Lynden High School – Integrated Course 1 (Possible 3 year map at end)

Unit 1

Driving question: *Could we ever run*

- ESS3.A Natural Resources
- LS2 .A Interdependent Relationships in
- PS3.A Definitions of Energy
- ESS2.D Weather and Climate

Unit 2

Driving question: *How does water chemistry affect food*

- PS1.A Structure and Properties of Matter
- PS1.B Chemical Reactions
- LS2 .B Matter and Energy Transfer in Ecosystems
- ESS2.C Role of Water in Earth Surface Processes
- PS3.C Relationship Between Energy and Forces

Unit 3

Driving question: *Can our food sustainability systems survive natural disasters?*

- ESS3.B Natural Hazards
- PS3.B Conservation of Energy and Energy
- LS1.C Matter and Energy Flow in Organisms

Story line

- Unit 1
  - Essential question: *Could we ever run out of food?*
  - DCI:
    - ESS3.A Natural resources (human)
    - LS2.A Interdependent relationships
    - PS3.A Energy
    - ESS2.D Weather and Climate
  - Storyline:
    - Human use of ecosystem resources/services and responsibilities. Humans are dependent on ecosystems for food and other ecosystem services. Humans have the capability to drastically alter ecosystems and a responsibility to ...
    - Interdependence of organisms and abiotic factors in ecosystem - ecosystems are composed of interacting biotic and abiotic factors and they have carrying capacities. Food is a limiting factor for organism/population growth. Acquiring food is affected by competition, predation, and disease.
    - Make sure to tie in energy as currency in ecosystem - Energy is the currency of ecosystems. Food provides chemical potential energy and molecules to living organisms. This energy is transferred between organisms. Other types of energy are necessary to produce food for humans.
    - Weather and climate drive food production.
  - Potential activities:
    - Wolf ecosystem dynamics in Washington (Mari has materials)
    - Extremophiles in Yellowstone - foreshadowing
    - Amount energy to produce a pound of beef - Case Bio
    - El Nino / La Nina

- Unit 2
  - Essential question: *How does water chemistry affect food production?*
  - DCI:
    - PS1.A Structure of Matter
    - PS1.B Chemical Reactions
    - LS2.B Cycles of Matter and Energy in Ecosystems
    - ESS2.C Role of Water in Earth's Surface Processes
    - PS3.C Relationship between Energy and Forces.
  - Story line:
    - The atomic structure of matter determines the characteristics of different substances. The periodic table to help us understand trends such as ionization and conductivity. These apply to ocean acidification and hydroponics.
    - Chemical reactions occur between molecules, causing new molecules to be produced. Many reactions in water involve carbon cycling, equilibrium and feedback.

        - The ocean is a complex system in which matter cycles and energy flows. Photosynthesis and respiration are central drivers.
        - Water on surface and underground - The water cycle, driven by energy from the sun and moved by gravity, allows us to grow food in some places and not in others. Water from terrestrial ecosystems eventually ends up in the ocean, due to gravity.
        - Large bodies of water, such as lakes and oceans, influence climate because of water's unique properties.
        - Relationship of energy and forces - Gravitational interactions between the moon and the Earth leads to tides, which in turn affect ocean acidification and food production.
    - Potential activities:
        - Hydroponics - Case Bio
        - Ocean acidification
        - Double ditch
        - Fast plants
- Unit 3
    - Essential question: *Can our food sustainability systems survive natural hazards?*
    - DCI:
        - ESS3.B Natural Hazards
        - PS3.B Conservation of Energy and Energy Transfer
        - LS1.C Organization for Matter and Energy Flow in Organisms
    - Story line:
        - Natural (disasters) lead to disruptions in these transfers of energy.
        - Energy can be transferred from one form to another, and is conserved during transformations.
        - Photosynthetic organisms take sunlight energy and store it in forms usable to themselves and other organisms. This energy is transferred between trophic levels in an ecosystem, with usable energy lost as heat between each level. Matter and energy are linked for many of these processes.

    - Potential activities
        - Missoula flood and Columbia basin
        - Damming of rivers and displacement
        - Photosynthesis/Respiration manipulation labs
        - Volcanoes
        - Calorimetry experiments

Unit 1: Could we ever run out of food?

Performance expectation: HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales

Learning Progression 1: LS2.A Interdependent Relationships in Ecosystems

Learning Target 1:

Ecosystems are composed of biotic and abiotic factors that interact in complex ways.

Success Criteria:

Formative Assessment

Learning Target 2:

Interactions between biotic factors include predation, competition, parasitism, and mutualism. These interactions affect populations of organisms differently.

Success Criteria:

Formative Assessment

Learning Target 3:

Some factors affect the size of a population based on the density of organisms in that population. Other factors affect the size of a population regardless of density.

Success Criteria:

Formative Assessment

Learning Target 4:

Density dependent and independent reduction factors reduce a population's size and overtime determine a population's carrying capacity.

Success Criteria:

Formative Assessment

BIG idea: Ecosystems are complex, dynamic, interconnected systems.

Driving Question: *How do invasive species affect ecosystem function and alter food production?*

Phenomenon: Local invasive species. Spotted wing drosophila. Starlings. Asian clams in Lake Whatcom. Eurasian ring-neck doves. Squirrels. Mill foil. Canary grass. Remember food production

Performance Expectation: ESS3-1Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

Unit 1: Could we ever run out of food?

Learning Progression 2: ESS3.A Natural Resources

Learning Target 1: Natural resources are found and used in many different forms (e.g. fresh water, fertile soils, fossil fuels, and minerals).

Success Criteria:

Formative Assessment

Learning Target 2: Availability of natural resources influences human development.

Success Criteria:

Formative Assessment

Learning Target 3: Costs and benefits are associated with resource use and extraction and are not always immediately obvious.

Success Criteria:

Formative Assessment

BIG idea: Resource availability has guided the development of human society. Yet all forms of resource extraction have associated costs.

Driving Question: *How has resource availability and extraction affected the Lynden community?*

Phenomena ideas: Comparing US economic progression to other countries.

Water issues in Whatcom County & Lynden. Whatcom conservation district. Rural watershed steward's program: mobile watershed.

Food costs and resource impacts.

Halo activity for Target 3 (Mari has activity)

Unit 1: Could we ever run out of food?

Learning Progression 3: PS3.A Definitions of Energy

Performance Expectation: HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects). HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

Learning Target 1: There are different types of energy (e.g. thermal, chemical, light, kinetic), but all come from interactions and motion at a microscopic level.

Success Criteria:

Formative Assessment

Learning Target 2: Energy arises from relative positions and interactions between microscopic particles.

Success Criteria:

Formative Assessment

Learning Target 3: Understanding energy at the microscopic level helps us understand its manifestation at the macroscopic level.

Success Criteria:

Formative Assessment

Learning Target 4: The storage of energy in molecules is chemical potential energy.

Success Criteria:

Formative Assessment

BIG idea: Energy is a measurable property of a system that depends on the motion and interactions of matter and radiation in that system.

Driving question: *How does preparing food in a kitchen show all the different forms of energy?*

Phenomena: Kitchen unit

Jean-Jacques is in charge

Unit 1: Could we ever run out of food?

Learning Progression 4: ESS2.D Weather and climate

Performance Expectation: HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

Learning Target 1: Distinguish between weather and climate

Success Criteria:

Formative Assessment

Learning Target 2: The sun's radiation is reflected, absorbed, stored, and redistributed in a variety of ways.

Success Criteria:

Formative Assessment

Learning Target 3: Historically, gradual atmospheric changes were due to plants and other organisms that captured CO_2 and released O_2.

Success Criteria:

Formative Assessment

Learning Target 4: Changes in the atmosphere due to human activity have increased CO_2 concentrations and thus affect climate.

Success Criteria:

Formative Assessment

BIG idea: Earth's climate is shaped by the sun's energy and changed by natural processes and human activity.

Driving question: *How do weather and climate drive food production?*

Phenomenon: The creeping threats of desertification and/or ocean acidification.

Performance Expectation: HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

Unit 2: How does water affect food production?

Learning Progression 5: PS1.A Structure and Properties of Matter

BIG idea: The microscopic structure of atoms determines their macroscopic properties.

Learning Target 1: Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons (and how we know this).

Success Criteria:

Formative Assessment

Learning Target 2: The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.

Success Criteria:

Formative Assessment

Learning Target 3: The structure and interactions of matter at the macroscopic scale are determined by electrical forces within and between atoms.

Success Criteria:

Formative Assessment

Learning Target 4: A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart.

Success Criteria:

Formative Assessment

Driving question: *What is food ultimately made of?*

Phenomena: Interactions curriculum (http://interactions.portal.concord.org

Use water molecule as an example

Performance Expectation: HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Unit 2: How does water affect food production?

Learning Progression 6: PS1.B Chemical Reactions

BIG idea: The characteristics of chemical reactions are determined by the types of collisions and the rearrangements between atoms.

Learning Target 1: Chemical reactions involve the collision of molecules and the rearrangement of atoms into new molecules (as opposed to physical change).

Success Criteria:
Formative Assessment

Learning Target 2: Changes in energy are associated with chemical reactions and determine why atoms would bond and separate.

Success Criteria:

Formative Assessment

Learning Target 3: The rate of a chemical reaction is influenced by a number of factors.

Success Criteria:

Formative Assessment

Learning Target 4: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions

Learning Target 5: In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present.

Success Criteria:

Formative Assessment

Driving question:
How are chemical reactions involved in food preparation?

Unit 2: How does water affect food production?

Performance Expectation: ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Learning Progression 8: ESS2.C Role of Water in Earth's Surface Processes

BIG idea: The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics.

Learning Target 1: Water's unique properties allow it to absorb, store, and release large amounts of energy (phase changes)

Success Criteria:

Formative Assessment

Learning Target 2: Water expands when it freezes and plays a role in mechanical weathering. Frozen water is less dense than liquid water.

Success Criteria:

Formative Assessment

Learning Target 3: Water can dissolve and transport materials such as debris, sediments, and organisms.

Success Criteria:

Formative Assessment

Learning Target 4: Water has the ability to lower viscosity and freezing points of material it is mixed with.

Success Criteria:

Formative Assessment

Driving Question: *How do the unique properties of water contribute to Earth processes?*

Phenomena:

Missoula flood (find the interactive website http://www.dnr.wa.gov/programs-and-services/geology/glaciers#the-missoula-floods.4)

Clean water column

Unit 2: How does water affect food production?

Learning Progression 9: PS3.C Relationship between Energy and Forces

Performance Expectation: HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction

Learning Target 1: Distinguish between energy and force.

Success Criteria:

Formative Assessment

Learning Target 2: Every force is mediated by a field, even everyday contact forces. Forces transfer energy through fields.

Success Criteria:

Formative Assessment

Learning Target 3: An energy field's strength varies with distance.

Success Criteria:

Formative Assessment

BIG idea: When two objects interacting through a field change relative position, the energy stored in the field is changed.

Driving question: *How do objects interact even if they are not touching*?

Phenomena: Back to Missoula flood. Waterfalls. Water dropped out of airplanes on burning forests.

Bending stream of water.

Unit 3: Can our food sustainability systems survive natural disasters?

Performance Expectation: HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

Learning Progression 10: ESS3.B Natural Hazards

Learning Target 1: Natural hazards include interior processes, surface processes, and severe weather.

Success Criteria:

Formative Assessment

Learning Target 2: Both natural resources and natural hazards vary in their distribution across the world.

Success Criteria:

Formative Assessment

Learning Target 3: Historical occurrences of natural hazards and availability of natural resources have shaped the distribution and migration of human populations.

Success Criteria:

Formative Assessment

Learning Target 4: Natural hazards and the current availability of natural resources can help us predict human population distribution and potential conflict.

Success Criteria:

Formative Assessment

BIG idea: Natural hazards and other geologic events have shaped and continue to shape the course of human history.

Performance Expectations: HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

Unit 3: Can our food sustainability systems survive natural disasters?

Learning Progression 11: PS3.B Conservation of Energy and Energy Transfer

BIG idea: Energy is conserved and transferred within systems.

Learning Target 1: The availability of energy limits what can occur in any system. Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system.

Success Criteria:

Formative Assessment

Learning Target 2: Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.

Success Criteria:

Formative Assessment

Learning Target 3: Energy can be quantified using mathematical equations. This allows the concept of conservation of energy to be used to predict and describe system behavior.

Success Criteria:

Formative Assessment

Learning Target 4: Uncontrolled systems always evolve toward more stable states— that is, toward more uniform energy distribution (entropy).

Success Criteria:

Formative Assessment

Performance Expectations: HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

Unit 3: Can our food sustainability systems survive natural disasters?

Learning Progression 12: LS1.C Matter and Energy Flow in Organisms

Learning Target 1: Life on Earth is carbon based, and there are many ways in which carbon, hydrogen, and oxygen (with some other elements) are combined to form molecules found in living things.

Success Criteria:

Formative Assessment

Learning Target 2: The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into carbohydrates plus released oxygen.

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Success Criteria:

Formative Assessment

Learning Target 3: The carbohydrates are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules, which are recombined in different ways to form products at different organizational scales.

Success Criteria:

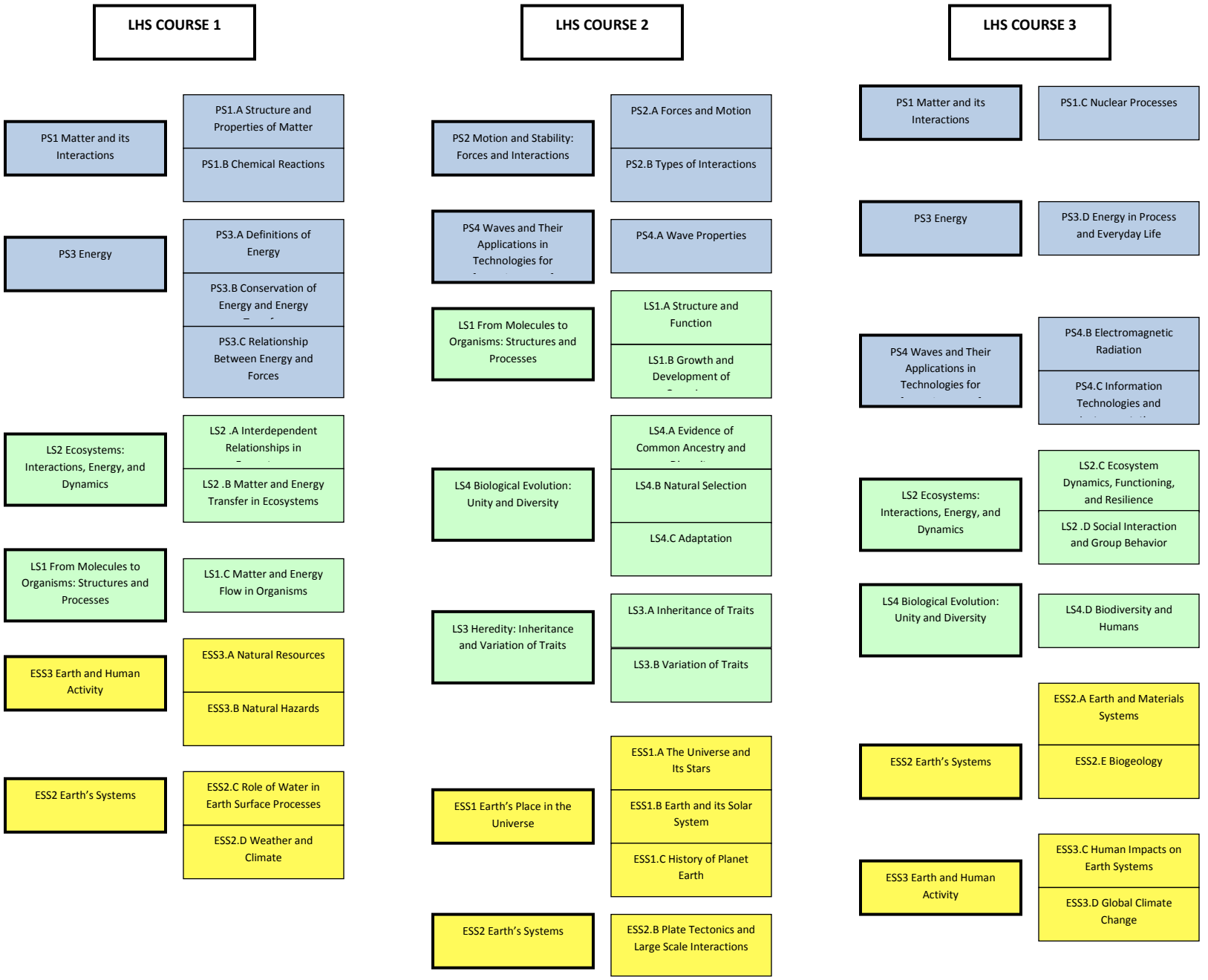
Formative Assessment

Learning Target 4: Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed. Cellular respiration also transfers the energy needed for life processes.

Success Criteria:

Formative Assessment

BIG idea: Matter and energy flow through organisms via cellular processes.


LHS COURSE 1
PS1 Matter and its Interactions
PS1.A Structure and Properties of Matter
PS1.B Chemical Reactions
PS3 Energy
PS3.A Definitions of Energy
PS3.B Conservation of Energy and Energy
PS3.C Relationship Between Energy and Forces
LS2 Ecosystems: Interactions, Energy, and Dynamics
LS2 .A Interdependent Relationships in
LS2 .B Matter and Energy Transfer in Ecosystems
LS1 From Molecules to Organisms: Structures and Processes
LS1.C Matter and Energy Flow in Organisms
ESS3 Earth and Human Activity
ESS3.A Natural Resources
ESS3.B Natural Hazards
ESS2 Earth's Systems
ESS2.C Role of Water in Earth Surface Processes
ESS2.D Weather and Climate
LHS COURSE 2
PS2 Motion and Stability: Forces and Interactions
PS2.A Forces and Motion
PS2.B Types of Interactions
PS4 Waves and Their Applications in Technologies for
PS4.A Wave Properties
LS1 From Molecules to Organisms: Structures and Processes
LS1.A Structure and Function
LS1.B Growth and Development of
LS4 Biological Evolution: Unity and Diversity
LS4.A Evidence of Common Ancestry and
LS4.B Natural Selection
LS4.C Adaptation
LS3 Heredity: Inheritance and Variation of Traits
LS3.A Inheritance of Traits
LS3.B Variation of Traits
ESS1 Earth's Place in the Universe
ESS1.A The Universe and Its Stars
ESS1.B Earth and its Solar System
ESS1.C History of Planet Earth
ESS2 Earth's Systems
ESS2.B Plate Tectonics and Large Scale Interactions
LHS COURSE 3
PS1 Matter and its Interactions
PS1.C Nuclear Processes
PS3 Energy
PS3.D Energy in Process and Everyday Life
PS4 Waves and Their Applications in Technologies for
PS4.B Electromagnetic Radiation
PS4.C Information Technologies and
LS2 Ecosystems: Interactions, Energy, and Dynamics
LS2.C Ecosystem Dynamics, Functioning, and Resilience
LS2 .D Social Interaction and Group Behavior
LS4 Biological Evolution: Unity and Diversity
LS4.D Biodiversity and Humans
ESS2 Earth's Systems
ESS2.A Earth and Materials Systems
ESS2.E Biogeology
ESS3 Earth and Human Activity
ESS3.C Human Impacts on Earth Systems
ESS3.D Global Climate Change