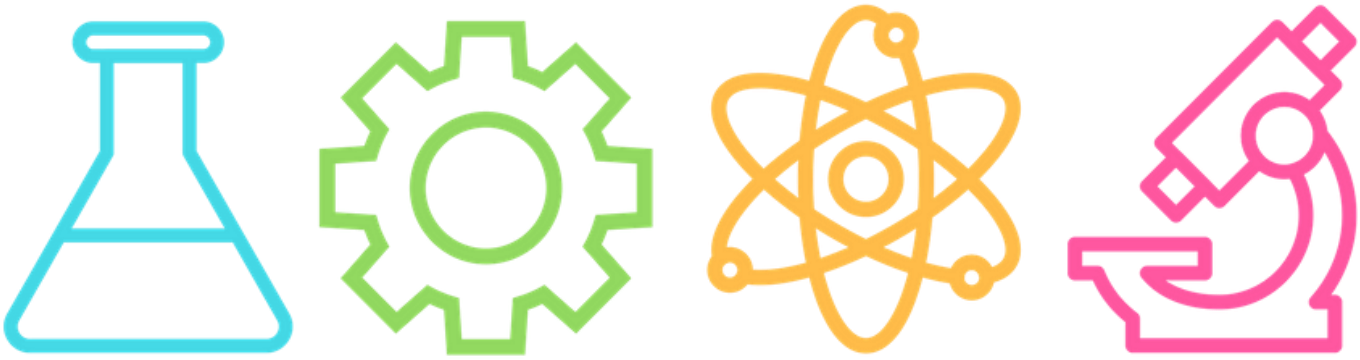
GCSE Combined Science: Trilogy



Core Practicals Log Book

Name:

Class:

Teachers:

Target:

Students are required to carry out all core practicals and make a contemporaneous record of work undertaken.

The following codes are used in this document

- **AT** – use of apparatus and techniques
- **WS**- working scientifically skills
- **MS**– mathematical skills.

You will be required to use certain techniques and apparatus and demonstrate working scientifically and mathematics skills as described in each of the core practicals below. Questions about these practicals, their procedures, techniques and skills will be included in your final GCSE exams. GCSE exam papers will contain a number of different types of question which will assess your practical skills and your understanding of practical techniques.

1. Questions that require a knowledge and understanding of a specific required practical activity procedure.

2. Questions that require a knowledge and understanding of apparatus and techniques from the list, but do not relate to a specific required practical activity.

3. Questions set in a practical context where students require an understanding of the science rather than direct experience of the practical activity**.**

Once a core practical has been completed you need to add the date of completion to this log.

Required practical activity - Microscopes

Use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included.

	Date completed
Apparatus and techniques AT 1 – use appropriate apparatus to record length and area. AT 7 – use a microscope to make observations of biological specimens and produce labelled scientific drawings.	
Key opportunities for skills development MS 1d, 3a – use estimations to judge the relative size or area of sub-cellular structures.	

Required practical activity - Osmosis

Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.

	Date completed
Apparatus and techniques AT 1 – use appropriate apparatus to record mass and time.	

AT 3 – use appropriate apparatus and techniques to observe and measure the process of osmosis. AT 5 – measure the rate of osmosis by water uptake.	
Key opportunities for skills development WS 2.1 – use the theory of osmosis to create hypotheses on plant tissue. WS 2.2 – plan experiments to test hypotheses. WS 2.4 – have due regard for accuracy of measurements and health and safety. WS 2.6 – make and record observations and measurements of mass. WS 2.7 – evaluate the method and suggest possible improvements and further investigations. WS 3.1 – present observations and other data in graphical form. WS 3.2 – translate mass data into graphical form. MS 1a, 1c – use simple compound measures of rate of water uptake. MS 1c – use percentages and calculate percentage gain and loss of mass of plant tissue. MS 2b – find mean mass of plant tissue. MS 4a, 4b, 4c, 4d – plot, draw and interpret appropriate graphs.	

Required practical activity – food tests

Use qualitative reagents to test for a range of carbohydrates, lipids and proteins.

To include: Benedict's test for sugars; iodine test for starch; and Biuret reagent for protein.

	Date completed
Apparatus and techniques AT 2 – safe use of a Bunsen burner and a boiling water bath. AT 8 – use of qualitative reagents to identify biological molecules	
Key opportunities for skills development WS 2.4 – carry out experiments appropriately having due regard for the correct manipulation of apparatus, and health and safety considerations.	

Required practical activity-Enzymes

Investigate the effect of pH on the rate of reaction of amylase enzyme.

Students should use a continuous sampling technique to determine the time taken to completely digest a starch solution at a range of pH values. Iodine reagent is to be used to test for starch every 30 seconds. Temperature must be controlled by use of a water bath or electric heater.

	Date completed
Apparatus and techniques AT 1 – use appropriate apparatus to record the volumes of liquids, time and pH. AT 2 – safe use of a water bath or electric heater. AT 5 – measure the rate of reaction by the colour change of iodine indicator.AT 8 – use of qualitative iodine reagent to identify starch by continuous sampling.	
Key opportunities for skills development WS 2.1 – use scientific theories and explanations and hypothesis on how pH affects amylase activity.	

WS 2.4 – carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements, and health and safety. WS 2.5 – describe the appropriate sampling technique to ensure samples are representative. WS 2.6 – make and record observations and measurements of time. WS 3.1 – present a graph of amylase activity against pH. WS 3.2 – translate numeric data into graphical form. MS 1a, 1c – carry out rate calculations for chemical reactions.	

Required practical activity - Photosynthesis

Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.

	Date completed
Apparatus and techniques AT 1 – use appropriate apparatus to record the rate of production of oxygen gas produced; and to measure and control the temperature of water in a large beaker that acts as a 'heat shield'. AT 2 – use a thermometer to measure and control temperature of water bath. AT 3 – use appropriate apparatus and techniques to observe and measure the process of oxygen gas production. AT 4 – safe and ethical use and disposal of living pondweed to measure physiological functions and responses to light. AT 5 – measuring rate of reaction by oxygen gas production.	
Key opportunities for skills development WS 2.1 – use scientific theories and explanations to develop hypotheses on how light intensity affects the rate of photosynthesis. WS 2.2 – plan experiments to test hypotheses. WS 2.5 – recognise that multiple samples will be needed at each light intensity. WS 2.6 – make and record observations of gas production. WS 3.1 – present a graph of light intensity against rate of photosynthesis. WS 3.2 – translate numeric data into graphical form. MS 1a, 1c – measure and understand the rate of photosynthesis reactions. MS 4a, 4c – plot and draw appropriate graphs of rate of photosynthesis against light intensity selecting appropriate scale for axes. MS 3a, 3d (HT) – understand and use inverse proportion: the inverse square law and light intensity in the context of photosynthesis.	

Required practical activity – Reaction time

Plan and carry out an investigation into the effect of a factor on human reaction time.

	Date completed
Apparatus and techniques AT 1 – use appropriate apparatus to record time. AT 3 – selecting appropriate apparatus and techniques to measure the process of reaction time. AT 4 – safe and ethical use of humans to measure physiological function of reaction time and responses to a chosen factor.	
Key opportunities for skills development MS 4a – translate information between numerical and graphical forms.	

Required practical activity – Field investigations

Measure the population size of a common species in a habitat.

Use sampling techniques to investigate the effect of a factor on the distribution of this species.

	Date completed
Apparatus and techniques AT 1 – use appropriate apparatus to record length and area. AT 3 – use transect lines and quadrats to measure distribution of a species. AT 4 – safe and ethical use of organisms and response to a factor in the environment. AT 6 – application of appropriate sampling techniques to investigate the distribution and abundance of organisms in an ecosystem via direct use in the field. AT 8 – use of appropriate techniques in more complex contexts including continuous sampling in an investigation.	
Key opportunities for skills development WS 2.1 – develop hypotheses regarding distribution of a species as a consequence of a factor. WS 2.2 – plan experiments to test hypotheses on distribution. WS 2.3 – apply a range of techniques, including the use of transects and quadrats, and the measurement of an abiotic factor. MS 1d, 3a – estimates of population size based on sampling. MS 2b – calculate arithmetic means. MS 2d – understand principles of sampling. MS 2f – understand the terms mean, mode and median as applied to ecological data. MS 4c – plot and draw appropriate graphs selecting appropriate scales for the axes.	

CHEMISTRY

Required practical activity - salts

Preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate, using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution.

	Date completed
Apparatus and techniques AT 2 – safe use of appropriate heating devices and techniques including use of a Bunsen burner and a water bath or electric heater. AT 3 – use of appropriate apparatus and techniques for conducting chemical reactions, including appropriate reagents. AT 4 – safe use of a range of equipment to purify and/or separate chemical mixtures including evaporation, filtration, crystallisation. AT 6 – safe use and careful handling of liquids and solids, including careful mixing of reagents under controlled conditions.	
Key opportunities for skills development WS 2.3 – apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.4 – carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations.	

Required practical activity- Electrolysis

Investigate what happens when aqueous solutions are electrolysed using inert electrodes. This should be an investigation involving developing a hypothesis.

	Date completed
Apparatus and techniques AT 3 – use of appropriate apparatus and techniques for conducting and monitoring chemical reactions. AT 7 – use of appropriate apparatus and techniques to draw, set up and use electrochemical cells for separation and production of elements and compounds. AT 8 – use of appropriate qualitative reagents and techniques to analyse and identify unknown samples or products including gas tests for hydrogen, oxygen and chlorine.	
Key opportunities and skills development WS 2.1 – use scientific theories and explanations to develop hypotheses. WS 2.2 – plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. WS 2.3 – apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.4 – carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. WS 2.6 – make and record observations and measurements using a range of apparatus and methods.	

Required practical activity- Reactions

Investigate the variables that affect temperature changes in reacting solutions such as, e.g. acid plus metals, acid plus carbonates, neutralisations, displacement of metals.

	Date completed
Apparatus and techniques AT 1 – use of appropriate apparatus to make and record a range of measurements accurately, including mass, temperature, and volume of liquids. AT 3 – use of appropriate apparatus and techniques for conducting and monitoring chemical reactions. AT 5 – making and recording of appropriate observations during chemical reactions including changes in temperature. AT 6 – safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes.	
Key opportunities and skills development WS 2.1 – use scientific theories and explanations to develop hypotheses. WS 2.2 – plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. WS 2.3 – apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.4 – carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations.	

WS 2.6 – make and record observations and measurements using a range of apparatus and methods. WS 2.7 – evaluate methods and suggest possible improvements and further investigations. MS 1a – recognise and use expressions in decimal form. MS 2a – use an appropriate number of significant figures. MS 2b – find arithmetic means. MS 4a – translate information between graphical and numeric form. MS 4c – plot two variables from experimental or other data.	

Required practical activity - Rates

Investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity. This should be an investigation involving developing a hypothesis.

	Date completed
Apparatus and techniques AT 1 – use of appropriate apparatus to make and record a range of measurements accurately, including mass, time, temperature, and volume of liquids and gases. AT 3 – use of appropriate apparatus and techniques for conducting and monitoring chemical reactions. AT 5 – making and recording of appropriate observations during chemical reactions including the measurement of rates of reaction by a variety of methods such as production of gas and colour change. AT 6 – safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes.	
Key opportunities for skills development WS 2.1 – use scientific theories and explanations to develop hypotheses. WS 2.2 – plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. WS 2.3 – apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.4 – carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. WS 2.6 – make and record observations and measurements using a range of apparatus and methods. WS 2.7 – evaluate methods and suggest possible improvements and further investigations. MS 1a – recognise and use expressions in decimal form. MS 1c – use ratios, fractions and percentages. MS 1d – make estimates of the results of simple calculations. MS 2a – use an appropriate number of significant figures. MS 2b – find arithmetic means. MS 4a – translate information between graphical and numeric form. MS 4b – understand that y = mx + c represents a linear relationship. MS 4c – plot two variables from experimental or other data. MS 4d – determine the slope and intercept of a linear graph. MS 4e – draw and use the slope of a tangent to a curve as a measure of rate of change.	

Required practical activity – Chromatography

Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate Rf values.

Apparatus and techniques AT 1 – use of appropriate apparatus to make and record a range of measurements accurately. AT 4 – safe use of a range of equipment to purify and/or separate chemical mixtures including chromatography.	
Key opportunities for skills development WS 2.4 – carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. WS 2.6 – make and record observations and measurements using a range of apparatus and methods.	

Required practical activity – Potable water

Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation.

	Date completed
Apparatus and techniques AT 2 – safe use of appropriate heating devices and techniques including use of a Bunsen burner and a water bath or electric heater. AT 3 – use of appropriate apparatus and techniques for the measurement of pH in different situations. AT 4 – safe use of a range of equipment to purify and/or separate chemical mixtures including evaporation, distillation.	
Key opportunities and skills development WS 2.3 – apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.4 – carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. WS 2.5 – recognise when to apply a knowledge of sampling techniques to ensure any samples collected are representative. WS 2.6 – make and record observations and measurements using a range of apparatus and methods. WS 2.7 – evaluate methods and suggest possible improvements and further investigations.	

PHYSICS

Required practical activity –Specific heat capacity

An investigation to determine the specific heat capacity of one or more materials. The investigation will involve linking the decrease of one energy store (or work done) to the increase in temperature and subsequent increase in thermal energy stored.

	Date completed
Apparatus and techniques AT1 – use appropriate apparatus to make and record measurements of mass, time and temperature accurately. AT5 – use, in a safe manner, appropriate apparatus to measure energy changes/transfers and associated values such as work done.	
Key opportunities for skills development WS 2.1 – Use scientific theories and explanations to develop hypotheses. WS 2.2 – Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. WS 2.3 – Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.4 – Carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. WS 2.6 – Make and record observations and measurements using a range of apparatus and methods. WS 2.7 – Evaluate methods and suggest possible improvements and further investigations. WS 3.1 – Present observations and other data using appropriate methods. WS 3.2 – Translate data from one form to another. WS 3.3 – Carry out and represent mathematical and statistical analysis. WS 3.4 – Represent the distribution of results and make estimations of uncertainty. WS 3.5 – Interpret observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions. WS 3.6 – Present reasoned explanations including relating data to hypotheses. WS 3.7 – Be objective, evaluate data in terms of accuracy, precision, repeatability and reproducibility and identify potential sources of random and systematic error. WS 3.8 – Communicate the scientific rationale for investigations, methods used, findings and reasoned conclusions through written and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms. WS 4.2 – Recognise the importance of scientific quantities and understand how they are determined. WS 4.3 – Use SI units (eg kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate. WS 4.6 – Use an appropriate number of significant figures in calculation. MS 2a – Use an appropriate number of significant figures. MS 2b – Find arithmetic means. MS 3b – Change the subject of an equation. MS 3c – Substitute numerical values into algebraic equations using appropriate units for physical quantities.	

<u>Required practical activity – Circuits, resistance</u>

Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the resistance of electrical circuits. This should include:

- **the length of a wire at constant temperature**
- **combinations of resistors in series and parallel.**

	Date completed

Apparatus and techniques AT 1 – use appropriate apparatus to measure and record length accurately. AT 6 – use appropriate apparatus to measure current, potential difference and resistance. AT 7 – use circuit diagrams to construct and check series and parallel circuits.	
Key opportunities for skills development WS 2.1 – Use scientific theories and explanations to develop hypotheses. WS 2.2 – Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. WS 2.3 – Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.4 – Carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. WS 2.5 – Recognise when to apply a knowledge of sampling techniques to ensure any samples collected are representative. WS 2.6 – Make and record observations and measurements using a range of apparatus and methods. WS 2.7 – Evaluate methods and suggest possible improvements and further investigations. WS 3.1 – Present observations and other data using appropriate methods. WS 3.2 – Translate data from one form to another. WS 3.3 – Carry out and represent mathematical and statistical analysis. WS 3.4 – Represent the distribution of results and make estimations of uncertainty. WS 3.5 – Interpret observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions. WS 3.6 – Present reasoned explanations including relating data to hypotheses. WS 3.7 – Be objective, evaluate data in terms of accuracy, precision, repeatability and reproducibility and identify potential sources of random and systematic error. WS 3.8 – Communicate the scientific rationale for investigations, methods used, findings and reasoned conclusions through written and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms. WS 4.2 – Recognise the importance of scientific quantities and understand how they are determined. WS 4.3 – Use SI units (eg kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate. WS 4.6 – Use an appropriate number of significant figures in calculation. MS 2a – Use an appropriate number of significant figures. MS 2b – Find arithmetic means. MS 4b – understand that y = mx + c represents a linear relationship. MS 4c – Plot two variables from experimental or other data. MS 4d – Determine the slope and intercept of a linear graph.	

<u>Required practical activity – I-V Characteristics</u>

Use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements including a filament lamp, a diode and a resistor at constant temperature.

	Date completed
Apparatus and techniques	

AT 6 – use appropriate apparatus to measure current and potential difference and to explore the characteristics of a variety of circuit elements. AT 7 – use circuit diagrams to construct and check series and parallel circuits including a variety of common circuit elements.	
Key opportunities for skills development WS 2.1 – Use scientific theories and explanations to develop hypotheses. WS 2.2 – Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. WS 2.3 – Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.4 – Carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. WS 2.5 – Recognise when to apply a knowledge of sampling techniques to ensure any samples collected are representative. WS 2.6 – Make and record observations and measurements using a range of apparatus and methods. WS 2.7 – Evaluate methods and suggest possible improvements and further investigations. WS 3.1 – Present observations and other data using appropriate methods. WS 3.2 – Translate data from one form to another. WS 3.3 – Carry out and represent mathematical and statistical analysis. WS 3.4 – Represent the distribution of results and make estimations of uncertainty. WS 3.5 – Interpret observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions. WS 3.6 – Present reasoned explanations including relating data to hypotheses. WS 3.7 – Be objective, evaluate data in terms of accuracy, precision, repeatability and reproducibility and identify potential sources of random and systematic error. WS 3.8 – Communicate the scientific rationale for investigations, methods used, findings and reasoned conclusions through written and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms. WS 4.2 – Recognise the importance of scientific quantities and understand how they are determined. WS 4.3 – Use SI units (eg kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate. WS 4.6 – Use an appropriate number of significant figures in calculation. MS 2a – Use an appropriate number of significant figures. MS 2g – Use a scatter diagram to identify a correlation between two variables. MS 4b – understand that y = mx + c represents a linear relationship. MS 4c – Plot two variables from experimental or other data.	

<u>Required practical activity - Density</u>

Use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids. Volume should be determined from the dimensions of a regularly shaped object and by a displacement technique for irregularly shaped objects. Dimensions to be measured using appropriate apparatus such as a ruler, micrometer or Vernier callipers.

	Date completed

Apparatus and techniques AT1 – use appropriate apparatus to make and record measurements of length, area, mass and volume accurately. Use such measurements to determine the density of solid objects and liquids.	
Key opportunities for skills development WS 1.2 – Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts. WS 2.1 – Use scientific theories and explanations to develop hypotheses. WS 2.2 – Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. WS 2.3 – Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.4 – Carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. WS 2.6 – Make and record observations and measurements using a range of apparatus and methods. WS 2.7 – Evaluate methods and suggest possible improvements and further investigations. WS 3.1 – Present observations and other data using appropriate methods. WS 3.5 – Interpret observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions. WS 3.8 – Communicate the scientific rationale for investigations, methods used, findings and reasoned conclusions through written and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms. WS 4.2 – Recognise the importance of scientific quantities and understand how they are determined. WS 4.3 – Use SI units (eg kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate. WS 4.6 – Use an appropriate number of significant figures in calculation. MS 2a – Use an appropriate number of significant figures. MS 2b – Find arithmetic means. MS 5c – Calculate areas of triangles and rectangles, surface areas and volumes of cubes.	

<u>Required practical activity- Force and extension</u>

Investigate the relationship between force and extension for a spring.

	Date completed
Apparatus and techniques AT 1 - use appropriate apparatus to make and record length accurately. AT 2 - use appropriate apparatus to measure and observe the effect of force on the extension of springs and collect the data required to plot a force-extension graph.	
Key opportunities for skills development	

WS 2.1 – Use scientific theories and explanations to develop hypotheses. WS 2.2 – Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. WS 2.3 – Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.4 – Carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. WS 2.6 – Make and record observations and measurements using a range of apparatus and methods. WS 3.1 – Present observations and other data using appropriate methods. WS 3.2 – Translate data from one form to another. WS 3.3 – Carry out and represent mathematical and statistical analysis. WS 3.5 – Interpret observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions. WS 3.8 – Communicate the scientific rationale for investigations, methods used, findings and reasoned conclusions through written and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms. WS 4.6 – Use an appropriate number of significant figures in calculation. MS 2a – Use an appropriate number of significant figures. MS 2b – Find arithmetic means. MS 4a – Translate information between graphical and numeric form. MS 4b – understand that y = mx + c represents a linear relationship. MS 4c – Plot two variables from experimental or other data.	

Required practical activity - Acceleration

Investigate the effect of varying the force on the acceleration of an object of constant mass and the effect of varying the mass of an object on the acceleration produced by a constant force.

	Date completed
Apparatus and techniques AT 1 – use appropriate apparatus to make and record measurements of length, mass and time accurately. AT 2 – use appropriate apparatus to measure and observe the effect of force. AT 3 – use appropriate apparatus and techniques for measuring motion, including determination of speed and rate of change of speed (acceleration/deceleration).	
Key opportunities for skills development WS 2.1 – Use scientific theories and explanations to develop hypotheses. WS 2.2 – Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. WS 2.3 – Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.4 – Carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. WS 2.6 – Make and record observations and measurements using a range of apparatus and methods.	

WS 2.7 – Evaluate methods and suggest possible improvements and further investigations. WS 3.1 – Present observations and other data using appropriate methods. WS 3.2 – Translate data from one form to another. WS 3.3 – Carry out and represent mathematical and statistical analysis. WS 3.4 – Represent the distribution of results and make estimations of uncertainty. WS 3.5 – Interpret observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions. WS 3.6 – Present reasoned explanations including relating data to hypotheses. WS 3.7 – Be objective, evaluate data in terms of accuracy, precision, repeatability and reproducibility and identify potential sources of random and systematic error. WS 3.8 – Communicate the scientific rationale for investigations, methods used, findings and reasoned conclusions through written and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms. WS 4.2 – Recognise the importance of scientific quantities and understand how they are determined. WS 4.3 – Use SI units (eg kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate. WS 4.6 – Use an appropriate number of significant figures in calculation. MS 2a – Use an appropriate number of significant figures. MS 2b – Find arithmetic means. MS 2g – Use a scatter diagram to identify a correlation between two variables. MS 4a – Translate information between graphical and numeric form. MS 4b – understand that y = mx + c represents a linear relationship. MS 4c – Plot two variables from experimental or other data.	

Required practical activity -Waves

Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements.

	Date completed
Apparatus and techniques AT4 – make observations of waves in fluids and solids to identify the suitability of apparatus to measure speed, frequency and wavelength.	
Key opportunities for skills development WS 2.3 – Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 2.6 – Make and record observations and measurements using a range of apparatus and methods. WS 3.8 – Communicate the scientific rationale for investigations, methods used, findings and reasoned conclusions through written and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms. WS 4.2 – Recognise the importance of scientific quantities and understand how they are determined. WS 4.3 – Use SI units (eg kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate.	

Required practical activity- IR radiation

Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface.

	Date completed
Apparatus and techniques AT1 – use appropriate apparatus to make and record temperature accurately. AT4 – make observations of the effects of the interaction of electromagnetic waves with matter.	
Key opportunities for skills development WS 3.8 – Communicate the scientific rationale for investigations, methods used, findings and reasoned conclusions through written and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms. WS 4.2 – Recognise the importance of scientific quantities and understand how they are determined. WS 4.3 – Use SI units (eg kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate. WS 4.6 – Use an appropriate number of significant figures in calculation. MS 2c – Construct and interpret frequency tables and diagrams, bar charts and histograms.	