Example Proficiency Scale: MS-PS-1.2 Chemical Reactions

Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of chemical reactions to predict chemical or physical changes expected during a specific reaction. Examples may include: – Change in reactant from elements in the same group – Lab using semi-familiar reactants to predict an outcome – Oxidization of Statue of Liberty – Gold penny lab – Handwarmer lab
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Analyze data about pure substances (element/compound) for similarities, differences, and patterns. ● Interpret the changes in data (e.g., density, melting point, boiling point, solubility, flammability, temperature, and odor) to determine if a chemical reaction has occurred.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as chemical properties, physical properties, chemical changes, physical changes, and chemical reaction. ● Explain the differences between chemical and physical properties. ● Explain the differences between chemical and physical changes. ● Recognize types of evidence that a chemical reaction has occurred. ● Identify that some chemical reactions release energy and others store energy. *(MS-PS-1.6)*
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-1.3 Natural and Synthetic Materials

Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Describe positive and negative impacts, due to the ways that humans use synthetic materials. Examples may include: – Recognize and recall specific vocabulary such as natural, synthetic, and chemical reaction – Recognize that some chemicals are made of single, small units and some are made from multiple, complex units (monomer vs. polymer) – Compare and contrast natural and synthetic materials – Recognize that chemical reactions allow us to derive synthetic materials from natural materials
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Construct an explanation to describe: ○ the relationship between natural materials and the synthetic materials that are derived from them, ○ examples of natural materials that are used to produce synthetic materials, and ○ how the structure of a natural material, and the synthetic material derived from it, impacts the function of those materials
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as natural, synthetic, and chemical reaction ● Recognize that some chemicals are made of single, small units and some are made from multiple, complex units (monomer vs. polymer) ● Compare and contrast natural and synthetic materials ● Recognize that chemical reactions allow us to derive synthetic materials from natural materials ● Recognize and recall specific vocabulary such as chemical properties, physical
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-1.4 States of Matter

Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of particle motion to explain a novel situation. Examples may include: – Explore differences in amounts of thermal energy and/or pressure needed to change various substances into different states of matter. – Explain the difference between water's phase diagram and Dry Ice's phase diagram. – Baking at different altitudes. – Pressure affects geothermal boiling point.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Develop a model(s) based on adding or removing thermal energy to predict and describe: ○ changes to particle motion, ○ changes to temperature, and ○ changes to states of matter. ● Use a model to summarize relationships: ○ between temperature and states of matter ○ between pressure and temperature.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as thermal energy, temperature, heat, pressure, kinetic energy, solid, liquid, and gas. ● Describe the relative motion (kinetic energy) of particles in solids, liquids and gases. ● Identify the changes to state of matter for melting, evaporation, condensation, and freezing.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-1.5 Conservation of Mass

Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus matter is conserved.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Use a model to explain a novel situation involving a chemical reaction to demonstrate the Law of Conservation of Mass. Examples may include: – Determining an unknown product in balanced chemical equations, given stating mass – Model to explain why the mass is different in an open system vs. a closed system (baking soda + vinegar)
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Develop a model of a chemical reaction to display conservation of mass (could involve a written equation with symbols or a drawn/physical representation). ● Use the model to describe how mass is conserved.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as reactants, products, balance, conservation, atom, molecule/compound, and chemical reaction. ● Identify the number of each type of atom in the reactants and products of a reaction (use coefficients and subscripts properly for counting atoms). ● Identify if mass is conserved in a chemical reaction (Law of Conservation of Mass). ● Recognize that all matter has mass.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-2.1 Newton's 3rd Law

Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of Newton's Third Law to a novel situation. Examples may include: – Design a solution to a novel situation. – Evaluate an existing design based on constraints and criteria. – Egg Lab with new constraints – Safely landing a rover on another planet – Professional football helmet design
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Given a scenario of two objects colliding, student will design a solution to include: ○ components in the system that are involved in the collision, ○ the forces exerted by the objects, ○ explanation of Newton's 3rd Law, and ○ description of criteria and constraints of the solution.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as force, mass, velocity, momentum, action, reaction, and acceleration. ● Summarize Newton's 3rd law. ● Explain what happens in collisions with: ○ same masses, both moving, ○ different masses, both moving, and ○ moving, stationary objects.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-2.2 Newton's 1st and 2nd Laws

Plan and conduct an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of Newton's 1st and 2nd laws to modify experimental design to include additional constraints (i.e., friction and air resistance) Examples may include: – Terminal velocity – Buoyancy – Catapult activity/analysis
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Plan an investigation regarding a change in an object's motion to include: ○ total forces acting on the object, and ○ the mass of the object. ● Conduct the investigation and gather evidence for the following scenarios: ○ motion of the object, ○ balanced forces (sum of forces = 0), and ○ unbalanced forces (sum of forces ≠ 0).
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as inertia, force, unbalanced forces, balanced forces, sum of forces, and mass. ● Summarize Newton's 1st and 2nd Laws. ● Compare and contrast balanced and unbalanced forces. ● Describe how a change in motion is affected by: ○ balanced forces, ○ unbalanced forces, and ○ different masses.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-2.5 Forces at a Distance and Fields

Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of fields and forces to evaluate a novel experimental design. Examples may include: – Evaluate the experimental design about forces at a distance involved a real-world situation (i.e., sharks hunting, bees navigating). – Evaluate an experimental design about Earth's magnetic field.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Conduct an investigation involving objects interacting at a distance to provide evidence about: ○ fields that exist, ○ cause and effect relationship between 2 or more objects, and ○ relationships between fields and forces. ● Evaluate the experiment and data to determine validity of investigation.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as forces, fields, attract, repel, variables, experimental control, magnetism, and gravity. ● Identify non-contact forces: ○ Gravity is an attractive force depending on mass. *(MS-PS-2.4)* ○ Electric attractive or repulsive depending on charge. ○ Magnetic attractive or repulsive depending on poles. ● Identify that fields vary in strength. *(MS-PS-2.3)* ● Explain the process of experimental design: independent variables, dependent variables, data collection, redesigning, and constraints.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-3.1 Kinetic Energy

Construct and interpret graphical displays of data to describe the relationship of kinetic energy to the mass of an object and to the speed of an object.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Predict what would happen to kinetic energy if both mass and speed are changed. Examples may include: – If mass and speed both double – Cutting mass in half and doubling speed – Tripling speed
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Construct a graph showing: ○ the linear proportional relationship between mass and kinetic energy, and ○ the nonlinear proportional relationship between speed and kinetic energy. ● Use a graph to explain why doubling mass results in doubling the kinetic energy. ● Use a graph to explain why doubling speed results in 4 times the kinetic energy. *NOTE: Focus is on the general relationship between KE, mass, and speed.*
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as mass, speed, and kinetic energy. ● Identify a linear and nonlinear graph. ● Identify how the mass and speed affect the kinetic energy of an object. *NOTE: KE increases as mass and/or speed increases. KE decreases as mass and/or speed decreases.*
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-3.2 Potential Energy

Develop a model to describe the relationship between the relative positions of objects interacting at a distance and the relative potential energy in a system.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of forces between objects interacting to predict changes in relative potential energy in a novel situation. Examples may include: – Different planet – Roller Coaster
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Develop a model of two objects in a system interacting at a distance that includes: ○ the relationship between potential energy and changes in distance, and ○ how a force (big or small) can change the potential energy.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as potential energy, force, field, electric, magnetic, gravitational, energy. ● Identify the forces through which two objects interact. ● Identify potential energy based on the position of two objects.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-3.3 Thermal Energy Transfer

Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of thermal energy transfer to predict the changes in results if the situation or device were altered. Examples may include: – Temperature swings in extreme environments (Moon, Mercury, Antarctica) – Improvements to device – Changes to experimental conditions (more heat applied)
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Design a device to minimize or maximize thermal energy transfer. ○ Include criteria and constraints. ● Construct the device. ● Test the device to determine effectiveness based on success criteria (i.e., mass lost, rate of temperature change). ● Describe the flow of thermal energy in the experiment.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as heat transfer, conductivity, insulation, constraint, criteria, equilibrium, any kinetic energy ● Recall that thermal energy moves from hotter regions or objects to colder ones. ● Recognize the main ways that energy is transferred (conduction, convection, radiation) ● Identify differences between temperature, thermal energy, and heat. ● When temperature changes, identify how state of matter, mass, and/or average kinetic energy changes. *(MS-PS-3.4)*
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-3.5 Kinetic Energy Transfer

Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of kinetic energy to predict how energy will be transferred in a novel situation. Examples may include: – Ancient civilizations moving heavy objects – Landslides, earthquakes – Spacecraft reentry
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Construct and present an argument explaining the ideas that: ○ when kinetic energy changes, energy is transferred to or from that object, and ○ there is a change in observable features before and after an interaction (i.e., motion, temperature, sound). ● Student evidence includes: ○ the different forms of energy transferred, and ○ reasoning that connects to argument.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as kinetic energy, energy transfer, friction, and Law of Conservation of Energy. ● Explain the basic idea behind the Law of Conservation of Energy. ● Identify observable features (i.e., motion, temperature, sound) before and after an interaction.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-4.2 Wave Behaviors

Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply knowledge of wave interactions with a medium to solve a novel problem or mystery. Examples may include: – Predict wave behavior with a new substance or situation. – Solve a mystery or phenomenon related to wave behavior.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Draw or build a model of a wave interacting with a substance. ● Use a model to describe: ○ the interaction of the wave and the substance (i.e., reflection, absorption, transmission). ○ changes in the wave structure based on the interaction. (i.e., amplitude, frequency, and wave speed).
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as wavelength, frequency, amplitude, crest, trough, reflection, absorption, and transmission. ● Draw or build a model of a wave. ● Identify waves as repeating patterns. ● Identify the three ways that waves could interact with materials (i.e., reflection, absorption, transmission). ● Identify how the energy of a wave is related to the amplitude of a wave. *(MS-PS-4.1)*
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.

Example Proficiency Scale: MS-PS-4.3 Digital Signals

Present qualitative scientific and technical information to support the claim that digitized signals (0's and 1's) can be used to encode and transmit information.

Grade: 8 Physical Science

Score 4.0	In addition to score 3.0 performance, in-depth inferences and applications that go beyond what was taught. ● Apply principles of information transmission to compare benefits and limitations of using digital signal technologies. Examples may include: – Compare and contrast analog and digital technologies. – Analysis of digital vs analog music, pictures, video.
3.5	In addition to score 3.0 performance, in-depth inferences and applications with partial success.
Score 3.0	Target Goal/Learning Intention: ● Obtain, evaluate, and communicate information about digital signals including: ○ how the structure of the signal encodes information, ○ how information is transmitted, and ○ the reliability.
2.5	No major errors or omissions regarding 2.0 content, skills and/or processes and partial success of 3.0 content, skills and/or processes.
Score 2.0	Simpler Goal/Intention: ● Recognize and recall specific vocabulary such as digital, analog, encode, transmit, signal, and wave. ● Identify the wavelength, frequency, and amplitude of a wave. ● Identify examples of ways in which waves can be used for communication purposes. ● Model how waves transmit information.
1.5	Partial demonstration of the 2.0 content, processes and/or skills but major errors or omissions regarding the 3.0 content, processes and/or skills.
Score 1.0	With help, partial demonstration of the 2.0 and 3.0 content, processes and/or skills.
0.5	With help, partial demonstration of the 2.0 content, processes and/or skills but not the 3.0 content, processes and/or skills.
Score 0.0	Even with help, no demonstration of content, processes and/or skills.