

**STATE GOAL 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.**

**Why This Goal Is Important:** The inquiry process prepares learners to engage in science and apply methods of technological design. This understanding will enable students to pose questions, use models to enhance understanding, make predictions, gather and work with data, use appropriate measurement methods, analyze results, draw conclusions based on evidence, communicate their methods and results, and think about the implications of scientific research and technological problem solving.

**A. Know and apply the concepts, principles and processes of scientific inquiry.**

<b>EARLY ELEMENTARY</b>	<b>LATE ELEMENTARY</b>	<b>MIDDLE/JUNIOR HIGH SCHOOL</b>	<b>EARLY HIGH SCHOOL</b>	<b>LATE HIGH SCHOOL</b>
<b>11.A.1a</b> Describe an observed event.	<b>11.A.2a</b> Formulate questions on a specific science topic and choose the steps needed to answer the questions.	<b>11.A.3a</b> Formulate hypotheses that can be tested by collecting data.	<b>11.A.4a</b> Formulate hypotheses referencing prior research and knowledge.	<b>11.A.5a</b> Formulate hypotheses referencing prior research and knowledge.
<b>11.A.1b</b> Develop questions on scientific topics.	<b>11.A.2b</b> Collect data for investigations using scientific process skills including observing, estimating and measuring.	<b>11.A.3b</b> Conduct scientific experiments that control all but one variable.	<b>11.A.4b</b> Conduct controlled experiments or simulations to test hypotheses.	<b>11.A.5b</b> Design procedures to test the selected hypotheses.
<b>11.A.1c</b> Collect data for investigations using measuring instruments and technologies.	<b>11.A.2c</b> Construct charts and visualizations to display data.	<b>11.A.3c</b> Collect and record data accurately using consistent measuring and recording techniques and media.	<b>11.A.4c</b> Collect, organize and analyze data accurately and precisely.	<b>11.A.5c</b> Conduct systematic controlled experiments to test the selected hypotheses.
<b>11.A.1d</b> Record and store data using available technologies.	<b>11.A.2d</b> Use data to produce reasonable explanations.	<b>11.A.3d</b> Explain the existence of unexpected results in a data set.	<b>11.A.4d</b> Apply statistical methods to the data to reach and support conclusions.	<b>11.A.5d</b> Apply statistical methods to make predictions and to test the accuracy of results.
<b>11.A.1e</b> Arrange data into logical patterns and describe the patterns.	<b>11.A.2e</b> Report and display the results of individual and group investigations.	<b>11.A.3e</b> Use data manipulation tools and quantitative (e.g., mean, mode, simple equations) and representational methods (e.g., simulations, image processing) to analyze measurements.	<b>11.A.4e</b> Formulate alternative hypotheses to explain unexpected results.	<b>11.A.5e</b> Report, display and defend the results of investigations to audiences that may include professionals and technical experts.
<b>11.A.1f</b> Compare observations of individual and group results.		<b>11.A.3f</b> Interpret and represent results of analysis to produce findings.	<b>11.A.4f</b> Using available technology, report, display and defend to an audience conclusions drawn from investigations.	
		<b>11.A.3g</b> Report and display the process and results of a scientific investigation.		

**B. Know and apply the concepts, principles and processes of technological design.**

<b>EARLY ELEMENTARY</b>	<b>LATE ELEMENTARY</b>	<b>MIDDLE/JUNIOR HIGH SCHOOL</b>	<b>EARLY HIGH SCHOOL</b>	<b>LATE HIGH SCHOOL</b>
<b>11.B.1a</b> Given a simple design problem, formulate possible solutions.	<b>11.B.2a</b> Identify a design problem and propose possible solutions.	<b>11.B.3a</b> Identify an actual design problem and establish criteria for determining the success of a solution.	<b>11.B.4a</b> Identify a technological design problem inherent in a commonly used product.	<b>11.B.5a</b> Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs.
<b>11.B.1b</b> Design a device that will be useful in solving the problem.	<b>11.B.2b</b> Develop a plan, design and procedure to address the problem identifying constraints (e.g., time, materials, technology).	<b>11.B.3b</b> Sketch, propose and compare design solutions to the problem considering available materials, tools, cost effectiveness and safety.	<b>11.B.4b</b> Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time.	<b>11.B.5b</b> Select criteria for a successful design solution to the identified problem.
<b>11.B.1c</b> Build the device using the materials and tools provided.	<b>11.B.2c</b> Build a prototype of the design using available tools and materials.	<b>11.B.3c</b> Select the most appropriate design and build a prototype or simulation.	<b>11.B.4c</b> Develop working visualizations of the proposed solution designs (e.g., blueprints, schematics, flowcharts, cad-cam, animations).	<b>11.B.5c</b> Build and test different models or simulations of the design solution using suitable materials, tools and technology.
<b>11.B.1d</b> Test the device and record results using given instruments, techniques and measurement methods.	<b>11.B.2d</b> Test the prototype using suitable instruments, techniques and quantitative measurements to record data.	<b>11.B.3d</b> Test the prototype using available materials, instruments and technology and record the data.	<b>11.B.4d</b> Determine the criteria upon which the designs will be judged, identify advantages and disadvantages of the designs and select the most promising design.	<b>11.B.5d</b> Choose a model and refine its design based on the test results.
<b>11.B.1e</b> Report the design of the device, the test process and the results in solving a given problem.	<b>11.B.2e</b> Assess test results and the effectiveness of the design using given criteria and noting possible sources of error.	<b>11.B.3e</b> Evaluate the test results based on established criteria, note sources of error and recommend improvements.	<b>11.B.4e</b> Develop and test a prototype or simulation of the solution design using available materials, instruments and technology.	<b>11.B.5e</b> Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements.
	<b>11.B.2f</b> Report test design, test process and test results.	<b>11.B.3f</b> Using available technology, report the relative success of the design based on the test results and criteria.	<b>11.B.4f</b> Evaluate the test results based on established criteria, note sources of error and recommend improvements.	<b>11.B.5f</b> Using available technology, prepare and present findings of the tested design solution to an audience that may include professional and technical experts.

			<b>11.B.4g</b> Using available technology, report to an audience the relative success of the design based on the test results and criteria.	
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