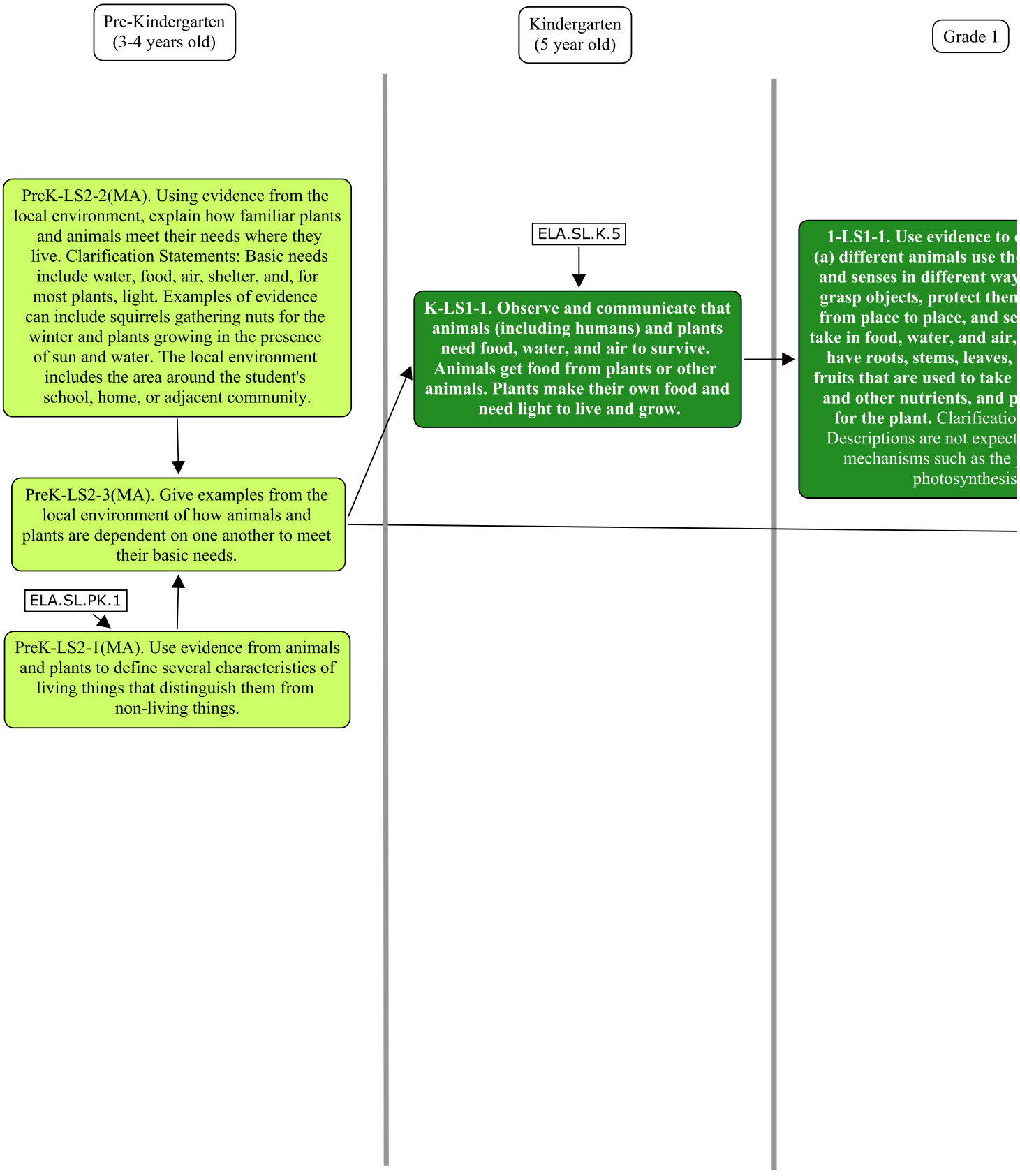
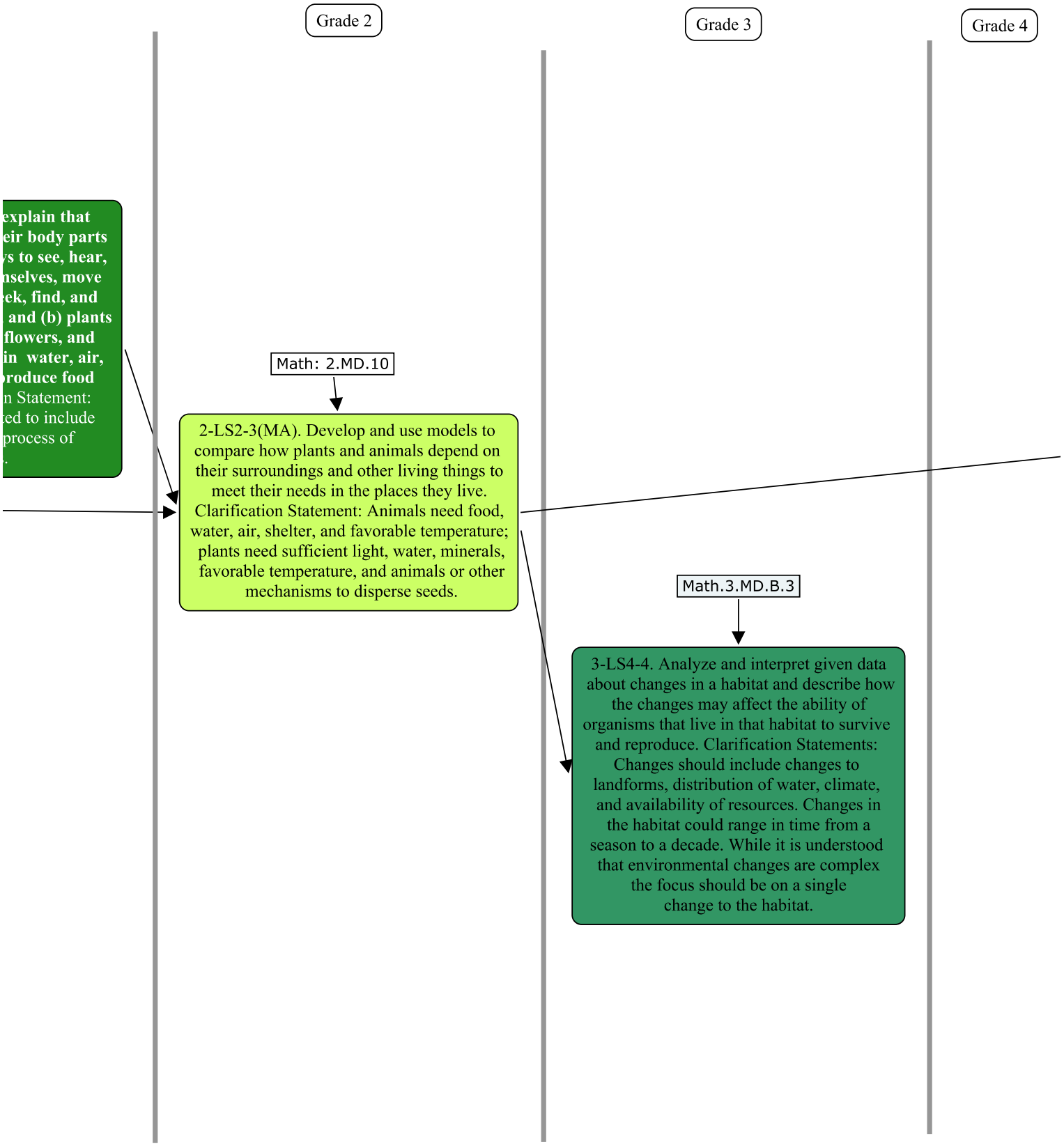

Pre-Kindergarten
(3-4 years old)
Kindergarten
(5 year old)
Grade 1
PreK-LS2-2(MA). Using evidence from the local environment, explain how familiar plants and animals meet their needs where they live. Clarification Statements: Basic needs include water, food, air, shelter, and, for most plants, light. Examples of evidence can include squirrels gathering nuts for the winter and plants growing in the presence of sun and water. The local environment includes the area around the student's school, home, or adjacent community.
PreK-LS2-3(MA). Give examples from the local environment of how animals and plants are dependent on one another to meet their basic needs.
ELA.SL.PK.1
PreK-LS2-1(MA). Use evidence from animals and plants to define several characteristics of living things that distinguish them from non-living things.
ELA.SL.K.5
K-LS1-1. Observe and communicate that animals (including humans) and plants need food, water, and air to survive. Animals get food from plants or other animals. Plants make their own food and need light to live and grow.
1-LS1-1. Use evidence to
(a) different animals use th
and senses in different way
grasp objects, protect them
from place to place, and se
take in food, water, and air,
have roots, stems, leaves,
fruits that are used to take
and other nutrients, and p
for the plant. Clarificatio
Descriptions are not expect
mechanisms such as the
photosynthesis

2016 MA STE Topic Strand Map: Flow of

Please direct comments, suggested edits, an
The standards and strand maps are avail
(*) denotes integration of technology/



Energy in Biological Systems (April 2016

d questions to: mathsciencetech@doe.mass.edu.
able at: www.doe.mass.edu/stem/review.html
engineering through a practice or core idea.

Grade 5

Grade 6

Grade 7

5-LS1-1. Ask testable questions about the process by which plants use air, water, and energy from sunlight to produce sugars and plant materials needed for growth and reproduction. State Assessment Boundary: The chemical formula or molecular details about the process of photosynthesis are not expected in state assessment.

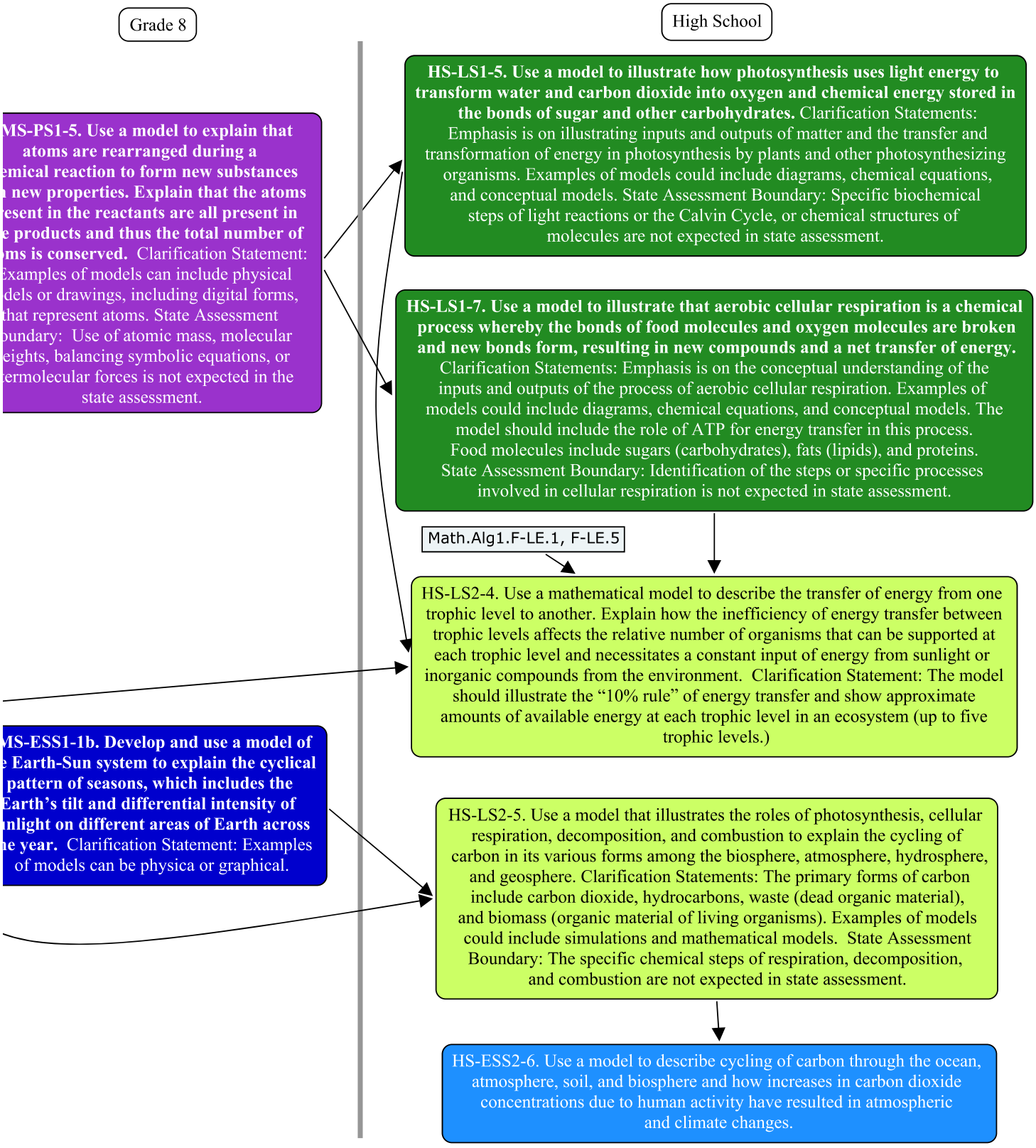
5-LS2-1. Develop a model to describe the movement of matter among producers, consumers, decomposers, and air, water, and soil in the environment to (a) show that plants produce sugars and plant materials, (b) show that animals can eat plants and/or other animals for food, and (c) show that some organisms, including fungi and bacteria, break down dead organisms and recycle some materials back to the air and soil. Clarification Statement: Emphasis is on matter moving throughout the ecosystem. State Assessment Boundary: Molecular explanations, or distinctions among primary, secondary, and tertiary consumers, are not expected in state assessment.

Math.4.MD.1

5-PS3-1. Use a model to describe that the food digest (a) contains energy that was once energy from the sun, and (b) provides energy and nutrients for life processes, including body repair, growth, motion, body warmth, and reproduction. Clarification Statement: Examples of models could include diagrams and flow charts. State Assessment Boundary: Details of cellular respiration, ATP, or molecular details of the processes of photosynthesis or respiration are not expected in state assessment.

5-LS2-2(MA). Compare at least two designs for a composter to determine which is most likely to encourage decomposition of materials.* Clarification Statement: Measures or evidence of decomposition should be on qualitative descriptions or comparisons.

7.MS-LS2-3. Develop a model to describe that matter and energy cycle among living and nonliving parts of an ecosystem and that both matter and energy are conserved through these processes. Clarification Statement: Cycling of matter should include the role of photosynthesis, cellular respiration, and decomposition, as well asand transfer among producers, consumers (primary, secondary, and tertiary), and decomposers. Models may include food webs and food chains. State Assessment Boundary: Cycling of specific atoms (such as carbon or oxygen), or the biochemical steps of photosynthesis, cellular respiration, and decomposition are not expected in state assessment.


Grade 8
High School
MS-PS1-5. Use a model to explain that atoms are rearranged during a emical reaction to form new substances new properties. Explain that the atoms esent in the reactants are all present in e products and thus the total number of oms is conserved. Clarification Statement: Examples of models can include physical dels or drawings, including digital forms, that represent atoms. State Assessment oundary: Use of atomic mass, molecular eights, balancing symbolic equations, or ermolecular forces is not expected in the state assessment.
HS-LS1-5. Use a model to illustrate how photosynthesis uses light energy to transform water and carbon dioxide into oxygen and chemical energy stored in the bonds of sugar and other carbohydrates. Clarification Statements: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models. State Assessment Boundary: Specific biochemical steps of light reactions or the Calvin Cycle, or chemical structures of molecules are not expected in state assessment.
HS-LS1-7. Use a model to illustrate that aerobic cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and new bonds form, resulting in new compounds and a net transfer of energy. Clarification Statements: Emphasis is on the conceptual understanding of the inputs and outputs of the process of aerobic cellular respiration. Examples of models could include diagrams, chemical equations, and conceptual models. The model should include the role of ATP for energy transfer in this process. Food molecules include sugars (carbohydrates), fats (lipids), and proteins. State Assessment Boundary: Identification of the steps or specific processes involved in cellular respiration is not expected in state assessment.
Math.Alg1.F-LE.1, F-LE.5
HS-LS2-4. Use a mathematical model to describe the transfer of energy from one trophic level to another. Explain how the inefficiency of energy transfer between trophic levels affects the relative number of organisms that can be supported at each trophic level and necessitates a constant input of energy from sunlight or inorganic compounds from the environment. Clarification Statement: The model should illustrate the “10% rule” of energy transfer and show approximate amounts of available energy at each trophic level in an ecosystem (up to five trophic levels.)
MS-ESS1-1b. Develop and use a model of e Earth-Sun system to explain the cyclical pattern of seasons, which includes the Earth’s tilt and differential intensity of nlight on different areas of Earth across e year. Clarification Statement: Examples of models can be physica or graphical.
HS-LS2-5. Use a model that illustrates the roles of photosynthesis, cellular respiration, decomposition, and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, hydrosphere, and geosphere. Clarification Statements: The primary forms of carbon include carbon dioxide, hydrocarbons, waste (dead organic material), and biomass (organic material of living organisms). Examples of models could include simulations and mathematical models. State Assessment Boundary: The specific chemical steps of respiration, decomposition, and combustion are not expected in state assessment.
HS-ESS2-6. Use a model to describe cycling of carbon through the ocean, atmosphere, soil, and biosphere and how increases in carbon dioxide concentrations due to human activity have resulted in atmospheric and climate changes.