

NTN Knowledge and Thinking Rubric for Scientific Research, Grade 12

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



NewTech Network

	EMERGING	E/ D	DEVELOPING	D/ P	PROFICIENT College Ready	P/ A	ADVANCED College Level
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 scientific question Provides limited or irrelevant content information 		<ul style="list-style-type: none"> Formulates a specific scientific question Provides general content information that is related to the question 		<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 		<ul style="list-style-type: none"> Formulates a specific, testable, and challenging scientific question Provides specific and relevant content information to provide insight into the inquiry
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.) 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 		<ul style="list-style-type: none"> Constructs accurate and detailed 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 the some or all of the design, as well as explaining limitations of the model
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 unclearly stated, 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 		<ul style="list-style-type: none"> Articulates a hypothesis about the investigated question, with an accurate and specific explanation of the relationship between 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 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 control Describes detailed, clear, and replicable experimental procedures including tools/instruments and types of measurements gathered 		<ul style="list-style-type: none"> Explains the alignment between the experimental design and the testable question, including pertinent identified variables and control Describes detailed, clear, and replicable experimental procedures including rationale for using the 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"> Gathers data from a single trial of the experiment 	<ul style="list-style-type: none"> Gathers data from several replications of the experiment that are clearly outside a reasonable range 	<ul style="list-style-type: none"> Gathers data from several replications of the experiment that are consistent within a reasonable range 	<ul style="list-style-type: none"> Gathers data from multiple replications of the experiment that are statistically significant, when appropriate, within a given range
<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"> 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 	<ul style="list-style-type: none"> Accurately analyzes data using appropriate and systematic methods to identify and explain patterns Explains limitations or precision of data, possible sources of error and their impact on conclusions
<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 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 	<ul style="list-style-type: none"> Compares and explains consistency of outcome with initial hypothesis, when appropriate. Explains the strengths AND weaknesses of the inferences drawn from data Suggests relationships or interactions between variables worth further investigation and poses new analysis or study
<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, or limitations are inaccurate 	<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 Discusses limitations of conclusions 	<ul style="list-style-type: none"> Draws valid scientific conclusions Explains how data and acceptable scientific theory support or refute conclusions Discusses limitations of conclusions, including identifying alternative explanations 	<ul style="list-style-type: none"> Draws and evaluates valid scientific conclusions Explains in detail how data and acceptable scientific theory support or refute the conclusion Discusses limitations of conclusions or unanswered questions, including explaining and evaluating potential 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"> 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 consistent with the evidence 	<ul style="list-style-type: none"> Uses multiple representations (words, tables, diagrams, graphs, and/or mathematical expressions) to communicate clear conclusions consistent with the evidence 	<ul style="list-style-type: none"> Uses multiple representations (words, tables, diagrams, graphs, and/or mathematical expressions) to communicate clear and specific conclusions consistent with the evidence