QUANTITATIVE AND SCIENTIFIC REASONING

Introduction

It is important to understand math and science as it affects our daily lives. Students need to be able to conduct experiments, model data, and make decisions based on an evaluation of data. Mathematical and scientific literacy is vital to an individual's meaningful land productive life. Computational mathematics and memorization of scientific facts is not enough. Students must be able to: propose avenues for investigating problems in the sciences, gather quantitative data, analyze data using appropriate statistical arguments, apply results to reach valid conclusions, and communicate the solution in a form others can understand. For students to develop the abilities that characterize science as inquiry, they must actively participate in empirical investigations and they must possess the necessary mathematical skills to evaluate date, make predictions, and assess uncertainty. This standard describes the fundamental abilities and understandings of inquiry as well as the larger framework of conducting scientific investigations of natural phenomena. Technology is a key tool in the investigation, summary, analysis, and reporting of data.

Content Standards

1. Concepts and Processes -*Students will understand and apply basic concepts, principles, and processes of life, physical, and health sciences. They will also study number sense, data analysis, geometry and measurement, probability, algebra and functions, and problem solving.*

a. math and science course requirements – projects, tests, papers

b. math and science WASL

2. Inquiry and Reasoning - *Students will develop abilities necessary to do scientific inquiry and apply scientific knowledge and skills to solve problems and meet challenges.*

- Identify and formulate questions and make predictions that guide scientific investigations.
- Design, conduct, and evaluate scientific investigations using appropriate technology, multiple measures and safe approaches through critical and creative thinking, problem solving, and logical reasoning.
- Make decisions and draw conclusions based on analysis, interpretation, evaluation, and integration of data as well as recognize the existence of alternative explanations.
    - **a. Lab reports** – These serve as the basis for assessment in this category. Students select work from chemistry, AP Biology and integrated science to show their ability to design and conduct investigations, to draw conclusions, record data, and analyze evidence. Students prepare a cover letter addressing how each of these areas is shown in their entries.

3. Applications and Ethics - *Students will understand the nature of scientific inquiry and know that science and technology are human endeavors interrelated to each other, to society, and to the workplace, and will communicate their ideas, make informed ethical decisions, and understand the implications of those decisions.*

- Employ historical, personal, and social perspectives with respect to the nature of science and technology.
- Make connections between science disciplines, science and humanities, as well as the world around us.
- Analyze intellectual honesty, understand limitations of science and technology, critique divergent results, and understand the evolution of ideas.
- Research, interpret, and defend scientific investigations, conclusions, or arguments; use data, logic, and analytical thinking as investigative tools; communicate ideas through written, oral and mathematical expression.

a. Research Investigation Project – Students choose a scientific research topic at the beginning of the year in chemistry. After weeks of research utilizing several sources of information, students write a research paper on the topic. Second semester, students design projects to extend their knowledge of the chosen topic. These projects must include a driving question and an analysis of data or an application of their knowledge. Students complete a report to document their process. These projects range from actual lab investigations, to studies on how best to teach the concept studied, to surveys of the general public about their level of understanding on the issue. This project must be presented orally.

4. Scientific and Mathematical Literacy –*Students will improve the written expression of their thinking and the understand the importance of credible sources of information. They will learn to analyze a variety of sources for information.*

a. Literary Analyses – Students read and analyze three diverse forms of scientific writing – books, articles, and professional journals. Students then write responses to these readings and include a summary of the text, an analysis of the writing style, and an analysis of the validity of the science.

b. Technical Writings – Students are presented with problems in math to read, analyze, solve, and explain. Students must show their work and their thinking processes for all the steps in solving the problem. In science, students were asked to explain a scientific concept to a variety of audiences as clearly and precisely as possible.

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Students at TCS may select from the following pieces to provide evidence of their proficiency in each area of the QSR portfolio-Math

QSR Portfolio Contents-Math

Assessments	Mathematical Literacy
❑ **Math WASL (level 3 or level 4)** ❑ **3 Math unit exams (1 for each year)** TCS Examples • Any unit exam • Any final or mid-term exam Running Start Examples • Tests from above 100 level math class	❑ **3 Technical Writings (1 from each year)** TCS Examples • Math technical writing Running Start Examples o Written explanation showing math or scientific reasoning on a test or a paper o Current event article analysis

Investigations/Projects

❑ **At least two semester projects that show students:**
- o Applied evidence and associated logical arguments to arrive at proper conclusions
- o Made predictions using appropriate models
- o Recognized patterns, put forth and tested a reasonable hypothesis

TCS Examples
- ❑ Analysis of Regression Project
- ❑ Periodic Function Project
- ❑ Public Opinion Data Analysis Project
- ❑ Optimization Project
- ❑ Demographic Data Modeling Project
- ❑ Geometric Representation Project

Running Start Examples
- o Project from 100 or above math class

Additional Comments

- ❑ At least 2 of the above pieces must show all samp les of work from the revision process
- ❑ At least 2 of the above pieces of work must show growth in mathematics over time. Samples from 9^{th}, 10^{th}, 11^{th}, and/or 12^{th} grade)