

Resource Guide for Earth Space Science Classes

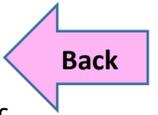
South Cross Bayou Water Reclamation Facility

Teacher Resources

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Earth Space Science Resource Overview

Choice! The following resources were designed to allow for teacher choice. Choice for teachers allows for customizing *what* students are expected to learn and differentiating *how* students are expected to demonstrate learning. By choosing the critical learning focus and the methods of demonstrating mastery, teachers design appropriate boundaries for students.

A tour of South Cross Bayou Wastewater Treatment Facility provides opportunities for your students to learn a tremendous amount of relevant information aligned to the Florida Standards for Earth Space Science. The Florida Standards have been provided and specific Learning Targets have been written to guide the learning expectations and outcomes. Teachers should review the [Florida Standards and Learning Targets](#) provided and choose which Learning Targets will be the critical focus for students.

A wide variety of Activity Options were developed to meet the needs and learning styles of diverse students. Activity Options have been grouped into three different point values based on the amount of student work associated with the activity. Teachers should review the [Activity Options](#) for the chosen Learning Targets and select a total of eleven Activity Options that are a good fit for their classroom and learners. (*Note: Students will only be expected to complete two of these eleven Activity Options*). To create a customized 20-50-80 Menu for their class, teachers should copy the eleven chosen Activity Options and paste them into the appropriate boxes of the template for the [20-50-80 Menu](#). This ensures that students will only see the eleven Activity Options that are predetermined by the teacher.

By establishing these boundaries, teachers can infuse *student* choice as well. Many teachers observe that if students have both choice and voice then there is an increase in motivation and desire to learn.

Students will preview the [20-50-80 Menu](#) before the SCB tour and predetermine *two* learning activities that best fit their interest, comfort and learning style. Students have many combinations to choose from to earn the necessary 100 points. Scaffolded supports for learning, as well as transparency of expectations, are provided through the descriptions on the [20-50-80 Menu](#), [Product Criteria Cards](#) and [All-Purpose Product Rubric](#) (or [SCB Resume Rubric](#)). The desired effect of students knowing *how* they will use the information from the SCB tour is an increase in motivation and desire to learn.

Earth Space Science Standards & Learning Targets



Pinellas County Schools Mission Statement/ Florida Standards
<input type="checkbox"/> Learning Targets

PCS Mission: Educate and prepare each student for college, career, and life.
<input type="checkbox"/> Identify and describe various careers available in wastewater treatment.
<input type="checkbox"/> Determine required education, training, and skills necessary for a career in wastewater treatment.
   
SC.912.N.3.5 Describe the function of models in science, and identify the wide range of models used in science.
<input type="checkbox"/> Discuss how each of the following characteristics of science are specifically present within SCB's processes to treat wastewater: use of models, adherence to ethical practices, identification and systematic testing of key variables, adaptability, and development of innovative technology and techniques that allow for improvements in quality of life.

SC.912.L.15.1 Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.
<input type="checkbox"/> Discuss the possibility of observed evolutionary change occurring in the anoxic and aeration tanks. Explain how this supports the theory of evolution.

SC.912.E.7.1 Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.
<input type="checkbox"/> Diagram and explain how South Cross Bayou Wastewater Treatment Facility is part of the Water Cycle.
<input type="checkbox"/> Diagram and explain how the anaerobic bacteria in the Digesters are part of the Carbon Cycle.
 
SC.912.E.7.3 Differentiate and describe the various interactions among Earth systems, including: atmosphere, hydrosphere, cryosphere, geosphere, and biosphere.
<input type="checkbox"/> Describe the different interactions that are occurring between the atmosphere, hydrosphere, geosphere, and biosphere at South Cross Bayou.
   
SC.912.E.7.8 Explain how various atmospheric, oceanic, and hydrologic conditions in Florida have influenced and can influence human behavior, both individually and collectively.
<input type="checkbox"/> Recognize how local weather conditions can change the operations of wastewater treatment.

SC.912.P.10.4 Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter.

- Describe how heat is transferred by convection, conduction, and or radiation in the UV System.
- Describe how heat is transferred by convection, conduction, and or radiation in the Digesters when sludge initially undergoes continuous thermal circulation.
- Describe how heat is transferred by conduction and then by convection in the dryer drum to process biosolids.
- Describe how the evaporator induces a change in the state of matter of the nitrogen gas in the pelletizer. Describe the purpose of this heat change in the pellets.

P.10.4

SC.912.P.10.18 Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications.

- Describe the ultraviolet light used in the UV system in terms of wavelength, frequency, and energy.

P.10.18

SC.912.P.12.2 Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as the functions of time.

P.12.2

- Analyze the motion of wastewater as it travels through the influent pump station.
- Analyze the motion of wastewater inside the teacups.
- Analyze the motion of the sand, grit, and solid material inside the teacups.
- Analyze the motion of the gritty material in the Grit Snails.
- Analyze the motion of the wastewater after aluminum sulfate (Alum) is added in the mixing facility.
- Analyze the motion of the wastewater after NALMET is added in the mixing facility.
- Analyze the motion of the vacuum arm that rotates in the bottom of the secondary clarifier tanks.
- Analyze the motion of the arm that rotates on the top of the secondary clarifier tanks.
- Analyze the motion of the wastewater through the baffles in the chlorine contact tank.
- Analyze the motion of the water as it travels through cascade outflow.
- Analyze the motion of the digested sludge as it travels through dewatering centrifuges.

SC.912.P.12.4 Describe how the gravitational force between two objects depends on their masses and the distance between them.

- Describe the impact to gravitational force if there is an increase in biosolid mass within the Tea Cups.
- Describe the impact to gravitational force if there is a decrease in sludge mass within the Primary Clarifier Tanks.

P.12.4

Earth Space Science Teacher Guide for 20-50-80 Menu



Learning Targets

Relevant [9-12 Science Standards for Earth Space Science](#) are provided and specific [Learning Targets](#) have been developed. Teachers choose the [Learning Targets](#) and associated [Activity Options](#) that are a desired critical focus for their students.

Student Materials Needed for Activity Options

lined paper	glue/tape	markers	colored pencils	white paper
scissors	coat hanger (for mobile)		smartphone or tablet with video recording	

Special Notes

Since the [Activity Options](#) have either a 20, 50 or 80 point value, the [All-Purpose Product Rubric](#) must be customized by the students. When using the [All-Purpose Product Rubrics](#) have students circle the correct point value for the product (20, 50 or 80) and record the correct partial point values at the top of the full and half credit columns. Use the tables below for partial point values:

Full	Half	No
4	2	0
4	2	0
4	2	0
4	2	0
4	2	0
20 Points Possible		

Full	Half	No
10	5	0
10	5	0
10	5	0
10	5	0
10	5	0
50 Points Possible		

Full	Half	No
16	8	0
16	8	0
16	8	0
16	8	0
16	8	0
80 Points Possible		

Time Frame

Allow one or two 50 minute class periods prior to your SCB visit to have students preview resources and predetermine two activities from the [20-50-80 Menu](#).

Allow two or three 50 minute class periods after your SCB visit to have students complete their two chosen activities from the [20-50-80 Menu](#).

Additional Forms

All-Purpose Product Rubrics (two per student)	SCB Resume Rubric (for SCB Career Resume)	Product Criteria Cards
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Earth Space Science Teacher Guide for Activity Options



Teachers, below is the master list of suggested in-class activities for students to demonstrate mastery on the [Learning Targets](#). You will narrow down three 20 point options, four 50 point options and three 80 point options and place the eleven options on the [20-50-80 Menu template](#). Prior to the SCB tour, students will choose two activities (with a sum of 100 points) from the options you provide. Back in the classroom after the SCB tour, students will complete both activities they have selected.

20 Points Options *Teachers, place <u>three</u> options on the 20-50-80 Menu .	
L.15.1	Write and illustrate a comic strip to depict how the aerobic bacteria in the Aeration Tanks, as well as the anaerobic bacteria in the Anoxic Tanks, are subject to “survival of the fittest”, where fitness may be based on the ability to survive in broad temperature ranges (or some other factor). Because each bacteria can reproduce quickly, be sure to explicitly demonstrate observed evolutionary change by including many generations subjected to the same “fitness” factor.
E.7.8	Write an internal email to SCB staff that describes a specific impending local weather condition and dictates the changes to operations to compensate for the impacts of the local weather condition.
E.7.3	Create a mobile to display five interactions between Earth’s systems from the perspective of the atmosphere. Describe five specific interactions that occur at SCB where the atmosphere interacts with the other systems: hydrosphere, geosphere, and biosphere. Be sure that each interaction is connected to the atmosphere, has a description of the event or process that occurs at SCB, and labels the second system of the interaction (biosphere, geosphere, or hydrosphere).
E.7.3	Create a mobile to display five interactions between Earth’s systems from the perspective of the hydrosphere. Describe five specific interactions that occur at SCB where the hydrosphere interacts with the other systems: atmosphere, geosphere, and biosphere. Be sure that each interaction is connected to the hydrosphere, has a description of the event or process that occurs at SCB, and labels the second system of the interaction (biosphere, geosphere, or atmosphere).
E.7.3	Create a mobile to display five interactions between Earth’s systems from the perspective of the geosphere. Describe five specific interactions that occur at SCB where the geosphere interacts with the other systems: hydrosphere, atmosphere, and biosphere. Be sure that each interaction is connected to the geosphere, has a description of the event or process that occurs at SCB, and labels the second system of the interaction (biosphere, atmosphere, or hydrosphere).
E.7.3	Create a mobile to display five interactions between Earth’s systems from the perspective of the biosphere. Describe five specific interactions that occur at SCB where the biosphere interacts with the other systems: hydrosphere, geosphere, and atmosphere. Be sure that each interaction is connected to the biosphere, has a description of the event or process that occurs at SCB, and labels the second system of the interaction (atmosphere, geosphere, or hydrosphere).

50 Points Options *Teachers, place <u>four</u> options on the 20-50-80 Menu .	
N.3.5	You are assistant to the education outreach coordinator at SCB. You have been tasked with recruiting science minded students for an internship at SCB. The regional science fair will be the perfect opportunity to recruit. Design a display board or a brochure that communicates how SCB embodies scientific practices and methods. Include <u>how</u> SCB does the following: use of models, adherence to ethical practices, identification and systematic testing of key variables, adaptability, and development of innovative technology and techniques that allow for improvements in quality of life.
E.7.1	Create a Pinellas County Wastewater Specific Carbon Cycle Diagram poster. View a generic carbon cycle diagram to get a starting point, but then customize the components to include the various specific Pinellas County carbon sources that enter our wastewater. Be sure to track the carbon as it moves through the SCB facility and track the way(s) it leaves the facility and rejoins the local ecosystem.
E.7.1	Create a Pinellas County Wastewater Specific Water Cycle Diagram poster. View a generic water cycle diagram to get a starting point, but then customize the components to include the various specific Pinellas County water source examples and include SCB water reclamation facility in the cycling of water in our local environment.
P.10.4	Create an interactive map of SCB water reclamation facility. For every location on the map where heat is transferred create a flap. Under the flap provide an explanation of how heat at this location is transferred by convection, conduction, and/or radiation and the role of this heat transfer in the water treatment or fertilizer pelletizer process.
P.10.18	Unfortunately, a fake news story was reported and went viral on social media. This fake news report indicated that local waterways contain radioactive water. Uninformed local residents are requesting an immediate shut down of the UV system at SCB, incorrectly stating that the UV radiation used to disinfect the treated wastewater prior to release in Joe's Creek is to blame for the supposed radioactive waterways. City officials have asked you, the Facilities Manager at SCB, to be an expert speaker at a town hall meeting to calm fears and provide facts. Write and record a 3 minute speech for the town hall meeting. In your speech: introduce yourself (including your profession), state that the news story was fake, provide the purpose of the UV System, describe what UV light is in terms of wavelength, frequency and energy by making a comparison to visible light, and remind the residents that local waterways are not radioactive. Conclude with one tip to help determine if a news story on social media is factual.
P.12.4	Write and present to the class Three Facts & A Fib for changes to gravitational force on objects throughout SCB. Present a total of 6 facts and 2 fibs. Construct each fact or fib as an if/then statement.
PCS Mission	Create a resume for a specific career at SCB. Use a professional template when creating your resume. Be factually accurate when writing the resume. For instance, professional/technical skills, school programs, length of time to complete degree, certifications, state licensure and previous work experience from actual work places. This activity will be graded using the SCB Resume Rubric instead of the All-Purpose Product Rubric.

80 Points Options *Teachers, place <u>three</u> options on the 20-50-80 Menu .	
P.12.2	Write a training manual for the position of chemist at SCB. Begin by describing the general duties of a chemist at SCB. Discuss the importance of the chemist in ensuring the removal of unwanted solids from the wastewater. Because the water treatment processes at SCB are time-sensitive, the chemist must ensure ideal conditions for chemical reactions to occur at proper rates. Provide relevant information about the mixing facility, and explain how a change of either concentration or temperature might affect flocculation (formation of the precipitant) at the mixing facility.

<p>PCS Mission</p>	<p>Write and present to the class Three Facts & A Fib for each of three different careers that are present at SCB. You may use resources provided by SCB to help you identify careers and give you general information, but your 9 facts and 3 fibs must be information that was not included in the SCB resources. Conduct independent research on the three careers when writing your facts and fibs.</p>
<p>PCS Mission</p>	<p>You are an employee at SCB and have been asked to speak at a local high school for the Great American Teach-In. Prepare a presentation that describes your role within the treatment facility. Share with class about a situation (power outage to the city due to storms, infiltration/inflow of stormwater due to leaking pipes, sensor failure in the monitoring of water parameters, etc) when you had to problem solve a major crisis.</p>
<p>PCS Mission</p>	<p>Create a WebQuest to explore new resource recovery practices being used throughout the world that are currently not being used at SCB. Consider that resource recovery is an innovative sustainable practice that helps offset the environmental and economic costs of wastewater treatment. Design a WebQuest that has participants researching and answering guided questions about relevant details.</p>

All-Purpose Product Rubric **Product:** _____ **20, 50, or 80 Point Option** **Name:** _____

Aspect	Full Credit <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">Points</div>	Half Credit <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">Points</div>	No Credit <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">0 Points</div>	Peer Feedback	Self Evaluation
Content: Is the content of the product well chosen?	Content chosen represents the best choice for the product. Graphics are well chosen and related to content.	Information or graphics are related to content, but are not the best choice for the product.	Information or graphics presented do not appear to be related to topic or task.		
Completeness: Is everything included in the product?	All information needed is included. Product meets the product criteria and the criteria of the task as stated.	Some important information is missing. Product meets the product criteria and the criteria of the task as stated.	Most important information is missing. The product does not meet the task or does not meet the product criteria.		
Creativity: Is the product original?	Presentation of information is from a new perspective. Graphics are original. Product has elements of fun and interest.	Presentation of information is from a new perspective. Graphics are not original. Product includes an element of fun and interest.	There is no evidence of new thoughts or perspective in the product.		
Correctness: Is all of the information included correct?	All information presented in the product is correct and accurate.	N/A	Any portion of the information presented in the product is incorrect.		
Communication: Is the information in the product well communicated?	All information is neat and easy to read. Product is in appropriate format and shows significant effort. Oral presentations are easy to understand and presented with fluency.	Most of the product is neat and easy to read. Product is in appropriate format and shows significant effort. Oral presentations are easy to understand, with some fluency.	The product is not neat and easy to read or the product is not in the appropriate format. It does not show significant effort. Oral presentation was not fluent or easy to understand.		
Total Grade					

SCB Resume Rubric

Career: _____

50 Point Option

Name: _____

Aspect	Full Credit	Half Credit	No Credit	Peer Feedback	Self Evaluation
<p>Format: Does this have the appearance of a professional job resume?</p>	<p>Resume is computer generated, has balanced margins, is visually appealing, highlights strengths & information, appropriate font style and size used with variety. 10 Points</p>	<p>Resume is computer generated, has balanced margins, highlights strengths & information, no variation in font style and/or size. 5 points</p>	<p>Resume is handwritten, format detracts from strengths & information, font distracts from readability. 0 Points</p>		
<p>Job-Specific Information: How well does your information describe your skillset?</p>	<p>Action phrases are used to describe duties and skills, information demonstrates ability to perform the job, and professional terminology is used when describing skills. 16 Points</p>	<p>3 duties/skills lack action phrases, some information demonstrates ability to perform the job, and some professional terminology is used when describing skills. 8 Points</p>	<p>5-6 duties/skills lack action phrases and information does not clearly demonstrate ability to perform the job. 0 Points</p>		
<p>Resume Content: How rich in detail is your resume?</p>	<p>Heading, objective, skills, experience, certification and education covered in detail. Extra information given to enhance resume. 14 Points</p>	<p>Heading, objective, skills, experience, certification and education covered with little detail. Minimal information given to enhance resume. 7 Points</p>	<p>Missing one or more: heading, objective, skills, experience, certification or education. No extra information given to enhance resume. 0 Points</p>		
<p>Spelling & Grammar: How well do you display your ability for written communication?</p>	<p>No spelling or grammar errors. 10 Points</p>	<p>3 spelling or grammar errors. 5 Points</p>	<p>5-6 spelling or grammar errors. 0 Points</p>		
Total Grade					

Name: _____

Date: _____

Earth Space Science 20-50-80 Menu

Student Directions: Choose two activities from the menu below. **The activities must total 100 points.** Place a checkmark next to each box to show which activities you will complete. All activities must be completed by _____.

20 Points	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	

50 Points	
<input type="checkbox"/>	

80 Points	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	

Students, attach the Product Criteria Cards for your two activities in the spaces below.

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Earth Space Science Product Criteria Cards

Student Directions: The cards below convey additional criteria for various products. Cut out the two applicable product criteria cards and attach each to your 20-50-80 Menu.

<p style="text-align: center;">Email</p> <ul style="list-style-type: none"> • Is typed and printed • Contains appropriate “To” “From” and “Subject” • Contains appropriate greeting and closing • Describes the message in two paragraphs (be sure to cover the who, what, where, when, why & how) • All actionable items are emphasized and include who is responsible and when the action should take place 	<p style="text-align: center;">Comic Strip</p> <ul style="list-style-type: none"> • 8.5” x 11” or larger • On white paper • 6+ cells • Contains meaningful dialogue • Imagery is in color 	<p style="text-align: center;">Town Hall Speech</p> <ul style="list-style-type: none"> • Was videotaped or audio recorded • Script was written and provided to teacher • Begins with introduction and explains your credentials or authority to speak on the subject • Provides appropriate background knowledge and detail for the type of audience • States the purpose for speaking • Has a clear wrap-up that restates the purpose of the speech • Voice was loud and easy to understand
<p style="text-align: center;">Interactive Map</p> <ul style="list-style-type: none"> • Includes a scale • Has two or more layers that are viewable by lifting paper • Images are in color and are clear • Explanations are thorough and concise • Has a title that explains the location 	<p style="text-align: center;">Poster</p> <ul style="list-style-type: none"> • Is the <u>size</u> of standard poster paper • Includes at least five pieces of important information • Has a clear title • Contains both words and pictures • Name is written on back 	<p style="text-align: center;">Training Manual</p> <ul style="list-style-type: none"> • 5+ pages • Has a cover that states the job/position and company • Contains contact information • Connects the mission/vision/purpose of the company to the mission/vision/purpose of the position • Contains concise step by step descriptions of job duties • Identifies what to look for if things go wrong • Explains impact of when things go wrong • Explains troubleshooting to fix or avoid problems • Has images or diagrams • Has descriptive section headings

<p style="text-align: center;">Mobile</p> <ul style="list-style-type: none"> • At least 10 pieces of related information • Includes color and pictures • 3+ layers of hanging material • Is balanced when hanging 	<p style="text-align: center;">Web Quest</p> <ul style="list-style-type: none"> • Must quest through at least 5 government websites • Websites should be linked in the document • Submit to teacher by PowerPoint • At least 3 questions for each website • The links and questions should be included as slides • Answers should be put in the notes section for each slide • Must address the topic 	<p style="text-align: center;">Presentation: Great American Teach-In</p> <ul style="list-style-type: none"> • Take on the role of the SCB employee • Cover at least 5 important facts about the job of the employee • Should be 3-5 minutes in length • Script must be approved by teacher before information is presented • Must have props or some form of costume • Allow for questions at the end of presentation
<p style="text-align: center;">Three Facts & A Fib</p> <ul style="list-style-type: none"> • Can be typed, written or on PPT • Contains exactly four statements: three true statements and one false statement • False statement should not be obvious • Paragraph should be included that explains why the fib is false 	<p style="text-align: center;">SCB Career Resume</p> <ul style="list-style-type: none"> • <i>See <u>SCB Resume Rubric</u> for product criteria.</i> 	<p style="text-align: center;">Display Board or Brochure</p> <ul style="list-style-type: none"> • Uses either a cardboard trifold board (of any size) or a standard sheet of paper folded to create three columns • Clear and visible overall title and section headings • Uses graphics, charts, images etc (can be hand drawn or printed) • Neat and legible • Thoroughly meets the content