

Curriculum Instruction Council

Agenda

When: Wednesday, December 15, 2010, 4:30- 5:45 PM

Where: Board of Education, Community Room, Administration Building

Please put cell phones on vibrate or silent

*** A light snack will be served ***

Time	Purpose/Topic	Preparation
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Introduction:

4:30

4:35 Action, Consent Agenda Items:

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| <ul style="list-style-type: none"> • Approval of November 10, 2010 Minutes • FACS Course Name Change • FACS Course Elimination • Art Course elimination and clarifications | Review |
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4:40 Proposals:

- | | |
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| <ul style="list-style-type: none"> • Middle School Earth Science Pilot • High School Biology and Earth Science Proposal | Read |
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5:15 Process Items:

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| <ul style="list-style-type: none"> • District of National Distinction | None |
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5:45 Adjourn

Parent Meeting immediately following CIC in the Professional Development Center

**Portage Public Schools
Curriculum Instruction Council
MINUTES
Wednesday, November 10, 2010**

Denise Bresson called the meeting of the Curriculum Instruction Council to order at 4:30 p.m. in the Board Room of the Administration Building.

Members present: Brian Abbott, Dave Babcock, Joanne Beverage, Tish Boerigter, Jennifer Bonner, Julia Braganini, Denise Bresson, Tim Brown, Amy DiMaggio, John Dunlop, Shawn Felicijan, Dale Freeland, Christy Gaines, Tom Gorczyca, Cori Hane, Mike Huber, Amy Koffler, Angie Kuppler, Holly Marusek, Rita McKenzie, Jim Moiles, Lynn Montgomery, Paul Murray, Kelli Palsrok, Ric Perry, Karen Prater, Rhonda Rasmussen, Mary Rogers, Deb Ross, Tama Salisbury, Chuck Schira, Mary Scott, Rick Searing, Jerry Swoboda, Connie Therkildsen, Derrick Townsend, Heidi Turchan, Gail Van Daff, Randy VanAntwerp, Rhonda VanderVeen, Stephanie Wagner, Jeanna Walker, Helen Wynkoop, Lisa Buchinger-Aldrich

Members absent: Christine Berro, Nancy Clinton, Maggie Hills, Katie McDaniel, Julie Mellor, Shelley Rowson, Kelly Schultz, Dan Vomastek, Karen Witvoet

Shared positions not in attendance: Barb Burkholz, Renee Flynn,Carolynn Meyers, Karen Norton, Marcia Working

Welcome:

Welcome extended to these new parent members:

Julie Mellor	Parent Representative MBE
Katie McDaniel	Parent Representative WOD

Reports:

By-Laws

Ms. Bresson distributed the amended By-Laws resulting from a discussion from the previous CIC meeting.

Performance Series Assessment

Marty Witt shared a brief update on the Performance Series Assessment. Based upon a preview of the assessment and the time/logistics of administration, we are proposing that Portage Public Schools limit the purchase of Performance Series to 3rd and 5th grades Reading and Math, and 7th grade Reading, Math and Science. The total cost for the revised proposal is \$28,370. This would eliminate the Language Arts tests at 5th and 7th grades.

Science Program Review

Ms. Bresson reported on the Secondary Science program. A small focus group representing PCHS and PNHS has had open dialogue with discussions focusing on scheduling complications. Denise will distribute a survey based on concerns of the group. One recommendation resulting from group discussions is the addition of an 8th grade Honors Science option. A proposal will come forward in December for 8-12 grades. As a result the January CIC meeting will be moved up to January 12.

Action Items

It was noted that Stephanie Wagner seconded the motion to approve the Earth Science textbooks, and not Shawn Felicijan, as written in the October 2010 minutes.

- John Dunlop moved to approve the October 20, 2010 minutes as written, with name change noted.

Shawn Felicijan seconded.

Motion carried.

Proposals

- Kelli Palsrok proposed the FACS course name change from Child Development to Parenting: Rewards and Responsibilities.
- Kelli Palsrok proposed the FACS course elimination of Exploring Child Management.
- Denise Bresson, presenting on behalf of the high school Art teachers, proposed the elimination of several classes that are not meeting District fill levels.

There being no further business, the meeting was adjourned at 5:08 p.m.

**C.I.C. November 10, 2010
PROPOSAL Q & A**

QUESTIONS

ART

Q: Are the art classes not adequately filled due to changing overall enrollment? Or... a change in requirements and demand on student schedules? Are there other reasons?

A: All of our courses are offered based upon adequate enrollment, particularly electives. We have not surveyed students regarding their choices. We do know from teachers, students, and counselors that scheduling electives has been more difficult sure to the increasing demands of the Michigan Merit Curriculum.

**Portage Public Schools
CURRICULUM INSTRUCTION COUNCIL**

Proposal to Institute Pilot Course, Program, or Instructional Materials

Date: December 8, 2010 Proposed Starting Date of Pilot: September 2011

Proposer(s): Denise Bresson

Grade Level(s) & Curricular Area(s) Affected: 8th grade and HS Earth Science

Proposed Pilot Site(s): West Middle School

- Briefly describe the proposed pilot and the anticipated manner of its implementation.

The science staff proposes a pilot that would add an option at the Middle School level to enroll in 8th grade science/HS Earth Science 1.

There are two options for implementing this pilot:

1. To offer High School Earth Science as one of the student's semester elective options. Upon successful completion, students would be awarded 0.5 high school credit.
2. To offer it as a full year course and the curriculum would consist of compacted 8th grade science curriculum and the high school Earth Science course. Upon successful completion, students would be awarded 0.5 high school credit.

The science teachers and I prefer option 1, as it would allow students to complete all of the 8th grade science content expectations and, for students who excel in science, it would allow them to opt for the HS Earth Science course.

We recognize that there are logistical concerns with scheduling and are confident that we will be able to solve the scheduling and staffing issues so that we can implement option number 1.

- Give the rationale for the proposal, including the possible ramifications for current curriculum or instruction:

One of the Board of Education's goals was to ensure that parental concerns in science were adequately addressed. One of the concerns that we heard was the perception that Earth Science could be accomplished in middle school. This course would provide those students who excel in science the opportunity to earn high school credit while still in middle school. This option would also free up space in their high school schedule to enroll in higher-level science courses. Students would still be required to complete 3 credits of science and a total of 26 credits "after" entering high school.

The rationale for the pilot, versus full implementation, is to allow staff to monitor progress of students and feasibility of maintaining fidelity to the high school curriculum content expectations at the 8th grade level. This content is currently taught at the 10th grade level and requires prerequisite knowledge in the areas of chemistry, physics, and biology in order to learn the content "in depth". With the implementation of a 7th grade standardized science assessment, we are more confident with appropriate placement and can monitor that as well.

Additionally, students may currently leave the middle schools to access high school curriculum and this will continue to be an option for students at CMS and NMS during the pilot.

Throughout this pilot, staff will continue to study the rigor of our course offerings in secondary science and make recommendations for adjustments, as necessary.

- Identify anticipated student outcomes:

(See attached)

- Estimate anticipated cost of pilot and briefly describe needs:

Staffing/Professional development: (Cost) .17 staffing for one section of science instruction at approximately (\$11,000)

Needs: A highly qualified Earth Science Instructor to teach the course

Instructional Materials/Supplies/Equipment: (Cost) None if the HS full year Biology is approved

Needs:

Technology/Software: (Cost) None

Needs:

6/14/01

Earth Science High School Content Expectations



HSCE Code	Expectation
Standard E1	INQUIRY, REFLECTION, AND SOCIAL IMPLICATIONS
Statement E1.1	Scientific Inquiry Science is a way of understanding nature. Scientific research may begin by generating new scientific questions that can be answered through replicable scientific investigations that are logically developed and conducted systematically. Scientific conclusions and explanations result from careful analysis of empirical evidence and the use of logical reasoning. Some questions in science are addressed through indirect rather than direct observation, evaluating the consistency of new evidence with results predicted by models of natural processes. Results from investigations are communicated in reports that are scrutinized through a peer review process.
E1.1A	Generate new questions that can be investigated in the laboratory or field.
E1.1B	Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables, accuracy of data analysis, logic of argument, logic of experimental design, and/or the dependence on underlying assumptions.
E1.1C	Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision).
E1.1D	Identify patterns in data and relate them to theoretical models.
E1.1E	Describe a reason for a given conclusion using evidence from an investigation.
E1.1f	Predict what would happen if the variables, methods, or timing of an investigation were changed.
E1.1g	Based on empirical evidence, explain and critique the reasoning used to draw a scientific conclusion or explanation.
E1.1h	Design and conduct a systematic scientific investigation that tests a hypothesis. Draw conclusions from data presented in charts or tables.
E1.1i	Distinguish between scientific explanations that are regarded as current scientific consensus and the emerging questions that active researchers investigate.
Statement E1.2	Scientific Reflection and Social Implications The integrity of the scientific process depends on scientists and citizens understanding and respecting the “Nature of Science.” Openness to new ideas, skepticism, and honesty are attributes required for good scientific practice. Scientists must use logical reasoning during investigation design, analysis, conclusion, and communication. Science can produce critical insights on societal problems from a personal and local scale to a global scale. Science both aids in the development of technology and provides tools for assessing the costs, risks, and benefits of technological systems. Scientific conclusions and arguments play a role in personal choice and public policy decisions. New technology and scientific discoveries have had a major influence in shaping human history. Science and technology continue to offer diverse and significant career opportunities.
E1.2A	Critique whether or not specific questions can be answered through scientific investigations.
E1.2B	Identify and critique arguments about personal or societal issues based on scientific evidence.
E1.2C	Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.
E1.2D	Evaluate scientific explanations in a peer review process or discussion format.
E1.2E	Evaluate the future career and occupational prospects of science fields.
E1.2f	Critique solutions to problems, given criteria and scientific constraints.
E1.2g	Identify scientific tradeoffs in design decisions and choose among alternative solutions.
E1.2h	Describe the distinctions between scientific theories, laws, hypotheses, and observations.
E1.2i	Explain the progression of ideas and explanations that lead to science theories that are part of the current scientific consensus or core knowledge.

Earth Science High School Content Expectations



HSCE Code	Expectation
E1.2j	Apply science principles or scientific data to anticipate effects of technological design decisions.
E1.2k	Analyze how science and society interact from a historical, political, economic, or social perspective.
Standard E2	EARTH SYSTEMS
Statement E2.1	Earth Systems Overview The Earth is a system consisting of four major interacting components: geosphere (crust, mantle, and core), atmosphere (air), hydrosphere (water), and biosphere (the living part of Earth). Physical, chemical, and biological processes act within and among the four components on a wide range of time scales to continuously change Earth's crust, oceans, atmosphere, and living organisms. Earth elements move within and between the lithosphere, atmosphere, hydrosphere, and biosphere as part of geochemical cycles.
E2.1A	Explain why the Earth is essentially a closed system in terms of matter.
E2.1B	Analyze the interactions between the major systems (geosphere, atmosphere, hydrosphere, biosphere) that make up the Earth.
E2.1C	Explain, using specific examples, how a change in one system affects other Earth systems.
Statement E2.2	Energy in Earth Systems Energy in Earth systems can exist in a number of forms (e.g., thermal energy as heat in the Earth, chemical energy stored as fossil fuels, mechanical energy as delivered by tides) and can be transformed from one state to another and move from one reservoir to another. Movement of matter and its component elements, through and between Earth's systems, is driven by Earth's internal (radioactive decay and gravity) and external (Sun as primary) sources of energy. Thermal energy is transferred by radiation, convection, and conduction. Fossil fuels are derived from plants and animals of the past, are nonrenewable and, therefore, are limited in availability. All sources of energy for human consumption (e.g., solar, wind, nuclear, ethanol, hydrogen, geothermal, hydroelectric) have advantages and disadvantages.
E2.2A	Describe the Earth's principal sources of internal and external energy (e.g., radioactive decay, gravity, solar energy).
E2.2B	Identify differences in the origin and use of renewable (e.g., solar, wind, water, biomass) and nonrenewable (e.g., fossil fuels, nuclear [U-235]) sources of energy.
E2.2C	Describe natural processes in which heat transfer in the Earth occurs by conduction, convection, and radiation.
E2.2D	Identify the main sources of energy to the climate system.
E2.2e	Explain how energy changes form through Earth systems.
E2.2f	Explain how elements exist in different compounds and states as they move from one reservoir to another.
Statement E2.3	Biogeochemical Cycles The Earth is a system containing essentially a fixed amount of each stable chemical atom or element. Most elements can exist in several different states and chemical forms; they move within and between the geosphere, atmosphere, hydrosphere, and biosphere as part of the Earth system. The movements can be slow or rapid. Elements and compounds have significant impacts on the biosphere and have important impacts on human health.
E2.3A	Explain how carbon exists in different forms such as limestone (rock), carbon dioxide (gas), carbonic acid (water), and animals (life) within Earth systems and how those forms can be beneficial or harmful to humans.
E2.3b	Explain why small amounts of some chemical forms may be beneficial for life but are poisonous in large quantities (e.g., dead zone in the Gulf of Mexico, Lake Nyos in Africa, fluoride in drinking water).
E2.3c	Explain how the nitrogen cycle is part of the Earth system.
E2.3d	Explain how carbon moves through the Earth system (including the geosphere) and how it may benefit (e.g., improve soils for agriculture) or harm (e.g., act as a pollutant) society.
Statement E2.4	Resources and Human Impacts on Earth Systems The Earth provides resources (including minerals) that are used to sustain human affairs. The supply of non-renewable natural resources is limited and their extraction and use can release elements and compounds into Earth systems. They affect air and water quality, ecosystems, landscapes, and may have effects on long-term climate. Plans for land use and long-term development must include an understanding of the interactions between Earth systems and human activities.
E2.4A	Describe renewable and nonrenewable sources of energy for human consumption (electricity, fuels), compare their effects on the environment, and include overall costs and benefits.
E2.4B	Explain how the impact of human activities on the environment (e.g., deforestation, air pollution, coral reef destruction) can be understood through the analysis of interactions between the four Earth systems.
E2.4c	Explain ozone depletion in the stratosphere and methods to slow human activities to reduce ozone depletion.
E2.4d	Describe the life cycle of a product, including the resources, production, packaging, transportation, disposal, and pollution.

Earth Science High School Content Expectations



HSCE Code	Expectation
Standard E3	THE SOLID EARTH
Statement E3.p1	Landforms and Soils (prerequisite) Landforms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruptions, and deposition of sediments transported in rivers, streams, and lakes through watersheds. Destructive forces include weathering and erosion. The weathering of rocks and decomposed organic matter result in the formation of soils. (prerequisite)
E3.p1A	Explain the origin of Michigan landforms. Describe and identify surface features using maps and satellite images. (prerequisite)
E3.p1B	Explain how physical and chemical weathering leads to erosion and the formation of soils and sediments. (prerequisite)
E3.p1C	Describe how coastal features are formed by wave erosion and deposition. (prerequisite)
Statement E3.p2	Rocks and Minerals (prerequisite) Igneous, metamorphic, and sedimentary rocks are constantly forming and changing through various processes. As they do so, elements move through the geosphere. In addition to other geologic features, rocks and minerals are indicators of geologic and environmental conditions that existed in the past. (prerequisite)
E3.p2A	Identify common rock-forming minerals (quartz, feldspar, biotite, calcite, hornblende). (prerequisite)
E3.p2B	Identify common igneous (granite, basalt, andesite, obsidian, pumice), metamorphic (schist, gneiss, marble, slate, quartzite), and sedimentary (sandstone, limestone, shale, conglomerate) rocks and describe the processes that change one kind of rock to another. (prerequisite)
Statement E3.p3	Basic Plate Tectonics (prerequisite) Early evidence for the movement of continents was based on the similarities of coastlines, geology, faunal distributions, and paleoclimatological data across the Atlantic and Indian Oceans. In the 1960s, additional evidence from marine geophysical surveys, seismology, volcanology, and paleomagnetism resulted in the development of the theory of plate tectonics. (prerequisite)
E3.p3A	Describe geologic, paleontologic, and paleoclimatologic evidence that indicates Africa and South America were once part of a single continent.
E3.p3B	Describe the three types of plate boundaries (divergent, convergent, and transform) and geographic features associated with them (e.g., continental rifts and mid-ocean ridges, volcanic and island arcs, deep-sea trenches, transform faults).
E3.p3C	Describe the three major types of volcanoes (shield volcano, stratovolcano, and cinder cones) and their relationship to the Ring of Fire.
Statement E3.1	Advanced Rock Cycle Igneous, metamorphic, and sedimentary rocks are indicators of geologic and environmental conditions and processes that existed in the past. These include cooling and crystallization, weathering and erosion, sedimentation and lithification, and metamorphism. In some way, all of these processes are influenced by plate tectonics, and some are influenced by climate.
E3.1A	Discriminate between igneous, metamorphic, and sedimentary rocks and describe the processes that change one kind of rock into another.
E3.1B	Explain the relationship between the rock cycle and plate tectonics theory in regard to the origins of igneous, sedimentary, and metamorphic rocks.
E3.1c	Explain how the size and shape of grains in a sedimentary rock indicate the environment of formation (including climate) and deposition.
E3.1d	Explain how the crystal sizes of igneous rocks indicate the rate of cooling and whether the rock is extrusive or intrusive.
E3.1e	Explain how the texture (foliated, nonfoliated) of metamorphic rock can indicate whether it has experienced regional or contact metamorphism.
Statement E3.2	Interior of the Earth The Earth can also be subdivided into concentric layers based on their physical characteristics: (lithosphere, asthenosphere, lower mantle, outer core, and inner core). The crust and upper mantle compose the rigid lithosphere (plates) that moves over a "softer" asthenosphere (part of the upper mantle). The magnetic field of the Earth is generated in the outer core. The interior of the Earth cannot be directly sampled and must be modeled using data from seismology.
E3.2A	Describe the interior of the Earth (in terms of crust, mantle, and inner and outer cores) and where the magnetic field of the Earth is generated.
E3.2B	Explain how scientists infer that the Earth has interior layers with discernable properties using patterns of primary (P) and secondary (S) seismic wave arrivals.
E3.2C	Describe the differences between oceanic and continental crust (including density, age, composition).

Earth Science High School Content Expectations



HSCE Code	Expectation
E3.2d	Explain the uncertainties associated with models of the interior of the Earth and how these models are validated.
Statement E3.3	Plate Tectonics Theory The Earth's crust and upper mantle make up the lithosphere, which is broken into large mobile pieces called tectonic plates. The plates move at velocities in units of centimeters per year as measured using the global positioning system (GPS). Motion histories are determined with calculations that relate rate, time, and distance of offset geologic features. Oceanic plates are created at mid-ocean ridges by magmatic activity and cooled until they sink back into the Earth at subduction zones. At some localities, plates slide by each other. Mountain belts are formed both by continental collision and as a result of subduction. The outward flow of heat from Earth's interior provides the driving energy for plate tectonics.
E3.3A	Explain how plate tectonics accounts for the features and processes (sea floor spreading, mid-ocean ridges, subduction zones, earthquakes and volcanoes, mountain ranges) that occur on or near the Earth's surface.
E3.3B	Explain why tectonic plates move using the concept of heat flowing through mantle convection, coupled with the cooling and sinking of aging ocean plates that result from their increased density.
E3.3C	Describe the motion history of geologic features (e.g., plates, Hawaii) using equations relating rate, time, and distance.
E3.3d	Distinguish plate boundaries by the pattern of depth and magnitude of earthquakes.
E3.r3e	Predict the temperature distribution in the lithosphere as a function of distance from the mid-ocean ridge and how it relates to ocean depth. <i>(recommended)</i>
E3.r3f	Describe how the direction and rate of movement for the North American plate has affected the local climate over the last 600 million years. <i>(recommended)</i>
Statement E3.4	Earthquakes and Volcanoes Plate motions result in potentially catastrophic events (earthquakes, volcanoes, tsunamis, mass wasting) that affect humanity. The intensity of volcanic eruptions is controlled by the chemistry and properties of the magma. Earthquakes are the result of abrupt movements of the Earth. They generate energy in the form of body and surface waves.
E3.4A	Use the distribution of earthquakes and volcanoes to locate and determine the types of plate boundaries.
E3.4B	Describe how the sizes of earthquakes and volcanoes are measured or characterized.
E3.4C	Describe the effects of earthquakes and volcanic eruptions on humans.
E3.4d	Explain how the chemical composition of magmas relates to plate tectonics and affects the geometry, structure, and explosivity of volcanoes.
E3.4e	Explain how volcanoes change the atmosphere, hydrosphere, and other Earth systems.
E3.4f	Explain why fences are offset after an earthquake, using the elastic rebound theory.
Standard E4	THE FLUID EARTH
Statement E4.p1	Water Cycle (prerequisite) Water circulates through the crust and atmosphere and in oceans, rivers, glaciers, and ice caps and connects all of the Earth systems. Groundwater is a significant reservoir and source of freshwater on Earth. The recharge and movement of groundwater depends on porosity, permeability, and the shape of the water table. The movement of groundwater occurs over a long period time. Groundwater and surface water are often interconnected. <i>(prerequisite)</i>
E4.p1A	Describe that the water cycle includes evaporation, transpiration, condensation, precipitation, infiltration, surface runoff, groundwater, and absorption. <i>(prerequisite)</i>
E4.p1B	Analyze the flow of water between the elements of a watershed, including surface features (lakes, streams, rivers, wetlands) and groundwater. <i>(prerequisite)</i>
E4.p1C	Describe the river and stream types, features, and process including cycles of flooding, erosion, and deposition as they occur naturally and as they are impacted by land use decisions. <i>(prerequisite)</i>
E4.p1D	Explain the types, process, and beneficial functions of wetlands.
Statement E4.p2	Weather and the Atmosphere (prerequisite) The atmosphere is divided into layers defined by temperature. Clouds are indicators of weather. <i>(prerequisite)</i>
E4.p2A	Describe the composition and layers of the atmosphere. <i>(prerequisite)</i>
E4.p2B	Describe the difference between weather and climate. <i>(prerequisite)</i>
E4.p2C	Explain the differences between fog and dew formation and cloud formation. <i>(prerequisite)</i>
E4.p2D	Describe relative humidity in terms of the moisture content of the air and the moisture capacity of the air and how these depend on the temperature. <i>(prerequisite)</i>

Earth Science High School Content Expectations



HSCE Code	Expectation
E4.p2E	Describe conditions associated with frontal boundaries (cold, warm, stationary, and occluded). <i>(prerequisite)</i>
E4.p2F	Describe the characteristics and movement across North America of the major air masses and the jet stream. <i>(prerequisite)</i>
E4.p2G	Interpret a weather map and describe present weather conditions and predict changes in weather over 24 hours. <i>(prerequisite)</i>
E4.p2H	Explain the primary causes of seasons. <i>(prerequisite)</i>
E4.p2I	Identify major global wind belts (trade winds, prevailing westerlies, and polar easterlies) and that their vertical components control the global distribution of rainforests and deserts. <i>(prerequisite)</i>
Statement E4.p3	Glaciers <i>(prerequisite)</i> Glaciers are large bodies of ice that move under the influence of gravity. They form part of both the rock and water cycles. Glaciers and ice sheets have shaped the landscape of the Great Lakes region. Areas that have been occupied by ice sheets are depressed. When the ice sheet is removed, the region rebounds (see also climate change). <i>(prerequisite)</i>
E4.p3A	Describe how glaciers have affected the Michigan landscape and how the resulting landforms impact our state economy. <i>(prerequisite)</i>
E4.p3B	Explain what happens to the lithosphere when an ice sheet is removed. <i>(prerequisite)</i>
E4.p3C	Explain the formation of the Great Lakes. <i>(prerequisite)</i>
Statement E4.1	Hydrogeology Fresh water moves over time between the atmosphere, hydrosphere (surface water, wetlands, rivers, and glaciers), and geosphere (groundwater). Water resources are both critical to and greatly impacted by humans. Changes in water systems will impact quality, quantity, and movement of water. Natural surface water processes shape the landscape everywhere and are affected by human land use decisions.
E4.1A	Compare and contrast surface water systems (lakes, rivers, streams, wetlands) and groundwater in regard to their relative sizes as Earth's freshwater reservoirs and the dynamics of water movement (inputs and outputs, residence times, sustainability).
E4.1B	Explain the features and processes of groundwater systems and how the sustainability of North American aquifers has changed in recent history (e.g., the past 100 years) qualitatively using the concepts of recharge, residence time, inputs, and outputs.
E4.1C	Explain how water quality in both groundwater and surface systems is impacted by land use decisions.
Statement E4.2	Oceans and Climate Energy from the Sun and the rotation of the Earth control global atmospheric circulation. Oceans redistribute matter and energy around the Earth through currents, waves, and interaction with other Earth systems. Ocean currents are controlled by prevailing winds, changes in water density, ocean topography, and the shape and location of landmasses. Oceans and large lakes (e.g., Great Lakes) have a major effect on climate and weather because they are a source of moisture and a large reservoir of heat. Interactions between oceanic circulation and the atmosphere can affect regional climates throughout the world.
E4.2A	Describe the major causes for the ocean's surface and deep water currents, including the prevailing winds, the Coriolis effect, unequal heating of the earth, changes in water temperature and salinity in high latitudes, and basin shape.
E4.2B	Explain how interactions between the oceans and the atmosphere influence global and regional climate. Include the major concepts of heat transfer by ocean currents, thermohaline circulation, boundary currents, evaporation, precipitation, climatic zones, and the ocean as a major CO2 reservoir.
E4.2c	Explain the dynamics (including ocean-atmosphere interactions) of the El Niño-Southern Oscillation (ENSO) and its effect on continental climates.

Earth Science High School Content Expectations



HSCE Code	Expectation
E4.2d	Identify factors affecting seawater density and salinity and describe how density affects oceanic layering and currents.
E4.2e	Explain the differences between maritime and continental climates with regard to oceanic currents.
E4.2f	Explain how the Coriolis effect controls oceanic circulation.
E4.r2g	Explain how El Niño affects economies (e.g., in South America). <i>(recommended)</i>
Statement E4.3	Severe Weather Tornadoes, hurricanes, blizzards, and thunderstorms are severe weather phenomena that impact society and ecosystems. Hazards include downbursts (wind shear), strong winds, hail, lightning, heavy rain, and flooding. The movement of air in the atmosphere is due to differences in air density resulting from variations in temperature. Many weather conditions can be explained by fronts that occur when air masses meet.
E4.3A	Describe the various conditions of formation associated with severe weather (thunderstorms, tornadoes, hurricanes, floods, waves, and drought).
E4.3B	Describe the damage resulting from and the social impact of thunderstorms, tornadoes, hurricanes, and floods.
E4.3C	Describe severe weather and flood safety and mitigation.
E4.3D	Describe the seasonal variations in severe weather.
E4.3E	Describe conditions associated with frontal boundaries that result in severe weather (thunderstorms, tornadoes, and hurricanes).
E4.3F	Describe how mountains, frontal wedging (including dry lines), convection, and convergence form clouds and precipitation.
E4.3g	Explain the process of adiabatic cooling and adiabatic temperature changes to the formation of clouds.
Standard E5	THE EARTH IN SPACE AND TIME
Statement E5.p1	Sky Observations (prerequisite) Common sky observations (such as lunar phases) can be explained by the motion of solar system objects in regular and predictable patterns. Our galaxy, observable as the Milky Way, is composed of billions of stars, some of which have planetary systems. Seasons are a result of the tilt of the rotation axis of the Earth. The motions of the moon and Sun affect the phases of the moon and ocean tides. <i>(prerequisite)</i>
E5.p1A	Describe the motions of various celestial bodies and some effects of those motions. <i>(prerequisite)</i>
E5.p1B	Explain the primary cause of seasons. <i>(prerequisite)</i>
E5.p1C	Explain how a light year can be used as a distance unit. <i>(prerequisite)</i>
E5.p1D	Describe the position and motion of our solar system in our galaxy. <i>(prerequisite)</i>
Statement E5.1	The Earth in Space Scientific evidence indicates the universe is orderly in structure, finite, and contains all matter and energy. Information from the entire light spectrum tells us about the composition and motion of objects in the universe. Early in the history of the universe, matter clumped together by gravitational attraction to form stars and galaxies. According to the Big Bang theory, the universe has been continually expanding at an increasing rate since its formation about 13.7 billion years ago.
E5.1A	Describe the position and motion of our solar system in our galaxy and the overall scale, structure, and age of the universe.
E5.1b	Describe how the Big Bang theory accounts for the formation of the universe.
E5.1c	Explain how observations of the cosmic microwave background have helped determine the age of the universe.

Earth Science High School Content Expectations



HSCE Code	Expectation
E5.1d	Differentiate between the cosmological and Doppler red shift.
Statement E5.2	The Sun Stars, including the Sun, transform matter into energy in nuclear reactions. When hydrogen nuclei fuse to form helium, a small amount of matter is converted to energy. Solar energy is responsible for life processes and weather as well as phenomena on Earth. These and other processes in stars have led to the formation of all the other chemical elements.
E5.2A	Identify patterns in solar activities (sunspot cycle, solar flares, solar wind).
E5.2B	Relate events on the Sun to phenomena such as auroras, disruption of radio and satellite communications, and power grid disturbances.
E5.2C	Describe how nuclear fusion produces energy in the Sun.
E5.2D	Describe how nuclear fusion and other processes in stars have led to the formation of all the other chemical elements.
Statement E5.2x	Stellar Evolution Stars, including the Sun, transform matter into energy in nuclear reactions. When hydrogen nuclei fuse to form helium, a small amount of matter is converted to energy. These and other processes in stars have led to the formation of all the other chemical elements. There is a wide range of stellar objects of different sizes and temperatures. Stars have varying life histories based on these parameters.
E5.2e	Explain how the Hertzsprung-Russell (H-R) diagram can be used to deduce other parameters (distance).
E5.2f	Explain how you can infer the temperature, life span, and mass of a star from its color. Use the H-R diagram to explain the life cycles of stars.
E5.2g	Explain how the balance between fusion and gravity controls the evolution of a star (equilibrium).
E5.2h	Compare the evolution paths of low-moderate-, and high-mass stars using the H-R diagram.
Statement E5.3	Earth History and Geologic Time The solar system formed from a nebular cloud of dust and gas 4.6 Ga (billion years ago). The Earth has changed through time and has been affected by both catastrophic (e.g., earthquakes, meteorite impacts, volcanoes) and gradual geologic events (e.g., plate movements, mountain building) as well as the effects of biological evolution (formation of an oxygen atmosphere). Geologic time can be determined through both relative and absolute dating.
E5.3A	Explain how the solar system formed from a nebula of dust and gas in a spiral arm of the Milky Way Galaxy about 4.6 Ga (billion years ago).
E5.3B	Describe the process of radioactive decay and explain how radioactive elements are used to date the rocks that contain them.
E5.3C	Relate major events in the history of the Earth to the geologic time scale, including formation of the Earth, formation of an oxygen atmosphere, rise of life, Cretaceous-Tertiary (K-T) and Permian extinctions, and Pleistocene ice age.
E5.3D	Describe how index fossils can be used to determine time sequence.
Statement E5.3x	Geologic Dating Early methods of determining geologic time, such as the use of index fossils and stratigraphic principles, allowed for the relative dating of geological events. However, absolute dating was impossible until the discovery that certain radioactive isotopes in rocks have known decay rates, making it possible to determine how many years ago a given mineral or rock formed. Different kinds of radiometric dating techniques exist. Technique selection depends on the composition of the material to be dated, the age of the material, and the type of geologic event that affected the material.
E5.3e	Determine the approximate age of a sample, when given the half-life of a radioactive substance (in graph or tabular form) along with the ratio of daughter to parent substances present in the sample.
E5.3f	Explain why C-14 can be used to date a 40,000 year old tree but U-Pb cannot.
E5.3g	Identify a sequence of geologic events using relative age dating principles.
Statement E5.4	Climate Change Atmospheric gases trap solar energy that has been reradiated from the Earth's surface (the greenhouse effect). The Earth's climate has changed both gradually and catastrophically over geological and historical time frames due to

Earth Science High School Content Expectations



HSCE Code	Expectation
	complex interactions between many natural variables and events. The concentration of greenhouse gases (especially carbon dioxide) has increased due to human industrialization which has contributed to a rise in average global atmospheric temperatures and changes in the biosphere, atmosphere, and hydrosphere. Climates of the past are researched, usually using indirect indicators, to better understand and predict climate change.
E5.4A	Explain the natural mechanism of the greenhouse effect including comparisons of the major greenhouse gases (water vapor, carbon dioxide, methane, nitrous oxide, and ozone).
E5.4B	Describe natural mechanisms that could result in significant changes in climate (e.g., major volcanic eruptions, changes in sunlight received by the earth, meteorite impacts).
E5.4C	Analyze the empirical relationship between the emissions of carbon dioxide, atmospheric carbon dioxide levels and the average global temperature over the past 150 years.
E5.4D	Based on evidence of observable changes in recent history and climate change models, explain the consequences of warmer oceans (including the results of increased evaporation, shoreline and estuarine impacts, oceanic algae growth, and coral bleaching) and changing climatic zones (including the adaptive capacity of the biosphere).
E5.4e	Based on evidence from historical climate research (e.g., fossils, varves, ice core data) and climate change models, explain how the current melting of polar ice caps can impact the climatic system .
E5.4f	Describe geologic evidence that implies climates were significantly colder at times in the geologic record (e.g., geomorphology, striations, and fossils).
E5.4g	Compare and contrast the heat-trapping mechanisms of the major greenhouse gases resulting from emissions (carbon dioxide, methane, nitrous oxide, fluorocarbons) as well as their abundance and heat trapping capacity.
E5.r4h	Use oxygen isotope data to estimate paleotemperature. <i>(recommended)</i>
E5.r4i	Explain the causes of short-term climate changes such as catastrophic volcanic eruptions and impact of solar system objects. <i>(recommended)</i>
E5.r4j	Predict the global temperature increase by 2100, given data on the annual trends of CO2 concentration increase. <i>(recommended)</i>

<p><i>ILT recommendation:</i></p> <p><input checked="" type="checkbox"/> This is a CIC issue</p> <p><input type="checkbox"/> This is not a CIC issue</p> <p><input type="checkbox"/> This is incomplete and requires more information to process</p>	<p><i>CIC recommendation:</i></p> <p><input type="checkbox"/> Accept the proposal as written</p> <p><input type="checkbox"/> Accept the proposal with modifications</p> <p><input type="checkbox"/> Reject the proposal</p> <p><input type="checkbox"/> Refer the original proposal to _____</p>
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CIC Form # 1A

**Portage Public Schools
CURRICULUM INSTRUCTION COUNCIL
General Proposal**

Date 12/7/2010

Submit completed proposal to District Curriculum Office

Proposer(s) Dale Freeland, Kathy Mirakovits, Jon Taylor, Chris Armitage, Daniall Poulsen, Dan Wytko, Aja Kaylor, Cathy Laurencig, Christine Hake, Stephanie Wagner, Becky Dalecki

Phone 323-5232

Address or School Portage Central and Northern High Schools

Topic of Curricular/Instructional Concern Science

Curricular Area [include grade level(s) and/or course titles] 10th grade Biology and 11th grade Earth Science

- Briefly describe the proposal:

After evaluating the science program sequence and analyzing reoccurring parent concerns, the science teachers are proposing the changes described below. While we could not address all of the concerns and still maintain the spiraling of content and skills into Level 2 and IB courses, we are recommending a few immediate changes and will continue to evaluate the rigor of our program 6-12.

- The science department proposes to implement full-year biology and honors biology courses for sophomores. Currently, students take one semester in their sophomore year and another semester prior to graduation. The courses will be titled, Biology and Honors Biology.
- In addition, the required Earth Science 1 semester course would be recommended in the junior year.
- Also, we recommend changing the name of Biology 3 to Anatomy and Physiology, as we would no longer have Biology 1 and 2 once the revised sequence is fully implemented.

The second phase of the science review would include a robust evaluation of our current courses to ensure that the rigor of all of our science courses prepares students for the next level of study and the Michigan Merit Exam and ACT assessment. Additionally, a middle school Pilot proposal, if approved will have future implications on Earth Science at the High School level for students who excel in science. (See MS proposal)

- Give the rationale for the proposal, including the possible ramifications for current curriculum or instruction:

Full year biology rationale:

The science teachers recommend that students take a full year of biology during their sophomore year, after learning the prerequisite knowledge in 9th grade chemistry and physics. (See attachment 1)

- This sequence would ensure that students have completed coursework aligned with the required biology content expectations prior to taking the MME/ACT. Currently we have students who take the MME and ACT with only one semester of biology.
- The MME is equally weighted in biology.

- The ACT predicts college Biology success in college (although the assessment does not test content knowledge, it does test skills applied in biology class).
- Under the MDE required credits for graduation, biology is the only science that all students must complete 1.0 credit. Since students are required to take two semesters, there is no reason to offer the “essential expectations” separate from the “core expectations”. This will also ensure continuity of instruction and content expectations.

Earth science in the junior year rationale:

It is recommended that students continue to take Earth Science at the high school level, as this is a capstone course requiring knowledge from biology, chemistry, and physics. The earth science benchmarks tie together all the sciences in which students are able to apply knowledge from chemistry, physics, and biology to the Earth Science Content Expectations. (See attachment 2)

- Identify staffing or professional development needs of the proposal:

None

- Itemize the cost of your proposal, including (1) instructional materials, (2) equipment, and (3) technology requirements:

Additional textbooks will be needed to accommodate “all students” taking biology in the same semester, as well offering the Biology II course currently offered to students who only need one semester of biology. These will cost approximately \$65. per student. Teachers have also discussed classroom sets for one year as we implement the change.

- State facility requirements of the proposal:

None

- Did you discuss this proposal with your building principal?

YES

NO

(Electronic)

Proposer's Signature

(Electronic)

Team Leader's Signature

Expectation	Prerequisite Knowledge Needed from Chemistry and Physics
Describe the composition of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids).	Recognize that proteins, starches, and other large biological molecules are polymers. Draw structural formulas for up to ten carbon chains of simple hydrocarbons. Given the formula for a simple hydrocarbon, draw and name the isomers.
Explain the general structure and primary functions of the major complex organic molecules that compose living organisms.	Recognize that proteins, starches, and other large biological molecules are polymers. Balance simple chemical equations applying the conservation of matter.
Describe how dehydration and hydrolysis relate to organic molecules.	Recognize that proteins, starches, and other large biological molecules are polymers. Balance simple chemical equations applying the conservation of matter.
Recognize and describe that both living and nonliving things are composed of compounds, which are themselves made up of elements joined by energy containing bonds, such as those in ATP.	Describe energy changes associated with chemical reactions in terms of bonds broken and formed (including intermolecular forces).
Recognize and explain that macromolecules such as lipids contain high energy bonds.	Explain the changes in potential energy (due to electrostatic interactions) as a chemical bond forms and use this to explain why bond breaking always requires energy. Describe energy changes associated with chemical reactions in terms of bonds broken and formed (including intermolecular forces).
Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis.	Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making. Describe energy changes associated with chemical reactions in terms of bonds broken and formed (including intermolecular forces). Balance simple chemical equations applying the conservation of matter. Distinguish between chemical and physical changes in terms of the properties of the reactants and products. Identify everyday examples of energy transfer by waves and their sources. Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy. Identify the principle involved when you see a transparent object (e.g., straw, a piece of glass) in a clear liquid. Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision).

Expectation	Prerequisite Knowledge Needed from Chemistry and Physics
Compare and contrast the transformation of matter and energy during photosynthesis and respiration.	Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making. Describe energy changes associated with chemical reactions in terms of bonds broken and formed (including intermolecular forces). Balance simple chemical equations applying the conservation of matter. Distinguish between chemical and physical changes in terms of the properties of the reactants and products. Account for and represent energy into and out of systems using energy transfer diagrams. Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision).
Describe how cells function in a narrow range of physical conditions, such as temperature and pH (acidity), to perform life functions.	Describe tests that can be used to distinguish an acid from a base. Classify various solutions as acidic or basic, given their pH. Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees. Describe how heat is conducted in a solid.
Explain how cellular respiration is important for the production of ATP (build on aerobic vs. anaerobic).	Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making. Describe energy changes associated with chemical reactions in terms of bonds broken and formed (including intermolecular forces).
Explain how major systems and processes work together in animals and plants, including relationships between organelles, cells, tissues, organs, organ systems, and organisms. Relate these to molecular functions.	Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making. Balance simple chemical equations applying the conservation of matter.

Expectation	Prerequisite Knowledge Needed from Chemistry and Physics
Describe how energy is transferred and transformed from the Sun to energy-rich molecules during photosynthesis.	Explain why an atom can absorb only certain wavelengths of light. Explain why chemical reactions will either release or absorb energy. Use the terms endothermic and exothermic correctly to describe chemical reactions in the laboratory. Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making. Account for and represent energy into and out of systems using energy transfer diagrams. Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision). Identify everyday examples of energy transfer by waves and their sources. Identify the principle involved when you see a transparent object (e.g., straw, a piece of glass) in a clear liquid.
Describe how individual cells break down energy-rich molecules to provide energy for cell functions.	Explain why it is necessary for a molecule to absorb energy in order to break a chemical bond. Explain why chemical reactions will either release or absorb energy. Use the terms endothermic and exothermic correctly to describe chemical reactions in the laboratory. Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making.
Explain the interrelated nature of photosynthesis and cellular respiration in terms of ATP synthesis and degradation.	Explain why an atom can absorb only certain wavelengths of light. Explain why chemical reactions will either release or absorb energy. Use the terms endothermic and exothermic correctly to describe chemical reactions in the laboratory. Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making. Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy. Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision).
Relate plant structures and functions to the process of photosynthesis and respiration.	Explain why an atom can absorb only certain wavelengths of light. Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy. Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision).

Expectation	Prerequisite Knowledge Needed from Chemistry and Physics
Describe how organisms acquire energy directly or indirectly from sunlight.	Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making. Explain why an atom can absorb only certain wavelengths of light. Account for and represent energy into and out of systems using energy transfer diagrams. Account for and represent energy transfer and transformation in complex processes (interactions). Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision).
Illustrate and describe the energy conversions that occur during photosynthesis and respiration.	Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making. Explain why chemical reactions will either release or absorb energy. Account for and represent energy into and out of systems using energy transfer diagrams. Account for and represent energy transfer and transformation in complex processes (interactions). Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision).
Recognize the equations for photosynthesis and respiration and identify the reactants and products for both.	Balance simple chemical equations applying the conservation of matter.
Explain how living organisms gain and use mass through the processes of photosynthesis and respiration.	Balance simple chemical equations applying the conservation of matter. Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making.
Write the chemical equation for photosynthesis and cellular respiration and explain in words what they mean.	Balance simple chemical equations applying the conservation of matter.
Summarize the process of photosynthesis.	Balance simple chemical equations applying the conservation of matter. Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making. Account for and represent energy into and out of systems using energy transfer diagrams. Account for and represent energy transfer and transformation in complex processes (interactions). Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision).

Expectation	Prerequisite Knowledge Needed from Chemistry and Physics
Identify how energy is stored in an ecosystem.	Describe the energy changes in photosynthesis and in the combustion of sugar in terms of bond breaking and bond making. Account for and represent energy into and out of systems using energy transfer diagrams. Account for and represent energy transfer and transformation in complex processes (interactions). Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision).
Describe energy transfer through an ecosystem, accounting for energy lost to the environment as heat.	Account for and represent energy transfer and transformation in complex processes (interactions).
Draw the flow of energy through an ecosystem. Predict changes in the food web when one or more organisms are removed.	Account for and represent energy into and out of systems using energy transfer diagrams.
Describe environmental processes (e.g., the carbon and nitrogen cycles) and their role in processing matter crucial for sustaining life.	Balance simple chemical equations applying the conservation of matter. Draw structural formulas for up to ten carbon chains of simple hydrocarbons.
Recognize that and describe how the physical or chemical environment may influence the rate, extent, and nature of population dynamics within ecosystems.	Classify various solutions as acidic or basic, given their pH. Distinguish between chemical and physical changes in terms of the properties of the reactants and products. Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision). Explain instances of energy transfer by waves and objects in everyday activities (e.g., why the ground gets warm during the day, how you hear a distant sound, why it hurts when you are hit by a baseball). Identify everyday examples of energy transfer by waves and their sources. Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy. Explain how various materials reflect, absorb, or transmit light in different ways. Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion.
Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).	Balance simple chemical equations applying the conservation of matter.
Analyze the relationships among organisms based on their shared physical, biochemical, genetic, and cellular characteristics and functional processes.	Recognize that proteins, starches, and other large biological molecules are polymers.

Expectation	Prerequisite Knowledge Needed from Chemistry and Physics
Describe the structure and function of DNA.	Identify the elements necessary for hydrogen bonding (N, O, F). Given the structural formula of a compound, indicate all the intermolecular forces present (dispersion, dipolar, hydrogen bonding).
Explain that gene mutation in a cell can result in uncontrolled cell division called cancer. Also know that exposure of cells to certain chemicals and radiation increases mutations and thus increases the chance of cancer.	Describe possible problems caused by exposure to prolonged radioactive decay. Explain how various materials reflect, absorb, or transmit light in different ways. Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy. Explain instances of energy transfer by waves and objects in everyday activities (e.g., why the ground gets warm during the day, how you hear a distant sound, why it hurts when you are hit by a baseball). Compare various wavelengths of light (visible and nonvisible) in terms of frequency and relative energy.
Explain how carbon can join to other carbon atoms in chains and rings to form large and complex molecules.	Given the formula for a simple hydrocarbon, draw and name the isomers. Draw structural formulas for up to ten carbon chains of simple hydrocarbons.
Recognize the six most common elements in organic molecules (C, H, N, O, P, S).	Recognize the six most common elements in organic molecules (C, H, N, O, P, S).
Recognize that proteins, starches, and other large biological molecules are polymers.	Recognize that proteins, starches, and other large biological molecules are polymers.

Expectation	Prerequisite Knowledge Needed from Biology, Chemistry and Physics
Identify the main sources of energy to the climate system.	Account for and represent energy transfer and transformation in complex processes (interactions). Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision). Explain how various materials reflect, absorb, or transmit light in different ways.
Explain how volcanoes change the atmosphere, hydrosphere, and other Earth systems.	Explain how various materials reflect, absorb, or transmit light in different ways. Describe tests that can be used to distinguish an acid from a base. Classify various solutions as acidic or basic, given their pH.
Explain the natural mechanism of the greenhouse effect including comparisons of the major greenhouse gases (water vapor, carbon dioxide, methane, nitrous oxide, and ozone).	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Explain instances of energy transfer by waves and objects in everyday activities (e.g., why the ground gets warm during the day, how you hear a distant sound, why it hurts when you are hit by a baseball).
Analyze the empirical relationship between the emissions of carbon dioxide, atmospheric carbon dioxide levels and the average global temperature over the past 150 years.	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees.
Based on evidence from historical climate research (e.g., fossils, varves, ice core data) and climate change models, explain how the current melting of polar ice caps can impact the climatic system .	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees. Explain instances of energy transfer by waves and objects in everyday activities (e.g., why the ground gets warm during the day, how you hear a distant sound, why it hurts when you are hit by a baseball).
Describe geologic evidence that implies climates were significantly colder at times in the geologic record (e.g., geomorphology, striations, and fossils).	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees. Explain instances of energy transfer by waves and objects in everyday activities (e.g., why the ground gets warm during the day, how you hear a distant sound, why it hurts when you are hit by a baseball).

Expectation	Prerequisite Knowledge Needed from Biology, Chemistry and Physics
Compare and contrast the heat-trapping mechanisms of the major greenhouse gases resulting from emissions (carbon dioxide, methane, nitrous oxide, fluorocarbons) as well as their abundance and heat trapping capacity.	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees. Explain instances of energy transfer by waves and objects in everyday activities (e.g., why the ground gets warm during the day, how you hear a distant sound, why it hurts when you are hit by a baseball). Balance simple chemical equations applying the conservation of matter.
Explain the causes of short-term climate changes such as catastrophic volcanic eruptions and impact of solar system objects. <i>(recommended)</i>	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees. Explain instances of energy transfer by waves and objects in everyday activities (e.g., why the ground gets warm during the day, how you hear a distant sound, why it hurts when you are hit by a baseball).
Predict the global temperature increase by 2100, given data on the annual trends of CO ₂ concentration increase. <i>(recommended)</i>	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees. Explain instances of energy transfer by waves and objects in everyday activities (e.g., why the ground gets warm during the day, how you hear a distant sound, why it hurts when you are hit by a baseball).
Explain why lakes with limestone or calcium carbonate experience less adverse effects from acid rain than lakes with granite beds.	Predict products of an acid-base neutralization. Describe tests that can be used to distinguish an acid from a base.
Explain why sulfur oxides and nitrogen oxides contribute to acid rain.	Recognize formulas for common inorganic acids, carboxylic acids, and bases formed from families I and II.
Explain why the Earth is essentially a closed system in terms of matter.	Balance simple chemical equations applying the conservation of matter.
Analyze the interactions between the major systems (geosphere, atmosphere, hydrosphere, biosphere) that make up the Earth.	Account for and represent energy into and out of systems using energy transfer diagrams. Account for and represent energy transfer and transformation in complex processes (interactions).
Explain, using specific examples, how a change in one system affects other Earth systems.	Account for and represent energy into and out of systems using energy transfer diagrams. Account for and represent energy transfer and transformation in complex processes (interactions).

Expectation	Prerequisite Knowledge Needed from Biology, Chemistry and Physics
Identify differences in the origin and use of renewable (e.g., solar, wind, water, biomass) and nonrenewable (e.g., fossil fuels, nuclear [U-235]) sources of energy.	Account for and represent energy into and out of systems using energy transfer diagrams. Account for and represent energy transfer and transformation in complex processes (interactions). Explain why chemical reactions will either release or absorb energy. Explain why matter is not conserved in nuclear reactions. Balance simple chemical equations applying the conservation of matter.
Explain how energy changes form through Earth systems.	Account for and represent energy into and out of systems using energy transfer diagrams.
Explain how elements exist in different compounds and states as they move from one reservoir to another.	Describe energy changes associated with changes of state in terms of the arrangement and order of the atoms (molecules) in each state. Use the positions and arrangements of atoms and molecules in solid, liquid, and gas state to explain the need for an input of energy for melting and boiling and a release of energy in condensation and freezing. Balance simple chemical equations applying the conservation of matter.
Explain how carbon exists in different forms such as limestone (rock), carbon dioxide (gas), carbonic acid (water), and animals (life) within Earth systems and how those forms can be beneficial or harmful to humans.	Balance simple chemical equations applying the conservation of matter. Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis. Recognize the equations for photosynthesis and respiration and identify the reactants and products for both.
Explain how the nitrogen cycle is part of the Earth system.	Balance simple chemical equations applying the conservation of matter. Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis. Recognize the equations for photosynthesis and respiration and identify the reactants and products for both. Describe environmental processes (e.g., the carbon and nitrogen cycles) and their role in processing matter crucial for sustaining life.
Explain how carbon moves through the Earth system (including the geosphere) and how it may benefit (e.g., improve soils for agriculture) or harm (e.g., act as a pollutant) society.	Balance simple chemical equations applying the conservation of matter. Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis. Recognize the equations for photosynthesis and respiration and identify the reactants and products for both.

Expectation	Prerequisite Knowledge Needed from Biology, Chemistry and Physics
Describe renewable and nonrenewable sources of energy for human consumption (electricity, fuels), compare their effects on the environment, and include overall costs and benefits.	Explain why all the stored energy in gasoline does not transform to mechanical energy of a vehicle. Identify the form of energy in given situations (e.g., moving objects, stretched springs, rocks on cliffs, energy in food). Describe the energy transformations when electrical energy is produced and transferred to homes and businesses. Identify common household devices that transform electrical energy to other forms of energy, and describe the type of energy transformation.
Describe natural mechanisms that could result in significant changes in climate (e.g., major volcanic eruptions, changes in sunlight received by the earth, meteorite impacts).	Compare various wavelengths of light (visible and nonvisible) in terms of frequency and relative energy. Identify everyday examples of energy transfer by waves and their sources. Explain how various materials reflect, absorb, or transmit light in different ways.
Explain how interactions between the oceans and the atmosphere influence global and regional climate. Include the major concepts of heat transfer by ocean currents, thermohaline circulation, boundary currents, evaporation, precipitation, climatic zones, and the ocean as a major CO ₂ reservoir.	Use the positions and arrangements of atoms and molecules in solid, liquid, and gas state to explain the need for an input of energy for melting and boiling and a release of energy in condensation and freezing. Describe energy changes associated with changes of state in terms of the arrangement and order of the atoms (molecules) in each state. Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees. Explain how various materials reflect, absorb, or transmit light in different ways.
Explain the dynamics (including ocean-atmosphere interactions) of the El Niño-Southern Oscillation (ENSO) and its effect on continental climates.	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees. Explain how various materials reflect, absorb, or transmit light in different ways.
Identify factors affecting seawater density and salinity and describe how density affects oceanic layering and currents.	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees. Explain how various materials reflect, absorb, or transmit light in different ways.
Explain the differences between maritime and continental climates with regard to oceanic currents.	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion.

Expectation	Prerequisite Knowledge Needed from Biology, Chemistry and Physics
Explain how the Coriolis effect controls oceanic circulation.	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion.
Explain how El Niño affects economies (e.g., in South America). (recommended)	Distinguish between rotation and revolution and describe and contrast the two speeds of an object like the Earth.
Explain how observations of the cosmic microwave background have helped determine the age of the universe.	Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy.
Relate events on the Sun to phenomena such as auroras, disruption of radio and satellite communications, and power grid disturbances.	Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy. Explain why radio waves can travel through space, but sound waves cannot.
Describe how nuclear fusion produces energy in the Sun.	Describe peaceful technological applications of nuclear fission and radioactive decay. Identify the source of energy in fission and fusion nuclear reactions.
Describe how nuclear fusion and other processes in stars have led to the formation of all the other chemical elements.	Describe peaceful technological applications of nuclear fission and radioactive decay. Identify the source of energy in fission and fusion nuclear reactions.
Explain how you can infer the temperature, life span, and mass of a star and its mass from its color. Use the H-R diagram to explain the life cycles of stars.	Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy. Explain why radio waves can travel through space, but sound waves cannot. Explain how various materials reflect, absorb, or transmit light in different ways.
Explain how the balance between fusion and gravity controls the evolution of a star (equilibrium).	Explain how your weight on Earth could be different from your weight on another planet.
Explain how stars, including our Sun, produce huge amounts of energy (e.g., visible, infrared, or ultraviolet light).	Explain how stars, including our Sun, produce huge amounts of energy (e.g., visible, infrared, or ultraviolet light).
Describe the greenhouse effect and list possible causes.	Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Explain how various materials reflect, absorb, or transmit light in different ways. Draw ray diagrams to indicate how light reflects off objects or refracts into transparent media.

Expectation**Prerequisite Knowledge Needed from Biology,
Chemistry and Physics**

List the possible causes and consequences of global warming.

Explain convection and the difference in transfer of thermal energy for solids, liquids, and gases using evidence that molecules are in constant motion. Explain how various materials reflect, absorb, or transmit light in different ways. Draw ray diagrams to indicate how light reflects off objects or refracts into transparent media.

Recommended Science Selections

8th grade

Choose one of the following	
	8 th grade Science
	8 th grade Science /High School Earth Science 1 (<i>WMS only, pending approval of pilot</i>)

9th grade

Choose one of the following	
	Chemistry 1 and Physics 1 (1 semester each)
	Honors Chemistry 1 and Honors Physics 1 (1 semester each)

10th grade

Choose one of the following	
	Biology (2 semesters) (formally Bio 1 and bio 2)
	Honors Biology (2 semesters)

11th grade Earth requirement

Select one of the following	
	Earth Science (1 semester)
	Honors Earth Science (1 semester)
	Earth Science credit was earned in 8 th grade (<i>WMS pilot</i>) *

11th grade Chemistry or Physics requirement

Choose one of the following	
	Chemistry 2 (1 semester)
	Physics 2 (1 semester)
	IB Chemistry HL 1 (2 semesters)
	IB Physics HL 1 (2 semesters)

*if Earth Science credit was earned in 8th grade, then one more semester of science is required for graduation.

SCIENCE ELECTIVES (Typically Grades 11/12)

<u>International Baccalaureate Science</u> IB Biology HL IB Biology SL IB Chemistry HL IB Environmental Systems and Societies SL IB Physics HL	<u>Core Extension Courses</u> Astronomy Anatomy and Physiology Chemistry 2 Chemistry 3-Organic Chemistry Physics 2 Physics 3 Michigan Geology and Meteorology
<u>Special Topic Electives</u> Ecology and the Environment Computer Electronics Forensic Science 1 Forensic Science 2	<u>EFE Science Options (3RD Science Credit)</u> Animal Tech/Internship Animal Science/Wildlife and Natural Resources Allied Health I and II Health Occupations Dental Assistant Emergency Med. Tech Pharmacy Tech. Veterinary Science

Earth Science I, a Capstone Course

Why are several Earth Science topics (benchmarks) appropriate at the high school level, following chemistry, physics and biology?

Below are the 5 units covered in Earth Science I (10th grade); determined by Michigan High School Content Standards and PPS High school and Middle school teachers. Unit titles are boxed, and individual topics within that unit are underlined. Concepts within the topics are written with the background prerequisite material in parenthesis.

Environmental Issues:

Biogeochemical cycles (nitrogen, carbon, water): photosynthesis (bio,chem.), cellular respiration (bio,chem.), molecular motion (physics), chemical reactions and chemical formulas (chem.)

Acid Rain: pH and chemical reactions with air pollutants/gases (chem.)

Earth Resources:

Renewable & Nonrenewable Energy Resources: energy conversions (physics), chemical reactions (chem.), combustion reactions (chem.), fission reactions (physics)

Oceanography:

Causes for Currents: Coriolis Effect (physics), temp and salinity/density (physics and chem), molecular motion (physics), unequal heating of the Earth (physics)

Climate Change:

Causes for Climate Change: Milankovich Cycles (physics), specific heat capacity (physics), greenhouse gas energy conversions (physics), greenhouse gas chemistry (chem.)

Evidence for climate change: oxygen isotopes (chemistry), radioactive decay (chem.), fossil evidence, coral layers, and tree rings (biology)

Astronomy:

Energy in stars: Fusion (physics and chem.), energy conversions and forces (physics)

Spectroscopy: light emission and elemental fingerprinting for color and blackbody radiation (physics and chemistry)

State of matter in stars: plasma (chemistry)

HR Diagram: instruments used to determine star life cycle of the stars—stages, mass, radius, life cycle, energy conversion rate (earth science, but at a level more appropriate for high school)

High School Parent Satisfaction Survey

Portage Public Schools has a continuous process for improving our curriculum and programs for our students. We are interested in your feedback to assist us in further improving your child's educational experience. Thank you in advance for sharing your experiences with scheduling academic and elective offerings.

100 Surveys Received

How would you rate your overall experience with Portage Public School's:

Academic Programs (96)- (0)	Very Satisfied 57%	Satisfied 39%	Dissatisfied 0	Very Dissatisfied 0	No Opinion 4%
Extra-Curricular Programs (89)- (3)	Very Satisfied 48%	Satisfied 41%	Dissatisfied 3%	Very Dissatisfied 0	No Opinion 8%
Academic Counseling Service (78)- (10)	Very Satisfied 46%	Satisfied 32%	Dissatisfied 10%	Very Dissatisfied 0	No Opinion 12%

How would you rate your overall experience with scheduling your child's required courses in:

Science (68)- (7)	Very Satisfied 31%	Satisfied 37%	Dissatisfied 6%	Very Dissatisfied 1%	No Opinion 25%
Language Arts (77)- (1)	Very Satisfied 39%	Satisfied 38%	Dissatisfied 1%	Very Dissatisfied 0	No Opinion 22%
Mathematics (75)- (0)	Very Satisfied 35%	Satisfied 41%	Dissatisfied 0	Very Dissatisfied 0	No Opinion 24%
Social Studies (77)- (0)	Very Satisfied 34%	Satisfied 43%	Dissatisfied 0	Very Dissatisfied 0	No Opinion 23%
Encore/Electives (69)- (2)	Very Satisfied 28%	Satisfied 41%	Dissatisfied 1%	Very Dissatisfied 1%	No Opinion 29%
World Language (73)- (3)	Very Satisfied 30%	Satisfied 43%	Dissatisfied 1%	Very Dissatisfied 2%	No Opinion 25%

Feedback Specific to High School Science:

This year, Portage Public Schools is reviewing our science program to ensure that students are able to maximize course selections, be prepared for the ACT and Michigan Merit Exam, and take full advantage of countywide programs such as Education for Employment. A small parent focus group convened to share their experiences navigating our science program. This focus group was comprised of Terri Noveria, Kelly Schultz, Patti Werme, P.J. Perry, William Perry (graduate), and Cheryl Hatch (KAMSC teacher).

During the conversation, a few primary concerns surfaced. Our goal is to gain a broader perspective from parents. Please respond to the following statements based upon your student's experiences.

I would or would have preferred that my child have/had a full year Biology Honors option (non-IB) in high school. (Focus Group)	Strongly agree 24%	Agree 18%	Disagree 5%	Strongly Disagree 3%	No Opinion 50%
	(42)- (8)				
I would or would have preferred that my child be able to take Biology in a full-year course format , rather than distributed over 2 years, as semester courses. (Focus Group)	Strongly agree 27%	Agree 22%	Disagree 4%	Strongly Disagree 1%	No Opinion 46%
	(49)- (5)				
I would be in favor of an 8 th grade option to take the High School Earth Science course. (Focus Group)	Strongly agree 23%	Agree 22%	Disagree 7%	Strongly Disagree 3%	No Opinion 45%
	(45)- (10)				
I would be in favor of an 8 th grade requirement to take the High School Earth Science course. (Focus Group)	Strongly agree 13%	Agree 15%	Disagree 22%	Strongly Disagree 4%	No Opinion 46%
	(28)- (26)				
Scheduling Science requirements and electives is/was difficult- especially in the Junior and Senior years. (Focus Group)	Strongly agree 12%	Agree 9%	Disagree 19%	Strongly Disagree 3%	No Opinion 57%
	(21)- (22)				
My child was prepared for the science coursework in his/her Freshman year (Chemistry I / Conceptual Physics I) (Focus Group)	Strongly agree 17%	Agree 39%	Disagree 8%	Strongly Disagree 2%	No Opinion 34%
	(56)- (10)				
I have a good understanding of the requirements for Science, as mandated by the Michigan Department of Education. (Admin)	Strongly agree 6%	Agree 49%	Disagree 11%	Strongly Disagree 3%	No Opinion 31%
	(55)- (14)				
I have been satisfied with the science program that PPS currently offers. (Admin)	Strongly agree 11%	Agree 45%	Disagree 10%	Strongly Disagree 3%	No Opinion 31%
	(56)- (13)				