Cris DeWolf

Biology I
Chippewa Hills High School, Remus, MI

Pacing Guide for Trimester 1 and 2

Biology IA		Biology IB	
1 2 3 4 5 6	7 8 9 10 11 12	1 2 3 4 5 6	7 8 9 10 11 12
Unit: Organization of Life In this unit, students learn about how life on Earth is organized – starting at the smallest scale and finishing at the largest. Topics include biochemistry, cell structure and function and ecology.	**Unit: Continuity of Life** In this unit, students learn about how living things reproduce, grow, and change over time. Topics include the cell cycle, mitosis, meiosis, growth & development, genetics, molecular biology, and evolution.	**Unit: Energy for Life** In this unit, stydents will learn about how life is powered by energy from the Sun. Topics include photosynthesis, cell respiration and ecology. A major emphasis will be on energy resources and hunan impacts on the biosphere.	**Unit: Human Systems** In this unit. Students will investigate the structure and function of the human body. Topics will include homeostasis, health and disease, and organs and organ systems. Dissections of the eye and heart will be performed (sheep and cow).
Common Core Standards CCSS are incorporated to daily instruction as often as possible from Standards for Literacy in History/Social Studies, Science, and technical Subjects found at: http://wvde.state.wv.us/ teach21/LiteracyStandards.pdf **HSSCEs** L2.p1A,L2.p1B,L2.p5A, L2.p5B, B2.2A, B2.2B, B2.2C, B2.2D, B2.2E	**Common Core Standards** CCSS are incorporated to daily instruction as often as possible from Standards for Literacy in History/Social Studies, Science, and technical Subjects found at: http://wvde.state.wv.us/ teach21/LiteracyStandards.pdf **HSSCEs** L2.p1C, L2.p2B,L2.p5C,B2.1C, B2.1d,B2.4g, B2.4h,B2.5g,B2.5h,B2.5i,L3.p3A, L3.p3B, L3.p3C, L3.p3D,B3.4A, B3.4B, B3.4C, B3.5A,B3.5B,B3.5C	**Common Core Standards** CCSS are incorporated to daily instruction as often as possible from Standards for Literacy in History/Social Studies, Science, and technical Subjects found at: http://wvde.state.wv.us/ teach21/LiteracyStandards.pdf **HSSCEs** L4.p1A,L4.p1B,L2.p4A,L2.p4B, B2.5e, L3.p2C,L3.p3C,B3.1A, B3.1B, B3.1C, B3.1D, B3.1e, B3.1f,B3.2A, B3.2B, B3.2C, B3.3A, B3.3b	**Common Core Standards** CCSS are incorporated to daily instruction as often as possible from Standards for Literacy in History/Social Studies, Science, and technical Subjects found at: http://wvde.state.wv.us/ teach21/LiteracyStandards.pdf **HSSCEs** L2.p1D,L2.p1E,L2.p2A,B2.3d,B 2.3e, B2.3f, B2.3g, B2.6a, B2.r6b, B2.r6c. B2.3A,B2.3B,B2.3C,B2.r6d,B2.r 6e
Resources Text: Biology – Campbell (Pearson)	**Resources** Text: Biology – Campbell (Pearson)	**Resources** Text: Biology – Campbell	**Resources** Text: Biology – Campbell

Chapters: 4-6, 16, 34 (Except 34.2), 35 Prentice Hall - BioCoach http://www.phschool.com/science/ biology_place/biocoach/ Prentice Hall – LabBench http://www.phschool.com/science/ biology_place/labbench/	Chapters: 9-15, 19, 20.1, Prentice Hall - BioCoach http://www.phschool.com/science/ biology_place/biocoach/ Prentice Hall – LabBench http://www.phschool.com/science/ biology_place/labbench/	(Pearson) Chapters: 7, 8, 34.2, 36 Prentice Hall - BioCoach http://www.phschool.com/science/ biology_place/biocoach/ Prentice Hall – LabBench http://www.phschool.com/science/ biology_place/labbench/	(Pearson) Chapters: 27-33 Prentice Hall - BioCoach http://www.phschool.com/science/ biology_place/biocoach/ Prentice Hall – LabBench http://www.phschool.com/science/ biology_place/labbench/

A major part of the unit titled "**Energy for Life**" will be a service learning project that was developed as an action plan for my participation in the NOAA Climate Stewards program. It was also funded through a NOAA grant. I have attached a copy of the plan with links to some of the resources below.

Fluorescent to LED – Proposed Changes in Light Sources and Staff Behaviors to Reduce the Carbon Footprint at Chippewa Hills High School

The Climate Science Issue – Electrical power generation is a source of greenhouse gases that can contribute to the problem of global climate change. Efforts can be made to reduce the carbon footprints of our homes, businesses, and schools by reducing the amount of electrical power used. This is one element of the green building movement, and can be a starting point on the road to obtaining LEED certification.

The Hypothesis to Test/Measurable Objective – If existing lighting is replaced (incandescent bulbs to fluorescent, fluorescent to LED) and behaviors are modified (switching lights off when not in use, putting appliances on power strips, etc.) then the number of kilowatt hours of electric power used will be significantly lowered, reducing both the cost of the electricity to the consumer and their carbon footprint. A three-pronged approach will be taken with the following sub-hypotheses: (1) If the district adopts LED lighting and replaces all fluorescent light bulbs in the secondary complex with LED equivalents, then the number of kilowatt hours of electric power used will be significantly lowered, reducing the carbon footprint of the district, as well as the annual cost of electricity; (2) If teachers turn off classroom lights when out of their rooms and use either a LED desk lamp or natural lighting during their preparation time then further reduction in power consumption will occur; and (3) If students and their families fully implement the switch from incandescent light bulbs to CF bulbs and place appliances and electronics such as microwave ovens, televisions, and computers on power strips that can be turned off when the appliance or electronic device is not in use then the number of kilowatt hours of electric power they use will be significantly lowered, reducing the carbon footprint of the district, as well as the annual cost of electricity

Stewardship Process and Activities – To test this hypothesis students will:

1. Learn to read both electric meters and their monthly utility statements. Data will be needed on the number of kilowatt-hours of electricity used in their households each month.
2. Use Excel to manage and analyze data.
3. Obtain information on monthly power consumption at the secondary complex.
4. Conduct a room-by-room survey of the high school to determine the number of fluorescent light fixtures in each classroom.
5. Determine the number of kilowatt-hours of electricity used by both fluorescent light tubes and their LED replacement tubes.
6. Determine the number of lumens provided by each of these types of bulb using Vernier LabQuests and light sensors.
7. Use a Vernier spectrophotometer to measure the emission spectra of each type of light bulb.
   *Item 7 and 8 will involve the students in using inquiry and research skills to evaluate and compare both the amount of light and the type of light produced by both types of bulb. The fundamental question being investigated is "Are LED light tubes a suitable replacement for fluorescent tubes in a school setting?"

8. All students will use a copy of the spreadsheet to determine:
   a. How much electricity is used by all the fluorescent light bulbs in the building.
   b. How much electricity would be used if all the fluorescent bulbs were replaced by LED equivalents.

c. The cost of such a replacement.
d. An estimate of the cost savings per year by replacing all of the bulbs.
e. How long it would take to payback the cost of replacing all of the fluorescent tubes with LED bulbs.
f. The reduction in CO2 emissions if the replacement with LED bulbs were to occur.
g. How much electricity consumption would be reduced if teachers used natural lighting or a desk lamp when on prep and turned lights off when not in their rooms
h. How much of a reduction in CO2 emissions would occur if this were done.

9. Students will develop a presentation about their project using the data they have gathered as well as information that they research from a variety of online resources. This presentation will be shared with the high school staff at a faculty meeting, with the Chippewa Hills Board of Education at one of their monthly meetings and at the Mecosta-Osceola Science and Engineering Fair. This presentation will help establish the need to consider taking steps to reduce the district's carbon footprint beyond simply an economic one. These presentations will also include excerpts from their science journals where they will document changes they are making at home.
10. All stakeholders will be invited to complete the Climate Steward Audience Knowledge Survey (middle school level - http://CSknow.questionpro.com) three times – once prior to the start of the project, once half way through the project, and once at the end of the project.

Timeline

Trimester One – Week 1

Day One

- Have the high school office send the link to the Climate Steward Audience Knowledge Survey to parents of all students in Biology IA. Also have it sent to both the teaching staff and support staff e-mail lists, and members of the school board. Ask that the survey be completed no later than the end of the week.
- Create student groups and establish group roles.
- Class presentation/discussion: Keeping up with Carbon (NASA video clip) http://www.nasa.gov/multimedia/videogallery/index.html?media_id=11462990

Day Two

- Carbon Dioxide – Sources and Sinks activity (Windows to the Universe) http://www.windows.ucar.edu/tour/link=/teacher_resources/teach_CO2.html
- *This will be used to embed Michigan High School Content Expectations pertaining to cell energy (Photosynthesis and Respiration) into this PBIL unit. Additional activities including labs on respiration and photosynthesis will be covered.
- Request electric utility records for high school/secondary complex from the 2011/2012 school year.

Day Three

- Respiration and Photosynthesis
  Activity One: What Sugar is the Best Energy Source for Fermentation in Yeast?
- Create project spreadsheets in the eMac lab.

Day Four

- Respiration and Photosynthesis

Activity Two: How Fast do Geraniums use Starch Reserves?
- Enter electric utility data into the student spreadsheets.

Day Five
- Class presentation/discussion – Power Source (CLEAN collection) http://serc.carleton.edu/NAGTWorkshops/energy/activities/32383.html Students explore sources of energy for human activity.
- Wrap up of both cell energy activities.

Trimester One – Week 2

Day One
- Conduct classroom light bulb survey.

Day Two
- Illumination and spectral analysis of fluorescent tube lights and LED tube lights.
- Power consumption tests for both types of tube lights using Kill-A-Watt meters. Also include an analysis of the power consumption of a 75-watt light bulb. This data will be needed for students to build a case for making changes at home.
- Update project spreadsheets with number of light bulbs, and consumption rates of each type of light bulb.

Day Three
- Class presentation/discussion – Carbon Footprint
- Calculate your carbon footprint: http://footprint.stanford.edu/
- Post an announcement to students, parents, staff, and school board to complete the 2nd survey no later than Monday of week 3.
- During class discussion, create spreadsheet formulas to calculate total power used by all the light bulbs in the high school, how much would be used in the switch was made to LED bulbs, how much would be saved if staff left lights off when not in their rooms, and how much would be saved if staff used an LED desk lamp during their preparation periods.
- Update spreadsheets.

Day Four
- It's Us (video clip) http://earththeoperatorsmanual.com/segment/6
- Begin work on group presentations (Rubric will be provided to students). Students may use PowerPoint or Prezi.

Day Five
- Continue work on group presentations.

Trimester One – Week 3

Day One
- Finalize group presentations.

Day Two
- Students present to peers. Peer-evaluation and discussion occurs. Edits are made. Groups are selected to present to the school board and the faculty. The group selected for presenting at the science fair work on their poster.

Discuss how the process went according to plan, or did not, how things emerged or evolved, and any unintended events if they occurred.

*Will be shared at a later date!

Stewardship Actions – This Project-Based Inquiry Learning (PBIL) unit will do much to help educate not just my students but also my colleagues, my student's families, and our greater community (via both the school board meeting presentation and the regional science fair) on how we can all act to reduce our carbon footprint. Each year that we do the project will carry its impact forward into the future.

Actual measurable impacts are expected, but cannot be shared until the project has been done and its impacts assessed.

Use of NOAA and other Climate Resources – List the NOAA and NOAA Partner resources that will be used to inform the project. Describe how each one is used.

Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education document (http://ncse.com/news/2012/03/introducing-energy-literacy-007262)

The climate literacy and energy awareness principles found on the CLEAN website (http://www.cleanet.org/clean/literacy/index.html
http://www.esrl.noaa.gov/gmd/education/carbon_toolkit/student_activity_ghg.html

International Student Carbon Footprint Challenge
http://footprint.stanford.edu/

*The resources above will be used as part of instruction/discussion, and also to use as a reference for student groups developing their presentations.

Career focus – How will students learn about STEM careers such as backgrounds of resource people and roles they play in the Stewardship Project?

I plan on requesting to hold a teleconference with a climate scientist using ReadyTalk. I am a PLC leader for the Lifelines for High School Climate Change Education project out of UC Berkeley and the Lawrence Hall of Science and will use my contacts with this program to set this up.

Data Collection, Analysis and Results– Data collection and analysis are described in the preceding sections.

Evaluation –In addition to the 3 surveys already mentioned, the teaching staff will be regularly surveyed once each month for the remainder of the school year to evaluate the impact the student's presentation has had on their attitudes and behaviors towards electricity usage in their classrooms. While it would be great to see the district adopt a policy to work towards replacing fluorescent lighting with LED it may be premature to expect a major change in light of the current economy and funding policies for education that are currently in place in Michigan. Students involved in the project will also be surveyed at 6 months to see what impacts the project may have had on their family's use of electricity. It would be great to see that many of them are making the move to at least using compact fluorescent lighting in their homes.

Conclusions - What evidence-based conclusions can you draw about the process and takeaways for

others wishing to replicate your efforts? What lessons did you learn? What were the barriers, unintended consequences and/or benefits? Which of the direct and indirect outcomes in the logic model can you show evidence for in your project? What are the limitations to your conclusions? What contrary or incomplete evidence diminish the strength of your conclusions or limit when they would apply?

**This section will be completed after the project has been completed.*

Presentations – Student presentations to peers, teachers, and board members and the public will be made via PowerPoint. I will coordinate with our principal to select a date where we can "piggyback" on a scheduled staff meeting, and with the superintendent's office to schedule time at a school board meeting.

Standards Correlations

National Science Standards

Science as Inquiry

Content Standard A
As a result of activities in grades 9–12, all students should develop:

1. Abilities necessary to do scientific inquiry
2. Understandings about scientific inquiry

Physical Science

Content Standard B
As a result of their activities in grades 9-12, all students should develop an understanding of:

1. Structure of atoms
2. Structure and properties of matter
3. Chemical reactions
4. Motions and forces
5. Conservation of energy and increase in disorder
6. Interactions of energy and matter

Life Science

Content Standard C
As a result of their activities in grades 9-12, all students should develop understanding of:

1. The cell
2. Molecular basis of heredity
3. Biological evolution
4. Interdependence of organisms
5. Matter, energy, and organization in living systems
6. Behavior of organisms

Michigan High School Content Expectations

P1.1 Scientific Inquiry

- P818.818A8 8Generate new questions that can be investigated in the laboratory or field.
- P818.818B8 8Evaluate 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.
- P818.818C8 8Conduct 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).
- P1.1h Design and conduct a systematic scientific investigation that tests a hypothesis. Draw conclusions from data presented in charts or tables.

P1.2 Scientific Reflection and Social Implications

- P1.2C Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.
- P1.2D Evaluate scientific explanations in a peer review process or discussion format.
- P1.2E Evaluate the future career and occupational prospects of science fields.
- P1.2f Critique solutions to problems, given criteria and scientific constraints.

E2.3 Biogeochemical Cycles

- 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.
- E2.3d 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.

E2.4 Resources and Human Impacts on Earth Systems

- 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

E5.4 Climate Change

- 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).

B3.3 Element Recombination

- B3.3b Describe environmental processes (e.g., the carbon and nitrogen cycles) and their role in processing matter crucial for sustaining life.

B3.4x Human Impact

- B3.4d Describe the greenhouse effect and list possible causes.
- B3.4e List the possible causes and consequences of global warming.

Budget

Item	Supplier	Quantity	Unit Cost	Total
SpectroVis Plus Spectrophotometer ORDER CODE SVIS-PL	Vernier	1	$459	$459
SpectroVis Optical Cable ORDER CODE	Vernier	1	$69	$69

SVIS-FIBER				
P3 International Kill A Watt EZ Meter	Home Depot	2	$28.97	$57.94
Brilliant 4' 18w Warm White LED T8 Tube Light	www.birddogdistributing.com	2	$59.99	$119.98

Project Total: $705.92