CAMBRIDGE NATIONAL IN SCIENCE

R071, R072, R073

A comprehensive 78 page overview of how the following qualifications match to the Learning Outcomes for Cambridge National in Science showing opportunities for holistic teaching.

21st Century Biology A 2012 J243	GCSE Mathematics B J567 Foundation Bronze
21st Century Chemistry A 2012 J244	GCSE Mathematics B J567 Foundation Gold
21st Century Physics A 2012 J245	GCSE Mathematics B J567 Foundation Initial
Gateway Biology B 2012 J263	GCSE Mathematics B J567 Foundation Silver
Gateway Chemistry B 2012J264	GCSE Mathematics B J567 Higher Silver
Gateway Physics B 2012 2012 J265	Cambridge National ICT Level 1/2 J800/J810/J820

The suggested matches in this document are not definitive. They are examples of where Maths, Science and ICT can be applied in Cambridge National in Science.

You can navigate this pdf by clicking on any of the outer tabs on the unit pages.
The Home button will return you to the Contents page.

Cambridge NATIONALS

OCR
Oxford Cambridge and RSA

CAMBRIDGE NATIONAL IN SCIENCE

Contents

Maths

Biology

Chemistry

Physics

ICT

CAMBRIDGE NATIONAL IN SCIENCE

Maths

R071 How scientific ideas have an impact on our lives

R072 How scientific ideas have developed

R073 How scientists test their ideas

CAMBRIDGE NATIONAL IN SCIENCE

Mapping GCSE Maths B J567 to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Foundation Initial	Foundation Bronze	Theme comments
LO1	**Personal and social choices related to energy supply** Energy calculations – quantity and costs	Number skills Algebra (quantity and cost calcs)	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra) **FIA2-3** Algebra (simple equations)	**FBN1-9** Number (basic maths) **FBA2-4** Algebra (equations)	Use number skills to analyse scientific data. Use algebra to solve problems (e.g. quantity and cost calculations)
LO2	**Benefits and risks of nuclear applications** Quantitative analysis inc calculation of risks and probabilities	Number skills Statistical analysis (risk calcs) Algebra (risk calcs)	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra) **FIN7** Number (percentages) **FIS1-5** Statistics (stat analysis) **FIA2-3** Algebra (simple equations)	**FBN1-9** Number (basic maths) **FBS1-3** Statistics (stat analysis) **FBA2-4** Algebra (equations)	Use number skills to analyse scientific data. Perform statistical analysis on scientific data (e.g. risks and probabilities) Use algebra to solve problems (e.g. quantitative analysis of risk)
LO3	**Measure energy transfer and calculate efficiency** Voltage, current, resistance, power calcs / Energy and time / Specific heat / Efficiency calcs	Number skills Measuring data Algebra (energy and power calcs) Graph plotting	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra) **FIG1-2** Geometry and measures (measuring data) **FIG5** Geometry and measures (volumes – relates to mass) **FIA2-3** Algebra (simple equations) **FIA4-5** Algebra (graphs)	**FBN1-9** Number (basic maths) **FBG4** Geometry and measures (volumes - mass) **FBA2-4** Algebra (equations) **FBA5** Algebra (graphs) **FBS8** (graphs)	Use number skills to analyse scientific data. Measure scientific quantities Use algebra to solve problems (e.g. energy and power calculations) Use and plot graphs representing scientific data (e.g. energy and power graphs)

Mapping GCSE Maths B J567 to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Foundation Initial	Foundation Bronze	Theme comments
LO4	**Improving human health** Assessment of fitness and health [I]	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data
		Measuring data	**FIG1-2** Geometry and measures (measuring data) **FIG5** Geometry and measures (volumes)	**FBG4** Geometry and measures (volumes)	Measure scientific data (e.g. volume and lung capacity, heart rate, cholesterol, glucose data)
		Algebra (volume calculations)	**FIA2-3** Algebra (simple equations)	**FBA2-4** Algebra (equations)	Use algebra to solve problems (e.g. volume and lung capacity)
		Plotting graphs from data	**FIA4-5** Algebra (axes and coordinates/ graphs)	**FBA5** Algebra (graphs) **FBS4** Statistics (real data graphs + misleading diagrams) **FBS8** Statistics (graphs)	Plot and use graphs representing data (e.g. volume and lung capacity)
LO5	**Benefits and risks of medical treatment** Quantitative treatment of risk	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data.
		Statistical analysis	**FIN7** Number (percentages) **FIS1-5** Statistics (stat analysis)	**FBS1-3** Statistics (stat analysis)	Perform statistical analysis on scientific data (e.g. risks and probabilities)
		Algebra (risk calcs)	**FIA2-3** Algebra (simple equations)	**FBA2-4** Algebra (equations)	Use algebra to solve problems (e.g. quantitative calculation of risk)
LO6	**Measure environmental effects of human activity** Sampling techniques – quadrats and transects Measuring levels from data	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data.
		Measuring data	**FIG1-2** Geometry and measures (measuring data) **FIG5** Geometry and measures (volumes – relates to mass)	**FBG4** Geometry and measures (volumes - mass)	Measure scientific quantities (e.g. particulates, CO, CO2, NOX)
		Plotting graphs from data	**FIA4-5** Algebra (axes and coordinates/ graphs)	**FBA5** Algebra (graphs) **FBS4** Statistics (real data graphs + misleading diagrams) **FBS8** Statistics (graphs)	Use and plot graphs representing scientific data (e.g. environmental data)
		Algebra (environmental data)	**FIA2-3** Algebra (simple equations)	**FBA2-4** Algebra (equations)	Use algebra to solve problems (e.g. using environmental data

Mapping GCSE Maths B J567 to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Foundation Initial	Foundation Bronze	Theme comments
LO7	**Materials from natural resources** Calc percentage yields Production quantities and energy budgets	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data.
		Measuring data	**FIG1-2** Geometry and measures (measuring data) **FIG5** Geometry and measures (volumes – relates to mass)	**FBG4** Geometry and measures (volumes and mass)	Measure scientific data (e.g. volume and mass of chemicals)
		Percentages and yield	**FIN7** Number (percentages)	**FBN6** Number (percentages)	Determine percentage yield of chemical reactions
		Algebra (production and cost data)	**FIA2-3** Algebra (simple equations)	**FBA2-4** Algebra (equations)	Use algebra to solve problems (e.g. production and costs data
LO8	**Properties of materials: structure and bonding** Properties of materials – melting/boiling point, strength, stiffness, hardness, density	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data
LO9	**Measure properties of materials and recommend uses** Gather and interpret data Gradients of graphs, average values, anomalous results	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data.
		Measuring data	**FIG1-2** Geometry and measures (measuring data) **FIG5** Geometry and measures (volumes – relates to mass)	**FBG4** Geometry and measures (volumes and mass)	Measure scientific quantities
		Statistical analysis	**FIN7** Number (percentages) **FIS1-5** Statistics (stat analysis)	**FBS1-3** Statistics (stat analysis)	Perform statistical analysis on scientific data (e.g. average values, percentage error)
		Graph plotting	**FIA4-5** Algebra (graphs)	**FBA5** Algebra (graphs) **FBS8** Statistics (graphs)	Use and plot graphs representing scientific data
		Identifying outliers and unexpected values	**FIA4-5** Algebra (axes and coordinates/ graphs)	**FBA5** Algebra (graphs) **FBS4** Statistics (real data graphs + misleading diagrams)	Understand outliers and unexpected values on scientific data and graphs
		Algebra (materials properties data)	**FIA2-3** Algebra (simple equations)	**FBA2-4** Algebra (equations)	Use algebra to solve problems (e.g. materials properties data)

CAMBRIDGE NATIONAL IN SCIENCE

R071 Foundation Silver
R071 Foundation Gold

Mapping GCSE Maths B J567 to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Foundation Silver	Foundation Gold	Theme comments
LO1	**Personal and social choices related to energy supply** Energy calculations – quantity and costs	Number skills	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills)	Use number skills to analyse scientific data.
		Algebra (quantity and cost calcs)	**FSA1-5** Algebra (linear algebra)	**FGA1-3** Algebra (linear algebra)	Use algebra to solve problems (e.g. quantity and cost calculations)
LO2	**Benefits and risks of nuclear applications** Quantitative analysis inc calculation of risks and probabilities	Number skills	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills)	Use number skills to analyse scientific data.
		Statistical analysis	**FSS1-5** Statistics (stat analysis – more complex [I])	**FGS1-3** Statistics (stat analysis – more complex [I])	Perform statistical analysis on scientific data (e.g. risks and probabilities)
		Algebra (risk calcs)	**FSA1-5** Algebra (linear algebra)	**FSA1-5** Algebra (linear algebra)	Use algebra to solve problems (e.g. quantitative analysis of risk)
LO3	**Measure energy transfer and calculate efficiency** Voltage, current, resistance, power calcs / Energy and time / Specific heat / Efficiency calcs	Number skills	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills)	Use number skills to analyse scientific data.
		Measuring data		**FGG1** Geometry and measures (measuring data) **FGG2** Geometry and measures (rates and compound measures)	Measure scientific quantities
		Algebra (energy and power calcs)	**FSA1-5** Algebra (linear algebra)	**FGS1-3** Statistics (stat analysis – more complex [I])	Use algebra to solve problems (e.g. energy and power calculations)
		Graph plotting	**FSA4** Algebra (linear tables and graphs)	**FGA4-6** Algebra (plot and use linear/ non-linear graphs)	Use and plot graphs representing scientific data (e.g. energy and power graphs)

Mapping GCSE Maths B J567 to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Foundation Silver	Foundation Gold	Theme comments
LO4	**Improving human health** Assessment of fitness and health [I]	Number skills Measuring data Algebra (volume calculations) Plotting graphs from data	**FSN1-6** Number (maths skills) **FSA1-5** Algebra (linear algebra) **FSA4** Algebra (linear tables and graphs)	**FGN1-6** Number (higher maths skills) **FGG1** Geometry and measures (measuring data) **FGG2** Geometry and measures (rates and compound measures) **FGA1-3** Algebra (linear algebra) **FSA4** Algebra (linear tables and graphs)	Use number skills to analyse scientific data Measure scientific data (e.g. volume and lung capacity, heart rate, cholesterol, glucose data) Use algebra to solve problems (e.g. volume and lung capacity) Plot and use graphs representing data (e.g. volume and lung capacity)
LO5	**Benefits and risks of medical treatment** Quantitative treatment of risk	Number skills Statistical analysis Algebra (risk calcs)	**FSN1-6** Number (maths skills) **FSS1-5** Statistics (stat analysis – more complex [I]) **FSA1-5** Algebra (linear algebra)	**FGN1-6** Number (higher maths skills) **FGS1-3** Statistics (stat analysis – more complex [I]) **FGA1-3** Algebra (linear algebra)	Use number skills to analyse scientific data. Perform statistical analysis on scientific data (e.g. risks and probabilities) Use algebra to solve problems (e.g. quantitative calculation of risk)
LO6	**Measure environmental effects of human activity** Sampling techniques – quadrats and transects Measuring levels from data	Number skills Measuring data Plotting graphs from data Algebra (environmental data)	**FSN1-6** Number (maths skills) **FSA4** Algebra (linear tables and graphs)	**FGN1-6** Number (higher maths skills) **FGG1** Geometry and measures (measuring data) FGG2 Geometry and measures (rates and compound measures) **FSA4** Algebra (linear tables and graphs)	Use number skills to analyse scientific data. Measure scientific quantities (e.g. particulates, CO, CO2, NOX) Use and plot graphs representing scientific data (e.g. environmental data) Use algebra to solve problems (e.g. using environmental data

Mapping GCSE Maths B J567 to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Foundation Silver	Foundation Gold	Theme comments
LO7	**Materials from natural resources** Calc percentage yields Production quantities and energy budgets	Number skills	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills)	Use number skills to analyse scientific data.
		Measuring data		**FGG1** Geometry and measures (measuring data) **FGG2** Geometry and measures (rates and compound measures)	Measure scientific data (e.g. volume and mass of chemicals)
		Percentages and yield	**FSN3** Number (percentages)	**FGN4** Number (percentages)	Determine percentage yield of chemical reactions
		Algebra (production and cost data)	**FSA1-5** Algebra (linear algebra)	**FGA1-3** Algebra (linear algebra)	Use algebra to solve problems (e.g. production and costs data
LO8	**Properties of materials: structure and bonding** Properties of materials – melting/boiling point, strength, stiffness, hardness, density	Number skills	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills)	Use number skills to analyse scientific data
LO9	**Measure properties of materials and recommend uses** Gather and interpret data Gradients of graphs, average values, anomalous results	Number skills	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills)	Use number skills to analyse scientific data
		Measuring data		**FGG1** Geometry and measures (measuring data) **FGG2** Geometry and measures (rates and compound measures)	Measure scientific quantities
		Statistical analysis	**FSS1-5** Statistics (stat analysis – more complex [I])	**FGS1-3** Statistics (stat analysis – more complex [I])	Perform statistical analysis on scientific data (e.g. average values, percentage error)
		Graph plotting	**FSA4** Algebra (linear tables and graphs)	**FSA4** Algebra (linear tables and graphs)	Use and plot graphs representing scientific data
		Identifying outliers and unexpected values	**FSA4** Algebra (plot linear graphs from tables) **FSS3** Statistics (draw and interpret graphs)	**FGA5** Algebra (linear and non-linear graphs)	Understand outliers and unexpected values on scientific data and graphs
		Algebra (materials properties data)	**FSA1-5** Algebra (linear algebra)	**FGA1-3** Algebra (linear algebra)	Use algebra to solve problems (e.g. materials properties data)

CAMBRIDGE NATIONAL IN SCIENCE

R071 Higher Silver
R071 Higher Gold

Mapping GCSE Maths B J567 to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Higher Silver	Higher Gold	Theme comments
LO1	**Personal and social choices related to energy supply** Energy calculations – quantity and costs	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data
		Algebra (quantity and cost calcs)	**HSA1-4** Algebra (solver harder linear equations)	**HGA1-4** Algebra (harder quadratics)	Use and manipulate more complex equations representing scientific formulae
LO2	**Benefits and risks of nuclear applications** Quantitative analysis inc calculation of risks and probabilities	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data
		Statistical analysis (risk calcs)	**HSS1-4** Statistics (higher stats)	**HGS1-4** Statistics (higher stats)	Perform statistical analysis on scientific data (e.g. probabilities, percentage error, risk calculations)
		Algebra (risk calcs)	**HSA1-4** Algebra (solver harder linear equations)	**HGA1-4** Algebra (harder quadratics)	Use and manipulate more complex equations representing scientific formulae
LO3	**Measure energy transfer and calculate efficiency** Voltage, current, resistance, power calcs Energy and time Specific heat Efficiency calcs	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data
		Algebra (energy and power calcs)	**HSA1-4** Algebra (solver harder linear equations)	**HGA1-4** Algebra (harder quadratics)	Use and manipulate more complex equations representing scientific formulae
		Graph plotting	**HSA5** Algebra (quadratics and cubic's) **HSA7** (straight line - y=mx+c)	**HGA5-6** Algebra (power and sin/cosine functions)	Use and plot complex graphs representing scientific data (e.g. straight line graphs, sin graphs)
LO4	**Improving human health** Assessment of fitness and health [I]	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data
		Algebra (volume calculations)	**HSA1-4** Algebra (solver harder linear equations)	**HGA1-4** Algebra (harder quadratics)	Use and manipulate more complex equations representing scientific formulae
		Plotting graphs from data	**HSA5** Algebra (quadratics and cubic's) **HSA7** (straight line - y=mx+c)	**HGA5-6** Algebra (power and sin/cosine functions)	Use and plot complex graphs representing scientific data (e.g. straight line graphs)

Mapping GCSE Maths B J567 to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Higher Silver	Higher Gold	Theme comments
LO5	**Benefits and risks of medical treatment** Quantitative treatment of risk	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data
		Statistical analysis	**HSS1-4** Statistics (higher stats)	**HGS1-4** Statistics (higher stats)	Perform statistical analysis on scientific data (e.g. probabilities, percentage error)
		Algebra (risk calcs)	**HSA1-4** Algebra (solver harder linear equations)	**HGA1-4** Algebra (harder quadratics)	Use and manipulate more complex equations representing scientific formulae
LO6	**Measure environmental effects of human activity** Sampling techniques – quadrats and transects Measuring levels from data	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data
		Plotting graphs from data	**HSA5** Algebra (quadratics and cubic's) **HSA7** (straight line - y=mx+c)	**HGA5-6** Algebra (power and sin/cosine functions)	Use and plot complex graphs representing scientific data (e.g. straight line graphs)
		Algebra (environmental data)	**HSA1-4** Algebra (solver harder linear equations)	**HGA1-4** Algebra (harder quadratics)	Use and manipulate more complex equations representing scientific formulae
LO7	**Materials from natural resources** Calc percentage yields Production quantities and energy budgets	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data
		Algebra (production and cost data)	**HSA1-4** Algebra (solver harder linear equations)	**HGA1-4** Algebra (harder quadratics)	Use and manipulate more complex equations representing scientific formulae
LO8	**Properties of materials: structure and bonding** Properties of materials – melting/boiling point, strength, stiffness, hardness, density	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data

Mapping GCSE Maths B J567 to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Higher Silver	Higher Gold	Theme comments
LO9	**Measure properties of materials and recommend uses**	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data
	Gather and interpret data Gradients of graphs, average values, anomalous results	Statistical analysis	**HSS1-4** Statistics (higher stats)	**HGS1-4** Statistics (higher stats)	Perform statistical analysis on scientific data (e.g. percentage error)
		Graph plotting	**HSA5** Algebra (quadratics and cubic's) **HSA7** (straight line - y=mx+c)	**HGA5-6** Algebra (power and sin/cosine functions)	Use and plot complex graphs representing scientific data (e.g. straight line graphs)
		Identifying outliers and unexpected values	**HSA7** Algebra (straight line- y=mx+c)	**HGA5-6** (power and sin/cosine functions)	Understand outliers and unexpected values on scientific data and graphs
		Algebra (materials properties data)	**HSA1-4** Algebra (solver harder linear equations)	**HGA1-4** Algebra (harder quadratics)	Use and manipulate more complex equations representing scientific formulae

CAMBRIDGE NATIONAL IN SCIENCE

R072 Foundation Initial
R072 Foundation Bronze

Mapping GCSE Maths B J567 to R072 – How scientific ideas have developed

	Keywords	Theme	Foundation Initial	Foundation Bronze	Theme comments
LO1	**Work of scientists: development of scientific ideas** Units and measurements; fundamental maths	Number skills Measuring data	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra) **FIG1-2** Geometry and measures (measuring data) **FIG5** Geometry and measures (volumes – relates to mass)	**FBN1-9** Number (basic maths) **FBG4** Geometry and measures (volumes - mass)	Use number skills to analyse scientific data. Measure scientific quantities (e.g. mass of chemicals, volumes)
LO2	**The scientific method** Units and measurements; fundamental maths	Number skills Measuring data	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra) **FIG1-2** Geometry and measures (measuring data) **FIG5** Geometry and measures (volumes – relates to mass)	**FBN1-9** Number (basic maths) **FBG4** Geometry and measures (volumes - mass)	Use number skills to analyse scientific data. Measure scientific quantities (e.g. mass of chemicals, volumes)
LO3	**Evaluate scientific information** Quantitative analysis – recognising patterns	Number skills Variables and solving problems	**FSN1-6** Number (maths skills) **FSA1-5** Algebra (linear algebra)	**FGN1-6** Number (higher maths skills) **FGA1-3** Algebra (linear algebra)	Use number skills to analyse scientific data. Use and manipulate equations representing linear scientific formulae
LO4	**Communicate scientific information** Using maths to communicate (conventions, symbols)	Number skills Variables and solving problems Graph plotting	**FSN1-6** Number (maths skills) **FSA1-5** Algebra (linear algebra) **FSA4** Algebra (linear tables and graphs)	**FGN1-6** Number (higher maths skills) **FGA1-3** Algebra (linear algebra) **FGA4-6** Algebra (plot and use linear/non-linear graphs)	Use number skills to analyse scientific data. Use and manipulate equations representing linear scientific formulae Use and plot linear and non-linear graphs representing scientific data

CAMBRIDGE NATIONAL IN SCIENCE

R072 Foundation Silver
R072 Foundation Gold

Mapping GCSE Maths B J567 to R072 – How scientific ideas have developed

	Keywords	Theme	Foundation Silver	Foundation Gold	Theme comments
LO1	**Work of scientists: development of scientific ideas** Units and measurements; fundamental maths	Number skills Measuring data	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills) **FGG1** Geometry and measures (measuring data) **FGG2** Geometry and measures (rates and compound measures)	Use number skills to analyse scientific data. Measure scientific quantities (e.g. mass of chemicals, volumes)
LO2	**The scientific method** Units and measurements; fundamental maths	Number skills Measuring data	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills) **FGG1** Geometry and measures (measuring data) **FGG2** Geometry and measures (rates and compound measures)	Use number skills to analyse scientific data. Measure scientific quantities (e.g. mass of chemicals, volumes)
LO3	**Evaluate scientific information** Quantitative analysis – recognising patterns	Number skills Variables and solving problems	**FSN1-6** Number (maths skills) **FSA1-5** Algebra (linear algebra)	**FGN1-6** Number (higher maths skills) **FGA1-3** Algebra (linear algebra)	Use number skills to analyse scientific data. Use and manipulate equations representing linear scientific formulae
LO4	**Communicate scientific information** Using maths to communicate (conventions, symbols)	Number skills Variables and solving problems Graph plotting	**FSN1-6** Number (maths skills) **FSA1-5** Algebra (linear algebra) **FSA4** Algebra (linear tables and graphs)	**FGN1-6** Number (higher maths skills) **FGA1-3** Algebra (linear algebra) **FGA4-6** Algebra (plot and use linear/ non-linear graphs)	Use number skills to analyse scientific data. Use and manipulate equations representing linear scientific formulae Use and plot linear and non-linear graphs representing scientific data

CAMBRIDGE NATIONAL IN SCIENCE

R072 Higher Silver
R072 Higher Gold

Mapping GCSE Maths B J567 to R072 – How scientific ideas have developed

	Keywords	Theme	Higher Silver	Higher Gold	Theme comments
LO1	**Work of scientists: development of scientific ideas** Units and measurements; fundamental maths	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials	Use higher level number skills to analyse scientific data
LO2	**The scientific method** Units and measurements; fundamental maths	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials	Use higher level number skills to analyse scientific data
LO3	**Evaluate scientific information** Quantitative analysis – recognising patterns	Number skills Variables and solving problems	**HSN1-4** Number (higher maths skills) **HSA1-4** Algebra (solver harder linear equations)	**HGN4-5** Number (calculators, exponentials) **HGA1-4** Algebra (harder quadratics)	Use higher level number skills to analyse scientific data Use and manipulate more complex equations representing scientific formulae
LO4	**Communicate scientific information** Using maths to communicate (conventions, symbols)	Number skills Variables and solving problems Graph plotting	**HSN1-4** Number (higher maths skills) **HSA1-4** Algebra (solver harder linear equations) **HSA5** Algebra (quadratics and cubic's) **HSA7 (**straight line - y=mx+c)	**HGN4-5** Number (calculators, exponentials) **HGA1-4** Algebra (harder quadratics) **HGA5-6** Algebra (power and sin/cosine functions)	Use higher level number skills to analyse scientific data Use and manipulate more complex equations representing scientific formulae Use and plot graphs representing scientific data (e.g. calibration graphs)

CAMBRIDGE NATIONAL IN SCIENCE

R073 Foundation Initial
R073 Foundation Bronze

Mapping GCSE Maths B J567 to R073 – How scientists test their ideas

	Keywords	Theme	Foundation Initial	Foundation Bronze	Theme comments
LO1	**Plan a scientific investigation** Variables, collecting data				
LO2	**Collect scientific data** Variables, collecting data	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data
		Measuring data	**FIG1-2** Geometry and measures (measuring data) **FIG5** Geometry and measures (volumes – relates to mass)	**FBG4** Geometry and measures (volumes - mass)	Measure scientific quantities (e.g. mass of chemicals, volumes)
LO3	**Analyse scientific information** Identifying trends and patterns (maths and graphical) Relationships, uncertainty, anomalous data	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data
		Statistical analysis	**FIN7** Number (percentages) **FIS1-5** Statistics (stat analysis)	**FBS1-3** Statistics (stat analysis)	Perform statistical analysis on scientific data (e.g. percentage error)
		Graph plotting	**FIA4-5** Algebra (graphs)	**FBA5** Algebra (graphs) **FBS8** Statistics (graphs)	Use and plot graphs representing scientific data
		Magnification and scale factor (graphs)	**FIA4-5** Algebra (axes and coordinates/ graphs)	**FBG8** Geometry and measures (scale factor)	Calculate magnification and scale in relation to features of samples
		Identifying outliers and unexpected values		**FBA5** Algebra (graphs) **FBS4** Statistics (real data graphs + misleading diagrams)	Understand outliers and unexpected values on scientific data and graphs

Mapping GCSE Maths B J567 to R073 – How scientists test their ideas

	Keywords	Theme	Foundation Initial	Foundation Bronze	Theme comments
LO4	**Evaluate scientific information** Identifying trends and patterns (maths and graphical) Relationships, uncertainty, anomalous data Validity and reliability	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data
		Statistical analysis	**FIN7** Number (percentages) **FIS1-5** Statistics (stat analysis)	**FBS1-3** Statistics (stat analysis)	Perform statistical analysis on scientific data (e.g. percentage error)
		Graph plotting	**FIA4-5** Algebra (graphs)	**FBA5** Algebra (graphs) **FBS8** Statistics (graphs)	Use and plot graphs representing scientific data
		Magnification and scale factor (graphs)		**FBG8** Geometry and measures (scale factor)	Calculate magnification and scale in relation to features of samples
		Identifying outliers and unexpected values	**FIA4-5** Algebra (axes and coordinates/ graphs)	**FBA5** Algebra (graphs) **FBS4** Statistics (real data graphs + misleading diagrams)	Understand outliers and unexpected values on scientific data and graphs
LO5	**Communicate scientific information** Present information – inc explanations, arguments, diagrams, graphs, flow charts, pictures and tables	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data
		Statistical analysis	**FIN7** Number (percentages) **FIS1-5** Statistics (stat analysis)	**FBS1-3** Statistics (stat analysis)	Perform statistical analysis on scientific data (e.g. percentage error)
		Graph plotting	**FIA4-5** Algebra (graphs)	**FBA5** Algebra (graphs) **FBS8** Statistics (graphs)	Use and plot graphs representing scientific data
		Magnification and scale factor (graphs)		**FBG8** Geometry and measures (scale factor)	Calculate magnification and scale in relation to features of samples
		Identifying outliers and unexpected values	**FIA4-5** Algebra (axes and coordinates/ graphs)	**FBA5** Algebra (graphs) **FBS4** Statistics (real data graphs + misleading diagrams)	Understand outliers and unexpected values on scientific data and graphs

CAMBRIDGE NATIONAL IN SCIENCE

R073 Foundation Silver
R073 Foundation Gold

Mapping GCSE Maths B J567 to R073 – How scientists test their ideas

	Keywords	Theme	Foundation Silver	Foundation Gold	Theme comments
LO1	**Plan a scientific investigation** Variables, collecting data	Number skills	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills)	Use number skills to analyse scientific data
		Measuring data		**FGG1** Geometry and measures (measuring data) **FGG2** Geometry and measures (rates and compound measures)	Measure scientific quantities (e.g. mass of chemicals, volumes)
LO2	**Collect scientific data** Variables, collecting data	Number skills	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills)	Use number skills to analyse scientific data
		Statistical analysis	**FSS1-5** Statistics (stat analysis – more complex [l])	**FGS1-3** Statistics (stat analysis – more complex [l])	Measure scientific quantities (e.g. mass of chemicals, volumes)
		Graph plotting	**FSA4** Algebra (linear tables and graphs)	**FGA4-6** Algebra (plot and use linear/ non-linear graphs)	
		Magnification and scale factor (graphs)	**FSN5** Number (ratio and proportion)	**FGG7** Geometry and measures (scale factor)	
		Identifying outliers and unexpected values	**FSA4** Algebra (plot linear graphs from tables) **FSS3** Statistics (draw and interpret graphs)	**FGA5** Algebra (linear and non-linear graphs)	

Mapping GCSE Maths B J567 to R073 – How scientists test their ideas

	Keywords	Theme	Foundation Silver	Foundation Gold	Theme comments
LO3	**Analyse scientific information** Identifying trends and patterns (maths and graphical) Relationships, uncertainty, anomalous data	Number skills	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills)	Use number skills to analyse scientific data
		Statistical analysis	**FSS1-5** Statistics (stat analysis – more complex [I])	**FGS1-3** Statistics (stat analysis – more complex [I])	Undertake more complex statistical analysis of scientific data
		Graph plotting	**FSA4** Algebra (linear tables and graphs)	**FGA4-6** Algebra (plot and use linear/non-linear graphs)	Use and plot linear and non-linear graphs representing scientific data
		Magnification and scale factor (graphs)	**FSN5** Number (ratio and proportion)	**FGG7** Geometry and measures (scale factor)	Calculate magnification, scale, ratio and proportion in relation to features of samples
		Identifying outliers and unexpected values	**FSA4** Algebra (plot linear graphs from tables) **FSS3** Statistics (draw and interpret graphs)	**FGA5** Algebra (linear and non-linear graphs)	Understand outliers and unexpected values on scientific data and graphs
LO4	**Evaluate scientific information** Identifying trends and patterns (maths and graphical) Relationships, uncertainty, anomalous data Validity and reliability	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data
		Statistical analysis	**FIN7** Number (percentages) **FIS1-5** Statistics (stat analysis)	**FBS1-3** Statistics (stat analysis)	Perform statistical analysis on scientific data (e.g. percentage error)
		Graph plotting	**FIA4-5** Algebra (graphs)	**FBA5** Algebra (graphs) **FBS8** Statistics (graphs)	Use and plot graphs representing scientific data
		Magnification and scale factor (graphs)		**FBG8** Geometry and measures (scale factor)	Calculate magnification and scale in relation to features of samples
		Identifying outliers and unexpected values	**FIA4-5** Algebra (axes and coordinates/graphs)	**FBA5** Algebra (graphs) **FBS4** Statistics (real data graphs + misleading diagrams)	Understand outliers and unexpected values on scientific data and graphs

Mapping GCSE Maths B J567 to R073 – How scientists test their ideas

	Keywords	Theme	Foundation Silver	Foundation Gold	Theme comments
LO5	**Communicate scientific information** Present information – inc explanations, arguments, diagrams, graphs, flow charts, pictures and tables	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data
		Statistical analysis	**FIN7** Number (percentages) **FIS1-5** Statistics (stat analysis)	**FBS1-3** Statistics (stat analysis)	Perform statistical analysis on scientific data (e.g. percentage error)
		Graph plotting	**FIA4-5** Algebra (graphs)	**FBA5** Algebra (graphs) **FBS8** Statistics (graphs)	Use and plot graphs representing scientific data
		Magnification and scale factor (graphs)		**FBG8** Geometry and measures (scale factor)	Calculate magnification and scale in relation to features of samples
		Identifying outliers and unexpected values	**FIA4-5** Algebra (axes and coordinates/ graphs)	**FBA5** Algebra (graphs) **FBS4** Statistics (real data graphs + misleading diagrams)	Understand outliers and unexpected values on scientific data and graphs

CAMBRIDGE NATIONAL IN SCIENCE

R073 Higher Silver
R073 Higher Gold

Mapping GCSE Maths B J567 to R073 – How scientists test their ideas

	Keywords	Theme	Higher Silver	Higher Gold	Theme comments
LO1	**Plan a scientific investigation** Variables, collecting data				
LO2	**Collect scientific data** Variables, collecting data	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data
LO3	**Analyse scientific information** Identifying trends and patterns (maths and graphical) Relationships, uncertainty, anomalous data	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data
		Statistical analysis	**HSS1-4** Statistics (higher stats)	**HGS1-4** Statistics (higher stats)	Perform statistical analysis on scientific data (e.g. percentage error)
		Graph plotting	**HSA5** Algebra (quadratics and cubic's) **HSA7** (straight line - $y=mx+c$)	**HGA5-6** Algebra (power and sin/cosine functions)	Use and plot graphs representing scientific data (e.g. calibration graphs)
		Magnification and scale factor (graphs)	**HSG6** Geometry and measures (scale factor)		Calculate magnification and scale in relation to features of samples
		Identifying outliers and unexpected values	**HSA7** Algebra (straight line- $y=mx+c$)	**HGA5-6** (power and sin/cosine functions)	Understand outliers and unexpected values on scientific data and graphs
LO4	**Evaluate scientific information** Identifying trends and patterns (maths and graphical) Relationships, uncertainty, anomalous data Validity and reliability	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data
		Statistical analysis	**HSS1-4** Statistics (higher stats)	**HGS1-4** Statistics (higher stats)	Perform statistical analysis on scientific data (e.g. percentage error)
		Graph plotting	**HSA5** Algebra (quadratics and cubic's) **HSA7** (straight line - $y=mx+c$)	**HGA5-6** Algebra (power and sin/cosine functions)	Use and plot graphs representing scientific data (e.g. calibration graphs)
		Magnification and scale factor (graphs)	**HSG6** Geometry and measures (scale factor)		Calculate magnification and scale in relation to features of samples
		Identifying outliers and unexpected values	**HSA7** Algebra (straight line- $y=mx+c$)	**HGA5-6** (power and sin/cosine functions)	Understand outliers and unexpected values on scientific data and graphs

Mapping GCSE Maths B J567 to R073 – How scientists test their ideas

	Keywords	Theme	Higher Silver	Higher Gold	Theme comments
LO5	**Communicate scientific information** Present information – inc explanations, arguments, diagrams, graphs, flow charts, pictures and tables	Number skills	**HSN1-4** Number (higher maths skills)	**HGN4-5** Number (calculators, exponentials)	Use higher level number skills to analyse scientific data.
		Statistical analysis	**HSS1-4** Statistics (higher stats)	**HGS1-4** Statistics (higher stats)	Perform statistical analysis on scientific data (e.g. percentage error)
		Graph plotting	**HSA5** Algebra (quadratics and cubic's) **HSA7** (straight line - y=mx+c)	**HGA5-6** Algebra (power and sin/cosine functions)	Use and plot graphs representing scientific data (e.g. calibration graphs)
		Magnification and scale factor (graphs)	**HSG6** Geometry and measures (scale factor)		Calculate magnification and scale in relation to features of samples
		Identifying outliers and unexpected values	**HSA7** Algebra (straight line- y=mx+c)	**HGA5-6** (power and sin/cosine functions)	Understand outliers and unexpected values on scientific data and graphs

CAMBRIDGE NATIONAL IN SCIENCE

R074 Higher Silver
R074 Higher Gold

Mapping GCSE Maths B J567 to R073 – How scientists test their ideas

	Keywords	Theme	Higher Silver	Higher Gold	Theme comments
LO1	**Plan a scientific investigation** Variables, collecting data				
LO2	**Collect scientific data** Variables, collecting data	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data.
		Measuring data	**FIG1-2** Geometry and measures (measuring data) **FIG5** Geometry and measures (volumes – relates to mass)	**FBG4** Geometry and measures (volumes - mass)	Measure scientific quantities (e.g. mass of chemicals, volumes)
LO3	**Analyse scientific information** Identifying trends and patterns (maths and graphical) Relationships, uncertainty, anomalous data	Number skills	**FIN1-12** Number (basic maths) **FIA1-3** Algebra (algebra)	**FBN1-9** Number (basic maths)	Use number skills to analyse scientific data.
		Statistical analysis	**FIN7** Number (percentages) **FIS1-5** Statistics (stat analysis)	**FBS1-3** Statistics (stat analysis)	Perform statistical analysis on scientific data (e.g. percentage error)
		Graph plotting	**FIA4-5** Algebra (graphs)	**FBA5** Algebra (graphs) **FBS8** Statistics (graphs)	Use and plot graphs representing scientific data
		Magnification and scale factor (graphs)	**FIA4-5** Algebra (axes and coordinates/graphs)	**FBG8** Geometry and measures (scale factor)	Calculate magnification and scale in relation to features of samples
		Identifying outliers and unexpected values		**FBA5** Algebra (graphs) **FBS4** Statistics (real data graphs + misleading diagrams)	Understand outliers and unexpected values on scientific data and graphs

Mapping GCSE Maths B J567 to R073 – How scientists test their ideas

		Keywords	Theme	Higher Silver	Higher Gold	Theme comments
LO4		**Evaluate scientific information** Identifying trends and patterns (maths and graphical) Relationships, uncertainty, anomalous data Validity and reliability	Number skills	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills)	Use number skills to analyse scientific data
			Statistical analysis	**FSS1-5** Statistics (stat analysis – more complex [I])	**FGS1-3** Statistics (stat analysis – more complex [I])	Undertake more complex statistical analysis of scientific data
			Graph plotting	**FSA4** Algebra (linear tables and graphs)	**FGA4-6** Algebra (plot and use linear/ non-linear graphs)	Use and plot linear and non-linear graphs representing scientific data
			Magnification and scale factor (graphs)	**FSN5** Number (ratio and proportion)	**FGG7** Geometry and measures (scale factor)	Calculate magnification, scale, ratio and proportion in relation to features of samples
				FSA4 Algebra (plot linear graphs from tables)		
			Identifying outliers and unexpected values	**FSS3** Statistics (draw and interpret graphs)	**FGA5** Algebra (linear and non-linear graphs)	Understand outliers and unexpected values on scientific data and graphs
LO5		**Communicate scientific information** Present information – inc explanations, arguments, diagrams, graphs, flow charts, pictures and tables	Number skills	**FSN1-6** Number (maths skills)	**FGN1-6** Number (higher maths skills)	Use number skills to analyse scientific data
			Statistical analysis	**FSS1-5** Statistics (stat analysis – more complex [I])	**FGS1-3** Statistics (stat analysis – more complex [I])	Undertake more complex statistical analysis of scientific data
			Graph plotting	**FSA4** Algebra (linear tables and graphs)	**FGA4-6** Algebra (plot and use linear/ non-linear graphs)	Use and plot linear and non-linear graphs representing scientific data

CAMBRIDGE NATIONAL IN SCIENCE

21st Century Biology J243

R071 How scientific ideas have an impact on our lives

R072 How scientific ideas have developed

R073 How scientists test their ideas

Gateway Biology J263

R071 How scientific ideas have an impact on our lives

R072 How scientific ideas have developed

R073 How scientists test their ideas

CAMBRIDGE NATIONAL IN SCIENCE

21st Century Biology

Mapping 21st Century Biology to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	21st Century Biology	Theme comments
LO1	**Personal and social choices related to energy supply** Primary and secondary energy sources, renewable, non-renewable, economic, environmental impacts			
LO2	**Benefits and risks of nuclear applications** EM and nuclear, radiation – benefits and harms, natural nuclear emissions	Healthcare	**B2.1** How do our bodies resist infection? **B2.3** What factors increase the risk of heart disease? **B5.1** How do organisms develop? **B5.2** How does an organism produce new cells?	Use of nuclear radiation in healthcare – benefits and risks
LO3	**Measure energy transfer and calculate efficiency** Voltage, current, resistance, power; energy, time; specific heat (mass, temp change); energy ip, op and efficiency	Energy and the human body [I]	**B7.3** Peak performance – energy balance	Understand the effects of blood sugar levels including diabetes
LO4	**Improving human health** Environmental factors that affect health – diet, exercise, smoking, drugs. Assessing fitness and health. Micro-organisms that cause disease	Infections and antibiotics [D] Heart disease [D] The body, lifestyle and exercise [D]	**B2.1** How do our bodies resist infection? **B2.2** What are vaccines and antibiotics and how do they work? **B2.3** What factors increase the risk of heart disease? **B7.1** Peak performance – movement and exercise **B7.2** Peak performance – circulation **B7.3** Peak performance – energy balance	Understand how our bodies can resist infection Understand how vaccines and antibiotics work against micro-organisms Understand the factors that affect heart disease, including the beneficial effects of good lifestyle, good diet and exercise Understand function of the skeleton. Recall the structure and function of body joints (e.g. cartilage, ligaments and tendons) Understand the function and operation of the circulatory system. Interpret data on the risks associated with an unhealthy lifestyle

Mapping 21st Century Biology to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	21st Century Biology	Theme comments
LO5	**Benefits and risks of medical treatment** Preventative and treatment; testing developments; drug trials; ethics	Genetics and diseases [D]	**B1.3** How can and should genetic information be used? How can we use our knowledge of genes to prevent disease?	Understand the relationship between genetics and diseases
		Infections and antibiotics [D]	**B2.1** How do our bodies resist infection? **B2.2** What are vaccines and antibiotics and how do they work?	Understand how our bodies can resist infection Understand how vaccines and antibiotics work against micro-organisms
		New technology and treatments [D]	**B7.5** New technologies	Understand how bacteria and fungi are used in the production of antibiotics. Recall examples of genetic modification such as in bacterial synthesis of medications.
LO6	**Measure environmental effects of human activity** Ecosystems; effects that can be measured – air/water pollution, noise, land-use. Measure non-living indicators – pH, temp, chem. Testing, particulates	Measuring environmental and climate change [D]	**B3.1** Systems in balance – how do different species depend on each other?	Understand how climate and environmental changes can be measured using indicators (e.g. nitrate level, temperature, CO2 and by changes in living organisms)
		Biodiversity [I]	**B3.3** What is the importance of biodiversity?	Understand how biodiversity relates to the variety of life on Earth
		Ecosystems [I]	**B7.4** What can we learn from natural ecosystems?	Understand the ecosystem as a closed loop system Understand the stability of ecosystems.
		New technologies and the environment [I]	**B7.5** New technologies	Understand how bacteria and fungi are used in the production of antibiotics and in enzymes (e.g. for food processing, making washing powder and biofuels)
LO7	**Materials from natural resources** Crude oil – new materials/plastics; cement/brick/glass/steel; metals and ores; ammonia; batch/continuous; sustainable and environmental impact Yields Polymerisation of alkenes, oxidation and reaction, chem symbols, reversible reactions, catalysts			

Mapping 21st Century Biology to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	21st Century Biology	Theme comments
LO8	**Properties of materials: structure and bonding** Structure and bonding of materials; polymers; alloys inc steel; use and properties of materials			
LO9	**Measure properties of materials and recommend uses** Analysis - maths			

CAMBRIDGE NATIONAL IN SCIENCE

21st Century Biology

Mapping 21st Century Biology to R072 – How scientific ideas have developed (LO2, 3 and 4 are in the context of LO1 Developments)

	Keywords	Theme	21st Century Biology J243	Theme comments
LO1	**Work of scientists: development of scientific ideas** How life on Earth has developed (inc DNA); evidence of evolution; How internal environment of human body is controlled; The history of the Earth and Universe (inc tectonics, climate change); Using waves to communicate	Genetics and cloning [D]	**B1.1** What are genes and how do they affect the way that organisms develop? **B1.2** Why can people look like their parents, brothers and sisters, but not be identical to them? **B1.3** How can and should genetic information be used? How can we use our knowledge of genes to prevent disease? **B1.4** How is a clone made? **B5.3** How do genes control growth and development within the cell?	Understand how genetics affect human characteristics and can be used to prevent disease.
		Systems in the body [D]	**B2.4** How do our bodies keep a healthy water balance? **B6.2** How is information passed through the nervous system? **B7.2** Peak performance – circulation **B7.3** Peak performance – energy balance	Understand body water balance including how dehydration can lead to adverse effects on health. Understand the function and operation of the nervous system. Understand the function and operation of the circulatory system. Understand the effects of blood sugar levels including diabetes.
		Life on Earth [D]	**B3.2** How has life on Earth evolved? **B3.1** systems in balance – how different species depend on each other? **B3.3** What is the importance of biodiversity **B5.1** How do organisms develop? **B6.1** How do animals respond to changes in their environment	Understand how life on Earth has evolved including the process of natural selection.
		New technologies [D]	**B7.5** New technologies	Understand how bacteria and fungi are used in the production of antibiotics and in enzymes (e.g. for food processing, making washing powder and biofuels). Recall examples of genetic modification such as in bacterial synthesis of medications and in resistant crop plants.

Mapping 21st Century Biology to R072 – How scientific ideas have developed (LO2, 3 and 4 are in the context of LO1 Developments)

	Keywords	Theme	21st Century Biology J243	Theme comments
LO2	**The scientific method** Collecting and analysing data; hypothesis and experiments; equipment and limitation; scientific community – credibility and review			
LO3	**Evaluate scientific information** Variables, quality and validity, interpret evidence and make conclusions			
LO4	**Communicate scientific information** Scientific, technical and mathematical language. Good presentation skills			

CAMBRIDGE NATIONAL IN SCIENCE

21st Century Biology

Mapping 21st Century Biology to R072 – How scientific ideas have developed (LO2, 3 and 4 are in the context of LO1 Developments)

	Keywords	Theme	21st Century Biology J243	Theme comments
LO1	**Plan a scientific investigation** Controlling variables, using equipment and techniques, sources of information	Antimicrobials	**B2.1** How do our bodies resist infection **B4.1** How do chemical reactions take place in living things	How scientists test their ideas – Antimicrobials; carrying out an investigation on the effectiveness of different concentrations of antimicrobials in preventing the growth of bacteria
LO2	**Collect scientific data** Collecting data including risk assessment			
LO3	**Analyse scientific information** Qualitative and quantitative analysis – relationships between variables inc anomalous data			
LO4	**Evaluate scientific information** Assess quality and validity of information, improving data collection, identify conflicting info and weaknesses			
LO5	**Communicate scientific information** Present information – inc explanations, arguments, diagrams, graphs, flow charts, pictures and tables			

CAMBRIDGE NATIONAL IN SCIENCE

Gateway Biology

Mapping Gateway Biology to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Gateway Biology	Theme comments
LO1	**Personal and social choices related to energy supply** Primary and secondary energy sources, renewable, non-renewable, economic, environmental impacts	Energy and the Sun [D] Alternative power	**B2b:** Energy flow **B6d:** Biofuels	Understand how energy from the Sun flows through ecosystems and how humans can harness it. Understand the need for renewable and alternative fuels
LO2	**Benefits and risks of nuclear applications** EM and nuclear, radiation – benefits and harms, natural nuclear emissions	Healthcare	**B5a:** Skeletons **B5b:** Circulatory systems and the cardiac cycle **5d:** respiratory systems **5e:** Digestion	When examining the body with such as X-Rays, Ct Scans body systems need to be understood so a diagnosis can be made
LO3	**Measure energy transfer and calculate efficiency** Voltage, current, resistance, power; energy, time; specific heat (mass, temp change); energy ip, op and efficiency	Energy and the Sun [D]	**B2b:** Energy flow	Understand how energy from the Sun flows through ecosystems and how humans can harness it

Mapping Gateway Biology to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Gateway Biology	Theme comments
LO4	**Improving human health** Environmental factors that affect health – diet, exercise, smoking, drugs. Assessing fitness and health. Micro-organisms that cause disease	Fitness and health [D]	**B1a:** Fitness and health	Explain and measure blood pressure. Recognise factors that increase risks of developing heart disease. Evaluate different ways of measuring fitness. Explain what a balanced diet should include.
			B1b: Human health and diet	
			B1c: Staying healthy **B1d:** The nervous system	Interpret diet, daily requirements and body mass index. Understand how lifestyle may affect resistance to diseases and might increase or reduce risk of cancers.
			B1e: Drugs and you	Understand how drugs can be beneficial or harmful (includes smoking and alcohol as part of lifestyle). Recognise that the body requires to maintain steady levels of water, temperature and CO_2.
			B1f: Staying in balance	
			B1h: Variation and inheritance	Analyse human characteristics, such as intelligence, body mass and height and determine if they are inherited or affected by environment.
			B3b: Proteins and mutations	Recall some examples of proteins including collagen, insulin and haemoglobin.
		Systems in the body [I]	**B3c:** Respiration	Understand the processes involved with respiration.
			B3e: The circulatory system	Explain the function and operation of the circulatory system.
			B5a: Skeletons	Understand the structure of the skeleton including bones and joints.
			B5b: Circulatory systems and the cardiac cycle **B5d:** Respiratory systems	Understand the circulatory system and the cardiac cycle. Understand the respiratory system, including conditions and diseases.
		Body repairs [D]	**B5h:** Growth and repair	Understand how the body grows and repairs itself, including the effect health, diet, exercise and disease.

Mapping Gateway Biology to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Gateway Biology	Theme comments
LO5	**Benefits and risks of medical treatment** Preventative and treatment; testing developments; drug trials; ethics	Drugs and body repairs [D]	**B1e:** Drugs and you	Understand how drugs can be beneficial or harmful (includes smoking and alcohol as part of lifestyle)
			B5c: Running repairs	Understand the types of repairs required to the circulatory system (e.g. to repair heart and blood conditions)
			B5h: Growth and repair	Understand how the body grows and repairs itself, including the effect health, diet, exercise and disease
		Micro-organisms and antibiotics [D]	**B6b:** Harmful micro-organisms	Recognise harmful micro-organisms such as bacteria can be controlled by antibiotics
		Gene therapy Stem cells	**B3b:** Proteins and mutations **B3g:** New genes for old **B3h:** Cloning **B6h:** Gene technology	Understand the use of gene therapy and stem cells in health treatment

Mapping Gateway Biology to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Gateway Biology	Theme comments
LO6	**Measure environmental effects of human activity** Ecosystems; effects that can be measured – air/water pollution, noise, land-use. Measure non-living indicators – pH, temp, chem. Testing, particulates	Classification [I]	**B2a:** Classification	Understand the classification of living organisms to understand their evolutions and ecological relationships
		Ecosystems and ecology [I]	**B2b:** Energy flow **B2d:** Interdependence **B2e:** Adaptations **B2f:** Natural selection **B4a:** Ecology in the local environment **B6f:** Microscopic life in water	Understand how energy from the Sun flows through ecosystems and how humans can harness it Understand how animals, plants and organisms co-exist and how they cope with competition and predation Recall how animals and plants adapt to their habitats to better compete for limited resources Understand evolution and the process of natural selection Appreciate the variety and diversity of organisms in the environment
		Recycling, pollution and sustainability [D]	**B2c:** Recycling **B5f:** Waste disposal **B2g:** Population and pollution **B2h:** Sustainability	Understand natural and man-made waste and how it is recycled Explain how an increasing population has led to an increased demand on natural resources and also an increase in pollution Understand why organisms become extinct and the reasons for conservation programmes. Explain the significance of population size, waste products, food and energy to achieving sustainable development
		Farming and the environment [D]	**B4h:** Farming **B4a:** Ecology in the local environment **B4b:** Photosynthesis **B4c:** Leaves and photosynthesis **B4d:** Diffusion and osmosis **B4e:** Transport in plants **B4f:** Plants need minerals **B4g:** Decay **B6e:** Life in the soil	Appreciate basic farming processes, including their effect on the environment
		Alternative energy [D]	**B6d:** Biofuels	Explain how alternative fuels such as biogas are produced from plants (biomass)

Mapping Gateway Biology to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Gateway Biology	Theme comments
LO7	**Materials from natural resources** Crude oil – new materials/plastics; cement/brick/glass/steel; metals and ores; ammonia; batch/continuous; sustainable and environmental impact Yields Polymerisation of alkenes, oxidation and reaction, chem symbols, reversible reactions, catalysts	Natural resources and demand [D]	**B2g:** Population and pollution	Explain how an increasing population has led to an increased demand on natural resources and also an increase in pollution
LO8	**Properties of materials: structure and bonding** Structure and bonding of materials; polymers; alloys inc steel; use and properties of materials			
LO9	**Measure properties of materials and recommend uses** Analysis - maths			

CAMBRIDGE NATIONAL IN SCIENCE

Gateway Biology

Mapping Gateway Biology to R072 – How scientific ideas have developed (LO2, 3 and 4 are in the context of LO1 Developments)

	Keywords	Theme	Gateway Biology	Theme comments
LO1	**Work of scientists: development of scientific ideas** How life on Earth has developed (inc DNA); evidence of evolution; How internal environment of human body is controlled; The history of the Earth and Universe (inc tectonics, climate change); Using waves to communicate	Systems in the body [D]	**B1d:** The nervous system **B1f:** Staying in balance	Understand the nervous system Recognise that the body requires to maintain steady levels of water, temperature and CO2 Recall that insulin controls blood sugar levels – including understanding diabetes.
			B3c: Respiration	Understand the processes involved with respiration.
			B3e: The circulatory system	Explain the function and operation of the circulatory system.
			B5a: Skeletons	Understand the structure of the skeleton including bones and joints.
			B5b: Circulatory systems and the cardiac cycle **B5d:** Respiratory systems	Understand the circulatory system and the cardiac cycle.
		Cells, variation, inheritance and DNA [D]		Understand the respiratory system, including conditions and diseases.
			B1h: Variation and inheritance	Analyse human characteristics, such as intelligence, body mass and height and determine if they are inherited or affected by environment.
			B3a: Molecules of life **B3d:** Cell division	Understand cells and their DNA. Understand the process of cell division.
		Genetics and cloning [D]	**B3g:** New genes for old	Understand genetic modification (GM), its risks and its benefits.
			B3h: Cloning **B6h:** Gene technology	Understand natural and man-made cloning. Understand the basic principles of genetic engineering (e.g. for plant and crop modification).
LO2	**The scientific method** Collecting and analysing data; hypothesis and experiments; equipment and limitation; scientific community – credibility and review			

Mapping Gateway Biology to R072 – How scientific ideas have developed (LO2, 3 and 4 are in the context of LO1 Developments)

	Keywords	Theme	Gateway Biology	Theme comments
LO3	**Evaluate scientific information** Variables, quality and validity, interpret evidence and make conclusions			
LO4	**Communicate scientific information** Scientific, technical and mathematical language. Good presentation skills			

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Gateway Biology

Mapping Gateway Biology to R073 – How scientists test their ideas

	Keywords	Theme	Gateway Biology	Theme comments
LO1	**Plan a scientific investigation** Controlling variables, using equipment and techniques, sources of information	Antimicrobials	**B6a:** Understanding microbes **B6b:** Harmful micro-organisms **B6c:** useful micro-organisms	Carry out assignment task
LO2	**Collect scientific data** Collecting data including risk assessment			
LO3	**Analyse scientific information** Qualitative and quantitative analysis – relationships between variables inc anomalous data			
LO4	**Evaluate scientific information** Assess quality and validity of information, improving data collection, identify conflicting info and weaknesses			
LO5	**Communicate scientific information** Present information – inc explanations, arguments, diagrams, graphs, flow charts, pictures and tables			

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21st Century Chemistry J244

R071 How scientific ideas have an impact on our lives

R072 How scientific ideas have developed

R073 How scientists test their ideas

Gateway Chemistry J264

R071 How scientific ideas have an impact on our lives

R072 How scientific ideas have developed

R073 How scientists test their ideas

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21st Century Chemistry

Mapping 21st Century Chemistry to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	21 Century Chemistry J244	Theme comments
LO1	**Personal and social choices related to energy supply** Primary and secondary energy sources, renewable, non-renewable, economic, environmental impacts	Generating energy and pollution [D]	**C1.1** Which chemicals make up air, and which ones are pollutants? How do I make sense of data about air pollution? **C1.2** What chemical reactions produce air pollutants? What happens to these pollutants in the atmosphere? **C1.3** What choices can we make personally, locally, nationally or globally to improve air quality? **C3.1** What are the origins of minerals in Britain that contribute to our economic wealth **C3.4** What can we do to make our use of chemicals safe and sustainable **C6.1** Chemicals and why we need them	Relate common pollutants found in air (e.g. carbon monoxide, oxides of nitrogen, sulphur dioxide) to the environmental problems it causes Understand how chemical reactions produce air pollutants (e.g. burning fossil fuels, using petrol, diesel and fuel oil) Understand how personal, local and national and global choices can improve air quality (e.g. use less electricity, remove pollution from industrial processes)
		Alternative energy sources [D]	**C7.2** Alcohols, carboxylic acids and esters	Understand sustainable applications (e.g. ethanol production from biomass)
LO2	**Benefits and risks of nuclear applications** EM and nuclear, radiation – benefits and harms, natural nuclear emissions	Generating energy and pollution [D]	**C1.1** Which chemicals make up air, and which ones are pollutants? How do I make sense of data about air pollution? **C1.2** What chemical reactions produce air pollutants? What happens to these pollutants in the atmosphere? **C1.3** What choices can we make personally, locally, nationally or globally to improve air quality?	Relate common pollutants found in air (e.g. carbon monoxide, oxides of nitrogen, sulphur dioxide) to the environmental problems it causes Understand how chemical reactions produce air pollutants (e.g. burning fossil fuels, using petrol, diesel and fuel oil) Understand how personal, local and national and global choices can improve air quality (e.g. use less electricity, remove pollution from industrial processes)
LO3	**Measure energy transfer and calculate efficiency** Voltage, current, resistance, power; energy, time; specific heat (mass, temp change); energy ip, op and efficiency	Energy [D]	**C7.3** Energy changes in chemistry	Understand exothermic and endothermic reactions

Mapping 21st Century Chemistry to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	21 Century Chemistry J244	Theme comments
LO4	**Improving human health** Environmental factors that affect health – diet, exercise, smoking, drugs. Assessing fitness and health. Micro-organisms that cause disease			
LO5	**Benefits and risks of medical treatment** Preventative and treatment; testing developments; drug trials; ethics	Healthcare	**C6.1** Chemicals and why we need them	The use of chemicals in healthcare
LO6	**Measure environmental effects of human activity** Ecosystems; effects that can be measured – air/water pollution, noise, land-use. Measure non-living indicators – pH, temp, chem. Testing, particulates	Generating energy and pollution [D]	**C1.1** Which chemicals make up air, and which ones are pollutants? How do I make sense of data about air pollution? **C1.2** What chemical reactions produce air pollutants? What happens to these pollutants in the atmosphere? **C1.3** What choices can we make personally, locally, nationally or globally to improve air quality?	Relate common pollutants found in air (e.g. carbon monoxide, oxides of nitrogen, sulphur dioxide) to the environmental problems it causes Understand how chemical reactions produce air pollutants (e.g. burning fossil fuels, using petrol, diesel and fuel oil) Understand how personal, local and national and global choices can improve air quality (e.g. use less electricity, remove pollution from industrial processes)
		The Earth's atmosphere, hydrosphere and lithosphere [D]	**C5.1** What types of chemicals make up the atmosphere? **C5.2** What reactions happen in the hydrosphere? **C5.3** What types of chemicals make up the Earth's lithosphere?	Understand the chemical composition of the atmosphere Recall that the Earth's hydrosphere (oceans, seas, lakes) consists mainly of water and dissolved compound such as salts Recall that the Earth's lithosphere (outer layer of Earth's crust) is made up a mixture of minerals
		Chemistry and experiments [I]	**C6.1** Chemicals and why we need them **C6.2** Planning, carrying out and controlling a chemical synthesis **C7.5** Analysis	Recall alkali's and acids including how they are tested for (e.g. pH value, litmus tests and universal indicators) Use periodic table, calculate relative mass of compound, determine percentage yield and explain rate of reaction Understand and perform qualitative and quantitative analysis used in chemistry including chromatography (i.e. Rf value) and titration

Mapping 21st Century Chemistry to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	21 Century Chemistry J244	Theme comments
LO7	**Materials from natural resources** Crude oil – new materials/plastics; cement/brick/glass/steel; metals and ores; ammonia; batch/continuous; sustainable and environmental impact Yields Polymerisation of alkenes, oxidation and reaction, chem symbols, reversible reactions, catalysts	Crude oil, polymers and nanotechnology [D]	**C2.2** Why is crude oil important as a source of new materials such as plastics and fibres? **C2.3** Why does it help to know about the molecular structure of materials such as plastics and fibres? **C2.4** What is nanotechnology and why is it important?	Understand the importance of crude oil in producing new materials such as plastics and fibres and that materials can also obtained or made from living things. Understand that it possible to manufacture different polymers with different properties suited to their application Understand that nanotechnology is used to modify properties of materials (e.g. for antibacterial products and in tennis rackets)
		Minerals, chemicals and the environment [D]	**C3.1** What were the origins of minerals in Britain that contribute to our economic wealth? **C3.2** Where does salt come from and why is it so important? **C3.3** Why do we need chemicals such as alkalis and chlorine and how do we make them? **C3.4** What can we do to make our use of chemicals safe and sustainable?	Understand the origins of minerals and their significance to society and economic wealth Understand the importance of salt and its production for the food industry and in other applications Understand the benefits and risks associated with chemicals including environmental impact and risks to the environment and human health Understand why we need chemicals such as alkali's, acids and chlorine Understand that pollution can sometimes be solved by turning wastes into useful chemicals
		Metals [D]	**C5.4** How can we extract useful metals from minerals?	Understand how useful minerals are extracted from the Earth (e.g. ores from rocks)
		Chemicals and why we need them [D]	**C6.1** Chemicals and why we need them **C6.2** Planning, carrying out and controlling a chemical synthesis	Understand the importance of chemical synthesis to provide food additives, fertilisers, paints, pigments and pharmaceuticals Identify the stages involved in chemical synthesis of an inorganic compound (e.g. choosing reaction, risk assessment, working with reactants, using apparatus, purifying product and measuring yield)
		Commercial production [D]	**C7.1** Green chemistry	Understand the processes involved with the bulk and small-scale production of chemicals Understand how chemical by-products and waste are handled
		Alcohols, acids and esters [D]	**C7.2** Alcohols, carboxylic acids and esters	Understand alcohols, carboxylic acid and ester production Understand sustainable applications (e.g. ethanol production from biomass)

Mapping 21st Century Chemistry to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	21 Century Chemistry J244	Theme comments
LO8	**Properties of materials: structure and bonding** Structure and bonding of materials; polymers; alloys inc steel; use and properties of materials	Material properties [D]	**C2.1** How do we measure the properties of materials and why are the results useful? **C2.3** Why does it help to know about the molecular structure of materials such as plastics and fibres?	Understand how to measure the properties of materials Understand that it possible to manufacture different polymers with different properties suited to their application
		Atomic structure and the periodic table [I]	**C4.1** What are the patterns in the properties of elements? **C4.2** How do chemists explain the patterns in the properties of elements? **C4.3** How do chemists explain the properties of compounds of Group 1 and Group 7 elements? **C6.2** Planning, carrying out and controlling a chemical synthesis	Understand and apply the periodic table. Understand and carry out tests on alkali metals (Group 1 elements) Understand halogens (Group 7 elements). Understand the structure of an atom, and relate this to elements in the periodic table Understand the properties of compounds in Group 1 and Group 7 (e.g. crystal structure, electrical conductivity) Identify the stages involved in chemical synthesis of an inorganic compound (e.g. choosing reaction, risk assessment, working with reactants, using apparatus, purifying product and measuring yield)
		Chemical analysis, energy and reactions [I]	**C7.5** Analysis **C7.3** Energy changes in chemistry **C7.4** Reversible reactions and equilibria	Understand and perform qualitative and quantitative analysis used in chemistry Understand exothermic and endothermic reactions Understand how industrial chemical processes rely on reversible reactions that can reach chemical equilibria
LO9	**Measure properties of materials and recommend uses** Analysis - maths	Material properties [D]	**C2.1** How do we measure the properties of materials and why are the results useful?	Understand how to measure the properties of materials
		Chemical analysis [D]	**C6.2** Planning, carrying out and controlling a chemical synthesis **C7.5** Analysis	Identify the stages involved in chemical synthesis of an inorganic compound (e.g. choosing reaction, risk assessment, working with reactants, using apparatus, purifying product and measuring yield) Understand and perform qualitative and quantitative analysis used in chemistry

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21st Century Chemistry

Mapping 21st Century Chemistry to R072 – How scientific ideas have developed (LO2, 3 and 4 are in the context of LO1 Developments)

	Keywords	Theme	21 Cent Chemistry J244	Theme comments
LO1	**Work of scientists: development of scientific ideas** How life on Earth has developed (inc DNA); evidence of evolution; How internal environment of human body is controlled; The history of the Earth and Universe (inc tectonics, climate change); Using waves to communicate	Atomic structure and the periodic table [D]

The Earth [D] | **C4.2** How do chemists explain the patterns in the properties of elements? **C4.3** How do chemists explain the properties of compounds of Group 1 and Group 7 elements?

C5.1 What types of chemicals make up the atmosphere? **C5.2** What reactions happen in the hydrosphere?

C5.3 What types of chemicals make up the Earth's lithosphere? | Understand the structure of an atom, and relate this to elements in the periodic table Understand the properties of compounds in Group 1 and Group 7 (e.g. crystal structure, electrical conductivity)

Understand the chemical composition of the atmosphere Recall that the Earth's hydrosphere (oceans, seas, lakes) consists mainly of water and dissolved compound such as salts Recall that the Earth's lithosphere (outer layer of Earth's crust) is made up a mixture of minerals |
LO2	**The scientific method** Collecting and analysing data; hypothesis and experiments; equipment and limitation; scientific community – credibility and review			
LO3	**Evaluate scientific information** Variables, quality and validity, interpret evidence and make conclusions			
LO4	**Communicate scientific information** Scientific, technical and mathematical language. Good presentation skills			

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21st Century Chemistry

Mapping 21st Century Chemistry to R073 – How scientists test their ideas

	Keywords	Theme	21 Cent Chemistry J244	Theme comments
LO1	**Plan a scientific investigation** Controlling variables, using equipment and techniques, sources of information			
LO2	**Collect scientific data** Collecting data including risk assessment			
LO3	**Analyse scientific information** Qualitative and quantitative analysis – relationships between variables inc anomalous data	Chemicals and the environment [I]	**C1.1** Which chemicals make up air, and which ones are pollutants? How do I make sense of data about air pollution?	Relate common pollutants found in air (e.g. carbon monoxide, oxides of nitrogen, sulphur dioxide) to the environmental problems it causes
		Atomic structure and the periodic table [I]	**C4.1** What are the patterns in the properties of elements? **C4.2** How do chemists explain the patterns in the properties of elements? **C4.3** How do chemists explain the properties of compounds of Group 1 and Group 7 elements?	Understand and apply the periodic table. Understand and carry out tests on alkali metals (Group 1 elements) Understand halogens (Group 7 elements). Understand the structure of an atom, and relate this to elements in the periodic table Understand the properties of compounds in Group 1 and Group 7 (e.g. crystal structure, electrical conductivity)
		Chemical reactions [I]	**C6.1** Chemicals and why we need them	Recall alkali's and acids including how they are tested for (e.g. pH Value, litmus tests and universal indicators) Interpret chemical symbol equations Understand chemical reactions (e.g. acid with an alkali to form a salt) Understand neutralisation reactions Understand exothermic and endothermic reactions. Identify the stages involved in chemical synthesis of an inorganic compound (e.g. choosing reaction, risk assessment, working with reactants, using apparatus, purifying product and measuring yield). Use periodic table, calculate relative mass of compound, determine percentage yield and explain rate of reaction
			C6.2 Planning, carrying out and controlling a chemical synthesis	
		Chemical analysis [D]	**C7.5** Analysis	Understand and perform qualitative and quantitative analysis used in chemistry including chromatography (i.e. Rf value) and titration

Mapping 21st Century Chemistry to R073 – How scientists test their ideas

	Keywords	Theme	21 Cent Chemistry J244	Theme comments
LO4	**Evaluate scientific information** Assess quality and validity of information, improving data collection, identify conflicting info and weaknesses	Chemicals and the environment [I]	**C1.1** Which chemicals make up air, and which ones are pollutants? How do I make sense of data about air pollution?	Relate common pollutants found in air (e.g. carbon monoxide, oxides of nitrogen, sulphur dioxide) to the environmental problems it causes
		Atomic structure and the periodic table [I]	**C4.1** What are the patterns in the properties of elements? **C4.2** How do chemists explain the patterns in the properties of elements? **C4.3** How do chemists explain the properties of compounds of Group 1 and Group 7 elements?	Understand and apply the periodic table. Understand and carry out tests on alkali metals (Group 1 elements) Understand halogens (Group 7 elements). Understand the structure of an atom, and relate this to elements in the periodic table. Understand the properties of compounds in Group 1 and Group 7 (e.g. crystal structure, electrical conductivity)
		Chemical reactions [I]	**C6.1** Chemicals and why we need them **C6.2** Planning, carrying out and controlling a chemical synthesis	Recall alkali's and acids including how they are tested for (e.g. pH Value, litmus tests and universal indicators) Interpret chemical symbol equations. Understand chemical reactions (e.g. acid with an alkali to form a salt) Understand neutralisation reactions Understand exothermic and endothermic reactions Identify the stages involved in chemical synthesis of an inorganic compound (e.g. choosing reaction, risk assessment, working with reactants, using apparatus, purifying product and measuring yield) Use periodic table, calculate relative mass of compound, determine percentage yield and explain rate of reaction
		Chemical analysis [D]	**C7.5** Analysis	Understand and perform qualitative and quantitative analysis used in chemistry including chromatography (i.e. Rf value) and titration

Mapping 21st Century Chemistry to R073 – How scientists test their ideas

	Keywords	Theme	21 Cent Chemistry J244	Theme comments
LO5	**Communicate scientific information** Present information – inc explanations, arguments, diagrams, graphs, flow charts, pictures and tables	Chemicals and the environment [I]	**C1.1** Which chemicals make up air, and which ones are pollutants? How do I make sense of data about air pollution?	Relate common pollutants found in air (e.g. carbon monoxide, oxides of nitrogen, sulphur dioxide) to the environmental problems it causes
		Atomic structure and the periodic table [I]	**C4.1** What are the patterns in the properties of elements? **C4.2** How do chemists explain the patterns in the properties of elements? **C4.3** How do chemists explain the properties of compounds of Group 1 and Group 7 elements?	Understand and apply the periodic table. Understand and carry out tests on alkali metals (Group 1 elements) Understand halogens (Group 7 elements). Understand the structure of an atom, and relate this to elements in the periodic table. Understand the properties of compounds in Group 1 and Group 7 (e.g. crystal structure, electrical conductivity)
		Chemical reactions [I]	**C6.1** Chemicals and why we need them **C6.2** Planning, carrying out and controlling a chemical synthesis	Recall alkali's and acids including how they are tested for (e.g. pH Value, litmus tests and universal indicators) Interpret chemical symbol equations. Understand chemical reactions (e.g. acid with an alkali to form a salt) Understand neutralisation reactions. Understand exothermic and endothermic reactions Identify the stages involved in chemical synthesis of an inorganic compound (e.g. choosing reaction, risk assessment, working with reactants, using apparatus, purifying product and measuring yield) Use periodic table, calculate relative mass of compound, determine percentage yield and explain rate of reaction
		Chemical analysis [D]	**C7.5** Analysis	Understand and perform qualitative and quantitative analysis used in chemistry including chromatography (i.e. Rf value) and titration

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Mapping Gateway Chemistry to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Gateway Chemistry J244	Theme comments
LO1	**Personal and social choices related to energy supply** Primary and secondary energy sources, renewable, non-renewable, economic, environmental impacts	Energy, fuels and pollution [D]	**C1a:** Making crude oil useful **C1b:** Using carbon fuels **C4a:** Atomic structure **C5a:** Moles and molar mass **C5b:** Percentage composition and empirical formula **C6:** Alcohols	Understand the production of energy using fuels and explain why increasing population and global development has lead to an increase in fossil fuels being burnt including effects such as pollution (e.g. acid rain, greenhouse effect) Relate common pollutants found in air (e.g. carbon monoxide, oxides of nitrogen, sulphur dioxide) to the environmental problems it causes.
		Alternative energy sources [D]	**C1c:** Clean air	Understand how hydrogen can be used in fuel cells including that it does not form a polluting waste product (unlike fossil fuels)
		The ozone layer [D]	**C6b:** Energy transfers – fuel cells **C6e:** Depletion of the ozone layer	Understand the environmental problem of the depletion of the ozone layer including how choloroflurocarbon (CFC) has contributed to this
LO2	**Benefits and risks of nuclear applications** EM and nuclear, radiation – benefits and harms, natural nuclear emissions	Energy, fuels and pollution [I]	**C1a:** Making crude oil useful **C1b:** Using carbon fuels **C6:** Alcohols	Explain why increasing population and global development has lead to an increase in fossil fuels being burnt including effects such as pollution (e.g. acid rain, greenhouse effect) Relate common pollutants found in air (e.g. carbon monoxide, oxides of nitrogen, sulphur dioxide) to the environmental problems it causes
		The ozone layer [I]	**C1c:** Clean air **C6e:** Depletion of the ozone layer	Understand the environmental problem of the depletion of the ozone layer including how choloroflurocarbon (CFC) has contributed to this
LO3	**Measure energy transfer and calculate efficiency** Voltage, current, resistance, power; energy, time; specific heat (mass, temp change); energy ip, op and efficiency	Energy [D]	**C7.3** Energy changes in chemistry	Understand exothermic and endothermic reactions

Mapping Gateway Chemistry to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Gateway Chemistry J244	Theme comments
LO4	**Improving human health** Environmental factors that affect health – diet, exercise, smoking, drugs. Assessing fitness and health. Micro-organisms that cause disease	Guideline daily amounts (GDA) [D] Health	**C5c:** Quantitative analysis **C1f:** Cooking and food additives	Understand everyday quantitative analysis (e.g. dilution of chemicals and substances, guideline daily amounts (GDA) on food packaging) Understand the affect of additives on diet and health
LO5	**Benefits and risks of medical treatment** Preventative and treatment; testing developments; drug trials; ethics			
LO6	**Measure environmental effects of human activity** Ecosystems; effects that can be measured – air/water pollution, noise, land-use. Measure non-living indicators – pH, temp, chem. Testing, particulates	Energy, fuels and pollution [D] Manufacturing and pollution [D] Water pollution [D] Measuring pH [D] Alternative energy [I] The ozone layer [I]	**C1c:** Clean air **C2d:** Making cars **C4h:** Purifying and testing water **C5d:** Titrations **C6b:** Energy transfers – fuel cells **C6e:** Depletion of the ozone layer	Relate common pollutants found in air (e.g. carbon monoxide, oxides of nitrogen, sulphur dioxide) to the environmental problems it causes Understand how the environment affects performance of materials (e.g. acid rain causes rusting) Understand the significance of pure water resources to the environment including the types of pollutants found in water and how they can be tested for Understand titration (e.g. how pH changes in the neutralisation of an alkali with an acid) using pH titration curves Understand how hydrogen can be used in fuel cells including that it does not form a polluting waste product (unlike fossil fuels) Understand the environmental problem of the depletion of the ozone layer including how choloroflurocarbon (CFC) has contributed to this

Mapping Gateway Chemistry to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Gateway Chemistry J244	Theme comments
LO7	**Materials from natural resources** Crude oil – new materials/plastics; cement/brick/glass/steel; metals and ores; ammonia; batch/continuous; sustainable and environmental impact Yields Polymerisation of alkenes, oxidation and reaction, chem symbols, reversible reactions, catalysts	Exploitation of natural resources [D]	**C1a:** Making crude oil useful **C1b:** Using carbon fuels	Describe the environmental problems with the exploitation of crude oil Understand the problems with the finite nature of natural resources such as crude oil. Explain why increasing population and global development has lead to an increase in fossil fuels being burnt including effects such as pollution (e.g. acid rain, greenhouse effect)
		Polymers [D]	**C1d:** Making polymers **C1e:** Designer polymers	Understand how polymers are mass produced (e.g. nylon) Understand the production and applications of designer polymers (e.g. GORE-TEX) Understand the environmental issues associated with polymers (e.g. they are not bio-degradable)
		Paints and pigments [D]	**C1h:** Paints and pigments	Understand how chemistry is used to manufacture paints and pigments.
		Materials, metals and alloys [D]	**C2b:** Construction materials **C2c:** Metals and alloys	Understand how raw materials such as sand, aggregate, clay and iron ores found in the Earth are used in construction Understand how metals are extracted from their ores and some of their applications
		Materials, then environment and sustainability [D]	**C2d:** Making cars	Understand how the environment affects performance of materials (e.g. acid rain causes rusting) Understand that natural resources are finite and the significance of good design and recycling
		Ammonia, fertilisers and salt [D]	**C2e:** Manufacturing chemicals: making ammonia **C2g:** Fertilisers and crop yields **C2h:** Chemicals from the sea: the chemistry of sodium chloride	Recall the process used to manufacture ammonia including its applications such as in fertilisers and nitric acid Understand industrial processes including rate, percentage yield and cost Explain how fertilisers are used to increase crop yield Understand the process involved of extracting salt from the sea, including its applications as a preservative and flavouring
		Commercial production [D]	**C3g:** Batch or continuous? **C3a:** Rate of reaction **C3d:** Reacting masses **C3e:** Percentage yield and atom economy **C3f:** energy	Understand commercial production methods used for chemicals including batch and mass production
		Nanochemistry [D}	**C3h:** Allotropes of carbon and nanochemistry	Understand the applications of carbon chemistry (e.g. in lubricants, drug delivery, semiconductors and pencils)
		Alcohols, fats and detergents [D]	**C6d:** Alcohols **C6g:** Natural fats and oils **C6h:** Detergents	Understand the manufacture and applications of alcohols/ethanol (e.g. alcoholic beverages, solvents, fuel for cars) Understand that natural fats and oils are an important raw material for the chemical industry Understand the chemistry of detergents and solvents

Mapping Gateway Chemistry to R071 – How scientific ideas have an impact on our lives

		Keywords	Theme	Gateway Chemistry J244	Theme comments
LO8		**Properties of materials: structure and bonding** Structure and bonding of materials; polymers; alloys inc steel; use and properties of materials	Polymers [D]	**C1d:** Making polymers **C1e:** Designer polymers	Understand how polymers are mass produced (e.g. nylon) Understand the production and applications of designer polymers (e.g. GORE-TEX) Understand the environmental issues associated with polymers (e.g. they are not bio-degradable)
			Metals, alloys and their properties [D]	**C2c:** Metals and alloys **C4g:** Metal structure and properties	Understand how metals are extracted from their ores and some of their applications Understand the structure, properties and typical application of metals
			Acids and bases [I]	**C2f:** Acids and bases	Understand acids and bases and how they can be tested for using pH value (e.g. litmus test)
			Chemical reactions [I]	**C3a:** Rate of reaction (1) **C3b:** Rate of reaction (2) **C3c:** Rate of reaction (3) **C3d:** Reacting masses **C3e:** Percentage yield and atom economy **C3f:** Energy	Understand the laboratory processes involved in measuring rate of reaction Understand and measure how temperature, pressure and concentration affect reaction rate Understand and measure how using a catalyst can affect the rate of reaction Understand and apply principles of atomic masses (e.g. using periodic table) Understand that percentage yield is a way of comparing actual amount of product made and the amount expected Understand endothermic and exothermic reactions
			Atomic structure and the periodic table [I]	**C4a:** Atomic structure **C4b:** Ionic bonding **C4c:** The Periodic Table and covalent bonding **C4d:** The Group 1 elements **C4e:** The Group 7 elements **C4f:** Transition elements **C4g:** Metal structure and properties	Understand atomic structure including the periodic table Understand ionic bonding including experiments on melting point and conductivity Understand the periodic table and the classification of elements Understand and carry out tests (e.g. flame test) on alkali metals Understand the physical properties and application of halogens. Recall and deduce whether an element is a transition element – including that transition elements are often coloured Understand the structure, properties and typical application of metals
			Moles, molar mass and chemical experiments [I]	**C5a:** Moles and molar mass **C5b:** Percentage composition and empirical formula **C5e:** Gas volumes **C5f:** Equilibria **C5g:** Strong and weak acids **C6a:** Electrolysis **C6c:** Redox reactions	Understand the relationship between mass, moles and molar mass of chemical substances Carry out practical experiments to determine how mass is converted in chemical reactions Understand apparatus and experiments to determine gas volume change during the course of a chemical reaction Understand how industrial chemical processes rely on reversible reactions that can reach chemical equilibria Understand strong and weak acids including how this is determined from measuring pH value Understand the process of electrolysis including its application in industrial processes Understand redox reactions
LO9		**Measure properties of materials and recommend uses** Analysis - maths			

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Mapping Gateway Chemistry to R072 – How scientific ideas have developed (LO2, 3 and 4 are in the context of LO1 Developments)

	Keywords	Theme	Gateway Chemistry J264	Theme comments
LO1	**Work of scientists: development of scientific ideas** How life on Earth has developed (inc DNA); evidence of evolution; How internal environment of human body is controlled; The history of the Earth and Universe (inc tectonics, climate change); Using waves to communicate	Structure of the Earth [D] The ozone layer [D]	**C2a:** The structure of the Earth **C6e:** Depletion of the ozone layer	Understand the structure of the Earth including tectonics and natural features that affect the environment such as volcanoes Understand the environmental problem of the depletion of the ozone layer including how choloroflurocarbon (CFC) has contributed to this
LO2	**The scientific method** Collecting and analysing data; hypothesis and experiments; equipment and limitation; scientific community – credibility and review			
LO3	**Evaluate scientific information** Variables, quality and validity, interpret evidence and make conclusions			
LO4	**Communicate scientific information** Scientific, technical and mathematical language. Good presentation skills.			

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Mapping Gateway Chemistry to R073 – How scientists test their ideas

	Keywords	Theme	Gateway Chemistry J264	Theme comments
LO1	**Plan a scientific investigation** Controlling variables, using equipment and techniques, sources of information	Electrolysis Burning fuels	**C6a:** Electrolysis **C1b:** Using carbon fuels **C4a:** Atomic structure **C4c:** The periodic table and covalent bonding	Carry out an assignment task Carry out an assignment task
LO2	**Collect scientific data** Collecting data including risk assessment			
LO3	**Analyse scientific information** Qualitative and quantitative analysis – relationships between variables inc anomalous data	Chemical reactions [I] Atomic structure and the periodic table [I] Quantitative analysis [I]	**C3a:** Rate of reaction (1) **C3b:** Rate of reaction (2) **C3c:** Rate of reaction (3) **C3d:** Reacting masses **C3e:** Percentage yield and atom economy **C3f:** Energy **C4a:** Atomic structure **C4b:** Ionic bonding **C4c:** The Periodic Table and covalent bonding **C4d:** The Group 1 elements **C4e:** The Group 7 elements **C4f:** Transition elements **C4g:** Metal structure and properties **C5c:** Quantitative analysis	Understand the laboratory processes involved in measuring rate of reaction Understand and measure how temperature, pressure and concentration affect reaction rate Understand and measure how using a catalyst can affect the rate of reaction Understand and apply principles of atomic masses (e.g. using periodic table) Understand that percentage yield is a way of comparing actual amount of product made and the amount expected. Understand endothermic and exothermic reactions Understand atomic structure including the periodic table Understand ionic bonding including experiments on melting point and conductivity Understand the periodic table and the classification of elements Understand and carry out tests (e.g. flame test) on alkali metals Understand the physical properties and application of halogens Recall and deduce whether an element is a transition element – including that transition elements are often coloured Understand the structure, properties and typical application of metals Understand everyday quantitative analysis (e.g. dilution of chemicals and substances, guideline daily amounts (GDA) on food packaging)

Mapping Gateway Chemistry to R073 – How scientists test their ideas

	Keywords	Theme	Gateway Chemistry J264	Theme comments
LO4	**Evaluate scientific information** Assess quality and validity of information, improving data collection, identify conflicting info and weaknesses	Chemical reactions [I]	**C3a:** Rate of reaction (1)	Understand the laboratory processes involved in measuring rate of reaction
			C3b: Rate of reaction (2)	Understand and measure how temperature, pressure and concentration affect reaction rate
			C3c: Rate of reaction (3)	Understand and measure how using a catalyst can affect the rate of reaction
			C3d: Reacting masses	Understand and apply principles of atomic masses (e.g. using periodic table)
			C3e: Percentage yield and atom economy	Understand that percentage yield is a way of comparing actual amount of product made and the amount expected
			C3f: Energy	Understand endothermic and exothermic reactions
		Atomic structure and the periodic table [I]	**C4a:** Atomic structure	Understand atomic structure including the periodic table
			C4b: Ionic bonding	Understand ionic bonding including experiments on melting point and conductivity
			C4c: The Periodic Table and covalent bonding	Understand the periodic table and the classification of elements
			C4d: The Group 1 elements	Understand and carry out tests (e.g. flame test) on alkali metals
			C4e: The Group 7 elements	Understand the physical properties and application of halogens
			C4f: Transition elements	Recall and deduce whether an element is a transition element – including that transition elements are often coloured
			C4g: Metal structure and properties	Understand the structure, properties and typical application of metals
		Quantitative analysis [I]	**C5c:** Quantitative analysis	Understand everyday quantitative analysis (e.g. dilution of chemicals and substances, guideline daily amounts (GDA) on food packaging)

Mapping Gateway Chemistry to R073 – How scientists test their ideas

		Keywords	Theme	Gateway Chemistry J264	Theme comments
LO5		**Communicate scientific information** Present information – inc explanations, arguments, diagrams, graphs, flow charts, pictures and tables	Chemical reactions [I]	**C3a:** Rate of reaction (1)	Understand the laboratory processes involved in measuring rate of reaction
				C3b: Rate of reaction (2)	Understand and measure how temperature, pressure and concentration affect reaction rate
				C3c: Rate of reaction (3)	Understand and measure how using a catalyst can affect the rate of reaction
				C3d: Reacting masses	Understand and apply principles of atomic masses (e.g. using periodic table)
				C3e: Percentage yield and atom economy	Understand that percentage yield is a way of comparing actual amount of product made and the amount expected
				C3f: Energy	Understand endothermic and exothermic reactions
			Atomic structure and the periodic table [I]	**C4a:** Atomic structure	Understand atomic structure including the periodic table
				C4b: Ionic bonding	Understand ionic bonding including experiments on melting point and conductivity
				C4c: The Periodic Table and covalent bonding	Understand the periodic table and the classification of elements
				C4d: The Group 1 elements	Understand and carry out tests (e.g. flame test) on alkali metals
				C4e: The Group 7 elements	Understand the physical properties and application of halogens
				C4f: Transition elements	Recall and deduce whether an element is a transition element – including that transition elements are often coloured
				C4g: Metal structure and properties	Understand the structure, properties and typical application of metals
			Quantitative analysis [I]	**C5c:** Quantitative analysis	Understand everyday quantitative analysis (e.g. dilution of chemicals and substances, guideline daily amounts (GDA) on food packaging)

CAMBRIDGE NATIONAL IN SCIENCE

21st Century Physics J245

R071 How scientific ideas have an impact on our lives

R072 How scientific ideas have developed

R073 How scientists test their ideas

Gateway Physics J265

R071 How scientific ideas have an impact on our lives

R072 How scientific ideas have developed

R073 How scientists test their ideas

CAMBRIDGE NATIONAL IN SCIENCE

21st Century Physics

Mapping 21st Century Physics to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	21st Century Physics J245	Theme comments
LO1	**Personal and social choices related to energy supply** Primary and secondary energy sources, renewable, non-renewable, economic, environmental impacts	Energy sources and generation [D]	**P3.1** How much energy do we use?	Understand that the demand for energy is increasing and the issues about the availability of energy sources Understand that power stations burn fossil fuels and produce carbon dioxide which contributes to global warming and climate change Suggest ways to reduce energy use in personal or national contexts
			P3.2 How can electricity be generated?	Understand alternative/renewable energy sources (e.g. hydroelectric, thermal, wind, wave and nuclear). Understand that nuclear power stations produce radioactive waste
			P3.3 Which energy sources should we choose?	Understand and discuss a range of energy sources (e.g. fossil fuels, nuclear, biofuel, solar, wind, water, geothermal) including their environmental impact
			P4.1 How can we describe motion? **P4.2** What are forces **P4. 3** What is the connection between forces and motion **P4.4** how can we describe motion in terms of energy changes **P5.1** Electric current – a flow of what? **P5.4** How is mains electricity produced? **P5.5** How are voltages and currents induced? **P5.6** How do electric motors work	Understand how energy can be converted mechanically such as wind converted to electrical energy by a wind turbine and then electricity transmitted and transformed for distribution
			P2.3 what is the evidence for global warming, why might be occurring, and how serious a threat is it.	Understand the need for renewable energies and the balance of the use of fossil fuels in the generation of electrical energy

Mapping 21st Century Physics to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	21st Century Physics J245	Theme comments
LO2	**Benefits and risks of nuclear applications** EM and nuclear, radiation – benefits and harms, natural nuclear emissions	Radioactivity – benefits and risks [D]	**P2.1** What types of electromagnetic radiation are there? What happens when radiation hits an object? **P2.2** Which types of electromagnetic radiation harm living tissue and why?	Understand different types of electromagnetic radiation (e.g. X-rays and ultraviolet radiation) Recall that barriers absorb ionising radiation (e.g. X-rays) and applications such as visualising bones
			P6.1 Why are some materials radioactive?	Understand why some natural materials are radioactive
			P6.2 How can radioactive materials be used and handled safely, including wastes?	Understand that radioactive materials require safe handling, and that nuclear power stations produce radioactive waste
		Energy sources and generation [D]	**P3.2** How can electricity be generated?	Understand alternative/renewable energy sources (e.g. hydroelectric, thermal, wind, wave and nuclear) Understand that nuclear power stations produce radioactive waste
			P3.3 Which energy sources should we choose?	Understand and discuss a range of energy sources (e.g. fossil fuels, nuclear, biofuel, solar, wind, water, geothermal) including their environmental impact
LO3	**Measure energy transfer and calculate efficiency** Voltage, current, resistance, power; energy, time; specific heat (mass, temp change); energy ip, op and efficiency	Energy and motion [D]	**P4.1** How can we describe motion? **P4.2** What are forces **P4.3** What is the connection between forces and motion **P4.4** How can we describe motion in terms of energy changes?	Understand the relationship between energy and motion Understand how energy can be converted mechanically such as wind converted to electrical energy by a wind turbine
		Electrical energy and power [D]	**P5.1** Electric current – a flow of what? **P5.2** What determines the size of the current in an electric circuit and the energy it transfers? **P5.3** How do parallel and series circuits work? **P5.4** How is mains electricity produced? How are voltages and currents induced? **P5.5** How do electric motors work?	Understand electrical energy and power in circuits (including voltage, resistance, current and power)

Mapping 21st Century Physics to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	21st Century Physics J245	Theme comments
LO4	**Improving human health** Environmental factors that affect health – diet, exercise, smoking, drugs. Assessing fitness and health. Micro-organisms that cause disease.	Health programme	**P4.1** How can we describe motion? **P4.2** What are forces **P4. 3** What is the connection between forces and motion	Understand how exercise can be beneficial and how it can be used in a health education programme
LO5	**Benefits and risks of medical treatment** Preventative and treatment; testing developments; drug trials; ethics	Radiation, diagnosis and treatment [D]	**P2.1** What types of electromagnetic radiation are there? What happens when radiation hits an object? **P2.2** Which types of electromagnetic radiation harm living tissue and why?	Understand different types of electromagnetic radiation (e.g. X-rays and ultraviolet radiation) Recall that barriers absorb ionising radiation (e.g. X-rays) and applications such as visualising bones
LO6	**Measure environmental effects of human activity** Ecosystems; effects that can be measured – air/water pollution, noise, land-use. Measure non-living indicators – pH, temp, chem. Testing, particulates.	Global warming [D]	**P2.3** What is the evidence for global warming, why might it be occurring, and how serious a threat is it?	Understand the evidence relating to global warming and how serious a threat this is to the Earth Recall that a rise in atmospheric carbon dioxide is as a result of burning fossil fuels and cutting down forests
		Alternative energy [D]	**P3.1** How much energy do we use?	Understand that the demand for energy is increasing and the issues about the availability of energy sources. Understand that power stations burn fossil fuels and produce carbon dioxide which contributes to global warming and climate change Suggest ways to reduce energy use in personal or national contexts
			P3.2 How can electricity be generated?	Understand alternative/renewable energy sources (e.g. hydroelectric, thermal, wind, wave and nuclear) Understand that nuclear power stations produce radioactive waste
			P3.3 Which energy sources should we choose?	Understand and discuss a range of energy sources (e.g. fossil fuels, nuclear, biofuel, solar, wind, water, geothermal) including their environmental impact
		Radioactivity and waste [D]	**P6.2** How can radioactive materials be used and handled safely, including wastes?	Understand that radioactive materials require safe handling, and that nuclear power stations produce radioactive waste

Mapping 21st Century Physics to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	21st Century Physics J245	Theme comments
LO7	**Materials from natural resources** Crude oil – new materials/plastics; cement/brick/ glass/steel; metals and ores; ammonia; batch/ continuous; sustainable and environmental impact Yields Polymerisation of alkenes, oxidation and reaction, chem symbols, reversible reactions, catalysts			
LO8	**Properties of materials: structure and bonding** Structure and bonding of materials; polymers; alloys inc steel; use and properties of materials	Properties of materials	**P4.2** What are forces **P5.1** Electric current – a flow of what?	Understand the physical properties that a material has
LO9	**Measure properties of materials and recommend uses** Analysis - maths	Testing materials for their properties	**P4.2** What are forces **P5.1** Electric current – a flow of what? **P5.2** What determines the size of the current in an electric circuit and the energy it transfers?	Understand how materials can be tested for their physical properties such as strength, stiffness and electrical conductivity

CAMBRIDGE NATIONAL IN SCIENCE

21st Century Physics

Mapping 21st Century Physics to R072 – How scientific ideas have developed (LO2, 3 and 4 are in the context of LO1 Developments)

	Keywords	Theme	21st Century Physics J245	Theme comments
LO1	**Work of scientists: development of scientific ideas** How life on Earth has developed (inc DNA); evidence of evolution; How internal environment of human body is controlled; The history of the Earth and Universe (inc tectonics, climate change); Using waves to communicate	The Earth and the Universe [D]	**P1.1** What do we know about the place of the Earth in the Universe? **P1.2** What do we know about the Earth and how it is changing? **P7.1** Naked eye astronomy **P7.2** Light, telescopes and images **P7.3** Mapping the Universe **P7.4** The Sun, the stars and their surroundings **P7.5** The astronomy community	Explain how the 'Big Bang' theory relates to how the Universe (including Earth) was formed Understand how the Earth is changing (e.g. continental erosion by the sea) and natural phenomena such as earthquakes Understand basic tectonics and their relationship to earthquakes, volcanoes and mountain building Astronomy and understanding the Universe in which we live
		Communicating using waves [D]	**P2.4** How are electromagnetic waves used in communications?	Understand how electromagnetic waves are used in communication
LO2	**The scientific method** Collecting and analysing data; hypothesis and experiments; equipment and limitation; scientific community – credibility and review			
LO3	**Evaluate scientific information** Variables, quality and validity, interpret evidence and make conclusions			
LO4	**Communicate scientific information** Scientific, technical and mathematical language. Good presentation skills			

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21st Century Physics

Mapping 21st Century Physics to R073 – How scientists test their ideas

	Keywords	Theme	21st Century Physics J245	Theme comments
LO1	**Plan a scientific investigation** Controlling variables, using equipment and techniques, sources of information			
LO2	**Collect scientific data** Collecting data including risk assessment			
LO3	**Analyse scientific information** Qualitative and quantitative analysis – relationships between variables inc anomalous data			
LO4	**Evaluate scientific information** Assess quality and validity of information, improving data collection, identify conflicting info and weaknesses			
LO5	**Communicate scientific information** Present information – inc explanations, arguments, diagrams, graphs, flow charts, pictures and tables			

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Gateway Physics

Mapping Gateway Physics to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Gateway Physics J265	Theme comments
LO1	**Personal and social choices related to energy supply** Primary and secondary energy sources, renewable, non-renewable, economic, environmental impacts	Heat and Energy [D] Energy sources and generation [D]	**P1a:** Heating houses **P1b:** Keeping homes warm **P2a:** Collecting energy from the Sun **P2b:** Generating electricity **P2e:** Nuclear radiations **P4h:** Fission and fusion **P2d:** Fuels for power **P2c:** Global warming	Understand heat and energy, and how it is calculated Understand convection, conduction and radiation of energy Describe how renewable energy from the sun can be harnessed Understand how power stations are used to generate electricity, including environmental implications Understand sources of fuel for generating power, and the economic and environmental issues associated with them (e.g. fossil fuels, biomass and nuclear fuels)
LO2	**Benefits and risks of nuclear applications** EM and nuclear, radiation – benefits and harms, natural nuclear emissions	Nuclear radiation [D] Radioactivity – benefits and risks [D]	**P2e:** Nuclear radiations **P4e:** What is radioactivity? **P4f:** Uses of radioisotopes **P4g:** Treatment **P4h:** Fission and fusion **P2b:** Generating electricity **P2c:** Global warming **P2d:** Fuels for power	Understand the environmental issues and benefits associated with nuclear radiation as a source of energy (e.g. harmful radiation, disposal of waste, not causing global warming) Understand the dangers associated with radioactive waste. Understand how radioisotopes can be used in dating the age of materials (e.g. rocks). Understand how radiation (e.g. X-Rays) can be used in analysis and treatment. Understand how nuclear fission and fusion can be used to generate electricity including environmental considerations. Understand how nuclear fission and fusion can pose a threat to our environment (e.g. the nuclear bomb). Understand the use of nuclear energy in the power industry

Mapping Gateway Physics to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Gateway Physics J265	Theme comments
LO3	**Measure energy transfer and calculate efficiency** Voltage, current, resistance, power; energy, time; specific heat (mass, temp change); energy ip, op and efficiency	Heat and Energy [D]	**P1a:** Heating houses **P1b:** Keeping homes warm	Understand heat and energy, and how it is calculated Understand convection, conduction and radiation of energy
		Energy from the Sun [D]	**P2a:** Collecting energy from the Sun	Describe how renewable energy from the sun can be harnessed
		Work, energy and power [D]	**P3d:** Work and power	Understand the relationship between work and power
			P3e: Energy on the move	Understand how sources of energy can be converted into propulsion (e.g. fossil fuels used to produce petrol and diesel for a motor vehicle)
			P3f: Crumple zones [I] **P3g:** Falling safely [I] **P3a:** Speed **P3b:** Changing speed **P3h:** The energy of games and theme rides	Understand how crumple zones absorb energy Understand the energy associated with falling Understand the energy associated with theme rides
		Electrical energy and power [D]	**P4c:** Safe electrical **P6a:** Resisting **P6b:** Sharing **P6e:** Motoring **P6f:** Generating **P6g:** Transforming **P6h:** Charging	Understand electrical energy and power in circuits (including voltage, resistance, current and power)
LO4	**Improving human health** Environmental factors that affect health – diet, exercise, smoking, drugs. Assessing fitness and health. Micro-organisms that cause disease	Exercise programme	**P3a:** Speed **P3b:** Changing speed **P3d:** Work and power **P3e:** energy on the move	Understand the physical properties of exercise drills on the body
LO5	**Benefits and risks of medical treatment** Preventative and treatment; testing developments; drug trials; ethics	Ultrasound and X-Rays [D]	**P4d:** Ultrasound **P4g:** Treatment **P4e:** what is radioactivity **P4f:** Use of radioisotopes	Understand how ultrasound can be used for diagnostic purposes Understand how radiation (e.g. X-Rays, radiation therapy, radioisotopes),can be used in analysis and treatment
		Electrostatics – defibrillators [I]	**P4a:** Sparks **P4b:** Uses of electrostatics	Understand how static electricity can be used for restarting the heart using a defibrillator

Mapping Gateway Physics to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	Gateway Physics J265	Theme comments
LO6	**Measure environmental effects of human activity** Ecosystems; effects that can be measured – air/water pollution, noise, land-use. Measure non-living indicators – pH, temp, chem. Testing, particulates	Stable Earth [D]	**P1h:** Stable Earth **P2c:** Global warming **P2d:** Fuels for power	Understand the relationship between environmental pollution (CFCs), the ozone layer and exposure to ultraviolet radiation Recall examples of greenhouse gases, reasons for climate change and the difficulties associated with understanding global warming
		Electrostatics - precipitators [I]	**P4a:** Sparks **P4b:** Uses of electrostatics	Understand how electrostatic precipitators can be used to remove smoke particles from chimneys
LO7	**Materials from natural resources** Crude oil – new materials/plastics; cement/brick/glass/steel; metals and ores; ammonia; batch/continuous; sustainable and environmental impact Yields Polymerisation of alkenes, oxidation and reaction, chem symbols, reversible reactions, catalysts	Environmental impact of the use of materials [D]	**P1a:** Heating houses **P1b:** Keeping houses warm **P2d:** Fuels for power **P3e:** Energy on the move	Understand the effect of production of material in the construction industry including transportation of materials as well of the range of materials used and the reason for their use
LO8	**Properties of materials: structure and bonding** Structure and bonding of materials; polymers; alloys inc steel; use and properties of materials	The use of materials in a complex product [I]	**P2f:** Crumple zones **P6e:** Motoring **P6f:** Generating **P6g:** Transforming **P6h:** Charging	Understand the properties of materials and why they are used in producing a complex product (such as an electric car)
LO9	**Measure properties of materials and recommend uses** Analysis - maths	Testing the properties of materials [D]	**P6a:** Resisting **P6b:** Sharing	Understand the measurement of physical properties of materials

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Gateway Physics

Mapping Gateway Physics to R072 – How scientific ideas have developed (LO2, 3 and 4 are in the context of LO1 Developments)

	Keywords	Theme	Gateway Physics J265	Theme comments
LO1	**Work of scientists: development of scientific ideas** How life on Earth has developed (inc DNA); evidence of evolution; How internal environment of human body is controlled; The history of the Earth and Universe (inc tectonics, climate change); Using waves to communicate	Communicating using waves [D]	**P1c:** A spectrum of waves **P1d:** Light and lasers **P5f:** Nature of waves **P5g:** Refraction of waves **P5h:** Optics **P1e:** Cooking and communicating using waves **P1f:** Data transmission **P1g:** Wireless signals **P5f:** Nature of waves **P5a:** Satellites, gravity and circular motion **P5e:** Satellite communication	Understand waves and wavelength. Understand how light and lasers can be used in recording and imaging. Understand how emission and absorption of infrared radiation is affected by properties of the surface of an object (e.g. surface temperature). Understand how waves can be used in data transmission. Understand how satellites can be used in communication.
		The Solar System [D]	**P2f:** Exploring our Solar System **P2g:** Threats to Earth **P2h:** The Big Bang	Evaluate the reasons why we would want to explore our solar system. Understand threats to the earth such as asteroid collision, and strategies for avoiding such catastrophes. Explain how the 'Big Bang' theory relates to how the Universe (including Earth) was formed
LO2	**The scientific method** Collecting and analysing data; hypothesis and experiments; equipment and limitation; scientific community – credibility and review			
LO3	**Evaluate scientific information** Variables, quality and validity, interpret evidence and make conclusions			
LO4	**Communicate scientific information** Scientific, technical and mathematical language. Good presentation skills			

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Gateway Physics

Mapping Gateway Physics to R073 – How scientists test their ideas

	Keywords	Theme	Gateway Physics J265	Theme comments
LO1	**Plan a scientific investigation** Controlling variables, using equipment and techniques, sources of information			
LO2	**Collect scientific data** Collecting data including risk assessment			
LO3	**Analyse scientific information** Qualitative and quantitative analysis – relationships between variables inc anomalous data	Heat and Energy [I] Electron movement [I]	**P1a:** Heating houses **P1b:** Keeping homes warm **P4a:** Sparks	Understand heat and energy, and how it is calculated Understand convection, conduction and radiation of energy Describe static electricity in terms of movement of electrons
LO4	**Evaluate scientific information** Assess quality and validity of information, improving data collection, identify conflicting info and weaknesses	Heat and Energy [I] Electron movement [I]	**P1a:** Heating houses **P1b:** Keeping homes warm **P4a:** Sparks	Understand heat and energy, and how it is calculated Understand convection, conduction and radiation of energy Describe static electricity in terms of movement of electrons
LO5	**Communicate scientific information** Present information – inc explanations, arguments, diagrams, graphs, flow charts, pictures and tables			

CAMBRIDGE NATIONAL IN SCIENCE

Cambridge National in ICT J800

R071 How scientific ideas have an impact on our lives

R072 How scientific ideas have developed

R073 How scientists test their ideas

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ICT to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	ICT	Theme comments
LO1	**Personal and social choices related to energy supply** Primary and secondary energy sources, renewable, non-renewable, economic, environmental impacts	Use ICT to research energy supply choices	**R001 (M)** **LO 1:** Understand how ICT can be used to meet business needs **R002 (M)** **LO 1:** Be able to use techniques to search for, store and share information	Use ICT to search for and research energy supply choices
LO2	**Benefits and risks of nuclear applications** EM and nuclear, radiation – benefits and harms, natural nuclear emissions	Use ICT to research benefits and risks of nuclear applications	**R001 (M)** **LO 1:** Understand how ICT can be used to meet business needs **R002 (M)** **LO 1:** Be able to use techniques to search for, store and share information	Use ICT to search for and research the benefits and risks of nuclear applications
LO3	**Measure energy transfer and calculate efficiency** Voltage, current, resistance, power; energy, time; specific heat (mass, temp change); energy ip, op and efficiency	Use ICT to perform energy calculations	**R002 (M)** **LO 2:** Be able to select and use software to handle data **R003 (B)** **LO 1:** Be able to create and populate spreadsheets to meet user requirements **LO 2:** Be able to select and use spreadsheet functions to meet user requirements **LO 3:** Be able to use spreadsheet models to present information to support decision making	Use ICT to record, analyse and present energy data

ICT to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	ICT	Theme comments
LO4	**Improving human health** Environmental factors that affect health – diet, exercise, smoking, drugs. Assessing fitness and health. Micro-organisms that cause disease	Use ICT to record and present a person's fitness data	**R002 (M)** **LO 2:** Be able to select and use software to handle data **R003 (B)** **LO 1:** Be able to create and populate spreadsheets to meet user requirements **LO 2:** Be able to select and use spreadsheet functions to meet user requirements **LO 3:** Be able to use spreadsheet models to present information to support decision making	Use ICT to record, analyse and present a person's fitness data (e.g. using a spreadsheet to record heart rate, VO2, speed and flexibility test data, lung capacity etc.)
LO5	**Benefits and risks of medical treatment** Preventative and treatment; testing developments; drug trials; ethics	Use ICT to research benefits and risks of medical treatment	**R001 (M)** **LO 1:** Understand how ICT can be used to meet business needs **R002 (M)** **LO 1:** Be able to use techniques to search for, store and share information	Use ICT to search for and research the benefits and risks of medical treatment
LO6	Measure environmental effects of human activity Ecosystems; effects that can be measured – air/water pollution, noise, land-use. Measure non-living indicators – pH, temp, chem. Testing, particulates	Use ICT to record and present environmental data	**R002 (M)** **LO 2:** Be able to select and use software to handle data **R003 (B)** **LO 1:** Be able to create and populate spreadsheets to meet user requirements **LO 2:** Be able to select and use spreadsheet functions to meet user requirements **LO 3:** Be able to use spreadsheet models to present information to support decision making	Use ICT to monitor, record and present pollution data (e.g. using data loggers and spreadsheets to record particulates, CO, CO2, NOx etc.)
LO7	Materials from natural resources Crude oil – new materials/plastics; cement/brick/glass/steel; metals and ores; ammonia; batch/continuous; sustainable and environmental impact Yields Polymerisation of alkenes, oxidation and reaction, chem symbols, reversible reactions, catalysts	Use ICT to research materials from natural resources.	**R001 (M)** **LO 1:** Understand how ICT can be used to meet business needs **R002 (M)** **LO 1:** Be able to use techniques to search for, store and share information	Use ICT to search for and research materials from natural resources

ICT to R071 – How scientific ideas have an impact on our lives

	Keywords	Theme	ICT	Theme comments
LO8	Properties of materials: structure and bonding Structure and bonding of materials; polymers; alloys inc steel; use and properties of materials	Use ICT to research the properties of materials	**R001 (M)** **LO 1:** Understand how ICT can be used to meet business needs **R002 (M)** **LO 1:** Be able to use techniques to search for, store and share information	Use ICT to search for and research the properties of materials
LO9	Measure properties of materials and recommend uses Analysis - maths	Use ICT to record, analyse and present materials property data	**R002 (M)** **LO 2:** Be able to select and use software to handle data **R003 (B)** **LO 1:** Be able to create and populate spreadsheets to meet user requirements **LO 2:** Be able to select and use spreadsheet functions to meet user requirements **LO 3:** Be able to use spreadsheet models to present information to support decision making	Use ICT to monitor, record and present materials property data

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ICT to R072 – How scientific ideas have developed (LO2, 3 and 4 are in the context of LO1 Developments)

	Keywords	Theme	ICT	Theme comments
LO1	**Work of scientists: development of scientific ideas** How life on Earth has developed (inc DNA); evidence of evolution; How internal environment of human body is controlled; The history of the Earth and Universe (inc tectonics, climate change); Using waves to communicate	Use ICT to research the work of scientists	**R001 (M) LO 1:** Understand how ICT can be used to meet business needs **R002 (M) LO 1:** Be able to use techniques to search for, store and share information	Use ICT to search for and research the work of scientists
LO2	**The scientific method** Collecting and analysing data; hypothesis and experiments; equipment and limitation; scientific community – credibility and review	Collect scientific data using internet searching. Collect and analyse scientific data using spreadsheets.	**R001 (M) LO 1:** Understand how ICT can be used to meet business needs **R002 (M) LO 1:** Be able to use techniques to search for, store and share information **R002 (M) LO 2:** Be able to select and use software to handle data **R003 (B) LO 1:** Be able to create and populate spreadsheets to meet user requirements **LO 2:** Be able to select and use spreadsheet functions to meet user requirements **LO 3:** Be able to use spreadsheet models to present information to support decision making	Use ICT to search for and present information about scientific data Use ICT to collect and analyse scientific data (e.g. using spreadsheets)

ICT to R072 – How scientific ideas have developed (LO2, 3 and 4 are in the context of LO1 Developments)

	Keywords	Theme	ICT	Theme comments
LO3	**Evaluate scientific information** Variables, quality and validity, interpret evidence and make conclusions	Evaluate scientific data using internet searching	**R002 (M)** **LO 2:** Be able to select and use software to handle data **R002 (M)** **LO 1:** Be able to use techniques to search for, store and share information	Use ICT to search for and present information about scientific data
		Evaluate scientific data using spreadsheets	**R002 (M)** **LO 2:** Be able to select and use software to handle data **R003 (B)** **LO 1:** Be able to create and populate spreadsheets to meet user requirements **LO 2:** Be able to select and use spreadsheet functions to meet user requirements **LO 3:** Be able to use spreadsheet models to present information to support decision making	Use ICT to evaluate scientific data (e.g. using spreadsheets)
LO4	Communicate scientific information Scientific, technical and mathematical language. Good presentation skills.	Use ICT to communicate scientific data.	**R002 (M)** **LO 3:** Be able to select and use software to communicate information for a business purpose **LO 4:** Be able to use software tools to format information	Use ICT to communicate scientific information
		Use advanced ICT methods to present scientific data.	**R007 (C)** **LO 1:** Be able to prepare for the production of dynamic products **LO 2:** Be able to create dynamic products **LO 3:** Be able to test functionality of dynamic products	Use advanced ICT presentation techniques to communicate scientific information

CAMBRIDGE NATIONAL IN SCIENCE

ICT to R073 – How scientists test their ideas

	Keywords	Theme	ICT	Theme comments
LO1	**Plan a scientific investigation** Controlling variables, using equipment and techniques, sources of information			
LO2	**Collect scientific data** Collecting data including risk assessment	Collect scientific data using internet searching	**R001 (M)** **LO 1:** Understand how ICT can be used to meet business needs **R002 (M)** **LO 1:** Be able to use techniques to search for, store and share information	Use ICT to search for and present information about scientific data
LO3	**Analyse scientific information** Qualitative and quantitative analysis – relationships between variables inc anomalous data	Perform scientific calculations using spreadsheets.	**R002 (M)** **LO 2:** Be able to select and use software to handle data **R003 (B)** **LO 1:** Be able to create and populate spreadsheets to meet user requirements **LO 2:** Be able to select and use spreadsheet functions to meet user requirements **LO 3:** Be able to use spreadsheet models to present information to support decision making	Use ICT to perform scientific calculations and represent data (e.g. using spreadsheets)

CAMBRIDGE NATIONAL IN SCIENCE

ICT to R073 – How scientists test their ideas

	Keywords	Theme	ICT	Theme comments
LO4	**Evaluate scientific information** Assess quality and validity of information, improving data collection, identify conflicting info and weaknesses	Evaluate scientific data using internet searching	**R001 (M)** **LO 1:** Understand how ICT can be used to meet business needs **R002 (M)** **LO 1:** Be able to use techniques to search for, store and share information	Use ICT to search for and present information about scientific data
		Evaluate scientific data using spreadsheets	**R002 (M)** **LO 2:** Be able to select and use software to handle data **R003 (B)** **LO 1:** Be able to create and populate spreadsheets to meet user requirements **LO 2:** Be able to select and use spreadsheet functions to meet user requirements **LO 3:** Be able to use spreadsheet models to present information to support decision making	Use ICT to evaluate scientific data (e.g. using spreadsheets)
LO5	**Communicate scientific information** Present information – inc explanations, arguments, diagrams, graphs, flow charts, pictures and tables	Use ICT to communicate scientific data	**R002 (M)** **LO 3:** Be able to select and use software to communicate information for a business purpose **LO 4:** Be able to use software tools to format information	Use ICT to communicate scientific data
		Use advanced ICT methods to present scientific data	**R007 (C)** **LO 1:** Be able to prepare for the production of dynamic products **LO 2:** Be able to create dynamic products **LO 3:** Be able to test functionality of dynamic products	Use advanced ICT presentation techniques to communicate scientific data

Contact us

Staff at the OCR Customer Contact Centre are available to take your call between 8am and 5.30pm, Monday to Friday.

We're always delighted to answer questions and give advice.

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