

Concept	Science Big Ideas	Simple Summary	KS2	KS3	KS4	KS5 Biology	KS5 Chemistry	KS5 Physics
Particles	All matter in the Universe is made of very small particles	Atoms are the building blocks of everything. They rearrange in reactions, have a nucleus with protons and neutrons, and form compounds.	Mixing creates new substances. Some mixtures separate. Substances can be solid, liquid, or gas. Heating/cooling changes states. Matter is conserved in melting/evaporation.	All substances are made of tiny particles called atoms. These atoms are always in motion and their behavior explains the properties of different materials.	Atoms consist of a nucleus made of protons and neutrons, surrounded by electrons. These particles have charges and their interactions hold atoms together. Some atoms can become ions by gaining or losing electrons. Unstable nuclei can undergo radioactivity, releasing radiation and energy. At the atomic scale, matter behaves differently than in everyday life.	Particles explain biological molecule structure/function, substance movement across cell membranes, and molecular interactions. Electrons in electron transport chains and redox reactions produce/transfer energy, aiding understanding of energy acquisition/utilization in organisms.	The AQA A level Chemistry specification delves into the intricate nature of atoms and particles, examining their atomic structure, electron configuration, bonding interactions, and their pivotal role in chemical reactions, equilibria, and the understanding of physical properties.	The AQA A level Physics specification explores the fundamental nature of atoms and particles, investigating their behavior in quantum mechanics, their role in energy transfer and electrical circuits, and their interactions in nuclear processes.
Interactions	Objects can affect other objects at a distance	Objects can affect each other without touching through radiation or fields like magnetism, electricity, and gravity. Gravity attracts all objects and keeps planets in orbit.	Objects can affect other objects without touching them. Light and sound travel and can be detected by our eyes and ears. Interactions include magnets, electric charges, and gravity.	Gravity is a force that pulls objects towards each other. It keeps planets in orbit, causes weight on Earth, and creates tides. The Moon's gravity is weaker, so objects weigh less there.	Radiation, like visible light, travels in waves. Other types include radio waves, X-rays, and gamma rays. Sound, however, requires a material to travel. Radiation can be reflected, absorbed, or transmitted, affecting objects. Some interactions, like magnetism and electricity, involve fields of influence.	The AQA A level Biology specification covers interactions such as fields and radiation through the study of biological processes influenced by electromagnetic radiation, including photosynthesis, vision, and the impact of radiation on living organisms.	The AQA A level Chemistry specification covers interactions like fields and radiation through the study of topics such as electromagnetic radiation, atomic and molecular structure, and chemical bonding influenced by electric and magnetic fields.	The AQA A level Physics specification covers interactions like fields and radiation through the study of topics such as electromagnetism, quantum physics, and the behavior of particles in electric and magnetic fields.
Forces	Changing the movement of an object requires a net force to be acting on it	Forces on objects are detected by their effect on motion or shape. Balanced forces keep objects still or at constant speed, while unbalanced forces cause changes in speed or direction. Opposing forces can make objects turn or twist, as seen in simple machines.	An object's speed is how far it travels in a given time. Changing motion depends on force and mass. Heavier objects have more inertia, taking longer to speed up or slow down.	All objects on Earth experience gravity. Objects at rest have forces opposing gravity. A book on a table stays in place because the table exerts an upward force equal to gravity. Floating objects have an upward force equal to the weight of the displaced fluid.	Unbalanced forces change an object's motion, either accelerating or decelerating it. Friction slows down moving objects. Satellites orbit Earth due to gravity. Forces can also cause objects to turn or twist. Pressure depends on force and area.	N/A	The concept of forces in the context of chemistry is covered in relation to intermolecular forces, bonding, and reactions, including concepts such as electrostatic forces and forces involved in chemical reactions.	The concept of forces in the AQA A level Physics specification covers topics such as Newton's laws of motion, gravitational forces, electromagnetic forces, and forces involved in energy transfer and particle interactions.
Energy	The total amount of energy in the Universe is always the same but can be transferred from one energy store to another during an event	Processes require energy to occur. Energy can be transferred between bodies. Some energy becomes less usable. Energy cannot be created or destroyed. After burning fossil fuels with oxygen, some energy becomes less usable and less convenient to use.	Energy is transferred between objects. Fuels like oil and wood are energy sources. Some are renewable (wind, sunlight), others non-renewable (fossil fuels).	Objects can store energy in various ways, such as chemical composition, movement, temperature, and position. Energy can be transferred through heat, motion, or electrical currents. Energy spreads and dissipates during processes, and it cannot be fully reversed.	Energy cannot be created or destroyed, only transferred. The total energy in the universe remains constant. We rely on various energy sources, but fossil fuels contribute to climate change. We need to find alternative ways to generate electricity and use it more efficiently.	In the AQA A level Biology specification, the concept of energy is covered in relation to metabolic processes, cellular respiration, photosynthesis, and the transfer of energy in ecological systems.	In the AQA A level Chemistry specification, the concept of energy is covered in relation to chemical reactions, enthalpy changes, thermodynamics, and energy transfer in various systems and processes.	In the AQA A level Physics specification, the concept of energy is covered in various forms such as kinetic, potential, thermal, electrical, and nuclear energy, as well as energy transfer and conservation principles.

Geodynamics	The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate	Sun's radiation heats Earth, causing air and ocean currents, shaping climates. Heat from Earth's interior moves molten rock, leading to plate movement, volcanoes, and earthquakes. Earth's surface changes through rock formation and weathering.	Earth's surface has soil, a mix of rocks, organic matter, air, water, and living things. Different rocks wear down into sand and silt. Water covers most of the Earth, recycled through evaporation, condensation, and precipitation.	The Sun's radiation passes through the Earth's atmosphere, providing energy for plants and warming the surface. The Earth emits infrared radiation, which is absorbed by the atmosphere, creating the greenhouse effect.	Plants produce oxygen through photosynthesis, which protects organisms from harmful UV radiation. Human activities add gases to the atmosphere, causing global warming. The Earth's crust consists of moving plates, causing earthquakes and volcanic activity.	Ecological succession can occur on land newly formed by volcanic eruptions. Ancestral species could be separated by volcanic activity, leading to allopatric speciation. Weathering releases phosphates from rocks, enabling plants to absorb them in the phosphate cycle.	N/A	The concept of geodynamics is covered in the AQA A level Physics specification through the study of Earth's structure, plate tectonics, seismic waves, and the principles of geophysics and geothermal energy.
Astronomy	Our solar system is a very small part of one of billions of galaxies in the Universe	The solar system includes the Sun, planets, and other objects. Earth's rotation around the Sun explains day, night, and seasons. Our solar system is part of a vast galaxy with billions of stars and planets.	Earth orbits the Sun in a year, while the Moon orbits Earth in about four weeks. Sun provides visible light. Earth's rotation creates day and night, and its tilted axis causes seasons.	The Earth is one of the planets in our solar system that orbits the Sun. The planets are at different distances and take different times to complete their orbits. Robotic and human missions explore the solar system.	Sometimes rocks orbiting the Sun come close to Earth, heating up and glowing as they enter the atmosphere, known as shooting stars. The laws that apply on Earth also apply throughout the Universe. The Sun is a star in the Milky Way galaxy, and the Universe is expanding from a big bang event.	N/A	N/A	The AQA A level Physics specification covers astronomy by exploring topics such as stellar evolution, cosmology, and the electromagnetic spectrum, providing an understanding of the universe, celestial objects, and their interactions.
Cells	Organisms are organised on a cellular basis and have a finite life span	Organisms are made of cells. Multi-cellular organisms have specialized cells. Life functions occur inside cells. Growth happens through cell divisions.	Living things can move, reproduce, and respond to stimuli. They need water, air, food, and proper temperature to survive. They go through life processes and eventually die.	All living things are made of cells, which carry out essential life processes. Cells divide, use food for energy, and specialize in different functions. Cells form tissues, organs, and systems in the body. Maintaining proper conditions is crucial for cell function and survival.	Cells contain different molecules that work together to carry out cell functions. In multicellular organisms, cells communicate and coordinate through substances. Cell membranes regulate what enters and leaves cells. Enzymes and hormones control cell activity, and the brain and spinal cord contribute through nerve signals. Cell cultures have medical applications. Diseases and cell programming affect cell function and can lead to organism death.	The AQA A level Biology specification delves into cell biology through the examination of cellular components, including organelles, and processes such as cellular respiration, protein synthesis, mitosis, and cell communication within multicellular organisms.	N/A	N/A
Interdependence	Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms	Food gives energy and materials for life functions and growth. Plants use sunlight for complex food. Animals depend on plants. Ecosystems have competition for energy and resources.	Animals rely on plants for food, shelter, clothing, and fuel. Plants need animals for pollination and seed dispersal.	Organisms in an ecosystem rely on each other and their environment. Plants, animals, and decomposers play specific roles. Energy and materials cycle through the ecosystem. Competition exists, and changes in conditions can affect populations.	Human activities impact ecosystems by selectively controlling plant and animal growth. Forestry and modern farming reduce species diversity by favoring specific plants and animals, leading to simplified ecosystems, loss of biodiversity, and cultural and wildlife loss.	The concept of interdependence is covered in the AQA A level Biology specification through the study of trophic levels, symbiotic relationships, and the intricate ecological networks that demonstrate the mutual reliance of organisms for resources and survival.	N/A	N/A
Inheritance	Genetic information is passed down from one generation of organisms to another	Genetic information is stored in DNA. Genes shape organisms. Asexual reproduction has genes from one parent. Sexual reproduction has genes from both parents.	Living things have offspring similar to their parents but not identical. Traits are inherited, while skills and behavior are learned.	Chromosomes in cells contain DNA, which holds genetic information. Cells divide and pass on this information through genes. Mutations can occur from errors or environmental factors, affecting individuals and potentially their offspring. Sexual reproduction combines genetic material, creating diverse combinations of genes for natural selection.	Asexual reproduction naturally creates populations with the same genes. Biotechnology enables artificial cloning to produce genetically identical organisms. The genome represents an organism's gene sequence, and mapping genomes helps understand genetic information. Gene manipulation can give organisms specific traits, including in gene therapy to treat diseases.	The concept of inheritance is explored in the AQA A level Biology specification through the examination of Mendelian genetics, allele frequencies, gene expression, genetic variation, and the role of DNA in transmitting hereditary information across generations.	N/A	N/A

Evolution	The diversity of organisms, living and extinct, is the result of evolution	All life comes from a common ancestor. Generations bring changes and survival traits. Failure to adapt leads to extinction.	There are many types of plants and animals, both living and extinct. Fossils help us learn about them. Organisms are classified based on similarities. Within a species, offspring vary but share traits. Different species cannot reproduce together.	Living things adapt to their environments through small differences in reproduction. Those better suited to the environment have a higher chance of survival and passing on their features. Over time, these changes accumulate, leading to the emergence of different species. This process of natural selection has been occurring for billions of years, starting with simple single-celled organisms. Some evolved into multicellular organisms, while others remained single-celled.	Natural adaptation occurs slowly due to climatic, geological, and population changes. Humans speed up this process through selective breeding. Human activities, like pollution and intensive farming, cause rapid environmental changes, leading to damaging effects on organisms and increased extinction rates. Biodiversity loss can harm ecosystems. Evolution on Earth is part of "cosmic evolution," encompassing gradual changes in galaxies that favor life.	The concept of evolution is covered in the AQA A level Biology specification through the study of natural selection, genetic variation, speciation, phylogenetic relationships, and the evidence for common ancestry among organisms.	N/A	N/A
Investigation	Science is about finding the cause or cause of phenomena in the natural world	Science seeks to understand natural phenomena using various methods. Explanations rely on evidence from observations, experiments, and patterns.	Science seeks to explain why things happen and their forms, assuming there are causes and reasons behind them. Observations, measurements, and experiments help uncover these explanations by isolating variables.	Careful observations and accurate descriptions are vital for scientific investigation. Multiple independent observers and clear reporting help ensure reliability. Different phenomena have different explanations. Hypotheses propose possible causes, which are tested by predicting and observing outcomes. If the prediction matches the observation consistently, the proposed cause is accepted.	Observing phenomena without experimental manipulation can reveal correlations between factors. Correlations can suggest hypotheses and make predictions. However, correlations alone are not conclusive evidence of causation. Mechanisms are explained using models based on scientific principles. Historical phenomena are explained by coherent hypotheses consistent with known facts and principles.	Scientific investigation skills are developed in the AQA A level Biology specification through practical activities, data analysis, critical evaluation of evidence, experimental design, and application of scientific methods in investigations.	Scientific investigation skills are developed in the AQA A level Chemistry specification through practical experiments, data analysis, research methodologies, critical thinking, and the application of scientific principles in investigations and problem-solving.	Scientific investigation skills are developed in the AQA A level Physics specification through practical experiments, data analysis, hypothesis testing, mathematical modeling, critical thinking, and the application of scientific principles in investigations and problem-solving.
Modelling	Scientific explanations, theories and models are those that best fit the evidence available at a particular time	Scientific theories explain phenomena, based on observations and predictions. Theories can change with new data, even if they were previously accurate.	In science, we search for explanations by collecting data through observations and measurements. The quality of our explanations depends on the data we gather and the theories we develop.	Scientists use models to explain observations and phenomena. These can be physical or theoretical, representing objects or abstract concepts. Computer-based models simulate phenomena and allow for easy variable manipulation. Some models are well-established, while others are tentative and subject to change.	Models help explain phenomena by identifying relationships within a system. They are developed by comparing predictions with real-world observations. Scientific explanations are based on theories or models that are repeatedly confirmed through observation and experimentation. New data may require changes or alternative ideas, and scientific understanding evolves over time.	The concept of scientific modeling is applied in the AQA A level Biology specification to represent biological phenomena, explain complex processes, make predictions, and aid understanding of biological systems and interactions.	The concept of scientific modeling is applied in the AQA A level Chemistry specification to represent chemical structures, reactions, and properties, aiding in the understanding, prediction, and explanation of chemical phenomena and processes.	The concept of scientific modeling is applied in the AQA A level Physics specification to represent physical systems, phenomena, and relationships, facilitating the understanding, analysis, and prediction of their behavior through mathematical and conceptual models.
Technology	The knowledge produced by science is used in engineering and technologies to create products to serve human ends	Science influences engineering and technology, impacting human activity. Technological advances enhance scientific understanding, sometimes preceding or following scientific ideas.	Technologies are created by solving problems through engineering, using science and other ideas. Different approaches are tried to find the best solution, based on clear goals and criteria for success.	Designing a solution to a problem involves creating drawings or models. Physical, mathematical, or computer models help test the effects of changes and improve the solution. Factors like cost, materials, and impact on users and the environment must be considered.	Science, engineering, and technology are interconnected. Scientific knowledge leads to technological advances, improving design and construction. Technology aids scientific developments and enables the creation of tools and machines. However, there are also challenges, such as waste disposal and resource depletion, requiring collaboration between scientists and engineers for solutions.	Examples of scientific technology in the AQA A level Biology specification include microscopes, DNA sequencing machines, PCR instruments, spectrophotometers, and bioinformatics tools used for data analysis and genetic research.	Examples of scientific technology in the AQA A level Chemistry specification include gas chromatographs, mass spectrometers, NMR spectrometers, electrochemical cells, and infrared spectrophotometers used for chemical analysis and characterization of substances.	Examples of scientific technology in the AQA A level Physics specification include particle accelerators, telescopes, lasers, spectrometers, and detectors used for studying particle physics, astrophysics, optics, and radiation.

Ethics	Applications of science often have ethical, social, economic and political implications	Scientific knowledge drives technological innovations. However, determining desirability requires ethical judgments considering justice, safety, and environmental impacts.	Science helps us understand how things work in nature, and this knowledge can be used to create solutions for human problems. While technology has improved lives, we must consider its impact on resources and the environment.	The applications of science have both positive and negative effects. While advancements in medicine and technology have improved human lives, they have also led to population growth and resource demands that harm the environment and developing countries. Technological progress, like air travel, contributes to greenhouse gases and global warming. The trade-off between benefits and drawbacks requires careful consideration.	Decisions on resource allocation and innovation require a balance of scientific understanding, ethical values, and practical considerations. While science helps identify implications, action choices involve moral judgments. Scientific evidence should guide decisions, but it is separate from opinions.	Examples of ethical issues in the AQA A level Biology specification include genetic engineering, animal testing, stem cell research, human cloning, and the use of animals in medical research.	Examples of ethical issues in the AQA A level Chemistry specification include the production and use of chemicals, waste disposal, pollution, and the impact of chemical processes on human health and the environment.	Examples of ethical issues in the AQA A level Physics specification include the use of nuclear energy, the development and use of weapons, environmental impacts of energy production, and privacy concerns in the use of technology.
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