

NTN Knowledge and Thinking Rubric for Scientific Research, Grade 10

The ability to reason, problem-solve, develop sound arguments or decisions, and create new ideas by using appropriate sources and applying the knowledge and skills of a discipline



	EMERGING	E/ D	DEVELOPING	D/ P	PROFICIENT	P/ A	ADVANCED (12 th Proficient)
SITUATING SCIENTIFIC INQUIRY <i>What is the evidence that the student can formulate a question and provide information to situate a scientific investigation?</i>	<ul style="list-style-type: none"> Formulates a general question, though not scientifically related Provides limited or irrelevant content information 		<ul style="list-style-type: none"> Formulates a general scientific question Provides general content information in the context of the topic 		<ul style="list-style-type: none"> Formulates a specific scientific question Provides general content information that is related to the question being tested 		<ul style="list-style-type: none"> Formulates or articulates a specific and empirically testable scientific question Provides specific and relevant content information to support the question being tested
DEVELOPING AND USING MODELS <i>What is the evidence that the student can develop and use a model for the investigation?</i>	<ul style="list-style-type: none"> Model is missing, irrelevant, or includes major conceptual or factual errors Discussion of how a model can guide or inform some or all of the design is missing 		<ul style="list-style-type: none"> Constructs generally accurate model(s) (drawing, diagram, etc.) though it is not used to help interpret or infer meaning Explains how models can be used in scientific inquiries, but there are no connections to the student's design 		<ul style="list-style-type: none"> Constructs generally accurate model(s) (drawing, diagram, etc.) to represent processes, components of a system, or relationships between systems States in general terms how model was used to guide, inform, or test some or all of the design 		<ul style="list-style-type: none"> Constructs accurate model(s) (drawing, diagram, etc) to represent processes, components of a system, or relationships between systems Explains how model was used to guide, inform, or test some or all of the design
STATING A HYPOTHESIS <i>What is the evidence that the student can articulate a hypothesis, when appropriate?</i>	<ul style="list-style-type: none"> Articulates a prediction that has a limited relationship to the question under investigation, when appropriate 		<ul style="list-style-type: none"> Articulates a relevant prediction of the expected results, but variables are not clearly stated, when appropriate 		<ul style="list-style-type: none"> Articulates a relevant prediction of the expected results, and a general idea of the experimental design, when appropriate 		<ul style="list-style-type: none"> Articulates a hypothesis about the investigated question, with a basic and accurate description of the variables, when appropriate
DESIGNING THE INVESTIGATION <i>What is the evidence that the student can design investigations to explore scientific phenomena?</i>	<ul style="list-style-type: none"> Experimental design is not aligned to the testable question Includes vague or incomplete experimental procedures; or uses inappropriate tools, instruments, or types of measurement 		<ul style="list-style-type: none"> Experimental design is related, but not explicitly aligned, to testable question Describes general experimental procedures 		<ul style="list-style-type: none"> Experimental design is related to the testable question Describes experimental procedures including tools/instruments used, but is not clear or detailed enough to be replicated 		<ul style="list-style-type: none"> Aligns experimental design with testable question, including pertinent identified variables and controls Describes detailed, clear, and replicable experimental procedures including tools/instruments and types of measurements gathered



<p>COLLECTING DATA <i>What is the evidence that the student can collect data from a sufficient number of trials?</i></p>	<ul style="list-style-type: none"> • Reports others' data only • Reports data from a single paper only 	<ul style="list-style-type: none"> • Gathers data from a single trial of the experiment • Reports data from a single study only, though more than one research paper was cited 	<ul style="list-style-type: none"> • Gathers data from several replications of the experiment • Reports data and findings from multiple studies and sources 	<ul style="list-style-type: none"> • Gathers data from several replications of the experiment that are consistent within a reasonable range • Reports data and findings from multiple studies and sources, including studies which may refute the result
<p>ANALYZING THE DATA <i>What is the evidence that the student can analyze the data?</i></p>	<ul style="list-style-type: none"> • Analyzes data using inappropriate methods or with major errors or omissions • Limitations or precision of data are not mentioned 	<ul style="list-style-type: none"> • Calculates data using appropriate methods with minor omissions • States generally that limitations and precision can impact data. 	<ul style="list-style-type: none"> • Accurately identifies patterns in data using appropriate methods with minor omissions • Mentions limitations or precision of data 	<ul style="list-style-type: none"> • Accurately identifies patterns in data in using appropriate and systematic methods • Explains limitations or precision of data and identifies possible sources of error
<p>GENERATING INTERPRETATIONS <i>What is the evidence that the student can interpret the results?</i></p>	<ul style="list-style-type: none"> • Does not compare consistency of outcome with initial hypothesis, when appropriate • Inferences drawn from data are absent • Makes no mention of variables needing further investigation 	<ul style="list-style-type: none"> • References consistency of outcomes with each replication, but not the initial hypothesis, when appropriate • Attempts to draw inferences, but connection to data is unclear • Notes in general terms that scientific research may need further investigation 	<ul style="list-style-type: none"> • References consistency of outcome with initial hypothesis, when appropriate • Draws inferences from data without discussing strengths or weaknesses • Makes note of variables that need further investigation 	<ul style="list-style-type: none"> • Compares consistency of outcomes with initial hypothesis, when appropriate. • Explains the strengths OR weaknesses of the inferences drawn from data • Suggests relationships or interactions between variables worth further investigation
<p>DRAWING EVIDENCE-BASED CONCLUSIONS <i>What is the evidence that the student draw conclusions based on evidence?</i></p>	<ul style="list-style-type: none"> • Conclusions are missing or unclear • Supporting data or scientific theory for conclusions are missing • There is no discussion of the limitations of any conclusions 	<ul style="list-style-type: none"> • Draws somewhat valid scientific conclusions • Mentions data OR acceptable scientific theory but does not explain how it supports or refutes the conclusion • Limitations of conclusions are discussed but are inaccurate 	<ul style="list-style-type: none"> • Draws somewhat valid scientific conclusions that directly supports or refutes the tested hypothesis • Mentions data and acceptable scientific theory but does not explain how it supports or refutes the conclusion • Limitations of conclusions are discussed 	<ul style="list-style-type: none"> • Draws valid scientific conclusions that directly supports or refutes the tested hypothesis • Explains how data and acceptable scientific theory support or refute conclusions • Limitations of conclusions are discussed, including identifying alternative explanations
<p>COMMUNICATING RESULTS <i>What is the evidence that the student can clearly present their scientific findings?</i></p>	<ul style="list-style-type: none"> • Uses only one representation to communicate conclusions 	<ul style="list-style-type: none"> • Attempts to use multiple representations to communicate conclusions, with inaccuracies 	<ul style="list-style-type: none"> • Uses multiple representations (words, tables, diagrams, graphs and/or mathematical expression) to communicate conclusions 	<ul style="list-style-type: none"> • Uses multiple representations (words, tables, diagrams, graphs, and/or mathematical expressions) to communicate clear conclusions

