***General MCAS Achievement Level Descriptors***

**Exceeding Expectations**   
A student who performed at this level exceeded grade-level expectations by demonstrating mastery of the subject matter.

**Meeting Expectations**  
A student who performed at this level met grade-level expectations and is academically on-track to succeed in the current grade in this subject.

**Partially Meeting Expectations**A student who performed at this level partially met grade-level expectations in this subject. The school, in consultation with the student’s parent/guardian, should consider whether the student needs additional academic assistance to succeed in this subject.

**Not Meeting Expectations**A student who performed at this level did not meet grade-level expectations in this subject. The school, in consultation with the student’s parent/guardian, should determine the coordinated academic assistance and/or additional instruction the student needs to succeed in this subject.

Student results on the MCAS tests are reported according to four achievement levels: *Exceeding Expectations, Meeting Expectations, Partially Meeting Expectations,* and *Not Meeting Expectations.* The descriptors below illustrate the knowledge and skills students demonstrate on MCAS at each level. **Knowledge and skills are cumulative at each level.** No descriptors are provided for the *Not Meeting Expectations* achievement level because students work at this level, by definition, does not meet the criteria of the *Partially Meeting Expectations* level.

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|  | | **Partially Meeting Expectations  *On MCAS, a student at this level:*** | | **Meeting Expectations  *On MCAS, a student at this level:*** | | **Exceeding Expectations  *On MCAS, a student at this level:*** | |
| **Understanding and Application of Disciplinary Core Ideas** | | Demonstrates a partial understanding of some scientific concepts and processes by identifying and sometimes describing or providing evidence for these concepts and processes.  Uses some basic scientific terms in common scientific examples. | | Demonstrates a solid understanding of many scientific concepts and processes by mostly describing, explaining, and providing evidence for these concepts and processes.  Mostly applies appropriate scientific terms in a variety of applications, including common science examples and some novel situations. | | Demonstrates a comprehensive, in-depth understanding of many scientific concepts and processes by consistently describing, explaining, and providing evidence for these concepts and processes.  Consistently applies scientific terms in appropriate contexts in both common science examples and many novel situations. | |
| **Understanding and Application of Scientific and Engineering Practices** | | Identifies a testable, scientific question for an investigation.  Completes a simple, commonly used model.  Uses simple graphs or data to draw general conclusions about a familiar scientific investigation or phenomena.  Identifies evidence to support a claim.  Describes a benefit or drawback of simple design features given a familiar device or prototype. | | Develops some testable, scientific questions for an investigation.  Completes or uses a model and describes some strengths and weaknesses of the model.  Analyzes multiple sources of data, including graphs and tables, to draw conclusions about a familiar scientific investigation or phenomena.  Provides some evidence to support a claim and constructs basic explanations for scientific phenomena or results from an investigation.  Analyzes design features of a familiar device or prototype and describes a benefit or drawback of the design. | | Consistently develops testable, scientific questions for an investigation.  Creates a model, consistently describes the strengths and weaknesses of the model, and provides information for how to improve the model.  Analyzes multiple sources of data, including graphs and tables, to draw conclusions about a novel or complex scientific investigation or phenomena.  Provides several pieces of evidence to support a claim and constructs thorough explanations for scientific phenomena or results from an investigation.  Analyzes design features of a novel device or prototype and constructs an explanation for how the design features meet criteria for success or are limited by constraints. | |
| **PS1. Matter and Its Interactions** | | | | | |
| **Partially Meeting Expectations**  ***On MCAS, a student at this level:*** | | **Meeting Expectations**  ***On MCAS, a student at this level:*** | | **Exceeding Expectations**  ***On MCAS, a student at this level:*** | |
| Interprets a model to determine that energy is released during the processes of fission, fusion, and radioactive decay. | | Analyzes a model to determine whether fission, fusion, or a radioactive decay (alpha, beta, or gamma) process occurred. | | Analyzes incomplete models of fission, fusion, and radioactive decay and describes the results of each in terms of energy and products. | |

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| **PS2. Motion and Stability: Forces and Interactions** | | |
| **Partially Meeting Expectations**  ***On MCAS, a student at this level:*** | **Meeting Expectations**  ***On MCAS, a student at this level:*** | **Exceeding Expectations**  ***On MCAS, a student at this level:*** |
| Solves simple problems involving average speed, velocity, and acceleration.  Interprets a position vs. time graph to determine how far an object is from its starting location.  Interprets a scenario to determine the relative magnitude of a force.  Determines a net force using Newton’s 2nd law or by interpreting a free-body force diagram with two colinear forces.  Solves simple momentum and change in momentum (impulse) problems.  Interprets a model to determine whether two charges will attract or repel.  Describes how the magnitude of charges or the distance between charges affects electrostatic forces.  Describes how the masses of objects or the distance between objects affects gravitational forces.    Solves simple problems using Ohm’s Law when given two of the three variables (current, voltage, or resistance).  Identifies a schematic symbol for a simple circuit element and generally explains its role. | Solves problems involving acceleration, velocity, and change in position for a given time.  Analyzes motion graphs and their slopes to solve for and compare speeds, velocities, accelerations, and net forces.  Analyzes free-body force diagrams to determine which diagram represents a given system.  Solves for an unknown force by interpreting a model with two or more colinear forces when also given the net force.  Solves for the total momentum or change in momentum of a system.  Interprets a model to determine the direction an object will move after a collision.  Compares the magnitude and the direction of the forces that two objects exert on each other when they collide.  Compares models of pairs of masses or charges to order the magnitude of the gravitational or electrostatic forces.  Completes a model to represent electrostatic forces between charges.  Interprets a model to support a claim that an electric current produces a magnetic field or a claim that a changing magnetic field produces an electric current.  Describes how a change to a circuit affects current, voltage, or resistance.  Interprets a series circuit diagram with several circuit elements and solves for current, resistance, or voltage.  Interprets simple series or parallel circuit diagrams and explains which circuit elements will have the same current through them and which elements will have the same voltage drop across them. | Solves a motion problem by analyzing a model and then applying information from the model to solve for velocity or acceleration.  Explains how changing a system would affect an object’s velocity or acceleration.  Solves force problems by analyzing motion graphs and then models the forces involved using free-body force diagrams.  Analyzes a motion graph and then applies information from the graph to solve a momentum problem.  Describes that the total momentum of a system stays the same during a collision and solves for velocity or mass by applying conservation of momentum.  Explains how forces involved in a collision can be minimized.  Applies proportional reasoning to solve for how changing the distance between a pair of masses or a pair of charges affects the forces between the pair.  Applies proportional reasoning when multiple variables are changed to determine the forces between a pair of masses or charges.  Describes the effect of a gravitational or electrostatic force between two objects by solving for the force using either Newton’s law of gravitation or Coulomb’s law.  Explains that the interplay of electric and magnetic forces is the basis for electric motors and generators.  Analyzes series and parallel circuit diagrams with multiple circuit elements to compare and solve for current, voltage, and resistance. |

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| **PS3. Energy** | | |
| **Partially Meeting Expectations**  ***On MCAS, a student at this level:*** | **Meeting Expectations**  ***On MCAS, a student at this level:*** | **Exceeding Expectations**  ***On MCAS, a student at this level:*** |
| Solves for gravitational potential energy when given the height and mass of an object.  Describes an example of energy being converted from one form to another.  Interprets a model to determine a location where gravitational potential energy or kinetic energy is either the greatest or the least.  Solves simple problems for work when given the force and distance.  Solves efficiency problems when given energy in and energy out.  Interprets a simple graph to determine when thermal equilibrium is reached.  Recognizes that heat flows from a substance with a higher temperature to a substance with a lower temperature.  Recognizes the relationship between average molecular motion and temperature.  Describes the relative amount of force between two magnets as they are moved closer together or farther apart. | Analyzes a model of a system and then uses information from the model to calculate kinetic energy or gravitational potential energy.  Describes that energy cannot be created or destroyed, but energy may enter or leave a system.  Compares an object’s kinetic energy at two positions or an object’s potential energy at two positions when mechanical energy is conserved.  Analyzes data to solve mechanical energy problems.  Interprets a model of a device and explains how to increase the efficiency of the device.  Explains how the temperatures in two substances change as the substances reach thermal equilibrium.  Describes how changing the mass of a substance affects the energy required to cause a temperature change.  Analyzes electric field diagrams and determines the direction and relative strength of the electric field around two charges.  Explains how the energy stored in a field between two magnets or two charges changes when they are moved different distances apart. | Constructs an explanation for how kinetic energy and potential energy change over time in a given model.  Explains how the mechanical energy of a system can change, due to work being done on the system by a force, while maintaining the law of conservation of energy.  Solves complex work problems, including first solving for initial and final mechanical energy.  Analyzes a graph to compare the energy efficiency of multiple devices.  Explains how the average molecular motion of molecules in two substances changes as the substances reach thermal equilibrium, and how energy is conserved in a system as thermal equilibrium is reached.  Analyzes a model and solves problems for the amount of heat transferred in a system, the specific heat of a substance, or the initial or final temperature of a substance.  Interprets a model to describe the motion of a freely moving charged particle and the energy stored in the field between two charged particles. |

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| **PS4. Waves and Their Applications in Technologies for Information Transfer** | | |
| **Partially Meeting Expectations**  ***On MCAS, a student at this level:*** | **Meeting Expectations**  ***On MCAS, a student at this level:*** | **Exceeding Expectations**  ***On MCAS, a student at this level:*** |
| Solves simple wave problems for velocity/speed, wavelength, or frequency when given two of these three variables.  Identifies the wavelength of a wave on a model.  Solves simple wave problems involving period and frequency when given one of the variables.  Identifies differences between mechanical waves and electromagnetic waves.  Recognizes the relationships between frequency and energy of a light particle.  Identifies evidence of light behaving like a wave or light behaving like a particle.  Interprets simple models of the photoelectric effect.  Interprets simple models of common wave behaviors, including resonance, diffraction, refraction, and interference. | Analyzes data to determine additional information needed to solve wave problems.  Describes how the particles in a medium move when a longitudinal or transverse wave travels through the medium.  Describes several properties of mechanical waves and electromagnetic waves.  Compares electromagnetic radiation in terms of frequency, energy, and wavelength.  Analyzes a model and explains the causes of resonance and refraction.  Analyzes a model of a technology or device and describes how wave behaviors or the photoelectric effect are used in the technology or device. | Analyzes models of waves and uses information from the models to solve problems.  Interprets a graph with relative speeds of mechanical waves to determine the states of matter of various media.  Constructs an explanation with evidence about how light can behave like a wave and how it can behave like a particle.  Explains the relationship between photon energy and the electrons ejected by the photoelectric effect.  Analyzes a model of constructive and destructive interference and determines the amplitude of a wave pulse that results from the interference.  Analyzes how a technology or device uses waves and describes how changing the properties of the waves would influence the device. |