Hilary Staples

I have decided to move my Global Climate change unit to the beginning of the year. First we did Basic Ecology and cycles with air pollution (smog, ozone depletion, acid deposition). Then we did Global Climate chapter with Climate change.

We watch excerpts from Inconvenient truth to get background.

We do a carbon footprint calculator **http://coolclimate.berkeley.edu/carboncalculator** or **http://www.carbonfootprint.com/calculator.aspx**

We also to a CO2, CO emissions from student car comparison lab (see attached- from GASTEC Corp.)

Students also make a short PSA about one issue of climate change with a partner.

DATE	CHAPTER	ACTIVITIES/LAB	Lyrical Lab days / Video/
Week 1- August	CH 1 + 2 Intro To Environmental Science (SENIOR RETREAT- FRI)	Syllabus, Rubrics etc. Assess previous knowledge – Bioregional Quiz W/S Commons Lab Review sheet of terms	VIDEO: Goldman prize intro ♫ Steel Pulse- Earth Crisis ♫ Led Zeppelin –That's the way (nature) http://www.examiner.com/x-4361-SF-Vegan-Examiner~y2009m6d22-Womens-Green-Voices
Week 2- Aug- Sept (Senior retreat)	(No school Monday) CH 2 integration activity	Ecological footprint: http://www.earthday.net/footprint/index.asp Energy term match up- review *Choose ecosystem/country Intro Quiz (1 + 2)	♫ Jack Johnson- Three R's ♫ Tomas Dolby- She blinded me with Science SVIDEO: Annenberg: many planets one earth
Week 3- of Sept. 6th	Ch 3: Ecosystems: energy	Owl Pellet Lab Solar calculation Pysteria Hysteria *Find 5 resources –biblio Create a foodweb	♫ Jackopierce- Someday You'll Understand STREAMING VIDEO: Annenberg: Ecosystems (http://www.learner.org/channel/courses/envsci/video/index.php) **Coastal Clean up Day = Sept 15th**
Week 4-	Ch 3 con't (MATTER: nutrient cycles and soil)	Creation of master cycle posters Watershed scrunch	♫ Harry Nilson- Think about your Troubles http://www.kqed.org/quest/television/tracking-raindrops
Week 5-	Ch. 15 AIR Pollution	Particulate plates? Ozone tags TEST	♫ Tom Lehrer-Pollution VIDEOS: Goldman Air Heroes & Ozone: Double Trouble, SVIDEO: Annenberg: Atmospheric pollution
Week 6-Oct	Ch. 4 - (CLIMATE and Biomes)	Report on your biome- where in the world.	♫ Ziggy Marley- Dragonfly **Open Garden day Sat 6th** volunteer?
Week 7-	Ch. 19 Global climate change	Exhaust testing Lab Carbon footprint calculator	VIDEO: convection currents clip ♫ They might be giants- Why does the sun shine ♫ Air Supply- All I need is the air that I breathe VIDEO- Excerp: An Inconvenient Truth, SVIDEO: Annenberg: Changing Climate
Week 8		**BIONEERS CONFERENCE Fri-Sunday**	♫ Ben Harper- With My Own 2 Hands
Week 9 (No school Monday)	Ch 8 Land Resources + Mining	Soil Lab *Oreo cookie plate tech.* Cookie Mining Lab	♫ Gillian Welch- Miner's refrain ♫ Sting- we work the Black Seam together VIDEO: Goldman Mining Heroes

Week 10	CH 12 Nonrenewable ENERGY	Researching your energy source	SVIDEO: Annenberg: Energy challenge
Week 11- of Nov. 1st	Ch 13 Energy Sustainability	Energy presentation/sales pitch Practice FRQs and calculations	♫ Jack Johnson- The Horizon Has Been Defeated VIDEO: Energy efficient home
Week 12	Energy con't	Energy audit (Need to save a PG&E bill to do a home analysis) TEST	♫ Coon Creek Girls- L&M Don't Stop Here anymore ♫ Midnight Oil- Blue Sky Mine VIDEO: A Crude Awakening
Week 13- of Nov. 14th	Ch. 4- EVOLUTION: & Community Ecology	Veg. survey Lab- **to the hills!** *5 organisms from web – TO ECOSYSTEM PROJECT NOI: Biomimicry **Brower Youth Awards 23rd** **7:30-9- Herbst Theater , SF?**	♫ Indea Arie- Nature ♫ Ani Difranco-Evolve VIDEO: Strange Days on Planet Earth: Predators- excerpt, Cane Toads
19th- 27th		***THANKSGIVING WEEK***	
Week 14 Nov.- Dec.	Ch. 6 Population Ecology	Eagle Lab and online simulation *http://www.learner.org/courses/envsci/interactives/ecology/* Add reproductive strategies and *Symbiotic, keystone, indicator and competition To ECOSYSTEM PROJECT	♫ Jack Johnson- Traffic in the Sky or Ani Difranco –Animal http://www.census.gov/ipc/www/idb/pyramids.html
Week 15 Review		Review	
Dec- 13th	**YBYN on Friday 10th**	**EXAMS**	
Dec-Jan	**CHRISTMAS BREAK**	**CHRISTMAS BREAK**	
		SECOND SEMESTER!	
Week 16- of Jan.	Ch. 9 WATER Resources	*Creek restoration* http://www.waterfootprint.org/ online tutorial http://mvhs1.mbhs.edu/riverweb/ Design your own lab Water testing	♫ Tracy Chapman- I'm Ready ♫ John Lennon- Saltwater VIDEO: Goldman- 3 Water heroes & The Water wars
Week 17	CH 14 WATER Pollution	DEBATE: Three Gorges Dam *Water issues of ecosystem- & maps	♫ Woody Guthrie- Grand Coulee Dam ♫ Greg Brown-Spring wind VIDEO: Cadillac Desert- excerpts
Week 18	Ch. 6 Population Ecology	Eagle Lab and online simulation *http://www.learner.org/courses/envsci/interactives/ecology/* Add reproductive strategies and *Symbiotic, keystone, indicator	♫ Jack Johnson- Traffic in the Sky or Ani Difranco –Animal http://www.census.gov/ipc/www/idb/pyramids.html

		and competition to web	
Week 19 Jan-Feb	Ch. 7 Human Population	UN Population Debate Human Demographic pyramids *http://www.learner.org/courses/envsci/interactives/demographics/demog.html* Prepare Debate materials **TEST**	♫ Joni Mitchell – Yellow Taxi ♫ James Taylor- Traffic Jam SVIDEO: Annenberg: HUMAN POP DYNAMICS or World in the Balance
Week 20	Ch 17 Human Health + Environmental Risks	**Field Trip to the Recycling Center** Reflection Waste Inventory http://www.chrisjordan.com/current_set2.php Trashion Fashion	SVIDEO- http://www.storyofstuff.com/ ♫ Cat Stevens- where do the children Play ♫ The Bobs- plastic and paper
Week 21	Ch. 16 Waste Generation and Disposal	Risk assessment LD50 calculations + and serial dilution ppm? NOI: Bioremediation jigsaw http://www.scorecard.org/ Environmental Justice question	Video: Rachel Carson – excerpts VIDEO: Hot Zone, SVIDEO: Annenberg: Risk, Exposure, and Health, PVC Audio- Lois Gibbs – pioneer of Enviro Justice movement
Feb16th-24th	**WINTER BREAK**	**WINTER BREAK**	
Week 22	CH 18 Conservation of Biodiversity	**Field trip to tidepools to collect data for Gulf of the Farallones Marine Sanctuary.**	Hilary's Africa PwrPT ♫ Yes- Don't Kill the Whale ♫ Gordon Lightfoot- Big Blue ♫ Folk Trio- Cold Missouri waters
Week 23- Feb- March		Lessons of Kaibab Lab Tag and recapture lab Poster child *NOI: The Green-Fire* Wolf	SVIDEO: Annenberg: Biodiversity Decline, (for fun) The Bio Daversity
Week 24	Ch. 10 Land Public and Private		♫ Bruce Cockburn- If a tree falls VIDEOS: Goldman Air Heroes & The Forest Wars,
Week 25	Ch 8 Land Management con't	Land Use debate	VIDEO: excerpt: Dirt: the Movie
Week 26	Ch 11 Feeding the World	Design your own lab: Salinity's affect of seed germination *NOI: Unnatural Selection*	♫ They Might Be Giants- Dr. Worm SVIDEO: Annenberg: Agriculture VIDEO: Food Inc, King Corn
March 29th- APRIL	**SPRING BREAK**	**SPRING BREAK** Organize notes and review for AP test Take home AP test	**March 29th- APRIL 7th**

7th			
Week 27 April	Food con't	**Ranch/Farm/Aquaculture Field Trip $6.00** Creation of field trip googlemap. *NOI: Think like a prairie + Have a cow* *TEST*	♫ The Seeds- Mr. Farmer VIDEO: Seas of Grass Video: Greening of Cuba ♫ Woody Guthrie- This Land is Your Land VIDEO: Land of Plenty Land of Want
April 15th- 19th		**SPRING DISCOVERY WEEK: Sustainability**	**Get OUTSIDE!**
Week 28 April	& Ch 20 Economics	**Goldman Awards : ExC** NOI: Natural Capitalism	♫ Greg Brown- The Poet Game ♫ Storyhill- Paradise lost Earth Day April 22
Week 29 April -May	Review Review!	Design a Green City step 1. NOI: Ecological Design Review + Study	♫ Ani Difranco- Up Up up up up up
Week 30	**YOU HAVE the First AP! Mon. 6th!**	***Review*** Intro to Action Project	♫ Neil Young – Mother Earth
Rest of year	Action Projects	Reflection- Baraka?	VIDEO: Baraka

Name:_____ Date:_____ Period:____

Car Exhaust Analysis

Overview:
In this experiment, you will collect and analyze automobile exhaust to find out the levels of Carbon Monoxide, Carbon Dioxide, and Nitrogen Oxides. You will compare the levels of these compounds immediately after the car is started to after the car has run for 5 minutes. Another option is to compare the results of different types of automobiles.

Background on Car Exhaust

There are more than 600 million cars driving roads all over the world. While pollution reduction laws have reduced harmful emissions over the past 20 years, the numbers of cars and trucks on the road and the miles they are driven have doubled in the same period. Vehicles are now driven two trillion miles each year in the United States.[1.]

The exhaust system of an automobile is designed to carry away the gases created when the fuel and oxygen in the air are burned in the combustion chamber of the engine. The exhaust from a combustion engine consists mostly of water vapor (H_2O), and carbon dioxide (CO_2).

Some exhaust contains toxic gases such as carbon monoxide (CO), nitrogen oxides (NO_x), Ozone (O_3), and particulate matter in high enough concentrations to contribute to respiratory problems in humans and wreak havoc in Earth's fragile atmospheric envelope of gasses of which most life depends.

Carbon monoxide is a colorless and odorless asphyxiant that combines with the hemoglobin in the bloodstream causing a decrease the amount of oxygen delivered to the tissues. This can lead to dizziness, loss of consciousness and in some cases—death. In the United States, 75% of CO emissions come from motor vehicles such as cars, trucks, boats, and construction equipment. The current Occupational Safety and Health Administration (OSHA) permissible exposure limit for carbon monoxide is 50 parts per million (ppm).[2]

Approximately half of the NO_x released in car exhaust is released in the initial minutes after start up, when the catalytic converter is not in full operation. Nitrogen oxides are created when the heat in the engine forces nitrogen in the air to combine with oxygen. This NO_x plays a significant role in the formation of acid rain and it plays a key role in upper atmosphere and in ground-level ozone formation. Reducing the NO_x released in the initial start-up of the car could successfully cut the environmental burden by as much as 25 percent.[3]

In a study of the effects of car exhaust on children, researchers discovered that a high rate of road traffic was correlated to increased respiratory symptoms in children.[4]

Policies and regulations that require automobile manufacturers to reduce harmful emissions have led to innovations like Catalytic Converters (most cars have been equipped since the mid-70's.)

In chemistry, a catalyst is a substance that causes or accelerates a chemical reaction without itself being affected. Catalysts participate in the reactions, but are neither reactants nor products of the reaction they catalyze. In the human body, enzymes are naturally occurring catalysts responsible for many essential biochemical reactions. In your car, the Catalytic Converter strips the Oxygen molecule from the NOx and holds onto the nitrogen and releases the O2. Then it oxidizes the carbon monoxide and turns it into carbon DIOXIDE.[5]

1. Environmental Protection Agency, Carbon Monoxide: Chief Causes for Concern, http://www.epa.gov/air/urbanair/co/chf1.html

2 US Dept of Labor, Occupational Health and Safety Guideline for Carbon Monoxide (Retrieved Feb 20011)

http://www.osha.gov/SLTC/healthguidelines/carbonmonoxide/recognition.html

3 Clean school bus initiative through EPA. (Retrieved Feb 2011)http://www.epa.gov/otaq/schoolbus/index.htm

4 Wjst., M. et. al., (1993) Road traffic and adverse effects on respiratory health in children. http://www.bmj.com/content/307/6904/596.abstract

5. Nice, Karim, Bryan, Charles, How Stuff Works, How Catalytic Converters Work, (Retrieved Feb 2011)http://auto.howstuffworks.com/catalytic-converter2.htm

Question Options:

Option A: How does the amount of time an automobile engine is running affect the balance of target gases in the exhaust?

Option B: How does the type of automobile engine affect the balance of target gases in the exhaust?

Example Hypothesis

The level of each of the target gases in the car exhaust will go up/down/stay the same after running for five minutes. Choose one and explain why you think this.

_____

_____

(If more than one car is tested):
The levels of each target gas will/will not be the same in each car. Explain.

_____

_____

Materials

1. Gastec Gas Sampling Pump
2. Carbon Dioxide Tubes 2EH (2)
3. Nitrogen Oxide Tubes 11EL (2)
4. Carbon Monoxide Tubes 1EL (2)
5. Materials to gather:
   - Old newspaper
   - Plastic Garbage Bag (~10gal)
   - Rubber band or twist tie
   - Tape (1 roll)
   - Scissors (1pr)
   - Automobiles to test (1 or more)

Procedure:

1. Prepare the paper tube and plastic bag for collecting samples:

A. Plastic Bag: Cut a 2-3mm hole toward the bottom of the plastic bag. Using a permanent marker, make a circle around the hole in the bag so you can find it when you need to.

B. Place a small piece of tape over the hole and make sure it is secure. Fold the end of the tape onto itself to create a small tab. This will make it easier to pull back each time you perform a test on your sample.)

2. Prepare the GV-50P BEFORE starting the car:

A. Make sure the pump handle is pushed into the chamber.
B. Break off the tip of both ends of the Carbon Dioxide Tube and place it in the yellow pump securely with the arrow pointing toward you.
C. Place a red rubber tip protector at the end of the glass detector tube.

3. Collect Exhaust sample. (You will test each sample for collect for several gases.)

A. Wrap the outside of the tailpipe with newspaper without blocking the exhaust.
B. Compress the bag to remove all of the air from it and make sure the tape over the sampling hole is secure before collecting the sample.
C. Hold the plastic bag against the newspaper that is wrapped around the tailpipe

Collect exhaust sample:

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someone start up the car while another person is ready to collect the sample of exhaust and twist the bag closed once it fills with the car exhaust. (*This happens very quickly so review steps before performing test.*)

E. Secure the rubber band or twist tie around the top of the bag so you are able to test the sample for three different gases: carbon monoxide, carbon dioxide and nitrogen oxide.

4. Test the sample: Carefully pull back the tape covering the sampling hole and insert the carbon dioxide tube tester into the bag and pull the pump handle until you hear a click. Wait for one minute, *keeping the tube in the bag for at least one minute*.

5. Collect the data: Write down in the data table listed below the number associated with the color change.

6. **Repeat steps 1-5 for Carbon Monoxide and Nitrogen Oxides.**

Tips for Successful Experimentation:

- If you are testing more than one car, it is good to have them all parked close so you can work with all the groups more easily.
- The experimental procedure can be tricky: The sampling bag should be emptied of all air.
- ***WARNING:*** the tailpipe can be very hot after the car has been running for five minutes. It is good to use extreme caution when collecting the sample to prevent from touching the tailpipe with bare hands or breathing the fumes from the automobile.

Data Results:

1. Car Make/Model/Year:_____ Time/Date:_____

Type of Gas Detected	Level Immediately after start-up	Level 5 minutes after start-up
CO2 (%)		
CO (ppm)		
NOx (ppm)		

2. Car Make/Model/Year:_____ Time/Date:_____

Type of Gas Detected	Level Immediately after start-up	Level 5 minutes after start-up
CO2 (%)		
CO (ppm)		
NOx (ppm)		

3. Car Make/Model/Year:_____ Time/Date:_____

Type of Gas Detected	Level Immediately after start-up	Level 5 minutes after start-up
CO2 (%)		
CO (ppm)		
NOx (ppm)		

Analyzing Data

1. Which of the target gases was highest at start-up? Was this the same for all vehicles? Describe.

2. Which of targeted gas levels was highest in the car exhaust after running for five minutes?

3. Which of targeted gas levels showed the greatest amount of change after running for five minutes?

4. Construct a data table and graph(s) showing the change over time of the level of each targeted gas and/or graphs comparing the different cars' exhaust components. (Attach)

Discussion of Results

1. Restate your hypothesis beginning with the statement, "The experimental data supported---or, did not support---my hypothesis,

2. Explain *how the data supports, or does not support,* your hypothesis referring to the specific measurements, calculations, or patterns you noticed.

3. How can the experimental design be improved to improve the data?

4. Why did these results occur? What is the significance of them? Identify any scientific, or social or technological concerns or opportunities that could be addressed. Recommend possible solutions.

5. What questions would you ask to extend this experiment?