertical motion. • Describe friction quantitatively. • Explain the nature of lift and drag forces. • Describe the effects of air resistance on the trajectory of a projectile. • Explain why falling objects can reach a terminal speed. • Discuss the factors that affect the maximum speed of a vehicle.
Week 23 3.4.1.6 Momentum	Define momentum. The conservation of linear momentum in one dimension. Force as rate of change of momentum. Define impulse and its relationship to the area under a force time graph. The relationship between impact forces and contact time. Distinguish between elastic an inelastic collisions. Apply the conservation of momentum to explosions.	Prior knowledge: Safety features in cars such as crumple zones.		CGP text p151-157 http://hyperphysics.phy-astr.gsu.edu/hbase/elacol.html http://hyperphysics.phy-astr.gsu.edu/hbase/inecol4.html http://www.animations.physics.unsw.edu.au/jw/momentum.html **Rich question:** Prove that an object of mass, *m*, must be stationary after an elastic collision with a stationary object also of mass *m*.	• Define momentum and recall the unit for momentum. • Discuss the conservation of linear momentum and apply it in calculations involving collisions in one dimension. • Relate force to rate of change of momentum. • Define impulse. • Deduce the effect on impact forces of contact times. • Distinguish between elastic and inelastic collisions. Apply momentum conservation to explosions.

Week 24 **3.4.1.7 Work, energy and power**	The relationship between energy transferred and work done. $W = Fs\cos\theta$ Rate of doing work is equal to the rate of energy transfer $P = \frac{\Delta W}{\Delta t} = Fv$ The significance of the area under a force displacement graph. Efficiency as the ratio of useful output power to input power.	Prior knowledge: Calculating work and power.	PHYA1 Jan 2013 Q1 PHYA1 Jan 2012 Q1 and Q2	CGP text p158-161 http://hyperphysics.phy-astr.gsu.edu/hbase/work.html https://phet.colorado.edu/en/simulations/category/physics/work-energy-and-power	• Recognise that when work is done energy is transferred. • Calculate the work done including situations where the force is not acting in the direction of displacement. • Calculate the rate of doing work. • Analyse situations in which the force acting is variable. • Recall that the work done or energy transferred is equal to the area under a force displacement graph. • Calculate efficiency as a ratio and as a percentage.
Week 25a **3.4.1.8 Conservation of energy**	The principle of conservation of energy. Kinetic energy and gravitational potential energy. Quantitative and qualitative applications of energy conservation.	Prior knowledge: Energy is always conserved.	PHYA1 Jan 2012 Q2 PHYA1 Jan 2013 Q1 PHYA1 May 2014 Q1	CGP text p162-167 http://hyperphysics.phy-astr.gsu.edu/hbase/conser.html http://www.nuffieldfoundation.org/node/1842	• Recall the principle of the conservation of energy. • Calculate kinetic and gravitational potential energy. • Describe energy changes involving kinetic, gravitational potential energy and work done against friction.
Week 25b	Likely PAZ 2				•

3.4.2 Materials					
Week 26 **3.4.2.1 Bulk properties of solids**	The definition of density. Hooke's law and the elastic limit. The force extension equation: $$F = k\Delta l$$ Definitions of tensile stress and tensile strain. The meaning of breaking stress. Elastic strain energy $$energy\ stored = \frac{1}{2}F\Delta l$$ Description of plastic behaviour, fracture and brittle behaviour related to force – extension graphs.	Prior knowledge: The definition of density. Investigation of Hooke's law using springs.	PHYA1 May 2013 Q4 PHYA1 May 2012 Q5 PHYA1 Jan 2012 Q4 • PHYA1 Jan 2011 Q1	CGP text p172-176 https://depts.washington.edu/bonebiomecha/ASBMRed/biomecha/bio.swf http://www-tc.pbskids.org/zoom/printables/activities/pdfs/eggbungeejump.pdf	• Define density and do calculations using the density equation. • State Hooke's law and explain what is meant by the elastic limit. • Apply the force extension equation and recognise that the constant, k, is known as the stiffness or the spring constant. • Demonstrate that they recognise the meanings of tensile stress and tensile strain. • Explain what breaking stress means. • Calculate elastic strain energy. • Recognise that the energy stored is equal to the area under a force – extension graph. • Explain what is meant by plastic behaviour, fracture and brittle behaviour. • Analyse stress – strain curves. • Apply energy conservation to examples involving elastic strain energy and energy to deform. • Analyse the energy changes taking place in an oscillating spring. Appreciate the importance of energy conservation in transport design.
Week 27 **3.4.2.2 The Young modulus**	The definition of the Young modulus. Interpretation of stress – strain curves. Application of energy conservation to examples involving elastic strain energy and energy to deform. The transformation of spring energy to kinetic and gravitational potential energy.		PHYA1 May 2014 Q4 PHYA1 Jan 2013 Q4 PHYA1 May 2011 Q6 • PHYA1 Jan 2011 Q6	CGP text p177-188 https://www.tes.co.uk/teaching-resource/Young-Modulus-AS-Physics-6130086/ http://tap.iop.org/mechanics/materials/228/page_46520.html	• Define the Young modulus and use it in calculations. Describe a method to determine the Young modulus.

	Appreciation of energy conservation issues in the context of ethical transport design.				
Week 28	RP4: Experiment to determine the Young modulus using a stress – strain graph.			CGP text p181-182	
3.5.1 Current electricity					
Week 29 **3.5.1.1 Basics of electricity And 3.5.1.4 Circuits (part)**	Electric current is the rate of flow of charge. Potential difference is the work done per unit charge. The definition of resistance. Combining resistors in series and in parallel. The relationship between currents, voltages and resistances in series and parallel circuits. Cells in series and identical cells in parallel.	Prior knowledge: Electric current as a flow of charge. Definitions of current, potential difference and resistance.	PHYA1 May 2012 Q7 PHYA1 Jan 2012 Q5(a)	CGP text p191-195 http://hyperphysics.phy-astr.gsu.edu/hbase/electric/elecur.html	• Recognise that current is the rate of flow of charge. • Recognise that potential difference is the work done per unit charge. • Recognise the equation defining resistance and can apply it in calculations.
Week 30 **3.5.1.2 Current-voltage characteristics**	The current – voltage characteristics for an ohmic conductor, a semiconductor diode and a filament lamp. Ohm's law as a special case where current is directly proportional to voltage under constant physical conditions.			CGP text p196-198 http://hyperphysics.phy-astr.gsu.edu/hbase/electric/ohmlaw.html	• Interpret current – voltage graphs and distinguish between the characteristics for an ohmic conductor, a semiconductor diode and a filament lamp. Recognise that Ohm's law is a special case for a component with constant resistance.
Week 31a		Prior	PHYA1 May 2014 Q6	CGP text p199 to	• Define resistivity and use the resistivity

3.5.1.3 Resistivity	Resistivity, $\rho = \frac{RA}{L}$ Description of the qualitative effect of temperature on the resistance of metal conductors. The effect of temperature on a negative temperature coefficient thermistor. Application of thermistors in temperature sensors. Superconductivity as a property of certain materials which have zero resistivity at or below the critical temperature. Applications of superconductors.	knowledge: The definition of resistance.	PHYA1 Jan 2013 Q7(a) PHYA1 Jan 2012 Q5(b)	201 http://phet.colorado.edu/en/simulation/resistance-in-a-wire http://hyperphysics.phy-astr.gsu.edu/hbase/electric/resis.html https://teachers.web.cern.ch/teachers/archiv/HST2001/accelerators/superconductivity/superconductivity.htm	equation in calculations. • Describe an experiment to determine the resistivity of a wire. • Describe the effect of temperature on the resistance of metal conductors. • Describe the effect of temperature on a negative temperature coefficient thermistor. • Describe application of thermistors including temperature sensors. • Explain what is meant by a superconductor. • Describe how superconductors can be used to produce strong magnetic fields and to reduce energy losses in the transmission of electric power.
Week 31b	RP5: Experiment to determine the resistivity of a wire.			CGP text 202-203,	•
Week 32 **3.5.1.4 Circuits**	The energy and power equations: $E = VIt$ $$P = VI = I^2R = \frac{V^2}{R}$$ The conservation of charge and energy in dc circuits.	Prior knowledge: Combining resistors in series. Energy and power in electric circuits.	PHYA1 May 2014 Q5 PHYA1 Jan 2013 Q6 and Q7(b) PHYA1 Jan 2012 Q6 PHYA1 Jun 2012 Q6 •	CGP text p204-206 http://www.tap.iop.org/electricity/circuits/index.html **Rich question:** What is the resistance between A and B? All resistors are 1 Ω 	• Calculate the total resistance for combinations of series and parallel resistors. • Analyse series and parallel circuits. • Analyse circuits involving combinations of cells in series and identical cells in parallel. • Calculate the energy and power in electric circuits. Explain how energy and charge are conserved in electric circuits.
Week 33 **3.5.1.5 Potential divider**	The potential divider used to supply constant or variable potential difference from a power supply.	Prior knowledge: The definition	PHYA1 May 2014 Q7	CGP text p1 to 18 http://tap.iop.org/electricity/circuits/11	• Demonstrate that they understand how a potential divider can provide a constant or variable potential difference from a power supply.

	The **use** of variable resistors, light dependent resistors and thermistors in potential divider circuits.	of resistance	PHYA1 May 2013 Q7 PHYA1 May 2012 Q7	8/page_46038.htm l	• Describe how variable resistors, light dependent resistors and thermistors can be used in potential divider circuits.
Week 34a **3.5.1.6 Electromotive force and internal resistance**	The definition of emf. Circuit equation when cells have appreciable internal resistance. $\in= I(R+r)$ Terminal pd.	Prior knowledge: The definition of resistance.	PHYA1 May 2013 Q6 • PHYA1 Jan 2012 Q7	CGP text p1 to 18 http://www.tap.iop.org/electricity/emf/index.html http://www.nuffieldfoundation.org/practical-physics/internal-resistance-potato-cell **Rich question:** Why is it important for car batteries to have very low internal resistances?	• Define emf with reference to cells. • Understand and perform calculations for circuits in which the internal resistance of the supply is not negligible. Explain what is meant by terminal pd.
Week 34b **3.5.1.6 Electromotive force and internal resistance**	RP6: Finding the emf and internal resistance of a cell				
Week 36	Paz3 Work experience Start circular motion from A2?				