Programme of study for Applied Science Year 12 Extended Certificate 2023-2024

Autumn (1st and 2nd term) Teacher 1, 2 and 3	Spring and Summer terms Teacher 1, 2 and 3
Other timescale: From: September 2023 To: May 2024	**Other timescale:** From: End of May 2024 To: July 2024
Topic: **Unit 1:** Fundamentals of Science. Exam 1 hour and 30min in total. Each paper Biology, Chemistry and Physics are 30min each. First exam to be sat in May 2020. All Extended Certificate and Diploma students to take this unit. **Skills (students should be able to do):** Researching, reading, essay writing, exam practice. Personal learning thinking skills including: • independent enquirers, • creative thinkers, • reflective learners, • team workers, • self-managers	**Topic:** **Unit 3:** Scientific Investigative skills. Exam based. 2 parts: practical then written exam. **Skills (students should be able to do):** • Researching, reading, essay writing, exam practice. Personal learning thinking skills including: • independent enquirers, • creative thinkers, • reflective learners, • team workers, • self-managers, • effective participants
Key Learning Outcomes (students should know): **AO1**: Students should be able to demonstrate knowledge of scientific facts, terms, definitions and scientific formulae Command words: give, label, name, state Marks: ranges from 12 to 18 marks **AO2:** Students should be able to demonstrate understanding of scientific concepts, procedures, processes and techniques and their application Command words: calculate, compare, discuss, draw, explain, state, write Marks: ranges from 39 to 45 marks	**Key Learning Outcomes (students should know):** **AO1:** Students should be able to demonstrate knowledge and understanding of scientific concepts, procedures, processes and techniques and their application in a practical investigative context. **AO2:** Students should be able to interpret and analyse qualitative and quantitative scientific information to make reasoned judgements and draw conclusions based on evidence in a practical investigative context

AO3: Students should be able to analyse, interpret and evaluate scientific information to make judgements and reach conclusions Command words: calculate, comment, compare, complete, describe, discuss, explain, state Marks: ranges from 18 to 24 marks **AO4:** Students should be able to make connections, use and integrate different scientific concepts, procedures, processes or techniques Command words: comment, compare, complete, discuss, explain Marks: ranges from 9 to 12 marks	**AO3:** Students should be able to evaluate practical investigative procedures used and their effect on the qualitative and quantitative scientific information obtained to make reasoned judgements **AO4:** Students should be able to make connections between different scientific concepts, procedures, processes and techniques to make a hypothesis and write a plan for a practical investigation.
End of year assessment to cover: • End of chapter test on various Chemistry topics • End of chapter test on various Biology topics • End of chapter test on various Physics topics. • Mock exam to be sat after Ester holidays.	**End of term 1 assessment to cover:** • Unit 3 only: various practical exams and then practical write-ups will be assessed. January mock exam on one practical exam and write up will also be given just before the actual exam.
Building understanding: Rationale for your sequence of lessons: Lessons have been broken down so it is preparing students to recall, select and apply scientific knowledge and understanding to vocational and realistic situations. Lessons will prepare students so that they will be able to use scientific terminology and concepts in given situations, and to use given information and apply appropriate mathematical and technical skills in context. Lessons will prepare students so that learners will be able to interpret and analyse information in order to make valid judgements. Lessons will prepare learners to be able to integrate relevant scientific knowledge and understanding from different areas to demonstrate a deeper understanding of how these apply to vocational and realistic situations. They will be able to use scientific terminology and concepts, communicating consistently and effectively in given situations. They will be able to select relevant information and apply appropriate	**Building understanding: Rationale for your sequence of lessons:** Lessons have been broken down so it is preparing students to demonstrate a sound knowledge and understanding of scientific concepts, procedures, processes and techniques and their application within a practical context. Lessons will prepare learners to interpret and analyse their own data and secondary data, leading to reasoned judgements on the qualitative and quantitative data they have collected during their investigation. The lessons prepare students to be able to draw links between different scientific concepts, procedures, processes and techniques to make a hypothesis and plan an investigation. Lessons help prepare learners to be able to make evaluative judgements on scientific data, processes and procedures that make reference to scientific reasoning. Lessons also prepare students to demonstrate a thorough understanding of how scientific concepts, procedures, processes and techniques can be integrated and applied within a practical context.

mathematical and technical skills to justify decisions or solve problems in context. Lessons will prepare learners to be able to interpret and analyse information in order to make valid judgements that are supported by evidence, with awareness of limitations	Lessons will prepare students to interpret, analyse and evaluate their own collected data and secondary data to support judgements and conclusions drawn. Lessons will prepare learners to use and integrate knowledge and understanding of scientific concepts, procedures, processes and techniques to make a hypothesis and plan an investigation that is fully supported by scientific reasoning. Lessons will also prepare learners to be able to provide rationalised evaluative judgements on scientific data, processes and procedures that are fully supported by scientific reasoning.
Home – Learning: • Knowledge (flipped learning) • -6 Mark essays to be set when appropriate. • -Exam Practice • -Pupils are to read extracts prior to the lessons. • -Revision for end of topic tests.	**Home – Learning:** • Knowledge (flipped learning) • Pupils are to read extracts prior to the lessons. • Exam Papers
Reading and literacy: Unit 1 revision guide students to read and make notes. Unit 1 Applied science textbook Unit 1 PowerPoints for Biology, Chemistry and Physics. **Literacy: Key terms which all students will need to understand for the exam:** Understand these definitions in order to understand the question: **Add/label:** Learners label or add to a stimulus material given in the question, for example labelling a diagram or adding units to a table. **Assess:** Learners give careful consideration to all the factors or events that apply and identify which are the most important or relevant. Make a judgement on the importance of something and come to a conclusion where needed.	**Reading and literacy:** Unit 3 revision guide students to read and make notes. Unit 3 Applied science textbook Unit 3 PowerPoints for Biology, Chemistry and Physics. **Literacy:** **Planning a scientific investigation** Developing a hypothesis for an investigation • Be able to formulate a hypothesis or a null hypothesis based on relevant scientific ideas. Selection of appropriate equipment, techniques and standard procedures • Be able to select and justify the use of equipment/techniques/standard procedures for quantitative and/or qualitative investigations. **Health and safety associated with the investigation** • Understand risks and hazards associated with the investigation.

Calculate: Learners obtain a numerical answer, showing relevant working. If the answer has a unit, this must be included. **Comment on:** Learners synthesise a number of variables from data/ information to form a judgement. More than two factors need to be synthesised. marks there must be a quantitative element to the answer. **Devise:** Learners plan or invent a procedure from existing principles/ideas. **Discuss:** Learners identify the issue/situation/problem/argument that is being assessed in the question. Explore all aspects of an issue/situation/problem/argument. Investigate the issue/situation, etc. by reasoning or argument. **Draw:** Learners produce a diagram, either using a ruler or using freehand. **Evaluate:** Learners review information then bring it together to form a conclusion, drawing on evidence, including strengths, weaknesses, alternative actions, relevant data or information. Come to a supported judgement of a subject's qualities and relation to its context. **Explain:** Learners' explanations require a justification/ exemplification of a point. The answer must contain some element of reasoning/justification – this can include mathematical explanations. **Give/state/name:** These generally require recall of one or more pieces of information. Give a reason why When a statement has been made and the requirement is only to give the reasons why.	**Variables in the investigation** • Independent. • Dependent. • Control. **Method for data collection and analysis** • Be able to produce a clear, logically ordered method to obtain results. • Be able to select relevant measurements and the range of measurements to be recorded. • Understand the importance of obtaining data accurately/reliably and to appropriate levels of precision. • Understand how variables can be controlled/measured/monitored. • Understand how the data/information can be analysed. **Evaluation** • Be able to make any recommendations for improvements to the investigation. • Be able to explain anomalous data. • Be able to determine quantitative and discuss qualitative sources of error. • Be able to discuss evidence of the reliability of the data collected during the investigation. • Be able to identify strengths and weaknesses within method/techniques/standard procedures/equipment used. • Be able to suggest improvements to an investigation.

Identify: Usually requires some key information to be selected from a given stimulus/resource. **Plot:** Learners produce a graph by marking points accurately on a grid from data that is provided and then drawing a line of best fit through these points. A suitable scale and appropriately labelled axes must be included if these are not provided in the question. **Predict:** Learners give an expected result. **Show that:** Learners prove that a numerical figure is as stated in the question. The answer must be to at least one more significant figure than the numerical figure in the question. **Sketch:** Learners produce a freehand drawing. For a graph this would need a line and labelled axes with important features indicated. The axes are not scaled. **State and justify/identify and justify:** When a selection is made and a justification has to be given for the selection. **State what is meant by:** When the meaning of a term is expected but there are different ways in which this meaning can be described. **Write:** When the question asks for an equation.	
Numeracy: **Physics:** Graphical representation of wave features. Be able to use the wave equation: v f = λ Be able to use the equation: calculation of speed T v = μ Understand the principles of fibre optics: o refractive index o calculation of critical angles at a glass–air interface Be able to use the inverse square law in relation to the intensity of a wave.	**Numeracy:** **Physics:** Equations • Power = VI (voltage × current). • Power = work done time • Work done = energy supplied or transformed. • Define – joules, kJ, calories (1 g by 1 oC), kilocalories, kWh. • The heat capacity of water will be given if required. • Calculate heat energy supplied by a fuel to water using: o heat energy = mass of water × specific heat capacity of water × temperature rise of water. • Calculate heat energy released from a fuel in kJ mol-1.

Biology: Interpretation of graphical displays of a nerve impulse and electrocardiogram (ECG) recordings. Calculate magnification and size of cells and organelles from drawings or images. **Chemistry:** Understand the following: o balanced equations o relative atomic mass o atomic number and relative molecular mass o moles, molar masses and molarities. Understand the quantities used in chemical reactions: o mass, volume of solution, concentration o reacting quantities o percentage yields.	**Biology:** Sampling sizes • Select sample sizes for investigation with regards to practical constraints and the need to collect sufficient data to make valid conclusions. **Drawing conclusions and evaluation:** Interpretation/analysis of data • Be able to identify trends/patterns in data. • Be able to compare primary and secondary data. • Be able to use data to draw conclusions that are valid and relevant to the purpose of the investigation. • Interpretation of statistical tests using tables of critical values and a 5% significance level, with reference to the null hypothesis. **Collection of quantitative/qualitative data** • Be able to collect data accurately/reliably and to appropriate levels of precision. • Be able to tabulate data in a clear and logical format using correct headings with units where appropriate. • Be able to identify anomalous data and take appropriate action. • Be able to recognise when it is appropriate to take repeats. • Be able to make qualitative observations and draw inferences. **Processing data** • Be able to carry out relevant calculations where appropriate, involving: o mean and standard deviation o use and interpretation of error bars o use of statistical tests, including t-test, chi-squared and correlation analysis o use of formulae o transposition of formulae o conversion of units o use of standard form o percentage error of measuring equipment. • Be able to display data in an appropriate format, including: o choosing an appropriate graph/chart/tables o correct plotting/labelling/scales.

Enrichment / opportunities to develop cultural capital (including careers, WRL and SMSC):	**Enrichment / opportunities to develop cultural capital (including careers, WRL and SMSC):**
Centres may involve employers in the delivery of this unit if there are local opportunities. There is no specific guidance related to this unit. However we offer a chance during Science week and throughout the year for these students to go on visits to universities, companies visiting the school so that students can understand the purpose of this course and enhance practical skills. These visits and talks enable students to choose a career pathway for them too.	Centres may involve employers in the delivery of this unit if there are local opportunities. There is no specific guidance related to this unit. However we offer a chance during Science week and throughout the year for these students to go on visits to universities, companies visiting the school so that students can understand the purpose of this course and enhance practical skills. These visits and talks enable students to choose a career pathway for them too.