

## Science scope and sequence chart: Grades 10 to 12 Advanced

	Grade 10	Grade 11	Grade 12
<b>SCIENTIFIC ENQUIRY</b>			
<b>Methods of scientific investigation</b>	<ul style="list-style-type: none"> <li>• Identification of a focused research question with predictions related to it</li> <li>• Selection of appropriate equipment and materials for the investigation</li> <li>• Identifying and controlling variables</li> <li>• Working constructively and adaptively with others</li> <li>• Evaluating experimental design, identifying weaknesses and developing realistic strategies for improvement</li> <li>• Working in an ethical manner with regard to acknowledging data sources and authenticity of results and with regard to living things and the environment</li> <li>• Making critical use of secondary information</li> </ul>	As Grade 10	As Grade 10
<b>Know how scientists work</b>	<ul style="list-style-type: none"> <li>• Historical development of major scientific ideas</li> <li>• Dissemination of scientific ideas</li> <li>• Balancing the opportunities offered by science with the environmental threats</li> </ul>	<ul style="list-style-type: none"> <li>• Historical development of major scientific ideas</li> <li>• Handling scientific controversies; scientific value of controversy around competing models</li> <li>• Influence on science of its economic, social cultural, moral and spiritual contexts</li> <li>• Power and limitations of science in addressing industrial, social and environmental questions</li> </ul>	<ul style="list-style-type: none"> <li>• Historical development of major scientific ideas</li> <li>• Development of scientific ideas entails periods of major changes followed by periods of slow elaboration</li> <li>• Influence on science of its economic, social cultural, moral and spiritual contexts</li> <li>• Power and limitations of science in addressing industrial, social and environmental questions</li> </ul>
<b>Processing and communicating information</b>	<ul style="list-style-type: none"> <li>• Presenting and processing raw data appropriately</li> <li>• Drawing valid conclusions, allowing for errors and uncertainties</li> <li>• Communicating results and conclusions</li> </ul>	As Grade 10	As Grade 10
<b>Handling equipment and making measurements</b>	<ul style="list-style-type: none"> <li>• Handling equipment competently with due regard for safety of self and others</li> <li>• Following instructions accurately while adapting to unforeseen circumstances</li> </ul>	As Grade 10	As Grade 10

	Grade 10	Grade 11	Grade 12
<b>BIOLOGY</b>			
<b>Biological molecules</b>	<ul style="list-style-type: none"> <li>• Chemical constituents of carbohydrates, lipids and proteins</li> <li>• Monosaccharides as monomers of other carbohydrates</li> <li>• Amino acids as monomers of proteins</li> <li>• Structure of starch, cellulose and proteins</li> <li>• Structure of glucose, amino acids, glycerol and fatty acids</li> <li>• Composition of triglycerides and phospholipids</li> <li>• Primary, secondary and tertiary structure of proteins</li> <li>• Relationships between structure and function and size and properties of biological molecules</li> <li>• Identification tests for proteins, sugars and starch</li> <li>• Separation and identification of compounds by chromatography and electrophoresis</li> </ul>		<ul style="list-style-type: none"> <li>• Structure of ATP and ADP</li> </ul>
<b>Cellular structures and processes</b>	<ul style="list-style-type: none"> <li>• Structure and ultrastructure of prokaryotic and eukaryotic cells</li> <li>• Cell organelles (nucleus, mitochondrion, chloroplast, endoplasmic reticulum and ribosome) and their functions</li> <li>• Use of electron microscope and ultracentrifuge in study of cellular structures</li> </ul>	<ul style="list-style-type: none"> <li>• Structure and role of mitochondria in respiration</li> <li>• Structure and role of chloroplasts in photosynthesis</li> <li>• Fluid mosaic model of cell membrane in relation to function</li> <li>• Diffusion, osmosis and active transport</li> </ul>	

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<b>Biological energetics</b>	<ul style="list-style-type: none"> <li>Enzymes as proteins and biological catalysts</li> <li>Importance of enzymes in lowering activation energies</li> <li>Enzyme substrate-complex action of enzymes</li> <li>Competitive and non competitive enzyme inhibition</li> <li>Effects of change in temperature, pH, substrate concentration on enzyme action</li> <li>Mechanism of enzyme action in terms of their structure</li> </ul>	<ul style="list-style-type: none"> <li>ATP as the immediate supply of energy for biological processes</li> <li>Basic stages in biochemistry of aerobic respiration (glycolysis, Krebs cycle, oxidative phosphorylation)</li> <li>Leaf structure in relation to photosynthesis</li> <li>Limiting factors for photosynthesis</li> <li>Basic stages in biochemistry of photosynthesis (light-dependent reaction, light-independent reaction)</li> <li>Role of ATP in respiration and photosynthesis</li> </ul>	<ul style="list-style-type: none"> <li>Basic stages in biochemistry of anaerobic respiration</li> <li>Comparison of reaction pathways in aerobic and anaerobic respiration</li> <li>Biochemical reactions in respiration</li> <li>Role of NAD in respiration</li> <li>Generation of ATP in aerobic and anaerobic respiration</li> <li>Decarboxylation and dehydrogenation reactions in respiration</li> <li>Relative energy values of carbohydrates, proteins and lipids as respiratory substrates</li> <li>Respiratory quotient</li> <li>Biochemical reactions in photosynthesis</li> <li>Cyclic and non-cyclic photophosphorylation in photosynthesis</li> <li>Use of ATP and NADP in light-independent stage of photosynthesis</li> <li>Calvin cycle</li> <li>Use of carbon-14 in study of photosynthesis</li> <li>Spectra of light absorbed and reflected by chlorophyll</li> <li>Separation of chlorophyll pigments by chromatography</li> </ul>
<b>Transport systems</b>	<ul style="list-style-type: none"> <li>Need for transport system in multicellular animals</li> <li>External and internal structure of human heart in relation to function</li> <li>Human cardiac cycle</li> <li>Initiation and regulation of human heart beat</li> <li>Human blood system as a double closed circulation system</li> <li>Major blood vessels in humans</li> <li>Structure of arteries, veins and capillaries</li> <li>Red blood cells as carriers of oxygen</li> </ul>	<ul style="list-style-type: none"> <li>Need for a transport system in multicellular plants</li> <li>Structure, function and distribution of phloem and xylem in roots, stems and leaves of dicotyledonous plants</li> <li>Movement of water between plant cells and between cells and their environment in terms of water potential</li> <li>Translocation</li> <li>Transpiration</li> </ul>	<ul style="list-style-type: none"> <li>Structure and function of red and white blood cells</li> <li>Role of blood, tissue fluid and lymph in transport</li> <li>Composition of blood and role of constituents in transport of oxygen and carbon dioxide</li> <li>Blood groups and their significance for blood transfusions</li> <li>Mechanisms for translocation</li> <li>Factors affecting transpiration</li> <li>Xerophytic adaptations for water conservation</li> </ul>

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<b>Control, coordination and homeostasis</b>		<ul style="list-style-type: none"> <li>• Organisms increase their chances of survival by responding to changes in their environment</li> <li>• Homeostasis</li> <li>• Principles of negative feedback</li> <li>• Process of thermoregulation in mammals</li> <li>• Roles of oestrogen, progesterone LH and FSH in the mammalian oestrous cycle</li> <li>• Similarities and differences between hormonal and nervous systems</li> </ul>	<ul style="list-style-type: none"> <li>• Structure, function and control of mammalian kidney in regulation of water and metabolic waste</li> <li>• Role of ADH</li> <li>• Temperature regulation</li> <li>• Role of thermoreceptors in hypothalamus</li> <li>• Causes and effects of heat stroke</li> <li>• Structure and function of neurones</li> <li>• Role of sensory receptors in mammals converting different forms of energy into nerve impulses</li> <li>• Structure and function of brain</li> <li>• Sodium and potassium ions in nerve impulse transmission</li> <li>• Human endocrine glands and their functions</li> <li>• Control of blood glucose concentration in humans</li> <li>• Role of auxins in plants</li> <li>• Role of gibberellins in plants</li> <li>• Role of abscisic acid in plants</li> </ul>
<b>Human health and disease</b>	<ul style="list-style-type: none"> <li>• Categories of disease and illness</li> <li>• Endemic, epidemic and pandemic diseases</li> <li>• Balanced diet</li> <li>• Energy and nutrient requirements</li> <li>• Consequences of malnutrition</li> <li>• Anorexia and obesity</li> <li>• Coronary heart disease</li> <li>• Diabetes</li> </ul>	<ul style="list-style-type: none"> <li>• Gaseous exchange system</li> <li>• Tidal volume and lung capacity</li> <li>• Effects of smoking and disease on gaseous exchange and cardiovascular systems</li> <li>• Bronchitis, emphysema, asthma and lung cancer</li> <li>• Blood pressure</li> <li>• Pulse rate and exercise</li> <li>• Causes, transmission, control and significance of HIV/AIDS</li> <li>• Production of antibodies by the body and their mechanism of action against antigens</li> </ul>	<ul style="list-style-type: none"> <li>• Stem cells and monoclonal antibodies</li> <li>• Immune system and allergies</li> <li>• Active and passive immunity and vaccination</li> <li>• Action of antibiotics and development of resistance</li> <li>• Causes, transmission, control and significance of cholera, influenza, malaria and TB</li> <li>• Gene therapy</li> </ul>

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<b>Biological basis of inheritance</b>	<ul style="list-style-type: none"> <li>• Structure and replication of DNA</li> <li>• Roles of DNA, mRNA and tRNA in protein synthesis</li> <li>• DNA as genetic code controlling sequence of amino acids in polypeptides</li> <li>• Changes in base sequence of DNA can change the amino acid sequence of a polypeptide and consequent function of a protein</li> <li>• DNA as vehicle of inheritance</li> <li>• Chromosomes as carriers of DNA</li> <li>• Structure and function of chromosomes</li> <li>• Diploid and haploid numbers</li> <li>• Sexual reproduction as a mechanism of passing genetic material from one generation to the next</li> <li>• How male and female gametes differ in size, number and motility</li> </ul>	<ul style="list-style-type: none"> <li>• Homologous chromosomes</li> <li>• Stages of mitosis</li> <li>• Mitosis as a mechanism to enable a constant number of chromosomes to be passed from cell to cell</li> <li>• Stages of meiosis</li> <li>• Meiosis as mechanism to enable a constant number of chromosomes to be passed from generation to generation</li> <li>• Genes and alleles as sections of DNA</li> <li>• Changes in structure of DNA as a source of genetic variation</li> <li>• Causes of mutation</li> <li>• Mutation as a change in DNA</li> <li>• Mutations can reduce the efficiency of or block enzyme action</li> <li>• Dominant and recessive alleles</li> <li>• Monohybrid crosses</li> <li>• Random assortment and crossing over creates genetic variation</li> <li>• Genetic basis of sex determination in humans</li> <li>• Sex linkage</li> </ul>	<ul style="list-style-type: none"> <li>• Incomplete dominance</li> <li>• Dihybrid crosses</li> <li>• Back cross</li> <li>• Co-dominance and multiple allele inheritance</li> <li>• Use of chi-squared test to determine significance of observed and expected results</li> <li>• Human Genome Project</li> <li>• Genetic fingerprinting, genetic screening and genetic counselling</li> </ul>
<b>Diversity, selection and evolution</b>	<ul style="list-style-type: none"> <li>• Species are classified into groups with shared features</li> <li>• The kingdom, phylum, class, order, family, genus, species classification system</li> <li>• Key features of the main groups of animals and plants</li> <li>• Causes of variation within populations</li> <li>• Continuous and discontinuous variation</li> </ul>	<ul style="list-style-type: none"> <li>• Evolution over a long period of time has given rise to the diversity of living organisms</li> <li>• Species are adapted to survive in particular environmental conditions</li> <li>• Predation, disease and competition result in differential survival and reproduction</li> <li>• Organisms with a selective advantage are more likely to survive and pass on genes to next generation</li> <li>• Natural selection and isolation can lead to new species</li> </ul>	<ul style="list-style-type: none"> <li>• Structural and physiological adaptations of organisms to their environment</li> <li>• Acclimatisation and adaptation</li> </ul>

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<b>Ecological relationships</b>	<ul style="list-style-type: none"> <li>Relationship of pyramids of numbers, biomass and energy to food chains and webs</li> <li>Energy flow through ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>Interactions between organisms can cause changes in the size of population</li> <li>Inter- and intra-specific competition for food and space, predation and disease limit the size of populations</li> <li>Ecosystems are dynamic and subject to change</li> <li>Impact of human activities on the environment</li> </ul>	<ul style="list-style-type: none"> <li>Carrying capacity</li> <li>Natural colonisation and ecological succession</li> <li>Population growth curves</li> <li>Biological control of populations</li> <li>Production and conservation interest conflict</li> <li>Preservation and conservation</li> </ul>
<b>Microbiology and biotechnology</b>	<ul style="list-style-type: none"> <li>Role of micro-organisms in recycling</li> <li>Carbon cycle</li> <li>Nitrogen cycle</li> <li>Mutualistic relationships in nitrogen fixation</li> </ul>	<ul style="list-style-type: none"> <li>Features of viruses, bacteria and fungi</li> <li>Culture techniques for micro-organisms and cells</li> <li>Genetic engineering</li> <li>Moral and ethical issues of genetic engineering</li> <li>Use of micro-organisms in food production</li> <li>Treatment of waste water</li> </ul>	<ul style="list-style-type: none"> <li>Biosensor use in monitoring blood glucose levels in relation to diabetes</li> <li>Treatment of human diabetes with insulin produced by genetic engineering</li> <li>Applications of monoclonal antibodies</li> <li>Use of immobilised enzymes</li> </ul>
<b>CHEMISTRY</b>			
<b>Matter</b>	<ul style="list-style-type: none"> <li>Atomic structure</li> <li>Relative atomic and molecular mass</li> <li>Isotopes</li> <li>Ionic, covalent and metallic bonding</li> <li>Ionic and covalent giant structures</li> <li>Allotropy</li> <li>Bonding and physical properties</li> <li>Write balanced molecular and ionic equations</li> <li>Main characteristics of the three states of matter</li> <li>Ceramics and composites</li> </ul>	<ul style="list-style-type: none"> <li>Induced dipole intermolecular forces</li> <li>Hydrogen bonding</li> <li>Dative bonding</li> <li>Relationship between physical properties and bond types</li> <li>s, p, d, and f orbitals and hybridisation</li> <li>Electron-pair repulsion and shapes of covalent molecules</li> <li><math>\sigma</math> and <math>\pi</math> bond overlap and molecular shape</li> <li>Calculations of reacting quantities using the mole, molarity and molar volume</li> <li>Empirical and molecular formulae calculations</li> <li>Use the equation <math>PV = nRT</math> to describe ideal gas behaviour</li> </ul>	

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<b>Industrial processes</b>	<ul style="list-style-type: none"> <li>• Purification techniques</li> <li>• Properties and uses of the main gases of the air</li> <li>• Fractionation of liquid air</li> <li>• Fractionation of petroleum</li> <li>• Hardness of water</li> <li>• Distillation of water</li> <li>• Electrolysis of electrolytes, both molten and in solution, and commercial applications</li> <li>• Industrial importance of the halogens and their compounds</li> <li>• Manufacture of steel, copper, aluminium</li> <li>• Environmental issues related to chemical production</li> <li>• Recycling</li> </ul>	<ul style="list-style-type: none"> <li>• Haber process for making ammonia, its oxidation to nitric acid and manufacture of fertilisers</li> <li>• Sulfur and the contact process for making sulfuric acid</li> <li>• Limestone and its products; cement</li> </ul>	<ul style="list-style-type: none"> <li>• Economics of the alkali industry</li> <li>• Economic balance between industrial processes and the environment</li> <li>• Exploitation of Qatar's natural gas</li> </ul>
<b>Patterns in chemical reactivity</b>	<ul style="list-style-type: none"> <li>• Periodicity in physical properties</li> <li>• Trends in chemical properties across the third period</li> <li>• Trends down groups I, II, VII and VIII</li> <li>• Common characteristics of transition metals</li> <li>• Metal reactivity series</li> <li>• Alloys, their properties and uses</li> <li>• Strong and weak acids and alkalis, pH</li> <li>• Neutralisation, titrations and indicators, salts, buffer solutions</li> <li>• Brønsted–Lowry theory of acids</li> </ul>	<ul style="list-style-type: none"> <li>• Chemistry of oxygen and sulfur</li> <li>• Chemistry of nitrogen and phosphorus, including ammonia and its compounds</li> <li>• Chemistry of carbon and silicon</li> <li>• Chemistry of the transition metals</li> <li>• Oxidation and reduction in terms of oxygen transfer and in terms of electron transfer</li> <li>• Redox reactions and oxidation number</li> <li>• Variable oxidation states and transition metals</li> <li>• Relating cell potentials to metal reactivity series</li> <li>• Half-cell reactions and standard electrode potentials</li> <li>• Fuel cells</li> <li>• Environmental issues related to rechargeable cells</li> <li>• The faraday and quantitative electrochemistry</li> </ul>	<ul style="list-style-type: none"> <li>• Periodicity in ionisation energy, electron affinity and electronegativity</li> <li>• s-block elements: properties, compounds and trends</li> <li>• p-block elements: properties, compounds and trends</li> <li>• d-block elements: properties, compounds and trends</li> <li>• Amphoteric elements</li> </ul>

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<b>Environmental chemistry</b>	<ul style="list-style-type: none"> <li>• Carbon, nitrogen and water cycles</li> <li>• Pollution of the atmosphere, natural sinks and residence time</li> <li>• Pollution from the combustion of hydrocarbons</li> <li>• Ozone layer and its protection</li> <li>• Atmospheric warming and climate change</li> <li>• Structure of the atmosphere</li> <li>• Low-level free radical generation</li> <li>• Oceans as sinks and climate drivers</li> <li>• Measures to reduce atmospheric pollution</li> <li>• Purification of water</li> <li>• Water pollution, eutrophication</li> <li>• Disposal of waste heat in industrial complexes</li> </ul>		
<b>Reaction kinetics and energetics</b>	<ul style="list-style-type: none"> <li>• Conditions affecting reaction rate</li> <li>• Explanation of kinetics in terms of kinetic particle model</li> <li>• Catalysis</li> <li>• Multiple-step reactions</li> <li>• Bimolecular reaction in terms of particle collisions and energy</li> <li>• Reversible reactions and dynamic equilibria</li> <li>• Exothermic and endothermic changes</li> <li>• Activation energy and energy profiles</li> <li>• Effect of a catalyst on the activation energy</li> <li>• Standard enthalpy change</li> <li>• Energy considerations associated with bond breaking and making</li> </ul>		<ul style="list-style-type: none"> <li>• Rate and equilibrium constants and equations</li> <li>• Order of reaction and half-life</li> <li>• Rate constant and temperature and energy of activation</li> <li>• Le Chatelier's principle</li> <li>• Acidity, titrations, pH, pK<sub>a</sub> and K<sub>w</sub></li> <li>• Buffer solutions</li> <li>• Solubility product</li> <li>• Enthalpy change and Hess's law</li> <li>• Born–Haber cycle</li> <li>• Entropy and disorder and the second law of thermodynamics</li> <li>• Standard entropy and free energy changes and reaction spontaneity</li> </ul>

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<b>Organic chemistry</b>		<ul style="list-style-type: none"> <li>Nomenclature, structure, bonding and shape</li> <li>Sources of organic compounds</li> <li>Alkanes, alkenes and arenes</li> <li>Aliphatic electrophilic and nucleophilic addition and substitution reactions</li> <li>Alcohols, halogen compounds, aldehydes and ketones, carboxylic acids and derivatives</li> <li>Phenol and bromobenzene, comparison with aliphatic compounds</li> <li>Amines and amides</li> </ul>	<ul style="list-style-type: none"> <li>Shape of organic compounds and electronic structure</li> <li>Electrophilic and nucleophilic reaction mechanisms</li> <li>Nomenclature, structure and bonding of aromatic compounds</li> <li>Chemistry of arenes and derivatives</li> <li>Mechanism of electrophilic substitution and factors affecting it</li> <li>Nitroarenes, amines and azo-compounds</li> </ul>
<b>Macromolecules</b>		<ul style="list-style-type: none"> <li>Addition and condensation polymerisation reactions</li> <li>Fats and oils, unsaturation, soap</li> <li>Natural polymers: proteins, cellulose and nucleic acids</li> </ul>	<ul style="list-style-type: none"> <li>Amino acids and proteins: structure and function</li> <li>Nucleotides and nucleic acids: structure and function</li> <li>Relationship between structure of polymers and physical properties</li> <li>Polymer additives, plasticisers, foams</li> </ul>
<b>PHYSICS</b>			
<b>Measurement</b>	<ul style="list-style-type: none"> <li>SI units</li> <li>Standard form</li> <li>Precision and accuracy</li> <li>Simplifying assumptions in problem solving</li> <li>Vectors and scalars</li> </ul>		
<b>Mechanics and kinematics</b>	<ul style="list-style-type: none"> <li>Displacement, speed, velocity and acceleration, equations of motion</li> <li>Effects of forces</li> <li>Dynamic and static friction; coefficients of friction</li> </ul>	<ul style="list-style-type: none"> <li>Newton's laws of motion and their application</li> <li>Gravitational and inertial mass, weight</li> <li>Conservation of momentum</li> <li>Centre of gravity</li> <li>Principle of moments and its applications</li> <li>Potential and kinetic energy</li> <li>Work, energy and power</li> </ul>	<ul style="list-style-type: none"> <li>Circular motion, angular velocity and momentum</li> <li>Universal gravitation</li> <li>Kinetic and potential energy of orbiting objects</li> </ul>

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<b>Matter and energy</b>	<ul style="list-style-type: none"> <li>• Kinetic particle theory of matter</li> <li>• Properties of solids and liquids, expansion, deformation and surface tension</li> <li>• Anomalous expansion of water</li> <li>• Pressure and density, floating and sinking</li> </ul>	<ul style="list-style-type: none"> <li>• Heat and temperature</li> <li>• Transmission of heat by conduction, convection and radiation</li> <li>• Ocean and atmospheric convection currents and weather</li> <li>• Specific heat capacity and specific latent heat</li> </ul>	<ul style="list-style-type: none"> <li>• Classification of solids in terms of tensile strength, compressive and shear stress</li> <li>• Stretching a solid; the Young modulus</li> <li>• Surface tension</li> <li>• Theoretical treatment of ideal gas particle movement</li> <li>• Absolute zero of temperature</li> <li>• Internal energy, kinetic energy and temperature</li> <li>• Laws of thermodynamics</li> </ul>
<b>Waves and oscillations, light and optics, sound</b>	<ul style="list-style-type: none"> <li>• Waves as a way of transmitting energy; longitudinal and transverse waves</li> <li>• Wave frequency, wavelength, velocity, period, displacement, amplitude and phase</li> <li>• Determination of velocity of sound and its dependence on the medium</li> <li>• The ear and limits of hearing</li> <li>• Standing and progressive waves, node and antinode</li> <li>• Reflection, refraction and dispersion of light and their consequences and applications</li> <li>• Mirrors and lenses and their applications</li> <li>• Total internal reflection and its applications</li> <li>• The eye and sight correction</li> </ul>	<ul style="list-style-type: none"> <li>• Reflection, refraction, superposition, interference and diffraction of waves</li> <li>• Diffraction and interference of electromagnetic waves</li> <li>• Doppler effect in sound and light</li> <li>• Electromagnetic spectrum</li> <li>• Coherence and polarisation of electromagnetic waves and applications</li> </ul>	<ul style="list-style-type: none"> <li>• Simple harmonic motion</li> <li>• Forced oscillation, resonance and damping</li> </ul>
<b>Electricity and magnetism</b>	<ul style="list-style-type: none"> <li>• Conductors, semiconductors and insulators,</li> <li>• Charging by friction, rules of electrostatics</li> <li>• Electric force fields</li> <li>• Making magnets; properties of magnets; rules of magnetism</li> <li>• Magnetic fields</li> <li>• Magnetic flux patterns due to a wire, a coil and a solenoid, and their many applications</li> <li>• Use of <math>Q = It</math>, <math>V = W/Q</math> and <math>V = IR</math></li> <li>• Resistors in series and parallel</li> <li>• Voltage, e.m.f. and internal resistance</li> </ul>	<ul style="list-style-type: none"> <li>• Function and use of capacitors</li> <li>• Use of different kinds of resistors as potential dividers</li> <li>• The transistor</li> <li>• Logic gates</li> <li>• Bistable and astable switching and memory</li> <li>• Electromagnetic induction; factors affecting induced e.m.f.; Faraday's and Lenz's laws</li> <li>• Eddy currents and their applications</li> <li>• AC generation</li> <li>• Transformers and AC transmission</li> </ul>	<ul style="list-style-type: none"> <li>• Electric field strength and force on charges in a field; Coulomb's law</li> <li>• Potential gradients</li> <li>• Capacitance and the relationship between coulombs, volts and energy; construction of capacitors</li> </ul>

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Quantum, atomic and nuclear physics		<ul style="list-style-type: none"> <li>• The nuclear atom and subatomic particles</li> <li>• Radioactive decay, half-life, properties of <math>\alpha</math>-, <math>\beta</math>- and <math>\gamma</math>-radiation</li> <li>• Background radiation</li> <li>• Radioisotopes and some of their uses</li> <li>• Nuclear fission and fusion, occurrence and uses</li> <li>• Properties of the electron and applications of electron beams</li> </ul>	<ul style="list-style-type: none"> <li>• Emission and absorption spectra and electron orbitals</li> <li>• <math>E = hf</math>, photons and the photoelectric effect</li> <li>• Quantisation of charge and Millikan's experiment</li> <li>• Wave-particle duality</li> <li>• Interconversion of matter and energy</li> </ul>
Astrophysics and cosmology			<ul style="list-style-type: none"> <li>• Structure of the visible Universe; stars and galaxies</li> <li>• Star life cycles and the nuclear reactions in them</li> <li>• Planetary formation</li> <li>• 'Big bang' theory, expansion of the Universe and the background radiation</li> </ul>

