GRACE COLLEGE **Curriculum Outline Year 11** **Science**

## Year 11 Curriculum Intent

**"Students will learn...**a broad and informative curriculum that encompasses the key concepts of biology, chemistry and physics and how they link together to allow students to enjoy the awe and wonder of Science.
**Students will be able to...**deploy their scientific literacy and skills effectively, enabling them to not only think critically but also engage as informed citizens in scientific discussions, and recognize the value of science when making informed decisions; ultimately contributing as functional members of society."
**Students will become...**appreciative of the world around them, how it works, where it began and the impact they can have on it - all while being prepared for further study and employment in scientific fields, achieving their personal best regardless of their background".

## Year 11 Curriculum Overview

| Half term 1 | Half term 2 | Half term 3 | Half term 4 | Half term 5 | Half term 6 |
|---|---|---|---|---|---|
| B5 Homeostasis and response<br>P5 Forces | B6 Inheritance, variation and evolution<br>C8 Chemical Analysis | P7 Magnetism and electromagnetism<br>C10 Using Resources | Revision | Revision / Exams | Revision / Exams |
| **Key Question** | | | | | |
| How does the body maintain optimum internal conditions?<br>How do forces affect the motion of objects? | How do we inherit characteristics and how do things evolve?<br>How do Chemists analyse chemicals? | What are the effects of magnetic fields and how does it relate to electricity?<br>How do humans utilise the Earth's resources? | How am I doing so far and what can I do to make myself even better? | How am I doing so far and what can I do to make myself even better? | How am I doing so far and what can I do to make myself even better? |
| **Key Vocabulary** | | | | | |
| Homeostasis, stimulus, receptor, effector, response, hormones, menstrual cycle, contraception<br>Force, Scalar, Vector, Acceleration, Newtons Laws, Terminal Velocity, Momentum, Work Done, Extension, Moments, Pressure, Weight, Resultant Force | Sexual, asexual, meiosis, genetics, variation, evolution, selective breeding, genetic engineering, extinction, classification<br>Pure substance, formulation, chromatography | Permanent, induced, attract, repel, poles, electromagnet, solenoid, magnetic flux density, motor effect<br>Potable Water, Sustainable, Recycling, Phytomining, Bioleaching, Ores, Alloys, Life Cycle Assessment, Corrosion, Ceramics | Progress, Growth Mind Set, Resilience, Reflective, Improvement | Progress, Growth Mind Set, Resilience, Reflective, Improvement | Progress, Growth Mind Set, Resilience, Reflective, Improvement |

Biology Chemistry Physics

GRACE COLLEGE

# CORE KNOWLEDGE

## Year 11 – SCIENCE HALF TERM 1

| | The knowledge you will need to recall: | How you will apply this knowledge: | This links to: |
|---|---|---|---|
| 1 | B5 Homeostasis and Response<br>- Recall the definition of homeostasis and explain how control systems regulate examples of internal conditions.<br>• The structure and function of the nervous system.<br>• Recall that the brain controls conscious behaviour and the<br>• HT: explain some of the difficulties of investigating brain function and treating brain damage and disease.<br>• TRIPLE: relate the structures of the eye to their functions including accommodation and adaptation to dim light<br>• TRIPLE: explain how mechanisms lower or raise body temperature in a given context.<br>• Describe the principles of hormonal coordination and control by the human endocrine system.<br>• Explain how blood glucose is monitored and controlled by the pancreas and what happens in people who suffer from diabetes (HT including the role of glucagon and link to negative feedback)<br>• TRIPLE: Understand how water level and nitrogen is balanced in the body through the functioning of the kidneys and negative feedback systems.<br>• Describe the roles of hormones in human reproduction, including the menstrual cycle.<br>• HT: explain the use of hormones in modern reproductive technologies to treat infertility<br>• HT: explain the roles of thyroxine and adrenaline in the body and how thyroxine levels are controlled by negative feedback. | Explain how the structure of the nervous system is adapted to its functions.<br>Explain how reflexes and conscious responses allow organisms to react to their surroundings.<br>plan and carry out an investigation into the effect of a factor on human reaction time.<br>identify the cerebral cortex, cerebellum and medulla on a diagram of the brain, and describe their functions.<br>TRIPLE: identify the key structures on a diagram of the eye and explain how their structure is related to their function<br>TRIPLE: interpret ray diagrams, showing two common defects of the eye and demonstrate how lenses correct them.<br>Identify the position of key glands on a diagram of the human body and explain their function.<br>Compare and contrast nervous and hormonal communication.<br>TRIPLE: explain the effect on cells of osmotic changes in body fluids<br>Describe the roles of hormones in human reproduction, including the menstrual cycle.<br>Evaluate the different hormonal and nonhormonal methods of contraception. | Year 11 inheritance and genetic testing |
| 2 | **P5 Forces**<br>• **Forces:** Vector quantities; either contact (friction, tension) or non-contact (gravity, electrostatic, magnetic).<br>• **Weight:** Force due to gravity; W=m×g<br>• **Resultant Force:** Single force with same effect as all acting forces;<br>• **Work Done:** Work Done =Force x Displacement; work transfers energy; friction converts work to heat.<br>• **Elasticity:** Extension/compression proportional to force (Hooke's Law, F=ke) up to limit of proportionality; energy stored as elastic potential energy<br>• **Moments:** Turning effect of force; moment = force × perpendicular distance; balanced moments equal clockwise and anticlockwise.<br>• **Pressure:** P=f/a;; pressure in fluids increases with depth and density; upthrust explained by pressure difference.<br>• **Scalar vs Vector:** Scalars (magnitude only, e.g., speed, distance), vectors (magnitude + direction, e.g., velocity, displacement, force).<br>• **Motion:** Speed =distance/time ; velocity is speed + direction; acceleration=change in velocity/time; equations for uniform acceleration<br>• **Newton's Laws:**<br>• 1st Law: Object remains at rest or constant velocity if resultant force zero.<br>• 2nd Law: F=ma.<br>• 3rd Law: Equal and opposite forces between interacting objects.<br>• **Stopping Distances:** Sum of thinking distance and braking distance; affected by speed, driver condition, and road/vehicle conditions.<br>• **Momentum:** p=mv; momentum conserved in closed systems | •**Calculate weight:** Given mass and gravitational field strength, find weight force.<br>•**Determine resultant forces:** Sum forces in one dimension; resolve forces into components for two dimensions.<br>•**Calculate work done:** For forces causing displacement; analyze energy transfer and heat generation due to friction.<br>•**Analyze elasticity:** Plot force-extension graphs; calculate spring constants; compute elastic potential energy stored in springs.<br>•**Calculate moments:** Find unknown forces or distances for balanced objects; solve lever problems.<br>•**Calculate pressure:** For forces on surfaces; pressure at different depths in fluids; analyze buoyancy and floating/sinking.<br>•**Interpret motion data:** Use distance-time and velocity-time graphs to calculate speed, velocity, acceleration, and displacement.<br>•**Apply Newton's laws:** Solve problems involving forces, acceleration, and motion changes; predict motion given forces.<br>•**Evaluate stopping distances:** Estimate effects of speed, driver reaction time, and conditions on total stopping distance for safety assessments.<br>•**Use momentum conservation:** Analyze collisions and explosions; calculate velocities before and after impact.<br>•**Explain safety devices:** Airbags, seat belts, helmets reduce force by increasing impact time, lowering rate of change of momentum.<br>•**Interpret vector diagrams:** Resolve forces; determine resultant forces in equilibrium and non-equilibrium cases. | Year 7<br>Forces: Speed<br>Energy: Energy Transfers and Work<br>Year 8:<br>Forces: Gravity<br>Year 9<br>Forces: Contact Forces<br>Forces: Pressure<br>Y11 P7 Magnetism and Electromagnetism |

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# CORE KNOWLEDGE

## Year 11 – SCIENCE HALF TERM 2

| | The knowledge you will need to recall: | How you will apply this knowledge: | This links to: |
|---|---|---|---|
| 3 | **C8 Chemical Analysis**<br>• State what a pure substance is and how melting point and boiling points can be used to identify them.<br>• State what a formulation is and give examples.<br>• State what chromatography is used for.<br>• State that chromatography involves a stationary phase and a mobile phase.<br>• Know how to calculate Rf values.<br>• Know that different compounds have different Rf values in different solvents, which can be used to help identify the compounds.<br>• State the tests for hydrogen, oxygen, carbon dioxide and chlorine. | • Use melting point and boiling point data to distinguish pure from impure substances.<br>• Identify formulations given appropriate information.<br>• Explain how paper chromatography separates mixtures<br>• Suggest how chromatographic methods can be used for distinguishing pure substances from impure substances.<br>• Investigate how paper chromatography can be used to separate and tell the difference between coloured substances.<br>• Interpret chromatograms and determine Rf values from chromatograms | Year 7<br>Matter: Separating Mixtures<br>Matter: Particle Model<br>Year 11:<br>C10 Using Resources |
| 4 | B6 – Inheritance, Variation and Evolution<br>• Meiosis produces genetically varied gametes with half the chromosome number; mitosis creates identical cells.<br>• Sexual reproduction involves gamete fusion and results in offspring with genetic variation.<br>• Asexual reproduction produces clones from one parent with no gamete fusion or genetic variation.<br>• Some organisms (e.g., fungi, malaria parasites, plants) can reproduce both sexually and asexually.<br>• DNA is a double helix made of nucleotides (sugar, phosphate, base); it carries genetic information in chromosomes.<br>• Genes are DNA segments that code for proteins; the genome is the complete set of an organism's DNA.<br>• Base pairs (A-T, C-G) determine amino acid sequences in proteins; a triplet of bases codes for one amino acid.<br>• Mutations are changes in DNA that occur randomly; most are harmless, but some can alter or benefit protein function.<br>• Protein synthesis (HT) occurs on ribosomes using templates and carrier molecules to build proteins in the correct order.<br>• Alleles are versions of a gene; dominant alleles are always expressed, recessive only when two copies are present.<br>• Genotype is the genetic makeup; phenotype is the observable trait. Punnett squares predict inheritance patterns.<br>• Some inherited disorders include dominant polydactyly and recessive cystic fibrosis.<br>• Evolution occurs by natural selection, where advantageous traits increase survival and reproduction.<br>• Selective breeding and genetic engineering are human-driven methods to alter organisms for desired traits.<br>• Classification systems have evolved from Linnaean hierarchy to the three-domain system (archaea, bacteria, eukaryotes). | •Interpret and compare processes of **mitosis vs meiosis** using diagrams or descriptions.<br>•**Explain advantages and disadvantages** of sexual and asexual reproduction in given scenarios.<br>•Use **Punnett squares** to predict outcomes of genetic crosses and interpret **ratios, genotypes, and phenotypes**.<br>•Determine **probability** of inheriting traits or disorders (e.g., cystic fibrosis, polydactyly).<br>•Analyse **family trees (pedigrees)** to identify inheritance patterns and carriers of genetic conditions.<br>•Evaluate the **benefits, risks, and ethics** of technologies like genetic engineering, embryo screening, and cloning.<br>•Apply understanding of **mutation effects** to explain variation, protein changes, or inherited diseases.<br>•Describe how **natural selection** leads to evolution and relate this to real-world examples (e.g., antibiotic resistance).<br>•Use **fossil evidence** and **evolutionary trees** to infer relationships and evolutionary changes over time.<br>•Explain how **selective breeding** and cloning can impact agriculture or biodiversity.<br>•Discuss the historical development of **Darwin's theory**, Mendel's discoveries, and their scientific significance.<br>•Apply classification knowledge to group organisms using **Linnaean hierarchy** or the **three-domain system**. | Year 7:<br>Organisms: Cells<br>Genes: Variation and Classification<br>Genes: Human Reproduction<br>Ecosystems: Plant Reproduction<br>Year 9:<br>Genes: Evolution and Inheritance |

GRACE COLLEGE
# CORE KNOWLEDGE

## Year 11 – SCIENCE HALF TERM 3

| | The knowledge you will need to recall: | How you will apply this knowledge: | This links to: |
|---|---|---|---|
| 1 | **P7 Magnetism and Electromagnetism**<br>• **Permanent magnets** have their own magnetic field; **induced magnets** only become magnetic in an external field and lose it when removed.<br>• Like poles **repel**, unlike poles **attract** – this is a **non-contact force**.<br>• A **magnetic field** is the region where magnetic forces act; it is strongest at the **poles** of a magnet.<br>• Magnetic field lines go from **north to south**, and field strength decreases with **distance** from the magnet.<br>• A **compass** contains a small bar magnet and aligns with the **Earth's magnetic field**.<br>• A **current in a wire** creates a magnetic field – the strength depends on **current and distance**.<br>• A **solenoid** creates a stronger, more uniform magnetic field, especially with an **iron core** (electromagnet).<br>• The **motor effect** is the force on a wire carrying current at 90° to a magnetic field.<br>• **Fleming's Left-Hand Rule** shows the directions of force, field, and current (HT only).<br>• Force on a conductor: **F = BIL** – used when current and magnetic field are perpendicular (HT only).<br>• In an **electric motor**, a current-carrying coil rotates in a magnetic field due to the motor effect (HT only).<br>• A **loudspeaker** uses the motor effect to convert electrical signals into sound (HT only).<br>• Moving a wire in a magnetic field induces a **potential difference** – the **generator effect** (HT only).<br>• The **generator effect** is used in **alternators (AC)** and **dynamos (DC)** to produce electricity (HT only).<br>• A **transformer** changes potential difference; step-up increases voltage, step-down decreases it. Uses:<br>  • **Vp/Vs = Np/Ns**, and **Vp × Ip = Vs × Is** for power conservation (HT only). | •Interpret and draw **magnetic field lines** around bar magnets, wires, and solenoids.<br>•Use and apply **F = BIL** to calculate magnetic force on a conductor in a magnetic field (HT only).<br>•Use **Fleming's Left-Hand Rule** to predict the direction of force on a conductor (HT only).<br>•Explain why a compass needle behaves as it does near magnets or the Earth.<br>•Predict and explain outcomes when magnets or magnetic materials interact (e.g., induced magnetism).<br>•Describe how to set up practicals to observe the magnetic effect of a current (e.g., compass deflection).<br>•Explain how solenoids and iron cores are used to create **electromagnets** for real-world devices.<br>•Analyse and explain diagrams of motors, loudspeakers, and electromagnetic devices (HT only).<br>•Apply the concept of the **generator effect** to explain how moving a magnet near a coil induces current (HT only).<br>•Interpret graphs of voltage over time for AC and DC generators (HT only).<br>•Use and rearrange transformer equations to calculate voltage, current, or turns ratio (HT only).<br>•Justify the use of **high voltage transmission** in the National Grid using transformer equations (HT only). | Year 8: Electromagentics: Electricity in the Home<br>Electromagnets: Voltage, Resistance and Current<br>Year 9: Electromagnetics: Magnets and Electromagnets |
| 2 | **C10 Using Resources**<br>• State what natural and finite resources are.<br>• State examples of natural products that are supplemented or replaced by agricultural and synthetic products<br>• Define sustainable development.<br>• State what potable water is.<br>• Sterilising agents used for potable water include chlorine, ozone or ultraviolet light.<br>• State two processes for desalination and that they both require large amounts of energy.<br>• State why Life Cycle Assessments (LCAs) are carried out and the 5 stages.<br>• State with examples what the terms reduce, reuse and recycle mean. | • Distinguish between finite and renewable resources given appropriate information.<br>• Distinguish between potable water and pure water<br>• Describe how potable water is obtained by treating fresh water, salty water and waste water.<br>• Give reasons for the steps used to produce potable water.<br>• Describe the differences in treatment of ground water and salty water.<br>• Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation.<br>• Describe some benefits and drawbacks of LCAs<br>• Interpret LCAs of materials or products given appropriate information.<br>• Carry out simple comparative LCAs for shopping bags made from plastic and paper.<br>• Evaluate ways of reducing the use of limited resources, given appropriate information | Year 7<br>Matter: Separating Mixtures<br>Year 8<br>Earth: Climate<br>Earth: Earths Resources<br>Year 9<br>B1 Cell Biology<br>Year 10:<br>C9 Atmosphere<br>Year 11:<br>C7 Organic Chemistry |

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# CORE KNOWLEDGE

## Year 10 – SCIENCE HALF TERM 4 - 6

| | The knowledge you will need to recall: | How you will apply this knowledge: | **This links to:** |
|---|---|---|---|
| **1** | **Revision**<br>**Understanding of all previous units for study found on Paper 1 and Paper 2** | • Exam questions during annual exams and terminal GCSE exams | All previous units |