

9-12 Physical Science Learning Targets

(Analysis) 9-12.P.1.1. Students are able to use the Periodic Table to determine the atomic structure of elements, valence number, family relationships, and regions (metals, nonmetals, and metalloids).

I can use the periodic table to find information about:

- the # of protons, electrons and neutrons and where they are located within the atom (atomic structure of elements),
- the # of outermost electrons in an atom (valence number),
- groups of elements with similar properties found in the same vertical column on the periodic table (family relationships)
- areas of elements (regions).

(Comprehension) 9-12.P.1.2. Students are able to describe ways that atoms combine.

I can tell in words or numbers (describe) how covalent, ionic and metallic bonds form (ways) based upon whether electrons are shared and/or transferred between atoms (atoms combine).

(Application) 9-12.P.1.3. Students are able to predict whether reactions will speed up or slow down as conditions change.

I can use information to make a best guess (predict) about whether a chemical change in a substance (reaction) will speed up or slow down as:

- temperature changes,
- size of the particles changes,
- density of the particles changes
- catalysts (particles that affect the reaction without being altered themselves) are added.

(Application) 9-12.P.1.4. Students are able to balance chemical equations by applying the Law of Conservation of Matter.

I can make both sides of chemical equations equal (balance) by using what I know about how the total mass of reactants, starting materials, is equal to total mass of products, ending materials, in a chemical reaction (Law of Conservation of Matter).

(Comprehension) 9-12.P.1.5. Students are able to distinguish among chemical, physical, and nuclear changes.

I can tell the differences (distinguish) among reactions that:

- form new substances with different properties (chemical change),
- change the form of a substance but not its chemical content (physical change)
- cause the nucleus of an atom to gain particles, fusion, or lose particles, fission (nuclear change).

(Analysis) 9-12.P.2.1. Students are able to apply concepts of distance and time to the quantitative relationships of motion using appropriate mathematical formulas, equations, and units.

I can use what I know (apply) about concepts of distance and time to find numerical values using formulas/equations and graphs (quantitative relationships of motion) for:

- speed (change in distance/change in time) using appropriate metric units,
- velocity (speed with direction $V = \Delta D / \Delta t$) using appropriate metric units
- acceleration (average $A_{avg} = \Delta V / \Delta t$ and instant $A = V_2 - V_1 / t$) using appropriate metric units.

(Application) 9-12.P.2.2. Students are able to predict motion of an object using Newton's Laws.

I can use information to make a best guess (predict) about the movement of anything with mass, including momentum (motion of an object) using the three laws that govern all movements of objects: Law of Inertia, Force = mass x acceleration, Action/Reaction (Newton's Laws).

(Application) 9-12.P.2.3. Students are able to relate concepts of force, distance, and time to the quantitative relationships of work, energy, and power.

I can tell in words or numbers the connections among (relate) the concept of a push or pull (force), distance and time using numerical terms (quantitative) that express the relationship of:

- distance covered multiplied by push or pull applied (work)
- the capacity to do work (energy)
- how fast work is done over a time period (power).

(Application) 9-12.P.3.1. Students are able to describe the relationships among potential energy, kinetic energy, and work as applied to the Law of Conservation of Energy.

I can use what I know about how energy is neither created nor destroyed in any chemical or physical changes (Law of Conservation of Energy) to tell in words and numbers (describe), the connections (relationships) among

- energy that is stored (potential energy)
- energy that is based on movement of matter (kinetic energy)
- energy that is transferred through motion (work).

(Comprehension) 9-12.P.3.2. Students are able to describe how characteristics of waves are related to one another.

I can tell in words or numbers (describe) how the frequency, wavelength, amplitude, speed and period (characteristics of waves) are related to one another.

(Application) 9-12.P.3.3. Students are able to describe electrical effects in terms of motion and concentrations of charged particles.

I can tell in words or numbers (describe) about magnetism, flow of electrons and attraction/repulsion of objects (electrical effects) in terms of:

- electrical current, resistance, static discharge (motion of charged particles),
- voltage, buildup of static charge (concentration of charged particles).