Subject	Y13 Core Knowledge – Autumn/Spring/Summer term	How to support students' learning
Science - Physics	**Autumn Term** **Further mechanics -** 1. Know how to use radians as a measure of the size of an angle. 2. Know the definition of angular speed and how to calculate it using both equations. 3. Fully understand that an object travelling in a circle is accelerating towards the centre of the circle and that this is due to centripetal force. 4. Use the equation for centripetal acceleration. 5. Know the characteristics of simple harmonic motion. 6. Sketch a graph of displacement, velocity and acceleration as a function of time for an object moving with SHM and understand the phase difference between them. 7. Know that velocity is given by the gradient of a displacement-time graph and that acceleration is the gradient of a velocity-time graph. 8. Describe how kinetic, potential and mechanical energy changes with displacement. 9. Use the 4 equations for SHM to find the velocity, acceleration, displacement and maximum velocity. 10. Independently complete the simple pendulum practical. 11. Understand what is meant by free and forced vibrations. 12. Know how the phase difference between the driver and oscillator changes with increasing driving frequency. 13. Know what resonance is. 14. Know what damping is. **Capacitors -** 15. Know the definition of capacitance. 16. Use the equation to calculate capacitance and the energy stored by a capacitor. 17. Describe how a capacitor works. 18. Plot a graph and use it to determine the energy stored by a capacitor. 19. Understand the terms permittivity and dielectric constant. 20. Describe the action of a simple polar molecule that rotates in an electric field. 21. Graphically represent the charging and discharging of a capacitor knowing what the	• CGP AQA A level Physics year 1 and 2 revision guide (can be bought through the school). • CGP AQA A level Physics year 1 and 2 textbook (can be bought through the school). • Seneca: https://senecalearning.com/en-GB/ Free revision resource.

	gradient and the area under the graph represents. 22. Independently complete the required practical for the discharging and charging of a capacitor. 23. Know what the time constant of a capacitor is and how to calculate it. **Thermal Physics -** 24. Show an understanding of internal energy and absolute zero. 25. Calculate specific heat capacity using the equation Q=mcΔθ. 26. Calculate specific latent heat using the equation Q=ml. 27. Compare and combine specific heat capacity and specific latent heat. 28. State and describe the three gas laws for a fixed mass of an ideal gas. 29. Practically investigate Charles' law and Boyle's law. 30. Effectively use the equations pV=nRT and pV=NkT. 31. Derive the formula pV=1/3 N〖c_((rms))〗2 for an ideal gas and state the assumptions made about an ideal gas in kinetic theory. 32. Demonstrate an understanding of the average molecular kinetic energy of a gas is 1/2 m〖c_((rms))〗2 = 3/2 kT=3RT/(2N_A). **Gravitational and electrical fields -** 33. Define a force field and know that they are represented by vectors. 34. Draw gravitational field lines and calculate the force between two-point masses using Newton's law of gravitation. 35. Define and calculate gravitational field strength, g. 36. Sketch the graph of g (gravitational field strength) against r (distance from the point mass). 37. Calculate gravitational potential, V, and show an understanding of the negative sign in V=-GM/r. 38. Sketch the graph of V (gravitational potential) against r (distance between the point masses). 39. Describe gravitational potential difference, ΔV , and understand what equipotential surfaces are. 40. Describe how the speed and orbital period will affect the radius of a satellite's orbit. 41. Derive Kepler's law showing T2∝r3	

	42. Compare synchronous orbits to geostationary and low orbiting satellites. 43. Show an understanding of escape velocity. **Spring and Summer Term** **Magnetic fields -** 44. Show an understanding of Flemming's left-hand rule. 45. Use $F=BIl$ when the field is perpendicular to the current in a wire. 46. Define the tesla. 47. Practically investigate how the force on a wire varies with current, flux density and length of wire using a top pan balance. 48. Show an understanding of the fact that charged particles moving through a magnetic field will experience a force and will follow a circular path. 49. Calculate the force on a charged particle whose velocity is perpendicular to a uniform magnetic field using $F=BQv$. 50. Determine the direction of force acting on negatively and positively charged particles. 51. Describe how the circular path of charged particles can be altered and applied in devices such as cyclotrons. 52. Distinguish between magnetic flux, magnetic flux density and magnetic flux linkage. 53. Calculate the magnetic flux and the magnetic flux linkage of a rectangular coil rotated in a magnetic field. 54. Practically investigate, using a search coil and oscilloscope, the effect on magnetic flux linkage of varying the angle between a search coil and magnetic field direction. 55. Know Lenz's law. 56. Know Faraday's law. 57. Apply Faraday's law and Lenz's law e.g., to a straight conductor moving in a magnetic field. 58. Calculate the e.m.f. induced in a coil rotating uniformly in a magnetic field. 59. Use an oscilloscope and show a familiarity of the operating controls. 60. Show how to calculate the peak, peak-to-peak and rms values for sinusoidal voltages and currents. 61. Use the equation for an ideal transformer to find the number of turns or voltage on either coil.	

	62. Explain what causes inefficiencies in transformers and explain how eddy currents can be produced. 63. Calculate the efficiency of a transformer. 64. Explain how and why electrical power is transmitted at high voltages. **Nuclear Physics -** 65. Fully explain how our knowledge of the structure of the nucleus has changed over time. 66. Know the properties of each type of nuclear radiation and explain how to identify them. 67. Explain the uses and dangers of each type of nuclear radiation. 68. Investigate the inverse square law. 69. Answer questions on radioactive decay involving molar mass or Avogadro's number. 70. Calculate the half-life. 71. Know how to calculate the binding energy of an atom. 72. Describe fully the process of fission and fusion.	