Standard #: MAFS.912.N-Q.1.3

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Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★

Grade: 912

Cluster: Reason quantitatively and use units to solve problems. (Algebra 1 - Supporting Cluster) (Algebra 2 - Supporting Cluster) -
Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

Date Adopted or Revised: 02/14

Content Complexity Rating: Level 2: Basic Application of Skills & Concepts - More Information

Date of Last Rating: 02/14

Status: State Board Approved

Assessed: Yes

Related Courses

Course Number	Course Title
1200310:	Algebra 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200320:	Algebra 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200370:	Algebra 1-A (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200400:	Intensive Mathematics (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000350:	Anatomy and Physiology (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000360:	Anatomy and Physiology Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2001350:	Astronomy Solar/Galactic (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2020910:	Astronomy Solar/Galactic Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000310:	Biology 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000320:	Biology 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000330:	Biology 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 and beyond (current))
2000430:	Biology Technology (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000370:	Botany (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003340:	Chemistry 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003350:	Chemistry 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003360:	Chemistry 2 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2001310:	Earth/Space Science (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2001320:	Earth/Space Science Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000380:	Ecology (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002480:	Forensic Science 1 (Specifically in versions: 2014 - 2015, 2015 - 2017, 2017 and beyond (current))
2002490:	Forensic Sciences 2 (Specifically in versions: 2014 - 2015, 2015 - 2017, 2017 and beyond (current))
2000440:	Genetics (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002400:	Integrated Science 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002410:	Integrated Science 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002430:	Integrated Science 2 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002440:	Integrated Science 3 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002450:	Integrated Science 3 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000390:	Limnology (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2002500:	Marine Science 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002510:	Marine Science 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002520:	Marine Science 2 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002530:	Marine Science 2 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003400:	Nuclear Radiation (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2020710:	Nuclear Radiation Honors (formerly 202071A) (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003310:	Physical Science (Specifically in versions: 2015 and beyond (current))
2003320:	Physical Science Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003380:	Physics 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003390:	Physics 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003410:	Physics 2 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))

2003600:	Principles of Technology 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003610:	Principles of Technology 2 (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2002540:	Solar Energy Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002550:	Solar Energy 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2002330:	Space Technology and Engineering (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2000410:	Zoology (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000800:	Florida's Preinternational Baccalaureate Biology 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200410:	Mathematics for College Success (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200700:	Mathematics for College Readiness (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002340:	Experimental Science 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002350:	Experimental Science 2 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002360:	Experimental Science 3 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002370:	Experimental Science 4 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7912070:	Access Liberal Arts Mathematics (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 - 2019, 2019 and beyond (current))
7912080:	Access Algebra 1A (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 - 2019, 2019 and beyond (current))
7920011:	Access Chemistry 1 (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 and beyond (current))
7920015:	Access Biology 1 (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 and beyond (current))
7920020:	Access Earth/Space Science (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 and beyond (current))
7920025:	Access Integrated Science 1 (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 and beyond (current))
2000315:	Biology 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000500:	Bioscience 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000510:	Bioscience 2 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2000520:	Bioscience 3 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2002405:	Integrated Science 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2020 (course terminated))
2002445:	Integrated Science 3 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2020 (course terminated))
2003345:	Chemistry 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
2003385:	Physics 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2020 (course terminated))
1200315:	Algebra 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1200375:	Algebra 1-A for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7912100:	Fundamental Algebraic Skills (Specifically in versions: 2013 - 2015, 2015 - 2017 (course terminated))
1207300:	Liberal Arts Mathematics 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7912075:	Access Algebra 1 (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 - 2019, 2019 and beyond (current))

Related Access Points

Access Point

Access Points Number	Access Points Title
MAFS.912.N-Q.1.AP.3a:	Describe the accuracy of measurement when reporting quantities (you can lessen your limitations by measuring precisely).

Related Resources

Teaching Idea

Name	Description
A Certain Uncertainty:	Students will measure the mass of one nickel 10 times on a digital scale precise to milligrams. The results will be statistically analyzed to find the error and uncertainty of the scale.
All Numbers Are Not Created Equal:	Although a sheet of paper is much thinner than the divisions of a ruler, we can make indirect measurements of the paper's thickness.
Now That is a Dense Graph:	In this activity, the density of ethanol is found by graphical means. In the second part, the density of sodium thiosulfate is found, also by graphical means. The values found are then analyzed statistically.
Now That is a Dense Graph:	Students will first measure and plot the total mass vs liquid volume in a graduated cylinder. They will then use slope and the mathematical formula for the plot to determine the density of the liquid, the density of a solid added to the liquid, and the mass of the graduated cylinder.
Pump Up the Volume:	This activity is a statistical analysis of recorded measurements of a single value - in this case, a partially filled graduated cylinder.
Pump Up the Volume:	This activity challenges students to analyze the statistical distribution of volume measurements from a partially filled graduated cylinder. The free app, GeoGebra is used to create a box plot to aid in the analysis.

Problem-Solving Task

Name	Description
Accuracy of Carbon 14 Dating I:	This task examines, from a mathematical and statistical point of view, how scientists measure the age of organic materials by measuring the ratio of Carbon 14 to Carbon 12. The focus here is on the statistical nature of such dating.

Accuracy of Carbon 14 Dating II:	This task examines, from a mathematical and statistical point of view, how scientists measure the age of organic materials by measuring the ratio of Carbon 14 to Carbon 12. The focus here is on the statistical nature of such dating.
Bus and Car:	This task operates at two levels. In part it is a simple exploration of the relationship between speed, distance, and time. Part (c) requires understanding of the idea of average speed, and gives an opportunity to address the common confusion between average speed and the average of the speeds for the two segments of the trip. At a higher level, the task addresses MAFS.912.N-Q.1.3, since realistically neither the car nor the bus is going to travel at exactly the same speed from beginning to end of each segment; there is time traveling through traffic in cities, and even on the autobahn the speed is not constant. Thus students must make judgments about the level of accuracy with which to report the result.
Calories in a Sports Drink:	This problem involves the meaning of numbers found on labels. When the level of accuracy is not given we need to make assumptions based on how the information is reported. An unexpected surprise awaits in this case, however, as no reasonable interpretation of the level of accuracy makes sense of the information reported on the bottles in parts (b) and (c). Either a miscalculation has been made or the numbers have been rounded in a very odd way.
Dinosaur Bones:	The purpose of this task is to illustrate through an absurd example the fact that in real life quantities are reported to a certain level of accuracy, and it does not make sense to treat them as having greater accuracy.
Felicia's Drive:	This task provides students the opportunity to make use of units to find the gas needed (MAFS.912.N-Q.1.1). It also requires them to make some sensible approximations (e.g., 2.92 gallons is not a good answer to part (a)) and to recognize that Felicia's situation requires her to round up. Various answers to (a) are possible, depending on how much students think is a safe amount for Felicia to have left in the tank when she arrives at the gas station. The key point is for them to explain their choices. This task provides an opportunity for students to practice MAFS.K12.MP.2.1: Reason abstractly and quantitatively, and MAFS.K12.MP.3.1: Construct viable arguments and critique the reasoning of others.

Lesson Plan

Name	Description
Amusement Park Physics:	Students will research various types of amusement park rides and use their findings to design a feasible ride of their own. They will summarize their findings and present their ride design to the class. Each student will then write a persuasive letter to a local amusement park describing the reasons their ride design is the best.
BIOSCOPES Summer Institute 2013 - Mechanical Energy:	This lesson is designed to be part of a sequence of lessons. It follows resource 52648 "BIOSCOPES Summer Institute 2013 - Forces" and precedes resource 52957 "BIOSCOPES Summer Institute 2013 - Thermal Energy." This lesson uses a predict, observe, and explain approach along with inquiry based activities to enhance student understanding of the conservation of energy.
Compacting Cardboard:	Students with investigate the amount of space that could be saved by flattening cardboard boxes. The analysis includes linear graphs and regression analysis along with discussions of slope and a direct variation phenomenon.
Crime Scene Measurements:	Using a crime scene scenario, students will measure length, mass, volume and temperature. They will calculate area and shoe size using a chart. Students will analyze soil samples using a microscope. Students will use the process of elimination based on their data to determine a suspect.
Farming in the Gilded Age: A Simulation:	This video is about a simulation created by a teacher to show the hardships of "gambling" in the world of farming, especially in a past, less civilized time. The students were given 2000 and had to put 500 aside for various expenses. They were then given a list of 11 objects (crops and livestock) that they could chose from to purchase with the remaining 1500. The catch is, they only have a certain amount of space to use, and must plan which items will be more efficient in a set area. To simulate the purchasing of the crops and livestock, the teacher cut out squares with each item on it. He then had each group come up to spend their money on what they found fit for their particular group. After each group chose their ratios of crops and livestock, there was then a simulated growing season that had problems with certain crops and benefits of others. They then repeat the process for the following year with a different scenario for the growing season. At the end of the simulation, the teacher acted as if he was the banker that loaned the 2000 in the beginning. This is where it comes full circle to show why farming was so difficult in the past, and how it declined due to poor weather and the lack of the ability to pay off loans given to start farming in the first place.
Forced To Learn:	Using inquiry techniques, students, working in groups, are asked to design and conduct an experiment to test Newton's Second Law of Motion. Upon being provided with textbooks, rulers, measuring tapes, mini-storage containers, golf balls, marbles, rubber balls, steel balls, and pennies they work cooperatively to implement and revise their hypotheses. With limited guidance from the teacher, students are able to visualize the direct relationships between force and mass; force and acceleration; and the inverse relationship between mass and acceleration.
Making Menus:	Students can organize information about a chemical substance into a menu that will help them establish their thoughts when converting using the concept of the mole. Ordering off their menu narrows the information to only what is relevant and allows them to easily set up factor label conversions.
Mass Mole Relationships: A Statistical Approach To Accuracy and Precision:	The lesson is a laboratory-based activity involving measurement, accuracy and precision, stoichiometry and a basic statistical analysis of data using a scatter plot, linear equation, and linear regression (line of best fit). The lesson includes teacher-led discussions with student participation and laboratory-based group activities.
Mole Relay:	To be successful in chemistry, students need a solid foundation in solving multi-step (sequential) problems. This activity uses inexpensive materials to strengthening students understanding of stoichiometry problems during an engaging group competition. A student-centered approach develops the reasoning skills needed for scientific thinking. Each student assumes a different role as they complete work in a complex stoichiometry problem. Students may receive immediate feedback from their teammates so that success is felt by all learners.
	In this lesson students should be able to :

Motion: Speed and Velocity:	• Identify appropriate SI units for measuring speed. • Compare and contrast average speed and instantaneous speed. • Interpret position-time graphs. • Calculate the speed of an object using slopes.
Ramp It Up:	Using inquiry techniques, students, working in groups, are asked to design and conduct experiments to test the Law of Conservation of Energy and the Law of Conservation of Momentum. Upon being provided with textbooks, rulers, measuring tapes, stopwatches, mini-storage containers, golf balls, marbles, rubber balls, steel balls, and pennies, they work cooperatively to implement and revise their hypotheses. With limited guidance from the teacher, students are able to visualize the relationships between mass, velocity, height, gravitational potential energy, kinetic energy, and total energy as well as the relationships between mass, velocity, and momentum.
Riding the Roller Coaster of Success:	Students compete with one another to design and build a roller coaster from insulation tubing and tape that will allow a marble to travel from start to finish with the lowest average velocity. In so doing, students learn about differences between distance and displacement, speed and velocity, and potential and kinetic energy. They also examine the Law of Conservation of Energy and concepts related to force and motion.
Shopping for a Home Mortgage Loan:	Students will analyze the data given to decide which type of loan they will buy. After selecting their options, students will estimate the first loan payment. FHA loans offer a better interest rate than conforming loans, but buying premium insurance is a requirement to qualify for an FHA loan, increasing the upfront cost of the loan. Fixed interest rate loans seem like the best choice because you have the same mortgage payment every month; however, adjustable rate loans offer a better interest rate and it has a cap on the interest rate.
Uncertainty of Measurement:	The students will learn the application of scientific notation, significant figures, accuracy and precision as they pertain to the collection of data (measurement).

Formative Assessment

Name	Description
Density:	Students are given a scenario in which density is calculated and are asked to select the answer that is most appropriate given the degree of accuracy in the initial measurements.
Tree Size:	Students are asked to determine if a diameter calculated to seven decimal places is appropriate given the degree of accuracy in the circumference measure used in its calculation.

Lesson Study Resource Kit

Name	Description
Measurement Matters:	This Lesson Study Resource Kit is an introductory unit on measurement for a Chemistry I course.

Perspectives Video: Teaching Idea

Name	Description
Rubber Band Races for Testing Measurement Accuracy:	This activity will send your measurement lab to new distances.

Assessment

Name	Description
Sample 2 - High School Algebra 1 State Interim Assessment:	This is a State Interim Assessment for 9th-12th grades.
Sample 3 - High School Algebra 1 State Interim Assessment:	This is a State Interim Assessment for 9th-12th grades.

Unit/Lesson Sequence

Name	Description
Sample Algebra 1 Curriculum	This sample Algebra 1 CMAP is a fully customizable resource and curriculum-planning tool that provides a framework for the Algebra 1 Course. The units and standards are customizable and the CMAP allows instructors to add lessons, worksheets, and other resources as needed. This CMAP also includes rows that automatically filter and display Math Formative Assessments System tasks, E-Learning Original Student Tutorials and Perspectives Videos that are aligned to the standards, available on CPALMS. Learn more about the sample Algebra 1 CMAP, its features and customizability by watching the following video:

Plan Using CMAP:

Using this CMAP

To view an introduction on the CMAP tool, please click here.

To view the CMAP, click on the "Open Resource Page" button above; be sure you are logged in to your iCPALMS account.

To use this CMAP, click on the "Clone" button once the CMAP opens in the "Open Resource Page." Once the CMAP is cloned, you will be able to see it as a class inside your iCPALMS My Planner (CMAPs) app.

To access your My Planner App and the cloned CMAP, click on the iCPALMS tab in the top menu.

All CMAP tutorials can be found within the iCPALMS Planner App or at the following URL: http://www.cpalms.org/support/tutorials_and_informational_videos.aspx

Student Resources

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Parent Resources

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