Topic:Science Inquiry Skills **Year Level: 6-10**

Level Descriptors (By end of Year 8)

Students identify and construct questions and problems that they can investigate scientifically and make predictions based on scientific knowledge. They plan experiments, identifying variables to be changed, measured and controlled. They consider accuracy and ethics when planning investigations, including designing field or experimental methods. Students summarise data from different sources and construct representations of their data to reveal and analyse patterns and relationships, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate scientific language, representations and simple word equations to communicate science ideas, methods and findings.

Level Descriptors (By end of Year 10)

Students develop questions and hypotheses that can be investigated using a range of inquiry skills. They independently design and improve appropriate methods of investigation including the control and accurate measurement of variables and systematic collection of data. They explain how they have considered reliability, precision, safety, fairness and ethics in their methods and identify where digital technologies can be used to enhance the quality of data. They analyse trends in data, explain relationships between variables and identify sources of uncertainty. When selecting evidence and developing and justifying conclusions, they account for inconsistencies in results and identify alternative explanations for findings. Students evaluate the validity and reliability of claims made in secondary sources with reference to currently held scientific views, the quality of the methodology and the evidence cited. They construct evidence-based arguments and use appropriate scientific language, representations and balanced chemical equations when communicating their findings and ideas for specific purposes.

Skill	Can Do Statements					Misconception Check
	6	7	8	9	10	
Questioning and Predicting ***Identifying and constructing questions***	I can **state** the aim /question /problem /claim to be investigated scientifically.	***Plus….*** I can **identify** the purpose/ reason for the task/activity.	***Plus...*** I can **explain** the link between relevant theory and the investigation (direction is clear)	***Plus...*** I can **discuss** what aspects need to be investigated further.	***Plus...*** I can **formulate** my own aim/ question/ problem/ claim to be investigated scientifically.	Question / problem is not scientifically testable

Proposing hypotheses		I can **write** a **hypothesis** with guidance.	I can **identify** the independent & dependent variables and **write** a **hypothesis** with guidance.	I can independently **identify** the independent & dependent variables and **write a hypothesis**	I can **write** my own **hypothesis** based on wider research.	Hypothesis does not link to the aim or theory of the investigation Belief that the written hypothesis HAS TO BE proven correct
Predicting possible outcomes based on scientific knowledge	I can **predict** expected results based on relevant information	I can **identify** the basis for the scientific prediction.	I can **explain** the scientific basis for the prediction	I can **explain** the link between the independent & dependent variables.	I can **use** wider research to **predict** possible outcomes of investigations	Belief that experimentation produces definitive answers Everything on the internet (wider research) is valid and reliable
Planning and Conducting ***Making decisions regarding how to investigate or solve a problem*** • Choose appropriate techniques for research (7/8) • Identify variables (7 - 10) • Identify potential hazards and ethical considerations(9/ 10)	I can **identify** possible ways to test or solve a problem	***Plus…*** I can **identify** an appropriate variable to test I can **identify** potential hazards	***Plus...*** I can **explain** the choice of variables to be controlled, changed and measured in investigations I can **discuss** potential hazards	***Plus...*** I can **explain** how independent and dependent variables relate and how to control outcomes I can **identify** ethical considerations	***Plus…*** I can **design** investigations with appropriate independent, dependant and controlled variables to test a desired outcome I can **discuss** ethical considerations	. Teachers are in charge of student research Teachers are in charge of risk assessment and safety Belief that there is a right answer to an ethical / moral question

Carrying out an investigation ● Choice of Investigation type (7-10) ● Work individually & collaboratively (7/8) ● Plan independently (9/10) ● Appropriate selection and use equipment to ensure accuracy (7/8) ● Recognise strengths and limitations of equipment (from various sources - equipment, data collection, human error) (9/10)	I can **conduct with guidance** a range of simple types of investigations I can **suggest** equipment and methods that might be used in an investigation.	I can **collaboratively conduct with guidance** a range of types of investigations I can **correctly identify** useful equipment and safe techniques from a range of examples.	I can **collaboratively plan a relevant** approach to an investigation I can **collaboratively select and safely operate the appropriate** equipment for an investigation	I can **collaboratively plan** our investigations to address risk management and the limitations in available equipment. I can **select equipment and techniques** to systematically ensure reliable and accurate results	I can **independently plan** my investigations to address risk management and the limitations in available equipment. I can **modify and adjust** the choice of my equipment & techniques to achieve more reliable results	Problems with experiments/investigation are based on the method only and not the experience (i.e. ability to find right equipment, teamwork etc) If there are equipment limitations the experiment is not good for anything Own observations are not valid or scientific. Don't understand difference between different types of limitation and have trouble thinking around them. They have trouble identifying good sources of data
Collection of data ● Repeat trials to improve accuracy and precision (9/10) ● Understand 'reliability' (9/10)	I can **collect** data using written notes	I can **collect and record** quantitative data accurately in a table	I can **collect and record** both quantitative and qualitative data using a table	I can **collect & record** both quantitative and qualitative data on a digital platform I can **repeat** tests to improve the accuracy and precision of my data	I can **explain** why repeated tests provide more accurate & precise data.	Getting multiple results is so I get it right/ prove my hypothesis right

Recording and processing ***Representing data in meaningful and useful ways*** ● Select correct graphical representations for type of data collected (7-10) ● Graphing conventions and the importance (labels, key, scale etc) (7/8) ● Compare data from multiple sources (7/8) ● Recognise different types of data (quantitative/qualitative, discrete and continuous) (9/10)	I can **present** recorded data in a graph	***Plus…*** I can **present** recorded data using correct graphing conventions (labels, key, scale etc). I can **include theoretical data** in my graph	***Plus...*** I can **identify** the strengths and limitations of the graphical representations used	***Plus…*** I can **select** the appropriate graphical representation for the specific type of data collected I can **label** which data is quantitative or qualitative I can **label** which data is discrete or continuous	***Plus…*** I can **justify** why I have chosen the graphical representation for the data collected I can **explain** how the selection of graphing conventions can influence how the data is interpreted.	Consideration of the whole experience of the investigation Students require more practice writing methods. Concise step by step instructions that another individual can pick up and replicate the process. Misconceptions- what is the difference between control and controlled variables (CVs and EVs) Need to improve opportunities to use specialised equipment to understand small variances in data and the significance of the variations.

Analysing and Evaluating ***Identify relationships, evaluate claims and draw conclusions*** • Identifying data that provides evidence to support or refute (7/8) • Drawing conclusions based on evidence (7/8) • Identify patterns & abnormalities (7/8) • Explain trends and patterns (9/10) • Exploring relationship between variables (9/10) • Describing data properties (e.g. mean, median, etc) and significance of data (9/10)	I can **state** whether the hypothesis is supported or refuted. I can **identify** true or false scientific claims. I can **select** various data properties I have collected to support my claim.	***Plus…*** I can **use evidence** to determine whether the hypothesis is supported or refuted. I can **write** a valid conclusion linked to results.	***Plus…*** I can **describe connections** between data collected and secondary data sources that support or refute the hypothesis I can **justify my conclusion using evidence** from wider sources.	***Plus…*** I can **evaluate** the merit of my conclusion. I can **use evidence to justify** the significance/merit of the scientific claim.	**Plus…** I can **compare** these claims to other sources of evidence to **further evaluate** the scientific conclusion/claim.	I can **reproduce** scientific evidence from reputable sources to support my claim.

Reflect on method used and suggest improvements ● Indicators of quality of data (7/8) ● Suggestions of improvement to methodology to improve accuracy (7/8) ● Validity and limitations of information from primary and secondary sources (9/10) ● Alternative explanations of the presented data (9/10)		**Plus…** I can **summarise** the data and **describe** a pattern/trend (e.g. line of best fit). I can **recognise** problems with the method that may have produced errors	**Plus...** I can **explain** the reasons for the pattern/trend. I can **suggest** improvements to the method that would result in collection of valid data	**Plus…** I can **identify the significance in the variance** in data, the errors within that data and then use these relationships **to make a conclusion.** I can **evaluate** multiple limitations of the methodology and its effect on the validity of data. I can **explain** why using class results are more reliable than using individual group results	**Plus..** I can **explain** the significance in the variance in data, the types of errors within that data, properties of that data and how these relationships **impact** on making conclusions. I can **analyse** the validity of data & **make suggestions** to change to an investigations to avoid errors. I can **change /improve investigations** to collect only valid data sets and avoid errors/outliers I can **propose** alternative questions and/or explanations that may arise from the data.	A graph is always right and they don't understand that graph can be manipulated by the scale to represent a large difference when there may not be one. What is line of best fit? Any graph for any data Problems with identification of patterns/trends Students do not use excel effectively to generate graphs

Communicating ***Conveying ideas, findings and solutions to others*** ● Using scientific language and representations (7/8) ● Using digital technologies to communicate and collaborate (7/8) ● Presenting results and ideas using a variety of presentation types and conventions (9/10)	I can **use everyday language to communicate** the outcome of my investigation I can **collect** and **record** data with a group.	***Plus...*** I can **use scientific language to communicate** the outcome of the investigation I can **use** digital platforms to **share** my work with my teacher I can **use** digital platforms to **present** outcomes of investigation in multiple formats.	***Plus...*** I can **differentiate** my language to communicate to different target audiences. I can **use** digital platforms to **collaborate with others in class** or externally I can **select** appropriate digital platforms to present outcomes of an investigation depending on the target audience.	***Plus...*** I can **apply** appropriate reporting conventions to present the outcomes of an investigation to a specified audience	***Plus...*** I can **present** a full formal scientific report adhering to VCE requirements.	They think that if the investigation doesn't prove the hypothesis then the investigation 'didn't work'. What can they learn from an investigation that had limitations or didn't prove the hypothesis? Don't look for problems/limitations Don't draw conclusions from secondary sources.