Continuum of Science Skills Grade 10
DRAFT October 2017

Summary

By the end of **Grade 10** students develop questions and hypotheses and independently design and improve appropriate methods of investigations (e.g. field work, laboratory experimentation). They explain how they considered reliability, safety, impartiality and ethical actions in their methods and identify where digital technologies can be used to enhance the quality of data. When analysing data, selecting evidence and developing and justifying conclusions, they identify alternative explanations for findings and explain any sources of uncertainty/error. 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 select appropriate representations and text types to communicate science ideas for specific purposes.

	Broad Areas / Skills	Grade 10
Science as a Human Endeavour	Nature and development of science	Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries
	Use and influence of science	People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities The values and needs of contemporary society can influence the focus of scientific research

Continuum of Science Skills Grade 10
DRAFT October 2017

Focus on Scientific Inquiry

	Broad areas of skills		Grade 10
Scientific Inquiry Skills	Initiating and Planning: The skills of questioning, identifying problems and developing preliminary ideas and plans.	Asking questions and defining problems	• Identify questions based on observations • Identify questions to investigate arising from practical problems and issues (208-2) • Rephrase questions in a testable form and clearly define practical problems (208-1) • State a prediction and a hypothesis based on background information or an observed pattern of events (208-5) • Support a question or prediction with an explanation • Identify dependent and independent variables in the hypothesis (if-then) • Use models to make testable predictions based on scientific evidence • State a prediction and a hypothesis based on available evidence and background information (212-4)
		Safety procedures	• Select and use apparatus and materials safely (213-8) • Demonstrate a knowledge of WHMIS standards by selecting and applying proper techniques for handling and disposing of lab materials (213-9)
		Fair testing	• Design an experiment identifying and controlling major variables (212-3) • Identify and manipulate the appropriate variable, while keeping all others constant, when multiple variables are present.
		Experimental design	• Evaluate and select appropriate instruments for collecting evidence and appropriate processes for problem solving, inquiring, and decision making (212-8) • Develop appropriate sampling procedures (212-9) • Select and defend the choice of sample and/or sample size to answer a question.
	Performing and Recording: The skills of carrying out a plan of action that include gathering evidence by observation and, in most cases, manipulating materials and equipment.	Procedure	• Follow and explain procedures and adapt or extend procedures where required (213-2) • Compose procedures and test to identify the strengths and weaknesses of this procedure.
		Observing	• Make observations, form inferences, and collect information that is relevant to a given question or problem (205-5) • Use observable characteristics to distinguish an object or system from a similar object or system
		Measuring	• Use instruments effectively and accurately for collecting data (213-3) • Estimate measurements (209-2) • Identify potential sources and determine the amount of error in measurement (210-10)
		Recording	• Demonstrate mastery of previous recording skills • Explore more complex types of charts and graphs. • Select most appropriate form of data collection

Continuum of Science Skills Grade 10
DRAFT October 2017

		Organizing Data	• Compile and display evidence and information, by hand and computer, in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots (214-3) • Compile and organize data, using appropriate formats and data treatments to facilitate interpretation of the data (213-5) • Begin to interpret patterns and trends in data, and infer or calculate linear and nonlinear relationships among variables (214-5) • Begin to identify and explain sources of error and uncertainty in measurement and express results in a form that acknowledged the degree of uncertainty (214-10) check Math for last 2 bullets
	Analyzing and Interpreting: The skills of examining information and evidence; of processing and presenting data so that they can be interpreted; and of interpreting, evaluating and applying the results. Including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data.	Constructing Explanations	• Develop complex models that can be used to explain a variety of phenomena within a system • Compare theoretical and empirical values and account for discrepancies (214-7) • Evaluate the relevance, reliability, and adequacy of data and data collection methods (214-8) • Provide a statement that addresses the problem or answers the question investigated in light of the link between data and the conclusion (214-11) • Evaluate the usefulness of different information sources in answering a given question (206-4)
		Evaluating and explanations	• Identify multiple perspectives that influence a science-related decision or issue (215-4) • Develop, present, and defend a position or course of action, based on findings (215-5) • Continue to use reasoning and evidence to construct a rebuttal or a counter argument to someone else's argument
	Communication and Teamwork: The skills of communicating scientific ideas and information for a particular purpose using appropriate scientific language, conventions and representations	Conventions, vocabulary and format	• Consistently use the conventions of written language in final products • Select and use appropriate numeric, symbolic, graphical, and linguistic modes of representation to communicate ideas, plans, and results (215-2) • Work collaboratively to develop and carry out investigations

N.B. Check gr. 10 math for alignments

Continuum of Science Skills Grade 10
DRAFT October 2017

Focus on problem solving

Broad areas of skills	Grades 9 & 10
Initiating and Planning: The skills of questioning, identifying problems and developing preliminary ideas and plans.	• identify questions to investigate arising from practical problems • propose and assess alternative solutions to a given practical problem, select one and develop a plan • evaluate and select appropriate procedures and instruments for collecting data and information and for solving problems
Performing and Recording: The skills of carrying out a plan of action that include gathering evidence by observation and, in most cases, manipulating materials and equipment.	• research, integrate and synthesize information from various print and electronic sources relevant to a practical problem • construct and test a prototype device or system • troubleshoot problems as they arise • select and use tools, apparatus and materials safely
Analyzing and Interpreting: The skills of examining information and evidence; of processing and presenting data so that they can be interpreted; and of interpreting, evaluating and applying the results.	• evaluate designs and prototypes on the basis of self-developed criteria; e.g., function, reliability, cost, safety, efficient use of materials, impact on the environment • analyze alternative solutions to a given problem • identify potential strengths and weaknesses of each • recommend an approach to solving the problem based on findings • solve problems by selecting appropriate technology to perform manipulations and calculations • identify new questions and problems that arise from what was learned • evaluate potential applications of results
Communicating and Teamwork: The development and communication of science ideas are collaborative processes.	• work collaboratively to test a prototype device or system and troubleshoot problems as they arise • select and use appropriate numeric, symbolic, graphical and linguistic modes of representation to communicate findings and conclusions • evaluate individual and group processes used in planning and carrying out problem-solving tasks

N.B. Problem solving is an iterative process. The objective is to bring the desired decision or result closer to discovery with each repetition. It is approached differently from scientific inquiry where there is a skills progression. Good reference source, *Science Buddy Engineering Design Process*
https://www.sciencebuddies.org/science-fair-projects/engineering-design-process/engineering-design-process-steps#theengineeringdesignprocess