Physical Science Performance Level Descriptors

Limited

A student performing at the **Limited Level** demonstrates a minimal command of Ohio's Learning Standards for Physical Science. A student at this level has an emerging ability to demonstrate knowledge of the classification properties and interactions among matter, apply knowledge of conservation of energy, transfer and transformation of energy, and forces and motion to describe physical situations, utilizing graphs, diagrams, and equations, and demonstrate knowledge of the evolution and expansion of the universe.

A student at the **Limited Level** can:

- Given a phase change graph, identify the temperature of the melting and/or boiling point;
- Given elemental properties, classify elements in the same group;
- Given a chemical name for a compound, identify the elements involved;
- Recognize that electrons can be lost, gained, or shared when atoms bond;
- Given a chemical equation, identify the reactants and products;
- Calculate for gravitational potential energy and kinetic energy;
- Identify the portion of the electromagnetic spectrum that has the lowest frequency, wavelength, or energy;
- Recognize the properties of an object that affect absorption and radiation rates of thermal energy;
- Recognize that electrons flow through a circuit;
- Interpret a free-body diagram to identify normal and tension forces;
- Recall that interactive force pairs are equal in magnitude but act in opposite directions;
- Recognize that the universe is expanding;
- Recognize that galaxies moving away from Earth have an observed redshift;
- Recall that fusion occurs in stars;
- Recall that the Hertzsprung-Russell (HR) diagram provides information about stars.

Physical Science Performance Level Descriptors

Basic

A student performing at the **Basic Level** demonstrates a partial command of Ohio's Learning Standards for Physical Science. A student at this level has a general ability to demonstrate knowledge of the classification properties and interactions among matter, apply knowledge of conservation of energy, transfer and transformation of energy, and forces and motion to describe physical situations, utilizing graphs, diagrams, and equations, and demonstrate knowledge of the evolution and expansion of the universe.

A student at the **Basic Level** can:

- Describe, using properties, the difference between homogenous and heterogeneous matter;
- Given a phase change graph, identify where the phase changes occur;
- Given data, determine values for various atomic properties (e.g., atomic number, mass number);
- Distinguish between the isotopes and ions of an element and describe properties of elements based on their position in the periodic table;
- Determine the chemical names of simple compounds given their formulas (or vice versa);
- Given a pair of elements, determine the formula of a compound between them and/or whether the bond would be covalent or ionic;
- Describe endothermic or exothermic reactions;
- Recognize when work is done on an object;
- Compare relative energies, frequencies and wavelengths of the different bands of the electromagnetic spectrum, including the colors of visible light;
- Explain the dissipations of energy from systems due to transformation into thermal energy;
- Describe the origin, motion and energy of electrons in circuits;
- Recall that interactive force pairs can never cancel each other;
- Interpret a free-body diagram to determine forces, including normal (for surfaces at any angle) and tension forces;
- For problems involving mass, weight and gravitational field strength, calculate one when given the other two;
- Calculate distance, displacement, average velocity, and acceleration based on graphical and tabular motion data;
- Identify information provided by a Hertzsprung-Russell diagram;
- Recall a major difference between nuclear fission and fusion.

Physical Science Performance Level Descriptors

Proficient

A student performing at the **Proficient Level** demonstrates an appropriate command of Ohio's Learning Standards for Physical Science. A student at this level has a consistent ability to demonstrate knowledge of the classification properties and interactions among matter, apply knowledge of conservation of energy, transfer and transformation of energy, and forces and motion to describe physical situations, utilizing graphs, diagrams, and equations, and demonstrate knowledge of the evolution and expansion of the universe.

A student at the **Proficient Level** can:

- Use one designated property (e.g., solubility, density, boiling/melting point) to separate a mixture;
- Interpret phase change graphs to identify changes in kinetic and/or potential energy;
- Create a diagram or model atoms, ions, isotopes, and various chemical bonds;
- Balance chemical equations;
- Describe properties of elements that lead to radioactive decay, interpret half-life graphs and produce a graph from half-life data;
- Given a real-world scenario, calculate values involving work or values involving conservation of energy in a closed system;
- Describe the characteristics and behaviors (e.g., superposition/interference, diffraction) of waves as a form of energy transfer;
- Compare radiant energy interactions between objects with differing characteristics that influence the rate of thermal absorption and emission (e.g., temperature, color, texture, exposed surface area in the system);
- Describe the relationships between voltage, current, and resistance in circuits;
- Represent, analyze and interpret data from diagrams, graphs, charts, and tables related to position vs. time, velocity vs. time, acceleration, and motion;
- Calculate force, mass or acceleration using values drawn from tables, graphs and free-body diagrams;
- Identify or describe interactive force pairs, and compare their magnitudes and directions;
- Explain how redshift provides information about the distances of galaxies and how this can be used as evidence for the Big Bang model of the universe;
- Interpret a Hertzsprung-Russell diagram in terms of mass, luminosity, temperature, and evolutionary stages of the main sequence stars;
- Explain the role of fusion in stars in the formation of elements.

Physical Science Performance Level Descriptors

Accelerated

A student performing at the **Accelerated Level** demonstrates a strong command of Ohio's Learning Standards for Physical Science. A student at this level has a superior ability to demonstrate knowledge of the classification properties and interactions among matter, apply knowledge of conservation of energy, transfer and transformation of energy, and forces and motion to describe physical situations, utilizing graphs, diagrams, and equations, and demonstrate knowledge of the evolution and expansion of the universe.

A student at the **Accelerated Level** can:

- Predict how unknown elements react when given properties;
- Given an ionic formula with an unknown, identify ionic charge and/or the elemental group and its location on the periodic table (e.g., XF_2);
- Describe the changes in motion and relative position of particles when given data or graphs (e.g., phase change graphs);
- Given half-life data of radioactive elements, evaluate which elements are appropriate for various applications and justify this using evidence;
- Calculate gravitational potential energy when the reference point is not the ground or lowest level;
- Given a real-world scenario, calculate values involving both work and conservation of energy in a closed system;
- Create a model to visually represent diffraction, superposition, constructive and destructive interference, or a change in wavelength due to the Doppler effect;
- Given a real-world scenario, recommend specific design features that relate to thermal energy absorption and emission (e.g., temperature, color, texture, exposed surface area in the system);
- Explain observed changes in current and voltage in a circuit in terms of electrons and energy transfer;
- Design and/or evaluate a circuit to meet real-world conditions and constraints;
- In a real-world scenario, construct a free-body diagram using information from motion vs. time graphs (or vice versa);
- Given a real-world context, interpret position vs. time, velocity vs. time and/or motion data to create a scenario that describes possible forces responsible for the motion (or vice versa);
- Compare and interpret spectroscopic data indicating the Doppler shift of various galaxies to determine relative motion and distances.

Physical Science Performance Level Descriptors

Advanced

A student performing at the **Advanced Level** demonstrates a distinguished command of Ohio's Learning Standards for Physical Science. A student at this level has a sophisticated ability to demonstrate knowledge of the classification properties and interactions among matter, apply knowledge of conservation of energy, transfer and transformation of energy, and forces and motion to describe physical situations, utilizing graphs, diagrams, and equations, and demonstrate knowledge of the evolution and expansion of the universe.

A student at the **Advanced Level** can:

- Design a solution to a real-world problem involving mixtures that need to be separated based on more than one property (e.g., solubility, density, boiling/melting point);
- Plan an experiment to determine values related to energy transformation and energy transferred through work on a system;
- Design or improve a system that involves work and energy transformation that meets certain constraints (e.g., height, speed, force, displacement);
- Design or critique solutions to engineering problems involving forces and motion;
- Design an experiment to measure the velocity of objects in a real-world scenario;
- Design an experiment using dynamics to determine a specific force in a given system of forces (e.g., friction force from spring scale);
- Relate red and blue shift to relative galaxy motion and distance by constructing a shifted spectrum.