Transferable Skills International GCSE Subject Mapping: Science (Single Combined Award)

Transferable skills will help students cope with the different demands of degree study and provide a solid skills base that enables them to adapt and thrive in different environments across educational stages; and ultimately into employment. A good international education should enable students to start developing transferable skills as early as possible. Developing these transferable skills where they naturally occur as part of the International GCSE curriculum can help build learner confidence and embed the importance of this well-rounded development.

Our approach to enhancing transferable skills in our International GCSEs ensures that it is not only the academic and cognitive skills that are developed, but those broader elements that universities highlight as being essential for success. Skills such as self-directed study, independent research, self-awareness of own strengths and weaknesses and time-management are skills that students cannot learn from a textbook but have to be developed through the teaching and learning experience that can be provided through an international curriculum.

In the tables below, we have taken a framework of skills and provided mapping to suggest where each skill can be assessed, and where each skill could be developed for this subject. This will enable teachers and learners to understand where they are developing each skill, and examples of how they can develop each skill through this International GCSE.

NRC framework skill	Skill interpretation in this subject	Where the skill is covered in content	Where the skill is explicitly assessed in examination	Opportunity for the skill to be developed through teaching and learning approach
Cognitive skills				
Cognitive Processes and Strategies				
Critical thinking	Using many different pieces of information from the three sciences and synthesise this information to make judgements.	Examples in several parts of the specification including: Biology 2.16 understand how factors affect the rate of movement of substances into and out of cells, including the effects of surface area to volume ratio, distance, temperature and concentration gradient 2.52 understand the need for a transport system in multicellular organisms 2.62 understand how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to the pathogen Chemistry 1.18 understand how elements are arranged in the Periodic Table: • in order of atomic number • in groups and periods • 1.42 understand why compounds with giant ionic lattices have high melting and boiling points 4.46 understand how to deduce the structure of a monomer from the repeat unit of an addition polymer and vice versa Physics 1.20 describe the factors affecting vehicle stopping distance, including speed, mass, road condition and reaction time	e.g. Biology SAM1 Qu 4(c) Chemistry SAM1 Qu 5 SAM 1 Qu 8 Physics SAM 1 Qu 3	Yes

		4.5 describe a variety of everyday and scientific devices and situations, explaining the transfer of the input energy in terms of the above relationship, including their representation by Sankey diagrams 5.12 understand why a force is exerted on a current-carrying wire in a magnetic field, and how this effect is applied in simple d.c. electric motors and loudspeakers		
Problem solving	Apply the principles and concepts of three sciences, including those related to the applications of physics, chemistry and biology in different contexts	Examples in several parts of the specification including: Biology 2.15 understand the processes of diffusion, osmosis and active transport by which substances move into and out of cells 2.61 understand how adaptations of red blood cells make them suitable for the transport of oxygen, including shape, the absence of a nucleus and the presence of haemoglobin 3.8 understand how the structure of the male and female reproductive systems are adapted for their functions Chemistry 1.8 understand how to classify a substance as an element, a compound or a mixture 1.47 explain why substances with a simple molecular structures are gases or liquids, or solids with low melting and boiling points 2.13 know that carbon dioxide is a greenhouse gas and that increasing amounts in the atmosphere may contribute to climate change Physics 1.11 describe the effects of forces between bodies such as changes in speed, shape or direction 2.8 understand how the current in a series circuit depends on the applied voltage and the number and nature of other components 6.13 use the left-hand rule to predict the direction of the resulting force when a wire carries a current perpendicular to a magnetic field 7.22 understand the role of shielding around a nuclear reactor	e.g. Biology SAM1 Qu 6 Chemistry SAM 1 Qu 1(a) SAM Paper 1 Qu 6 Physics SAM 1 Qu 3	Yes
Analysis	Analyse and interpret data and experimental methods, drawing conclusions, which are consistent with	Examples in several parts of the specification including: Biology	e.g. Biology	Yes

	evidence from experimental activities.	2.11 understand how temperature changes can affect enzyme function, including changes to the shape of active site 2.16 understand how factors affect the rate of movement of substances into and out of cells, including the effects of surface area to volume ratio, distance, temperature and concentration gradient 4.2 *practical: investigate the population size of an organism in two different areas using quadrats* Chemistry 1.17 be able to calculate the relative atomic mass of an element (A_r) from isotopic abundances 1.26 calculate relative formula masses (including relative molecular masses) (M_r) from relative atomic masses (A_r) 2.10 understand how to determine the percentage by volume of oxygen in air using experiments involving the reactions of metals (e.g. iron) and non-metals (e.g. phosphorus) with air 3.3 calculate the heat energy change from a measured temperature change using the expression $Q = mc\Delta T$ Physics 1.3 plot and explain distance−time graphs 2.1 calculate the currents, voltages and resistances of two resistive components connected in a series circuit 5.21 use the relationship between the pressure and Kelvin temperature of a fixed mass of gas at constant volume: $\frac{p_1}{T_1} = \frac{p_2}{T_2}$ 5.2 use the relationship between the pressure and volume of a fixed mass of gas at constant temperature: $p_1V_1 = p_2V_2$	SAM1 Qu. 3 SAM 1 Qu 5 (c) Chemistry SAM 1 Qu 6 SAM 1 Qu 7 Physics SAM 1 Qu 4	
Reasoning	Evaluate information related to physics, chemistry and biology, making judgements on the basis of this	Examples in several parts of the specification including: Biology	e.g. Biology	Yes

	information. .	1.4 understand the term pathogen and know that pathogens may include fungi, bacteria, protoctists or viruses. 2.11 understand how temperature changes can affect enzyme function, including changes to the shape of active site 2.62 understand how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to the pathogen Chemistry 2.1 understand how the similarities in the reactions of these elements with water provide evidence for their recognition as a family of elements 2.6 use knowledge of trends in Group 7 to predict the properties of other halogens Physics 8.8 Understand how stars can be classified according to their colour	SAM1 Qu 4 (c) Chemistry SAM 1 Qu 3 Physics SAM 1 Qu 2(b)	
Interpretation	Select, organise and present relevant information clearly and logically using appropriate vocabulary, definitions and conventions.	Examples in several parts of the specification including: Biology 2.47 understand the role of the intercostal muscles and the diaphragm in ventilation 3.19 understand how genes exist in alternative forms called alleles which give rise to differences in inherited characteristics 3.38 explain Darwin's theory of evolution by natural selection 4 b feeding relationships Chemistry 1.16 know what is meant by the terms atomic number, mass number, isotopes and relative atomic mass (A_r) 2.15 understand how metals can be arranged in a reactivity series based on their reactions with: • water • dilute hydrochloric or sulfuric acid	e.g. Biology SAM 1 Qu 2 Chemistry SAM 1 Qu 9(d) SAM 1 Qu 4 Physics SAM 1 Qu 8	Yes

		4.21 understand how to draw the structural and displayed formulae for alkanes with up to five carbon atoms in the molecule, and to name the unbranched-chain isomers Physics 1.7 plot and explain velocity-time graphs 4.2 describe energy transfers involving energy stores: • energy stores: chemical, kinetic, gravitational, elastic, thermal, magnetic, electrostatic, nuclear • energy transfers: mechanically, electrically, by heating, by radiation (light and sound) 7.5 describe the nature of alpha (α) particles, beta (β^-) particles, and gamma (γ) rays, and recall that they may be distinguished in terms of penetrating power and ability to ionise		
Decision Making	Evaluate data and experimental methods, drawing conclusions, which are consistent with evidence from secondary sources and experimental activities. Suggest possible improvements and further investigations.	Examples in several parts of the specification including: Biology 2.9 *practical: investigate food samples for the presence of glucose, starch, protein and fat* 2.12 *practical: investigate how enzyme activity can be affected by changes in temperature* 5.6 *practical: investigate the role of anaerobic respiration by yeast in different conditions* Chemistry 1.10 describe these experimental techniques for the separation of mixtures: • simple distillation • fractional distillation • filtration • crystallisation • paper chromatography 2.14 *practical: determine the approximate percentage by volume of oxygen in air using a metal or a non-metal* Physics 1.5 *practical: investigate the motion of everyday objects such as toy*	e.g. Biology SAM 1 Qu. 3 SAM 1 Qu 7 Chemistry SAM 1 Qu 1(b) Physics	

		cars or tennis balls 3.17 *practical: investigate the refraction of light, using rectangular blocks, semi-circular blocks and triangular prisms*		
Adaptive learning	Learn about unifying patterns and themes in the three sciences and use them in new and changing situations.	Examples in several parts of the specification including: Biology 1.2 describe the common features shown by eukaryotic organisms: plants, animals, fungi and protoctists 2.4 know the similarities and differences in the structure of plant and animal cells 4.1 understand the terms population, community, habitat and ecosystem 4.5 understand how abiotic and biotic factors affect the population size and distribution of organisms Chemistry 1.1 understand the three states of matter in terms of the arrangement, movement and energy of the particles 1.16 know what is meant by the terms atomic number, mass number, isotopes and relative atomic mass (A_r) 3.1 know that chemical reactions in which heat energy is given out are described as exothermic, and those in which heat energy is taken in are described as endothermic Physics 2.6 know the difference between mains electricity being alternating current (a.c.) and direct current (d.c.) being supplied by a cell or battery 3.10 know that light is part of a continuous electromagnetic spectrum that includes radio, microwave, infrared, visible, ultraviolet, x-ray and gamma ray radiations and that all these waves travel at the same speed in free space 8.4 Explain that gravitational force: • causes moons to orbit planets • causes the planets to orbit the Sun • causes artificial satellites to orbit the Earth • causes comets to orbit the Sun	e.g. Biology Chemistry SAM 1 Qu 4 Physics SAM 1 Qu 2(b)	Yes

Executive function	Use experimental and investigative skills based on correct and safe laboratory techniques. Evaluate the effectiveness of an investigation in terms of accuracy, validity and reliability.	Use the embedded practicals to develop investigative skills. Evaluate their effectiveness. Plan investigations using the skills developed in the embedded practicals.		
Creativity				
Creativity	Apply existing knowledge of scientific processes to situations set in an unfamiliar context.	Command words such as 'show that' and 'comment on' require candidates to use ideas developed within the specification to answer questions set in an unusual context.	e.g. Biology SAM 1 Qu 4(c)	Yes May be evidenced in homework tasks
Innovation	Using a novel strategy to apply existing knowledge of scientific concepts in unaccustomed situations.	Questions involving a critical analysis of unfamiliar data in tabular or graphical form.		Yes

NRC framework skill	Skill interpretation in this subject	Where the skill is covered in content	Where the skill is explicitly assessed in examination	Opportunity for the skill to be developed through teaching and learning approach
Intrapersonal skills				
Intellectual openness				
Adaptability	Ability to select and apply knowledge and understanding of scientific processes, which is not prompted or provided to scientific problems.	Many questions would assess this		Yes
Personal and social responsibility	Appreciate ethical issues in science.	Biology 5.15 understand how genetically modified plants can be used to improve food production Chemistry 2.13 know that carbon dioxide is a greenhouse gas and that increasing amounts in the atmosphere may contribute to climate change 4.13 understand why carbon monoxide is poisonous, in terms of its effect on the capacity of blood to transport oxygen 4.16 understand how sulfur dioxide and oxides of nitrogen oxides contribute to acid rain Physics 1.20 describe the factors affecting vehicle stopping distance, including speed, mass, road condition and reaction time 3.13 explain the detrimental effects of excessive exposure of the human body to electromagnetic waves, including: • microwaves: internal heating of body tissue • infrared: skin burns • ultraviolet: damage to surface cells and blindness • gamma rays: cancer, mutation and describe simple protective measures against the risks 7.16 describe the dangers of ionising radiations, including: • that radiation can cause mutations in living organisms • that radiation can damage cells and tissue the problems arising from the disposal of radioactive waste and how the associated risks can be reduced		Yes
Continuous learning	Planning and reflecting on own learning- setting goals and meeting them regularly			Yes Students identify areas where they need extra help or practice.

Intellectual interest and curiosity	Identifying a problem under own initiative, planning a solution and carrying this out.			Yes in sections like astronomy
Work ethic/conscientiousness				
Initiative	Using scientific knowledge, independently (without guided learning), to further own understanding.			Yes Reading New Scientist
Self-direction	Planning and carrying out science based problem solving under own direction.			Yes
Responsibility	Taking responsibility for any errors or omissions in own work and creating a plan to improve.			Yes
Perseverance	Actively seeking new ways to continue and improve own learning despite setbacks.			Yes
Productivity	Develop a fluency in technical language so sophisticated answers of depth are produced in extended answers to scientific questions.	Some of the longer questions that require several steps would assess this.	e.g. Biology SAM 1 Qu 6 Chemistry SAM 1 Qu 2 (c) Physics SAM 1 Qu 2(b)	Yes
Self regulation (metacognition, forethought, reflection)	Developing and refining a strategy over time for applications of science, to different contexts reflecting on the success or otherwise of the strategy			Yes
Ethics	Producing output with a specific moral purpose for which one is accountable.			Yes
Integrity	Taking ownership for own work and willingly responds to questions and challenges.			Yes
Positive Core Self Evaluation				
Self monitoring/self evaluation/self reinforcement	Planning and reviewing own work as a matter of habit.			Yes

NRC framework skill	Skill interpretation in this subject	Where the skill is covered in content	Where the skill is explicitly assessed in examination	Opportunity for the skill to be developed through teaching and learning approach
Interpersonal skills				
Teamwork and collaboration				
Communication	Able to communicate a scientific process or technique (verbally or written) to peers and teachers and answer questions from others.			Yes e.g. in group discussion
Collaboration	Carrying out a peer review to provide supportive feedback to another.			Yes
Teamwork	Working with other students in a science based problem-solving exercise.	Numerous opportunities for collaborative practical work.		Yes
Co-operation	Sharing own resources and own learning techniques with other students.			Yes
Interpersonal skills	Using verbal and non-verbal communication skills in a dialogue about science.			Yes
Leadership				
Leadership	Leading others in a group activity to effectively solve a scientific problem			Yes
Responsibility	Taking responsibility for the outcomes of a team exercise even if one is not solely responsible for the output.			Yes
Assertive communication	Chairing a debate, allowing representations and directing the conversation to a conclusion.			Yes
Self presentation	Presenting a scientific problem or idea to an audience to seek solutions.			Yes